# PLANNING COMMISSION
# REGULAR MEETING AGENDA

**Wednesday, May 28, 2025**
**7 p.m.**

**City Council Chamber**
**200 Old Bernal Avenue**
**Pleasanton, CA 94566**

The meeting will be held at the City Council Chambers at 200 Old Bernal Ave and will be broadcast live at https://www.youtube.com/user/TheCityofPleasanton.

**Public participation:** It is requested that members of the public wishing to address the Planning Commission submit a speaker card. When public comment is opened on an agenda item, individuals may speak once per agenda item.

In Person at the City Council Chambers:

- Submit a physical speaker card to the Recording Secretary at the meeting. When your name is called, please provide comment at the podium.

## PUBLIC HEARING PROCEDURE

Each of the items listed will be heard as shown on the agenda unless the Planning Commission chooses to change the order. As each item is called, the hearing will proceed as follows:

- A Planning Division staff member will make a presentation on each case and answer Planning Commission questions, as needed.
- The applicant will be asked to present, if desired, or answer questions. Applicant presentations should be no longer than ten minutes.
- The Chair then calls on anyone desiring to speak on the item. Speakers are requested to state their names for the public record and to keep their testimony to no more than three minutes each, with minimum repetition of points made by previous speakers and by being as brief as possible in making their testimony.
- Following public testimony, the applicant will be given the opportunity to respond to issues raised by the public. The response should be limited to five minutes.

The public hearing will then be closed. The Planning Commissioners then discuss among themselves the application under consideration and act on the item. Planning Commission actions may be appealed to the City Council. Appeals must be filed with the City Clerk's Office within 15 days of the Planning Commission's action.

The Planning Commission Chair may enforce other rules as may further the fair and efficient running of the meeting, such as reducing the amount of testimony time allotted to the applicant and all those who wish to speak when the meeting agenda is lengthy or when there are numerous speakers for any specific item. The audience is requested to respect and extend courtesy to all those wishing to testify on all cases by being quiet while others are speaking.

**Notice**

Under Government Code §54957.5, any writings/documents regarding an item on this agenda provided to a majority of the Planning Commission after distribution of the agenda packet will be available for public inspection at City Hall in the Planning Division, 200 Old Bernal Avenue, Pleasanton.

**Accessible Public Meetings**

The City of Pleasanton can provide special assistance for persons with disabilities to participate in public meetings. To make a request for a disability-related modification or accommodation (e.g., an assistive listening device), please contact Melinda Denis, Planning and Permit Center Manager, by phone at 925-931-5631 or by email at mdenis@cityofpleasantonca.gov at the earliest possible time. If you need sign language assistance, please provide at least two working days' notice prior to the meeting date.

**CALL TO ORDER, PLEDGE OF ALLEGIANCE, AND ROLL CALL**

**AGENDA AMENDMENTS**

**CONSENT CALENDAR -** *Consent Calendar items are considered routine and will be enacted by one motion unless a request for removal for discussion or explanation is received from the Planning Commission or a member of the public by submitting a speaker card for that item.*

1. Actions of the Zoning Administrator

2. Approve the minutes of May 14, 2025

3. City of Pleasanton Draft Fiscal Year 2025/26 through Fiscal Year 2029/30 Capital Improvement Program

**MEETING OPEN TO THE PUBLIC**

4. Public Comment from the audience regarding items not listed on the agenda – *Speakers are encouraged to limit comments to 3 minutes*

**PUBLIC HEARINGS AND OTHER MATTERS**

5. **P24-0532, 5555 W. Las Positas Boulevard (Stanford Health Care Tri-Valley) -** Application for Design Review approval to construct a three-story, approximately 66,000-square-foot building addition, one water and three wastewater storage tanks, and related site improvements for Stanford Health Care Tri-Valley located at 5555 W. Las Positas Boulevard

6. **P25-0192, City of Pleasanton, Innovation-based Businesses (IBB) Zoning Text Amendments -** Application to amend Chapters 18.08, 18.20, 18.40, 18.48, 18.84, 18.88, 18.92, and Table 18.44.080 of the Pleasanton Municipal Code (PMC) to: (1) modify the definition of Light Industrial; (2) establish the definition of an Innovation-Based Business (IBB); (3) modify Table 18.44.080 to permit or conditionally permit IBB uses in the I-P, I-G, O, PUD-C-O, PUD-I, PUD-I/C-O, and PUD-MU Districts, and the following Districts of the Hacienda PUD Area: OGPD, OPD, OMPD, CDP, IPD, MOIPD, MCOIRPD, and MCOIPD; (4) modify the Design Review requirements for (a) industrial tenants leasing space in a previously reviewed and approved building; and (b) industrial tenants that are permitted by right within an industrial zone; and (5) modify specific and related development standards for IBB uses

**MATTERS FOR COMMISSION'S REVIEW/ACTION/INFORMATION**

7. Reports from Meetings Attended (e.g., Committee, Task Force, etc.)

8. Actions of the City Council

9. Future Planning Calendar

**MATTERS INITIATED BY COMMISSION MEMBERS**

**ADJOURNMENT**

# PLANNING COMMISSION MEETING MINUTES

**Wednesday, May 14, 2025**

## CALL TO ORDER, PLEDGE OF ALLEGIANCE, AND ROLL CALL

Chair Morgan called the regular meeting of the Planning Commission to order at 7 p.m. from the City Council Chambers located at 200 Old Bernal Avenue.

Commissioner Jain led the Pledge of Allegiance.

Commissioners Present: Commissioners Dave Jagoe, Anurag Jain, Vivek Mohan, Brandon Pace, Stephanie Wedge, and Chair Ken Morgan,

Commissioners Absent:

## AGENDA AMENDMENTS

None.

## CONSENT CALENDAR

1. Actions of the Zoning Administrator

   Recommendation: Receive report.

2. Approve the meeting minutes of April 23, 2025

   Recommendation: Approve the meeting minutes.

Chair Morgan opened the public comment. There being no speakers, Chair Morgan closed the public comment.

**MOTION:** It was m/s by Pace/Wedge to approve the Consent Calendar, as recommended. Motion passed by the following roll call vote:

| | |
|---|---|
| Ayes: | Commissioners Mohan, Jain, Pace, Wedge, and Chair Morgan |
| Noes: | None |
| Abstain: | None |
| Absent: | None |

## MEETING OPEN TO THE PUBLIC

3. Public comment regarding items not listed on the agenda.

Chair Morgan opened the public comment. There being no speakers, Chair Morgan closed the public comment.

DRAFT

**PUBLIC HEARING AND OTHER MATTERS**

4. P24-0421 and P24-0420, Danville Brewing Company, 3595 Utah Street - Applications for: 1) Conditional Use Permit approval of a brew pub tasting room; and 2) Design Review approval to construct an approximately 8,100-square-foot beer production brewery and brew pub tasting room building, an approximately 2,000-square-foot covered patio, and related site improvements on a vacant lot located at 3595 Utah Street

   Recommendation: Adopt Resolution No. PC-2025-10 approving the applications.

Senior Planner Eric Luchini presented the item.

Chair Morgan opened the public comment. Public comments were received from: William Long, applicant; Marcus Maita, applicant; and Melanie Sadek.

Chair Morgan closed the public comment.

**MOTION:** It was m/s by Jain/Wedge to adopt Resolution No. PC-2025-10, as recommended. Motion passed by the following roll call vote:

| | |
|---|---|
| Ayes: | Commissioners Jain, Mohan, Pace, Wedge, and Chair Morgan |
| Noes: | None |
| Absent: | None |
| Abstain: | None |

**MATTERS FOR COMMISSION'S REVIEW/ACTION/INFORMATION**

5. Subcommittee Representatives Selection for 2025

   Recommendation: Elect a subcommittee representative to fill the vacancy for an alternate member on the Heritage Tree Board of Appeals.

   Director Ellen Clark presented the item.

**MOTION:** It was m/s by Jain/Pace to nominate Commissioner Jagoe as the alternate member of the Heritage Tree Board of Appeals for the term beginning May 15, 2025. Motion passed by the following roll call vote:

| | |
|---|---|
| Ayes: | Commissioners Jain, Mohan, Pace, Wedge, and Chair Morgan |
| Noes: | None |
| Absent: | None |
| Abstain: | None |

6. Reports from Meetings Attended (e.g., Committee, Task Force, etc.)

Commissioner Jain reported attending the Bicycle, Pedestrian, and Trails Committee meeting of April 28, 2025.

7. Actions of the City Council

Director Clark provided a brief overview of the items listed in the report.

DRAFT

8. Future Planning Calendar

Planning Manager Melinda Denis provided a brief overview of the items listed in the report.

**MATTERS INITIATED BY COMMISSION MEMBERS**

Commissioner Mohan requested the Planning Commission agendize an item for the Planning Commission to provide recommendations to the City Council around land use and development priorities. By consensus, the Commission supported consideration of a draft communication to the City Council to be agendized for review at a future meeting.

**ADJOURNMENT**

Chair Morgan adjourned the meeting at 8:36 p.m.

_____

Estela Ramirez, Recording Secretary

DRAFT

# Planning Commission Agenda Report

May 28, 2025
Item 3

**SUBJECT:** **City of Pleasanton Draft Fiscal Year 2025/26 through Fiscal Year 2029/30 Capital Improvement Program**

**PURPOSE:** Conduct review of the City's Five-Year Capital Improvement Program of the City for consistency with the general plan pursuant to Government Code Section 65103

**EXHIBITS:**
A. Draft Resolution for CIP General Plan Conformance
B. Draft Capital Improvement Program

## BACKGROUND

Pursuant to Section 65103 of the Government Code, which describes the function of local planning agencies, the Planning Commission is assigned the responsibility to annually review the Capital Improvement Program of the City for its consistency with the General Plan. The City updates its Five-Year Capital Improvement Plan (CIP) every two years, generally at the same time as the biennial budget update. The Five-Year CIP is scheduled to come before the City Council for adoption in June.

The City has completed a draft Five-Year CIP. These projects represent a variety of improvements identified as necessary through a number of completed studies.

On April 10, 2025, staff presented their recommendations for the general-funded projects and received the Council's input. The Council approved staff's recommendations for seven critical/urgent CIP projects and funding for two core projects – a total of $16.6 million of general-funded projects that went through the City's recently adopted CIP Prioritization Process. The projects will address regulatory requirements, prevent facility closures, or be significantly grant-funded.

On May 20, 2025, staff presented the draft Five-Year CIP Fiscal Year (FY) 2025/26 through FY 2029/30 to City Council for review and comment. The report included additional information on annual core and enterprise projects.

## DISCUSSION

As described, the City updates its CIP every two years, adding new projects at the beginning of each cycle and updating them mid-term. This year marks the start of the new project cycle.

Given the City's budget constraints, a more in-depth screening and prioritization process was used to identify the most important and high-priority projects through a Capital Improvement Program Prioritization Process (CIPPP) approved by the City Council. As part of the CIPPP (see the December 17, 2024, staff report), all City departments were asked to submit "high priority" projects for inclusion in the upcoming CIP. Each project in the CIP is tied to costs and funding, with individual projects receiving funding from various sources, including the City's general fund. In total, 27 general-fund-supported projects were submitted, totaling $53.4 million.

Because the allocation of general funds is a critical question in the upcoming two-year budget, the City Council was requested to review and provide early input on the list of general-funded CIP projects. On April 10, the City Council approved moving forward with nine critical projects, totaling $16.6 million of general fund allocations. Additionally, annual core projects and enterprise projects, funded through restricted funds (i.e., funds such as grants, enterprise funds that are limited or restricted in the types of projects that may be funded), were included in the draft CIP (see Exhibit B).

The Fiscal Year 2025/26 capital budget, which the Commission is now reviewing, has a total revenue of $84.9 million. This includes $63.6 million in prior-year fund balances and reserves, with $46.6 million coming from restricted funds. A total of $54 million in expenditures is planned for 22 projects, including the nine general fund-supported projects ($16.6 million).

The draft CIP is organized by project category and includes the following sections:

- Transportation & Streets
- Parks
- Miscellaneous
- Water
- Sewer
- Storm
- Facilities.

Each project has a description sheet that provides an overview, justification, cost estimates, and funding details. Project identification numbers are also included, where the first two digits correspond to the fiscal year when the project was first funded, and the remaining digits represent the City's internal project number.

General Plan Conformance

The 2005 General Plan reflects the City's comprehensive plan guiding conservation and development in Pleasanton. Numerous related plans derive from the land use and policy direction established in the General Plan, including but not limited to:

1) Climate Action Plan CAP 2.0 (2023)
2) Housing Element Update (2023)
3) Recycled Water Feasibility Study (2013)
4) Urban Water Management Plan (2020)

5) Bicycle and Pedestrian Master Plan (2017)
6) Downtown Parks and Trail System Master Plan (2002)
7) Parks and Recreation Master Plan (2014)
8) Trails Master Plan (2019)
9) Pleasanton Pioneer Cemetery Master Plan (2014)
10) Alviso Adobe Community Park Master Plan (2000)
11) Library and Recreation Strategic Plan (2019)
12) Water System Management Plan (2025)
13) Sewer System Management Plan (2025).

Findings of conformance to the General Plan were made with the adoption of each of these documents, and thus, the proposed capital improvements can be determined to be consistent with the General Plan to the extent they are consistent with these various implementing documents.

In addition, the General Plan includes several goals and policies with which the CIP would be consistent, including:

***Circulation Element***

- Goal 2: Develop and manage a local and regional street and highway system that accommodates future growth while maintaining acceptable levels of service.
- Policy 1: Complete the City's street and highway system in accordance with the General Plan Map, Figures 3-7 and 3-10, and Table 3-8.
- Policy 22: Create and maintain a safe, convenient and effective bicycle system that encourages increased use.
- Policy 23: Create and maintain a safe and convenient pedestrian system that encourages walking as an alternative to driving.

***Public Facilities and Community Programs Element***

- Goal 1: Provide sufficient public facilities and community programs to efficiently serve existing and future development while preserving and enhancing the quality of life for existing and future residents.
- Goal 3: Promote responsible financing and construction to preserve and enhance Pleasanton's public facilities.
- Policy 1: Coordinate future capital improvement expenditures with the City's long-range capital improvement schedule to maximize the economies of scale, consistent with the community character.
    - Program 1.1: Allocate funds in each year's Capital Improvement Program according to long-term capital improvement needs.
    - Program 1.2: Update the City's long-range capital improvement schedule, as development needs change over time.
- Policy 6: Continue to maintain and improve public facilities.

***Water Element***

- Policy 4: Ensure an adequate water system and a high-quality water supply for existing and future development, and maintain an adequate reserve of water in storage facilities.
- Policy 8: Ensure an adequate storm drainage system to serve existing and future development.

**STAFF RECOMMENDATION**
Staff recommends that the Planning Commission:

1. Review the City of Pleasanton Draft Fiscal Year 2025/26 through Fiscal Year 2029/30 Capital Improvement Program and Adopt the Resolution (Exhibit A), finding the Five-year Capital Improvement Program and FY 2025/26 Capital Budget are in conformance with the City's General Plan.

**Primary Author**:
Adam Nelkie, Assistant Director of Public Works/City Engineer, 925-931-5675 or anelkie@cityofpleasantonca.gov

**Reviewed/Approved By**:
Kimberly Cilley, Assistant City Attorney
Siew-Chin Young, Director of Public Works
Ellen Clark, Director of Community Development

**EXHIBIT A**

# RESOLUTION NO. PC-2025-11

## A RESOLUTION OF THE PLANNING COMMISSION OF THE CITY OF PLEASANTON FINDING THE CITY OF PLEASANTON'S FIVE-YEAR CAPITAL IMPROVEMENT PROGRAM FOR FISCAL YEARS 2025/26 THROUGH 2029/30, AND THE FISCAL YEAR 2025/26 CAPITAL BUDGET, TO BE IN CONFORMANCE WITH THE CITY'S GENERAL PLAN

**WHEREAS**, Section 65103(c) of the California Government Code mandates that the Planning Commission of each city shall annually review the capital improvement program of the city for its consistency with the city's general plan; and

**WHEREAS**, the City of Pleasanton prepares and updates its Five-Year Capital Improvement Program (CIP) every two years in coordination with the biennial budget process; and

**WHEREAS**, the draft Five-Year CIP for Fiscal Years 2025/26 through 2029/30, including the Fiscal Year 2025/26 and 2026/27 Capital Budget, was presented to the Planning Commission for review on May 28, 2025; and

**WHEREAS**, the draft CIP includes general fund-supported, core, and enterprise-funded projects that have been identified through a citywide prioritization process and reflect regulatory requirements, safety needs, infrastructure renewal, and alignment with adopted master plans and community priorities; and

**WHEREAS**, the draft CIP identifies a total of $54 million in expenditures for Fiscal Year 2025/26, supported by $84.9 million in revenue sources, including $16.6 million in general fund allocations toward nine high-priority projects; and

**WHEREAS**, each proposed project within the CIP is supported by project-specific data, cost estimates, and funding sources, and is organized by category, including Transportation & Streets, Parks, Miscellaneous, Water, Sewer, Storm, and Facilities; and

**WHEREAS**, the proposed CIP and FY 2025/26 Capital Budget are found to be in conformance with the goals, policies, and programs of the City's 2005 General Plan, as well as related adopted planning documents, including but not limited to the Climate Action Plan (CAP 2.0), Housing Element, Bicycle and Pedestrian Master Plan, and Water and Sewer System Management Plans; and

**WHEREAS**, the draft CIP is consistent with General Plan goals and policies including, but not limited to: ensuring adequate infrastructure, promoting responsible public facility investment, enhancing multi-modal transportation options, and coordinating capital improvements with long-range planning objectives.

**NOW, THEREFORE BE IT RESOLVED,** the Planning Commission of the City of Pleasanton, does resolve, declare, determine, and order the following:

DRAFT

**SECTION 1:** The Planning Commission of the City of Pleasanton hereby finds that the City's Five-Year Capital Improvement Program for Fiscal Years 2025/26 through 2029/30, and the Fiscal Year 2025/26 Capital Budget, are in conformance with the Pleasanton General Plan.

**PASSED, APPROVED AND ADOPTED by the Planning Commission of the City of Pleasanton at a regular meeting held on May 28, 2025, by the following vote:**

Ayes:
Noes:
Absent:
Abstain:

**ATTEST:**

_____ _____

Melinda Denis
Secretary, Planning Commission

Ken Morgan
Chair

**APPROVED AS TO FORM:**

_____

Kimberly Cilley
Assistant City Attorney

City of Pleasanton, CA

# FY 2025/26 – FY2029/30
# Capital Improvement Program








# CITY OF PLEASANTON, CALIFORNIA
# CAPITAL IMPROVEMENT PROGRAM
## FY 2025/26 – FY 2029/30




### City Council

Jack Balch, Mayor
Jeff Nibert, Vice Mayor
Craig Eicher, Councilmember
Matt Gaidos, Councilmember
Julie Testa, Councilmember

### Staff

Gerry Beaudin, City Manager
Pamela Ott, Assistant City Manager
Susan Hsieh, Director of Finance
Siew-Chin Yeong, Director of Public Works
Adam Nelkie, City Engineer/Assistant Director of Public Works
Chris Yi, Financial Services Manager
Dawn DeMarcus, Senior Budget & Finance Analyst
Gerry Parco, Senior Civil Engineer

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To the Honorable Mayor and Councilmembers,

In accordance with the City's ordinance, I am pleased to present the two-year Proposed Capital Budget and the five-year Capital Improvement Program (CIP) from FY 2025/26 to FY 2029/30. As the City faces an ongoing structural deficit, with revenues not keeping pace with expenses, the proposed budget and the CIP does not fully account for the City's true capital investment needs due to the lack of funding. The Asset Management Plan, currently under development, will provide a more comprehensive understanding of the City's needs. This CIP reflects a balanced approach to investing and planning for high-priority projects in various program areas, such as water, sewer, and General Fund supported community infrastructure.

Consistent with the City's two-year budget policy, it is recommended that the Proposed Capital Budget, which represents the first two years (FY 2025/26 and FY 2026/27) of the CIP be adopted and that funds be appropriated. The projects included in the final three years (FY 2027/28, FY 2028/29 and FY 2029/30) of the CIP represent those that are identified as priority but not as critical compared to the ones included in the first two years, moved out due to staffing resources, or delayed because of limited funding in the first two years. Proposed projects in the CIP are based on urgent and critical identified needs, which are subject to revision, as necessary, to accommodate changes in priorities and/or expected funding levels. The two-year Proposed Capital Budget is approximately $86.0 million. Over a five-year period, the Proposed CIP totals approximately $221.7 million.

The total fiscal resources available for the CIP incorporate estimates for future revenue collection that are subject to economic and political elements outside of the City's control. In addition to assuming $61.5 million in new debt, $35.0 million for water projects and $26.5 million for sewer projects, the debt amount required will be contingent on the additional revenues from rate increases. As such, the City's ability to fund projects included in this CIP could change if the City does not receive the anticipated revenues. While some of the capital program revenues, such as the state gas tax and related transportation revenues, have remained mostly stable, several other revenue sources have been revised to be lower in the Proposed Capital Budget and CIP. For example, one of the core funding sources for the City's capital program is development-related fees, which have been impacted in recent years due to delays associated with proposed commercial and residential developments and recent state law that requires appropriate fees to be collected only at final inspection or occupancy. As a result, several projects budgeted for this funding source have been postponed.

As part of the ongoing budget monitoring process, staff will periodically conduct a review of the Capital Budget and CIP. If these reviews determine that adjustments are needed, staff will provide the City Council with any recommended changes to projects and corresponding revenues for FY 2026/27 as part of the Mid-Term Budget Review process or through a standalone City Council agenda report.

## Capital Improvement Program Book Organization

This document is arranged by project category. Starting with the Proposed Budget and CIP, it has seven categories: Transportation & Streets, Parks, Miscellaneous, Water, Sewer, Storm, and Facilities.

Project description sheets, which provide a project description and justification as well as cost and funding information, are included for each funded project in all seven project categories. Summary financial tables detailing expenditures for each CIP project category are included in this section.

Project identification numbers are included on project description sheets and financial tables. The first two digits of these numbers reflect the fiscal year when the project was first funded. The additional digits reflect City project numbers.

## Development of CIP Recommendations

The CIP is presented to address the City's priority capital improvement needs given the available funding over the next five years. When making decisions regarding project recommendations, staff relies on numerous sources of information, including Capital Improvement Program Prioritization Process, Bicycle and Pedestrian Master Plan, Parks Master Plan, Cemetery Master Plan, Alviso Adobe Strategic Plan, Impact Fee Nexus Study, Pavement Management Plan, Repair and Replacement Plans, and Water and Sewer Management Plans. Staff used these plans and recent design and construction documents to develop cost estimates. The following sections identify new and ongoing projects included in this CIP based on the Capital Improvement Prioritization Program.

## Capital Improvement Program Process and Prioritization (CIPPP)

A CIP prioritization process using a systematic approach to rank projects is intended to help the City allocate resources effectively and make data-driven decisions on capital investments. A CIP process and prioritization strategy that aligns with the ONE Pleasanton Strategic Plan and community input is an essential step in ensuring resources are effectively allocated to the most critical projects, helping to address urgent needs, optimize funding, and meet regulatory deadlines, while acknowledging local priorities. In December 2024, the City Council approved the prioritization evaluation developed around six key categories, each with a weighted scoring system, to assess the relative importance of various projects. The process also establishes procedures for excluding annual core and enterprise-funded programs from prioritization and introduces a sunset clause to remove outdated or stalled projects from the CIP. Notably, the CIP prioritization process intentionally aligns with the City's broader strategic goals, particularly in sustainability and environmental impacts, ensuring necessary capital investments and supporting the City's long-term vision for growth and improvement.



The FY 2025/26 - FY 2029/30 CIP was developed in accordance with the CIPPP and the direction provided by the City Council on April 10, 2025 for the General Fund supported projects. That included funding for seven urgent, critical projects and two core projects that are included within the program. Core projects, as outlined in the CIPPP, along with enterprise projects, are recommended for funding to ensure basic investments in the City's infrastructure.

The water and sewer management plans have identified significant capital needs for infrastructure investments. Following the adoption of updated water and sewer rates, a substantial increase in sewer and water enterprise expenditures is anticipated during this CIP timeframe. Proposed projects are based on staff-recommended increases to water and sewer rates, and the projects will be adjusted accordingly based on City Council-approved water and sewer rates.

The table below lists the General Fund supported projects recommended from the CIPPP.

| Fiscal Year | Project Name | Funds Needed |
|---|---|---|
| 2026 | West Las Positas Multimodal Reconstruction - Willow to Stoneridge | $9.0 million ($3.8 million GF Misc., $5.2 million GF Streets) |
| 2026 | Library Fire Alarm Replacement | $0.8 million ($0.6 million GF Misc., $0.2 million Public Facility Impact Fee) |
| 2026 | West Las Positas Multimodal Reconstruction - Design of Owens to Santa Rita | $1.0 million ($0.8 million Grant, $0.2 million Measure BB) |
| 2026 | I-580 Overcrossing Bicycle & Pedestrian Improvements | $0.7 million ($0.5 million Grant, $0.2 million Measure BB) |
| 2026 | Pleasanton Traffic Model | $0.2 million Gas Tax |
| 2027 | Non-Functional Turf Replacement, AB 1572 | $1.1 million ($0.9 million GF Parks, $0.2 million Park Development Impact Fee) |
| 2026-30 | Park Trail & Pathway Resurfacing Program | $0.7 million ($0.2 million GF Misc., $0.5 million Measure BB) |
| 2026-30 | Core Projects: Annual Facility Replacement and Annual Storm | $3.2 million Various Sources |
| | **TOTAL** | **$16.7 million** |

## PROGRAM FINANCIAL OVERVIEW

A summary of available annual financial resources (including beginning balances) and recommended annual expenditures are listed in the tables below. Summary financial tables showing all recommended projects and available funding are included at the end of this section. All project expenditures and revenues segregated by source are included in the detailed financial tables located in the respective CIP project category.

All revenues identified below—development fees, gas taxes, grants, interest earnings, and General Fund—are projected based on staff estimates in the year they are expected to be received. As indicated previously, staff utilizes the Mid-Term Budget Review process to make any adjustments necessary to address fluctuations in estimated revenues or project expenditures that ensures the capital budget accurately reflects project development.

In addition, the table incorporates staff recommendations for the defunding of existing projects so the funding can be reprogrammed under the new prioritization process. General Fund projects intended to be defunded are a result of the sunset clause in the CIPPP, and water and sewer projects recommended to be defunded are to be reprogrammed under the updated master plans.

| Existing CIP Defunding | |
|---|---|
| **Category** | **FY 2024/25** |
| **Transportation & Streets** | **$382,229** |
| **Facilities** | **$1,306,774** |
| **Parks** | **$692,912** |
| **Water** | **$1,355,290** |
| **Sewer** | **$3,192,500** |
| **Storm** | **$4,237,744** |
| **TOTAL** | **$11,167,449** |

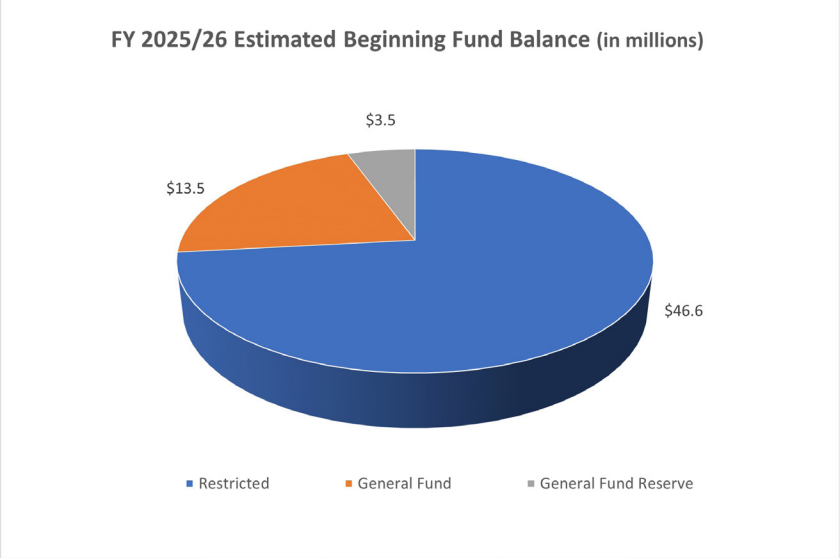
A summary of available annual financial resources (including beginning balances) and recommended annual expenditures by project category are listed in the following table.

## SOURCES OF FINANCIAL RESOURCES, EXPENDITURES, AND FUND BALANCES[1]

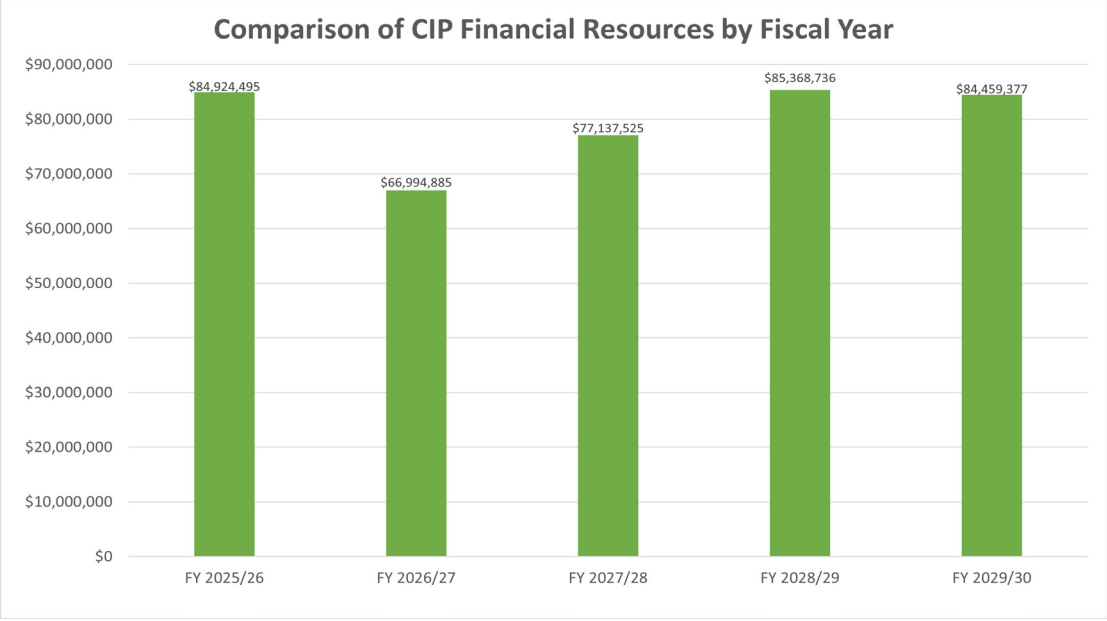
| | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 | Total |
|---|---|---|---|---|---|---|
| **Beginning Fund Balance*** | **$63,617,246** | **$29,671,137** | **$33,684,603** | **$33,194,307** | **$35,349,818** | **$63,617,246** |
| **Revenue Category** | | | | | | |
| Gas Tax, Measure BB & Highway Funds | $7,068,556 | $7,211,994 | $7,359,368 | $7,464,875 | $7,594,005 | $36,698,798 |
| City Development Fees | - | - | - | 500,000 | 815,000 | 1,315,000 |
| Grants and Miscellaneous | 2,571,355 | 1,253,760 | 1,253,760 | 1,253,760 | 1,253,760 | 7,586,395 |
| Annual General Fund Contribution | 7,221,000 | 9,391,000 | 9,560,000 | 9,726,000 | 9,892,000 | 45,790,000 |
| Transfer In from Other Funds | 1,534,894 | 2,034,894 | 10,259,894 | 9,709,894 | 15,534,894 | 39,074,470 |
| Interest Earnings | 2,057,889 | 2,432,100 | 2,019,900 | 2,019,900 | 2,019,900 | 10,549,689 |
| Anticipated Debt Proceeds | 853,555 | 15,000,000 | 13,000,000 | 21,500,000 | 12,000,000 | 62,353,555 |
| **Total Resources** | **$84,924,495** | **$66,994,885** | **$77,137,525** | **$85,368,736** | **$84,459,377** | **$266,985,153** |
| **Expenditures and Reserves** | | | | | | |
| Facilities | $2,032,154 | $325,000 | $265,000 | $525,000 | $525,000 | $3,672,154 |
| Parks | 3,746,477 | 1,069,000 | 130,000 | 120,000 | 220,000 | 5,285,477 |
| Sewer | 3,750,000 | 1,460,000 | 7,600,000 | 13,070,000 | 13,610,000 | 39,490,000 |
| Storm Drain | 1,900,000 | 200,000 | 200,000 | 200,000 | 200,000 | 2,700,000 |
| Transportation and Streets | 31,087,735 | 8,012,500 | 8,475,000 | 9,237,500 | 10,525,000 | 67,337,735 |
| Water | 3,210,000 | 14,820,000 | 19,905,000 | 19,556,000 | 13,356,500 | 70,847,500 |
| Miscellaneous | 8,268,906 | 6,141,000 | 6,060,000 | 5,976,000 | 5,892,000 | 32,337,906 |
| **Capital Expenditures** | **$53,995,272** | **$32,027,500** | **$42,635,000** | **$48,684,500** | **$44,328,500** | **$221,670,772** |
| Other Expenditures | $1,258,086 | $1,282,782 | $1,308,218 | $1,334,418 | $1,361,403 | $6,544,907 |
| **Total Expenditures** | **$55,253,358** | **$33,310,282** | **$43,943,218** | **$50,018,918** | **$45,689,903** | **$228,215,679** |
| **Projected Ending Fund Balance** | **$29,671,137** | **$33,684,603** | **$33,194,307** | **$35,349,818** | **$38,769,474** | **$38,769,474** |

*Represents the beginning unappropriated amount for each fiscal year.

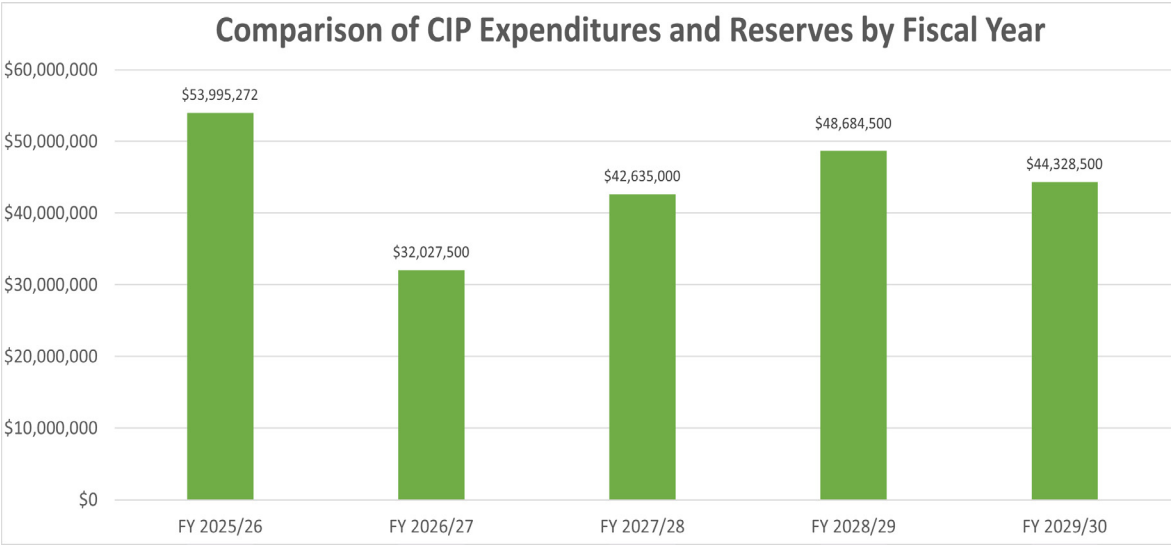
[1] To accurately reflect the amount of financial resources available each year by category, the above annual dollar amounts include all available resources for each year including beginning fund balances. However, the "Total" column has been adjusted to reflect only the FY 2025/26 beginning fund balance. Similarly, for ending fund balances, the "Total" column reflects only the FY 2029/30 ending fund balance. As a result, the "Total" column does not equal the sum of the individual years.




Total available financial resources, including unappropriated beginning fund balances and transfers, projected in the Proposed Capital Budget, representing the first two years of the CIP, are approximately $84.9 million for FY 2025/26 and $67.0 million for FY 2026/27, respectively. A total of $63.6 million is in the beginning fund balance, which includes $18.1 million in capital project reserves and $11.2 million from the proposed defunding of FY 2024/25 projects. For the first two years of the CIP, the General Fund contribution is approximately $7.2 million for FY 2025/26 and $9.4 million for FY 2026/27. General Fund contribution reflects funds set aside to address deferred maintenance needs and items from the anticipated Asset Management Plan. The following chart provides a graphic representation of a comparison of total financial resources between the five years of the CIP.



Total capital expenditures and reserves recommended in the first two years of this CIP are approximately $54.0 million for FY 2025/26 and $32.0 million for FY 2026/27 for a total of $86.0 million over the two funded years of the CIP and a total of $221.7 million over all five years. The chart below provides a graphic representation of a comparison of the CIP expenditures and reserves in each of the five years. For FY 2025/26, the reserve projects account for approximately $18.1 million. Other expenditures, such as interfund indirect costs and payments to the California State Water Resources Control Board for its State Revolving Fund Loan, total approximately $6.5 million over the five-year period.




## SUMMARY OF THE MAJOR REVENUE SOURCES

### Beginning Balances

Initial beginning balances are based on FY 2024/25 estimated ending fund balances that will be available July 1, 2025. Subsequent beginning fund balances are a combination of prior year beginning fund balances plus estimated revenues less expenditure allocations. The estimated beginning balance, representing the unappropriated amount not counting existing project reserves, for all project categories for this CIP is $63.6 million. While the beginning balances represent funds that have not been specifically appropriated, each beginning fund balance reflects individual funds within each CIP project category, and as such, portions of the fund balances are restricted and earmarked for specific future uses.

As part of the Capital Budget and CIP development process, staff examined the current fiscal year capital budget for all the existing projects and identified a series of budget adjustments based on revised revenue projections and project priorities. These recommended adjustments, presented to the City Council at its April 10, 2025 meeting, focused mainly on capital projects funded by the General Fund. Included in the Proposed Capital Budget and CIP is a comprehensive set of recommended adjustments also for other capital funds. It should be noted that fund balance calculations account for these recommended adjustments.

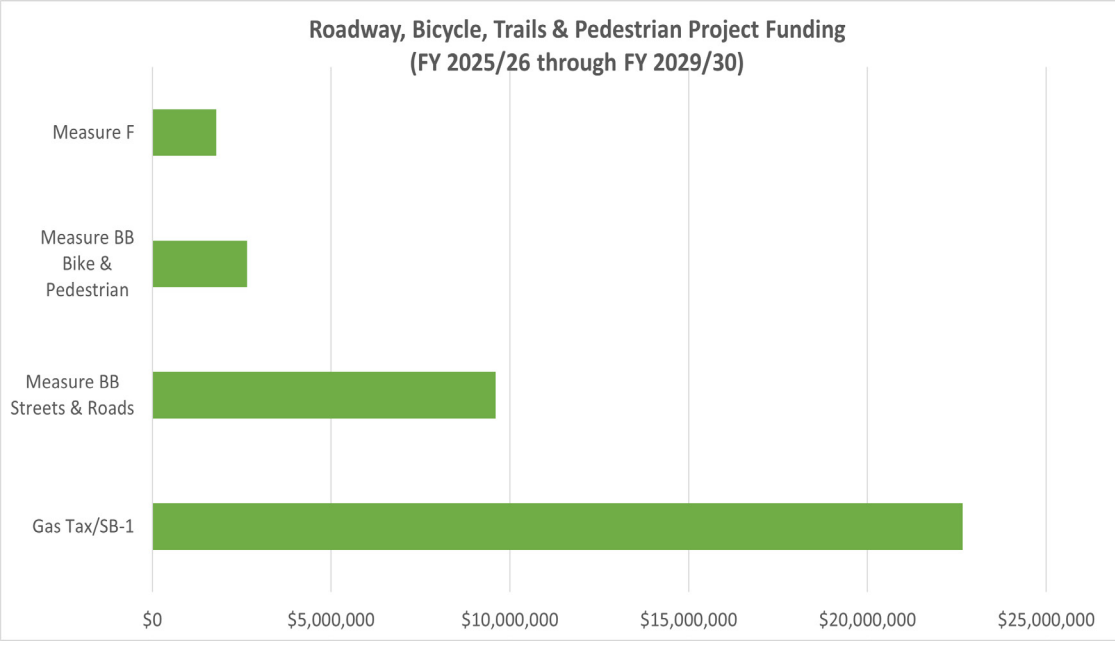
## State and Local Gas Tax and Highway Related Revenue

Gas Taxes and highway related revenue are used for street repairs and improvements and placed in the Transportation and Streets section of the CIP. In addition to the Gas Tax collected annually from the state gas taxes, this CIP includes funding from Measure BB, Measure F Vehicle Registration Fee (VRF) Program, and grants. Gas Tax revenues are allocated annually to cities on a statewide allocation formula which is based primarily on population. These funds, which can be used for new construction or repair and maintenance of existing street systems or street lighting, are determined by the amount of gas sold in the state. A summary of Transportation and Street related revenue anticipated is detailed below.

In general, ongoing street maintenance revenues, including Gas Tax, Measure BB, and Measure F, are expected to remain the same over the next five years. The table below details all street maintenance, bicycle, trails, and pedestrian funds, excluding development impact fees and beginning balances included in the CIP. In addition to the funding below, the City will receive $1.2 million annually from Pleasanton Garbage Service for vehicle impact fees that are being applied toward the streets program.

**SUMMARY OF ROADWAY, BICYCLE, TRAILS, AND PEDESTRIAN FUNDING**

| Fund Source | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 | Total |
|---|---|---|---|---|---|---|
| Measure BB Bike & Pedestrian | $520,307 | $525,562 | $530,870 | $536,232 | $541,648 | $2,654,619 |
| Measure BB Streets & Roads | 1,879,515 | 1,899,814 | 1,920,332 | 1,941,072 | 1,962,036 | 9,602,769 |
| Measure F | 356,591 | 356,591 | 356,591 | 356,591 | 356,591 | 1,782,955 |
| Gas Tax/SB-1 | 4,312,143 | 4,430,027 | 4,551,575 | 4,630,980 | 4,733,730 | 22,658,455 |
| **Total** | **$7,068,556** | **$7,211,994** | **$7,359,368** | **$7,464,875** | **$7,594,005** | **$36,698,798** |



## Local Development Fees

This category of revenue consists of fees collected by the City to offset the impact of new development. The major sources and expected revenue from these sources are as follows:

**LOCAL DEVELOPMENT RELATED FEES**

| Fund Source | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 | Total |
|---|---|---|---|---|---|---|
| Capital Facilities Fees | - | - | - | $500,000 | $500,000 | $1,000,000 |
| Traffic Impact Fees | - | - | - | - | 315,000 | 315,000 |
| **Total** | **-** | **-** | **-** | **$500,000** | **$815,000** | **$1,315,000** |

Development fee revenue included in this CIP reflects those new residential and commercial projects that are in the process of receiving final City Council approvals, including approved planned unit developments. Revenues from development projects that are currently under initial review or those that are in the early planning stages are not included in the CIP. Notwithstanding this, since the City does not control the timeline for these developments, the development fee projections are staff's best estimate of anticipated development activity for the next five years, and even approved projects may be affected by the economy and the health of the housing and construction industry that is generally outside the City's purview.

Effective January 1, 2025, Senate Bill 937 defers the collection of development impact fees, moving the collection from the issuance of building permits to the final inspection or the certificate of occupancy, whichever occurs first. This change will delay the anticipated revenue from development impact fees, including traffic impact fees, making new development impact fees available for this cycle in the outer years of the capital program. Revenue projections for City development contributions, sewer connection fees, water connections fees and Tri-Valley Transportation Fee are impacted by the change in collection date; these amounts are minimal if any are anticipated at this time. Staff will be monitoring development-related fees and will update the projections as part of the Mid-Term Budget Review if needed.

## Transfers from the General Fund

The CIP includes a proposed General Fund contribution of approximately $45.8 million over the five-year period from FY 2025/26 to FY 2029/30, including approximately $30.3 million for deferred maintenance and $15.5 million for CIP projects. The proposed allocation to address deferred maintenance that is identified in the Asset Management Plan by fiscal year includes approximately $6.2 million in FY 2025/26, $6.1 million in FY 2026/27, $6.1 million in FY 2027/28, $6.0 million in FY 2028/29 and $5.9 million in FY 2029/30. The proposed General Fund contribution of $15.5 million to CIP projects by fiscal year includes approximately $1.0 million in FY 2025/26, $3.2 million in FY 2026/27, $3.5 million in FY 2027/28, $3.8 million in FY 2028/29 and $4.0 million in FY 2029/30. The contribution in FY 2025/26 is only $1.0 million due to the diversion of $2.0 million to the Repair and Replacement (R&R) Program to extend the service life of the Dolores Bengtson Aquatic Center, continue to operate Fire Station #2, and replace high-use segments of the Bernal Synthetic Fields.

**GENERAL FUND CONTRIBUTIONS TO THE CIP**

| FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 | Total |
|---|---|---|---|---|---|
| $7,221,000 | $9,391,000 | $9,560,000 | $9,726,000 | $9,892,000 | $45,790,000 |

Historically, the General Fund contribution has been used for a full range of Facilities, Parks Miscellaneous and Street projects, and the CIP will continue this practice. Some of the projects that will be funded through the General Fund contributions include West Las Positas Boulevard Multimodal Reconstruction, Library Fire Alarm Replacement, and Non-Functional Turf Replacement.

An internal assessment estimated $900 million in CIP and Repair & Replacement needs over the next decade, prior to the implementation of the Asset Management Program, to maintain infrastructure and other assets in a "state of good repair". The Asset Management Plan is scheduled to be completed by year-end 2025 and will provide a complete asset list with high-level condition assessment and a prioritized implementation plan linked to a long-term funding strategy. Staff may provide additional recommendations to adjust the FY 2026-2030 Capital Improvement Program during the two-year budget cycle, based on the results of the Asset Management Plan. Refer to Appendix A for a listing of unfunded projects.

## SUMMARY OF CIP EXPENDITURES

The CIP includes a total of 40 capital projects recommended for funding during the five years of this CIP and reappropriating funding for 18 reserve projects in FY 2026/27. The Proposed Capital Budget for the next two years includes approximately $54.0 million and $32.0 million in expenditures for capital and reserve projects in FY 2025/26 and FY 2026/27, respectively, for a total of $86.0 million. Total five-year anticipated expenditures for capital projects in the CIP are estimated at $221.7 million. It should be noted that Other Expenditures of approximately $2.5 million in the first two years, and $6.5 million over a five-year period, consist of interfund transfers for operating costs and payments of approximately $2.2 million for the California State Water Resources Control Board State Revolving Fund Loan. Combined, the overall expenditure included in the CIP is $228.2 million over a five-year period, including $62.4 million in anticipated debt for sewer and water enterprise projects to help meet regulatory compliance and system health.

A summary of the major funded projects is below:

### Transportation and Streets

- $35.6 million for the West Las Positas Boulevard Multimodal Reconstruction: $17.0 million for the five-year CIP and an estimated $18.6 million in current funding for the pavement reconstruction project. Phase 1 will be between Willow Road to Stoneridge Drive, reconstructing or replacing portions of the roadway and sidewalk, including pedestrian, bicycle, and transit improvements.

- $22.7 million for Annual Street Resurfacing & Reconstruction: the first year's funding is being applied toward West Las Positas Boulevard Multimodal Reconstruction. In recent years, funding for this project has generally ranged between $3.0 million and $4.0 million. The addition of the Pleasanton Garbage Service vehicle impact fee with proposed annual funding of approximately $6.0 million over the five-year period will allow the City to improve the maintenance for local roads and streets. The actual streets to be resurfaced will be determined following an update to the City's pavement management system. Notwithstanding this funding, staff anticipates that additional street maintenance funding will be needed in the future to meet ongoing street maintenance needs to maintain the current pavement condition index.

- $11.3 million over a five-year period for various street related maintenance and improvement projects, including Annual Slurry Sealing of Various Streets ($6.0 million), Annual Curb & Gutter & ADA Ramp ($3.6 million), Annual Sidewalk & ADA Ramp ($0.8 million) for installation of curb and gutter and ADA curb ramps, Annual Safety Improvements at Various Locations ($0.6 million), and Annual Traffic Buttons & Line Markers Installation ($0.3 million). These funded amounts are consistent with funding in recent years.

- $1.3 million for Bi-Annual Traffic Signal Installations for traffic signals at various locations to be determined consistent with the General Plan and the City traffic improvement fees. Signal locations will be presented to the City Council prior to awarding a contract for design and installation.

- $1.3 million for Annual Bicycle & Pedestrian Improvements at various locations.

### Parks

- $1.1 million for the Nonfunctional Turf Conversion for Assembly Bill 1572, which aims to convert approximately 2.4 acres of nonfunctional turf across 11 locations within the city for mulching or installation of drought-tolerant plantings.

- $0.7 million over five years for Park Trail & Pathway Resurfacing Program to repair and resurface park trails and pathways on various city parks and properties that were identified as priorities in the Trails Master Plan or by staff.

### Miscellaneous

- There is one new miscellaneous project, Deferred Maintenance – Asset Management Plan, for approximately $30.3 million over a five-year period. The annual amount/contribution from the General Fund ranges from $5.9 million to $6.2 million. The funds are required to address deferred maintenance needs and fund critical projects from the Asset Management Plan, which is expected to be completed at the end of 2025.

### Water and Sewer

- $26.0 million for the City Ground Water Supply Project, $22.0 million for the five-year CIP and $4.0 million in current funding to install new wells and recover the City's groundwater production quota.

- $22.7 million combined for sewer lift station improvements and sewer siphons repairs includes Sunol Boulevard Sewer Improvements ($1.6 million), Amberwood Siphon Replacement ($3.3 million), Sewer Lift Station 5 Replacement ($6.1 million), Bernal Avenue Sewer Improvements – Tawny Drive to Nevada St. ($3.3 million), Sewer Lift Station Improvements at LS-2, 7, and 8 ($1.4 million), Sewer Pipe Improvements at Kamp Drive & Stoneridge Drive, Stoneridge Mall ($6.1 million), and Sewer Lift Stations Improvements at LS-4,12,13 and 15 repairs and improvements ($0.9 million) over a five-year period.

- $11.6 million over five years is a combined total for both water and sewer emergency power improvements to protect the City's utility systems from an increasing risk of power outages.

- $11.3 million over the five-year period for Annual Sewer Inspection System Improvements for collection system repairs and replacement to increase capacity and replace aging pipelines.

- $10.9 million over the five-year period for Water Meter and AMI System Replacement to replace and upgrade the City's Advanced Metering Infrastructure (AMI) for water.

- $8.7 million over the five-year period for Annual Water Distribution System Improvements for the replacement and upgrade of piping, valves, and other appurtenances as recommended in the City's Water System Management Plan.

- $8.0 million combined for Water Tank Inspections & Repairs Program ($1.3 million), Water Tank 1300 Rehabilitation ($3.0 million), the Grey Eagle Pump Station Replacement ($2.2 million), and the Foothill Pump Station Rehabilitation ($1.5 million).

- $13.6 million over a three-year period (FY 2027/28, FY 2028/29 and FY 2029/30) for the Kilkare and Sunol Fire Flow Improvements Program to improve service levels and reduce operating and maintenance costs while enhancing fire flow capacity and customer capacity and replacing aging pipelines.

- $1.2 million in FY 2028/29 for the Supervisory Control and Data Acquisition (SCADA) Communications Network Improvement to the communication network system for the City.

### Storm Drain

- $2.2 million in funding for the Storm System Management Plan, $1.7 million for the five-year CIP and an estimated $0.5 million in current funding to complete all the necessary field inspections and develop a comprehensive plan to make the enterprise fund self-sustaining.

- $1.0 million over the five-year period for annual storm drain repair and replacement.

### Facilities

- $2.2 million over the five-year period for the Annual Facility Replacement Project that will replace aging roofs, insulation, and HVAC systems across multiple City-owned buildings and facilities and develop a Facility Use Master Plan that will identify and plan for the efficient use of City assets.

- $0.8 million for the replacement of the fire alarm system at the City library.

## CONCLUSION

This CIP presents a wide range of capital projects that will address many community interests and needs, including necessary maintenance of existing infrastructure and new critical projects. In many ways, this CIP focuses on balancing the need for ongoing infrastructure maintenance while addressing new needs and priorities. However, as presented to the City Council at the April 10, 2025 meeting, challenges remain due to unfunded and deferred capital projects requiring significant additional resources over the next several years. With the completion of the Asset Management Plan at the end of 2025, the funding gap for deferred maintenance and critical projects is expected to be significant, as previously identified by staff over two years ago.

To address ongoing capital needs, staff will continue to rely on the City Council's comprehensive priority setting process that integrates with the City's strategic plan that identifies and prioritizes key projects and programs. In addition, staff and the City Council will continue exploring opportunities for revenue enhancements and new revenue streams to ensure the City is well-maintained with infrastructure and facilities that meet community needs.

Staff is confident that this plan addresses the City's immediate current capital improvement requirements and through the collective efforts of the City Council and the community, these future challenges will be met in a way that maintains the high quality of existing streets, facilities, and utility infrastructure and allows for the development of new infrastructure and facilities in a cost efficient and effective manner.

Respectfully submitted,



Gerry Beaudin
City Manager

FY 2025/26 - FY 2029/30

# Capital Improvement Plan Revenues

Capital Improvement Program

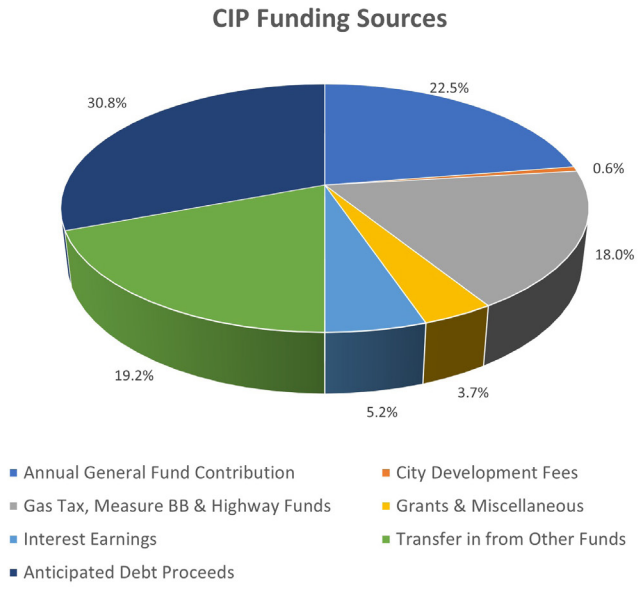
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# Capital Improvement Plan Revenues

The Capital Improvement Plan (CIP) is projected to receive approximately $203.4 million in revenue over the five-year span.[1] This amount is derived from different sources that pay for the CIP projects. This section highlights the categories and composition of these revenue sources.

## General Fund

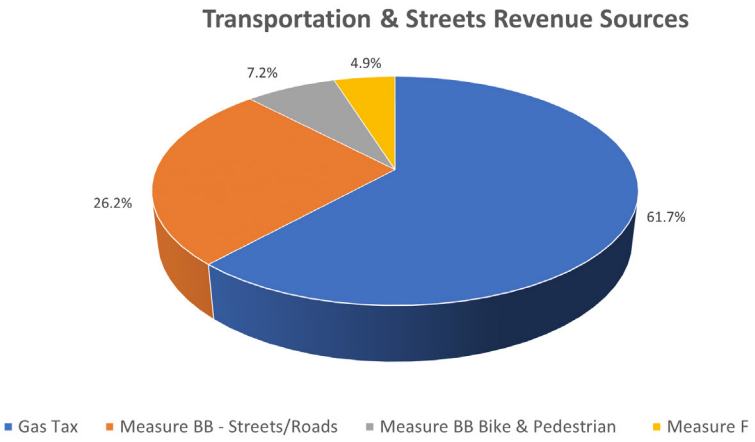
The General Fund is the City's unrestricted fund that captures a variety of taxes, including Property Tax, Sales Tax, Transient Occupancy Tax (TOT), and Business License Tax. It also includes fees for services, franchise fees, interest income and other sources. While most of these revenues are used to fund operations, the General Fund annually contributes to the CIP for construction and improvements on City-owned facilities and infrastructure. These General Fund contributions are either directly allocated to projects or held in reserve for future projects as they complete the design phase. The General Fund represents approximately 22.5 percent of the total CIP revenues.




## Transportation & Street Funds

Transportation funds are a collection of revenues and resources that are restricted in use to street repairs and improvement projects only. The biggest contributor to transportation funds is the Gas Tax, including SB-1 funds, followed by Measure BB.

[1] Beginning fund balances are also a major funding source for the CIP. The total estimated beginning fund balance for all capital funds in FY 2025/26 is $63.6 million and represents a cumulative total of unappropriated funds based on prior year revenues from all of the sources discussed in this section. Subsequent estimated beginning fund balances are a combination of prior year beginning fund balances plus estimated revenues less expenditures.

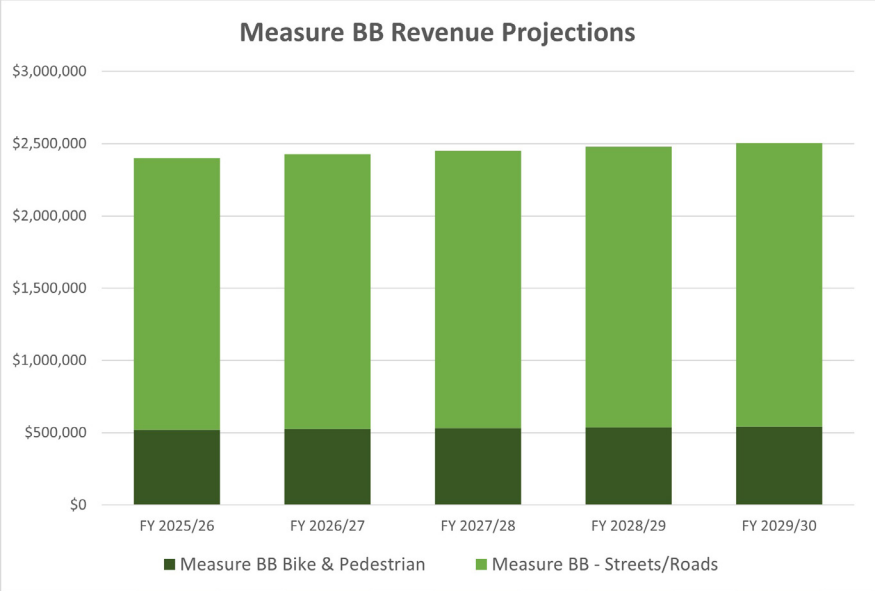



**Gas Tax** typically refers to the tax that the State of California charges on the sale of gasoline. Most, if not all, of this tax is passed along to drivers and charged per gallon on sales at the pump. Gas tax revenues are allocated annually to cities on a statewide allocation formula which is based primarily on population. These funds, including SB-1 funding can be used for new construction or repair and maintenance of existing street systems or street lighting, and are determined by the amount of gas sold in the state. Gas taxes make up approximately 61.7 percent of the transportation funds and are placed in a special capital fund. Funds are monitored and dispersed appropriately to various Transportation and Streets capital projects based on gas tax regulations.

In addition to the Gas Tax collected annually from the State of California gas taxes, the Transportation funds include funding from several local measures.

**Measure BB** was established in 2014 and added another half-cent sales tax to the initial measure and extended it to 2045. Measure BB increased to one cent on July 1, 2022, when Measure B expired on March 31, 2022. This tax is administered by the Alameda County Transportation Commission (ACTC).

**Measure BB** makes up for approximately 33.4 percent of the transportation funds and is tracked in two separated funds, Measure BB – Streets & Roads Fund and Measure BB – Bikes & Pedestrian Fund. The City receives approximately $2.4 million combined revenue for the measure with about one percent growth annually. This revenue is split between street/road projects and bike/pedestrian projects at about 78 percent and 22 percent, respectively. These funds are passed-through based and are used for capital projects based on priority projects as determined by the City.




**Measure F**, also known as the Vehicle Registration Fee (VRF) program, was approved by voters in 2012. This program collects a $10 per year vehicle registration fee, which is dedicated to Alameda County's transportation network improvements with the aim of reducing traffic congestion and pollution. ACTC also administers this program and provides funding allocations to local municipalities in the County. Measure F makes up for approximately 4.9 percent of the transportation funds. The City uses Measure F funds toward local streets and transportation related capital projects.

## Development Impact Fees

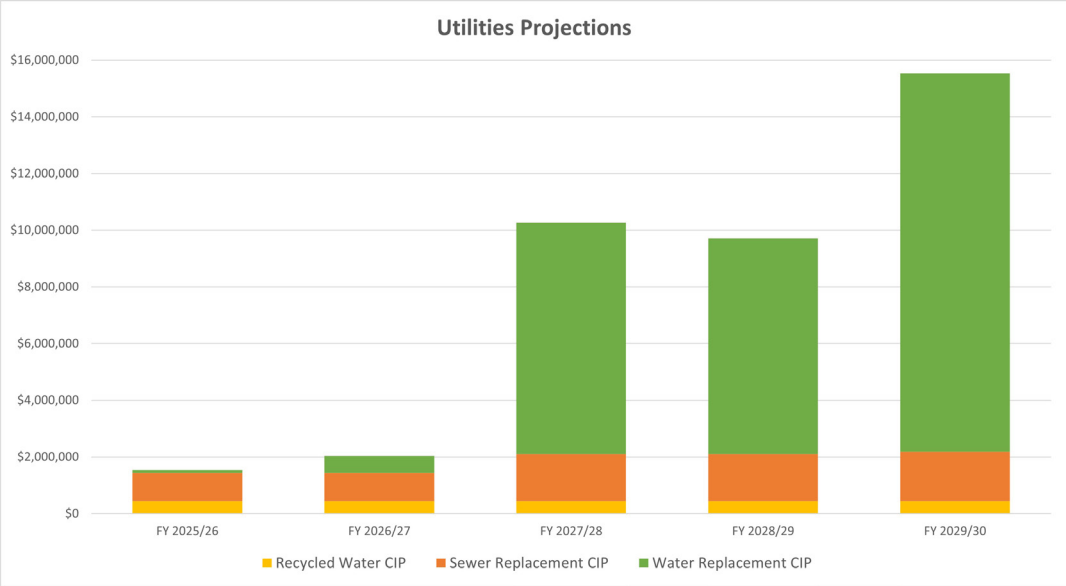
The CIP includes funding from the City's development impact fees like the Capital Facilities Fee, Transportation Improvement Fees, and non-city fees such as the Tri-Valley Transportation Fee. Combined, these development-related fees comprise 0.6 percent of the CIP funding sources.

Impact fees are one-time charges on new development collected and used by the City to cover the cost of capital facilities and infrastructure that is required to serve new residential and commercial growth. Impact fees were previously collected upon issuance of a building permit, but with the passage of Senate Bill 937, the fees are now collected at the time of the issuance of the certificate of occupancy; this effectively delays the fee collection schedule and sets the fee collection trigger at the completion of the project. If the project does not reach the certificate-of-occupancy milestone for any reason, the City will not be able to collect the fee for services rendered. Fees from new development where permits have been issued are projected in FY 2028/29 and FY 2029/30 to reflect this change and are subject to economic conditions. The City currently has an established impact fee program that specifies areas of use and restricts the maximum Capital Facility Fees use on future projects at 22.7 percent, although it is now available for most future projects under the identified areas of use, which include:

- Public Facility Fees that fund:
  - Parks & Recreation Facilities
  - Public Facilities, including fire stations, public safety training facilities, the City library, downtown parking, and the Civic Center
- Transportation Improvements under the Traffic Impact Fee program can be funded at 100 percent.

## Transfers In from Other Funds

This revenue category, which accounts for 19.2 percent of the total projected revenues, consists of various transfers from funds other than the General Fund. Contributions are from the Utility Enterprise Funds for approximately $39.1 million over a five-year period. Normally, these utility funds make annual contributions based on revenues generated from City-operated utilities like Water, Recycled Water, Sewer, and Storm Drain. While most of these revenues are used to fund the utility operations, a portion is transferred to the capital funds annually to pay for infrastructure maintenance and improvement projects directly related to these utilities. However, due to operating funding challenges in these utility programs, the collected revenues fall far short of the operating and improvement costs, resulting in annual enterprise funding deficits. The Water Rate Study, based on the Water System Management Plan (WSMP) and identified projects, is working to establish new, increased water user rates that will account for inflation, asset maintenance, and end-of-useful-life replacement, among other factors, ensuring funding resources for future replacement and improvement needs. A sewer rate study will be undertaken to account for the capital projects that will be identified in the Sanitary Sewer Management Plan, and rate increases are anticipated to bring in the necessary revenue to support the recommended CIP program.

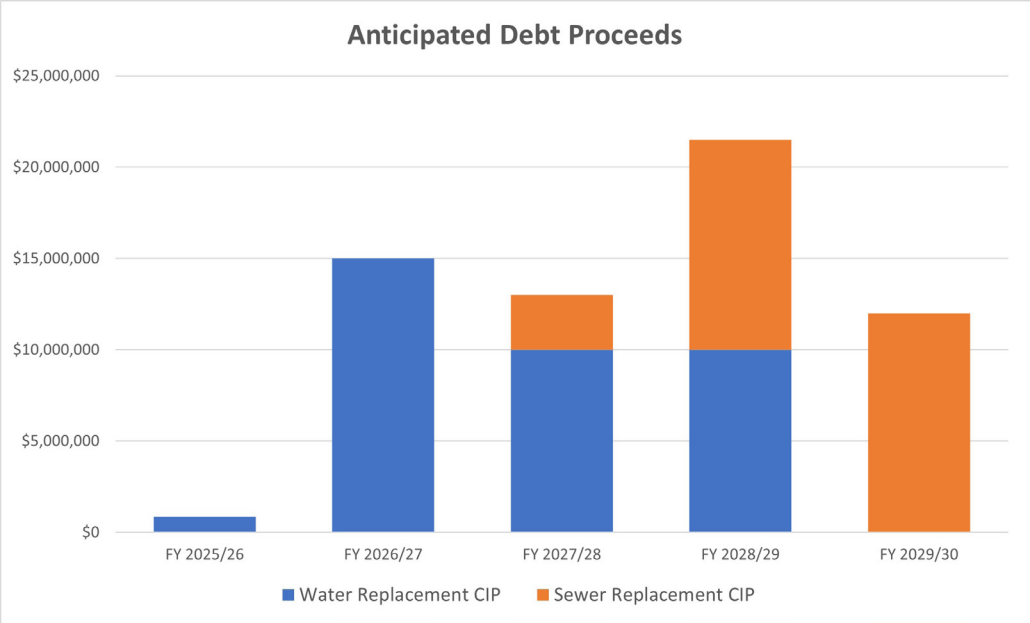



## Other Revenue Sources

These CIP funding categories consist of smaller sources, including interest earnings on fund balances of all CIP funds, miscellaneous grants, transportation grants, and the Pleasanton Garbage Service Vehicle Impact Fees. The Pleasanton Garbage Service Impact Fees are approximately $1.2 million per fiscal year and $6.0 million over the next five years. The combined contribution of these categories to the CIP is 8.9 percent, where 3.7 percent comes from Grants and Miscellaneous, and 5.2 percent comes from interest earnings.

## Anticipated Debt Proceeds

Existing and proposed debt financing is necessary to support the water and sewer enterprise capital programs to ensure regulatory compliance and system health. This CIP funding category consists of approximately $0.9 million in appropriations from the 2024 Water Revenue Bond in FY 2025/26 for unappropriated bond proceeds, $35.0 million for Water, and $26.5 million for Sewer related projects in anticipated debt proceeds for FY 2026/27 to FY 2029/30. The combined contribution of these categories to the CIP is 30.8 percent, where 13.0 percent is for the Sewer Replacement CIP and 17.8 percent is for the Water Replacement CIP.



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FY 2025/26 - FY 2029/30

# Summary Financial Tables

Capital Improvement Program

# CIP Fund Balance Summary - All Funds

| | | | FY 2025/26 | | | FY 2026/27 | | |
|---|---|---|---|---|---|---|---|---|
| Fund | Fund Description | Beginning Balance | Estimated Revenue | Estimated Expenditure | Year-End Fund Balance | Estimated Revenue | Estimated Expenditure | Year-End Fund Balance |
| 160 | Gas Tax | $914,020 | $4,440,043 | $4,830,000 | $524,063 | $4,583,427 | $3,862,500 | $1,244,990 |
| 161 | Marilyn Kane Trail Reserve | 120,793 | 2,100 | - | 122,893 | 2,600 | - | 125,493 |
| 162 | Miscellaneous CIP Grants | (281,981) | 1,275,000 | 1,275,000 | (281,981) | - | - | (281,981) |
| 163 | Measure B Bike & Pedestrian | 182,011 | 7,989 | 190,000 | - | - | - | - |
| 165 | Measure BB Bike & Pedestrian | 702,796 | 560,507 | 675,000 | 588,303 | 573,762 | 580,000 | 582,065 |
| 166 | Measure F | 27,290 | 367,791 | 350,000 | 45,081 | 369,991 | 400,000 | 15,072 |
| 167 | Specific Plans | 886,118 | 15,700 | 133,902 | 767,916 | 18,900 | - | 786,816 |
| 170 | Measure BB - Streets/Roads | 515,640 | 1,937,715 | 2,350,000 | 103,355 | 1,969,614 | 1,900,000 | 172,969 |
| 172 | Transportation Development Grant | 120,728 | 42,595 | 42,595 | 120,728 | - | - | 120,728 |
| 173 | JDEDZ Transportation Fee | 1,027,034 | 2,000 | 1,027,034 | 2,000 | 2,400 | - | 4,400 |
| 201 | Miscellaneous CIP-Gen | 7,585,261 | 7,732,200 | 12,474,703 | 2,842,758 | 10,004,500 | 6,481,000 | 6,366,258 |
| 202 | Downtown & North Pleas CIP | 408,686 | 90,000 | 430,000 | 68,686 | 60,000 | - | 128,686 |
| 203 | Capital Facilities Impact Fees | 1,889,887 | 17,800 | 937,000 | 970,687 | 21,300 | 74,000 | 917,987 |
| 204 | Misc Developer Contributions | 601,281 | 11,300 | - | 612,581 | 13,600 | - | 626,181 |
| 211 | Street CIP - Gen | 6,329,912 | 1,368,860 | 7,308,462 | 390,310 | 1,403,960 | 1,300,000 | 494,270 |
| 212 | Traffic Impact Fees | 1,916 | 191,100 | - | 193,016 | 229,300 | - | 422,316 |
| 214 | Trivalley Transportation | 2,419,666 | 41,600 | 1,852,522 | 608,744 | 58,200 | - | 666,944 |
| 215 | Streets Developer Contribution | 7,069,616 | 125,200 | 6,673,219 | 521,597 | 150,200 | - | 671,797 |
| 221 | Park CIP - Gen | 3,079,659 | 39,900 | - | 3,119,559 | 47,900 | 850,000 | 2,317,459 |
| 222 | Park Development Impact Fees | 6,698,013 | 171,000 | 4,435,834 | 2,433,179 | 205,200 | 100,000 | 2,538,379 |
| 223 | Parks Developer Contributions | 463,695 | 6,000 | - | 469,695 | 7,200 | - | 476,895 |
| 241 | Sewer Developer Contributions | 43,310 | 800 | - | 44,110 | 900 | - | 45,010 |
| 421 | Water Replacement CIP | 3,861,874 | 1,048,055 | 3,773,500 | 1,136,429 | 15,713,400 | 13,130,605 | 3,719,224 |
| 422 | Water Connection Fees | 4,218,082 | 74,700 | - | 4,292,782 | 89,700 | 2,116,800 | 2,265,682 |
| 426 | Recycled Water CIP | 284,256 | 434,894 | 484,894 | 234,256 | 434,894 | 484,894 | 184,256 |
| 431 | Sewer Replacement CIP | 7,000,705 | 1,207,700 | 4,081,134 | 4,127,271 | 1,249,200 | 1,801,068 | 3,575,403 |
| 432 | Sewer Connection Fees | 3,128,899 | 57,400 | 28,558 | 3,157,741 | 68,800 | 29,415 | 3,197,126 |
| 441 | Storm Drain Replacement/Renov | 4,318,075 | 37,300 | 1,900,000 | 2,455,375 | 44,800 | 200,000 | 2,300,175 |
| | **Total** | **$63,617,246** | **$21,307,249** | **$55,253,358** | **$29,671,137** | **$37,323,748** | **$33,310,282** | **$33,684,603** |

| FY 2027/28 | | | FY 2028/29 | | | FY 2029/30 | | |
|---|---|---|---|---|---|---|---|---|
| Estimated Revenue | Estimated Expenditure | Year-End Fund Balance | Estimated Revenue | Estimated Expenditure | Year-End Fund Balance | Estimated Revenue | Estimated Expenditure | Year-End Fund Balance |
| $4,679,475 | $4,015,000 | $1,909,465 | $4,758,880 | $5,162,500 | $1,505,845 | $4,861,630 | $5,600,000 | $767,475 |
| 2,100 | - | 127,593 | 2,100 | - | 129,693 | 2,100 | - | 131,793 |
| - | - | (281,981) | - | - | (281,981) | - | - | (281,981) |
| - | - | - | - | - | - | - | - | - |
| 571,070 | 1,010,000 | 143,135 | 576,432 | 635,000 | 84,567 | 581,848 | 345,000 | 321,415 |
| 367,791 | 380,000 | 2,863 | 367,791 | 360,000 | 10,654 | 367,791 | 300,000 | 78,445 |
| 15,700 | - | 802,516 | 15,700 | - | 818,216 | 15,700 | - | 833,916 |
| 1,978,532 | 2,000,000 | 151,501 | 1,999,272 | 2,000,000 | 150,773 | 2,020,236 | 2,000,000 | 171,009 |
| - | - | 120,728 | - | - | 120,728 | - | - | 120,728 |
| 2,000 | - | 6,400 | 2,000 | - | 8,400 | 2,000 | - | 10,400 |
| 10,071,200 | 6,265,000 | 10,172,458 | 10,237,200 | 6,382,000 | 14,027,658 | 10,403,200 | 6,298,000 | 18,132,858 |
| 60,000 | - | 188,686 | 60,000 | - | 248,686 | 60,000 | - | 308,686 |
| 17,800 | 60,000 | 875,787 | 517,800 | 119,000 | 1,274,587 | 517,800 | 119,000 | 1,673,387 |
| 11,300 | - | 637,481 | 11,300 | - | 648,781 | 11,300 | - | 660,081 |
| 1,368,860 | 1,200,000 | 663,130 | 1,368,860 | 1,200,000 | 831,990 | 1,368,860 | 1,200,000 | 1,000,850 |
| 191,100 | - | 613,416 | 191,100 | - | 804,516 | 506,100 | 1,300,000 | 10,616 |
| 41,600 | - | 708,544 | 41,600 | - | 750,144 | 41,600 | - | 791,744 |
| 125,200 | - | 796,997 | 125,200 | - | 922,197 | 125,200 | - | 1,047,397 |
| 39,900 | - | 2,357,359 | 39,900 | - | 2,397,259 | 39,900 | - | 2,437,159 |
| 171,000 | - | 2,709,379 | 171,000 | - | 2,880,379 | 171,000 | - | 3,051,379 |
| 6,000 | - | 482,895 | 6,000 | - | 488,895 | 6,000 | - | 494,895 |
| 800 | - | 45,810 | 800 | - | 46,610 | 800 | - | 47,410 |
| 18,244,500 | 18,139,327 | 3,824,397 | 17,694,500 | 19,996,479 | 1,522,418 | 13,444,500 | 13,811,673 | 1,155,245 |
| 74,700 | 2,207,400 | 132,982 | 74,700 | 16,000 | 191,682 | 74,700 | 16,500 | 249,882 |
| 434,894 | 484,894 | 134,256 | 434,894 | 484,894 | 84,256 | 434,894 | 484,894 | 34,256 |
| 4,882,700 | 7,951,300 | 506,803 | 13,382,700 | 13,431,839 | 457,664 | 13,957,700 | 13,982,694 | 432,670 |
| 57,400 | 30,297 | 3,224,229 | 57,400 | 31,206 | 3,250,423 | 57,400 | 32,142 | 3,275,681 |
| 37,300 | 200,000 | 2,137,475 | 37,300 | 200,000 | 1,974,775 | 37,300 | 200,000 | 1,812,075 |
| **$43,452,922** | **$43,943,218** | **$33,194,307** | **$52,174,429** | **$50,018,918** | **$35,349,818** | **$49,109,559** | **$45,689,903** | **$38,769,474** |

# CIP Revenue Details

| Project Category | Fund | Fund Description | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Facilities | 203 | Public Facilities Impact Fees | $17,800 | $21,300 | $17,800 | $517,800 | $517,800 |
| | | **Subtotal** | **$17,800** | **$21,300** | **$17,800** | **$517,800** | **$517,800** |
| Miscellaneous | 201 | Miscellaneous CIP - General Fund | $7,732,200 | $10,004,500 | $10,071,200 | $10,237,200 | $10,403,200 |
| | 204 | Miscellaneous Developer Contributions | 11,300 | 13,600 | 11,300 | 11,300 | 11,300 |
| | | **Subtotal** | **$7,743,500** | **$10,018,100** | **$10,082,500** | **$10,248,500** | **$10,414,500** |
| Parks | 221 | Park CIP - General Fund | $39,900 | $47,900 | $39,900 | $39,900 | $39,900 |
| | 222 | Park Development Impact Fees | 171,000 | 205,200 | 171,000 | 171,000 | 171,000 |
| | 223 | Parks Developer Contributions | 6,000 | 7,200 | 6,000 | 6,000 | 6,000 |
| | | **Subtotal** | **$216,900** | **$260,300** | **$216,900** | **$216,900** | **$216,900** |
| Sewer | 241 | Sewer Developer Contributions | $800 | $900 | $800 | $800 | $800 |
| | 431 | Sewer Replacement CIP | 1,207,700 | 1,249,200 | 4,882,700 | 13,382,700 | 13,957,700 |
| | 432 | Sewer Connection Fees | 57,400 | 68,800 | 57,400 | 57,400 | 57,400 |
| | | **Subtotal** | **$1,265,900** | **$1,318,900** | **$4,940,900** | **$13,440,900** | **$14,015,900** |
| Storm Drain | 441 | Storm Drain Replacement/Renovation | $37,300 | $44,800 | $37,300 | $37,300 | $37,300 |
| | | **Subtotal** | **$37,300** | **$44,800** | **$37,300** | **$37,300** | **$37,300** |
| Transportation & Streets | 160 | Gas Tax | $4,440,043 | $4,583,427 | $4,679,475 | $4,758,880 | $4,861,630 |
| | 161 | Marilyn Kane Trail Reserve | 2,100 | 2,600 | 2,100 | 2,100 | 2,100 |
| | 162 | Miscellaneous CIP Grants | 1,275,000 | - | - | - | - |
| | 163 | Measure B Bike & Pedestrian | 7,989 | - | - | - | - |
| | 165 | Measure BB Bike & Pedestrian | 560,507 | 573,762 | 571,070 | 576,432 | 581,848 |
| | 166 | Measure F | 367,791 | 369,991 | 367,791 | 367,791 | 367,791 |
| | 167 | Specific Plan | 15,700 | 18,900 | 15,700 | 15,700 | 15,700 |
| | 170 | Measure BB - Streets/ Roads | 1,937,715 | 1,969,614 | 1,978,532 | 1,999,272 | 2,020,236 |
| | 172 | TDA Grant | 42,595 | - | - | - | - |
| | 173 | JDEDZ Transportation Fee | 2,000 | 2,400 | 2,000 | 2,000 | 2,000 |
| | 202 | Downtown & North Pleasanton (DNP) | 90,000 | 60,000 | 60,000 | 60,000 | 60,000 |
| | 211 | Street CIP - General | 1,368,860 | 1,403,960 | 1,368,860 | 1,368,860 | 1,368,860 |
| | 212 | Traffic Impact Fee | 191,100 | 229,300 | 191,100 | 191,100 | 506,100 |
| | 214 | Tri-Valley Transportation | 41,600 | 58,200 | 41,600 | 41,600 | 41,600 |
| | 215 | Streets Developer Contribution (SDC) | 125,200 | 150,200 | 125,200 | 125,200 | 125,200 |
| | | **Subtotal** | **$10,468,200** | **$9,422,354** | **$9,403,428** | **$9,508,935** | **$9,953,065** |
| Water | 421 | Water Replacement CIP | $1,048,055 | $15,713,400 | $18,244,500 | $17,694,500 | $13,444,500 |
| | 422 | Water Expansion CIP | 74,700 | 89,700 | 74,700 | 74,700 | 74,700 |
| | 426 | Recycled Water CIP | 434,894 | 434,894 | 434,894 | 434,894 | 434,894 |
| | | **Subtotal** | **$1,557,649** | **$16,237,994** | **$18,754,094** | **$18,204,094** | **$13,954,094** |
| | | **Grand Total** | **$21,307,249** | **$37,323,748** | **$43,452,922** | **$52,174,429** | **$49,109,559** |

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## CIP Projects by Funding Source

| Fund | Fund Description | Project Name | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 | Total |
|---|---|---|---|---|---|---|---|---|
| 160 | Gas Tax | Annual Safety Improvements at Various Locations | $100,000 | $105,000 | $110,000 | $115,000 | $120,000 | $550,000 |
| | | Annual Slurry Sealing of Various Streets | - | 1,550,000 | 1,600,000 | 1,375,000 | 1,500,000 | 6,025,000 |
| | | Annual Street Resurfacing & Reconstruction | - | 1,100,000 | 1,165,000 | 2,550,000 | 2,800,000 | 7,615,000 |
| | | Annual Traffic Buttons & Line Marker Installation | 50,000 | 52,500 | 55,000 | 57,500 | 60,000 | 275,000 |
| | | Pleasanton Traffic Model Update | 230,000 | - | - | - | - | 230,000 |
| | | West Las Positas Boulevard Multimodal Reconstruction | 4,300,000 | - | - | - | - | 4,300,000 |
| | | Annual Curb & Gutter & ADA Ramp | - | 900,000 | 925,000 | 900,000 | 950,000 | 3,675,000 |
| | | Annual Sidewalk & ADA Ramp | 150,000 | 155,000 | 160,000 | 165,000 | 170,000 | 800,000 |
| | **Total** | | **$4,830,000** | **$3,862,500** | **$4,015,000** | **$5,162,500** | **$5,600,000** | **$23,470,000** |
| 162 | Miscellaneous CIP Grants | I-580 Overcrossing Bicycle & Pedestrian Improvements | $525,000 | - | - | - | - | $525,000 |
| | | West Las Positas Multimodal Reconstruction -Owens Drive to Santa Rita Road | 750,000 | - | - | - | - | 750,000 |
| | **Total** | | **$1,275,000** | **-** | **-** | **-** | **-** | **$1,275,000** |
| 163 | Measure B Bike & Pedestrian | West Las Positas Boulevard Multimodal Reconstruction | $190,000 | - | - | - | - | $190,000 |
| | **Total** | | **$190,000** | **-** | **-** | **-** | **-** | **$190,000** |
| 165 | Measure BB Bike & Pedestrian | Annual Bicycle & Pedestrian Improvements | - | $ 100,000 | $505,000 | $515,000 | $125,000 | $1,245,000 |
| | | Annual Street Resurfacing & Reconstruction | - | 450,000 | 375,000 | - | - | 825,000 |
| | | I-580 Overcrossing Bicycle & Pedestrian Improvements | $175,000 | - | - | - | - | 175,000 |
| | | Park Trail & Pathway Resurfacing Program | - | 30,000 | 130,000 | 120,000 | 220,000 | 500,000 |
| | | West Las Positas Boulevard Multimodal Reconstruction | 250,000 | - | - | - | - | 250,000 |
| | | West Las Positas Multimodal Reconstruction - Owens Drive to Santa Rita Road | 250,000 | - | - | - | - | 250,000 |
| | **Total** | | **$675,000** | **$580,000** | **$1,010,000** | **$635,000** | **$345,000** | **$3,245,000** |
| 166 | Measure F (MF) | Annual Street Resurfacing & Reconstruction | - | $400,000 | $380,000 | $360,000 | $300,000 | $1,440,000 |
| | | West Las Positas Boulevard Multimodal Reconstruction | $350,000 | - | - | - | - | 350,000 |
| | **Total** | | **$350,000** | **$400,000** | **$380,000** | **$360,000** | **$300,000** | **$1,790,000** |
| 167 | Specific Plan | Old Vineyard Ave Ped Trail-Ph 2 & 3 | $133,902 | - | - | - | - | $133,902 |
| | **Total** | | **$133,902** | **-** | **-** | **-** | **-** | **$133,902** |
| 170 | Measure BB - Streets/Roads | Annual Street Resurfacing & Reconstruction | - | $1,900,000 | $2,000,000 | $2,000,000 | $2,000,000 | $7,900,000 |
| | | West Las Positas Boulevard Multimodal Reconstruction | $2,350,000 | - | - | - | - | 2,350,000 |
| | **Total** | | **$2,350,000** | **$1,900,000** | **$2,000,000** | **$2,000,000** | **$2,000,000** | **$10,250,000** |
| 172 | TDA Grant | Annual Bicycle & Pedestrian Improvements | $42,595 | - | - | - | - | $42,595 |
| | **Total** | | **$42,595** | **-** | **-** | **-** | **-** | **$42,595** |
| 173 | JDEDZ Transp.Fee | JDEDZ Transportation Fee Reserve | $1,027,034 | - | - | - | - | $1,027,034 |
| | **Total** | | **$1,027,034** | **-** | **-** | **-** | **-** | **$1,027,034** |
| 201 | Misc CIP - General Fund | Annual Facility Replacement | $398,000 | $251,000 | $205,000 | $406,000 | $406,000 | $1,666,000 |
| | | Capital Improvement Program Reserve | 1,220,700 | - | - | - | - | 1,220,700 |
| | | Deferred Maintenance - Asset Management Plan | 6,221,000 | 6,141,000 | 6,060,000 | 5,976,000 | 5,892,000 | 30,290,000 |
| | | Downtown Beautification CIP Reserve | 160,003 | - | - | - | - | 160,003 |
| | | Library Fire Alarm Upgrade | 580,000 | - | - | - | - | 580,000 |
| | | Park Trail & Pathway Resurfacing Program | 95,000 | 89,000 | - | - | - | 184,000 |
| | | West Las Positas Boulevard Multimodal Reconstruction | 3,800,000 | - | - | - | - | 3,800,000 |
| | **Total** | | **$12,474,703** | **$6,481,000** | **$6,265,000** | **$6,382,000** | **$6,298,000** | **$37,900,703** |
| 202 | Downtown & North Pleasanton CIP (DNP) | West Las Positas Boulevard Multimodal Reconstruction | $430,000 | - | - | - | - | $430,000 |
| | **Total** | | **$430,000** | **-** | **-** | **-** | **-** | **$430,000** |
| 203 | Public Facilities Impact Fees (PFIF) | Alviso Adobe Strategic Plan Implementation | $650,000 | - | - | - | - | $650,000 |
| | | Annual Facility Replacement | 117,000 | $74,000 | $60,000 | $119,000 | $119,000 | 489,000 |
| | | Library Fire Alarm Upgrade | 170,000 | - | - | - | - | 170,000 |
| | **Total** | | **$937,000** | **$74,000** | **$60,000** | **$119,000** | **$119,000** | **$1,309,000** |
| 211 | Street CIP - General Fund | Annual Street Resurfacing & Reconstruction | - | $1,300,000 | $1,200,000 | $1,200,000 | $1,200,000 | $4,900,000 |
| | | Use Of Dublin Fwy Reimbursemnt | $2,108,462 | - | - | - | - | 2,108,462 |
| | | West Las Positas Boulevard Multimodal Reconstruction | 5,200,000 | - | - | - | - | 5,200,000 |
| | **Total** | | **$7,308,462** | **$1,300,000** | **$1,200,000** | **$1,200,000** | **$1,200,000** | **$12,208,462** |

# CIP Projects by Funding Source

| Fund | Fund Description | Project Name | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 | Total |
|---|---|---|---|---|---|---|---|---|
| 212 | Traffic Impact Fees (TIF) | Bi-Annual Traffic Signal Installations | - | - | - | - | $1,300,000 | $1,300,000 |
| | **Total** | | **-** | **-** | **-** | **-** | **$1,300,000** | **$1,300,000** |
| 215 | Streets Developer Contribution (SDC) | 2nd Bridge Bernal/Laguna | $1,707,143 | - | - | - | - | $1,707,143 |
| | | Clara Lane Extension Reimbursement | 663,041 | - | - | - | - | 663,041 |
| | | Dublin Canyon Road Widening | 2,332,705 | - | - | - | - | 2,332,705 |
| | | Extension Of Livingston Way | 25,479 | - | - | - | - | 25,479 |
| | | Happy Valley Bypass Road & Improvement | 645,905 | - | - | - | - | 645,905 |
| | | Old Vineyard Avenue Pedestrian Trail-Ph 2 & 3 | 30,673 | - | - | - | - | 30,673 |
| | | Vineyard Corridor Improvements | 30,673 | - | - | - | - | 30,673 |
| | | Westbound Bernal Avenue at First Street/Sunol Boulevard Intersection Improvements | 1,237,600 | - | - | - | - | 1,237,600 |
| | **Total** | | **$6,673,219** | **-** | **-** | **-** | **-** | **$6,673,219** |
| 221 | Park CIP - General Fund | Nonfunctional Turf Conversion for AB1572 | - | $850,000 | - | - | - | $850,000 |
| | **Total** | | **-** | **$850,000** | **-** | **-** | **-** | **$850,000** |
| 222 | Park Development Impact Fees | Alviso Adobe Strategic Plan Implementation | $117,154 | - | - | - | - | $117,154 |
| | | New Community Park - Site Acquisition Reserve | 3,501,477 | - | - | - | - | 3,501,477 |
| | | Nonfunctional Turf Conversion for AB1572 | 150,000 | $100,000 | - | - | - | 250,000 |
| | | Pioneer Cemetery Master Plan Implementation | 667,203 | - | - | - | - | 667,203 |
| | **Total** | | **$4,435,834** | **$100,000** | **-** | **-** | **-** | **$4,535,834** |
| 421 | Water Replacement CIP | Annual Water Distribution System Improvements | $550,000 | $680,000 | $710,000 | $5,320,000 | $1,380,000 | $8,640,000 |
| | | City Ground Water Supply | - | 9,263,200 | 8,467,600 | - | - | 17,730,800 |
| | | Foothill Pump Station Rehabilitation | - | - | - | 1,540,000 | - | 1,540,000 |
| | | Grey Eagle Pump Station Replacement | - | - | - | - | 2,240,000 | 2,240,000 |
| | | Kilkare and Sunol Fire Flow Improvements Program | - | - | 4,630,000 | 4,000,000 | 5,000,000 | 13,630,000 |
| | | SCADA Communications Network Improvements | - | - | - | 1,180,000 | - | 1,180,000 |
| | | Water Meter and AMI System Replacement | 2,020,000 | 2,100,000 | 2,180,000 | 2,270,000 | 2,360,000 | 10,930,000 |
| | | Water System Emergency Power Improvements Program | 590,000 | 610,000 | 1,660,000 | 1,600,000 | 1,660,000 | 6,120,000 |
| | | Water Tank 1300 Rehabilitation | - | - | - | 2,950,000 | - | 2,950,000 |
| | | Water Tank Inspections and Repairs Program | - | - | - | 630,000 | 650,000 | 1,280,000 |
| | | West Las Positas Boulevard Multimodal Reconstruction | 150,000 | - | - | - | - | 150,000 |
| | **Total** | | **$3,310,000** | **$12,653,200** | **$17,647,600** | **$19,490,000** | **$13,290,000** | **$66,390,800** |
| 422 | Water Expansion CIP | Annual Water Distribution System Improvements | - | - | $15,000 | $16,000 | $16,500 | $47,500 |
| | | City Ground Water Supply | - | $2,116,800 | 2,192,400 | - | - | 4,309,200 |
| | **Total** | | **-** | **$2,116,800** | **$2,207,400** | **$16,000** | **$16,500** | **$4,356,700** |
| 426 | Recycled Water CIP | Annual Recycled Water System Improvements | $50,000 | $50,000 | $50,000 | $50,000 | $50,000 | $250,000 |
| | **Total** | | **$50,000** | **$50,000** | **$50,000** | **$50,000** | **$50,000** | **$250,000** |
| 431 | Sewer Replacement CIP | Amberwood Siphon Replacement | - | $270,000 | $3,060,000 | - | - | $3,330,000 |
| | | Annual Sewer Inspection and Replacement | $730,000 | 750,000 | 2,300,000 | $3,580,000 | $3,900,000 | 11,260,000 |
| | | Bernal Ave Sewer Improvements - Tawny Drive to Nevada Street | - | - | - | 400,000 | 2,930,000 | 3,330,000 |
| | | Sewer Lift Station 5 Replacement | - | - | 810,000 | 5,310,000 | - | 6,120,000 |
| | | Sewer System Emergency Power Improvements Program | 1,420,000 | 440,000 | 1,150,000 | 1,190,000 | 1,230,000 | 5,430,000 |
| | | Sewer Lift Station Improvements at LS 4, 12, 13 and 15 | - | - | - | - | 940,000 | 940,000 |
| | | Sewer Lift Station Improvements at LS 2, 7 and 8 | - | - | - | - | 1,420,000 | 1,420,000 |
| | | Sewer Pipe Improvements - Stoneridge Mall Road | - | - | - | 470,000 | 3,190,000 | 3,660,000 |
| | | Sewer Pipe Improvements - Kamp Drive and Stoneridge Drive | - | - | 280,000 | 2,120,000 | - | 2,400,000 |
| | | Sunol Boulevard Sewer Improvements | 1,600,000 | - | - | - | - | 1,600,000 |
| | **Total** | | **$3,750,000** | **$1,460,000** | **$7,600,000** | **$13,070,000** | **$13,610,000** | **$39,490,000** |
| 441 | Storm Drain Replacement/ Renovation | Annual Storm Water Repair and Replacement | $200,000 | $200,000 | $200,000 | $200,000 | $200,000 | $1,000,000 |
| | | Storm Water System Management Plan | 1,700,000 | - | - | - | - | 1,700,000 |
| | **Total** | | **$1,900,000** | **$200,000** | **$200,000** | **$200,000** | **$200,000** | **$2,700,000** |
| | | **Grand Total** | **$53,995,272** | **$32,027,500** | **$42,635,000** | **$48,684,500** | **$44,328,500** | **$221,670,772** |

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# Transportation & Streets Projects

| Project Number | Project Name | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 | Total |
|---|---|---|---|---|---|---|---|
| 11514 | West Las Positas Boulevard Multimodal Reconstruction | $17,020,000 | - | - | - | - | $17,020,000 |
| 22570 | I-580 Overcrossing Bicycle & Pedestrian Improvements | 700,000 | - | - | - | - | 700,000 |
| 26514 | West Las Positas Boulevard Multimodal Reconstruction - Owens Drive to Santa Rita Road | 1,000,000 | - | - | - | - | 1,000,000 |
| 26588 | Pleasanton Traffic Model Update | 230,000 | - | - | - | - | 230,000 |
| FY503 | Annual Street Resurfacing & Reconstruction | - | $5,150,000 | $5,120,000 | $6,110,000 | $6,300,000 | 22,680,000 |
| FY504 | Annual Slurry Sealing Of Various Streets | - | 1,550,000 | 1,600,000 | 1,375,000 | 1,500,000 | 6,025,000 |
| FY507 | Annual Traffic Buttons & Line Marker Installation | 50,000 | 52,500 | 55,000 | 57,500 | 60,000 | 275,000 |
| FY509 | Annual Curb & Gutter and ADA Ramp | - | 900,000 | 925,000 | 900,000 | 950,000 | 3,675,000 |
| FY512 | Annual Sidewalk and ADA Ramp | 150,000 | 155,000 | 160,000 | 165,000 | 170,000 | 800,000 |
| FY532 | Bi-Annual Traffic Signal Installations | - | - | - | - | 1,300,000 | 1,300,000 |
| FY541 | Annual Safety Improvements at Various Locations | 100,000 | 105,000 | 110,000 | 115,000 | 120,000 | 550,000 |
| FY543 | Annual Bicycle & Pedestrian Improvements | 42,595 | 100,000 | 505,000 | 515,000 | 125,000 | 1,287,595 |
| | **Grand Total** | **$19,292,595** | **$8,012,500** | **$8,475,000** | **$9,237,500** | **$10,525,000** | **$55,542,595** |

# Existing Transportation & Streets Projects & Reserves

| Project Number | Project Name | Funding Source | Estimated Current Budget | Recommended Adjustments | Recommended Final Budget | Status |
|---|---|---|---|---|---|---|
| 11514 | West Las Positas Boulevard Multimodal Reconstruction | 160 | $2,167,209 | - | $2,167,209 | Design |
| | | 162 | 8,167,000 | - | 8,167,000 | |
| | | 163 | 184,047 | - | 184,047 | |
| | | 165 | 810,161 | - | 810,161 | |
| | | 201 | 2,500,000 | - | 2,500,000 | |
| | | 202 | 3,040,525 | - | 3,040,525 | |
| | | 211 | 912,397 | - | 912,397 | |
| | | 421 | 250,000 | - | 250,000 | |
| | | 431 | 500,000 | - | 500,000 | |
| 15525 | Hopyard Road & Owens Drive Intersection Improvements | 165 | 813,854 | - | 813,854 | Construction |
| | | 211 | 1,286,119 | - | 1,286,119 | |
| | | 212 | 2,499,307 | - | 2,499,307 | |
| | | 216 | 1,145,810 | - | 1,145,810 | |
| 15551 | Sunol Boulevard Interchange Improvements | 162 | 2,650,000 | - | 2,650,000 | Design |
| | | 212 | 1,574,847 | - | 1,574,847 | |
| 17556 | Westbound Bernal Avenue at First Street/Sunol Boulevard Intersection Improvements | 160 | 1,950,000 | - | 1,950,000 | On Hold |
| | | 215 | 1,237,600 | - | 1,237,600 | |
| 18531 | Stoneridge Drive & I-680 On-Ramp | 162 | 625,633 | - | 625,633 | Construction |
| | | 212 | 6,107,977 | - | 6,107,977 | |

| Project Number | Project Name | Funding Source | Estimated Current Budget | Recommended Adjustments | Recommended Final Budget | Status |
|---|---|---|---|---|---|---|
| 21596 | JDEDZ Right of Way and Misc. | 211 | $4,852 | - | $4,852 | Construction |
| 22521 | 2022 Bi-Annual Evaluation/Reclassification of Street Surfaces | 160 | 15,000 | ($15,000) | - | Cancelled |
| 22570 | I-580 Overcrossing Bicycle & Pedestrian Improvements | 162 | 250,000 | - | - | Planning |
| 23505 | Annual Sidewalk & Intersection Ramp Installations (ADA) | 160 | 92,099 | - | 92,099 | Construction |
| 23507 | Annual Traffic Buttons & Line Marker Installation | 160 | 22,835 | - | 22,835 | Construction |
| 23512 | Annual Sidewalk Maintenance | 160 | 21,305 | - | 21,305 | Construction |
| 23532 | Bi-Annual Traffic Signal Installations | 160 | 591,889 | (93,987) | 497,902 | Construction |
| | | 212 | 665,882 | - | 665,882 | |
| 23541 | Annual Intersection Improvements at Various Locations | 212 | 119,814 | - | 119,814 | Cancelled |
| 23543 | Annual Bicycle & Pedestrian Related Improvements at Various Locations | 163 | 55,172 | (10,862) | 44,310 | Completed |
| | | 165 | 311,049 | (61,553) | 249,496 | |
| 24503 | Annual Street Resurfacing & Reconstruction | 160 | 2,761,294 | - | 2,761,294 | Construction |
| | | 165 | 168,487 | - | 168,487 | |
| | | 166 | 799,822 | - | 799,822 | |
| | | 170 | 3,515,025 | - | 3,515,025 | |
| | | 211 | 408,392 | - | 408,392 | |
| 24504 | Annual Slurry Sealing of Various Streets | 160 | 403,873 | - | 403,873 | Completed |
| 24512 | Annual Sidewalk Maintenance | 160 | 91,631 | - | 91,631 | Construction |
| 24534 | Annual Expedited Speed Lump Program | 160 | 50,000 | - | 50,000 | Consolidate to 25503 |
| 24541 | Annual Intersection Improvements at Various Locations | 160 | 100,000 | - | 100,000 | Consolidate to 25503 |
| 24543 | Annual Bicycle & Pedestrian Related Improvements at Various Locations | 165 | 20,323 | - | 20,323 | In Design |
| | | 172 | 493,513 | - | - | |
| 24546 | Annual Trail Resurfacing Project | 165 | 100,000 | - | 100,000 | Planning |
| 24555 | Annual Neighborhood Traffic Calming Devices | 160 | 50,000 | (45,000) | 5,000 | Cancelled |
| 25503 | Annual Street Resurfacing & Reconstruction | 160 | 1,975,000 | - | 1,975,000 | Construction |
| | | 166 | 400,000 | - | 400,000 | |
| | | 170 | 1,975,000 | - | 1,975,000 | |
| 25504 | Annual Slurry Sealing of Various Streets | 160 | 385,000 | - | 385,000 | Construction |
| 25505 | Annual Sidewalk & Intersection Ramp Installations (ADA) | 160 | 140,678 | (60,678) | 80,000 | Completed |
| 25507 | Annual Traffic Buttons & Line Marker Installation | 160 | 50,000 | - | 50,000 | Planning |
| 25509 | Annual Curb & Gutter for Street Resurfacing | 160 | 609,322 | - | 609,322 | Construction |
| 25512 | Annual Sidewalk Maintenance | 160 | 150,000 | - | 150,000 | Planning |
| 25521 | 2025 Bi-Annual Evaluation/Reclassification of Street Surfaces | 160 | 25,000 | - | 25,000 | Planning |
| 25534 | Annual Expedited Speed Lump Program | 160 | 50,000 | - | 50,000 | Consolidate to 25503 |
| 25541 | Annual Intersection Improvements at Various Locations | 160 | 100,000 | - | 100,000 | Planning |
| 25543 | Annual Bicycle & Pedestrian Related Improvements at Various Locations | 165 | 100,000 | - | 100,000 | Planning |
| | | 172 | 80,000 | - | 80,000 | |
| 25546 | Annual Trail Resurfacing Project | 165 | 100,000 | - | 100,000 | Planning |
| 25555 | Annual Neighborhood Traffic Calming Devices | 160 | 50,000 | (50,000) | - | Cancelled |
| 01541 | Tri-Valley Transportation Fees Reserve | 214 | 1,852,517 | - | 1,852,517 | Reserve |
| 03506 | Happy Valley Bypass Road & Improvements | 215 | 645,905 | - | 645,905 | Reserve |
| 05526 | 2nd Bridge Bernal/Laguna | 215 | 1,707,143 | - | 1,707,143 | Reserve |
| 12533 | Vineyard Avenue Corridor improvements | 215 | 30,673 | - | 30,673 | Reserve |
| 21564 | Old Vineyard Ave Ped Trail-Phases 2&3 | 167 | 133,902 | - | 133,902 | Reserve |
| | | 215 | 30,673 | - | 30,673 | |
| 80532 | Clara Lane Extension Reimbursement | 215 | 663,041 | - | 663,041 | Reserve |
| 93530 | Extension of Livingston Way | 215 | 25,479 | - | 25,479 | Reserve |
| 98516 | Dublin Canyon Road Widening | 215 | 2,332,705 | - | 2,332,705 | Reserve |
| 98590 | Use of Dublin Freeway Reimbursement | 211 | 2,108,462 | - | 2,108,462 | Reserve |
| 99523 | JDEDZ Transportation Fee Reserve | 173 | 1,012,518 | - | 1,012,518 | Reserve |

# West Las Positas Boulevard Multimodal Reconstruction

Project Number: 11514

| | |
|---|---|
| Department: | **Community & Economic Development -Traffic Engineering** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **$35,551,339** |
| CIP Rating Score: | **100** |




Project Description:

This project will focus on West Las Positas (WLP) Boulevard pavement reconstruction. Phase 1 will be between Willow Road to Stoneridge Drive, reconstructing or replacing portions of the roadway and sidewalk. It will also include pedestrian, bicycle, and transit improvements to bring the corridor up to an all users and abilities design standard. This funding will support the design & construction of this phase of the project.

Project Justification:

The roadway section on WLP Boulevard adjacent to the Arroyo Mocho Canal continues to settle and crack, requiring the road to be reconstructed. The WLP Boulevard corridor is identified in the 2018 Pedestrian Bicycle Master Plan as the highest-priority corridor. The addition of bicycle and pedestrian improvements will bring this corridor up to an 'all ages and abilities' standard.

## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Gas Tax | 160 | $2,167,209 | $4,300,000 | - | - | - | - |
| Miscellaneous CIP Grants | 162 | $8,167,000 | - | - | - | - | - |
| Measure B - Bike & Ped | 163 | $184,047 | $190,000 | - | - | - | - |
| Measure BB - Bike & Ped | 165 | $810,161 | $250,000 | - | - | - | - |
| Measure F | 166 | - | $350,000 | - | - | - | - |
| Measure BB - Streets/ Roads | 170 | - | $2,350,000 | - | - | - | - |
| Miscellaneous CIP - General Fund | 201 | $2,500,000 | $3,800,000 | - | - | - | - |
| North Pleasanton 1 ID | 202 | $3,040,525 | $430,000 | - | - | - | - |
| Street CIP | 211 | $912,397 | $5,200,000 | - | - | - | - |
| Water Replacement CIP | 421 | $250,000 | $150,000 | - | - | - | - |
| Sewer Replacement CIP | 431 | $500,000 | - | - | - | - | - |

# I-580 Overcrossing Bicycle & Pedestrian Improvements

Project Number: 22570

| | |
|---|---|
| Department: | **Community & Economic Development -Traffic Engineering** |
| Project Phase: | **Design** |
| Total Budget: | **$950,000** |
| CIP Rating Score: | **98** |




Project Description:

This project will generate the design for improvements to the bicycle and pedestrian facilities connecting the city of Pleasanton to the city of Dublin. As part of the 2018 Pedestrian and Bicycle Master Plan, the City developed both short- and long-range designs for improvements to the I-580 overcrossings at Santa Rita Road, Hacienda Road, and Hopyard Road. This funding will support the project design.

Project Justification:

The I-580 overcrossings are ranked No. 3 in the Pedestrian and Bicycle Master Plan, making this project highly competitive for regional and federal grant funding, as it connects two local agencies and crosses a major freeway system. This project will be funded from grants from Alameda CTC and Measure BB Bike and Pedestrian funding. This project is in alignment with the ONE Pleasanton Strategic Plan goal of - Investing in Our Environment to invest in parks, bicycle, and pedestrian infrastructure.

## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Miscellaneous CIP Grants | 162 | $250,000 | $525,000 | - | - | - | - |
| Measure BB - Bike & Pedestrian | 165 | - | $175,000 | - | - | - | - |

# West Las Positas Boulevard Multimodal Reconstruction - Owens Drive to Santa Rita Road

Project Number: 26514

| | |
|---|---|
| Department: | **Community & Economic Development -Traffic Engineering** |
| Project Phase: | **Design** |
| Total Budget: | **$1,000,000** |
| CIP Rating Score: | **98** |



Project Description:

This project will focus on West Las Positas (WLP) Boulevard between Owens Drive and Santa Rita Road, specifically the design phase for the reconstruction or replacement of portions of the roadway and sidewalk. It will also include pedestrian, bicycle, and transit improvements to bring the corridor up to an 'all users and abilities' design standard. This funding will support the project design.

Project Justification:

The WLP Boulevard corridor from Hopyard to Santa Rita Road is identified in the 2018 Pedestrian Bicycle Master Plan as the highest-priority corridor. This project will be funded from grants from Alameda CTC and Measure BB Bike and Pedestrian funding. This project is in alignment with the ONE Pleasanton Strategic Plan goal of - Investing in Our Environment to invest in parks, bicycle, and pedestrian infrastructure.

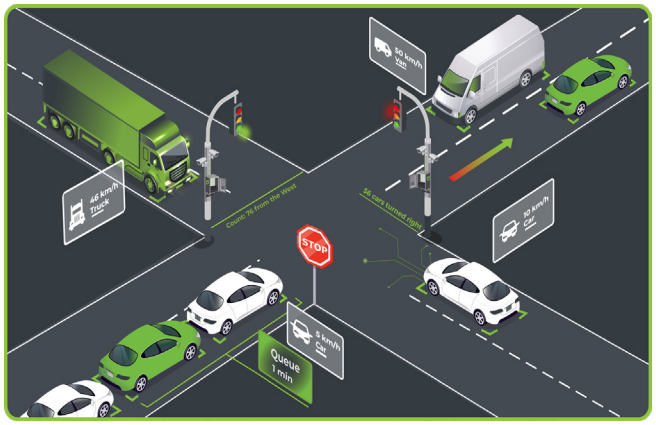
## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Miscellaneous CIP Grants | 162 | - | $750,000 | - | - | - | - |
| Measure BB - Bike & Pedestrian | 165 | - | $250,000 | - | - | - | – |

# Pleasanton Traffic Model Update

**Project Number: 26588**

| | |
|---|---|
| Department: | **Community & Economic Development -Traffic Engineering** |
| Project Phase: | **Study** |
| Total Budget: | **$230,000** |
| CIP Rating Score: | **93** |




Project Description:

This project will engage a consultant to update the existing 2015 citywide traffic model to current design standards and modeling techniques, projecting future land use development as well as traffic and travel patterns.

Project Justification:

An update to the 2015 citywide traffic model is required for state and federal compliance and will assist the City in making critical decisions about infrastructure needs and prioritization related to land development, traffic patterns, and land use trends. This aligns with the ONE Pleasanton Strategic Plan goals #1, #2, and #3: Investing in Our Environment.

## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Gas Tax Fund | 160 | - | $230,000 | - | - | - | – |

# Annual Street Resurfacing & Reconstruction

**Project Number: FY503**

| | |
|---|---|
| Department: | **Public Works - Engineering** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **N/A - Annual Project** |
| CIP Rating Score: | **Core** |



Project Description:

This annual project involves resurfacing and reconstructing city streets with a new layer of asphalt. The actual locations each year will be determined after the annual review of the Pavement Management System (PMS) survey data and field analysis. The project will include performing base repairs and crack sealing, replacing existing traffic loop detectors, installing traffic signal cameras, and reconstructing pavement surfaces. Traffic striping will be updated to accommodate new bike lanes in accordance with the Bicycle and Pedestrian Master Plan.

Project Justification:

This annual project is needed to help keep city streets in a serviceable, smooth riding condition for vehicular traffic, and to maintain streets at the current Pavement Condition Index. The funding level is identified from the Pavement Management System based on the City's actual cost of treatments.

## Project Funding

| Fund Description | Fund # | FY 2025/26 | FY 2026/27 27503 | FY 2027/28 28503 | FY 2028/29 29503 | FY 2029/30 30503 |
|---|---|---|---|---|---|---|
| Gas Tax | 160 | - | $1,100,000 | $1,165,000 | $2,550,000 | $2,800,000 |
| Measure BB - Bike & Pedestrian | 165 | - | $450,000 | $375,000 | - | - |
| Measure F | 166 | - | $400,000 | $380,000 | $360,000 | $300,000 |
| Measure BB - Streets/ACTC | 170 | - | $1,900,000 | $2,000,000 | $2,000,000 | $2,000,000 |
| Street CIP - General Fund | 211 | - | $1,300,000 | $1,200,000 | $1,200,000 | $1,200,000 |

# Annual Slurry Sealing of Various Streets

Project Number: FY504



| | |
|---|---|
| Department: | **Public Works - Engineering** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **N/A - Annual Project** |
| CIP Rating Score: | **Core** |

Project Description:

This annual project provides for the slurrying of various city streets with slurry seal. Actual locations will be determined after reviewing the Pavement Management System (PMS) survey data and field information analysis, which is completed on a biannual basis. Traffic striping will be updated to accommodate new bike lanes, where possible, in accordance with the Bicycle and Pedestrian Master Plan and Complete Streets Policy.

Project Justification:

The application of slurry seal treatment seals and protects street surfaces and extends the useful life of the existing asphalt pavement.

## Project Funding

| Fund Description | Fund # | FY 2025/26 | FY 2026/27 27504 | FY 2027/28 28504 | FY 2028/29 29504 | FY 2029/30 30504 |
|---|---|---|---|---|---|---|
| Gas Tax | 160 | - | $1,550,000 | $1,600,000 | $1,375,000 | $1,500,000 |

# Annual Traffic Buttons & Line Marker Installation

**Project Number: FY507**

| | |
|---|---|
| Department: | **Community & Economic Development -Traffic Engineering** |
| Project Phase: | **Construction** |
| Total Budget: | **N/A - Annual Project** |
| CIP Ranking Score: | **Core** |



Project Description:

This annual project secures contract services to complete street pavement markings and signage revisions. The work schedule and priorities will be established annually by the Traffic Engineering and Street Maintenance Program.

Project Justification:

This annual project will enhance safety by improving and maintaining roadway traffic control markings.

## Project Funding

| Fund Description | Fund # | FY 2025/26 26507 | FY 2026/27 27507 | FY 2027/28 28507 | FY 2028/29 29507 | FY 2029/30 30507 |
|---|---|---|---|---|---|---|
| Gas Tax | 160 | $50,000 | $52,500 | $56,000 | $57,500 | $60,000 |

# Annual Curb & Gutter & ADA Ramp

Project Number: FY509



| | |
|---|---|
| Department: | **Public Works - Engineering** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **N/A - Annual Project** |
| CIP Rating Score: | **Core** |

Project Description:

This project is part of the annual resurfacing of city streets, as various sections of curb and gutter must be replaced along streets scheduled for resurfacing. The Americans with Disabilities Act (ADA) requires that all intersection ramp areas be upgraded to current standards when the street is resurfaced. City staff determines curb and gutter replacement locations through field inspections.

Project Justification:

This annual project will restore proper street gutter drainage run-off to protect the pavement from failure due to saturated subgrade conditions. This project will also reduce maintenance costs and help keep city streets safe.

## Project Funding

| Fund Description | Fund # | FY 2025/26 | FY 2026/27 27509 | FY 2027/28 28509 | FY 2028/29 29509 | FY 2029/30 30509 |
|---|---|---|---|---|---|---|
| Gas Tax | 160 | - | $900,000 | $925,000 | $900,000 | $950,000 |

# Annual Sidewalk & ADA Ramp

**Project Number: FY512**

| | |
|---|---|
| Department: | **Public Works - O&M** |
| Project Phase: | **Construction** |
| Total Budget: | **N/A - Annual Project** |
| CIP Rating Score: | **Core** |



Project Description:

This project involves dividing the city into inspection zones, where sidewalks are assessed for offsets or irregularities that create potential tripping hazards. A scope of work is developed from these inspections, and each identified offset is addressed by cutting the surface to make it level with the existing and surrounding pavement. This approach ensures safe and accessible pedestrian pathways throughout the city.

Project Justification:

Continuous sidewalk maintenance is essential to ensure compliance with the Americans with Disabilities Act (ADA). Failure to address identified irregularities poses legal liability to the City and increases the risk of pedestrian injuries. Proactively maintaining sidewalks supports Pleasanton's commitment to accessibility, safety, and the overall quality of life for its residents.

## Project Funding

| Fund Description | Fund # | FY 2025/26 26512 | FY 2026/27 27512 | FY 2027/28 28512 | FY 2028/29 29512 | FY 2029/30 30512 |
|---|---|---|---|---|---|---|
| Gas Tax | 160 | $150,000 | $155,000 | $160,000 | $165,000 | $170,000 |

# Bi-Annual Traffic Signal Installations

**Project Number: FY532**

| | |
|---|---|
| Department: | **Community & Economic Development -Traffic Engineering** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **$1,300,000** |
| CIP Rating Score: | **Core** |




Project Description:

This biannual project will install traffic signals at high-priority locations identified in the Traffic Signal Priority List. Traffic Engineering will conduct a signal warrant analysis each spring to assess the need for, and rank, intersections that have been identified as potential future traffic signal locations.

Project Justification:

Traffic signals are essential for controlling vehicular, bicycle, and pedestrian movements. They assign the right-of-way to various traffic flows, influence traffic movement, and help reduce the frequency and severity of certain types of crashes, particularly right-angle collisions.

## Project Funding

| Fund Description | Fund # | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 30532 |
|---|---|---|---|---|---|---|
| Traffic Impact Fees | 212 | - | - | - | - | $1,300,000 |

# Annual Safety Improvements at Various Locations

Project Number: FY541

| | |
|---|---|
| Department: | **Community & Economic Development -Traffic Engineering** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **N/A - Annual Project** |
| CIP Rating Score: | **Core** |



Project Description:

This project will provide intersection safety improvements in the upcoming 5-year plan at the following locations: 1. Hopyard Road at North Valley Trails Drive, 2. Hacienda Drive at I-580 Eastbound Off-ramp, 3. Hopyard Road at I-580 Eastbound ramp, 4. Hopyard Road at I-580 Westbound Off-ramp, 5. Stoneridge Drive at I-680 Northbound ramp.

Project Justification:

This project will provide intersection safety improvements at various locations throughout the city, significantly enhancing traffic safety and intersection level of service. It will protect public health and safety, maintain compliance with regulatory requirements, and update roadway safety infrastructure.

## Project Funding

| Fund Description | Fund # | FY 2025/26 26541 | FY 2026/27 27541 | FY 2027/28 28541 | FY 2028/29 29541 | FY 2029/30 30541 |
|---|---|---|---|---|---|---|
| Gas Tax | 160 | $100,000 | $105,000 | $110,000 | $115,000 | $120,000 |

# Annual Bicycle & Pedestrian Improvements

Project Number: FY543

| | |
|---|---|
| Department: | **Community & Economic Development -Traffic Engineering** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **N/A - Annual Project** |
| CIP Rating Score: | **Core** |



Project Description:

This annual project will install bicycle and pedestrian improvements on streets identified by the Safe Streets for All (SS4A) Plan or the Traffic Engineer. The scope for each fiscal year will be determined by the final streets improvement list. The shown FY budgets may be combined with other related transportation projects to align with the work shown in the final streets list.

Project Justification:

This work promotes collaboration between projects and maximizes the use of funds. Project locations identified in the Safe Streets for All and will incorporate the recommended improvements.

## Project Funding

| Fund Description | Fund # | FY 2025/26 26543 | FY 2026/27 27543 | FY 2027/28 28543 | FY 2028/29 29543 | FY 2029/30 30543 |
|---|---|---|---|---|---|---|
| Measure BB - Bike & Pedestrian | 165 | - | $100,000 | $505,000 | $515,000 | $125,000 |
| TDA Grant | 172 | $42,595 | - | - | - | - |

## Parks Projects

| Project Number | Project Name | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 | Total |
|---|---|---|---|---|---|---|---|
| 26787 | Nonfunctional Turf Conversion for AB1572 | $150,000 | $950,000 | - | - | - | $1,100,000 |
| FY546 | Park Trail & Pathway Resurfacing Program | 95,000 | 119,000 | $130,000 | $120,000 | $220,000 | 684,000 |
| | **Grand Total** | **$245,000** | **$1,069,000** | **$130,000** | **$120,000** | **$220,000** | **$1,784,000** |

# Existing Parks Projects & Reserves

| Project Number | Project Name | Funding Source | Estimated Current Budget | Recommended Adjustments | Recommended Final Budget | Status |
|---|---|---|---|---|---|---|
| 01737 | General Trail Improvements and Development | 221 | $91,747 | - | $91,747 | Planning |
| | | 222 | 412,750 | - | 412,750 | |
| 06451 | Landscape Median Construction & Renovation | 201 | 5,306 | - | 5,306 | Construction |
| 06716 | Lions Wayside Park Improvements | 222 | 1,789,090 | - | 1,789,090 | Construction |
| 16733 | Pleas Tennis/Community Park LED Light | 222 | 120,000 | ($120,000) | - | Cancelled |
| 20772 | Design Phase 1 of Bernal Comm Farm | 201 | 57,772 | (57,772) | - | Cancelled |
| 20773 | Design Inclusionary/All Access Play | 222 | 283,485 | - | 283,485 | Cancelled |
| 21775 | Tennis/Community Park Court Lighting | 222 | 250,000 | - | 250,000 | Cancelled |
| 22773 | COP Urban Forest Master Plan | 129 | 80,938 | - | 80,938 | Design |
| 23668 | Cemetery Storm Repairs & Renovation | 222 | 101,655 | (101,655 ) | - | Completed |
| 24744 | Annual Court Resurfacing | 221 | 100,000 | - | 100,000 | Construction |
| 24747 | Annual Irrigation Upgrades | 221 | 9,443 | - | 9,443 | Construction |
| 24767 | Callippe Preserve Trail Renovations | 221 | 65,500 | (10,000) | 55,500 | Construction |
| 25744 | Annual Court Resurfacing | 221 | 500,000 | (50,000) | 450,000 | Construction |
| 25745 | Annual Playground Renovations | 221 | 550,000 | - | 550,000 | In Design |
| 25747 | Annual Irrigation Upgrades | 221 | 150,000 | - | 150,000 | Construction |
| 25748 | Annual Park Trail & Pathway Resurfacing | 221 | 200,000 | - | 200,000 | Planning |
| 25783 | Augustin Bernal Fuels Reduction | 162 | 1,048,900 | - | 1,048,900 | In Design |
| 03728 | New Comm Park: Site Acq Reserve | 222 | 3,501,477 | - | 3,501,477 | Reserve |
| 18544 | City Street Median Island R&R | 211 | 613,668 | - | 613,668 | Reserve |

# Nonfunctional Turf Conversion for AB 1572

Project Number: 26787

| | |
|---|---|
| Department: | **Public Works - Engineering** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **$1,100,000** |
| CIP Rating Score: | **92** |




Project Description:

This project aims to convert approximately 2.4 acres of nonfunctional turf across 11 locations within the city to mulch or drought-tolerant plantings. It includes a design phase to modify irrigation systems and create a sustainable landscape design, followed by a construction phase to implement the turf reduction plan as outlined in the 2024 Citywide Turf Reduction Study. The project supports water conservation efforts and improves the aesthetic and ecological value of these areas.

Project Justification:

This project aims to comply with the California State Assembly Bill 1572 (AB 1572), prohibiting the use of potable water to irrigate nonfunctional turf. The goal of AB 1572 is to reduce unnecessary water use in support of the City's water conservation efforts and improve the aesthetic and ecological value of these areas. AB 1572 takes effect on January 1, 2027. If non-compliant, the City may be subject to civil liability and penalties.

## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Park CIP - General Fund | 221 | - | - | $850,000 | - | - | - |
| Park Development Impact Fees | 222 | - | $150,000 | $100,000 | - | - | - |

# Park Trail & Pathway Resurfacing Program

Project Number: FY546

| | |
|---|---|
| Department: | **Public Works - Engineering** |
| Project Phase: | **Construction** |
| Total Budget: | **N/A - Annual Project** |
| CIP Rating Score: | **90** |



Project Description:

This program project involves resurfacing or replacing various city park and property pathways and trails identified as priorities in the Trails Master Plan or by staff. The work will include crack sealing, spot repairs or new trail surface. The following trails are scheduled for updates over the next 5 years: 1. Sutter Gate Park, 2. Marilyn Murphy Kane Trail, 3. Iron Horse Trail, 4. Arroyo Mocho Trail (east of Santa Rita Rd), 5. Bernal Community Park oak woodland trail.

Project Justification:

Replacement and/or repair work is necessary to maintain the sustainability and usability of pathways and trails for the safe use of residents. These trails and paths have been identified for repair or replacement in the Trails Master Plan, by residents or staff, or due to storm damage and/or age. This project is in alignment with the ONE Pleasanton Strategic Plan goal of - Investing in Our Environment to invest in parks, bicycle, and pedestrian infrastructure..

## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 27546 | FY 2027/28 28546 | FY 2028/29 29546 | FY 2029/30 30546 |
|---|---|---|---|---|---|---|---|
| Measure BB - Bike & Pedestrian | 165 | - | - | $30,000 | $130,000 | $120,000 | $220,000 |
| Miscellaneous CIP - General Fund | 201 | - | $95,000 | $89,000 | - | - | – |

## Miscellaneous Projects

| Project Number | Project Name | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 | Total |
|---|---|---|---|---|---|---|---|
| 26489 | Deferred Maintenance - Asset Management Plan | $6,221,000 | $6,141,000 | $6,060,000 | $5,976,000 | $5,892,000 | $30,290,000 |
| | **Grand Total** | **$6,221,000** | **$6,141,000** | **$6,060,000** | **$5,976,000** | **$5,892,000** | **$30,290,000** |

# Existing Miscellaneous Projects & Reserves

| Project Number | Project Name | Funding Source | Estimated Current Budget | Recommended Adjustments | Recommended Final Budget | Status |
|---|---|---|---|---|---|---|
| 16437 | ADA Transition Plan | 201 | $1,000,000 | - | $1,000,000 | In Design |
| 18437 | Valley Ave Soundwall Replacement | 201 | 1,237,140 | - | 1,237,140 | In Design |
| 20466 | Street Light LED Conversion | 211 | 187,826 | - | 187,826 | Close |
| 22416 | Annual Soundwall Repair & Replacement | 201 | 190,242 | - | 190,242 | Consolidate to 18437 |
| | | 203 | 225,000 | - | 225,000 | Consolidate to 18437 |
| 23416 | Annual Soundwall Repair & Replacement | 201 | 100,000 | - | 100,000 | Consolidate to 18437 |
| 24416 | Annual Soundwall Repair & Replacement | 201 | 125,000 | - | 125,000 | Consolidate to 18437 |
| 24460 | Asset Management Plan | 201 | 987,911 | - | 987,911 | In Design |
| 24461 | Climate Action Plan Implementation | 201 | 1,000,000 | - | 1,000,000 | Planning |
| | | 162 | 140,450 | - | 140,450 | - |
| 25416 | Annual Soundwall Repair & Replacement | 201 | 125,000 | - | 125,000 | Consolidate to 18437 |
| 25582 | Foothill Highschool Southbound Left Turn | 201 | 471,578 | - | 471,578 | Completed |
| 06418 | CIPR - Capital Imp Prog Reserve | 201 | 1,220,700 | - | 1,220,700 | Reserve |
| 16446 | Pioneer Cemetery Master Plan Implementation | 222 | 667,203 | - | 667,203 | Reserve |
| 18440 | Downtown Beautification CIP Reserve | 201 | 160,003 | - | 160,003 | Reserve |

# Deferred Maintenance - Asset Management Plan

Project Number: 26489



| | |
|---|---|
| Department: | **Public Works** |
| Project Phase: | **Planning** |
| Total Budget: | **$30,290,000** |
| CIP Rating Score: | **N/A** |

Project Description:

Annual allocation for managing and prioritizing maintenance and repairs to aging infrastructure and assets that have been deferred due to limited resources. Insufficient resources have negatively impacted the City's ability to properly invest in facilities and other infrastructure used to serve the community. Community assets, such as buildings and facilities, parks and medians, storm drain systems, police and fire vehicles, equipment, information technology, streetlights, traffic signals, streets and roads, sound walls, and traffic poles, are significantly underfunded. Annual allocation will help to fund critical priority projects.

Project Justification:

Internal assessment estimated approximately $900 million in CIP and Repair & Replacement needs over the next decade to maintain the existing infrastructure and other assets in a state of good repair. With the completion of the Asset Management Plan at the end of 2025, the funding gap for deferred maintenance and critical projects is expected to be significant, as previously identified by staff over two years ago. Aging community assets, such as facilities, if not repaired and replaced, will deteriorate and become unusable to the community. Aging infrastructure may also pose significant risks and liabilities for the City.

## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Miscellaneous CIP - General Fund | 201 | - | $6,221,000 | $6,141,000 | $6,060,000 | $5,976,000 | $5,892,000 |

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# Water Projects

| Project Number | Project Name | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 | Total |
|---|---|---|---|---|---|---|---|
| 24174 | City Ground Water Supply | - | $11,380,000 | $10,660,000 | - | - | $22,040,000 |
| 26137 | Water Meter and AMI System Replacement | $2,020,000 | 2,100,000 | 2,180,000 | $2,270,000 | $2,360,000 | 10,930,000 |
| 29163 | SCADA Communications Network Improvements | - | - | - | 1,180,000 | - | 1,180,000 |
| 29191 | Foothill Pump Station Rehabilitation | - | - | - | 1,540,000 | - | 1,540,000 |
| 29192 | Water Tank 1300 Rehabilitation | - | - | - | 2,950,000 | - | 2,950,000 |
| 30194 | Grey Eagle Pump Station Replacement | - | - | - | - | 2,240,000 | 2,240,000 |
| FY133 | Annual Recycled Water System Improvements | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 250,000 |
| FY162 | Water System Emergency Power Improvements Program | 590,000 | 610,000 | 1,660,000 | 1,600,000 | 1,660,000 | 6,120,000 |
| FY183 | Annual Water Distribution System Improvements | 550,000 | 680,000 | 725,000 | 5,336,000 | 1,396,500 | 8,687,500 |
| FY190 | Kilkare and Sunol Fire Flow Improvements Program | - | - | 4,630,000 | 4,000,000 | 5,000,000 | 13,630,000 |
| FY193 | Water Tank Inspections and Repairs Program | - | - | - | 630,000 | 650,000 | 1,280,000 |
| | **Grand Total** | **$3,210,000** | **$14,820,000** | **$19,905,000** | **$19,556,000** | **$13,356,500** | **$70,847,500** |

# Existing Water Projects

| Project Number | Project Name | Funding Source | Estimated Current Budget | Recommended Adjustments | Recommended Final Budget | Status |
|---|---|---|---|---|---|---|
| 21162 | Emergency Power Improvements Utility System | 421 | $272,000 | - | $272,000 | In Design |
| 22190 | Water System Management Plan | 421 | 330,816 | ($100,000) | 230,816 | In Design |
| 22199 | Lemoine Bypass Pipeline (DS-5) | 421 | 158,020 | (125,000) | 33,020 | On Hold |
| 23180 | Recycled Water System Management Plan | 426 | 300,000 | - | 300,000 | Planning |
| 23183 | Annual Water Distribution System | 421 | 36,208 | (36,208) | - | Completed |
| 24171 | Near-Term Water Improvements | 421 | 9,142,231 | (650,000) | 8,492,231 | Construction |
| 24172 | Improvements (Bernal) | 421 | 483,150 | (233,343) | 249,807 | Construction |
| 24174 | City Ground Water Supply | 421 | 3,997,300 | - | 3,997,300 | Design |
| 24181 | Turnout 4 Pre-packaged Booster Station Procurement | 421 | 1,300,000 | - | 1,300,000 | Construction |
| 24183 | Annual Water Distribution System | 421 | 60,739 | (60,739) | - | Completed |
| 25133 | Annual Recycled Water Repair & Replacement | 426 | 50,000 | - | 50,000 | On Hold |
| 25183 | Annual Water Distribution System | 421 | 728,000 | (150,000) | 578,000 | In Design |

# City Groundwater Supply Project

Project Number: 24174

| | |
|---|---|
| Department: | **Public Works - Utilities & Environmental Services** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **$26,037,300** |
| CIP Rating Score: | **Enterprise** |



Project Description:

This project is funded for FY 2024/25 and FY 2025/26 to study the feasibility and design the installation of new groundwater wells in collaboration with Zone 7, along with related City transmission piping improvements. The goal is to recover the use of the City's groundwater production quota, which is currently unavailable due to PFAS concentrations that has caused existing City wells to be taken offline. Additional funding is allocated for FY 2026/27 and FY 2027/28 as placeholders for construction if the project is deemed feasible.

Project Justification:

This project is expected to improve the long-term reliability and cost efficiency of the City's water supply by recovering the use of the City's groundwater production quota, reducing the need to purchase additional water from Zone 7 at the wholesale rate as a replacement.

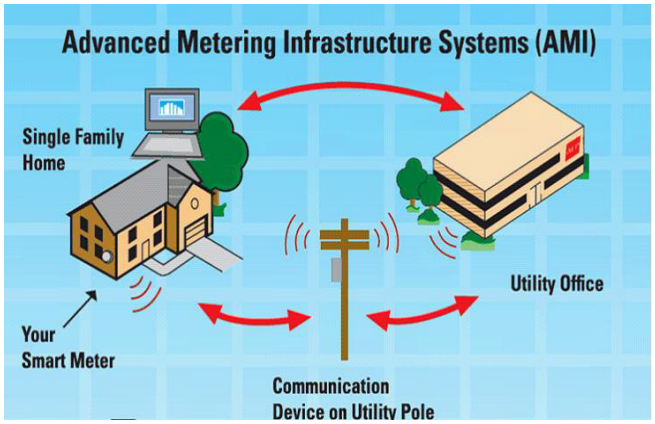
## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Water Replacement CIP | 421 | $3,997,300 | - | $9,263,200 | $8,467,600 | - | - |
| Water Expansion CIP | 422 | - | - | $2,116,800 | $2,192,400 | - | - |

# Water Meter and AMI System Replacement

Project Number: 26137

| | |
|---|---|
| Department: | **Public Works - Utilities & Environmental Services** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **$10,930,000** |
| CIP Rating Score: | **Enterprise** |




Project Description:

This project involves replacing the City's customer advanced metering infrastructure (AMI), including customer meters, radio transmission units, and related software. It is identified in the Water System Management Plan as project RR-8.

Project Justification:

The existing meter system is failing requiring replacement of over 300 meters per week, far above the industry average. The project will improve efficiency of utility billing, help manage water loss, and improve condition of customer meters.

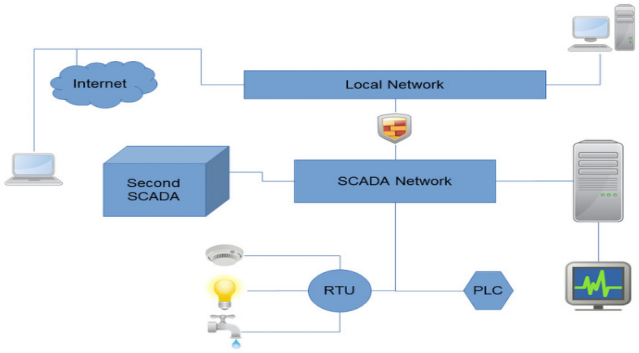
## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Water Replacement CIP | 421 | - | $2,020,000 | $2,100,000 | $2,180,000 | $2,270,000 | $2,360,000 |

# SCADA Communications Network Improvements

Project Number: 29163

| | |
|---|---|
| Department: | **Public Works – Utilities & Environmental Services** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **$1,180,000** |
| CIP Rating Score: | **Enterprise** |




Project Description:

This project involves improving the SCADA (Supervisory Control and Data Acquisition) communications network for the water system. It is identified as project SP-1 in the Water System Management Plan. The project will be completed in three phases: Evaluation, Design, and Construction. This budget includes funding for all three phases.

Project Justification:

This project will enhance the redundancy and resiliency of the SCADA communications network, reducing the risk of failures that could impact the monitoring and control of the water system.

## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Water Replacement CIP | 421 | - | - | - | - | $1,180,000 | - |

# Foothill Pump Station Rehabilitation

Project Number: 29191

| | |
|---|---|
| Department: | **Public Works – Utilities & Environmental Services** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **$1,540,000** |
| CIP Rating Score: | **Enterprise** |




Project Description:

This project involves rehabilitating the Foothill Pump Station, including pumps, valves, electrical equipment, instrumentation and controllers, and security improvements. The project will be divided into three phases: predesign, final design, and construction, all of which are included in this budget. This project was identified in the City's Water System Management Plan as project RR-3.

Project Justification:

The project will reduce operations and maintenance costs and extend the useful life of Foothill Pump Station by improving its condition.

## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Water Replacement CIP | 421 | - | - | - | - | $1,540,000 | - |

# Water Tank 1300 Rehabilitation

Project Number: 29192

| | |
|---|---|
| Department: | **Public Works - Utilities & Environmental Services** |
| Project Phase: | **Maintenance** |
| Total Budget: | **$2,950,000** |
| CIP Rating Score: | **Enterprise** |




Project Description:

This project aims to rehabilitate Tank 1300 by performing corrosion repairs and applying new coating systems. It was identified in the City's Water System Management Plan as project RR-1.

Project Justification:

This project will reduce operations and maintenance costs and extend the useful life of Tank 1300 by improving its condition. The existing coating system and cathodic protections systems are reaching end of their useful life.

## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Water Replacement CIP | 421 | - | - | - | - | $2,950,000 | - |

# Grey Eagle Pump Station Replacement

Project Number: 30194

| | |
|---|---|
| Department: | **Public Works – Utilities & Environmental Services** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **$2,240,000** |
| CIP Rating Score: | **Enterprise** |




Project Description:

The Grey Eagle pipeline and pump station transfers water from the Grey Eagle Pressure Zone to the Kottinger Pressure Zone, as outlined in the City's Water System Management Plan (WSMP). The waterline connection and pump station improvements were recommended in the WSMP as necessary improvements to maintain system reliability and efficiency.

Project Justification:

This project will improve service levels and reduce operations and maintenance costs for the City's water distribution system by enhancing fire flow capacity, customer service capacity, and the condition of aging assets. The existing pump station is reaching the end of its useful life and is in need of replacement.

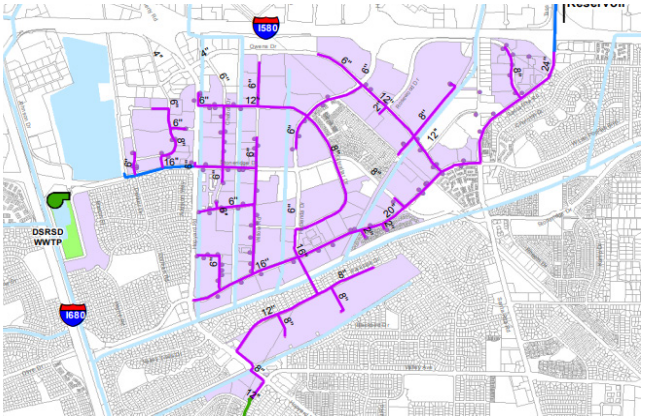
## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Water Replacement CIP | 421 | - | - | - | - | - | $2,240,000 |

# Annual Recycled Water System Improvements

Project Number: FY133

| | |
|---|---|
| Department: | **Public Works – Utilities & Environmental Services** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **N/A - Annual Project** |
| CIP Rating Score: | **Enterprise** |




Project Description:

This annual project includes improvements to recycled water distribution piping and appurtenances, such as mains, valves and service laterals. The improvements will be based on recommendations from the City's Recycled Water System Management Plan white paper and coordinated with future street resurfacing locations.

Project Justification:

This project will improve service levels and reduce operations and maintenance costs for the City's recycled water distribution system by enhancing flow capacity, customer service capacity, and the condition of aging assets.

## Project Funding

| Fund Description | Fund # | FY 2025/26 26133 | FY 2026/27 27133 | FY 2027/28 28133 | FY 2028/29 29133 | FY 2029/30 30133 |
|---|---|---|---|---|---|---|
| Recycled Water CIP | 426 | $50,000 | $50,000 | $50,000 | $50,000 | $50,000 |

# Water System Emergency Power Improvements Program

Project Number: FY162

| | |
|---|---|
| Department: | **Public Works - Utilities & Environmental Services** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **N/A - Annual Project** |
| CIP Rating Score: | **Enterprise** |




Project Description:

This project involves designing and constructing improvements to the emergency power systems that support the City's water pump station facilities. The goal is to enhance reliability and ensure continued operation during utility power outages. This project is included in the City's Water System Management Plan as project SP-2.

Project Justification:

PG&E has implemented a Public Safety Power Shut-off program to reduce the threat of wildfires that results in an increased risk of simultaneous utility power outages at the City's water pump stations. This project improves the reliability of the City's water system emergency power systems to keep pump stations online during utility power outages and will comply with air quality regulations.

## Project Funding

| Fund Description | Fund # | FY 2025/26 26162 | FY 2026/27 27162 | FY 2027/28 28162 | FY 2028/29 29162 | FY 2029/30 30162 |
|---|---|---|---|---|---|---|
| Water Replacement CIP | 421 | $590,000 | $610,000 | $1,660,000 | $1,600,000 | $1,660,000 |

# Annual Water Distribution System Improvements

Project Number: FY183

| | |
|---|---|
| Department: | **Public Works – Utilities & Environmental Services** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **N/A - Annual Project** |
| CIP Rating Score: | **Enterprise** |



Project Description:

This annual project includes replacing and/or installing water mains (including at bridge and culvert crossings), valves, services, and other needed appurtenances. Locations will be determined from a priority list managed by the Public Works Department and in coordination with future street resurfacing locations.

Project Justification:

This project will improve service levels and reduce operations and maintenance costs for the City's water distribution system by enhancing fire flow capacity, customer service capacity, and condition of aging assets.

## Project Funding

| Fund Description | Fund # | FY 2025/26 26183 | FY 2026/27 27183 | FY 2027/28 28183 | FY 2028/29 29183 | FY 2029/30 30183 |
|---|---|---|---|---|---|---|
| Water Replacement CIP | 421 | $550,000 | $680,000 | $710,000 | $5,320,000 | $1,380,000 |
| Water Expansion CIP | 422 | - | - | $15,000 | $16,000 | $16,500 |

# Kilkare and Sunol Fire Flow Improvements Program

Project Number: FY190

| | |
|---|---|
| Department: | **Public Works - Utilities & Environmental Services** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **N/A - Annual Project** |
| CIP Rating Score: | **Enterprise** |




Project Description:

The Kilkare–Sunol fire flow improvements were identified in the Water Distribution System Capacity Master Plan (WDSCMP) as having flow capacity deficiencies exceeding 30 percent, resulting in a Priority A classification for implementation. These improvements will be guided by recommendations from both the WDSCMP and the City's Water System Management Plan.

Project Justification:

This project will improve service levels and reduce operating and maintenance costs for the City's water distribution system by enhancing fire flow capacity, customer service capacity, and the condition of aging assets.

## Project Funding

| Fund Description | Fund # | FY 2025/26 | FY 2026/27 | FY 2027/28 28190 | FY 2028/29 29190 | FY 2029/30 30190 |
|---|---|---|---|---|---|---|
| Water Replacement CIP | 421 | - | - | $4,630,000 | $4,000,000 | $5,000,000 |

# Water Tank Inspections and Repairs Program

Project Number: FY193



| | |
|---|---|
| Department: | **Public Works - Utilities & Environmental Services** |
| Project Phase: | **Maintenance** |
| Total Budget: | **N/A - Annual Project** |
| CIP Rating Score: | **Enterprise** |

Project Description:

This project will involve performing structural inspections of the City's 21 water tanks to assess their condition and recommend any necessary rehabilitation to extend their useful life. This project is included in the City's Water System Management Plan as project RR-4.

Project Justification:

This project will extend the useful life of the City's water tanks by performing inspections to identify rehabilitation needs. The implementation of these recommendations will be incorporated into subsequent facility rehabilitation projects.

## Project Funding

| Fund Description | Fund # | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 29193 | FY 2029/30 30193 |
|---|---|---|---|---|---|---|
| Water Replacement CIP | 421 | - | - | - | $630,000 | $650,000 |

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## Sewer Projects

| Project Number | Project Name | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 | Total |
|---|---|---|---|---|---|---|---|
| 26295 | Sunol Boulevard Sewer Improvements | $1,600,000 | - | - | - | - | $1,600,000 |
| 27296 | Amberwood Siphon Replacement | - | $270,000 | $3,060,000 | - | - | 3,330,000 |
| 28297 | Sewer Lift Station 5 Replacement | - | - | 810,000 | $5,310,000 | - | 6,120,000 |
| 28298 | Sewer Pipe Improvements -Kamp & Stoneridge Drive | - | - | 280,000 | 2,120,000 | - | 2,400,000 |
| 29299 | Bernal Avenue Sewer Improvements - Tawny Drive to Nevada Street | - | - | - | 400,000 | $2,930,000 | 3,330,000 |
| 29200 | Sewer Pipe Upsize Improvements - Stoneridge Mall | - | - | - | 470,000 | 3,190,000 | 3,660,000 |
| 30201 | Sewer Lift Station Improvements at LS 4, 12, 13 and 15 | - | - | - | - | 940,000 | 940,000 |
| 30202 | Sewer Lift Station Improvements at LS 2, 7 and 8 | - | - | - | - | 1,420,000 | 1,420,000 |
| FY278 | Annual Sewer Inspection System Improvements | 730,000 | 750,000 | 2,300,000 | 3,580,000 | 3,900,000 | 11,260,000 |
| FY250 | Sewer System Emergency Power Improvements Program | 1,420,000 | 440,000 | 1,150,000 | 1,190,000 | 1,230,000 | 5,430,000 |
| | **Grand Total** | **$3,750,000** | **$1,460,000** | **$7,600,000** | **$13,070,000** | **$13,610,000** | **$39,490,000** |

# Existing Sewer Projects

| Project Number | Project Name | Funding Source | Estimated Current Budget | Recommended Adjustments | Recommended Final Budget | Status |
|---|---|---|---|---|---|---|
| 16245 | Sewer Capacity Evaluation | 431 | $212,597 | - | $212,597 | In Design |
| | | 432 | 39,609 | - | 39,609 | |
| 21162 | Emergency Power Improvements Utility System | 431 | 750,000 | - | 750,000 | In Design |
| 22289 | Sewer System Management Plan | 431 | 507,823 | ($300,000) | 207,823 | In Design |
| 23278 | Annual Sewer Collection System Improvements | 431 | 1,392,500 | (1,392,500) | - | Cancelled |
| 24265 | Sewer Station S-14 Electrical Improvements | 431 | 650,638 | - | 650,638 | Construction |
| 25278 | Annual Sewer Collection System Improvements | 431 | 1,500,000 | (1,500,000) | - | Cancelled |

# Sunol Boulevard Sewer Improvements

Project Number: 26295

| | |
|---|---|
| Department: | **Public Works – Utilities & Environmental Services** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **$1,600,000** |
| Funding Source: | **Enterprise** |




Project Description:

This project upsizes 1,400 linear feet of 10-inch sewer pipe with 15-inch sewer pipe along Sunol Boulevard from Junipero Street to manholes near Monaco Drive.

Project Justification:

The 2024 Sanitary Sewer System Capacity Evaluation Report identified potential sewer overflows due to insufficient capacity of the existing sewer main. The project will increase capacity of the system.

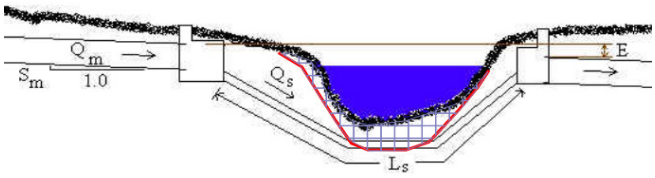
## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Sewer Replacement CIP | 431 | - | $1,600,000 | - | - | - | - |

# Amberwood Siphon Replacement

Project Number: 27296

| | |
|---|---|
| Department: | **Public Works - Utilities & Environmental Services** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **$3,330,000** |
| CIP Rating Score: | **Enterprise** |




Project Description:

This project will replace the existing Amberwood Siphon that conveys sewer below the Arroyo Mocho near Sutter Gate Park.

Project Justification:

The existing Amberwood Siphon is being impacted due to erosion of the Arroyo Mocho that has exposed the sewer line crossing within the channel. The project will install a new sewer crossing below the proposed future channel bottom protecting it from any future impacts from channel erosion.

## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Sewer Replacement CIP | 431 | - | - | $270,000 | $3,060,000 | - | - |

# Sewer Lift Station 5 Replacement

Project Number: 28297

| | |
|---|---|
| Department: | **Public Works – Utilities & Environmental Services** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **$6,120,000** |
| CIP Rating Score: | **Enterprise** |




Project Description:

This project replaces existing sanitary sewer lift station #5 and updates to current standards. The project will also include the addition of a sanitary sewer siphon under the Arroyo De La Laguna that feeds the lift station.

Project Justification:

Condition assessments found that lift station #5 has reached the end of its useful life and needs to replaced immediately because of imminent failure or potential safety hazards. An additional siphon is needed to provide a secondary line in conformance with current standards.

## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Sewer Replacement CIP | 431 | - | - | - | $810,000 | $5,310,000 | - |

# Sewer Pipe Improvements - Kamp Drive & Stoneridge Drive

Project Number: 28298

| | |
|---|---|
| Department: | **Public Works - Utilities & Environmental Services** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **$2,400,000** |
| CIP Rating Score: | **Enterprise** |




Project Description:

This project upsizes existing 1,200 linear foot of 10-inch sewer pipe in Kamp Drive and Stoneridge Drive to 12-inch.

Project Justification:

The 2024 Sanitary Sewer System Capacity Evaluation Report identified potential sewer overflows due to in-sufficent capacity of the existing sewer main and for future conditions associated with the development from housing site updates and East Pleasanton.

## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Sewer Replacement CIP | 431 | - | - | - | $280,000 | $2,120,000 | - |

# Bernal Avenue Sewer Improvements - Tawny Drive to Nevada Street

Project Number: 29299

| | |
|---|---|
| Department: | **Public Works - Utilities & Environmental Services** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **$3,330,000** |
| CIP Rating Score: | **Enterprise** |




Project Description:

This project upsizes 3,000 linear feet of 10-inch sewer pipe to 12-inch in Bernal Avenue, and will connect the sewer system in Bernal Avenue to the existing 18-inch sewer in Nevada Street via a new 12 inch pipe bridge crossing over Arroyo Del Valle.

Project Justification:

The 2024 Sanitary Sewer System Capacity Evaluation Report identified potential sewer overflows due to insufficient capacity of the existing sewer main. The project will increase capacity of the system.

## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Sewer Replacement CIP | 431 | - | - | - | - | $400,000 | $2,930,000 |

# Sewer Pipe Improvements - Stoneridge Mall

Project Number: 29200

| | |
|---|---|
| Department: | **Public Works - Utilities & Environmental Services** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **$3,660,000** |
| CIP Rating Score: | **Enterprise** |




Project Description:

This project upsizes 1,300 linear foot of 10-inch sewer pipelines to 12-inch in Stoneridge Mall Road and Stonedale Drive.

Project Justification:

The 2024 Sanitary Sewer System Capacity Evaluation Report identified potential sewer overflows due to insufficient capacity of the existing sewer main and for future conditions associated with the development for Housing Element Rezone Site 2 at the Stoneridge Shopping Center.

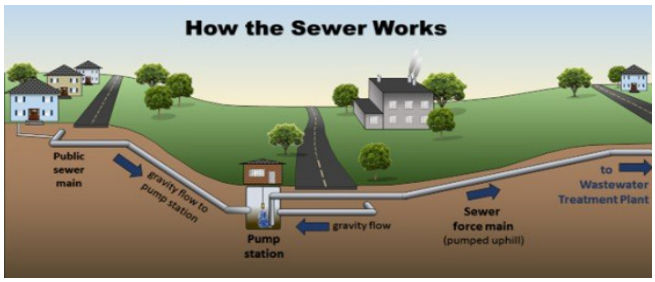
## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Sewer Replacement CIP | 431 | - | - | - | - | $470,000 | $3,190,000 |

# Sewer Lift Station Improvements at LS 4, 12, 13 and 15

Project Number: 30201

| | |
|---|---|
| Department: | **Public Works – Utilities & Environmental Services** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **$940,000** |
| CIP Rating Score: | **Enterprise** |




Project Description:

This project addresses necessary improvements at four of the City's sewer lift stations: #4, #12, #13, and #15 to bring the stations up to current standards. The projects includes electrical upgrades, ventilation and mechanical system replacements.

Project Justification:

Condition assessments at all City lift stations were performed by Woodard & Curran. Stations #4, #12, #13, and #15 were found to have "Criticality 3: repair/replace immediately because of imminent failure or potential safety hazard" ratings for electrical, mechanical, and/or health & safety categories.

## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Sewer Replacement CIP | 431 | - | - | - | - | - | $940,000 |

# Sewer Lift Station Improvements at LS 2, 7 and 8

Project Number: 30202

| | |
|---|---|
| Department: | **Public Works – Utilities & Environmental Services** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **$1,420,000** |
| CIP Rating Score: | **Enterprise** |




Project Description:

This project addresses necessary improvements at three of the City's sewer lift stations: #2, #7 & #8 to bring the stations up to current standards. The projects includes electrical upgrades, ventilation and mechanical system replacements.

Project Justification:

Condition assessments at all City lift stations were performed by Woodard & Curran. Stations #2, #7, and #8 were found to have a "Criticality 3: repair/ replace immediately because of imminent failure or potential safety hazard" rating in the electrical, mechanical, and/or health & safety categories.

## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Sewer Replacement CIP | 431 | - | - | - | - | - | $1,420,000 |

# Annual Sewer Inspection System Improvements

Project Number: FY278

| | |
|---|---|
| Department: | **Public Works - Utilities & Environmental Services** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **N/A - Annual Project** |
| CIP Rating Score: | **Enterprise** |



Project Description:

This covers high-priority projects identified in the sewer condition assessment and manhole condition assessment studies and includes pipe replacements, pipe lining, pipe point repairs, and manhole repairs. Projects for each year of the program have been coordinated with the street resurfacing project.

Project Justification:

These projects were identified as high-risk, high-priority projects in the sewer condition assessment and manhole condition assessment studies conducted by Woodard & Curran (2024).

## Project Funding

| Fund Description | Fund # | FY 2025/26 26278 | FY 2026/27 27278 | FY 2027/28 28278 | FY 2028/29 29278 | FY 2029/30 30278 |
|---|---|---|---|---|---|---|
| Sewer Replacement CIP | 431 | $730,000 | $750,000 | $2,300,000 | $3,580,000 | $3,900,000 |

# Sewer System Emergency Power Improvements Program

Project Number: FY250

| | |
|---|---|
| Department: | **Public Works - Utilities & Environmental Services** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **N/A - Annual Project** |
| CIP Rating Score: | **Enterprise** |



Project Description:

This project is to design and construct improvements to the emergency power systems for the sewer system that support the City's sewer pump station facilities, with the goal of improving the reliability of continued operation during utility power outages. This project was included in the City's Sewer System Management Plan.

Project Justification:

PG&E has implemented a Public Safety Power Shut-off program to reduce the threat of wildfires, which has resulted in an increased risk of simultaneous utility power outages at the City's sewer pump stations. This project improves the reliability of the City's sewer pump stations during utility power outages, while ensuring compliance with upcoming air quality regulations.

## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 26250 | FY 2026/27 27250 | FY 2027/28 28250 | FY 2028/29 29250 | FY 2029/30 30250 |
|---|---|---|---|---|---|---|---|
| Sewer Replacement CIP | 431 | - | $1,420,000 | $440,000 | $1,150,000 | $1,190,000 | $1,230,000 |

## Storm Drain Projects

| Project Number | Project Name | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 | Total |
|---|---|---|---|---|---|---|---|
| 25659 | Storm Water System Management Plan | $1,700,000 | - | - | - | - | $1,700,000 |
| FY615 | Annual Storm Water Repair and Replacement | 200,000 | $200,000 | $200,000 | $200,000 | $200,000 | 1,000,000 |
| | **Grand Total** | **$1,900,000** | **$200,000** | **$200,000** | **$200,000** | **$200,000** | **$2,700,000** |

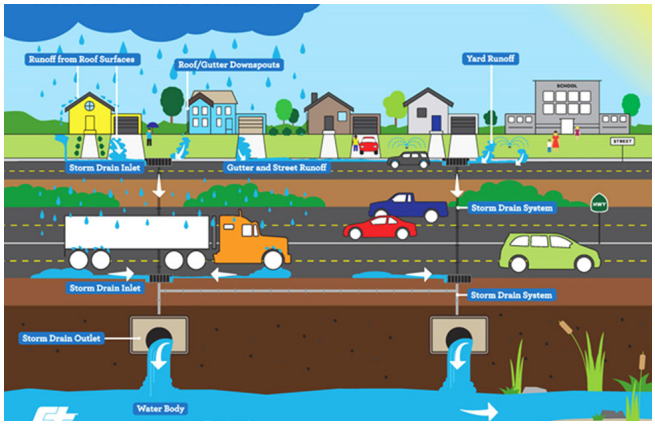
# Existing Storm Drain Projects

| Project Number | Project Name | Funding Source | Estimated Current Budget | Recommended Adjustments | Recommended Final Budget | Status |
|---|---|---|---|---|---|---|
| 22484 | Sassafras Court Storm Drain Interceptor | 441 | $596,875 | - | $596,875 | Design |
| 23415 | Annual Storm Repair/ Replacement | 441 | 152,965 | ($152,965) | - | Completed |
| 23443 | Annual Installation of Trash Capture Devices | 441 | 25,000 | - | 25,000 | On Hold |
| 24415 | Annual Storm Repair/ Replacement | 441 | 56,424 | (44,779) | 11,645 | Completed |
| 24662 | Sycamore Creek Storm Drain Improvements | 441 | 4,978,939 | - | 4,978,939 | Design |
| 24676 | East Vineyard Detention Pond Outfall Repair | 441 | 607,195 | - | 607,195 | Design |
| 24677 | Oak Tree Farm Outfall and Channel Stabilization | 441 | 628,492 | - | 628,492 | Design |
| 24678 | Augustin Bernal Trail Creek Crossing Culverts and Retaining Wall | 441 | 1,293,890 | - | 1,293,890 | Design |
| 24679 | Park Pathway Restoration (Alviso Adobe & Tawny Parks) | 441 | 150,000 | - | 150,000 | Design |
| 24680 | Sycamore Creek Storm Improvements (Sycamore Road) | 441 | 5,000,000 | (4,000,000) | 1,000,000 | Design |
| 25415 | Annual Storm Repair/ Replacement (Puri Court) | 441 | 1,750,000 | - | 1,750,000 | Construction |
| 25659 | Storm Water System Management Plan | 441 | 500,000 | - | 500,000 | Planning |
| 25666 | Storm Drain Lift Station Improvements | 441 | 40,000 | (40,000) | - | Cancelled |

# Storm Water System Management Plan

Project Number: 25659

| | |
|---|---|
| Department: | **Public Works – Utilities & Environmental Services** |
| Project Phase: | **Planning** |
| Total Budget: | **$2,200,000** |
| CIP Rating Score: | **Existing CIP** |




Project Description:

The Storm Water System Management Plan will be an integrative planning document for the overall management of the City's storm water system. The plan will establish objectives and performance measures for collection and conveyance, capacity, infrastructure renewal and upgrades, and operations and maintenance. It will also identify the necessary maintenance and replacement costs. The storm drain system will be evaluated against these objectives and performance measures to identify areas requiring improvement.

Project Justification:

This project will develop a management plan that includes short- and long-term recommended projects, programs, and actions to ensure the storm drain system continues to meet desired service levels. The plan will develop the financial plan to become self supporting. This will be the first plan prepared for the City's storm drain system and aligns with the ONE Pleasanton Strategic Plan goal of – Investing in Our Environment to develop the Storm Water Master Plan.

## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Storm Drain Replacement and Renovation | 441 | $500,000 | $1,700,000 | - | - | - | – |

# Annual Storm Repair & Replacement

Project Number: FY615

| | |
|---|---|
| Department: | **Public Works - Utilities & Environmental Services** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **N/A - Annual Project** |
| CIP Rating Score: | **Core** |



Project Description:

This project will provide erosion control and other storm protection measures for City-owned property. The project includes the repair, replacement, or installation of new storm facilities to protect property from damage associated with storm activity, improve storm water quality, and reduce the work required to safely remove accumulated debris and silt. Work would either be performed by City staff or through contracted services.

Project Justification:

There is an ongoing need to perform repairs or remedial measures to prevent or limit storm damage and improve storm water quality. Recent elevated rain runoff flows have significantly impacted the storm water system infrastructure.

## Project Funding

| Fund Description | Fund # | FY 2025/26 26615 | FY 2026/27 27615 | FY 2027/28 28615 | FY 2028/29 29615 | FY 2029/30 30615 |
|---|---|---|---|---|---|---|
| Storm Drain Replacement and Renovation | 441 | $200,000 | $200,000 | $200,000 | $200,000 | $200,000 |

## Facilities Projects

| Project Number | Project Name | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 | Total |
|---|---|---|---|---|---|---|---|
| 26386 | Library Fire Alarm Upgrade | $750,000 | - | - | - | - | $750,000 |
| FY349 | Annual Facility Replacement | 515,000 | $325,000 | $265,000 | $525,000 | $525,000 | 2,155,000 |
| | **Grand Total** | **$1,265,000** | **$325,000** | **$265,000** | **$525,000** | **$525,000** | **$2,905,000** |

# Existing Facilities Projects & Reserve

| Project Number | Project Name | Funding Source | Estimated Current Budget | Recommended Adjustments | Recommended Final Budget | Status |
|---|---|---|---|---|---|---|
| 17423 | Design/Construct New Fire Station 3 | 201 | $150,000 | - | $150,000 | In Design |
| 17753 | Century House Facility Assessment | 201 | 195,043 | - | 195,043 | Cancelled |
| 18424 | Design Fire Station 2 Improvements | 203 | 473,625 | ($473,625) | - | Cancelled |
| 22482 | Police Department Training Facility | 203 | 550,000 | (550,000) | - | Cancelled |
| 22781 | Design of Aquatic Center 50-Meter Pool Deck | 203 | 37,106 | (37,106) | - | Cancelled |
| 23457 | OSC Fire Alarm and Notification System | 201 | 1,100,000 | - | 1,100,000 | In Design |
| 23479 | Design of Police Dept. Secured Police & Staff Vehicular Parking | 201 | 200,000 | - | 200,000 | Planning |
| 23493 | Library Lighting | 201 | 533,418 | (184,678) | 348,740 | Completed |
| 23494 | Design of City Administration | 203 | 51,000 | (51,000) | - | Cancelled |
| 24374 | Motor Control Center Replacement and Temporary Power for Ken Mercer Sports Park | 203 | 24,063 | - | 24,063 | Construction |
| | | 221 | 151,014 | - | 151,014 | Construction |
| 18725 | Alviso Adobe Strategic Plan Implementation | 203 | 650,000 | - | 650,000 | Reserve |
| | | 222 | 117,154 | - | 117,154 | - |

# Library Fire Alarm Upgrade

**Project Number: 26386**

| | |
|---|---|
| Department: | **Library & Recreation** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **$750,000** |
| CIP Rating Score: | **96** |



Project Description:

This project involves upgrading the fire alarm system at the Library. The system will remain active throughout construction. The scope of work includes replacing the existing control panel and wiring to support the upgraded system; upgrading detection and notification devices; and increasing the battery backup capacity to meet code requirements during power outages. Additionally, the scope includes modifying the fire backflow assembly to bring it up to current standards.

Project Justification:

The Library's fire alarm system, installed in the 1980s, has exceeded its operational life and has become increasingly unreliable, due to obsolete parts and technology. This poses a safety risk to patrons and staff. Upgrading the system is essential to ensure safety, enhance emergency response, and maintain compliance with current codes and standards. This project supports the ONE Pleasanton Strategic Plan goal of - Investing in Our Environment to invest Public Facilities.

## Project Funding

| Fund Description | Fund # | Current Funding | FY 2025/26 | FY 2026/27 | FY 2027/28 | FY 2028/29 | FY 2029/30 |
|---|---|---|---|---|---|---|---|
| Miscellaneous CIP - General Fund | 201 | - | $580,000 | - | - | - | – |
| Public Facilities Impact Fees | 203 | - | $170,000 | - | - | - | - |

# Annual Facility Replacement

**Project Number: FY349**

| | |
|---|---|
| Department: | **Public Works - O&M** |
| Project Phase: | **Design & Construction** |
| Total Budget: | **N/A - Annual Project** |
| CIP Rating Score: | **Core** |



Project Description:

This project involves the study of City-owned facility space use and the replacement of aging roofs, insulation, and HVAC systems across multiple City-owned facilities. FY 2025/26: Facility & Space Use Master Plan. FY 2026/27: Replacement of the Gingerbread Preschool Roof & 8-HVAC units. FY 2027/28: Replacement of the Senior Center roof system. FY 2028/29: Replacement of the Senior Center HVAC system. FY 2029/30: Replacement of the roof insulation at the Water & Sewer buildings and the Streets and Parks buildings (four Public Works buildings in total)

Project Justification:

The replacement of roofs, insulation, and HVAC systems is essential to maintaining the safety, functionality, and energy efficiency of City-owned facilities. Aging infrastructure leads to higher maintenance costs and decreased occupant comfort. By addressing 9 HVAC units and 9 roof systems, this project will improve building performance, reduce operational disruptions, and enhance long-term sustainability, aligning with the City's commitment to maintaining reliable public facilities.

## Project Funding

| Fund Description | Fund # | FY 2025/26 26349 | FY 2026/27 27349 | FY 2027/28 28349 | FY 2028/29 29349 | FY 2029/30 30349 |
|---|---|---|---|---|---|---|
| Miscellaneous CIP - General Fund | 201 | $398,000 | $251,000 | $205,000 | $406,000 | $406,000 |
| Public Facilities Impact Fees | 203 | $117,000 | $74,000 | $60,000 | $119,000 | $119,000 |

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# Appendix A

**List of unfunded Capital Improvement Projects submitted for FY25/26 through FY29/30**

| Project Names | Project Costs (FY24/25) |
|---|---|
| **Facilities** | |
| City-Wide Access Control System Replacement and Security Integration | $4,200,000 |
| Fire Station 2 Emergency Generator Replacement | $320,000 |
| EOC and PW DOC/ Training Center | $575,000 |
| Fire Station 2 Kitchen Remodel | $350,000 |
| LPFD Fire Station 2 Building Exterior Repairs | $200,000 |
| LPFD Training Center Remodel | $460,000 |
| LPFD Fire Station 2 Bunks and Bathrooms Remodel | $2,000,000 |
| LPFD Fire Station 2 Sitework Renovation | $410,000 |
| LPFD Fire Station 4 Shower Remodel | $210,000 |
| PD Vehicle Storage | $310,000 |
| Century House Master Plan* | $4,500,000 |
| Fire Station 3 Parking Lot Gate | $260,000 |
| **Miscellaneous** | |
| Railroad Quiet Zone | $175,000 |
| **Parks** | |
| Aquatic Center 50m pool renovation | $5,200,000 |
| Playground Renovations Program | $1,065,000 |
| Bernal Park Synthetic Turf Replacement | $6,100,000 |
| All Abilities Playground | $136,515 |
| Irrigation Upgrades Program | $600,000 |
| Court Resurfacing Program | $1,920,000 |
| Pleasanton Skatepark* | $7,775,000 |
| **Total** | **$36,766,515** |

*Defunded based on City Council's recommendation on March 19, 2024, to redirect funds for 2023 winter storm repairs.

# Planning Commission Agenda Report

May 28, 2025
Item 5

| | |
|---|---|
| **SUBJECT:** | **P24-0532** |
| **APPLICANT:** | Molly Swenson for Stanford Health Care Tri-Valley |
| **OWNER:** | Stanford Health Care Tri-Valley |
| **PURPOSE:** | Application for Design Review approval to construct a three-story, approximately 66,000-square-foot building addition, one water and three wastewater storage tanks, and related site improvements for Stanford Health Care Tri-Valley located at 5555 W. Las Positas Boulevard. |
| **LOCATION:** | 5555 W. Las Positas Boulevard |
| **GENERAL PLAN:** | Other Public and Institutional |
| **ZONING:** | PUD-P-I (Planned Unit Development – Public & institutional) |
| **EXHIBITS:** | A. Draft Resolution and Conditions of Approval<br>B. Plans and Narrative dated "Received April 22, 2025"<br>C. Location and Notification Map |

## STAFF RECOMMENDATION

Staff recommends the Planning Commission:

1. Find the Project is within the scope of the Initial Study/Negative Declaration adopted by the City Council for PUD-86-11 and no additional environmental review is required under the California Environmental Quality Act (Public Resources Code Section 21166; Guidelines Section 15162.)
2. Approve the Design Review (DR) application, filed as P24-0532, based on the required findings, and subject to the draft Conditions of Approval in Exhibit A

## EXECUTIVE SUMMARY

The project proposes to make improvements at the existing Stanford Health Care Tri-Valley facility, including the partial demolition of the existing emergency department façade and existing canopy to allow for the construction of a three-story, approximately 66,000-square-foot building addition ("East Wing addition"); reconfiguration of the internal campus loop drive; additional parking stalls; one above grade portal water storage tank with an approximately 3,309 square-foot enclosure; three underground wastewater storage tanks; and related site improvements. The scope of the improvements is consistent with the existing Planned Unit

Development Plan (PUD-86-11), with the building and site modifications subject to Design Review approval. The Planning Commission may approve, approve with conditions, or deny the application. As proposed and conditioned, staff concludes the findings can be made to approve the project, including findings of conformance with all applicable development standards.

## BACKGROUND

Site Area and Description

The subject site encompasses approximately 27.7 acres and houses the Stanford Health Care Tri-Valley (SHC) campus, as depicted in Figure 1. Located at the northwest corner of Santa Rita Road and West Las Positas Boulevard, the campus includes the main hospital building, medical offices, and a central utility plant. The project site is relatively flat, with an access drive from each primary street bordering the site except Old Santa Rita Road.

SHC is bordered by several developments:

- To the west, across Owens Drive, the Hacienda Commons Apartments.
- To the north, across Andrews Drive, multifamily residential homes.
- To the northeast, across Old Santa Rita Road, a commercial bank and parking lot.
- To the east, across Santa Rita Road, multifamily residential homes.
- To the south, across West Las Positas Boulevard, the Las Positas Gardens Townhomes.

**Figure 1: Aerial Photograph of Stanford Health Care Tri-Valley Hospital**



General Plan, Zoning, and PUD Development Plan

The subject site is designated by the Land Use Element of the Pleasanton General Plan for "Other Public and Institutional." The proposed project is located in the Stanford Health Care (SHC) Tri-Valley Hospital medical center, originally known as Valley Memorial Hospital. The site is zoned Planned Unit Development – Public & Institutional (PUD-P-I). It is subject to the conditions of approval of PUD-86-11 adopted by the City Council under Ordinance No. 1275 (adopted on October 28, 1986).

Per Ordinance No. 1275, an overall Master Site Plan was approved for an approximately 488,000 square-foot medical center complex; the ordinance granted design approval for the Phase 1 building only, with four development phases anticipated. Although not necessarily precisely aligned to the phasing in the original approval, the site has seen progressive construction over time, including construction of the main hospital building totaling approximately 185,500 square feet, an emergency helipad, two medical office buildings totaling approximately 90,000 square feet, and an approximately 6,825 square-foot central utility plant.

Table 1, below, provides a summary of the existing and proposed facilities and their conformance to the project's allowable square-footage capacity. With the development of the proposed project (an additional approximately 66,000 square feet of net building area), another approximately 139,675 square feet of building expansion would remain available.

**Table 1: Allowable Square-footage Capacity**

| Building | Existing Floor Area (SF) | Net Change (SF) | Future Floor Area (SF) |
|---|---|---|---|
| 5565 MOB[1] | 45,000 | | 45,000 |
| 5575 MOB | 45,000 | | 45,000 |
| Main Hospital + West Wing | 174,000 | | 174,000 |
| ASSB[2] (Lab + Pharmacy) | 11,500 | | 11,500 |
| Central Utility Plant (CUP) | 6,825 | | 6,825 |
| Proposed East Wing | | 66,000 | 66,000 |
| Future Buildings/Additional Allowable Area | | | 139,675 |
| **Total** | **282,325** | **66,000** | **488,000** |

Per PUD-86-11-1M, each subsequent phase requires Design Review approval by the Planning Commission. The Design Review application is now before the Planning Commission for consideration, which is the final body reviewing the proposed building expansion unless the approval is appealed.

Staff notes that the regulatory environment for hospitals is different than most other types of development, with respect to issuance of building permits. Because the East Wing addition is part of a full-service hospital, the California Office of Statewide Health Planning and Development (OSHPD) would review the building permit. OSHPD would also be the agency involved in inspecting the proposed construction as it proceeds. The Livermore-Pleasanton

[1] MOB: Medical Office Building
[2] ASSB: Ancillary Support Services Building

Fire Department would review and inspect the proposed East Wing addition for emergency access. The City of Pleasanton would review and inspect the non-building elements of the project, such as the site development's grading, landscape and irrigation design, and parking lot design.

**PROJECT DESCRIPTION**

*The Proposed Building and Site Improvements*

The project proposes an approximately 66,000 square-foot three-story hospital addition with a maximum addition of a 24-bed nursing unit on the second floor referred to as the "East Wing addition" (See Figure 2: Site Plan).

The building's exterior will feature a blend of brick, accent brick, exposed concrete columns, metal panels, and low-emissivity glazing, harmonizing with the existing hospital and medical office structures. Key architectural elements include a new metal canopy extending from the Emergency Department entrance to the main hospital entrance, a stair tower at the north end to define the building's massing, and a separate metal canopy sheltering five ambulance bays.

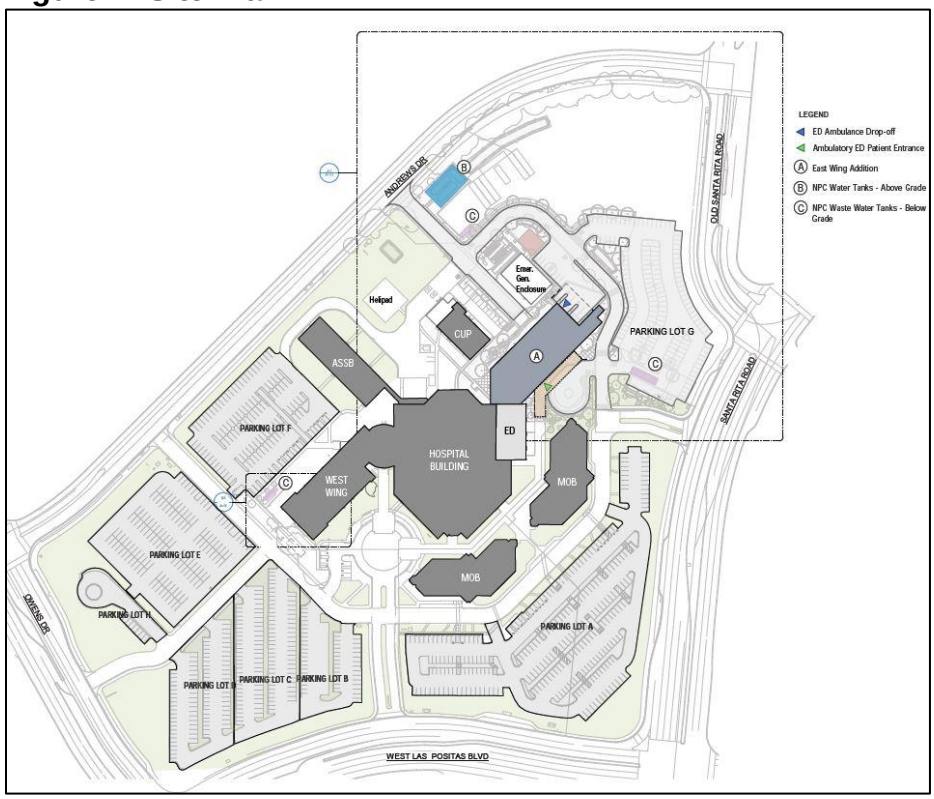
Other related aspects of the project include:

- Installation of emergency water and wastewater storage tanks
- Rooftop mechanical penthouse and rooftop equipment screening
- Partially reconfiguring the existing campus loop with corresponding pathway connectivity (e.g. sidewalks)
- Provide a temporary ambulance canopy & parking area to support hospital operations during construction.

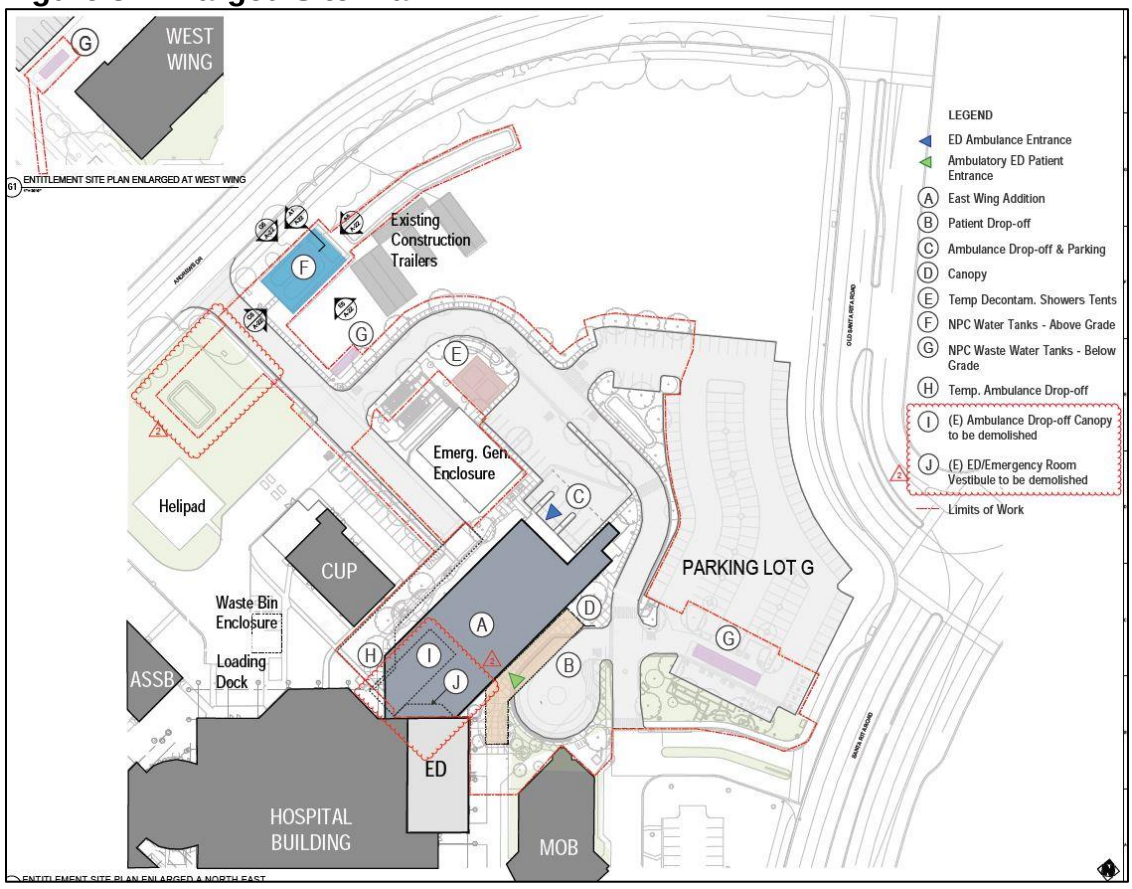
The proposed project's emergency water and wastewater storage tanks are required by the State of California. The storage tanks include one approximately 3,308 square-foot portable water storage tank located above grade within an enclosure, and three below-grade wastewater storage/holding tanks ranging in size from 10,000 to 50,000 gallons. Additionally, and as mentioned above, the project proposes site improvements consisting of adding new landscape areas (approximately 29,414 square feet), sidewalks, and circulation improvements, including reorientation of the campus loop, and modifying parking lot G (adjacent to the East Wing).

The East Wing addition also proposes a two-phase approach with respect to the occupancy of the new space, tied to the availability of replacement parking. Phase 1 consists of the occupation and operation of floors one and three, with concurrent completion of the on-site improvements as noted above. During Phase 1, the second floor (including the up to 24-bed nursing unit) will be constructed as a shell space. Phase 2 involves the build-out of the second-floor shelled space, at which point the project must provide 31 parking spaces prior to operation (see the analysis section of this report for more details on parking).

## Figure 2: Site Plan




## Figure 3: Enlarged Site Plan

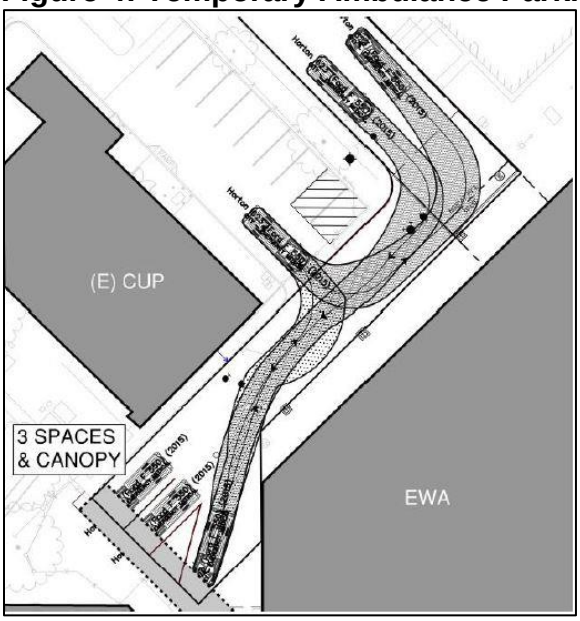


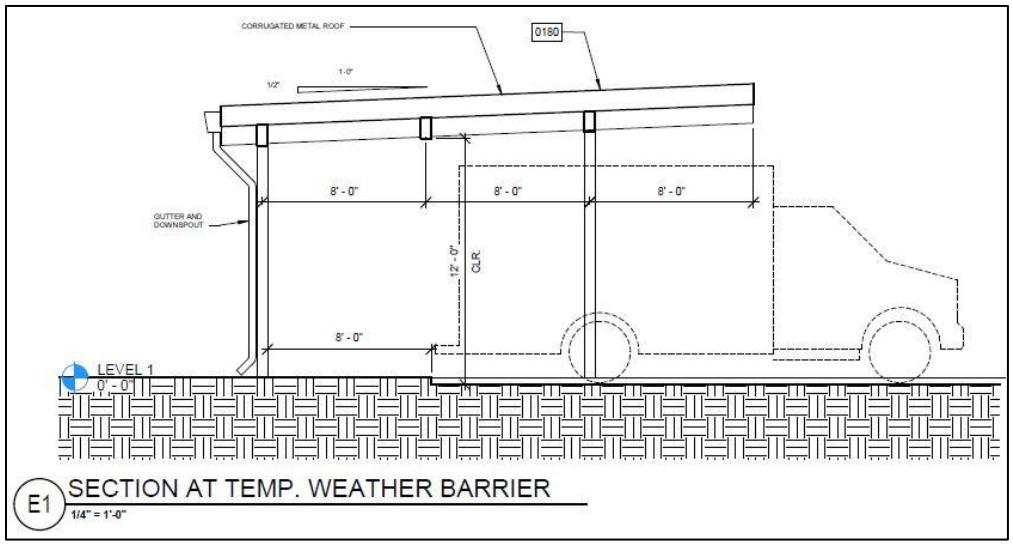
*Construction Phasing*

The proposed project includes a construction schedule that anticipates the work to be completed in approximately 4 1/2 years. The preliminary phasing includes make-ready work (e.g., rerouting of existing underground utilities, reconfiguring the existing campus loop, constructing a temporary ambulance canopy, etc.), demolition, construction of the new East Wing addition, and renovation of the existing Emergency Department.

To maintain ambulance operational services intact during the make-ready work, a temporary ambulance parking location with a canopy is included. Located south of the existing Central Utility Plant, the proposed location of the temporary ambulance bay is in the same vicinity as the existing bay. Refer to Figure 4 below regarding the temporary ambulance canopy/parking area.

**Figure 4: Temporary Ambulance Parking and Canopy**




Please refer to the attached narrative in Exhibit B for additional information regarding the construction schedule and phasing.

## ANALYSIS

General Plan Land Use & Public Facilities and Community Programs Conformance

The subject site is designated by the Land Use Element of the Pleasanton General Plan for Other Public and Institutional, which allows a variety of public and institutional uses. The proposed improvements would expand and enhance the existing healthcare facility, as contemplated and approved under PUD-86-11. As such, the proposed project is consistent with the General Plan land use designation.

The proposed use would also be consistent with the General Plan Land Use and Public Facilities and Community Programs Policies and Programs listed below, as the proposed use would: (1) strengthen the site's role as a critical community resource by expanding medical facilities; and (2) improve public health services by increasing the community's access to emergency care, inpatient services, and medical treatment as a whole.

General Plan Land Use

*Overall Community Development*

Policy 4: Allow development consistent with the General Plan Land Use Map.

Program 4.1: Ensure consistency between the General Plan Land Use Map and the zoning designation for all properties within the City's sphere of influence.

Public Facilities and Community Programs

*Human Services*

Policy 21: Promote a healthy community through the provision of health and mental health facilities and services, and healthy community design.

Program 21.1: Facilitate the provision of high-quality, affordable health care and mental health care in appropriate locations in Pleasanton.

Zoning and PUD Development Plan Standard Conformance

The subject site has a zoning designation of Planned Unit Development – Public & Institutional (PUD-P-I). The project's development standards are those established by the PUD Development Plan (PUD-86-11). As described below, the project conforms to the PUD Development Plan.

Site Layout/Pedestrian and Vehicular Access/Traffic

The proposed East Wing addition would not substantially alter the site's overall access and circulation. The project would continue providing vehicular access via driveways from West Las Positas Boulevard, Owens Drive, Santa Rita Road, and Andrews Drive (see Figure 2 above). As a result of the addition and the reconfiguration of the campus loop, new sidewalks are planned along the perimeter of the East Wing addition and at the passenger drop-off zone, linking to the current on-site pedestrian pathways.

The project's traffic analysis, prepared by TJKM, approximates 54 new AM peak hour vehicle trips and 57 new PM peak hour vehicle trips. The City's Traffic Engineering Division reviewed the project's traffic analysis, which determined, as conditioned, that the project's additional trip

generation would not cause any new impacts or cause unacceptable operating conditions at nearby intersections.

Parking

The applicable parking standards for the project were established as part of the original project PUD Master Plan approvals, as follows:

- For hospitals providing sleeping accommodations: 1.79 parking spaces per bed.

With a proposed count of 24 nursing unit beds, 43 parking spaces are required per the standard above. Table 2 summarizes and compares the project's required and proposed parking. Note the proposed expansion does not add a new medical office area, with the proposed first and third floor uses instead providing supportive functions to the 24-bed nursing unit.

**Table 2: Overall Parking Inventory w/ Existing & Proposed**

| | **Parking Spaces** |
|---|---|
| Total On-Site Existing Parking Spaces | 989 |
| Existing Parking Spaces Demand Requirement (Hospital & Medical Office Buildings) | 613 |
| Total Parking Requirement (Existing & East Wing Addition) | 656 |
| **Surplus Parking On-Site** | **333** |

Based on Table 2 above, the proposed project (generally referred to as Phase I) will be sufficiently parked, including during the observed periods of peak occupancy.

Staff notes, as part of the required traffic study for Phase 2 of the project, consisting of the conversion of the existing second floor into a 24-bed nursing unit, require an additional 31 on-site parking spaces to be provided prior to occupancy of the second floor. Phase 2 would not require any additional Planning review because all improvements for conversion would be entirely within the building. Accordingly, staff is recommending a condition of approval with this East Wing addition requiring the applicant to install the required 31 on-site parking spaces prior to occupancy of Phase 2.

Per the Climate Action Plan 2.0 (CAP 2.0), two short-term bicycle parking spaces (e.g., bicycle racks) for each 9,000 square feet of gross-floor area (minimum of two spaces); and one long-term bicycle parking space (i.e., bicycle locker, enclosed storage, or racks within building) for each 9,000 square feet of gross-floor area. The project proposes eighteen (18) bicycle parking

spaces at the exterior of the East Wing addition and an enclosed space to accommodate eight (8) bicycle parking spaces.

The proposed project conforms to the vehicle and bicycle parking standards per the PUD development plan and CAP 2.0.

Building Architecture/Design

As described, the proposed project includes the construction of a new three-story addition to the existing hospital building and addition of a new 5-vehicle ambulance bay with canopy at the building's north end. Figure 5 provides an overall rendering of the new wing; Figure 6 provides an image of the building elevation; Figure 7 provides a cross-section; and Figure 8 illustrates the proposed building materials.

As shown, the addition will align with the established architectural style of the existing hospital campus. Its exterior will feature a mix of materials, including brick, accent brick, exposed concrete columns, metal panels, and glazing, in harmony with the current hospital and medical office structures. A stair tower positioned at the building's north end will serve as a vertical design element to enhance the structure's massing. Low-E glass will be used for the exterior windows. A new metal canopy will be installed at the passenger drop-off and Emergency Department entrance, extending toward the existing arcade breezeway to offer sheltered access from the Emergency Department to the hospital's main entrance

The proposed building will be approximately 50 feet in height to the top of the parapet, with consistent floor-to-floor heights of approximately 15 feet 4 inches on each of the first three levels. A roof-mounted mechanical penthouse (approximately 2,347 square feet in area) will increase the total height of the building to approximately 59 feet 10 inches (Figures 6 & 7). In addition to the mechanical penthouse, other rooftop equipment will be screened with metal panels to match the existing mechanical screened enclosures. The maximum height shown on the original Development Plan is approximately 78 feet 6 inches. The proposed East Wing addition conforms to the Development Plan with a proposed maximum height of approximately 59 feet 10 inches.[3] The overall master plan shall substantially conform to the uses, plans, and elevations on file with the Planning Department. The height noted in the report is the tallest height shown on the Phase 1 plans.

[3] The PUD approvals state that "the overall master plan shall substantially conform to the uses, plans, and elevations on file with the Planning Department." In the absence of a more precise standard, staff interprets this as allowing for buildings up to the height of the tallest building shown in the Phase 1 plans, which is 78'-6".

**Figure 5: Rendering of East Wing Addition**

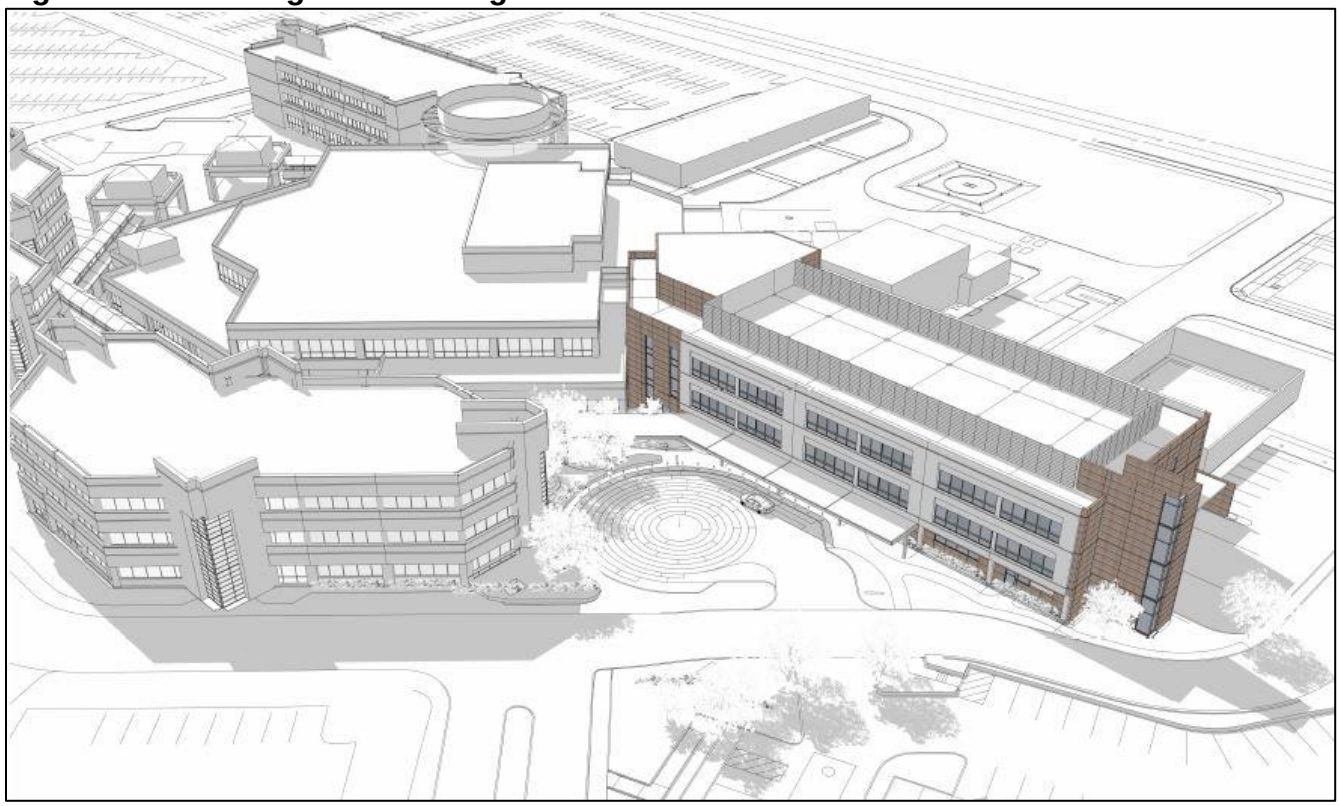


**Figure 6: Section of East Wing Addition**

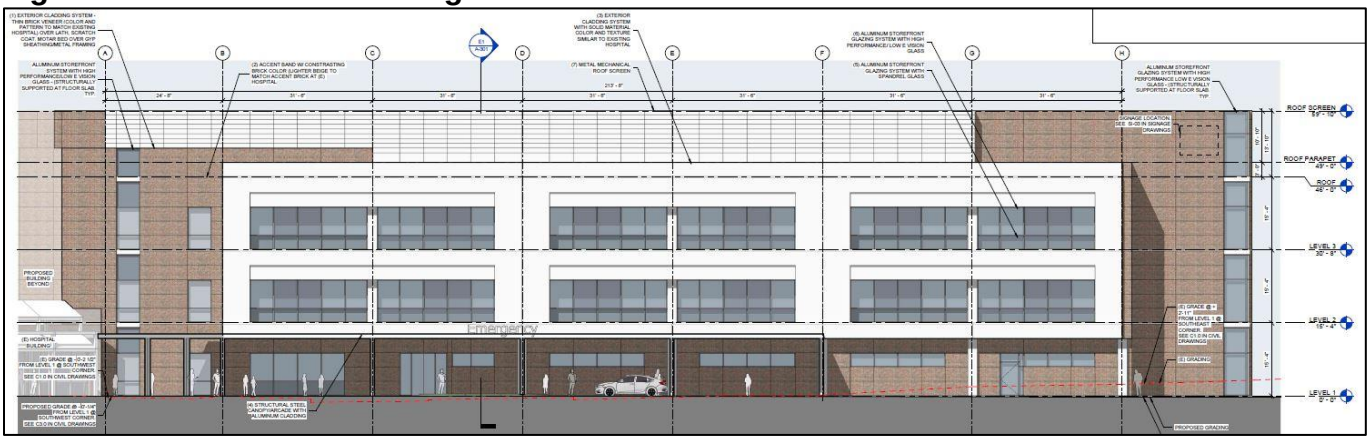


**Figure 7: Section of East Wing Addition**

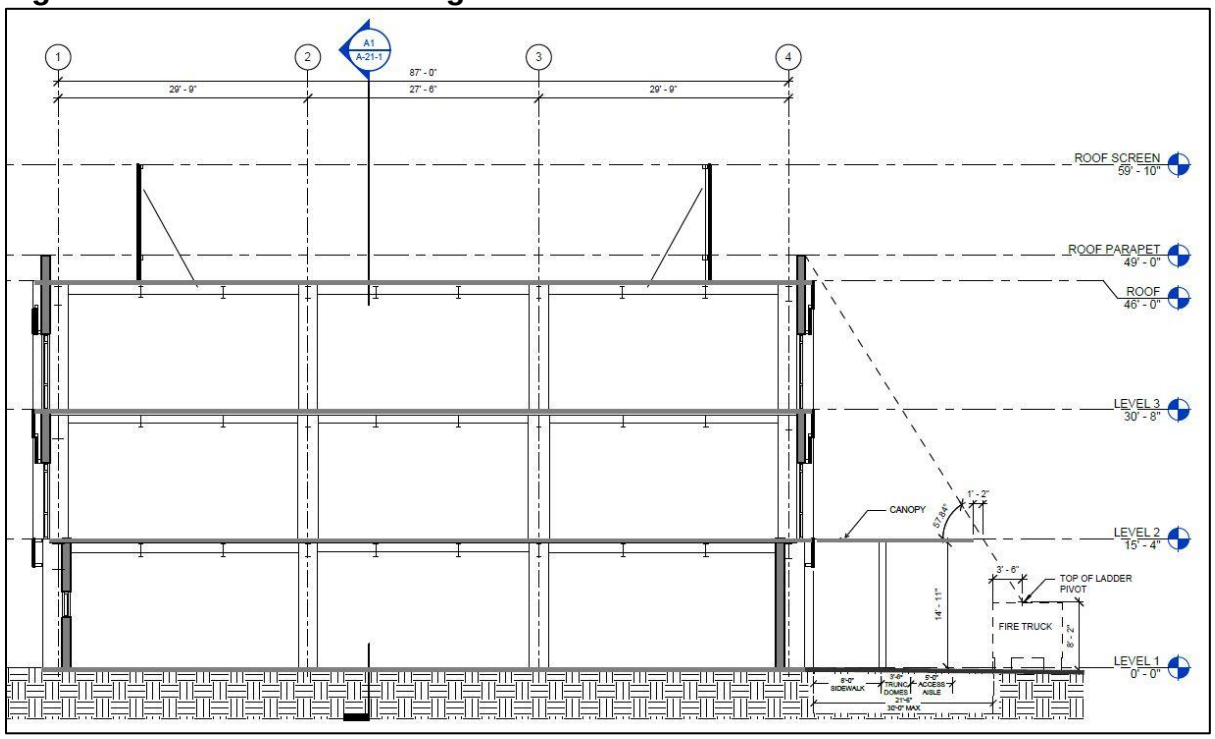
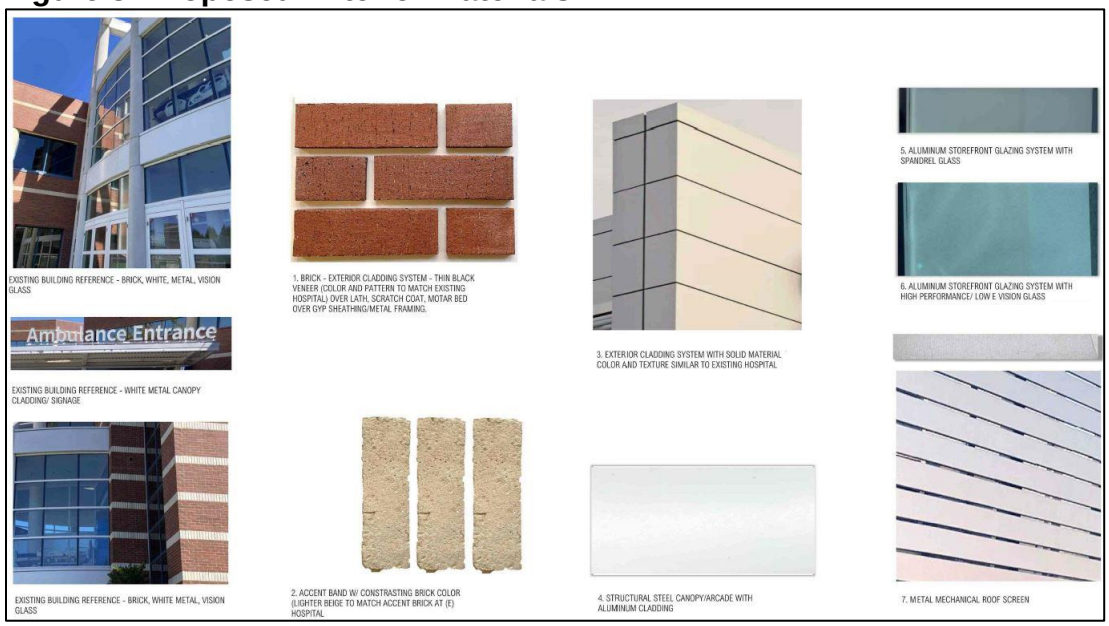



**Figure 8: Proposed Exterior Materials**




Tree Removal and Landscaping

A total of 64 trees were identified within the immediate vicinity of the project, including 22 heritage-sized trees as defined in the Municipal Code. The project includes the removal of 22 on-site trees, which include three Heritage Trees. The project's landscaping plan provides 43 trees and a variety of shrubs throughout the project, most of which would be planted around paseos and amenity areas (Figure 9). A recommended condition of approval requires the project to comply with the City's Water Efficiency Landscape Ordinance (WELO) and Bay

Friendly design and tree and shrub species selection that conforms with the “Very Low” and “Low” rating on the Water Use Classification of Landscape Species database.

**Figure 9: Proposed Landscape Plan**




Grading and Drainage

The subject site is relatively level, and the applicant proposes maintaining the existing grades. Site drainage will be directed towards landscaped bio-retention basins in various areas of the subject site for retention and treatment before draining into the City’s storm drain system. As conditioned, staff believes the proposed grading and drainage plan acceptable and in compliance with applicable stormwater runoff requirements.

Utilities

The project would include the installation of all required on-site utilities with connections to municipal systems to serve the project. The structure would be designed to meet the requirements of the Uniform Building Code, Fire Code, and other applicable City codes.

Helipad

The proposed project does not modify the helipad west of the Central Utility Plant. The proposed East Wing expansion will not interfere with the current flight patterns. The use of the helipad is conditioned per PUD-86-11, which limits its use to emergency situations and states that no regularly scheduled uses of the facility will be permitted.

Climate Action Plan 2.0 (CAP 2.0)

In 2022, the City adopted the Climate Action Plan 2.0 (CAP 2.0). Staff analyzed how the project is consistent with or implements the applicable measures outlined in the CAP 2.0. As a non-residential project located near Arroyo Mocho Trail and a bus line, the project is consistent with Transportation & Land Use Strategy 2 and 3 of the CAP 2.0: to reduce vehicle miles traveled (VMT) by incorporating parking spaces designated for carpool and car-share, and integrating accessible infrastructure that accommodates multiple modes of transportation. The project will include bicycle racks and storage areas along the new addition and provide EV charging parking spaces.

## ALTERNATIVES

As outlined in the above analysis, staff believes the project, as proposed and conditioned, would be compatible with the other uses in the vicinity and not create adverse impacts, and recommends the Planning Commission approve the project. However, alternatives to the proposal that the Planning Commission could consider include:

1. Deny the project; or
2. Approve the proposal with modifications to the site layout and building design.

## DESIGN REVIEW CRITERIA

Pleasanton Municipal Code Section 18.20 sets forth Design Review Criteria. These criteria are outlined in the draft Resolution included as Exhibit A and include preservation of natural beauty, relationship of the proposed buildings with the streetscape and surroundings, and compatibility of architecture, among other criteria. As described in Exhibit A and based on the information and analysis provided in this Agenda Report, staff recommends that the Commission make the required findings to approve the project.

## PUBLIC NOTICE

Notice of this application was sent to surrounding property owners and tenants within a 1,000-foot radius of the subject parcel and published in the newspaper. At the time this report was published, staff had not received any public comments.

## ENVIRONMENTAL ASSESSMENT

An Initial Study/Negative Declaration (IS/ND) for Valley Memorial Hospital was adopted by the City Council for PUD-86-11 which included a rezoning from Public and Institutional to Planned Unit Development-Public and Institutional District and development plan approval for an approximately 488,000-square-foot medical center complex and related facilities to be constructed in four phases, located on an approximately 27.7 acre site, located at the northwest corner of the intersection of Santa Rita Road and West Las Positas Boulevard (“the Project). Stanford Health Care Tri-Valley completed its affiliation with the ValleyCare Health system in 2014. The proposed addition of approximately 66,000 square feet is within the scope of the IS/ND, which results in a total square footage of approximately 348,425 square feet

(282,325 square feet (existing) + 66,000 square feet (addition)), which is 139,675 square feet less than the 488,000 square feet originally approved in the PUD Master Site Plan. The reconfiguration of the internal campus loop drive and the addition of water and wastewater storage tanks and other site improvements are related facilities within the scope of the previously approved IS/ND. The City is not required to prepare a subsequent EIR or subsequent ND unless: 1) there are substantial changes to the project; 2) there are substantial changes in the project's circumstances or 3) new information that could not have been known at the time the ND was adopted becomes available and such changes or new information require major revisions to the previous ND due to new significant effects or a substantial increase in the severity of previously identified significant effects(Public Resources Code Section 21166; Guidelines Section 15162). There are no substantial changes to the project or the circumstances under which the project is being undertaken that involve new significant environmental effects or substantially increase the severity of previously identified impacts. The proposed project is within the scope of the square footage and nature of facilities analyzed in the IS/ND and approved under PUD-86-11. Furthermore, there is no new information of substantial importance that was unknown at the time the City Council adopted the IS/ND regarding the project or its effects. Therefore, no new environmental document is required.

## SUMMARY/CONCLUSION

Staff has reviewed the project proposal and finds it consistent with the applicable PUD development plan and City regulations. The building design is considered attractive, and the architectural style, finish colors, and materials will complement the surrounding development and conform to the Master Plan, as specified in PUD-86-11 and the Design Review requirements.

**Primary Author**: Diego Mora, Associate Planner, 925-931-5618 or dmora@cityofpleasantonca.gov.

**Reviewed/Approved By**:
Eric Luchini, Senior Planner
Melinda Denis, Planning and Permit Center Manager/Deputy Director of Community Development
Ellen Clark, Director of Community Development
Kim Cilley, Assistant City Attorney

**Resolution No. PC-2025-12**

**A RESOLUTION OF THE PLANNING COMMISSION OF THE CITY OF PLEASANTON FINDING THE PROJECT IS WITHIN THE SCOPE OF THE INITIAL STUDY/NEGATIVE DECLARATION ADOPTED BY THE CITY COUNCIL FOR PUD 86-11 AND APPROVING AN APPLICATION FOR A DESIGN REVIEW AT 5555 W. LAS POSITAS BOULEVARD, AS FILED UNDER CASE NO. P24-0532**

**WHEREAS**, on August 29, 2025, Molly Swenson, on behalf of Stanford Health Care Tri-Valley, ("Applicant") applied for Design Review approval under case No. P24-0532 to construct a three-story, approximately 66,000-square-foot building addition, one water and three wastewater storage tanks, and related site improvements for Stanford Health Care Tri-Valley located at 5555 W. Las Positas Boulevard (the "Project"); and

**WHEREAS**, zoning for the property is PUD-P-I (Planned Unit Development – Public & institutional) District; and

**WHEREAS,** on October 28, 1986, the City Council adopted Ordinance No. 1275, approving PUD-86-11 for an up to approximately 488,000-square-foot master planned medical center complex at this location; and

**WHEREAS,** PUD-86-11 contemplates development of the medical center complex in several phases, with development within future phases subject to Design Review approval by the Planning Commission; and

**WHEREAS**, on May 28, 2025, the Planning Commission held a duly-noticed public hearing and considered relevant exhibits, recommendations of the City staff concerning this application, and received testimony from the applicant and interested parties.

**NOW, THEREFORE BE IT RESOLVED** by the Planning Commission of the City of Pleasanton, based on the entire record of proceedings, including the oral and written agenda reports and all public comment and testimony:

**Section 1:** Prior to taking action on the Project, and at a properly noticed public meeting, the Planning Commission reviewed written and oral staff reports, conducted a public hearing on the Project and took testimony, and received into the record all pertinent documents related to the Project (collectively, the "Record Evidence"). The Planning Commission's determination is based on the Record Evidence, which is incorporated into this Resolution by reference.

**Section 2:** Findings for California Environmental Quality Act (CEQA)
The Planning Commission finds an Initial Study/Negative Declaration for Valley Memorial Hospital was adopted by the City Council for PUD-86-11 which included a rezoning from Public and Institutional to Planned Unit Development-Public and Institutional District and development plan approval for an approximately 488,000-square-foot medical center complex and related facilities to be constructed in four phases, located on an approximately 27.7 acre site, located at the northwest corner of the intersection of Santa Rita Road and West Las Positas Boulevard

DRAFT

("the Project). Stanford Health Care Tri-Valley completed its affiliation with the ValleyCare Health system in 2014. The proposed addition of approximately 66,000 square feet is within the scope of the IS/ND, which results in a total square footage of approximately 348,425 square feet (282,325 square feet (existing) + 66,000 square feet (addition)), which is 139,675 square feet less than the 488,000 square feet originally approved in the PUD Master Site Plan. The reconfiguration of the internal campus loop drive and the addition of water and wastewater storage tanks and other site improvements are related facilities within the scope of the previously approved IS/ND. The City is not required to prepare a subsequent EIR or subsequent ND unless: 1) there are substantial changes to the project; 2) there are substantial changes in the project's circumstances or 3) new information that could not have been known at the time the ND was adopted becomes available and such changes or new information require major revisions to the previous ND due to new significant effects or a substantial increase in the severity of previously identified significant effects (Public Resources Code Section 21166; Guidelines Section 15162). There are no substantial changes to the project or the circumstances under which the project is being undertaken that involve new significant environmental effects or substantially increase the severity of previously identified impacts. The proposed project is within the scope of the square footage and nature of facilities analyzed in the IS/ND and approved under PUD-86-11. Furthermore, there is no new information of substantial importance that was unknown at the time the City Council adopted the IS/ND regarding the project or its effects. Therefore, no new environmental document is required.

**Section 3:** Findings for Design Review Approval
With respect to the approval of the Design Review (Case P24-0532), the Planning Commission has considered each of the nine criteria set forth in Section 18.20.030 of the Pleasanton Municipal Code, with conformance to relevant criteria outlined as follows:

- The Planning Commission finds that the proposed design of the building addition would be harmonious and of a design compatible with the existing building and aesthetics of the medical center complex as a whole (Criteria 2 and 3), and would be of an architectural style appropriate to the building and its surrounding (Criteria 7), since it would include materials and a building design consistent with the architectural character and themes of the existing development, such as using brick, accent brick, exposed concrete columns, metal panels, and low-emissivity glazing, harmonizing with the existing hospital and medical office structures.
- The Planning Commission finds the proposed development considers preservation of the natural beauty on the site and the landscaping is designed to enhance the project and streetscape. The project includes the removal of 22 on-site trees, which include three (3) Heritage Trees. The project's landscaping also includes the planting of forty-three (43) trees and a variety of shrubs proposed throughout the project, most of which would be planted around paseos and amenity areas (Criteria 1, 4 and 5).

The Planning Commission finds and concludes the considerations under the required Design Criteria have been duly considered and made to approve the subject application.

**Section 4:** The Planning Commission hereby approves Case No. P24-0532, an application to construct a three-story, approximately 66,000-square-foot building addition, one water and three wastewater storage tanks, and related site improvements for Stanford Health Care

Tri-Valley, located at 5555 W. Las Positas Boulevard, subject to the Conditions of Approval shown in Exhibit A, attached hereto and incorporated herein by reference.

**Section 5**: This resolution shall become effective on the later of the following: 1) the day following the first meeting of the City Council after the City Council has received notice of the decision; or 2) the day after the expiration of the 15-day appeal period.

**DPASSED, APPROVED AND ADOPTED by the Planning Commission of the City of Pleasanton at a regular meeting held on May 28, 2025, by the following vote:**

Ayes:
Noes:
Absent:
Abstain:

**ATTEST:**

| | |
|---|---|
| _____ | _____ |
| Melinda Denis | Ken Morgan |
| Secretary, Planning Commission | Chair |

**APPROVED AS TO FORM:**

_____
Kimberly Cilley
Assistant City Attorney

**EXHIBIT A**
**DRAFT CONDITIONS OF APPROVAL**

**P24-0532**
**5555 W. Las Positas Boulevard**
**May 28, 2025**

The applicant is hereby notified, as part of this approval, that (s)he is required to satisfy and maintain compliance with the conditions of approval below. Where approval by the Director of Community Development, Planning Division, Director of Engineering/City Engineer, City Attorney, Chief Building and Safety Official, Fire Department or other City staff is required, review shall be for compliance with all applicable conditions of approval, adopted policies and guidelines, ordinances, laws and regulations, and accepted practices related to the approval. In addition to complying with the conditions below, the applicant is required to comply with all applicable federal, state, and local laws that pertain to this project, whether or not specifically noted herein.

This approval is granted for a Design Review (P24-0532) to construct a three-story, approximately 66,000-square-foot building addition, one water and three wastewater storage tanks, and related site improvements for Stanford Health Care Tri-Valley located on Assessor Parcel No(s). 946-3200-35-2 at 5555 W. Las Positas Boulevard. Development shall be substantially as shown on the project materials listed below:

a. Project plans, Architectural, Landscape, and Civil plans prepared by Taylor Design, dated "Received" on April 22, 2025, and Project Narrative prepared by Stanford Health Care Tri-Valley dated "Received" on April 22, 2025, and kept on file in the Planning Division of the Community Development Department.

b. Arborist Report and Arborist addendum prepared by Dryad, LLC for Stanford Health Care Tri-Valley, dated November 2024 and March 2025, and kept on file in the Planning Division of the Community Development Department.

c. Traffic Technical Memorandum prepared by TJKM Transportation Consultants for Stanford Health Care Tri-Valley, dated January 31, 2025, and kept on file in the Planning Division of the Community Development Department.

d. Geotechnical Investigation Report by Cornerstone Earth Group for Stanford Health Care Tri-Valley dated October 21, 2024 (BSK PROJECT NO. G00000369), and kept on file in the Planning Division of the Community Development Department.

e. Sewer and Water Demand Study Technical memorandum by BKF Engineers for Stanford Health Care Tri-Valley dated August 21, 2024 (BKF Job Number: 20221230), and kept on file in the Planning Division of the Community Development Department.

The project materials listed above are collectively the "Approved Plans".

THIS APPROVAL IS GRANTED SUBJECT TO THE FOLLOWING CONDITIONS:

1. APPROVAL AND REVISIONS: The proposed development shall be in substantial conformance with the "Approved Plans," except as modified by the following conditions. Minor changes to the plans may be allowed subject to the approval of the Director of Community Development if found to be in substantial conformance with the approved exhibits. Planning Division approval is required before any changes are implemented in site design, grading, architectural design, house colors or materials, green building measures, landscape material, etc.

2. EXPIRATION – DESIGN REVIEW: This design review approval shall lapse 1 year from the effective date of approval unless a building permit is issued and construction has commenced and is diligently pursued towards completion, or the City has approved a time extension.

3. CONDITIONS OF APPROVAL CHECKLIST: The applicant shall submit a "Conditions of Approval Checklist" indicating all conditions in Exhibit A have been satisfied, incorporated into the building permit plans or improvements plans, and/or addressed. Said checklist shall be attached to all building permit and engineering permit submittals for review by the City prior to issuance of permits.

4. APPEAL PERIOD: The building permit submittal will only be accepted after completion of the appeal period provided in the Municipal Code unless the applicant submits a signed statement acknowledging the plan check fees may be forfeited in the event the approval is overturned on appeal, or the design is significantly changed as a result of the appeal. In no case will a building permit be issued prior to the expiration of the appeal period.

5. LIABILITY AND INDEMNIFICATION: To the extent permitted by law, the project applicant shall hold harmless, defend (with counsel acceptable to the City), and indemnify the City, its City Council, its officers, commissions, employee and agents from and against any claim, action, or proceeding brought by a third party against the indemnified parties and/or the applicant to attack, set aside, or void the approval of the project or any permit authorized hereby for the project, including without limitation, reimbursing the City its attorneys' fees and costs incurred in defense of the litigation. The City may, in its sole discretion, elect to defend any such action with attorneys of its choice.

**PLANNING DIVISION – 925-931-5600**

6. APPROVAL: Except as modified by the conditions in this approval, all Conditions of Approval of PUD-86-11 shall remain in full force and effect. **(Project Specific Condition)**

Site Development and Building Design

7. BUILDING MATERIALS AND COLORS: The building materials and colors shall be stated on the building permit plans.

8. PAVING MATERIALS: The color, material, design, and product specifications for the paving materials used on-site shall be in conformance with the Approved Plans and included with the building permit submittal. Any proposed modifications to the final paving design details shall be subject to review and approval by the Planning Division prior to issuance of building permits.

9. FENCE/WALL: All fencing and walls shall be shown on the construction plans with the building permit submittal. If modifications to this fencing is proposed, it should be clearly indicated that on the plan and require the adjacent property owner's permission. The design and location must be approved by the Planning Division and comply with all requirements.

10. LIGHTING PLAN: The applicant shall submit a lighting plan with the building permit submittal. The plan shall include photometric contours, manufacturer's specifications on the fixtures, and mounting heights. All exterior lighting including landscape lighting shall be directed downward and designed or shielded so as to not shine onto neighboring properties or streets. No landscaping up-lighting shall be permitted. The type and location of all exterior light fixtures shall be reviewed and approved by the Director of Community Development prior to building permit issuance.

11. MECHANICAL EQUIPMENT – SCREENING: The applicant shall effectively screen from view all ducts, meters, air conditioning equipment, and any other mechanical equipment, whether on the structure, on the ground, or on the roof, with materials architecturally compatible with the building. Screening details shall be shown on the plans submitted for building permit, the adequacy of which shall be determined by the Director of Community Development. All required screening shall be installed prior to final occupancy.

12. BUILDING SURVEY: The applicant shall submit a building survey and/or record of survey and a site development plan in accordance with the provisions of Chapter 18.68 of the PMC. These plans shall be approved by the Chief Building Official prior to building permit issuance. The site development plan shall include all required information to design and construct site, grading, paving, drainage, and utilities.

13. FINAL INSPECTION: Final inspection by the Planning Division is required prior to occupancy.

Green Building and Sustainability Measures

14. Climate Action Plan 2.0 Compliance: Prior to building permit issuance, a GHG Emission Compliance Checklist shall be provided, to the Planning Division for review and approval by the Director of Community Development. The measures shall be shown on

the building permit plans submitted to the Building and Safety Division. The Checklist shall include notation indicating the sheet(s) the measure can be found. Prior to building permit final, all of the measures indicated on the approved checklist shall be inspected and approved by the City of Pleasanton.

Construction Practices and Noticing

15. WORK HOURS: All demolition and construction activities, inspections, plan checking, material delivery, staff assignment or coordination, etc., shall be limited to the hours of 8 a.m. to 5 p.m., Monday through Friday. No construction shall be allowed on State or Federal Holidays, Saturdays or Sundays. The Director of Community Development may allow earlier "start times" or later "stop times" for specific construction activities, e.g., concrete pouring. All construction equipment shall meet Department of Motor Vehicles (DMV) noise standards and shall be equipped with muffling devices. Prior to construction, the hours of construction shall be posted on site.

16. CONSTRUCTION PARKING: Campers, trailers, motor homes, or any other similar vehicle are not allowed on the construction site except when needed as sleeping quarters for a security guard subject to receipt of a temporary conditional use permit (per PMC 18.116.010.E).

17. CONSTRUCTION TRAILERS: A construction trailer shall be allowed to be placed on the project site for daily administration/coordination purposes during the construction period.

18. PORTABLE TOILETS: Portable toilets used during construction shall be kept on the project site and as far as possible from existing residences and shall be emptied to prevent odor.

19. DISTURBANCE COORDINATOR: The applicant shall designate a "disturbance coordinator" who shall be responsible for responding to any complaints regarding construction noise, dust, construction parking, etc. The coordinator (who may be an employee of the general contractor) shall determine the cause of the complaint and shall require the implementation of reasonable measures warranted to correct the problem. A telephone number of the disturbance coordinator shall be posted on the construction site fence. The sign shall also list an emergency after-hours contact number for the disturbance coordinator, or designee.

20. DUST CONTROL: The applicant shall submit a written dust control plan or procedure as part of the building permit plans.

21. CUTRUAL RESOURCES: If any prehistoric or historic artifacts, or other indication of cultural resources are found once the project construction is underway, all work shall stop within 20-meters (66 feet) of the find. A qualified archaeologist shall be consulted for an immediate evaluation of the find prior to resuming groundbreaking construction activities within 20-meters of the find. If the find is determined to be an important archaeological resource, the resource shall be either avoided, if feasible, or recovered

consistent with the requirements of the State California Environmental Quality Act (CEQA) Guidelines. In the event of discovery or recognition of any human remains in any on-site location, there shall be no further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent remains until the County coroner has determined, in accordance with any law concerning investigation of the circumstances, the manner and cause of death and has made recommendations concerning treatment and dispositions of the human remains to the person responsible for the excavation, or to their authorized representative. A similar note shall appear on the building permit and/or improvement plans.

Fees

22. FEES: The applicant shall pay any and all fees to which the property may be subject, prior to issuance of grading and/or building permits, or prior to recordation of the final map, whichever is applicable. The type and amount of the fees shall be those in effect at the time the permit is issued.

**BUILDING AND SAFETY DIVISION – 925-931-5300**

23. BUILDING AND FIRE CLEARANCE: Prior to issuance of a business license, the applicant shall contact the Building and Safety Division and the Fire Department to ensure the proposed use of the tenant space meets Building and Fire Code requirements. If required, the applicant shall obtain all appropriate City permits.

24. DIGITAL PLAN SUBMITTAL REQUIREMENT – COMMERCIAL, MULTI-FAMILY RESIDENTIAL AND CONDOMINIUM PROJECTS: The applicant shall submit site plan and building information to the City's Geographic Information Services (GIS) Division in a digital format prior to issuance of the building permit. All changes or revisions to the approved plans during construction which affect the digital submittal, shall be resubmitted for GIS review no later than 1 month prior to scheduling a final inspection. The updated digital submittal will be checked and approved before the building permit will be finalized and certificate of occupancy granted (if applicable). For phased project, the digital submittal must be approved prior to the first occupancy of any phase. The information will be used for public safety and emergency response planning by the Police and Fire Departments. Refer to the "Digital Plan Submittal Requirements" for necessary data and file formatting requirements.

If the property has verified sewer capacity in excess of the minimum needed for each unit, using the calculation method above, the property owner may allocate the excess capacity at the property owner's discretion to any of the units with uses requiring more sewer capacity.

The newly apportioned sewer allocation shall be included in a recorded document, such as the CC&Rs, and the City records shall be updated to reflect the division of sewer allocation. Any modifications to the CC&Rs or other recorded document that affects sewer allocation shall be subject to the approval of the Director of Operations and Water Utilities. Any allocation by the property owner of excess sewer capacity to one of the

units needing additional capacity is subject to the requirement that property owner provide the City with written notice by certified mail to the Director of Operations and Water Utilities if such allocation is not included in an amendment to the CC&Rs or other recorded document subject to approval of the Director of Operations and Water Utilities.

The property owners' association shall be responsible for the collection and payment of all sewer and water user fees.

## LANDSCAPE ARCHITECTURE DIVISION – 925-931-5672

Landscaping

25. LANDSCAPING: Detailed landscape and irrigation plans encompassing all planting areas, both on-site and off-site, shall be included in the building permit plans. All plans shall be prepared by a licensed landscape architect and shall provide the species, location, size, quantities, and spacing of all plants. Minimum plant sizes are 1-gallon containers for ground cover, 5-gallon containers for shrubs, and 15-gallon containers for trees. Plant species shall be of a drought-tolerant nature and the irrigation design shall utilize low-volume drip, bubbler, or other water conserving irrigation systems to the maximum extent possible. The drawings shall be subject to the review and approval of the City Landscape Architect prior to building permit issuance.

26. WATER EFFICIENT LANDSCAPE ORDINANCE (WELO): The project shall comply with the City of Pleasanton's Water Efficient Landscape Ordinance (WELO) and Bay Friendly Basics Landscape Checklist. The applicant shall submit a Landscape Documentation Package in PDF format to the Landscape Architecture Division, which shall be subject to review and approval by the City Landscape Architect prior to building permit issuance. The Landscape Documentation Package shall include:

    a. Project Information;
    b. Water Efficient Landscape Worksheet;
    c. Soil management report;
    d. Landscape design plan;
    e. Irrigation design plan; and
    f. Grading design plan.

27. CERTIFICATE OF COMPLETION: Upon completion of construction and prior to final inspection by the Building and Safety Division, the applicant's landscape architect shall submit a Certificate of Completion Package in PDF format to the Landscape Architecture Division for review and approval. The Certificate of Completion Package shall include:

    a. Project information sheet;
    b. Certificate of installation according to the landscape documentation package;
    c. Irrigation scheduling;
    d. Schedule of irrigation, landscape and irrigation maintenance;
    e. Landscape irrigation audit report; and

f. Soil management report (if not previously submitted).

28. LANDSCAPING INSTALLATION: Prior to building permit final all landscaping shall be installed as shown on the approved building permit set and shall be inspected and approved by the Landscape Architecture Division.

29. EROSION CONTROL: For purposes of erosion control, the applicant shall plant a hydro seed mixture designed by the applicant's landscape architect and approved by the Landscape Architecture Division prior to installation. The erosion control shall be maintained by the applicant until permanent landscaping is in place.

30. BACKFLOW AND IRRIGATION METER SCREENING: All backflow prevention devices and above ground irrigation controls shall be located and screened to minimize their visual impacts. These devices with their proposed screening shall be shown on the landscaping and utility plans submitted with the building permit plans or improvement plans and shall be subject to the review and approval of the City Landscape Architect prior to their installation. If above-ground, they shall be painted forest green or an equivalent dark-green color. Screens shall consist of berms, walls, or landscaping satisfactorily integrated into the landscape plan. Landscape screens shall include shrubbery designed by species and planting density to establish a complete screen within 1 year from the date of planting. Weather protection devices, such as measures to protect pipes from freezing, shall require approval by the City Landscape Architect prior to use; at no time shall fabric or other material not designed and/or intended for this purpose be wrapped around or otherwise placed on these devices. **Project Specific**

31. MAINTENANCE: The applicant and all future owners of the property shall, at no expense to the City, maintain all the landscaped areas related to the project in a healthful, attractive and reasonably weed-free manner consistent with the approved landscape plan, for the duration of the existence of the project.

32. SITE LIGHTING: All site lighting shall be designed for consistency with the International Dark-Sky Association's (IDA) Model Lighting Ordinance. This project site shall be considered to be in an LZ-2 zone for design purposes. Lighting shall be subject to review and approval by the City Landscape Architect prior to building permit issuance. **Project Specific**

<u>Trees</u>

33. TREE REPORT: The applicant shall comply with the recommendations of the tree report prepared by Torrey Young with Dryad, LLC dated November 22, 2024, including the addendum dated March 14, 2025. No tree trimming or pruning other than that specified in the tree report shall occur. The applicant shall arrange for the Project Arborist to conduct a field inspection prior to building permit issuance to ensure all recommendations have been properly implemented. The Project Arborist shall certify in writing all recommendations have been followed.

34. TREE REMOVAL MITIGATION: Any trees approved to be removed by the City shall have its full value paid into the City's Urban Forestry Fund. A credit for replanting trees shall be as follows:

    a. $250 credit for a 15-gallon size replacement tree;
    b. $500 credit for a 24-inch box size replacement tree; and
    c. $1,000 credit for a 36-inch box size replacement tree.
    **Project Specific**

35. TREE DISPOSITION PLAN: Provide a tree disposition plan that shows trees to remain, trees to be removed, the value of each tree, the total value of the trees to remain and be protected, and the total value of trees to be removed. The plan shall also include the tree protection recommendations from the arborist report. **Project Specific**

36. Failure to comply with these tree protection recommendations may result in a "stop work order".

37. TREE BOND: Any tree affected by development/construction must be protected per the Municipal Code. The applicant shall post cash, letter of credit, or other security satisfactory to the Director of Engineering/City Engineer, for all Heritage Trees and any other significant tree as deemed by the City Landscape Architect. This bond or security will be for the value of the tree(s), up to a maximum of $100,000, and shall be held for a minimum of 1 year following acceptance of public improvements or completion of construction, whichever is later, and shall be forfeited if the trees are destroyed or substantially damaged. An arborist shall be onsite during any tree work (i.e. root pruning, trimming, setting up tree protection, etc.). The bond or security may be released early with a certification letter by the arborist confirming he/she was present during said tree work and work was performed in accordance with the arborist's recommendations.

38. ROOT CONTROL BARRIER: The applicant shall provide root control barriers and 4-inch perforated pipe for all trees located within 8-feet of pavement or other hardscape, determined by the City Landscape Architect. Root barriers shall be located along the edge of the pavement wherever the tree is within 8-feet of pavement or hardscape. Information and details shall be included in the landscape plan submittal for review and approval by the Landscape Architecture Division.

39. TREE PRUNING: Pruning shall be conducted by a certified arborist familiar with the International Society of Arboriculture (ISA) pruning guidelines and shall comply with the guidelines established by the ISA, Tree Pruning Guidelines, current edition, to maintain the health of the trees.

40. TREE PROTECTION FENCING: Prior to issuance of a grading or building permit, the applicant shall install temporary 6-foot tall chain-link fencing (or other fence type acceptable to the Landscape Architecture Division) outside of the existing tree drip lines. The location of the tree protection fencing shall be shown on the demolition plans (if applicable), grading, building, and/or landscape plans. The fencing shall remain in

place until final landscape inspection by the Landscape Architecture Division. Removal of such fencing prior to approval may result in a “stop work order.”

41. SHADE TREES: There shall be a minimum of 50 percent shade cover in the parking area within 15 years. There shall be a minimum of 20 percent shade cover in any commercial landscape areas within 15 years. There shall be a minimum of 20 percent shade cover over any hardscape areas in a non-residential environment within 15 years. **Project Specific**

**PUBLIC WORKS DEPARTMENT – LAND DEVELOPMENT – 925-931-5650**

42. CONDITIONS OF APPROVAL: These Conditions of Approval shall be depicted on a plan sheet(s) in the submitted plans for construction. (Address this condition prior to plan approval)

43. ENGINEERING DIVISION FEES FOR SERVICE: The Engineering Division assesses fees for services including plan-check, permit issuance, and inspection according to the City’s adopted Master Fee Schedule. These fees are separate and distinct from fees assessed by the Community Development Department (including Planning and Building Division fees). The applicant is responsible for payment of all Engineering Division fees prior to services rendered or permit issuance, whichever is first. (Address this condition prior to plan approval)

44. ADHERENCE TO CITY STANDARDS: All public improvements shall be designed and constructed in conformance with the City of Pleasanton Municipal Code and the City’s adopted Standard Specifications and Details in effect at the time of issuance of the permit(s). Said standards are available for download at: https://www.cityofpleasantonca.gov/our-government/public-works/engineering/ (Address this condition during all aspects of design and construction)

45. CLEAN WATER PROGRAM (HYDROMODIFICATION PROJECTS): Because the project creates and/or replaces more than 43,560 square feet (1.00 acre) of impervious surface, increases impervious surface over pre-project conditions, and is located in a susceptible area, it is considered a Hydromodification (HM) Project according to Provision C.3.g of the Municipal Regional Stormwater NPDES Permit. Said permit regulates stormwater runoff in Pleasanton. The Alameda Countywide Clean Water Program developed a C.3 Guidance Manual to assist applicants in addressing these regulations. The Guidance Manual is available for download at:

    https://www.cleanwaterprogram.org/businesses/development.html

46. HM projects must include stormwater treatment measures in the site design to cause no increase in the erosion potential of the receiving stream over the pre-project (existing) condition. To demonstrate compliance, the City encourages use of the Bay Area Hydraulic Model (BAHM). The model software can be downloaded at no cost from Clear Creek Solutions. (Address this condition prior to plan approval)

47. ENCROACHMENT PERMIT: Any work performed within the City's right-of-way, City easements, or City-owned property shall be subject to an Encroachment Permit as defined in Pleasanton Municipal Code Chapter 13.04. All encroachment permit work is subject to adopted City of Pleasanton Standard Specifications and Details and shall be performed by properly-licensed contractors as determined by the City Engineer. Said contractors must provide evidence of proper licensure (typically a Class "A" General Engineering Contractor license or appropriate Class "C" Specialty Contractor license as issued by the California Contractors State License Board), insurance and City-issued Business License upon application for a permit. (Address this condition prior to permit issuance)

48. TEMPORARY TRAFFIC CONTROL: Work in the public right-of-way or publicly-accessible easement areas require submittal, review, approval, and implementation of a temporary traffic control plan. The plan shall be in writing and subject to review and approval of the City's Traffic Engineer. The plan must conform to the California Manual on Uniform Traffic Control Devices (CA MUTCD), with specific emphasis on Part 6 "Temporary Traffic Control".

49. If Flaggers will be utilized, said personnel must be trained in the proper fundamentals of flagging moving traffic before entering the right-of-way. The City may demand to see evidence of said training before allowing said personnel into the right-of-way.

50. Any alterations to pedestrian paths of travel must conform to current standards for the disabled. Any walking member of the public with a visual impairment (cane or guide dog) must be escorted through the construction zone. (Address this condition during construction)

51. OPERATION AND MAINTENANCE AGREEMENT: Regulated projects are subject to a Stormwater Treatment Measure Maintenance Agreement between the City and property owner to assure long-term maintenance of the installed measures. The City will provide a template agreement. Once executed, the agreement must be recorded against the property. (Address this condition prior to temporary building occupancy)

52. UTILITY ENCLOSURES: Proposed utility enclosures including vaults, meter boxes, splice boxes, and pedestals shall be installed in the public right-of-way, in a public service easement (PSE), or in a utility company specific easement. The locations for utility enclosures shall be considered in the following order of preference: (1) PSE area behind public sidewalk; (2) parkstrip area between the roadway curb & gutter and the sidewalk; (3) within the public sidewalk set flush to grade; (4) within driveway approach areas set flush to the surface with traffic-rated lids. In no case shall an above-ground pedestal or utility cabinet obstruct sight-line visibility for vehicle drivers at intersections or driveways. Deviations from this standard must be approved by the City Engineer. (Address this condition prior to plan approval)

53. DRY UTILITIES (ELECTRICITY, CATV, TELECOM): All dry utilities including electricity, telecommunications, cable television, street lights, alarm systems, etc. required to serve the project shall be installed underground from the point-of-connection

at the utility purveyor's network to the service point. Aerial drops from utility poles will not be allowed without prior approval of the City Engineer. (Address this condition prior to plan approval)

54. CONSTRUCTION GENERAL PERMIT: This application is subject to a Construction General Permit according to the National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000002. The general permit is applicable to development sites that disturb one or more acres of land surface. The applicant will be required to register the project with the State Water Board's Stormwater Multi-Application and Report Tracking System (SMARTS) website. A Qualified SWPPP Developer (QSD) and a Qualified SWPPP Practitioner (QSP) must be responsible for permit compliance. The SMARTS system will generate a Waste Dischargers Identification (WDID) number, which must be printed on the grading and/or erosion control plans. (Address this condition prior to permit issuance)

55. HIGH VISIBILITY SAFETY APPAREL: All workers on foot who are exposed to the hazard of vehicular traffic shall wear warning garments such as vests, jackets, or shirts manufactured in accordance with the requirements of the American National Standards Institute (ANSI)/International Safety Equipment Association (ISEA) 107-2004 Performance Class 2, high visibility safety apparel and headwear, or any updates adopted by Cal OSHA. During hours of darkness, warning garments shall be retroreflective with visibility from a minimum 1,000 feet. (Address this condition during construction)

56. EXCAVATION SAFETY: All excavations must be performed in conformance with California Government Code Section 4216 et seq. No excavation shall occur until proper notice is provided to Underground Service Alert (usanorth811.org) by calling either 811 or 800-642-2444 at least 72-hours prior to the work so buried utilities can be marked. All excavations shall be covered or barricaded to prevent entry when work is inactive. Open excavations in the public right-of-way must be covered by skid-resistant steel plates that are firmly affixed to the surface with leading edges ramped. Excavations 5-feet and deeper require a protective system as defined by Cal-OSHA. If a shoring system or trench boxes will be utilized as the protective system, said system shall either be manufactured and installed according to manufacturer recommendations, or designed by a registered professional engineer and installed according to approved plans. No excavation shall be performed atop or adjacent to a high-risk facility until authorized by the owner of the facility. High-risk facilities are defined as gas transmission pipelines and hazardous liquid pipelines as regulated by the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (US DOT PHMSA) (Address this condition during construction)

57. POLLUTANT REDUCTION IN STORMWATER: At no time during construction of the project shall pollutants be allowed to enter, clog, or contaminate storm drain pipe networks or open stormwater channels in violation of Pleasanton Municipal Code §9.14.080 et seq. The applicant shall contain all trash and debris for proper disposal to authorized landfills or recyclers. Erosion control features shall be deployed during the rainy season that extends from October 1st to April 15th each year, or any time rain is

forecast outside of this period. Best Management Practices (BMPs) shall be strictly followed. Street sweepers must be employed if soil or debris is tracked onto the public roads from vehicles exiting the site. Standard BMPs are available from the California Stormwater Quality Association (CASQA), the United States Environmental Protection Agency (EPA), Caltrans, and others. Notes and/or illustrations shall be added to the plans that describe the BMPs to be utilized during construction. The use of manufactured erosion control woven blankets and straw wattles that utilize plastic monofilament netting is specifically prohibited. (Address this condition during construction)

58. SWPPP REPORTING: Copies of any monitoring and/or sampling reports required by the stormwater pollution prevention plan (SWPPP) and submitted by the Legally Responsible Person (LRP) to the State of California's SMARTS database shall also be submitted to the City of Pleasanton inspector assigned to the project. The LRP shall also submit to the City a copy of the required Annual Report no later than September 1st of each year that construction is active or when erosion control features have been deployed. The report must include a summary of all sampling and analysis performed (Risk Levels 2 and 3 only), a log of all inspections performed, a summary of any required corrective actions taken, and a summary of any violations. (Address this condition during construction)

59. HAUL ROUTE: Deliveries to and from the project site shall conform to the Commercial Vehicle Regulations included in Pleasanton Municipal Code Chapter 11.48. Vehicles with gross weights exceeding 3 tons but less than 8 tons are prohibited on any City roadway other than those designated a Commercial Vehicle Route unless a Transportation Permit has first been obtained. Said Commercial Vehicle Routes include First Street, Stanley Boulevard, and Sunol Boulevard. In addition to weight restrictions, vehicles that exceed 96 inches in width and/or 60 feet in length are also required to obtain a Transportation Permit. For information about Transportation Permits call 925-931-5677. (Address this condition prior to permit issuance)

60. DUST CONTROL: Dust control measures must be employed during all phases of construction to prevent airborne nuisance to neighboring properties. All stockpiles or unused materials that can create dust shall be covered or removed. Exposed soil areas shall be routinely watered until surfacing materials or landscaping is installed. Use of dust palliatives shall conform to Caltrans Standard Specification Section 18. Any damage caused by airborne dust to neighboring properties shall be cleaned with costs paid by the applicant. If the applicant fails the address dust as directed by the City, the City shall have the right to enter the property to effectuate the correction, with all costs paid by the applicant or levied as a lien against the applicant's property. (Address this condition during construction)

61. PROPERTY NUISANCE: At no time during construction of the project shall the condition of the property become a nuisance as defined in Pleasanton Municipal Code §9.28.020. The City shall have the right to inspect the property for conditions that violate the code standard. If a nuisance is found, the applicant shall immediately submit a plan of correction. Depending on the severity of the nuisance, the City may suspend

all construction work until the condition is corrected. Any of the following conditions shall be considered severe: Leaking chemicals that can cause environmental damage; open excavations or any excavation deeper than 4 feet that lacks proper shoring; unsecured materials that can fall to the ground causing damage or injury; open or exposed utilities that could cause electrical shock or contamination of sewer, potable water systems, groundwater wells, or storm drainage networks. If the applicant fails the address the nuisance as directed by the City, the City shall have the right to enter the property to effectuate the correction, with all costs paid by the applicant or levied as a lien against the applicant's property. (Address this condition during construction)

62. NOISE: Construction noise is regulated under Pleasanton Municipal Code Chapter 9.04. Noise is prohibited outside of the hours of 8:00 am and 8:00 pm daily except Sundays and holidays when noise is prohibited outside the hours of 10:00 am and 6:00 pm. Noise is defined as a level exceeding 83 dBA at a distance of 25 feet or 86 dBA at any point beyond the boundary of the property under construction. If the applicant fails the address the noise as directed by the City, the City shall have the right to enter the property to effectuate the correction, with all costs paid by the applicant or levied as a lien against the applicant's property. Exceptions to these regulations require a special permit granted by the City for circumstances when strict compliance would be impractical or unreasonable, and contingent upon proper noticing to surrounding property owners that includes the dates and times when noise levels will be exceeded and the specific reasons why an exception to the regulation has been granted. (Address this condition during construction)

63. DROUGHT RESTRICTIONS: If the City Council declares a drought during a time when this development is under construction, as described in §9.30.010 et seq. of the Pleasanton Municipal Code, the applicant shall utilize only recycled water under Stage 1 or greater restrictions for all non-potable construction-related water needs. Recycled water is available at designated locations within the City, subject to the applicant's receipt of a temporary hydrant meter from the Operations Service Center located at 3333 Busch Road. The applicant is responsible for all water costs based on current billing rates. (Address this condition during construction)

64. DAMAGE TO EXISTING PUBLIC OR PRIVATE IMPROVEMENTS: The applicant shall repair damage to existing public or private improvements on and near the project site and along the haul route at the applicant's expense if caused by construction activities. (Address this condition prior to acceptance of improvements or issuance of an Occupancy Permit)

65. GEOGRAPHIC INFORMATION SYSTEMS: The City's Geographic Information Systems (GIS) staff publishes digital maps that enable first responders to efficiently navigate to locations where calls for service have been requested. The maps are also shared with agencies and departments that provide other critical services to residents such as mail delivery. To keep these maps current, the City requires as-built plan or map information to be submitted by the applicant in a format that integrates with ArcGIS by ESRI. The "Digital Submittal Requirements" are available for download at the following weblink:

https://www.cityofpleasantonca.gov/gov/depts/gis.asp

(Address this condition prior to acceptance of improvement or issuance of an Occupancy Permit)

**FIRE DEPARTMENT – 925-454-2361**

The Fire Prevention Bureau reviews building/civil drawings for conceptual on-site fire mains and fire hydrant locations only. Plan check comments and approval DO NOT include: 1.) Installation of the on-site fire mains and fire hydrants. Specific installation drawings submitted by the licensed underground fire protection contractor shall be submitted to the Fire Prevention Bureau for approval; and 2.) Backflow prevention or connections to the public water mains.

66. FIRE HAZARDS: The project developer shall keep the site free of fire hazards from the start of lumber construction until the final inspection.

67. FIRE CODE: All construction shall conform to the requirements of the 2022 Pleasanton Fire Code and local ordinances. All required permits shall be obtained prior to work commencement.

68. SITE SAFETY: Site safety during construction shall be in accordance with Fire Code chapter 33.

69. FIRE SPRINKLERS: Automatic fire sprinklers shall be installed in all occupancies in accordance with the 2022 Pleasanton Building, Fire and Residential Codes with local amendments and ordinances.

70. EMERGENCY RESPONDER RADIO: Emergency responder radio coverage shall be provided in accordance with section 510 of the Fire Code.

71. FIRE PROTECTION FACILITIES: Prior to any construction framing, the applicant shall provide adequate fire protection facilities, including, but not limited to a water supply and water flow in conformance to the City's Fire Department Standards able to suppress a major fire.

72. WATER FLOW AND CONTROL VALVES: All fire sprinkler system water flow and control valves shall be complete and serviceable prior to final inspection. Prior to the occupancy of a building having a fire alarm system, the Fire Department shall test and witness the operation of the fire alarm system.

73. ELECTRICAL CONDUIT: Electrical conduit shall be provided to each fire protection system control valve including all valve(s) at the water connections. The Livermore-Pleasanton Fire Department requires electronic supervision of all valves for automatic sprinkler systems and fire protection systems.

74. HAZARDOUS MATERIALS: Should any operation or business activity involve the use, storage or handling of hazardous materials, the firm shall be responsible for contacting

the Livermore-Pleasanton Fire Department prior to commencing operations. Please contact the Hazardous Materials Coordinator at 925/454-2361.

75. FIRE HYDRANTS: Fire hydrants shall be installed at spacing not greater than 300 feet in industrial and commercial developments. Fire hydrants shall be installed at spacing not greater than 400 feet in residential developments.

76. FIRE LANE MARKING: On-site access ways, turn arounds, and internal drives shall be designated as fire lanes and identified as such by red curb striping and posted with signs at locations approve by the Fire Department. Signs shall be according to State standards and read “No Parking – Fire Lane” and must be shown on the plans. The red curb striping, sign location(s), and sign language shall be included in the building permit submittal for review and approval by the Livermore-Pleasanton Fire Department prior to building permit issuance.

The following schedule for NO PARKING signs shall apply:

| *Width* | *Requirements* |
|---|---|
| 36 feet or greater | No requirements |
| Between 28 and 36 feet | Post one side |
| Between 20 and 28 feet | Post both sides |
| Less than 20 feet | Not permitted |
| Cul-de-Sac | Not permitted |

77. EMERGENCY VEHICLE ACCESS ROADS: Access roads shall have 13 feet, 6 inches unobstructed vertical clearance, 20 feet of unobstructed width (26 feet where occupied building floors exceed 30 feet height), and inside turning radius of 31 feet and outside turning radius of 51 feet. Unobstructed shall mean a clear travel way, excluding parking width, and designed for an emergency vehicle weight of 70,000 pounds under all weather conditions. Unobstructed width shall not include the width of rolled curbs, sidewalks, or non-drivable surfaces. All exterior portions of buildings must be within 200 feet of an access road. Yard and parking area may be able to be located farther than 200 feet from access roads, depending on the specific use.

78. FIRE VEHICLE TURNAROUNDS: Where Fire Department vehicle access through or around a site involves changes in direction or curves, inside radius of 45 feet and outside radius of 55 feet shall be provided to facilitate fire truck turning radius for entry and exit from the site. Dead-end access ways and internal drives shall not exceed 300 feet in length and shall terminate in cul-de-sacs no less than 96 feet in diameter or hammer-head (tee). Standards and options are available through the Livermore-Pleasanton Fire Department, Fire Prevention Bureau.

79. PREMISES IDENTIFICATION: Address numbers shall be installed on the front or primary entrance for all buildings. Minimum building address character size shall be 12-inch high by 1-inch stroke. In all cases address numerals shall be of contrasting background and clearly visible in accordance with the Livermore-Pleasanton Fire

Department Premises Identification Standards. This may warrant field verification and adjustments based upon topography, landscaping or other obstructions.

80. COMMERCIAL – NEW CONSTRUCTION: The following items shall be provided prior to any construction above the foundation or slab.

    a. Emergency vehicle access shall be provided to the site, including areas where construction is occurring. If Public Works Improvements are part of the project to access the site, an emergency vehicle access plan shall be submitted for review and approval to the Fire Department.
    b. If permanent access or site paving is not provided, the carrying capacity of the emergency vehicle access shall be 70,000 pounds under all weather conditions.
    c. Site staging area(s) shall be provided for materials and equipment. All staging areas shall be outside of the emergency vehicle access route shown on the approved plans.
    d. Where on-site fire hydrant(s) are required, they shall be installed, flushed and all valves open prior to any construction above the foundation or slab. This includes concrete tilt-up and masonry buildings.
    e. On-site fire hydrant(s) shall not be obstructed and shall be sufficiently above grade to have all hydrant valves and outlets accessible for emergency use.
    f. Where a project is phased as part of the development, specific access, water supply and fire hydrant installations will be required as part of each phase. As needed a phasing plan with these improvements will be required.
    g. Where on-site grading/utility plans are submitted for review and approval prior to building construction drawings, emergency vehicle access routes, fire hydrant locations, material staging areas, etc. shall be provided.

81. FINAL INSPECTION: Prior to request for final inspection, all access roads, on-site access and fire hydrants shall be provided. All fire hydrants shall be accepted, inspected and tested to applicable City Standards.

**TRAFFIC ENGINEERING DIVISION – 925-931-5677**

82. TRAFFIC IMPACT FEES: The applicant or responsible party shall pay all applicable traffic impact fees for the Project as required under applicable law and calculated as outlined in Pleasanton Municipal Code 3.26.050 “Amount of Fee”. The fee shall be reduced by the amount of any credit authorized by Section 3.26.070 of the Pleasanton Municipal Code. Should credits exceed the amount of the fee, a reimbursement may be given pursuant to Section 3.26.080 of the Pleasanton Municipal Code. The fee shall be paid prior to building permit issuance.

83. TRAFFIC CONTROL PLAN (TCP): Comprehensive traffic control measures shall be implemented pursuant to Pleasanton Municipal Code section 13.04.240 and 13.04.250 during construction, including scheduling of major truck trips and deliveries, to avoid peak travel hours. If necessary, as determined by the Traffic Engineer, proper lane closure procedures such as flagger stations, signage, cones, and other warning devices shall be implemented during construction.

84. TRUCK ROUTES: The haul route for all materials to and from the Project site shall be approved by the City's Traffic Engineer prior to issuance of a building permit, and shall include the provision to monitor the street surfaces used for the haul route so that any damage and debris attributable to the haul trucks is identified and corrected at the expense of the Project applicant or developer.

85. SIGNAGE AND STRIPING: The plans submitted to the Building and Safety Division for plan check shall include improvement plans for this Project that contain signage and striping details for both on- and off-site. Said improvement plans shall be subject to the review and approval of the City Traffic Engineer prior to building permit issuance.

86. PARKING: Per sheet A-14, parking requirements are met under the proposal that the second floor will be constructed but not occupied (shelled only). Once build-out of the second-floor shell is completed, the applicant agrees to provide an additional 31 parking spaces within the site to accommodate the increased parking demand.

***END***

CITY OF PLEASANTON

INITIAL STUDY

ENVIRONMENTAL CHECKLIST FORM

I. BACKGROUND

1. Name of Proposal Valley Memorial Hospital , PUD-86-11

2. Proponent Valley Memorial Hospital

   Contact Person Wayne Runestrand

3. Address 1111 E Stanley Boulevard Phone No. 447-7000 ex5244

   Livermore,

   California 94550

4. Date Checklist Submitted August 8, 1986

5. Person Preparing Checklist Lawrence Lew

II. POSSIBLE ENVIRONMENTAL IMPACTS

This application proposes the development of an approximately 488,000 square foot medical center complex consisting of offices, behaviorial medicine, skilled nursing, residential, acute/ambulatory care, and related facilities. The complex is to be developed on the approximately 28 acre site in four phases.

1. Conformance of Proposal with General Plan Policies.

   This project is consistent with the General Plan Land Use Element designation of Public and Institutional.

| May be Significant | X Insignificant | Insignificant if Mitigated |
|---|---|---|

2. Impact on Existing Uses (on and off site)

   The project site is presently vacant as are adjacent parcels north and west of the site. This property was rezoned to the present "P" (Public and Institutional) District in September 1976. The parcel to the north of the site was recently approved for a 456-unit apartment complex. The area south of the site across W. Las Positas Blvd. has been developed for high density residential uses. A fire station is located across Santa Rita Road from the site as are other multiple and

single-family residences. A business park is being developed in the area west of the project site.

| May be Significant | X Insignificant | Insignificant if Mitigated |
|---|---|---|

3. Geologic Impacts
(hazards, change in topography, erosion, etc.)

The site is relatively flat with a slight rise at the central portion of the property. No areas of erosion are evident on the site. Site grading will be required to accommodate the proposed multi-building complex. It is not anticipated that fill material will need to be imported for construction. A geologic & soils condition report for this site was previously prepared (Burkland and Associates) for the rezoning action. The report indicated that there were no stability nor seismic-related problems anticipated with site development given the availability of engineering techniques to accommodate any potential expansive soils affecting the site.

| May be Significant | X Insignificant | Insignificant if Mitigated |
|---|---|---|

4. Air Quality Impacts
(emissions, odors, change in microclimate)

Site development will result in an increase in area emissions due to building operations & vehicle circulation. Emissions should not be significant given the overall levels projected for development in the region. Initially, emissions may be marginally reduced due to a reduction of miles travelled for local residents who must now travel to hospitals in other areas.

| May be Significant | X Insignificant | Insignificant if Mitigated |
|---|---|---|

5. Water Related Impacts
(runoff, flood hazard, quality and quantity of surface and ground waters)

Runoff will increase as a result of site development. Urban pollutants, typical of those found in other developed environments, would be introduced in surface flows. On-site improvements to accommodate the increased runoff will be subject to City review and standards. The Environmental Element of the General Plan indicates that the project site is not a significant water recharge area. The flood hazard maps

of the U. S. Dept. of Housing & Urban Development indicates that the project site is located within a flood-prone area. The affected area is subject to periods of shallow flooding where depths are considered to average less than one foot. Regulations require that remedial construction measures be taken in such areas. Widening and other improvements to the area's drainage/flood control channels are being undertaken to reduce or eliminate this flood potential.

| May be Significant | X Insignificant | Insignificant if Mitigated |
|---|---|---|

6. Plant and Animal Impacts
(effect on existing ecosystem, rare or endangered species, etc.)

The existing grassland ecosystem will be replaced by structures & parking areas. Ornamental landscaping species will be introduced. Small rodents & birds which frequent the site will be displaced to other open space areas. Historically, the site had been used for agricultural purposes. The soils survey of the U.S. Dept. of Agriculture indicates that the project site is prime agricultural soils (Class I). The location of the property relative to more urbanized land uses make continued agricultural use of the property marginal.

| May be Significant | X Insignificant | Insignificant if Mitigated |
|---|---|---|

7. Transportation/Circulation Impacts
(additional traffic, congestion, parking, hazards, etc.)

The project site has frontage on Santa Rita Road, Old Santa Rita Road, West Las Positas Boulevard, Owens Drive, and Andrews Drive, all public streets. Driveway entrances are proposed all street frontages except Old Santa Rita Road. An internal circulation system will be developed over the phases of construction to allow for adequate circulation and access to parking. The emergency vehicle access to the hospital is intended to serve all approaches. A helipad facility is proposed for the third phase development to be located on the top of the five story acute care facility. A traffic study was completed for this project (TJKM) and indicated that prior to buildout of all phases, traffic generated by

this project and other development in the area would cause deterioration of adjacent intersections to unacceptable levels. However, planned inprovements to the area's circulation system would return these intersections to acceptable levels.

| May be Significant | X Insignificant | Insignificant if Mitigated |
|---|---|---|

8. Noise Impacts
(increases, exposure to high levels)

Noise levels will increase as a result of site development and would be principally attributable to traffic generated. Emergency vehicle operation will occur. The hospital site is located at the intersection of two major streets and corresponding noise corridors. Medical facility complexes are subject to interior noise standards. The main hospital facility is located approximately 400 feet from either of the street frontages. Operation of the helipad facility will cause short-term noise impacts at the facility and along the corridor approach routes to the hospital. Operation of the helipad are subject to federal, state and local regulations.

| May be Significant | X Insignificant | Insignificant if Mitigated |
|---|---|---|

9. Impacts on Public Services
(fire, police, schools, parks, Maintenance, etc.)

Services have been extended to this area in conjunction with development of the surrounding area. A fire station is located across Santa Rita Road from the site.

| May be Significant | X Insignificant | Insignificant if Mitigated |
|---|---|---|

10. Impact on Utilities
(water, sewer, storm water drainage, solid waste,etc.)

Utilities have been extended to this area in conjunction with other developments in the area. Extension of utilities will be subject to specific conditions and requirements of the City and other public and private agencies.

| May be Significant | X Insignificant | Insignificant if Mitigated |
|---|---|---|

11. Growth-Inducing Impact

This project would facilitate the development of uses in this area consistent with the zoning scheme adopted for this area in 1976. Medical offices, for example, could be built on the adjacent property. Support commercial and other office development has occurred on previous vacant properties in the vicinity. Compatibility with nearby residential areas would be a factor in determining the intensity of any medical-related uses in the vicinity. The development of the hospital is intended to fulfill a projected need for medical services in the area as the employement and residential base increases.

| May be Significant | X Insignificant | Insignificant if Mitigated |
|---|---|---|

12. Energy Impacts

The hospital conplex will be subject to State energy conservation standards. The location of the site will provide ease of access from both the local street system and I-580. Development of the facility will result in reduced vehicle miles travelled to other medical facilities in the region.

| May be Significant | X Insignificant | Insignificant if Mitigated |
|---|---|---|

13. Aesthetic Impacts
(obstruction of views, design, etc.)

The site plan emphasizes medical office/entrance areas toward the public streets while the hospital activities are concentrated in the central portion of the site. The site plan shows substantial setbacks from the public street frontages. Because of the siting and orientation, entrances to the complex buildings are not obvious. However, signage and landscaping elements should provide adequate guidance for public access.

| May be Significant | X Insignificant | Insignificant if Mitigated |
|---|---|---|

14. Impacts on Archaeological or Historical Sites

An archaeological survey was completed for the site (Chavez) in conjunction with the rezoning application. The report indicated that no indications of archaeological remains were encountered. However, if archaeological or historical artifacts are discovered

during development, construction should be halted to allow for an adequate evaluation of the resources.

| May be Significant | X Insignificant | Insignificant if Mitigated |
|---|---|---|

| | Yes | No |
|---|---|---|
| 15. Is there any serious public controversy concerning the environmental effects of the proposed project? If so, list below. | ___ | ✓ |

III. MANDATORY FINDINGS OF SIGNIFICANCE

| | | |
|---|---|---|
| 1. Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory? | ___ | ✓ |
| 2. Does the project have the potential to achieve short-term, to the disadvantage of long-term, environmental goals? (A short-term impact on the environment is one which occurs in relatively brief, definitive period of time while long-term impacts will ensure well into the future.) | ___ | ✓ |
| 3. Does the project have impacts which are individually limited, but cumulatively considerable? (A project may impact on on two or more separate resources; where the impact on each resource is; relatively small; but where the effect of the total of those impacts on the environment is significant.) | ___ | ✓ |
| 4. Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly of indirectly? | ___ | ✓ |

IV. STAFF RECOMMENDATION

✓ I find the proposed project would not have a significant effect on the environment and, thus, recommend a Negative Declaration be prepared.

____ I find that the mitigation measures recommended in the Initial Study for those aspects of the project which could have a significant effect would reduce the effects to insignificant levels and, thus, if such measures are included as conditions to project approval, I recommend a Negative Declaration be prepared.

____ I find the proposed project may have a significant effect on the environment, and, thus, recommend an Environmental Impact Report be prepared.

Date August 8, 1986 Signature Brian W. Swift

tpnegdec

FILED
ALAMEDA COUNTY

NOV 6 1986

RENE C. DAVIDSON, County Clerk
By

# NOTICE OF DETERMINATION

TO: ___ Office of Planning and Research
1400 Tenth Street, Room 121
Sacramento, CA 95814

or

X County Clerk, 1225 Fallon St., Oakland, CA 94612
County of Alameda

FROM: City of Pleasanton
P. O. Box 520
Pleasanton, CA 94566

SUBJECT: Filing of Notice of Determination in compliance with Section 21108 or 21152 of the Public Resources Code.

PUD-86-11, Valley Memorial Hospital
Project Title

| N/A | Brian W. Swift | (415) 847-8023 |
|---|---|---|
| State Clearinghouse Number (If submitted to Clearinghouse) | Contact Person | Telephone Number |

27.7 ac. northwest corner of Santa Rita Road and West Las Positas Boulevard
Project Location

Project Description: Application of Valley Memorial Hospital for rezoning from "P" (Public and Institutional) to PUD (Planned Unit Development)-Public and Institutional District and development plan approval for an approximately 488,000 sq. ft. medical center complex consisting of offices, behavioral medicine, skilled nursing, residential, acute/ambulatory care, and related facilities to be constructed in four phases, to be located on an approximately 27.7 acre site, located at the northwest corner of the intersection of Santa Rita Road and West Las Positas Boulevard.

This is to advise that the City of Pleasanton has approved the above described project and has made the following determinations regarding the above described project:

1. The project ___ will/ X will not have a significant effect on the environment.

2. __An Environmental Impact Report was prepared for this project pursuant to the provisions of CEQA.

   X A Negative Declaration was prepared for this project pursuant to the provisions of CEQA.

   The EIR or Negative Declaration and record of project approval may be examined at: Planning Department, City of Pleasanton, 200 Old Bernal Avenue, Pleasanton, CA 94566.

3. Mitigation measures ___ were/ X were not made a condition of approval of the project.

4. A statement of Overriding Considerations ___ was/ X was not adopted for this project.

Date Received for Filing _____

Brian W. Swift
Brian W. Swift, Director of Planning and Community Development

Date Approved: 10/28/86
Mailed: 10/29/86

CLERK'S CERTIFICATE OF POSTING: Pub Res 21152
I posted [illegible] copy of this document was posted at the courthouse, Oakland, CA., for the period prescribed by law.
Executed at Oakland, Cal.
on 11/6/86
COUNTY CLERK
by Yvette Johnson

EXHIBIT B

# Stanford Health Care Tri-Valley

# East Wing Hospital Addition

# Design Review Application

# Project Narrative

PREPARED FOR:

Stanford Health Care Tri-Valley

5555 West Las Positas Boulevard
Pleasanton, CA 94588

PREPARED BY:

TAYLOR design
550 Montgomery St
Suite 925
San Francisco CA 94111

Architect's Project Number: 6370.101

Prepared on: **November 22, 2024**
**Revised 4/22/2025**

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## ABBREVIATIONS

| | |
|---|---|
| AADT | Average Annual Daily Traffic |
| ASSB | Ancillary Support Services Building |
| BAAQMD | Bay Area Air Quality Management District |
| CAN | California Application Notice |
| CBC | California Building Code |
| CDPH | California Department of Public Health |
| CEQA | California Environmental Quality Act |
| CUP | Central Utility Plant |
| DGSF | Department Gross Square Feet |
| ED | Emergency Department |
| EVCS | Electric Vehicle Charging Station |
| HOPD | Hospital-based Outpatient Department |
| MOB | Medical Office Building |
| NPC | Non-structural Performance Category |
| OSHPD | Office of Statewide Health Planning and Development |
| PUD | Planned Unit Development |
| SF | Square Feet |
| SHC | Stanford Health Care |
| SHC TV | Stanford Health Care Tri-Valley |
| SPC | Structural Performance Category |
| SPD | Sterile Processing Department |

## PROJECT SUMMARY

Stanford Health Care (SHC) Tri-Valley Hospital is a medical center complex at the northwest corner of the intersection between W. Las Positas Boulevard and Santa Rita Road in North Pleasanton, California. It is a Planned Unit Development (PUD) – Public and Institutional District. Since its integration with Stanford Health Care (SHC) in 2015, Stanford Health Care Tri-Valley (SHC-TV) has been growing in its role as an essential presence in Pleasanton and the greater area.

The original PUD application for SHC Tri-Valley (formerly Valleycare Medical Center) was approved in 1986, which allowed for phased development of an approximately 488,000 SF medical center complex. The allowable site capacity for this site is as follows:

| **Allowable Site Capacity within 1986 PUD Limits** | | | |
|---|---|---|---|
| **Building** | **Existing Floor Area (SF)** | **Net Change (SF)** | **Future Floor Area (SF)** |
| 5565 MOB | 45,000 | | 45,000 |
| 5575 MOB | 45,000 | | 45,000 |
| Main Hospital + West Wing | 174,000 | | 174,000 |
| ASSB (Lab + Pharmacy) | 11,500 | | 11,500 |
| Central Utility Plant (CUP) | 6,825 | | 6,825 |
| Proposed East Wing | | 66,000 | 66,000 |
| Future Buildings / Additional Allowable Area | | | 139,675 |
| **TOTAL** | **282,325** | **66,000** | **488,000** |

This project's purpose is to build a new three-story, approximately 66,000 square foot hospital addition at the east side of the existing SHC Tri-Valley Hospital located at 5555 W. Las Positas Boulevard in Pleasanton, California.

SHC Tri-Valley has seen increased demand for emergency services since 2020. Currently, there is a deficiency of approximately 18,000 DGSF total. Projected emergency room volumes are expected to increase by approximately 20% within the next ten years.

To address the growing needs of the community, the first-floor level will expand the existing Emergency Department to a total of 42 examination and treatment locations including new waiting, registration, triage, security vestibule, ambulance parking, staff lounge with outdoor staff patio, and support spaces. Approximately 1/3 of the existing Emergency Department will also be renovated with the remainder of the Emergency Department cosmetically refreshed.

The second-floor level will be designed as a shell space to accommodate a potential 24-bed nursing unit (Phase 2) to support future inpatient volume. The Phase 2 build-out of the shelled space will include another 31 parking stalls in addition to the 989 parking stalls provided in the current phase. In addition to the potential nursing unit, the second-floor level will include two Labor and Delivery rooms that will replace two existing rooms displaced by the connection for the new hospital addition.

The existing Lab, Pharmacy and Sterile Processing Department are undersized relative to current needs and SHC Tri-Valley intends to combine code required space with functional needs housed in the existing Ancillary

Support Services Building (ASSB). Currently there is a deficiency of approximately 14,000 DGSF for these key support services. The third-floor level will include a new Laboratory, Pharmacy and Sterile Processing Department (SPD) to help resolve these capacity shortfalls and support the greater Emergency Department objectives. After activation of the new SPD space on the third-floor level, the existing SPD on the first-floor level will be backfilled with storage.

The roof level will include an enclosed mechanical penthouse approximately 3,500 square feet in area and a screened mechanical enclosure for the remainder of the new roof area.

In preparation for construction of the new hospital addition several make-ready projects will be required. These include re-routing of existing underground utilities within the footprint of the new hospital addition, reconfiguration of the existing loop drive, demolition of the existing ambulance canopy and construction of a new temporary ambulance canopy/parking area (Figure 1). Additional site modifications include reconfiguration of the existing campus loop road and new surface parking to replace existing parking spaces displaced by the new work.

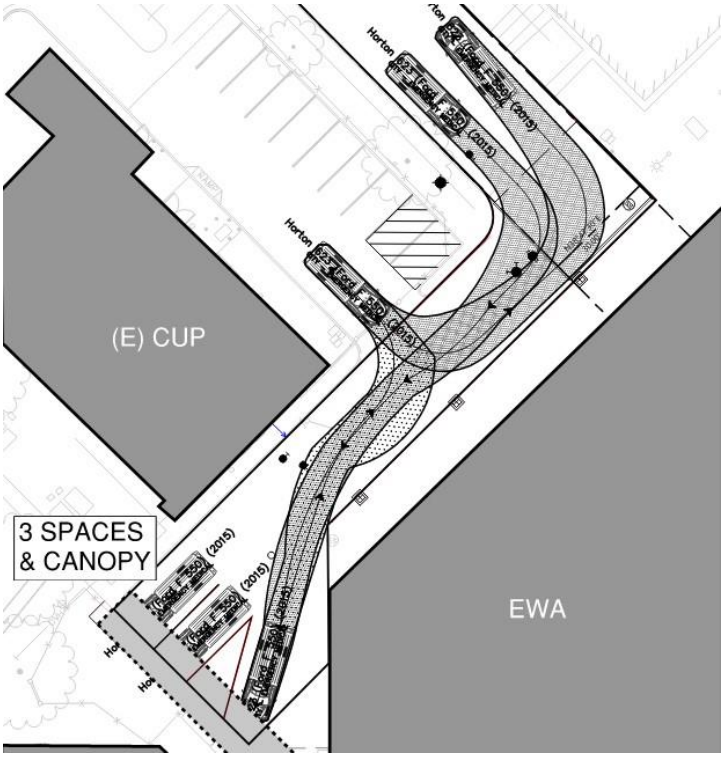



Figure 1 - Temporary Ambulance Parking and Canopy

Emergency water and wastewater storage tanks are required for the hospital to meet the 2030 State of California deadline for seismic resiliency. The project's scope includes installation of new NPC-5 compliant potable water and wastewater storage tanks for the entire hospital and SPC 4D and NPC 4 evaluation and upgrades to the existing arcade canopy near the emergency department.

## EXISTING SITE

The existing approximately 27.7-acre campus is subdivided into 5 parcels. It is bordered by W. Las Positas Boulevard, Santa Rita Road, Old Santa Rita Road, Andrews Drive and Owens Drive.

Parcel 946-3200-31-2 is located on the south side of the site and contains a three-story medical office building with the address of 5565 W. Las Positas Boulevard. Parcel 946-3200-34 is located on the southeast side of the site and contains a three-story medical office building with the address of 5575 W. Las Positas Boulevard. The existing two-story main hospital building including the existing Emergency Department, three-story West Wing, Central Utility Plant (CUP) and one-story ASSB building are located on Parcel 946-3200-35-2 at the center of the site with the address of 5555 W. Las Positas Boulevard. An access road from Andrews Drive is located at the west side of this parcel. An existing helipad is also located on this parcel to the west of the CUP. Parcel 946-3200-29-1 at the south end of the site contains parking and access roads from W. Las Positas Boulevard to the south, Owens Drive to the southwest and Andrews Drive to the east. Parcel 946-3200-36 is located at the north end of the site and currently contains an emergency generator enclosure, parking for staff and the Emergency Department and several temporary administration and construction trailers. An access point from Santa Rita Road is located at the east side of this parcel.

Lot Line Adjustment Application P24-0437 to merge parcels 946-3200-35-2 (5555 W. Las Positas Boulevard – Parcel 1: Approximately 8.57 acres) and 946-3200-36 (Parcel 2: Approximately 6.12 acres) into a single parcel has been approved by the City of Pleasanton. The merged parcel will be approximately 14.69 acres and will contain the existing hospital and new building addition. The Lot Line Adjustment is in the process of being recorded at the County.

The existing buildings at this site range in height from one-story to three stories. The Medical Office Buildings, West Wing and main hospital building are of a modern geometric design and clad in red brick with tan brick accent bands and beige concrete support columns. The existing CUP and emergency generator enclosure are also clad in brick to match the main hospital and medical office building color palette. Fenestration consists of vertical and horizontal tinted glass surfaces with blue-grey metal frames. Entry points and stairwells at the medical office buildings are vertical tower elements that extend above the parapets and have curtainwall glazing to articulate these buildings and serve as a wayfinding tool to identify the entries. The circular entry rotunda at the main hospital is composed of curtain wall glazing with white metal panels.

The Porte Cochere at the main entrance is defined by two pyramid-shaped metal roof pavilions with clerestory glass and brick clad column supports. Open air breezeways extend from the Porte Cochere structures to the rotunda at the west and existing emergency department at the east side of the hospital. These arcades connect the entry points for the main hospital and medical office buildings and consist of structural steel framing with a blue standing seam metal roof and clerestory glazing.

The existing one-story ASSB building is clad in stucco with red and beige coloring similar to other buildings on the site. Windows at this building are punched openings with blue metal frames.

## NEIGHBORHOOD CONTEXT

The central location of the main hospital building on the site emphasizes the prominence of the project location at the intersection of two six-lane arterial roadways (W. Las Positas Boulevard and Santa Rita Road). The site is bordered on at least three sides by residential uses.

### ANDREWS DRIVE:

To the north and east of the site, along Andrews Drive is a multi-family residential development called Eaves Pleasanton operated by Avalon. This complex consists of a series of two and three-story, wood framed rental apartment buildings clad in wood siding with asphalt shingle roofing. Outdoor green spaces and play areas for children are located between groups of buildings along Andrews Drive. A tree lined landscape buffer is located on the hospital side of Andrews Drive with curb and sidewalk across the street. Portions of the perimeter are bermed landscape areas that create a visual barrier towards the site.

### OLD SANTA RITA ROAD:

A small area at the northeastern corner of the site is bounded by Old Santa Rita Road. Across the street are a large surface parking lot and one-story Chase Bank building. The Chase Bank building is clad in brick and stucco with a stone wainscot base and has a flat roof. The south side of this building has a sloped roof with red clay tile roofing.

### SANTA RITA ROAD:

The eastern side of the site is bounded by Santa Rita Road, which is a main thoroughfare with access from I-580 to the north. Across the street on Santa Rita Road is a complex of two-story multi-family dwellings with stucco cladding and sloped asphalt shingle roofs. An 8’ high stone screen wall separates this complex from the streetscape along Santa Rita Road. The northeast lot at the intersection of Santa Rita Road and W. Las Positas Boulevard is Fire Station 3. This building is a single story building clad in a combination of brick, stucco and wood siding material. The area to the southeast of the intersection of Santa Rita Road and W. Las Positas Boulevard is Santa Rita Square shopping center consisting of one-story, stucco clad commercial buildings with red clay tile roofing. A bus stop is situated on the west (hospital) side of Santa Rita Road approximately midway between the east entrance to the hospital campus and intersection of Santa Rita Road and W. Las Positas Boulevard.

### W. LAS POSITAS BOULEVARD:

The south side of W. Las Positas Boulevard is lined with two-story multifamily residential units clad in stucco and wood siding with tile mansard roofing. An 8’ high masonry wall along W. Las Positas Road screens these apartment buildings from the roadway and hospital campus. A bus stop is situated on the west (hospital) side of Santa Rita Road approximately midway between the main entrance to the hospital campus and intersection of Santa Rita Road and W Las Positas Boulevard. A second bus stop is located across the street.

### OWENS DRIVE:

The southwest portion of the site is bounded by Owens Drive. Across the street is the Hacienda Commons apartment complex consisting of two and three-story multifamily residential buildings clad in stucco with tile roofing. A landscape buffer separates pedestrian walkways on each side from the street with a central landscape planter separating traffic in each direction.

## SITE CONSTRAINTS

The area of the proposed east wing hospital addition is bordered to the south by the existing two-story hospital building with mechanical penthouse, existing emergency department and existing arcade structure. To the east is an existing vehicular turnaround and patient drop-off area for the Emergency Department and the 5575 medical office building. To the north are a generator enclosure and temporary trailers. To the northwest are the existing Central Utility Plant (CUP), loading dock and support spaces, and helipad.

An existing ambulance parking area and canopy are currently within the footprint of the east wing hospital addition. A temporary ambulance drop-off area will need to be established prior to the start of construction of the new addition. The existing onsite road that connects Santa Rita Road and Andrews Drive will also need to be reconfigured around the new addition.

Due to proximity to the CUP and generator yard, several existing underground utilities exist within the footprint of the new addition that will need to be relocated (Figure 2).

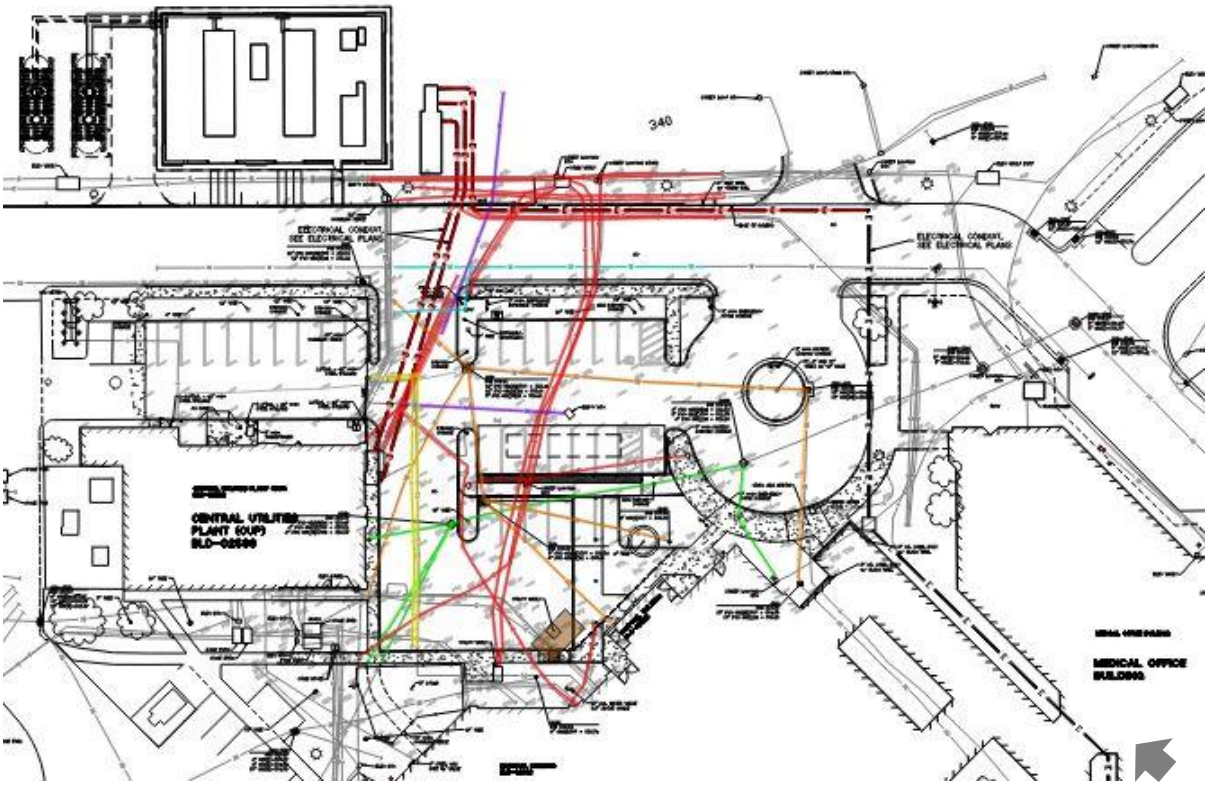



Figure 2 – Existing Underground utilities near and within the expansion footprint

# MAKE READY

Prior to start of construction for the new east wing hospital addition several make ready projects need to be completed as follows:

## UTILITIES

As part of the development of this project, a significant amount of existing utility systems, both civil and non-civil, will need to be relocated and it is anticipated that new utility systems will need to be installed.

### STORM DRAINAGE

The East Wing Hospital Addition conflicts with the existing storm drainage system within this part of the campus. The system will need to be split, relative to the direction it flows. The project area, to the west of the addition, will be directed to the existing system that directs storm water towards Andrews Drive. The project area, to the east of the addition, will be directed to the existing system that directs storm water towards W. Las Positas Boulevard. The grading design will direct runoff to on-site treatment areas prior to the water discharging into the main collection system. It is anticipated that pipe sizes will range from 6” to 18”. Bio-retention areas will be strategically placed in areas where storm water runoff can be collected. Each of the treatment areas will consist of bio-treatment soil, 18” minimum, with an infiltration rate of 5”/hour, 12” of drain rock and perforated 4” collection pipe and an overflow drainage inlet.

### SANITARY SEWER

The East Wing Hospital Addition conflicts with the existing sanitary sewer system within this part of the campus. Unlike the existing storm drainage system, the existing sanitary sewer system directs sewerage to the east, where it turns and heads in a southwestern direction. Due to the length of the hospital addition, routing a new sewer line around the building will not provide enough fall for the sewerage to flow via gravity. As such, a new 8” sewer line will be installed, along the western side of the new addition. This new line will convey sewerage toward Andrews Drive and will connect to the existing public sewer line.

### WATER

The new East Wing Hospital Addition conflicts with the existing site water and fire services to the medical office building located at 5575 W. Las Positas Boulevard. The project will reroute the domestic water and fire water services to clear the new East Wing building footprint, along the western side of the addition, around the ambulance drop-off, and reconnect within the patient drop-off area. Existing water services to the hospital will remain.

Existing underground utilities will be relocated in a phased manner to minimize impacts to hospital and medical office building operations.

## TEMPORARY AMBULANCE ACCESS AND PARKING

A portion of the existing paved area at the current ambulance parking area will be reconfigured to provide temporary ambulance parking for ambulances during construction. Access to this area will utilize the existing access road from Andrews Drive. A temporary ambulance canopy will be built near the existing hospital and north end of the existing Emergency Department.

## RING ROAD AND STAFF / EMERGENCY DEPARTMENT PARKING

The existing ring road will be reconfigured to go around the new building addition. The final configuration will allow for a continuous 26’ wide fire department access around the site. A new passenger drop-off area will be provided at the entrance to the expanded Emergency Department. A canopy in this area will provide sheltered access to the entrance from the drop-off area. The existing staff and emergency department parking lot adjacent to the loop road will be reconfigured to accommodate parking spaces displaced by the hospital addition and road reconfiguration. Ambulance parking will be located at the north end of the hospital addition with five covered ambulance parking spaces. Five additional parking spaces will be provided for ambulances and other emergency vehicles in this area.

# ARCHITECTURAL DESIGN

## EAST WING HOSPITAL ADDITION:

The proposed East Wing hospital addition will utilize the existing established architectural vernacular of the hospital campus. The exterior façade will consist of a combination of brick, accent brick, exposed concrete columns, metal panels and glazing consistent with the existing hospital and medical office buildings. A new metal canopy at the passenger drop-off area and Emergency Department entrance will extend towards the existing arcade breezeway and provide covered protection from the Emergency Department to the hospital's main entrance. A stair tower at the north end of the building will be a vertical element to articulate the building massing. Exterior glazing will be low-E glass. A metal canopy at the north end of the building will cover 5 ambulance bays.

The building will be approximately 50'-0" in height to top of parapet with 15'-4" floor to floor at first, second and third floor levels. A mechanical penthouse approximately 3,500 square feet in area will be at the roof level with total building height at mechanical penthouse approximately 59'-10". Outdoor rooftop mechanical equipment will be screened with metal panels to match existing mechanical screened enclosures with top of screened enclosures approximately 59'-10" above grade.

## NPC-5 COMPLIANCE:

The 2019 California Plumbing Code Section 615.4 states that "The emergency water storage capacity shall be computed based on an approved Water Conservation/Water Rationing Plan to provide for 72 hours of operation, accepted by the licensing agency." Nonstructural Performance Category 5 (NPC-5) refers to the ability of a hospital facility to support 72 hours of emergency operation. The scope of this project includes the installation of new potable water and wastewater storage tanks to bring the hospital into compliance with NPC-5 requirements by January 1, 2030.

The proposed potable water storage tank will be above grade and will include a pump station and water filtration skid. It is sized based on the current and future anticipated baseline water usage requirements for the entire hospital building, including the proposed East Wing hospital addition.

The potable water storage tank, pump station and water filtration skid will be located on the western side of the site north of the existing access from Andrews Drive and will be connected to the existing water service on the south side of this access road. A screened, open air brick masonry enclosure with accent brick will screen this equipment. The enclosure will be sized to accommodate a second tank for future hospital expansion. The walls of the enclosure will be approximately 14'-6" tall. The existing landscape berm along the eastern side will be extended towards the enclosure to reduce the visible height of the wall from Andrews Drive.

New below grade wastewater storage tanks will be installed as part of this project to comply with NPC-5 requirements. One tank will be installed at the south end of the existing staff and emergency department parking lot north of the existing access from Santa Rita Road. A second tank will be installed in the lawn area west of the existing west wing building between the west wing and parking lot. A portion of the wastewater will be diverted to Andrews Drive and a small below grade storage tank will be installed in the parking area north of the existing Central Utility Plant for this section of waste piping.

# ACCESS AND PARKING

## SITE ACCESS

There are currently five driveways that provide access to the site. The main access for the public to the hospital complex is located on the north side of W. Las Positas Boulevard. The driveway from this access point culminates in a circular drive and passenger drop-off area. The passenger drop-off area provides immediate access to the arcade breezeways connecting to the main hospital entrance, medical office buildings and existing Emergency Department. Additional access points are located at Owens Drive, Santa Rita Road and two access points along Andrews Drive. The northern access road at Andrews Drive provides access to the hospital's existing loading area for service and deliveries as well as waste removal. This project will not add to or alter any of the existing access points. Existing monument signs and directional signage will not be modified as part of this project.

On-site vehicular traffic is channeled around the hospital and medical office buildings via a loop road allowing for emergency vehicle access around the site.

## PARKING

Existing surface parking lots at the south, west and east sides of the site will not be modified and are not a part of this project. Existing Emergency Department parking spaces and Staff / Emergency Department spaces displaced by the new east wing hospital addition and ring road reconfiguration will be relocated to the north end of the existing staff and emergency department parking lot (Parking Lot G) and west of the proposed ambulance parking area resulting in a net zero change in total parking spaces provided on the site. Parking calculations for the site are as follows:

| Building | Metric | Factor | Parking Required | Parking Provided |
|---|---|---|---|---|
| MOB (HOPD) | 2,120 SF | 1/286 | 2,120 SF x 1 stall/286 SF = 7 stalls | 7 stalls |
| MOB (Other) | 87,880 SF | 1/286 | 87,880 SF x 1 stall/286 SF = 307 stalls | 307 stalls |
| Hospital* | 191 beds | 1.79 | 191 beds x 1.79 stalls/bed = 342 stalls | 675 stalls |
| **Total** | | | **656 stalls** | **989 stalls** |

* Hospital = 167 existing beds + 24 potential proposed beds in East Wing Addition

Accessible parking calculations for the site are as follows:

| Building | Metric | Parking Required |
|---|---|---|
| MOB (HOPD) | 7 stalls | 7 stalls x 1 accessible/10 stalls = 1 stall |
| MOB (Other) | 307 stalls | 307 stalls x 1 accessible/50 stalls = 6 stalls |
| Hospital* | 675 stalls | 675 stalls x 1 accessible/50 stalls = 14 stalls |
| **Total Required** | | **21 stalls** |
| Total provided | | 41 stalls |

Per CAL Green Code requirements for non-residential new construction 10% of parking spaces shall be Level 2 EVCS, and 10% shall be Level 2 EV Capable. For the new East Wing hospital addition and potential future nursing unit on the second floor, a total of 43 parking spaces will be required. Per City of Pleasanton Municipal Code Section 18.88.020.B *"If, in the application of the requirements of this chapter, a fractional number is obtained, one parking space shall be provided for a fraction of one-half or more, and no parking space shall be required for a fraction of less than one-half."* Based on the 10% requirements noted above, a total of four (4) Level 2 EVCS and four (4) Level 2 EV Capable parking spaces will be provided as part of this project. These spaces will be in the staff and Emergency Department parking lot east of the new hospital addition.

City of Pleasanton Municipal Code Chapter 18.88 requires that at least 10% of the off-street parking spaces required by Municipal Code Section 18.88.30 be designated as spaces for carpool, vanpool, carshare, and alternative fuel vehicles. The four (4) Level 2 EV Capable parking spaces will be in the existing Emergency Department and Staff Parking Lot near the hospital entrance and will initially be used for alternative vehicle parking. Signage will be provided to indicate these spaces as alternative vehicle parking. One space will be designated for Vanpool and four (4) spaces will be designated for carpool, car-share or alternative fuel vehicles (including, but not limited to ethanol, biodiesel, fuel cell (hydrogen), natural gas vehicles, but not including hybrid or biofuel vehicles where one of the fuels is gasoline or diesel.). These spaces will have electrical infrastructure in place so that when the demand warrants, as determined by the Community Development Director, these spaces can be used for electrical vehicle charging.

Another 31 parking spaces in addition to the 989 proposed parking spaces in the current phase will be provided in the future as part of the Phase 2 build-out of the second-floor shelled space.

## PEDESTRIAN ACCESS

Sidewalks are proposed around the perimeter of the east wing hospital addition and at the passenger drop-off area. These will connect to the existing on-site pedestrian circulation. A crosswalk will be provided to provide access from the Staff / Emergency Department parking lot to the Emergency Department entrance.

## TRANSIT CONNECTIONS

The existing hospital campus currently complies with CAP 2.0 (P10) and Municipal Code (17.26) for transit connections. There are existing bus stops located adjacent to the hospital campus on Santa Rita Road and W. Las Positas Boulevard. Pedestrian walkways provide access from these bus stops to the hospital and medical office buildings.

## ACTIVE TRANSPORTATION

Per CAP 2.0 (P8) new construction non-residential projects should provide two (2) short term bicycle parking spaces (e.g. bicycle racks) for each 9,000 SF of gross floor area (minimum 2 spaces) and one long-term bicycle parking space (i.e. bicycle locker, enclosed storage, or racks within building) for each 9,000 SF of gross floor area. The site landscape and hardscape design will provide approximately eighteen (18) bicycle parking spaces at the exterior of the building and an enclosed space to accommodate eight (8) bicycle parking spaces.

## HELIPAD

The existing at grade helipad west of the Central Utility Plant will remain and existing flow from the helipad to the Emergency Department will be maintained. The helipad is used for emergency situations involving transfers of critically ill patients including accident victims in a life-threatening condition and situations including organ donors. Helicopters using the helipad follow Interstate 580/680, Owens Drive, and Old Santa Rita Road corridors in their approach to the helipad. Proposed new structures will not interfere with the current flight paths.

## LANDSCAPING

The landscape site design enhances campus beauty, fosters patient and staff comfort and security, and is focused on low maintenance, low water use and sustainability. Integrated with the surrounding campus, it ensures seamless circulation and easy navigation for patients and staff. The staff & patient spaces create a welcoming atmosphere that is supportive of the campus community.

The design integrates the staff & patient spaces and circulation within a biophilic landscape. It provides connections to adjacent parking, bike parking and pedestrian corridors, and as well to a variety of amenity spaces. At the drop-off area are benches along the path of travel as well as social, collaborative, waiting and respite areas near to the Emergency Department waiting room & entry. There is also a staff lounge patio at the back side of the Emergency Department adjacent to the staff lounge. These areas feature furnishings selected for comfort, ease of use and group as well as individual seating. This allows staff & patients to select, based on their needs, from a variety of outdoor amenity spaces at different scales and degree of privacy.

The materials used in the landscape are durable, low maintenance and contemporary materials. The forms are organic and curvilinear forms which help to soften the feel of the landscape and create an attractive contrast to the orthogonal design of the architecture and existing campus.

The planting for the site will be drought tolerant, low water use native and climate adapted species. Plants will be selected both to create a contemporary landscape design that is both unique to the ED expansion and cohesive with the existing landscape design. The low water use plantings will contribute to overall irrigation water use reductions. Shade trees will be located strategically throughout the site to mitigate heat, enhance beauty and achieve the required shade calculations for hardscape, landscape and parking areas. Evergreen shrubs along building facades provide a buffer between room windows, circulation and programmed courtyard areas.

The irrigation for the site will be designed to support thriving plantings by strategically and efficiently providing the least amount of water required. The system will feature a weather-based irrigation controller with automatic rain shutoff. The plants will be irrigated with high efficiency drip irrigation and trees with deep root water tubes with bubblers. This design will meet or exceed Model Water Efficient Landscape Ordinance (MWELO) and local water agency requirements.

## PERMITTING

Certain aspects of the East Wing Hospital Addition project will be submitted to the City of Pleasanton for review during the permit review process with other aspects under jurisdiction and review by the California Office of Statewide Planning and Development (OSHPD). California Application Notice (CAN) 2-0, revised January 10, 2017, Code Section 7-103 outlines components of this project that will be under OSHPD jurisdiction and those that will be under local or other jurisdictions. In addition to CAN-2-0, OSHPD Advisory Guide Series – A9 provides clarification of sitework under OSHPD jurisdiction vs. local jurisdiction.

OSHPD is the enforcing agency for OSHPD 1 health facilities as specified and stated in California Building Code Section 1.10. While having jurisdiction as the "fire code official", OSHPD does not have a "fire department" with fire-fighting apparatus. It is therefore OSHPD policy to work closely with local fire departments regarding many aspects of fire and life safety relative to buildings under its jurisdiction.

The City of Pleasanton retains jurisdiction, as the enforcing agency, with respect to location of the structure(s) on the property, building height and massing, landscaping, grading or site work (except work associated with construction of buildings under OSHPD jurisdiction), parking lot construction, and the general aesthetics of the site or building.

The following aspects of the project will be submitted to the Office of Statewide Health Planning and Development (OSHPD) for permit approvals as part of an incremental review process:

1. Geotechnical Report
2. OSHPD Functional Program
3. Increment 1: Make Ready, Sitework
    a. New electrical infrastructure
    b. Relocation of underground utility infrastructure serving the hospital building
    c. Site work
    d. Temporary exiting and access plans
    e. Temporary construction barriers
    f. Selective demolition (site demolition, existing ambulance canopy, existing ambulance vestibule)
    g. Temporary ambulance canopy, fire sprinkler protection, lighting
4. Increment 2: Core and Shell:
    a. Footings and foundations
    b. Building superstructure
    c. Building envelope
    d. Elevator and mechanical, electrical, plumbing shafts
    e. Mechanical, electrical and information technology rooms
5. Increment 3: Tenant Improvements – New East Wing Hospital Addition:
    a. Phasing of temporary wall removal at existing hospital building
    b. New East Wing Hospital Addition
    c. Tie-ins at first and second floor levels
    d. Labor, Delivery, Recovery and Post-partum rooms at second floor
    e. ADA, exiting plans, FF&E

   f. Seismic bracing and overhead utilities
   g. Fire alarm and fire sprinkler protection
6. Increment 4: Tenant Improvements – Existing Emergency Department and Sterile Processing Department
   a. Renovation of existing Emergency Department
   b. Backfill of existing Sterile Processing Department (SPD)

The hospital campus is also required to be brought up to OSHPD requirements for seismic compliance by January 1, 2030. In addition to the permit submittal pages described above, the following submittals will be required to comply with 2030 seismic compliance requirements:

1. SPC upgrades to portion of existing arcade canopy near existing emergency department.
2. NPC-5 potable water storage tanks and wastewater storage tanks required to provide 72-hour capacity during a major seismic event.
3. Water Rationing Plan.
4. New emergency generator and fuel tank.

# APPLICABLE CODES AND STANDARDS

## APPLICABLE CODES:

2012 NFPA 99 Healthcare Code

2012 NFPA 101 Life Safety Code

2018 FGI Guidelines for Design and Construction of Outpatient Facilities

2022 California Administrative Code (CAC)

Part 1, Title 24, California Code of Regulations (CCR)

2022 California Building Code (CBC)
Part 2, Title 24, CCR

2022 California Electrical Code (CEC)
Part 3, Title 24, CCR

2022 California Mechanical Code (CMC)
Part 4, Title 24, CCR

2022 California Plumbing Code (CPC)
Part 5, Title 24, CCR

2022 California Energy Code (CEC)
Part 6, Title 24, CCR

2022 California Historical Building Code (CHBC)
Part 8, Title 24, CCR

2022 California Fire Code (CFC)
Part 9, Title 24, CCR

2022 California Existing Building Code (CEBC)
Part 10, Title 24, CCR

2022 California Green Building Standards Code (CALGreen)
Part 11, Title 24, CCR

2022 California Referenced Standards Code (CRSC)
Part 12, Title 24, CCR

Applicable sections of the Interim Code Cycle that will go into effect on July 1, 2024 will also apply to this project.

USP-797 and USP-800 – Pharmacy

American National Standards Institute (ANSI)

ANSI/TIA-568-D, Generic Telecommunications Cable for Customer Premises
ANSI/TIA-569-E, Telecommunications Pathways and Spaces
ANSI/TIA-606-C, Administration Standard for Telecommunications Infrastructure

ANSI/TIA-607-D, Generic Telecommunications Bonding and grounding

ANSI/TIA-758-B, Customer-Owned Outside Plant Telecommunications Infrastructure

ANSI/TIA-1179-A, Healthcare Facility Telecommunications Infrastructure Standard

Institute of Electrical and Electronics Engineers (IEEE)

National Electrical Manufactures Association (NEMA)

Underwriters Laboratories (UL)

Telecommunications Industry Association (TIA)

Building Industry Consulting Service International (BICSI)

BICSI 004, Information Communication Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities

Stanford Health Care Infrastructure Cable Engineering (ICE) Telecommunication Infrastructure Design Standards, Version 6.0

Stanford Security Services Physical Security Systems Standards, v1.0

2024 City of Pleasanton Municipal Code

Occupancy Description: General Acute Care Hospital
Occupancy Type: Institutional Group I-2 – Hospitals, Business Group B (Third Floor)
Construction Classification: Type I-A – Fully Sprinklered

## PROPOSED SCHEDULE AND PHASING

As a part of the design review process with the City of Pleasanton, the design team will work with Stanford Health Care, the city and the general contractor to submit a story pole or ground staking plan showing the layout, height and location of all proposed structures including the new East Wing Hospital Addition and enclosure for the new NPC-5 water storage tanks. The goal will be to have staking or story poles installed prior public notification and the Planning Commission hearing.

The initial building permit application for work under City of Pleasanton jurisdiction will be submitted following the design review process.

Incremental permit submittals will be submitted and processed through OSHPD for scope under their jurisdiction including East Wing Hospital Addition, renovation of the existing Emergency Department, backfill of the existing SPD space, NPC-5 potable water and wastewater storage tanks, and SPC-4 upgrades at the arcade canopies.

We anticipate construction duration of approximately 4-1/2 years, including initial make ready work.

The following is a proposed preliminary phasing for make ready, demolition, construction of the new East Wing Hospital Addition and renovation of the existing Emergency Department*:

1. Reconfigure ring road and install underground utilities – west side.
2. Reconfigure ring road and install underground utilities – east side including new drop-off.
3. Make ready inside the existing ED.
4. Construct new temporary ambulance canopy.
5. Selective demolition at exterior of existing building and ambulance canopy.
6. Install NPC-5 Potable Water storage tank.
7. Install NPC-5 Wastewater storage tanks.
8. Install new emergency generator and fuel tank.
9. Construct new East Wing Hospital Addition.
10. Activate new East Wing Hospital Addition.
11. Renovate existing ED.
12. Activate existing ED.

* Proposed phasing is not necessarily sequential, and some phases may overlap.

# HEALTH RISK ASSESSMENT AND AIR QUALITY ANALYSIS

The proposed improvements at the site have already undergone environmental review and received California Environmental Quality Act (CEQA) approvals. As a City of Pleasanton Condition of Approval, phases of development on the site are required to prepare a Health Risk Assessment and Air Quality Analysis. A Health Risk Assessment and Air Quality Analysis has been performed for this project consistent with Bay Area Air Quality Management District (BAAQMD) screening thresholds and criteria.

## STATIONARY SOURCES

The BAAQMD Stationary Source Screening Map was used to identify the location of stationary sources permitted by the district and conservative values for cancer risk, chronic hazard index and $PM_{2.5}$. Please refer to screening report for identified permitted stationary sources within 1,000 feet of this project. The sum of all stationary sources' risks, $PM_{2.5}$ and hazards do not exceed the cumulative thresholds. The following are BAAMQMD permitted equipment at 5555 W. Las Positas Boulevard (hospital site).

### EMERGENCY GENERATORS:

The hospital campus has two emergency generators installed to provide electrical power in the event of loss of normal utility power. An older 1,250 KW emergency generator was installed at the Central Utility Plant. The second emergency generator has a capacity of 2,000 KW and was installed in a generator yard enclosure about two years ago. The 2,000 KW generator provides emergency power to parts of the hospital not supported by the 1,250 KW generator but also has the capacity and electrical arrangement in place to back up the older 1,250 KW generator entirely. The 2,000 KW generator is BAAQMD Tier 4 compliant. Both installed generators have current BAAQMD permits to operate.

As part of the East Wing Hospital Addition project, the hospital will install a second 2,000 KW BAAQMD Tier 4 compliant emergency generator at the existing generator yard. This new generator will provide emergency power to support the East Wing Hospital Addition building with spare capacity to support future expansion. The 1,250 KW generator will be removed, and the emergency load will be switched over entirely to the first 2,000 KW generator already installed. The updated configuration will allow both 2,000 KW emergency generators to operate concurrently in parallel to meet load demand and to provide a higher level of redundancy.

### STEAM BOILERS:

The hospital campus has two dual fuel fired high pressure steam boilers installed at the Central Utility Plant. Each steam boiler output capacity is 10.8 million btu/hr. (10,300 lbs./hr.) at 125 psig steam pressure. The steam boilers provide heat source to generate heating hot water and domestic hot water and provide steam to steam equipment such as sterilizers and space humidification. The central plant currently operates one boiler only and the remaining boiler is for standby. The steam system will be extended to serve the new East Wing Hospital Addition to generate heating hot water and domestic hot water and provide steam for sterile processing equipment. Two boilers will then be operating in parallel and staged to meet steam load demand. Both installed steam boilers have current BAAQMD permit to operate.

## MOBILE SOURCES

### HIGHWAYS:

There are no highways within 1,000 feet of the project property line. The nearest highways are I-580 approximately 1 mile to the north of the site and I-680 approximately 4 miles to the west of the site.

### MAJOR ROADWAYS:

The property is bounded by Santa Rita Road to the east, Old Santa Rita Road to the northeast, Andrews Drive to the west, W. Las Positas Boulevard to the South and Owens Drive to the southwest. Santa Rita Road, W. Las Positas Boulevard and Owens Drive are major roadways with at least 10,000 average annual daily traffic (AADT) within 1,000 feet of the property lines. AADT for the roadways are as follows:

| Roadway | AADT |
|---|---|
| Owens Drive | 10,100 |
| W. Las Positas Boulevard | 18,500 |
| Santa Rita Road | 29,500 |
| Old Santa Rita Road | 2,100 |

Per the BAAQMD Mobile Source Screening Map the Roadway Cancer Risk is between 4.154 and 20.771 in a million for most of the site including where the proposed East Wing Hospital Addition will be situated. The eastern and southern portions have a moderate Roadway Cancer Risk between 20.771 and 58.99 in a million. The southeast corner of the site, at the intersection of Santa Rita Road and W. Las Positas Boulevard has a cancer risk between 58.99 and 132.104 in a million.

Roadway Chronic Hazard is between 0.014 and 0.058 hazard index at the center and west side of the site, between 0.058 and 0.155 hazard index at the eastern and southern portions of the site and between 0.155 and 0.345 hazard index at the intersection of Santa Rita Road and W. Las Positas Boulevard.

Roadway Particulate Matter 2.5 ($PM_{2.5}$) is between 0.101 and 0.418 $\mu g/m^3$ for most of the site and between 0.418 and 1.139 $\mu g/m^3$ along the eastern and southern portions of the site.

### RAIL:

There are no rail lines or railyards within 1,000 feet of the property lines. The nearest rail lines are approximately 1 mile to the north of the site along the I-580 corridor with Dublin Pleasanton BART station approximately 1.5 miles from the site.

### MARINE:

There are no ocean-going vessels, commercial harbor craft or ports within 1,000 feet of the project fence line.

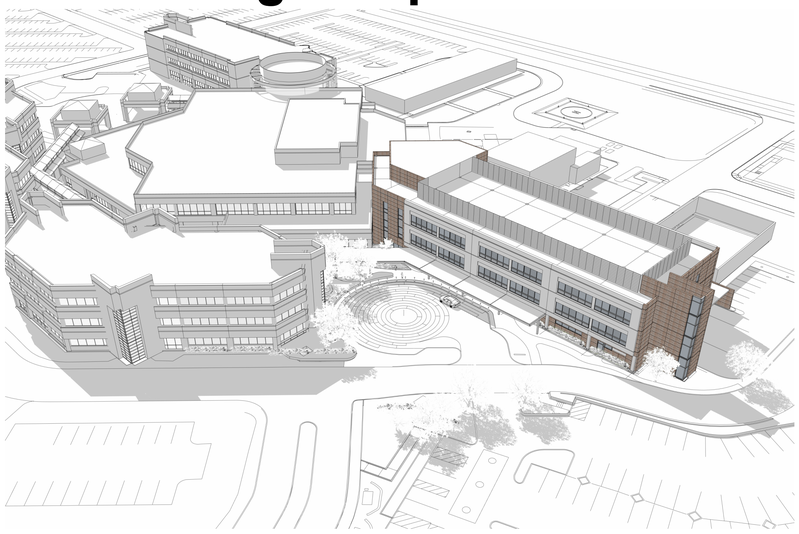
## CONCLUSION

Based on the Health Risk Assessment and Air Quality Analysis the project can assume no significant impact for risk and hazards from permitted stationary sources. There are risks and hazards associated with the proximity of the site to major roadways with at least 10,000 AADT. The proposed risk reduction strategy for this project will be to situate the proposed East Wing Hospital Addition towards the center of the site and maintain existing perimeter parking lots, landscaping and open space to reduce potential risks to receptors.

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# STANFORD HEALTH CARE TRI-VALLEY

# East Wing Hospital Addition



## PROJECT INFORMATION

**PROJECT INFORMATION**

PROJECT AREA: 66,000 SF
LEVEL 1 - 20,000 SF FULLY BUILT OUT
LEVEL 2 - 23,200 SF SHELLED
LEVEL 3 - 22,800 SF FULLY BUILT OUT

PROJECT SCOPE OF WORK: THIS PROJECT'S SCOPE OF WORK IS TO BUILD A NEW THREE- STORY, APPROXIMATELY 66,000 SQUARE FOOT HOSPITAL ADDITION AT THE EAST SIDE OF THE EXISTING SHC TRI-VALLEY HOSPITAL LOCATED AT 5555 W. LAS POSITAS BOULEVARD IN PLEASANTON, CALIFORNIA.

THE SECOND-FLOOR LEVEL WILL BE DESIGNED AS A SHELL SPACE TO ACCOMMODATE A POTENTIAL 24-BED NURSING UNIT (PHASE 2) TO SUPPORT FUTURE INPATIENT VOLUME.

THE PROJECT'S SCOPE INCLUDES INSTALLATION OF NEW NPC-5 COMPLIANT POTABLE WATER AND WASTEWATER STORAGE TANKS FOR THE ENTIRE HOSPITAL.

PHASE 2 OF THE PROJECT (BUILDOUT OF THE 2ND FLOOR) WILL INCLUDE ANOTHER 31 PARKING STALLS IN ADDITION TO THE 989 PARKING STALLS PROVIDED IN THIS CURRENT PHASE.

**AUTHORITIES HAVING JURISDICTION (AHJ)**

PLANNING: CITY OF PLEASANTON
FIRE DISTRICT: LIVERMORE - PLEASANTON FIRE DEPARTMENT
PLAN REVIEW/BUILDING PERMIT: CITY OF PLEASANTON

CITY OF PLEASANTON – SCREENING AROUND THE WATER TANKS, CONNECTION TO PUBLIC UTILITIES & SITE CIRCULATION FOR EMERGENCY VEHICAL ACCESS, PARKING & LANDSCAPING.

OSHPD – NEW NPC-5 COMPLIANT POTABLE WATER AND WASTEWATER STORAGE TANKS, EXISTING HOSPITAL RENOVATIONS & EAST WING ADDITION .

**LOCATION AND ZONING**

ADDRESS: 5555 WEST LAS POSITAS BLVD
PLEASANTON, CA 94588
ASSESSOR'S PARCEL NUMBER: APN 946-3200-29-01, APN 946-3200-35-02, APN 946-3200-36
ZONING DISTRICT(S): PUD-P-I (PUBLIC &INSTITUTIONAL)
EXISTING USE: INSTITUTIONAL GROUP I-2 HOSPITAL
PROPOSED USE: INSTITUTIONAL GROUP I-2 HOSPITAL

**BUILDING INFORMATION**

EXISTING BUILDING OCCUPANCY: INSTITUTIONAL GROUP I-2 HOSPITAL
PROPOSED BUILDING OCCUPANCY: INSTITUTIONAL GROUP I-2 HOSPITAL
EXISTING BUILDING HEIGHT: 49' - 0 3/4"
PROPOSED BUILDING HEIGHT: 65' - 0", INCLUDING PENTHOUSE
EXISTING STORIES ABOVE GRADE PLANE: SEE TABLE BELOW (ALLOWABLE SITE CAPACITY WITHIN 1986 PUD LIMITS)
PROPOSED STORIES ABOVE GRADE PLANE: THREE STORIES ABOVE GRADE PLUS A MECHANICAL PENTHOUSE
EXISTING BUILDING AREA: SEE TABLE BELOW (ALLOWABLE SITE CAPACITY WITHIN 1986 PUD LIMITS)
BUILDING AREA (AS DESCRIBED PER CBC SECTION 202): 62,000 SF
TYPE OF CONSTRUCTION: TYPE 1-A, FULLY SPRINKLERED
FIRE SPRINKLER COVERAGE: FULL

## BUILDING INFORMATION

**ALLOWABLE SITE CAPACITY WITHIN 1986 PUD LIMITS**

| BUILDING | EXISTING FLOOR AREA (SF) | PROPOSED (SF) FLOOR AREA | BLDG HEIGHT | FUTURE FLOOR AREA (SF) |
|---|---|---|---|---|
| 5565 MOB | 45,000 | - | 3 | 45,000 |
| 5575 MOB | 45,000 | - | 3 | 45,000 |
| MAIN HOSPITAL + WEST WING | 174,000 | - | 1-3 | 174,000 |
| ASSB ( LAB + PHARMACY) | 11,500 | - | 1 | 11,500 |
| CENTRAL UTILITY PLANT (CUP) | 6,825 | - | 2 | 6,825 |
| PROPOSED EAST WING | - | 66,000 | 3 | 66,000 |
| FUTURE BUILDINGS/ADDITIONAL ALLOWABLE AREA | - | - | - | 139,675 |
| **TOTAL** | **282,325** | **66,000** | **-** | **488,000** |

## APPLICABLE CODES AND STANDARDS

1. THE CONTRACTOR SHALL NOTIFY THE DESIGN PROFESSIONAL OF RECORD IN RESPONSIBLE CHARGE WHERE A CONFLICT OR DISCREPANCY OCCURS BETWEEN THE CONSTRUCTION DRAWINGS AND ANY OTHER PORTION OF THE CONSTRUCTION DOCUMENTS, FIELD CONDITIONS, OR WHERE ANY CONDITIONS ARISE NOT COVERED BY THESE DOCUMENTS WHEREIN WORK WILL NOT COMPLY WITH CODE REQUIREMENTS.

2. **THE INTENT OF THE PLANS AND SPECIFICATIONS ARE TO CONSTRUCT OR ALTER THE BUILDING IN ACCORDANCE WITH TITLE 24, CALIFORNIA CODE OF REGULATIONS.** SHOULD ANY CONDITIONS DEVELOP NOT COVERED BY THE APPROVED PLANS AND SPECIFICATIONS WHEREIN THE FINISHED WORK WILL NOT COMPLY WITH TITLE 24, CALIFORNIA CODE OF REGULATIONS, A CHANGE ORDER DETAILING AND SPECIFYING THE REQUIRED WORK SHALL BE SUBMITTED TO AND APPROVED BY THE AUTHORITY HAVING JURISDICTION (AHJ) BEFORE PROCEEDING WITH THE WORK.

3. WORK PERFORMED WITHOUT AHJ APPROVAL IS DONE SO AT SOLE RISK TO THE CONTRACTOR WHO SHALL PROVIDE FOR REMOVAL, REPLACEMENT, OR CORRECTION OF WORK AT NO INCREASED COST UNLESS APPROVED TO PROCEED BY THE OWNER.

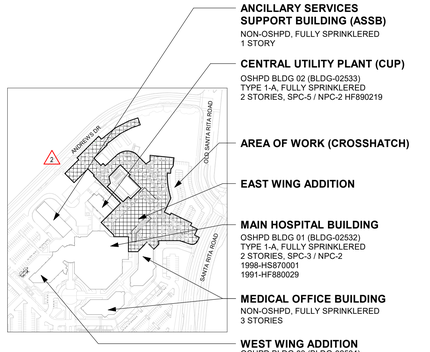
4. CONSTRUCTION, WORKMANSHIP AND MATERIAL SHALL CONFORM TO THE 2022 CALIFORNIA BUILDING STANDARDS CODE (CBSC).
   - A. 2022 CALIFORNIA ADMINISTRATIVE CODE (CAC), PART 1, TITLE 24, CALIFORNIA CODE OF REGULATIONS (CCR)
   - B. 2022 CALIFORNIA BUILDING CODE (CBC), PART 2, TITLE 24, CCR, BASED ON THE 2021 INTERNATIONAL BUILDING CODE (IBC)
   - C. 2022 CALIFORNIA ELECTRICAL CODE (CEC), PART 3, TITLE 24, CCR, BASED ON THE 2020 NATIONAL ELECTRICAL CODE (NEC)
   - D. 2022 CALIFORNIA MECHANICAL CODE (CMC), PART 4, TITLE 24, CCR, BASED ON THE 2021 UNIFORM MECHANICAL CODE (UMC)
   - E. 2022 CALIFORNIA PLUMBING CODE (CPC), PART 5, TITLE 24, CCR, BASED ON THE 2021 UNIFORM PLUMBING CODE (UPC)
   - F. 2022 CALIFORNIA ENERGY CODE (TITLE 24), PART 6, TITLE 24, CCR.
   - G. 2022 CALIFORNIA FIRE CODE (CFC), PART 9, TITLE 24, CCR, BASED ON THE 2021 INTERNATIONAL FIRE CODE (IFC)
   - H. 2022 CALIFORNIA GREEN BUILDING STANDARDS CODE (CALGREEN), PART 11, TITLE 24, CCR, INCLUDING LOCAL JURISDICTION AMENDMENTS.
   - I. CURRENT LOCAL JURISDICTION AMENDED CODES, REGULATIONS, AND ORDINANCES. **NOTE: SEE OSHPD CAN 2-0 FOR EXTENTS OF LOCAL JURISDICTION FOR PROJECTS UNDER OSHPD-1 JURISDICTION.**

5. FOR HEALTHCARE OCCUPANCIES LICENSED UNDER A HOSPITAL'S CALIFORNIA DEPARTMENT OF PUBLIC HEALTH LICENSE; CONSTRUCTION, WORKMANSHIP AND MATERIAL SHALL CONFORM TO THE FOLLOWING:
   - A. 2022 NFPA 72 NATIONAL FIRE ALARM AND SIGNALING CODE
   - B. 2012 NFPA 99 (HEALTH CARE FACILITY CODE) AND NFPA 101 - LIFE SAFETY CODE - APPLICABLE FOR PROJECTS WITH CMS PATIENTS (CENTERS FOR MEDICARE & MEDICAID).
   - C. 2012 NFPA 101 - LIFE SAFETY CODE - APPLICABLE FOR A OCCUPANCY ASSEMBLY AREAS PER CBC 1030.6.2

## VICINITY MAP




## FACILITY MAP




**ANCILLARY SERVICES SUPPORT BUILDING (ASSB)**
NON-OSHPD, FULLY SPRINKLERED
1 STORY

**CENTRAL UTILITY PLANT (CUP)**
OSHPD BLDG 02 (BLDG-025533)
TYPE 1-A, FULLY SPRINKLERED
2 STORIES, SPC-5 / NPC-2 HF890219

**AREA OF WORK (CROSSHATCH)**

**EAST WING ADDITION**

**MAIN HOSPITAL BUILDING**
OSHPD BLDG 01 (BLDG-02532)
TYPE 1-A, FULLY SPRINKLERED
2 STORIES, SPC-3 / NPC-2
1998-HS870001
1991-HF880029

**MEDICAL OFFICE BUILDING**
NON-OSHPD, FULLY SPRINKLERED
3 STORIES

**WEST WING ADDITION**
OSHPD BLDG 03 (BLDG-02534)
TYPE 1-A, FULLY SPRINKLERED
3 STORIES, SPC-5 / NPC-4
2000-HS973195

## PROJECT TEAM

**OWNER**
STANFORD HEALTH CARE TRI-VALLEY
66 WILLOW PLACE
MENLO PARK, CA 94025
CONTACT: MOLLY SWENSON
PHONE: (650) 400-1048
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WEBSITE: WWW.STANFORDHEALTHCARE.ORG

**ARCHITECT**
TAYLOR DESIGN
550 MONTGOMERY STREET, SUITE 925
SAN FRANCISCO, CA 94111
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PHONE: (415) 857-8041
EMAIL: JAMANAT@WEARETAYLOR.COM

**STRUCTURAL ENGINEER**
DEGENKOLB ENGINEERS
601 12 STREET, SUITE 400
OAKLAND, CA 94607
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**CIVIL ENGINEER**
BKF
980 9TH STREET, SUITE 2300
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**LANDSCAPE**
RHAA
225 MILLER AVE
MILL VALLEY, CA 94941
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**SIGNAGE**
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5001 24TH STREET
SACRAMENTO, CA 95822
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EMAIL: BRENTR@WEIDNERCA.COM

**MECHANICAL ENGINEER**
GAYNER ENGINEERS
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**ELECTRICAL ENGINEER**
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1133 POST STREET
SAN FRANCISCO, CA 94109
MAIN CONTACT: HELEN WONG
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**LOW VOLTAGE**
PAE CONSULTING ENGINEERS, INC.
48 GOLDEN GATE AVE
SAN FRANCISCO, CA 94102
CONTACT: STEVE KELLY
PHONE: (415) 544-7500
EMAIL: STEVE.KELLY@PAE-ENGINEERS.COM

**MEDICAL EQUIPMENT (BIM)**
ONE-EQ
1717 PACIFIC AVE
DALLAS, TX 75201
MAIN CONTACT: IRENE BICKELL
PHONE: (213) 633-1100
EMAIL: IRENE.BICKELL@ONE-EQ.COM

**SPECIALTY CONSULTANT - LAB**
ACCUMEN, INC.
3333 HAYDEN ROAD, SUITE 1
SCOTTSDALE, AZ 85261
CONTACT: KIMBERLY ZUNKER
PHONE: (940) 257-6770
EMAIL: KZUNKER@ACCUMEN.COM

**SPECIALTY CONSULTANT - PHARMACY, SPD, VERTICAL TRANSPORTATION**
ST. ONGE
1400 WILLIAMS ROAD
YORK, PA 17402
CONTACT:HUE ROACH
PHONE: (717) 840-8181
EMAIL: HROACH@STONGE.COM

## SHEET INDEX


| SHEET # | SHEET NAME |
|---|---|
| 01 ARCHITECTURE GENERAL | |
| G-01 | COVER SHEET |
| G-60 | AXON EXISTING |
| G-61 | AXON PROPOSED |
| G-62 | EXISTING SITE PLAN - SITE PHOTOS KEY |
| G-63 | EXISTING SITE CONDITIONS - SITE PHOTOS |
| G-64 | EXISTING SITE CONDITIONS - SITE PHOTOS |
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| SI-04 | SIGN DETAILS |
| SI-05 | SIGN DETAILS |
| 09 ARCHITECTURE (FOR REFERENCE ONLY) | |
| A-1573 | EXTERIOR DETAILS - TEMPORARY AMBULANCE DROP OFF |
| 010 CIVIL (FOR REFERENCE ONLY) | |
| TOPO | (SEE 5 SHEETS OF SUPPLEMENTAL DRAWINGS) |
| Grand total: 56 | |


**DESIGN PROFESSIONAL STAMP**

PRELIMINARY: NOT FOR CONSTRUCTION

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CITY OF PLEASANTON
PLANNING DIVISION
EXHIBIT B

**CONSULTANT**

**AGENCY APPROVAL**

**REVISION SCHEDULE**

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/22/2024 |
| 2 | BACKCHECK #02 | 1/31/2025 |
| 3 | BACKCHECK #03 | 3/19/2025 |
| 4 | BACKCHECK #04 | 4/21/2025 |

**PROJECT INFORMATION**

**STANFORD HEALTH CARE TRI-VALLEY**
**East Wing Hospital Addition**

FACILITY NAME: STANFORD HEALTH CARE - TRI-VALLEY
FACILITY ADDRESS: 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588
OWNER PROJECT NUMBER: 2022514

AUTHORITY HAVING JURISDICTION: CITY OF PLEASANTON
AGENCY FACILITY NUMBER: 16632
AGENCY BUILDING NUMBER: TBD
AGENCY PROJECT NUMBER: TBD

ARCHITECT PROJECT NO: 6370.101

**SHEET TITLE** **ISSUE DATE: 08/23/2024**

**COVER SHEET**

**SHEET NUMBER**

**G-01**

PACKAGE ISSUANCE: DESIGN REVIEW SUBMITTAL

FILE NAME: Autodesk Docs://6370-SHC-TV E Wing Hospital Addition/6370-SHC-TV E Wing Hospital Addition-Entitlements-R24.rvt

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E1 EXISTING SOUTH VIEWING AXON
3" = 1'-0"



A1 EXISTING NORTH EAST VIEWING AXON
3" = 1'-0"

FILE NAME: Autodesk Docs://6370-SHC-TV E Wing Hospital Addition/6370-SHC-TV E Wing Hospital Addition-Entitlements-R24.rvt

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CONSULTANT

AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
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PROJECT INFORMATION

**STANFORD HEALTH CARE TRI-VALLEY**
**East Wing Hospital Addition**

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| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
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| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

## AXON EXISTING

SHEET NUMBER — SCALE: 3" = 1'-0"

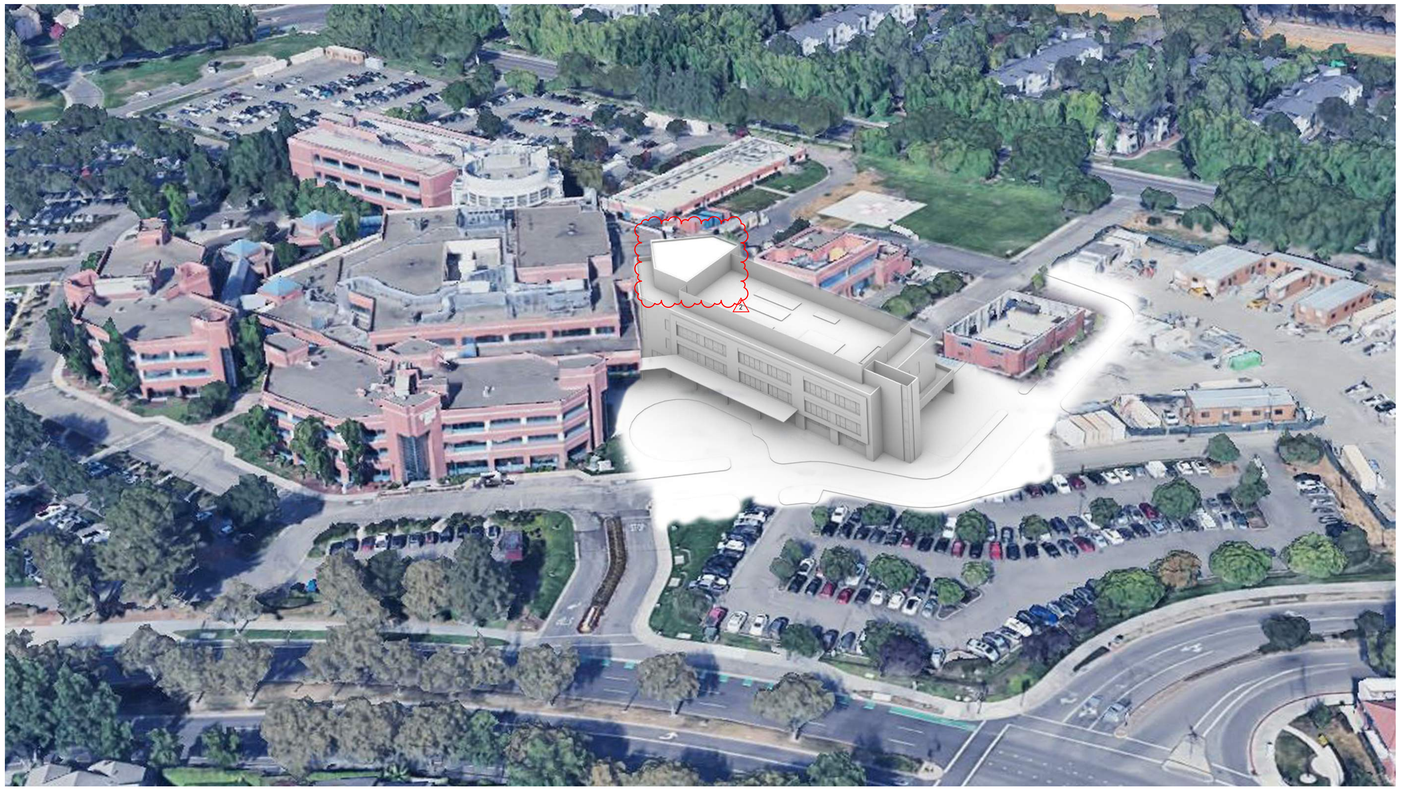
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E1 SOUTH VIEWING AXON
1 1/2" = 1'-0" entitlement



A1 NORTH EAST VIEWING AXON
1 1/2" = 1'-0"

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| 1 | BACKCHECK #01 | 11/22/2024 |
| 2 | BACKCHECK #02 | 2/6/2025 |

PROJECT INFORMATION

# STANFORD HEALTH CARE TRI-VALLEY
## East Wing Hospital Addition

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2022514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE ISSUE DATE: 08/23/2024

## AXON PROPOSED

SHEET NUMBER SCALE: 1 1/2" = 1'-0"

# G-61

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## LEGEND

- (A) ER AMBULANCE DROP OFF & CANOPY
- (B) ER PATIENT DROP-OFF
- (C) CONSTRUCTION TRAILERS
- (D) ED PARKING

A1 ENTITLEMENT SITE KEY PLAN FOR SITE PHOTOS
1" = 60'-0"

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AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/22/2024 |
| 2 | BACKCHECK #02 | 2/6/2025 |

PROJECT INFORMATION

**STANFORD HEALTH CARE TRI-VALLEY**
**East Wing Hospital Addition**

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 20225514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/24

**EXISTING SITE PLAN - SITE PHOTOS KEY**

SHEET NUMBER — SCALE: As indicated

**G-62**

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G5 ENTRANCE TO SITE FROM W LAS POSITAS BLVD
3" = 1'-0" ENTITLEMENTS



G7 ENTRANCE TO SITE FROM SANTA RITA RD
3" = 1'-0" ENTITLEMENTS



G9 ENTRANCE TO SITE FROM ANDREWS DR
3" = 1'-0" ENTITLEMENTS



E5 ENTRANCE TO SITE FROM W LAS POSITAS BLVD
3" = 1'-0" ENTITLEMENTS




E7 ENTRANCE TO SITE FROM SANTA RITA RD
3" = 1'-0" ENTITLEMENTS



E9 ENTRANCE TO SITE FROM ANDREWS DR
3" = 1'-0" ENTITLEMENTS



C5 ENTRANCE TO SITE FROM W LAS POSITAS BLVD
3" = 1'-0" ENTITLEMENTS




C7 ENTRANCE TO SITE FROM SANTA RITA RD
3" = 1'-0" ENTITLEMENTS



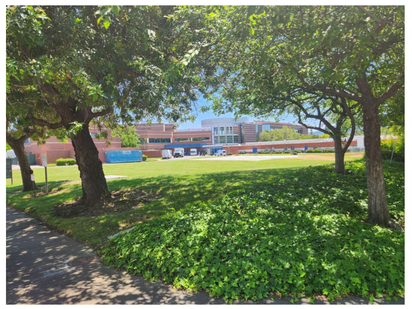
C9 ENTRANCE TO SITE FROM ANDREWS DR
3" = 1'-0" ENTITLEMENTS




A5 ENTRANCE TO SITE FROM W LAS POSITAS BLVD
1/4" = 1'-0" ENTITLEMENTS



A7 ENTRANCE TO SITE FROM SANTA RITA RD
3" = 1'-0" ENTITLEMENTS



A9 ENTRANCE TO SITE FROM ANDREWS DR
3" = 1'-0" ENTITLEMENTS

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CONSULTANT

AGENCY APPROVAL

REVISION SCHEDULE

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|---|---|---|
| 1 | BACKCHECK #01 | 11/22/2024 |

PROJECT INFORMATION

**STANFORD HEALTH CARE TRI-VALLEY**
**East Wing Hospital Addition**

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2022514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE ISSUE DATE: 08/23/2024

## EXISTING SITE CONDITIONS - SITE PHOTOS

SHEET NUMBER SCALE: As indicated

# G-63

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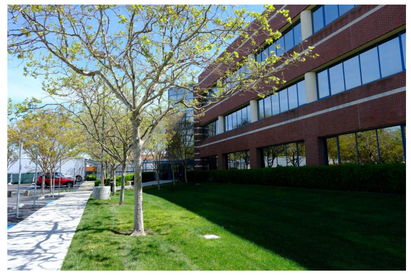

G1 ON SITE CONTEXT
3" = 1'-0" ENTITLEMENTS




G3 ON SITE CONTEXT
3" = 1'-0" ENTITLEMENTS



G5 ON SITE CONTEXT
3" = 1'-0" ENTITLEMENTS



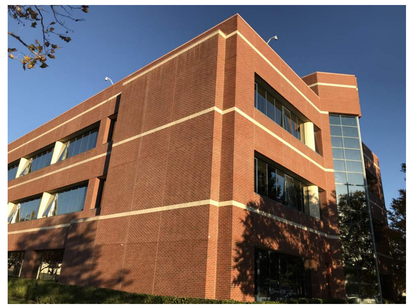
G7 ON SITE CONTEXT
3" = 1'-0" ENTITLEMENTS




G9 ON SITE CONTEXT
3" = 1'-0" ENTITLEMENTS




E3 ON SITE CONTEXT
3" = 1'-0" ENTITLEMENTS



E5 ON SITE CONTEXT
3" = 1'-0" ENTITLEMENTS



E7 ON SITE CONTEXT
3" = 1'-0" ENTITLEMENTS



E9 ON SITE CONTEXT
3" = 1'-0" ENTITLEMENTS




A5 ON SITE CONTEXT
3" = 1'-0" ENTITLEMENTS



A7 ON SITE CONTEXT
3" = 1'-0" ENTITLEMENTS



C9 ON SITE CONTEXT
3" = 1'-0" ENTITLEMENTS



A9 ON SITE CONTEXT
3" = 1'-0" ENTITLEMENTS

TAYLOR design

DESIGN PROFESSIONAL STAMP

CONSULTANT

AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/22/2024 |
| 2 | BACKCHECK #02 | 2/6/2025 |

PROJECT INFORMATION

**STANFORD HEALTH CARE TRI-VALLEY**
**East Wing Hospital Addition**

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2022514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE ISSUE DATE: 08/23/2024

**EXISTING SITE CONDITIONS - SITE PHOTOS**

SHEET NUMBER SCALE: 3" = 1'-0"

**G-64**

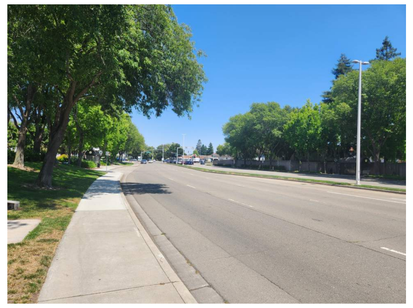
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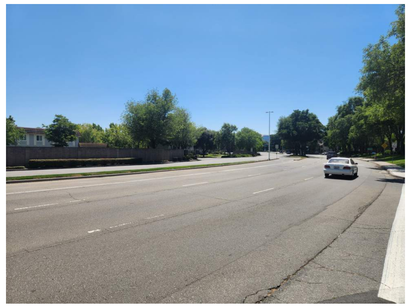
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G5 FIRE STATION ON WEST LAS POSITAS
3" = 1'-0" ENTITLEMENTS



G7 ON W LAS POSITAS BLVD TO THE SOUTH
1/4" = 1'-0" ENTITLEMENTS



G9 ON W LAS POSITAS BLVD TO THE SOUTH
1/4" = 1'-0" ENTITLEMENTS



E5 FIRESTATION ON SANTA RITA ROAD
3" = 1'-0" ENTITLEMENTS



E7 ON SANTA RITA TO THE EAST
1/4" = 1'-0" ENTITLEMENTS



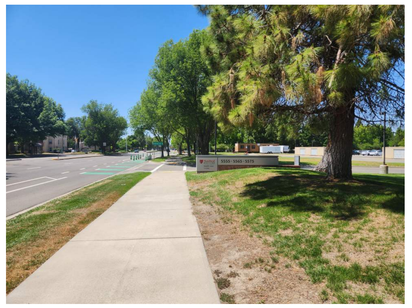
E9 ON SANTA RITA TO THE EAST
1/4" = 1'-0" ENTITLEMENTS




C5 CHASE BANK ON OLD SANTA RITA RD
3" = 1'-0" ENTITLEMENTS



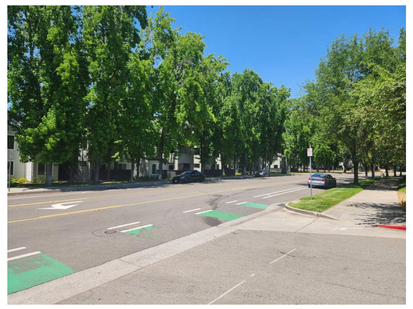
C7 ON OWENS TO THE WEST
1/4" = 1'-0" ENTITLEMENTS



C9 ON OWENS TO THE WEST
1/4" = 1'-0" ENTITLEMENTS



A5 ON ANDREWS DRIVE TO THE NORTH
1/4" = 1'-0" ENTITLEMENTS



A7 ON ANDREWS DRIVE TO THE NORTH
1/4" = 1'-0" ENTITLEMENTS



A9 ON ANDREWS DRIVE TO THE NORTH
1/4" = 1'-0" ENTITLEMENTS

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TAYLOR design

DESIGN PROFESSIONAL STAMP

CONSULTANT

AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/22/2024 |

PROJECT INFORMATION

**STANFORD HEALTH CARE TRI-VALLEY**
**East Wing Hospital Addition**

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
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| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE ISSUE DATE: 08/23/2024

## EXISTING NEIGHBORHOOD PROPERTIES - SITE PHOTOS

SHEET NUMBER SCALE: As indicated

# G-65

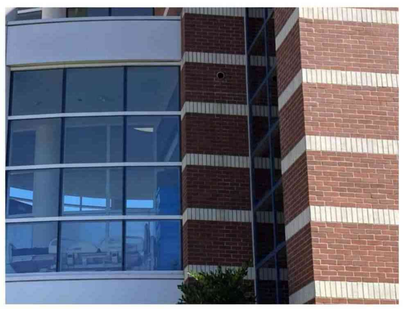
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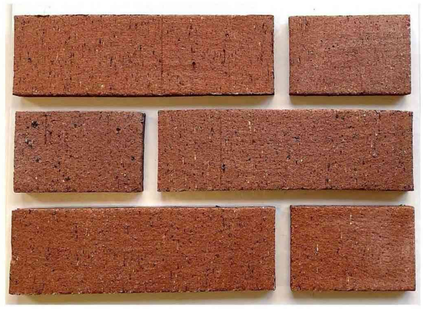
EXISTING BUILDING REFERENCE - BRICK, WHITE, METAL, VISION GLASS



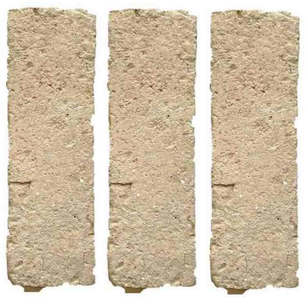

EXISTING BUILDING REFERENCE - WHITE METAL CANOPY CLADDING/ SIGNAGE



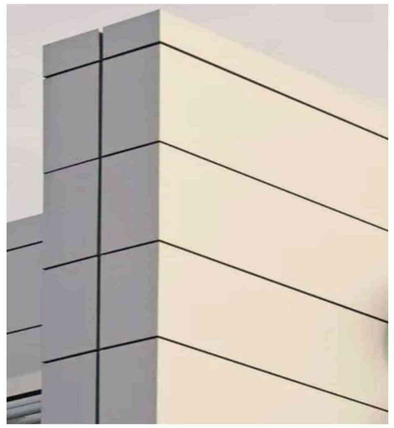
EXISTING BUILDING REFERENCE - BRICK, WHITE METAL, VISION GLASS



1. BRICK - EXTERIOR CLADDING SYSTEM - THIN BLACK VENEER (COLOR AND PATTERN TO MATCH EXISTING HOSPITAL) OVER LATH, SCRATCH COAT, MOTAR BED OVER GYP SHEATHING/METAL FRAMING.



2. ACCENT BAND W/ CONSTRASTING BRICK COLOR (LIGHTER BEIGE TO MATCH ACCENT BRICK AT (E) HOSPITAL



3. EXTERIOR CLADDING SYSTEM WITH SOLID MATERIAL COLOR AND TEXTURE SIMILAR TO EXISTING HOSPITAL



4. STRUCTURAL STEEL CANOPY/ARCADE WITH ALUMINUM CLADDING

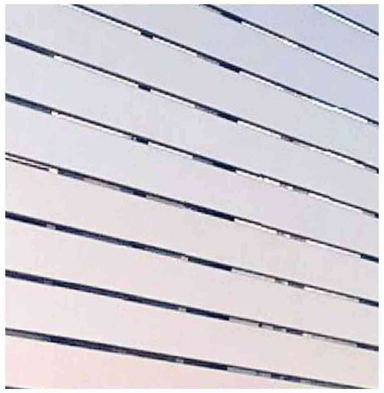


5. ALUMINUM STOREFRONT GLAZING SYSTEM WITH SPANDREL GLASS



6. ALUMINUM STOREFRONT GLAZING SYSTEM WITH HIGH PERFORMANCE/ LOW E VISION GLASS





7. METAL MECHANICAL ROOF SCREEN

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AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/22/2024 |

PROJECT INFORMATION

**STANFORD HEALTH CARE TRI-VALLEY**
**East Wing Hospital Addition**

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2023514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

## MATERIAL BOARD

SHEET NUMBER — SCALE:

**G-70**

PACKAGE ISSUANCE: DESIGN REVIEW SUBMITTAL

FILE NAME: Autodesk Docs://6370-SHC-TV E Wing Hospital Addition/6370-SHC-TV E Wing Hospital Addition-Entitlements-R24.rvt

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## LEGEND

- ED Ambulance Drop-off
- Ambulatory ED Patient Entrance
- (A) East Wing Addition
- (B) NPC Water Tanks - Above Grade
- (C) NPC Waste Water Tanks - Below Grade

A1 ENTITLEMENT SITE PLAN OVERALL
1" = 60'-0"

PACKAGE ISSUANCE: DESIGN REVIEW SUBMITTAL

FILE NAME: Autodesk Docs://6370-SHC-TV E Wing Hospital Addition/6370-SHC-TV E Wing Hospital Addition-Entitlements-R24.rvt

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CITY OF PLEASANTON
PLANNING DIVISION
EXHIBIT B

CONSULTANT

AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/22/2024 |
| 2 | BACKCHECK #02 | 2/6/2025 |

PROJECT INFORMATION

**STANFORD HEALTH CARE TRI-VALLEY**
**East Wing Hospital Addition**

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2022514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

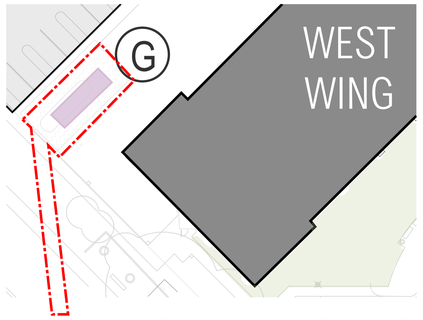
SHEET TITLE — ISSUE DATE: 08/23/2024

## OVERALL SITE PLAN - PROPOSED

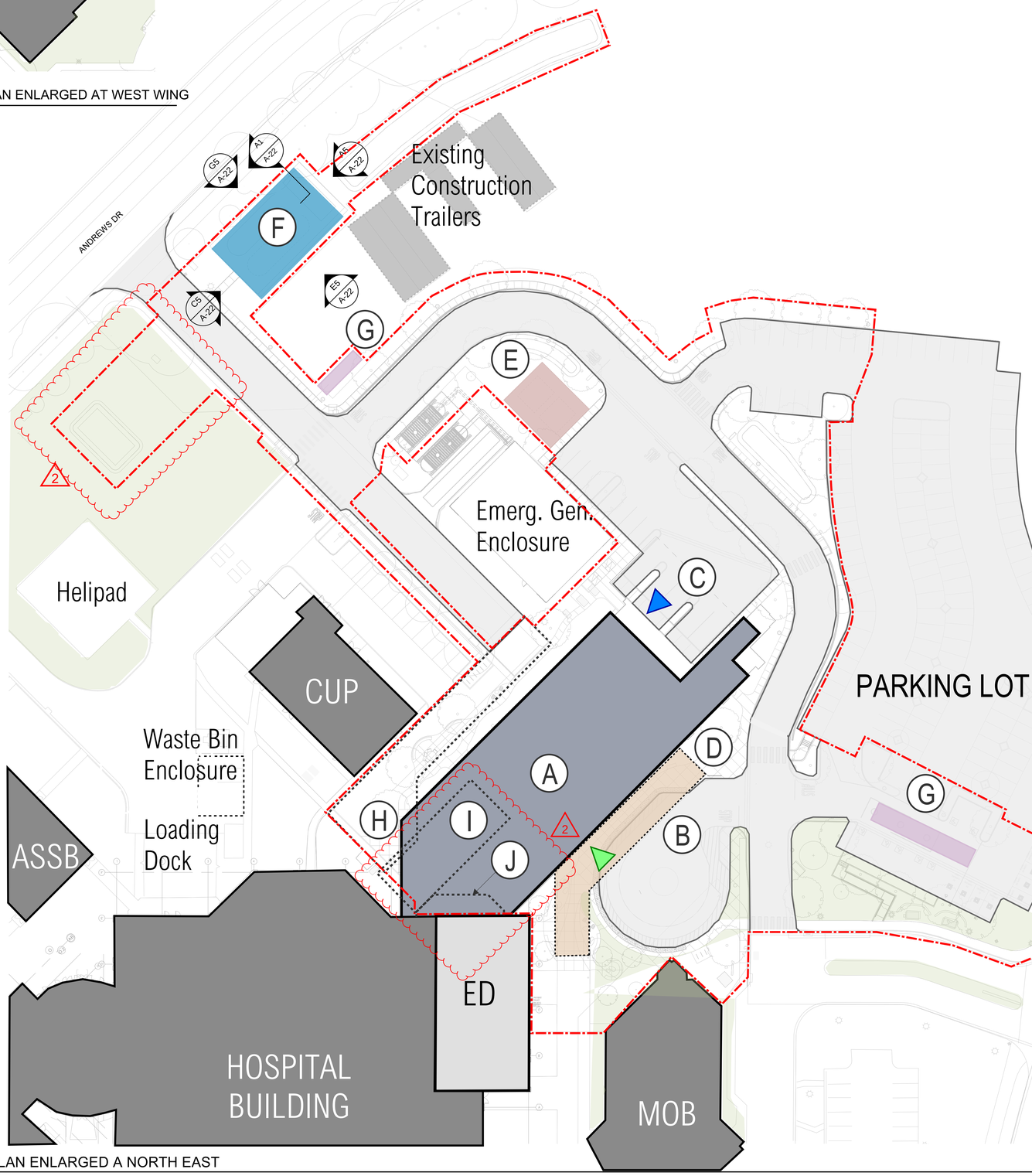
SHEET NUMBER — SCALE: 1" = 60'-0"

A-10 2

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G1 ENTITLEMENT SITE PLAN ENLARGED AT WEST WING
1" = 30'-0"




A1 ENTITLEMENT SITE PLAN ENLARGED A NORTH EAST
1" = 30'-0"

## LEGEND

- ED Ambulance Entrance
- Ambulatory ED Patient Entrance
- (A) East Wing Addition
- (B) Patient Drop-off
- (C) Ambulance Drop-off & Parking
- (D) Canopy
- (E) Temp Decontam. Showers Tents
- (F) NPC Water Tanks - Above Grade
- (G) NPC Waste Water Tanks - Below Grade
- (H) Temp. Ambulance Drop-off
- (I) (E) Ambulance Drop-off Canopy to be demolished
- (J) (E) ED/Emergency Room Vestibule to be demolished
- Limits of Work

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REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/22/2024 |
| 2 | BACKCHECK #02 | 2/6/2025 |

PROJECT INFORMATION

**STANFORD HEALTH CARE TRI-VALLEY**
**East Wing Hospital Addition**

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2022514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

**ENLARGED SITE PLAN A**

SHEET NUMBER — SCALE: 1" = 30'-0"

**A-11**

PACKAGE ISSUANCE: DESIGN REVIEW SUBMITTAL

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**LEGEND**

- ED Ambulance Drop-off
- Ambulatory ED Patient Entrance
- (A) East Wing Addition
- (B) NPC Water Tanks - Above Grade
- (C) NPC Waste Water Tanks - Below Grade

**THE FLOWS**

- Patient
- Staff
- Materials/Equipment/Vendor
- Ambulance

A1 ENTITLEMENT SITE CIRCULATION PLAN
1" = 60'-0"

FILE NAME: Autodesk Docs://6370-SHC-TV E Wing Hospital Addition/6370-SHC-TV E Wing Hospital Addition-Entitlements-R24.rvt

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**REVISION SCHEDULE**

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/22/2024 |
| 2 | BACKCHECK #02 | 2/6/2025 |

**PROJECT INFORMATION**

**STANFORD HEALTH CARE TRI-VALLEY**
**East Wing Hospital Addition**

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2022514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

**SITE CIRCULATION PLAN**

SHEET NUMBER — SCALE: 1" = 60'-0"

**A-12** 2

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# PARKING INFORMATION

**PARKING INFORMATION - VEHICLE STALLS**

| BUILDING USE | METRIC | FACTOR | PARKING REQUIRED | PARKING PROVIDED |
|---|---|---|---|---|
| MOB (HOPD)* | 2,120 SF | 1/286 | 2,120 SF X 1 SPACE / 286 SF = 7 STALLS | 7 |
| MOB (OTHER) | 87,880 SF | 1/286 | 87,880 SF X 1 SPACE / 286 SF = 307 STALLS | 307 |
| HOSPITAL | 191 BEDS | 1.79 | 191 BEDS X 1.79 SPACES / BED = 342 STALLS | 675 |
| **TOTAL PARKING REQUIRED** | | | **656 STALLS** | **989 STALLS (COMPLIES)** |

* - HOSPITAL OUTPATIENT DEPARTMENT
** - 167 EXISTING BEDS + 24 POTENTIAL PROPOSED BEDS IN EAST WING ADDITION

**TOTAL PARKING SUMMARY**

| PARKING SPACE TYPE | EXISTING | REQUIRED | PROVIDED |
|---|---|---|---|
| REGULAR (INCLU. COMPACT) | 950 | 627 | 940 |
| ACCESSIBLE | 39 | 21 | 41 |
| EVCS LEVEL 2 & EV CAPABLE LEVEL 2 | 0 | 8 | 8 |
| TOTAL | 989 | 656 | 989 |

**ACCESSIBLE PARKING INFORMATION - VEHICLE STALLS**

| BUILDING USE | METRIC | ACCESSIBLE PARKING REQUIRED |
|---|---|---|
| MOB (HOPD) | 7 STALLS | 7 SPACES X 1 ACCESSIBLE / 10 STALLS = 1 STALLS |
| MOB (OTHER) | 307 STALLS | 307 SPACES X 1 ACCESSIBLE / 50 STALLS = 6 STALLS |
| HOSPITAL | 675 STALLS | 675 SPACES X 1 ACCESSIBLE / 50 STALLS = 14 STALLS |
| **TOTAL ACCESSIBLE PARKING REQUIRED** | | **21 STALLS** |
| **TOTAL ACCESSIBLE PARKING PROVIDED** | | **41 STALLS (COMPLIES)** |

**PARKING INFORMATION - OTHERS (FOR EAST WING HOSPITAL ADDITION)**

| TYPE | METRIC | REQUIRED | PROVIDED |
|---|---|---|---|
| EVCS LEVEL 2 | 43 SPACES | 43 SPACES X 10% = 4.3 = 4 | 4 |
| EV CAPABLE LEVEL 2 | 43 SPACES | 43 SPACES X 10% = 4.3 = 4 | 4 |
| ALTERNATIVE VEHICLE CARPOOL/ VANPOOL | 43 SPACES | 43 SPACES X 10% = 4.3 = 4 | INCLUDED IN EV CAPABLE LEVEL 2 |
| BICYCLES | | | |
| SHORT TERM | 66,000 SF | 66,000 SF X 2 / 9,000 SF = 15 | 18 |
| LONG TERM | 66,000 SF | 66,000 SF X 1 / 9,000 SF = 7 | 8 |

PHASE 2 OF THE PROJECT (BUILDOUT OF THE 2ND FLOOR) WILL INCLUDE ANOTHER 31 PARKING STALLS IN ADDITION TO THE 989 PARKING STALLS PROVIDED IN THE CURRENT PHASE. 4




## LEGEND

- ED Ambulance Drop-off
- Ambulatory ED Patient Entrance
- (A) East Wing Addition
- (B) NPC Water Tanks - Above Grade
- (C) NPC Waste Water Tanks - Below Grade

A1 ENTITLEMENT OVERALL PARKING PLAN
1" = 60'-0"

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PRELIMINARY: NOT FOR CONSTRUCTION

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**REVISION SCHEDULE**

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/22/2024 |
| 2 | BACKCHECK #02 | 1/31/2025 |
| 4 | BACKCHECK #04 | 4/21/2025 |

**PROJECT INFORMATION**

**STANFORD HEALTH CARE TRI-VALLEY**
**East Wing Hospital Addition**

FACILITY NAME: STANFORD HEALTH CARE - TRI-VALLEY
FACILITY ADDRESS: 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588
OWNER PROJECT NUMBER: 2022514

AUTHORITY HAVING JURISDICTION: CITY OF PLEASANTON
AGENCY FACILITY NUMBER: 16632
AGENCY BUILDING NUMBER: TBD
AGENCY PROJECT NUMBER: TBD

ARCHITECT PROJECT NO: 6370.101

SHEET TITLE — ISSUE DATE: 08/23/2024

**OVERALL PARKING SUMMARY**

SHEET NUMBER — SCALE: 1" = 60'-0"

**A-14** 4

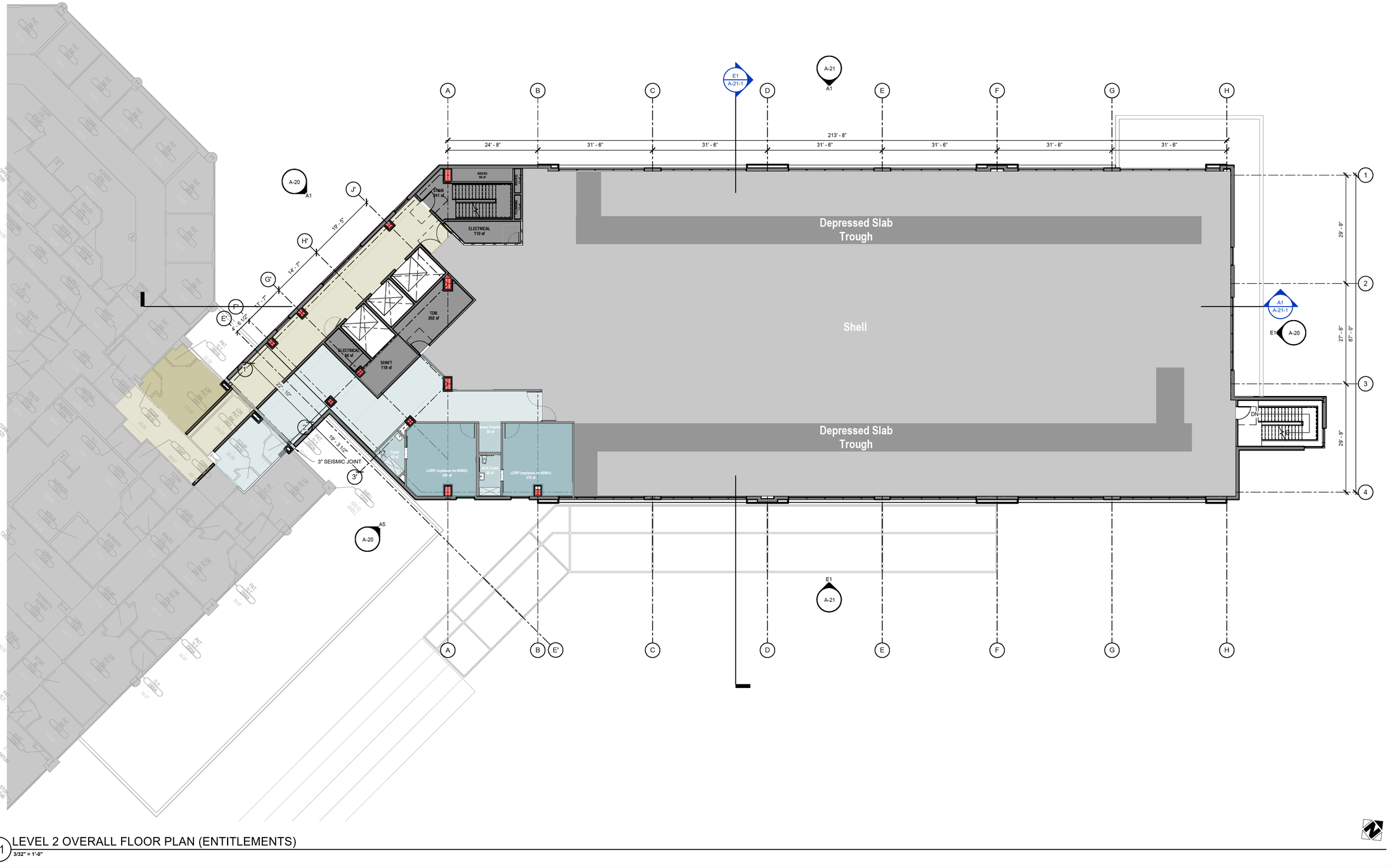
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FILE NAME: Autodesk Docs://6370-SHC-TV E Wing Hospital Addition/6370-SHC-TV E Wing Hospital Addition-Entitlements-R24.rvt

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(E) CUP
(E) EMERGENCY GENERATOR
OUTDOOR STAFF AREA
MAIN ENTRY
PATIENT DROP OFF
AMBULANCE ENTRY
AMBULANCE DROP OFF
AMBULANCE DROP OFF
Trauma/Resus. 262 sf
Ambulance Vest 221 sf
Reception 291 sf
Entry Vestibule 241 sf
General Waiting 2,118 sf
Staff Lounge 305 sf
Shared Office 140 sf
Medical Director 120 sf
Director 122 sf
Shared Office 219 sf
Soiled Utility 119 sf
Consult 104 sf
Discharge 110 sf
Public 57 sf
Triage 57 sf
Clean Supply 58 sf
Mod Prep 119 sf
Staff Lockers 100 sf
Staff/Shower 57 sf
Nourishment 37 sf
Clean Supply 61 sf
Nourishment 61 sf
Clean Supply 58 sf
Elec. Closet
Soil Work Room 92 sf
EMS Storage 75 sf
Janitor 31 sf
Wheelchair Storage 73 sf
Asbestos 91 sf
RISERS 56 sf
STAIR 222 sf
TDR 190 sf
ELECTRICAL 183 sf
ELECTRICAL 267 sf
Treatment
Treatment
Treatment

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A1 LEVEL 2 OVERALL FLOOR PLAN (ENTITLEMENTS)

3/32" = 1'-0"

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AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/22/2024 |

PROJECT INFORMATION

# STANFORD HEALTH CARE TRI-VALLEY
## East Wing Hospital Addition

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2022514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

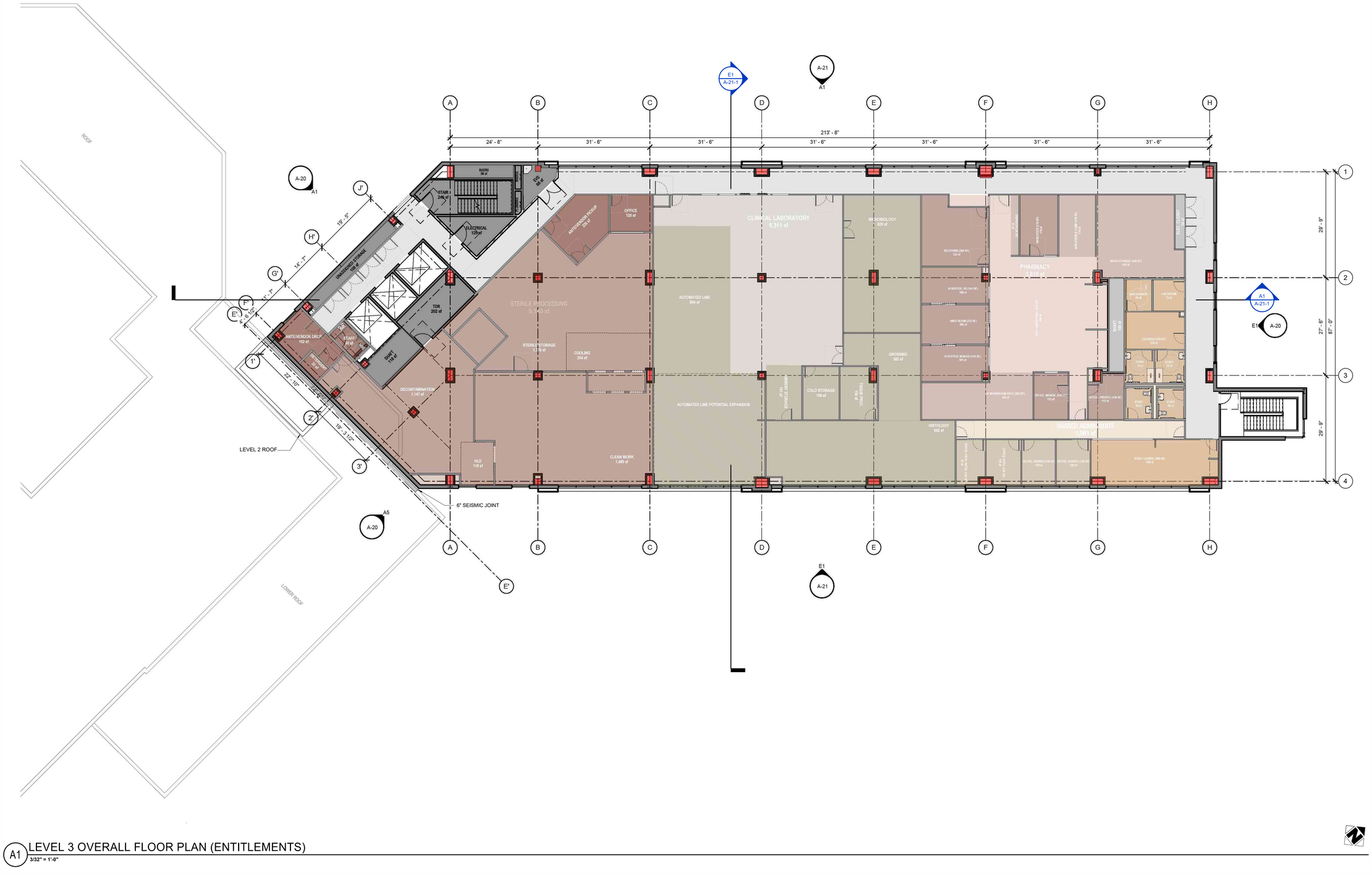
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## LEVEL 2 OVERALL FLOOR PLAN

SHEET NUMBER — SCALE: 3/32" = 1'-0"

# A-17

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A1 LEVEL 3 OVERALL FLOOR PLAN (ENTITLEMENTS)

3/32" = 1'-0"

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PACKAGE ISSUANCE: DESIGN REVIEW SUBMITTAL

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AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/22/2024 |

PROJECT INFORMATION

# STANFORD HEALTH CARE TRI-VALLEY
## East Wing Hospital Addition

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2022514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

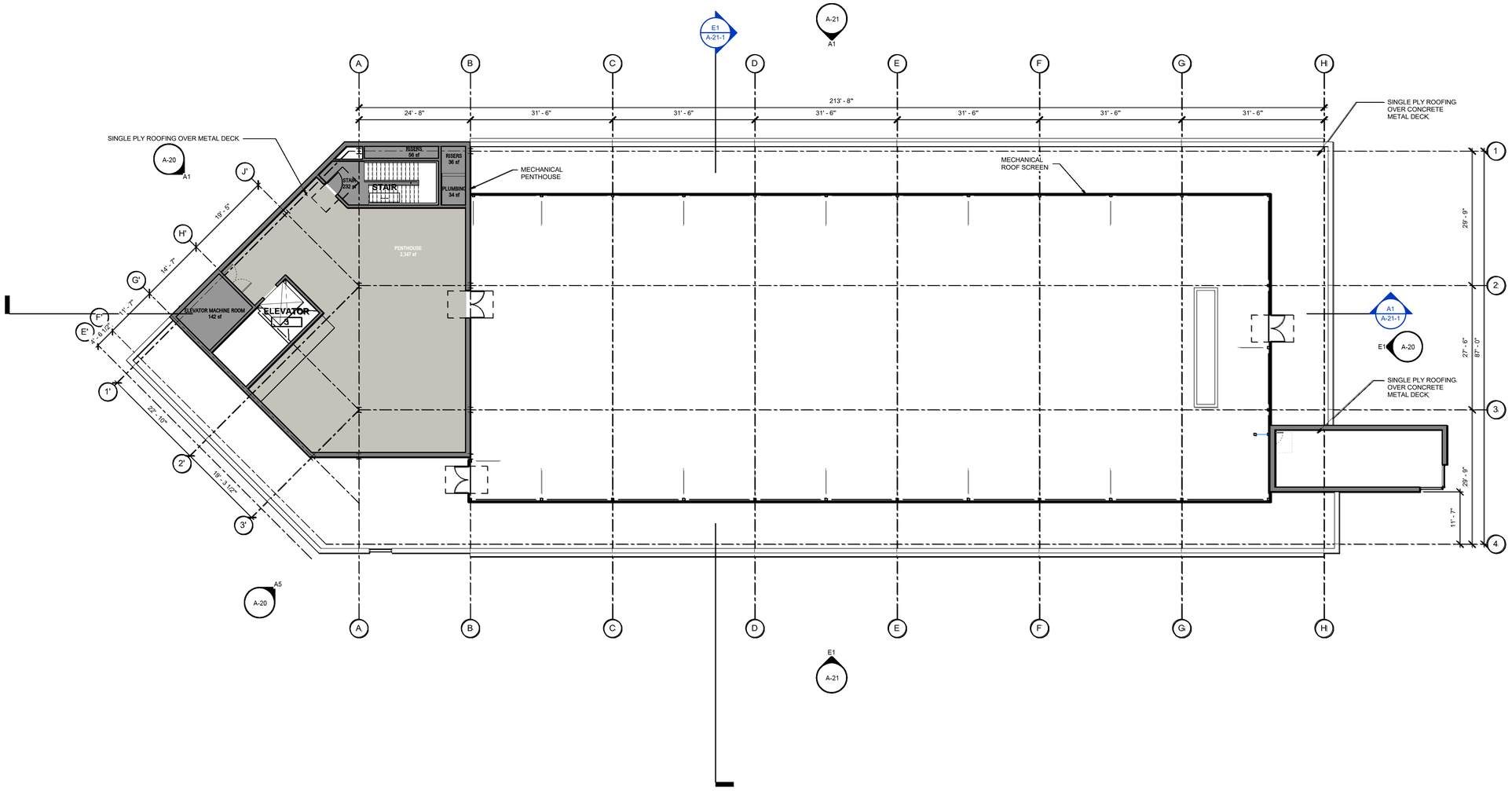
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## LEVEL 3 OVERALL FLOOR PLAN

SHEET NUMBER — SCALE: 3/32" = 1'-0"

# A-18

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A1 OVERALL ROOF PLAN
3/32" = 1'-0"

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REVISION SCHEDULE

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|---|---|---|
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PROJECT INFORMATION

# STANFORD HEALTH CARE TRI-VALLEY
## East Wing Hospital Addition

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 20225I4 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

OVERALL ROOF PLAN

SHEET NUMBER — SCALE: 3/32" = 1'-0"

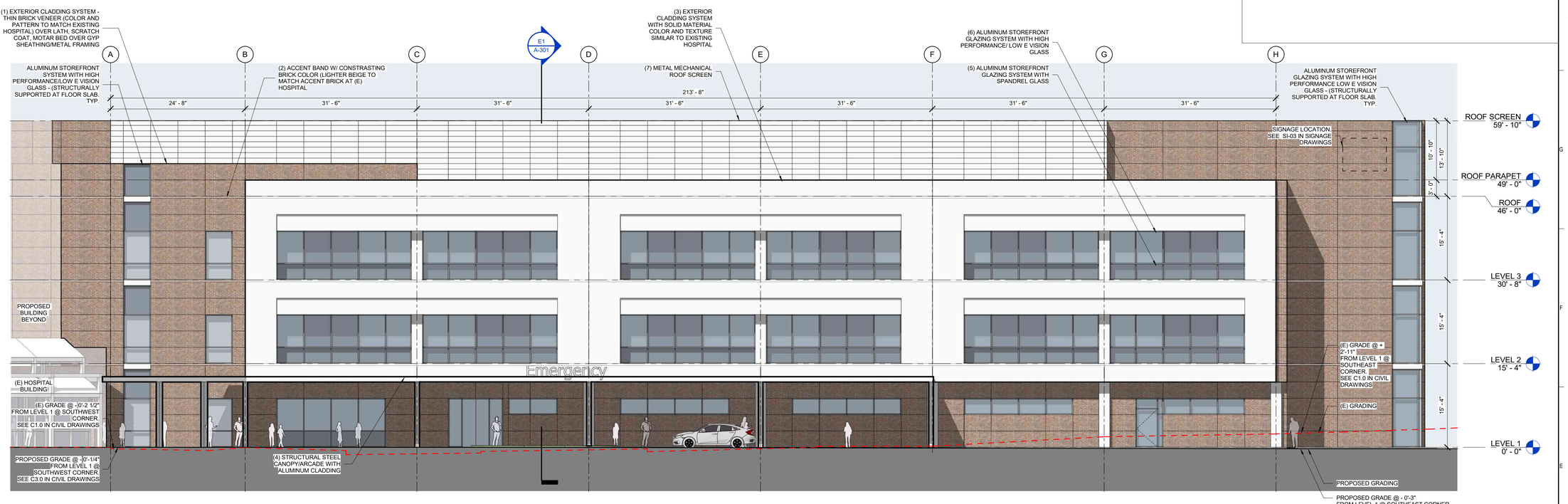
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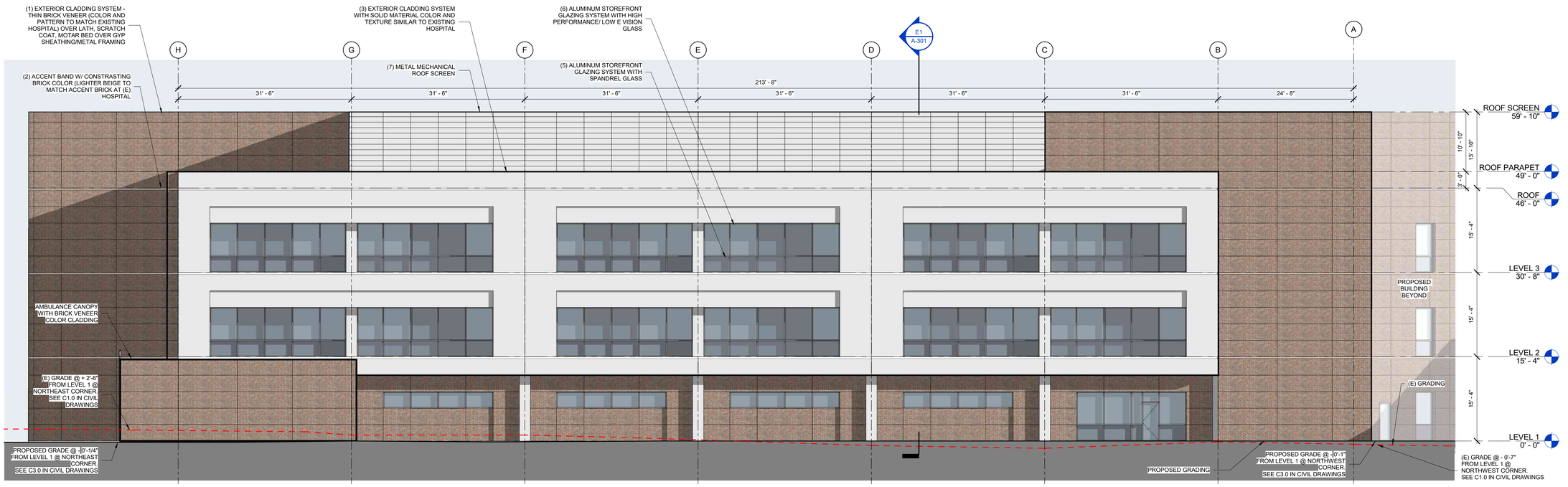
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## EXTERIOR ELEVATION GENERAL NOTES

1. REFERENCE A-241 FOR EXTERIOR MATERIAL BOARD. NOTE THAT FINAL MATERIALS TO BE DETERMINED AS PROJECT PROGRESS.
2. MATERIALS TO BE CONSISTENT WITH AND SIMILAR TO EXISTING CAMPUS MATERIAL PALETTE.
3. GRADING IS DIAGRAMATIC IN NATURE. PLEASE SEE C1.0 AND C3.0 FOR GRADING INFORMATION.




E1 SOUTH ELEVATION
1/8" = 1'-0"




A1 NORTH ELEVATION
1/8" = 1'-0"

FILE NAME: Autodesk Docs://6370-SHC-TV E Wing Hospital Addition/6370-SHC-TV E Wing Hospital Addition-R24.rvt

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AGENCY APPROVAL

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| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/22/2024 |

PROJECT INFORMATION

# STANFORD HEALTH CARE TRI-VALLEY
## East Wing Hospital Addition

| | |
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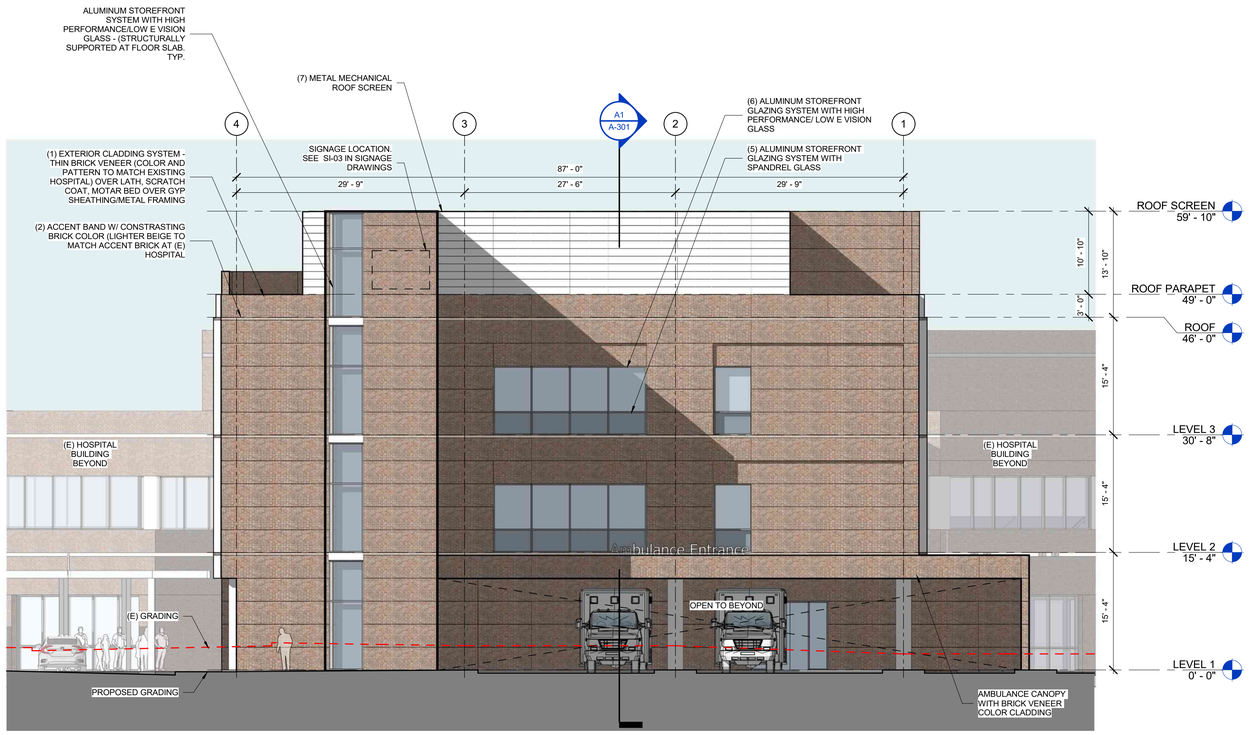
## EXTERIOR ELEVATIONS

SHEET NUMBER — SCALE: As indicated

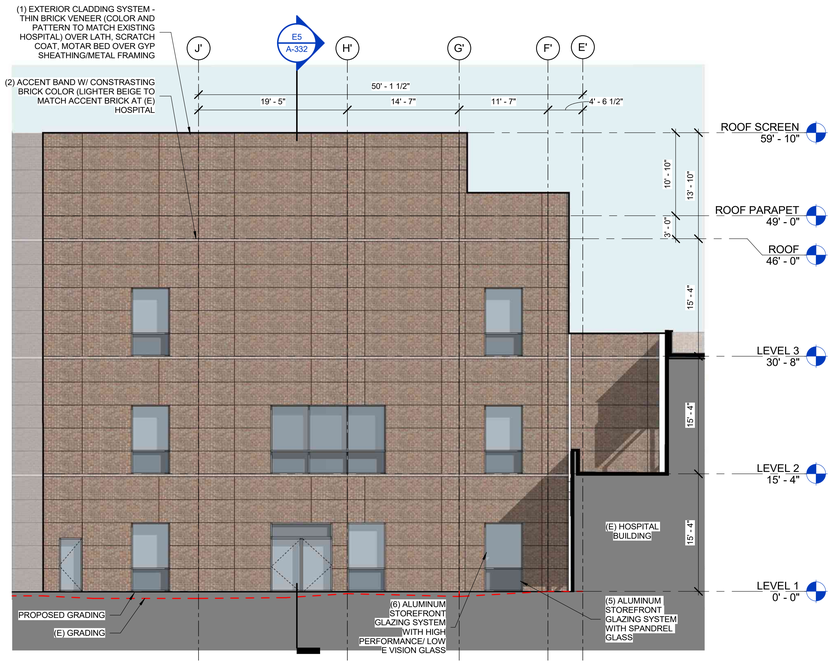
# A-20

PACKAGE ISSUANCE: DESIGN REVIEW SUBMITTAL

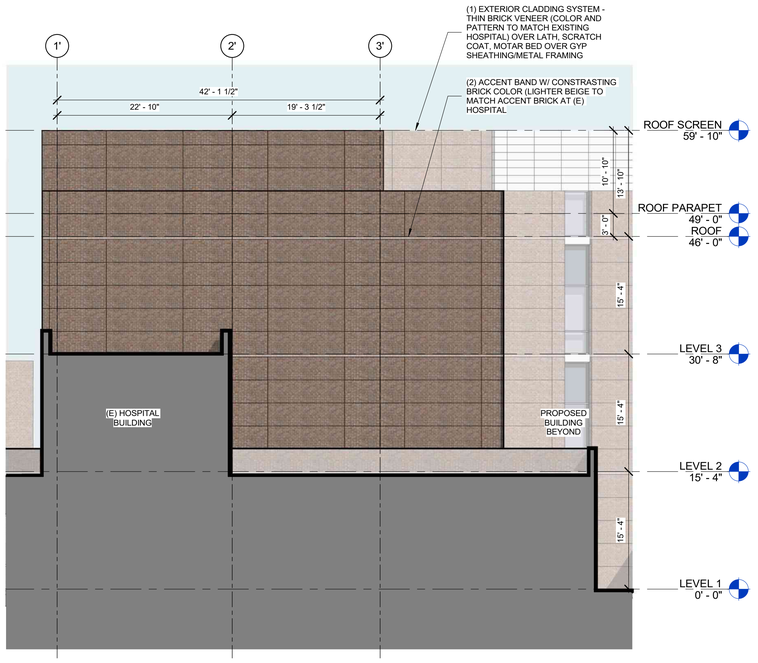
© 11/12/2024 1:47:11 PM TAYLOR & ASSOCIATES ARCHITECTS. IF THIS DRAWING IS NOT 30"x42" IT HAS BEEN MODIFIED




E1 EAST ELEVATION
1/8" = 1'-0"




A1 NORTHWEST ELEVATION
1/8" = 1'-0"




A5 WEST ELEVATION
1/8" = 1'-0"

## EXTERIOR ELEVATION GENERAL NOTES

1. REFERENCE A-241 FOR EXTERIOR MATERIAL BOARD. NOTE THAT FINAL MATERIALS TO BE DETERMINED AS PROJECT PROGRESS.
2. MATERIALS TO BE CONSISTENT WITH AND SIMILAR TO EXISTING CAMPUS MATERIAL PALETTE.
3. GRADING IS DIAGRAMATIC IN NATURE. PLEASE SEE C1.0 AND C3.0 FOR GRADING INFORMATION.

TAYLOR design

DESIGN PROFESSIONAL STAMP

CONSULTANT

AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/22/2024 |

PROJECT INFORMATION

# STANFORD HEALTH CARE TRI-VALLEY
## East Wing Hospital Addition

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2022514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

## EXTERIOR ELEVATIONS

SHEET NUMBER — SCALE: As indicated

A-21

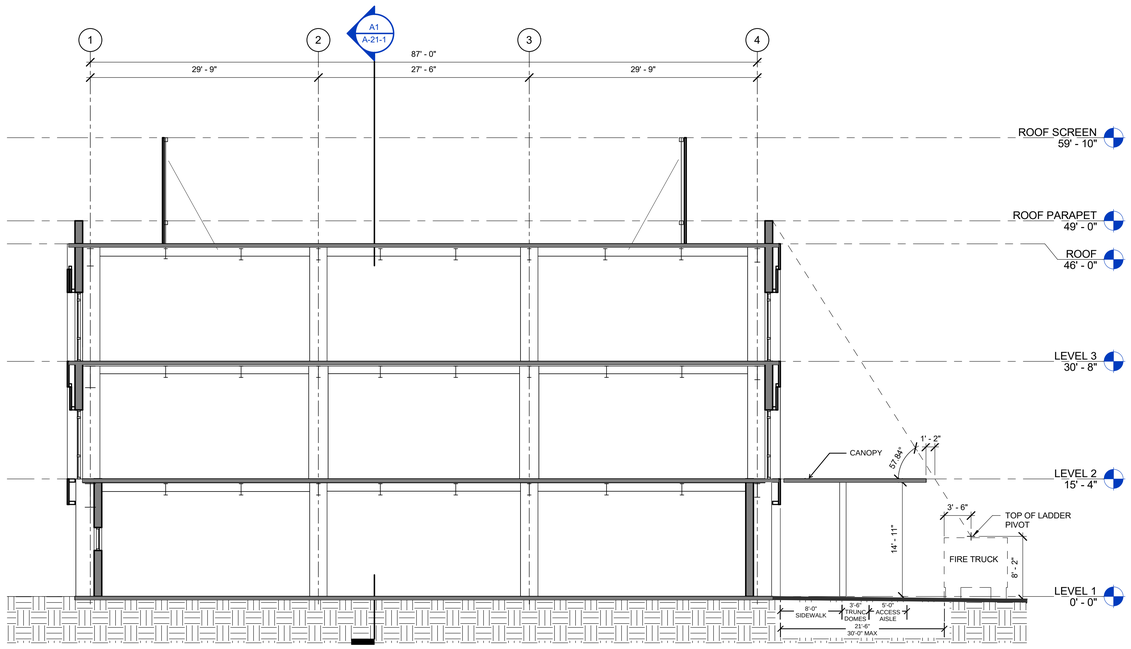
PACKAGE ISSUANCE: DESIGN REVIEW SUBMITTAL

FILE NAME: Autodesk Docs://6370-SHC-TV E Wing Hospital Addition/6370-SHC-TV E Wing Hospital Addition-R24.rvt

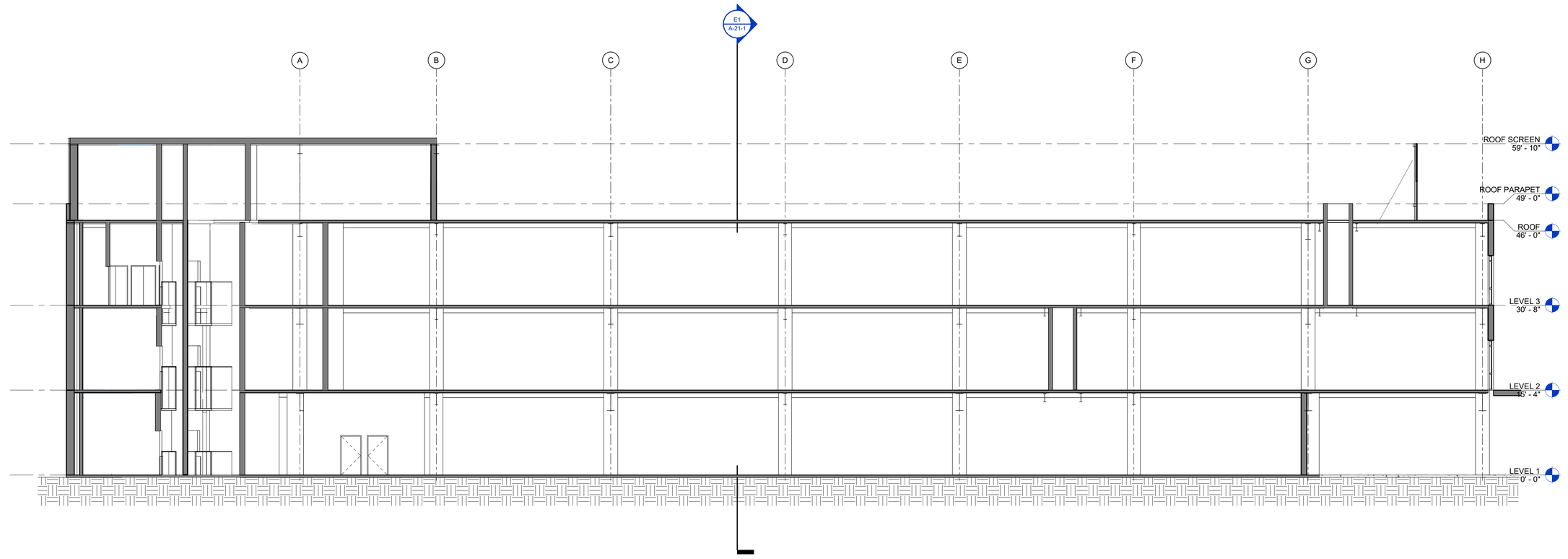
© 11/12/2024 6:12:36 PM TAYLOR & ASSOCIATES ARCHITECTS. IF THIS DRAWING IS NOT 30"x42" IT HAS BEEN MODIFIED

## KEYNOTE LEGEND

| KEY | KEYNOTE TEXT |
|---|---|
| 0180 | CANOPY |




E1 BUILDING SECTION
1/8" = 1'-0"




A1 BUILDING SECTION
1/8" = 1'-0"

FILE NAME: Autodesk Docs://6370-SHC-TV E Wing Hospital Addition/6370-SHC-TV E Wing Hospital Addition-Entitlements-R24.rvt

PACKAGE ISSUANCE: DESIGN REVIEW SUBMITTAL

TAYLOR design

DESIGN PROFESSIONAL STAMP

CONSULTANT

AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/22/2024 |

PROJECT INFORMATION

# STANFORD HEALTH CARE TRI-VALLEY
## East Wing Hospital Addition

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2022314 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

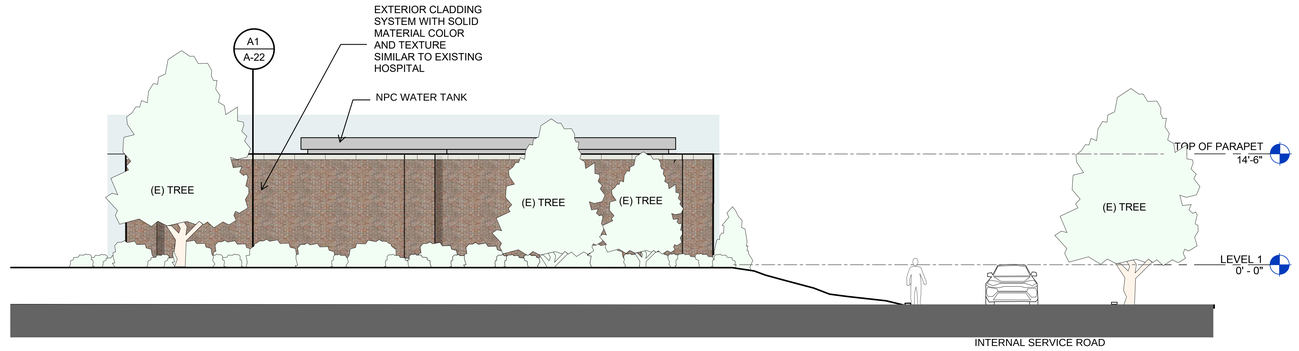
SHEET TITLE — ISSUE DATE: 08/23/2024

## BUILDING SECTIONS

SHEET NUMBER — SCALE:

# A-21-1

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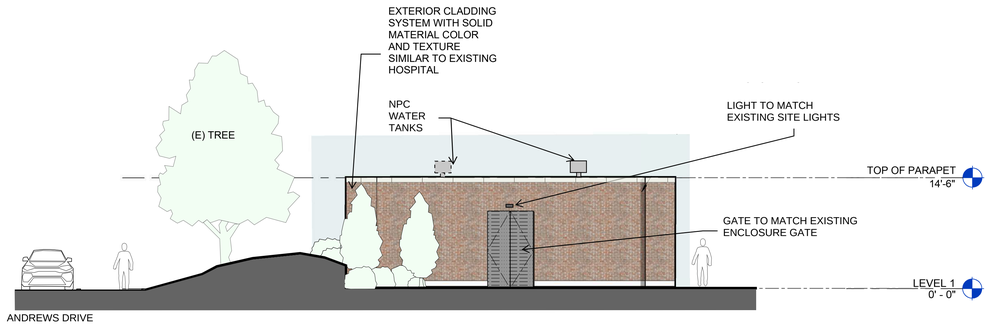

G5 SOUTHEAST ELEVATION
1/8" 1'-0"



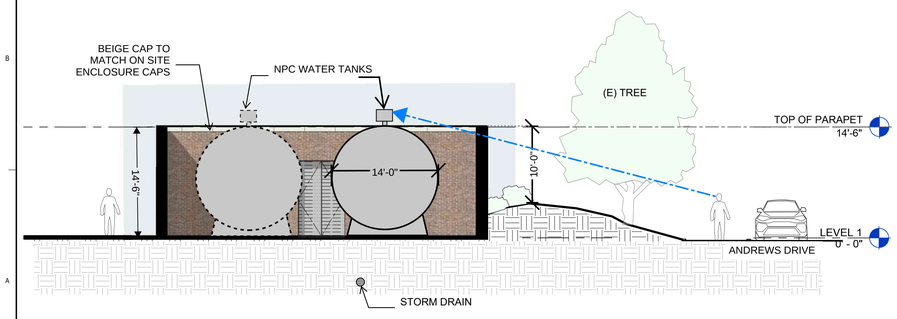

E5 NORTHWEST ELEVATION
1/8" 1'-0"



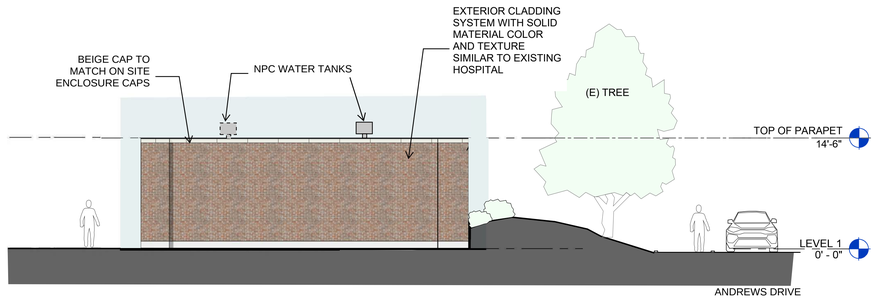
EXISTING GENERATOR YARD (FOR REFERENCE ONLY)




C5 SOUTHWEST ELEVATIONS
1/8" 1'-0"




A1 SECTION
1/8" = 1'-0"




A5 NORTHEAST ELEVATION
1/8" = 1'-0"

## EXTERIOR ELEVATION GENERAL NOTES

1. REFERENCE MATERIALS SHEET. NOTE THAT FINAL MATERIALS TO BE DETERMINED AS PROJECT PROGRESS.
2. MATERIALS TO BE CONSISTENT WITH AND SIMILAR TO EXISTING CAMPUS MATERIAL PALETTE.

TAYLOR design

DESIGN PROFESSIONAL STAMP

CONSULTANT

AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/22/2024 |

PROJECT INFORMATION

# STANFORD HEALTH CARE TRI-VALLEY
# East Wing Hospital Addition

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2022514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

## NPC WATER TANKS - ELEVATIONS & SECTIONS

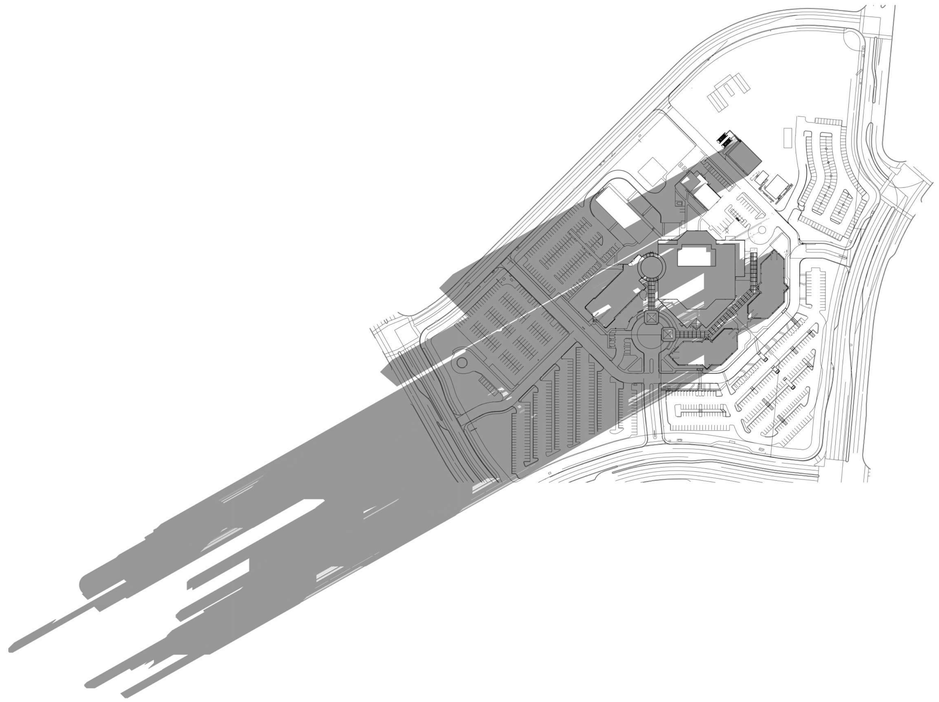
SHEET NUMBER — SCALE: 1" = 1'-0"

# A-22

PACKAGE ISSUANCE: DESIGN REVIEW SUBMITTAL

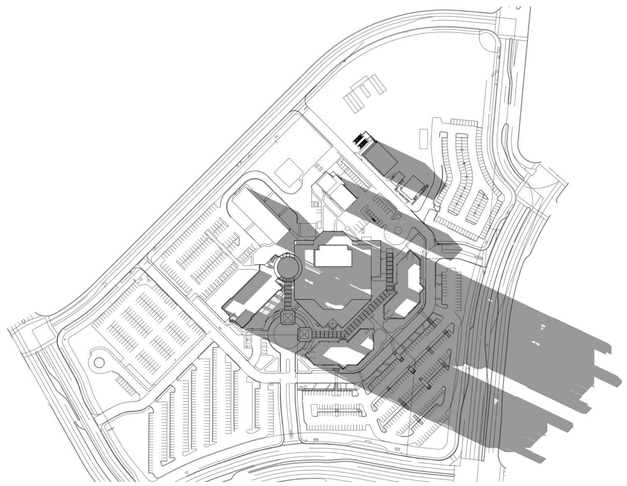
FILE NAME: Autodesk Docs://6370-SHC-TV E Wing Hospital Addition/6370-SHC-TV E Wing Hospital Addition-Entitlements-R24.rvt

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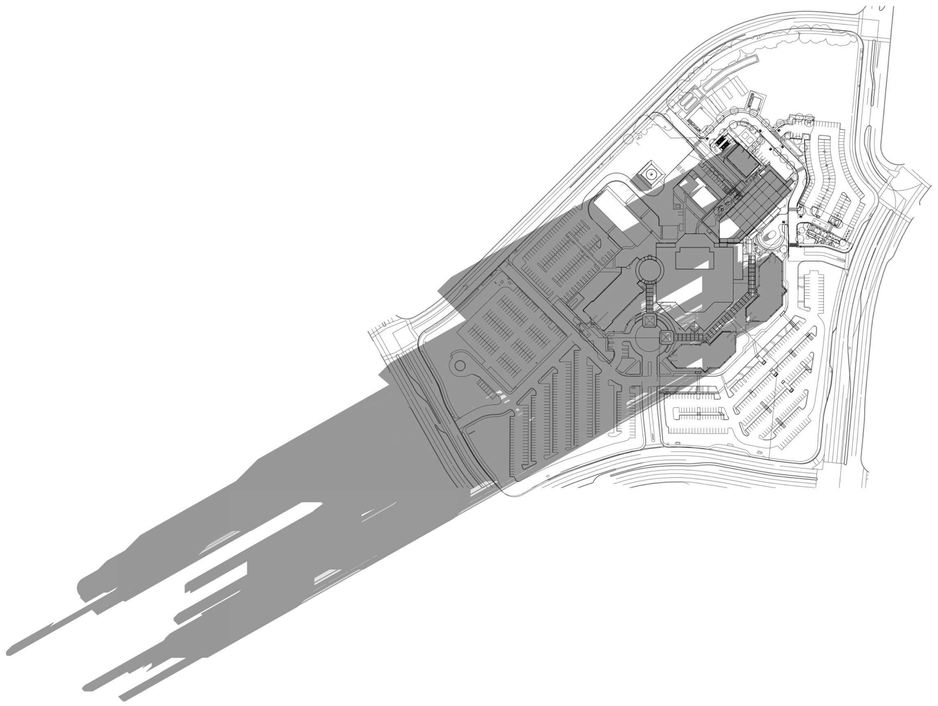
**TIME: 5:00 AM**

E1 EXISTING -SUMMER SOLSTICE @ DAWN
1" = 1'-0"



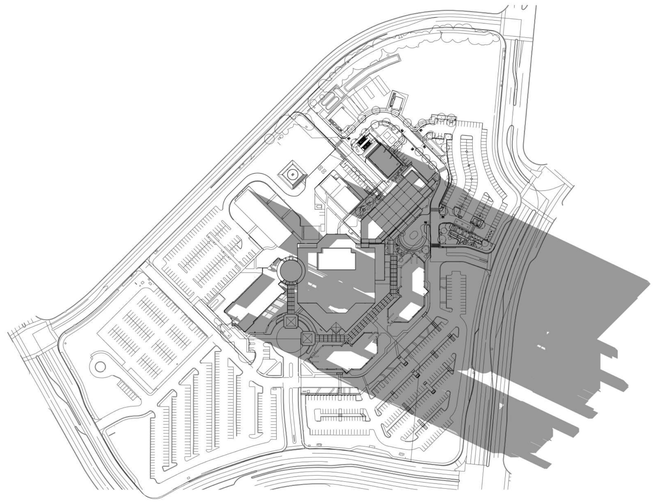
**TIME: 7:00 PM**

E6 EXISTING - SUMMER SOLSTICE @ DUSK
1" = 1'-0"



**TIME: 5:00 AM**

A1 PROPOSED -SUMMER SOLSTICE @ DAWN
1" = 1'-0"



**TIME: 7:00 PM**

A6 PROPOSED - SUMMER SOLSTICE @ DUSK
NTS

FILE NAME: Autodesk Docs://6370-SHC-TV E Wing Hospital Addition/6370-SHC-TV E Wing Hospital Addition-Entitlements-R24.rvt

TAYLOR design

DESIGN PROFESSIONAL STAMP

CONSULTANT

AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/22/2024 |

PROJECT INFORMATION

**STANFORD HEALTH CARE TRI-VALLEY**
**East Wing Hospital Addition**

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2022514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

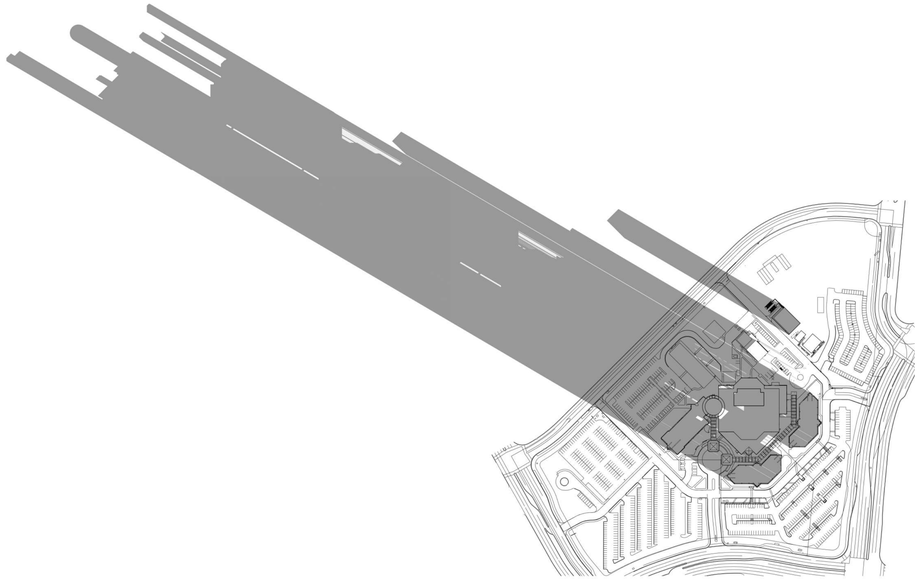
**SOLAR ACCESS/ SHADOW STUDY**

SHEET NUMBER — SCALE: 1" = 1'-0"

**A-23**

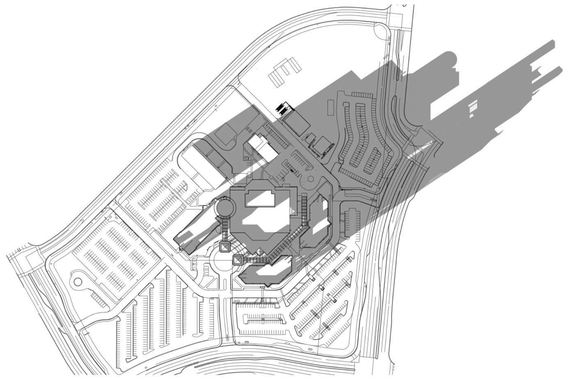
PACKAGE ISSUANCE: DESIGN REVIEW SUBMITTAL

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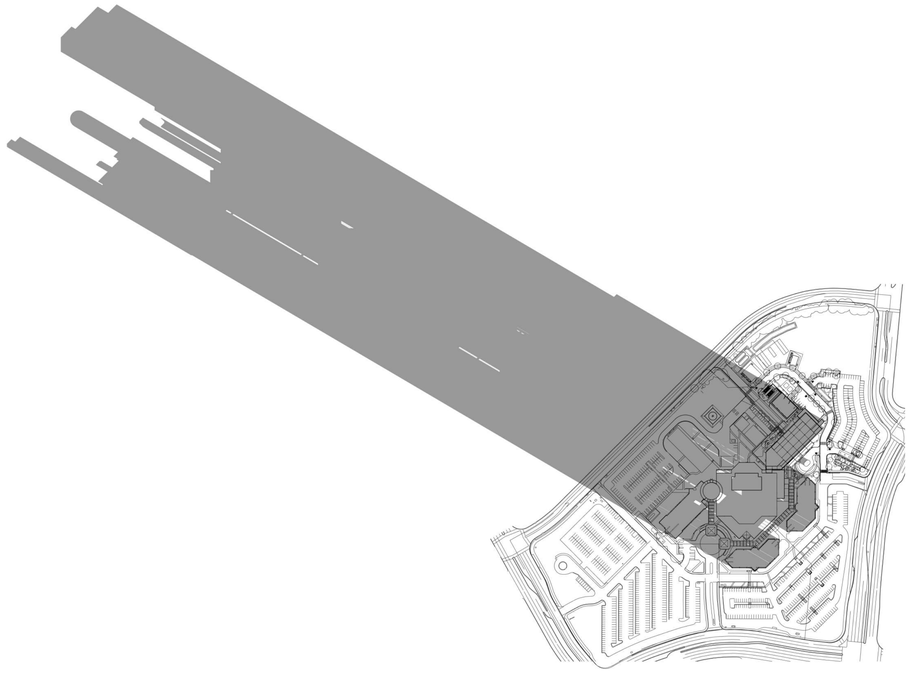
**TIME: 7:30 AM**

E1 EXISTING -WINTER SOLSTICE @ DAWN
NTS



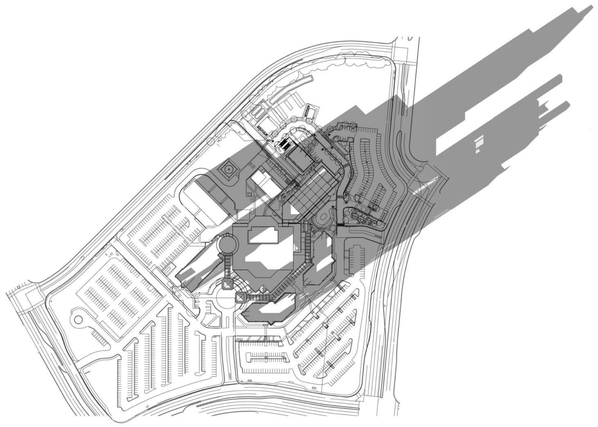
**TIME: 4:30 PM**

E6 EXISTING -WINTER SOLSTICE @ DUSK
NTS



**TIME: 7:30 AM**

A1 PROPOSED -WINTER SOLSTICE @ DAWN
NTS



**TIME: 4:30 PM**

A6 PROPOSED -WINTER SOLSTICE @ DUSK
NTS

FILE NAME: Autodesk Docs://6370-SHC-TV E Wing Hospital Addition/6370-SHC-TV E Wing Hospital Addition-Entitlements-R24.rvt

TAYLOR design

DESIGN PROFESSIONAL STAMP

CONSULTANT

AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/22/2024 |

PROJECT INFORMATION

**STANFORD HEALTH CARE TRI-VALLEY**
**East Wing Hospital Addition**

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2022514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

## SOLAR ACCESS/ SHADOW STUDY

SHEET NUMBER — SCALE: 1" = 1'-0"

# A-24

PACKAGE ISSUANCE: DESIGN REVIEW SUBMITTAL

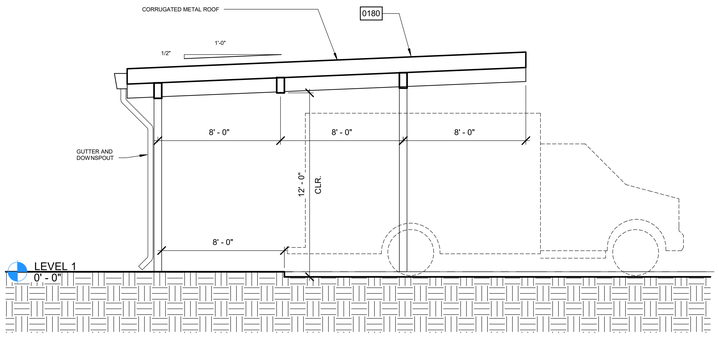
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## KEYNOTE LEGEND

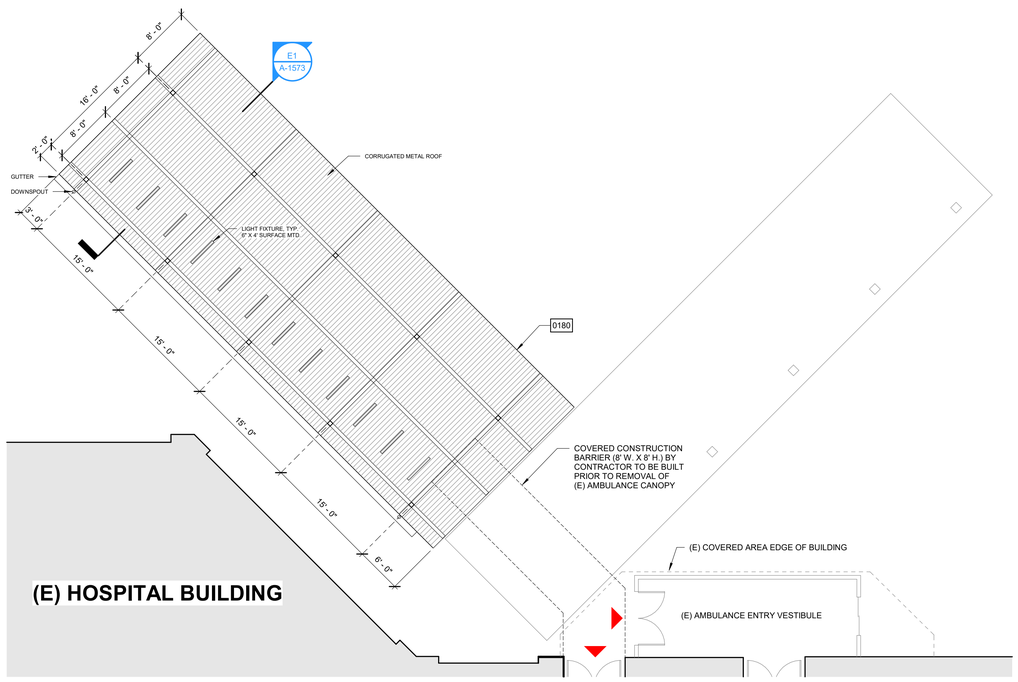
| KEY | KEYNOTE TEXT |
|---|---|
| 0180 | CANOPY |
| 5002 | (E) CANOPY |
| 5005 | SIDEWALK |
| 5006 | (E) SIDEWALK |

**FOR REFERENCE ONLY**

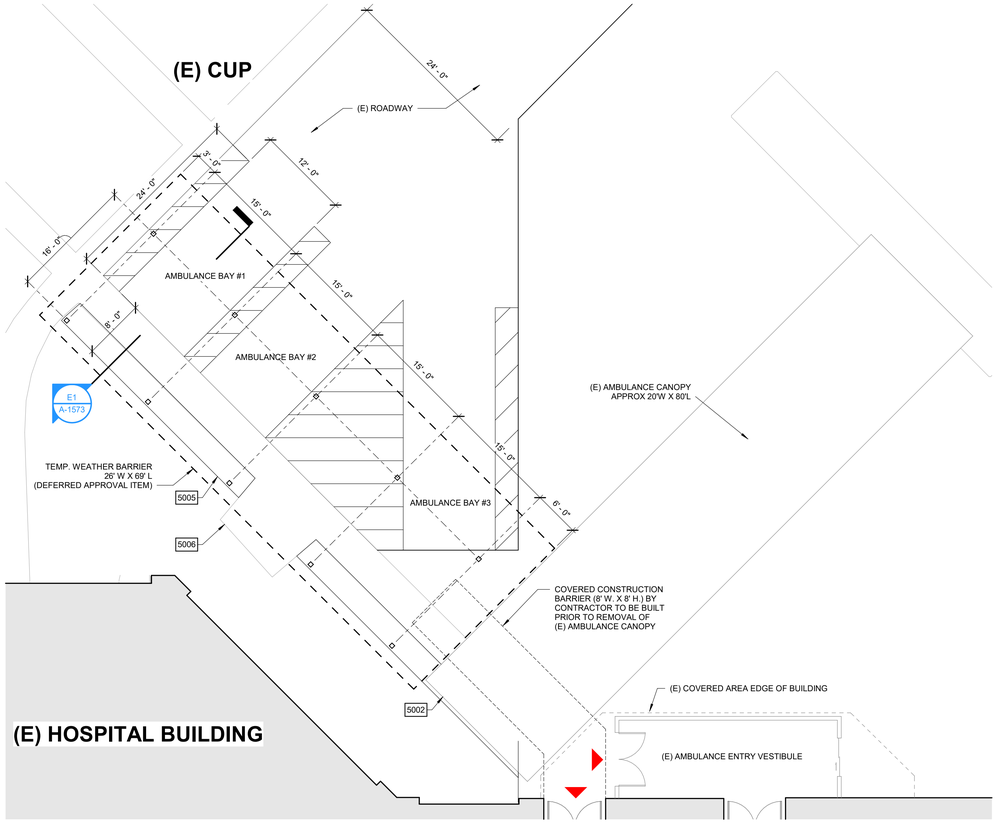
RECEIVED
02.10.25
P24-0532
CITY OF PLEASANTON
PLANNING DIVISION
EXHIBIT B




E1 SECTION AT TEMP. WEATHER BARRIER
1/4" = 1'-0"




A1 TEMPORARY AMBULANCE DROP OFF - RCP
1/8" = 1'-0"




A6 TEMPORARY AMBULANCE DROP-OFF - ENLARGED PLAN
1/8" = 1'-0"

TAYLOR design

**DESIGN PROFESSIONAL STAMP**

**AGENCY APPROVAL**

**REVISION SCHEDULE**

| NO. | REVISION NAME | DATE: |
|---|---|---|

**PROJECT INFORMATION**

# STANFORD HEALTH CARE TRI-VALLEY INCREMENT 1 - SITE WORK

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 20225514 |
| AUTHORITY HAVING JURISDICTION: | OSHPD |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | BLD 02 - 02533; BLD 06 - 064430 |
| AGENCY PROJECT NUMBER: | I250001-01-01 |
| ARCHITECT PROJECT NO: | 6370.101 |

**SHEET TITLE** **ISSUE DATE: 01/06/25**

## EXTERIOR DETAILS -TEMPORARY AMBULANCE DROP OFF

**SHEET NUMBER**

# A-1573

FILE NAME: Autodesk Docs://6370-SHC-TV E Wing Hospital Addition/6370-SHC-TV E Wing Hospital Addition-CandS-R24.rvt

**PACKAGE ISSUANCE:100% OSHPD CONSTRUCTION DOCUMENTS**

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## GENERAL NOTES

1. ALL WORK SHALL CONFORM TO THE REQUIREMENTS OF THE UNIFORM BUILDING CODE, CAL-OSHA, ALAMEDA COUNTY AND STATE REQUIREMENTS, THE GOVERNING BUILDING AUTHORITY AND ANY SPECIAL REQUIREMENTS OF THE BUILDING PERMIT. ALL CODES, STANDARDS AND SPECIFICATIONS SHALL BE AS AMENDED TO DATE, ANY VIOLATION WILL RESULT IN STOPPING OF ALL WORK UNTIL THE VIOLATION IS CORRECTED.

2. THE DRAWINGS AND SPECIFICATIONS DESCRIBE IN GENERAL THE QUALITY AND CHARACTER OF THE MATERIALS, SHAPE AND CONFIGURATION OF IMPROVEMENTS AND THE DESIGN INTENT OF THE COMPLETED, INSTALLED WORK. MISCELLANEOUS ITEMS OF WORK, MATERIAL, EQUIPMENT, ETC., NECESSARY TO COMPLETE THE INSTALLATION SHALL BE PROVIDED BY THE CONTRACTOR WHETHER OR NOT MENTIONED IN THE SPECIFICATIONS OR SHOWN ON THE DRAWINGS. SPECIFIC NOTES AND DETAILS SHALL TAKE PRECEDENCE OVER GENERAL NOTES AND TYPICAL DETAILS.

3. CONTRACTOR SHALL PROTECT EXISTING FACILITIES FROM DAMAGE. ANY DAMAGE CAUSED BY THE CONTRACTOR SHALL BE REPAIRED OR REPLACED AT NO ADDITIONAL COST TO THE OWNER. BARRICADES, SIGNS, LIGHTS, ETC., REQUIRED FOR THE PROTECTION OF PUBLIC, PERSONNEL, PROPERTY AND MATERIAL SHALL BE PROVIDED FOR AND MAINTAINED DURING CONSTRUCTION BY THE CONTRACTOR, AND SHALL CONFORM TO ALL GOVERNING CODES, ORDINANCES AND REGULATIONS. THE CONTRACTOR SHALL EMPLOY ALL MEANS NECESSARY TO CONTROL DUST AT AND NEAR THE SITE OF WORK AND ALONG APPROACH ROUTES TO THE CONSTRUCTION SITE.

4. CONTRACTOR SHALL PROVIDE ALL TOOLS, TRANSPORTATION, UTILITIES, TEMPORARY FACILITIES, AND OTHER SERVICES AS NECESSARY FOR PROPER EXECUTION OF THE WORK, AND SHALL ASSUME FULL RESPONSIBILITY FOR PROTECTION AND SAFEKEEPING OF THESE ELEMENTS DURING CONSTRUCTION. THE CONTRACTOR SHALL CONTACT THE OWNER'S REPRESENTATIVE FOR DESIGNATION OF THE MATERIAL STORAGE AREA AT THE JOB SITE.

5. CONTRACTOR SHALL MAINTAIN "GOOD HOUSEKEEPING" PRACTICES AT THE JOB SITE. EXCESS BUILDING MATERIALS AND DEBRIS SHALL BE REMOVED PROMPTLY FROM THE JOB SITE AND DISPOSED OF AT AN APPROVED DUMPSITE. THE JOB SITE SHALL BE LEFT "BROOM CLEAN" AT THE END OF EACH WORKDAY. BEFORE ACCEPTANCE BY THE OWNER'S REPRESENTATIVE, THE COMPLETED CONSTRUCTION SHALL BE CLEARED, ANY APPLICABLE LABELS REMOVED, AND ALL OTHER TOUCHUP WORK COMPLETED. ALL FINISH MATERIALS SHALL BE PROTECTED AT ALL TIMES AGAINST SUBSEQUENT DAMAGE UNTIL FINAL ACCEPTANCE BY THE OWNER'S REPRESENTATIVE.

6. CONTRACTOR SHALL FIELD INVESTIGATE, VERIFY AND BE RESPONSIBLE FOR ALL CONDITIONS, ELEVATIONS AND DIMENSIONS OF THE PROJECT, AS SHOWN ON OR REFERENCED ON THE DRAWINGS, AND NOTIFY THE OWNER'S REPRESENTATIVE ABOUT ANY CONDITION REQUIRING MODIFICATION OR CHANGE PRIOR TO BIDDING. EXAMINE THE DRAWINGS AND SPECIFICATIONS AND CLEARLY UNDERSTAND THE EXISTING CONDITIONS UNDER WHICH THE WORK IS TO BE PERFORMED PRIOR TO BIDDING. ENTERING INTO AN AGREEMENT WITH THE OWNER INDICATES THAT THE CONTRACTOR HAS VISITED THE SITE, FAMILIARIZED HIMSELF OR HERSELF WITH EXISTING CONDITIONS AND REVIEWED SAME WITH REQUIREMENTS OF CONTRACT DOCUMENTS. NO ALLOWANCES OF ANY KIND WILL BE MADE FOR ANY EXTRA COST DUE TO THE CONTRACTOR'S FAILURE TOO INFORM THE OWNER OF DISCREPANCIES IN TIME TO ISSUE CORRECTIVE ADDENDA PRIOR TO BIDDING. THE CONTRACT DOCUMENTS ILLUSTRATE THE INTENT OF THE WORK TO BE PERFORMED.

7. CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONTRACTOR SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS.

8. UNDERGROUND UTILITIES INDICATED ARE FOR INFORMATION ONLY. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THE LOCATION AND DEPTH OF ALL UTILITIES INCLUDING TELEPHONE, WATER, GAS, TV, TRAFFIC SIGNAL, STREET LIGHTING, ETC. WITH THE APPROPRIATE AGENCY. NEITHER THE OWNER NOR THE LANDSCAPE ARCHITECT ASSUMES RESPONSIBILITY THAT THE UNDERGROUND UTILITIES INDICATED WOULD BE THOSE ENCOUNTERED. CONTRACTOR SHALL NOTIFY UNDERGROUND SERVICE ALERT (U.S.A. 800-642-2444) TWO WORKING DAYS MINIMUM PRIOR TO ANY EXCAVATION.

9. CONTRACTOR IS RESPONSIBLE FOR COORDINATING HIS WORK TO AVOID CONFLICTS BETWEEN SEWER LATERALS, STORM DRAINS AND WATER MAINS.

10. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO NOTIFY THE OWNER'S REPRESENTATIVE OF ANY DIFFERENCES IN LOCATIONS OF EXISTING UTILITIES FROM THAT SHOWN, OR ANY CONFLICTS WITH THE DESIGN BEFORE CONTINUING WORK IN THAT AREA.

11. UTILITY CONNECTIONS AND DISCONNECTIONS NECESSARY TO COMPLETE THE WORK SHALL BE PERFORMED IN SUCH A MANNER AS TO MINIMIZE UTILITY SERVICE INTERRUPTIONS TO FACILITY OPERATIONS IN THE VICINITY OF CONSTRUCTION. COORDINATE ALL "DOWN TIME" WITH THE OWNER AND WITH THE APPROPRIATE AGENCY.

12. ALL EXISTING UTILITY STRUCTURES (SHOWN OR NOT SHOWN ON THE DRAWINGS) WITHIN THE AREA OF WORK SHALL BE ADJUSTED OR RECONSTRUCTED TO THE FINISH GRADES SHOWN AND SPECIFIED.

13. PROVIDE ADEQUATE COVER FOR THE PROTECTION OF ALL PROPOSED AND EXISTING UTILITIES DURING THE CONSTRUCTION OF THIS PROJECT.

14. ANY PERMANENT MONUMENTS OR POINTS DAMAGED OR DESTROYED SHALL BE REPLACED BY A LICENSED ENGINEER OR LAND SURVEYOR AT THE CONTRACTOR'S EXPENSE.

15. CONTRACTOR SHALL COORDINATE HIS WORK WITH THE WORK UNDER CONTRACTS THAT MAYBE UNDERWAY CONCURRENTLY WITH THIS PROJECT.

16. TRAFFIC CONTROL: PRIOR TO BEGINNING ANY WORK ON EXISTING STREETS, ADVANCE-WARNING SIGNS SHALL BE INSTALLED. TRAFFIC CONTROL SHALL BE PROVIDED IN ACCORDANCE WITH CALTRANS "MANUAL OF TRAFFIC CONTROLS FOR CONSTRUCTION AND MAINTENANCE WORK ZONES" CURRENT EDITION AND ANY ADDITIONAL CITY REQUIREMENTS. FAILURE TO COMPLY MAY RESULT IN IMMEDIATE STOPPAGE OF WORK UNTIL THE PROPER TRAFFIC CONTROL IS IN ORDER. CONTRACTOR SHALL PREPARE A TRAFFIC CONTROL PLAN FOR CITY REVIEW AND APPROVED PRIOR TO ANY WORK REQUIRING TRAFFIC CONTROL.

17. PROVIDE BARRICADES TO PROTECT THE GENERAL PUBLIC AND TO PREVENT UNCONTROLLED ACCESS TO THE SITE AT ALL TIMES.

18. PROVIDE FOR EGRESS AND INGRESS TO ON-SITE FACILITIES THAT ARE TO REMAIN OPERATIONAL DURING ALL PHASES OF CONSTRUCTION.

19. THE CONTRACTOR'S ATTENTION IS DIRECTED TO THE REQUIREMENTS OF THE DIVISION OF INDUSTRIAL SAFETY PERTAINING TO "CONFINED SPACE". ANY MANHOLE, CULVERT, DROP INLET OR TRENCH, WHICH COULD CONTAIN AIR THAT IS NOT READILY VENTILATED, MAY BE CONSIDERED A "CONFINED SPACE".

20. TRENCHES SHALL BE SHORED IN ACCORDANCE WITH CAL-OSHA 'CONSTRUCTION SAFETY ORDERS' CURRENT EDITION.

21. CONTRACTOR IS RESPONSIBLE FOR MATCHING EXISTING STREETS, SURROUNDING LANDSCAPE,AND OTHER IMPROVEMENT WITH A SMOOTH TRANSITION IN PAVING, CURBS, GUTTERS, SIDEWALKS,GRADING, ETC. AND TO AVOID ANY ABRUPT OR APPARENT CHANGES IN GRADES OR CROSS SLOPE, LOW SPOTS, OR HAZARDOUS CONDITIONS.

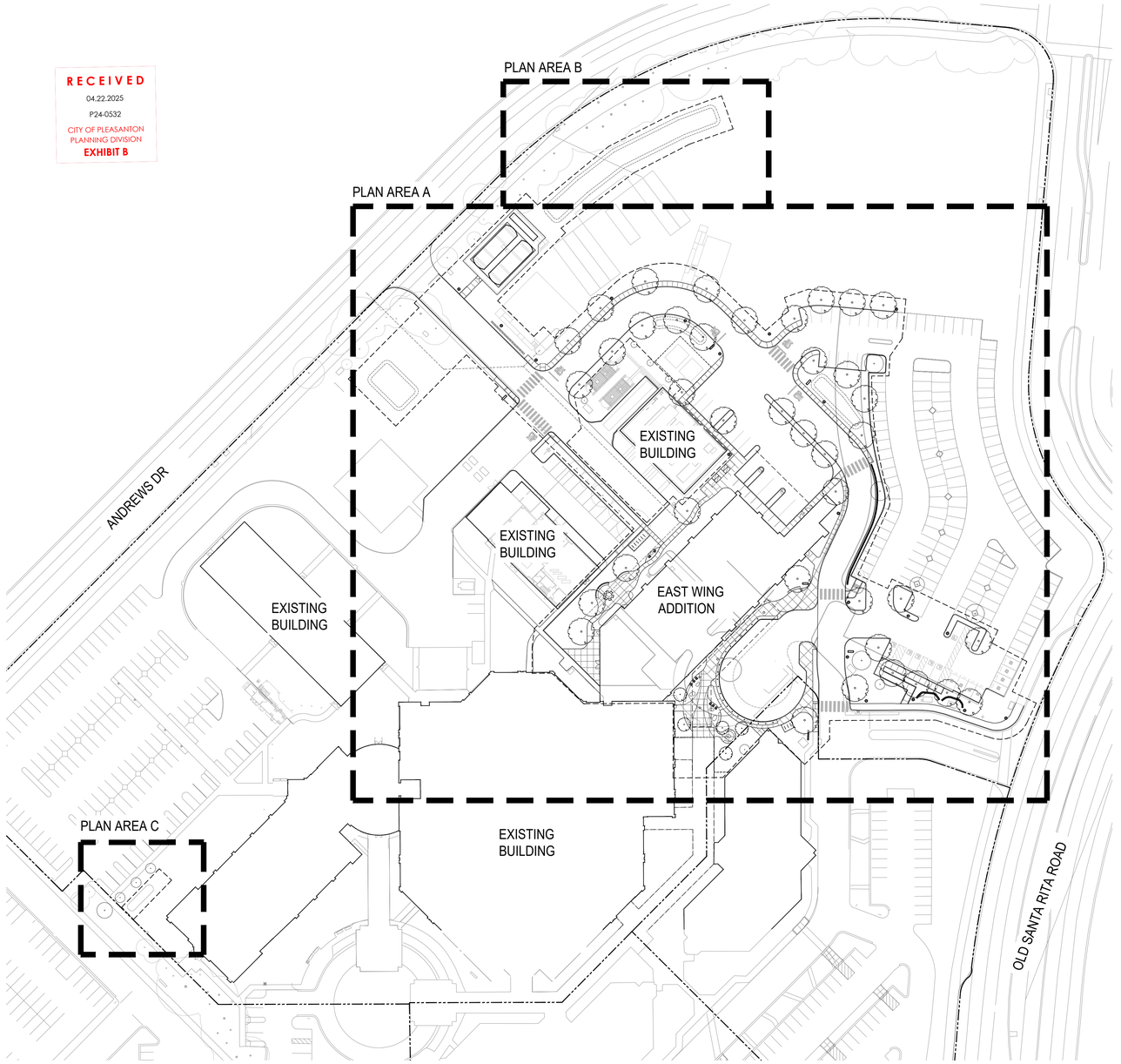
22. CONSTRUCTION OPERATIONS: WASTEWATER GENERATED DURING CONSTRUCTION SHALL NOT BE DISCHARGED TO THE STORM DRAIN SYSTEM. THIS INCLUDES WASTE FROM PAINTING, SAW CUTTING, CONCRETE WORK, ETC. THE CONTRACTOR SHALL MAKE ARRANGEMENTS TO ELIMINATE DISCHARGE TO THE STORM DRAIN SYSTEM AND, IF NECESSARY, PROVIDE AN AREA FOR ON SITE WASHING ACTIVITIES DURING CONSTRUCTION, MATERIALS THAT COULD CONTAMINATE STORM RUNOFF SHALL BE STORED IN AREAS WHICH ARE DESIGNED TO PREVENT EXPOSURE TO RAINFALL AND NOT ALLOW STORM WATER TO RUN ONTO THE AREA. GRADING AND DRAINAGE FEATURES SHALL BE CONSTRUCTED SO THAT WATER FLOW DOES NOT DRAIN TO OTHER PROPERTIES.

23. FLUSHING OF STREETS AND PARKING LOTS TO REMOVE DIRT AND CONSTRUCTION DEBRIS IS PROHIBITED UNLESS PROPER SEDIMENT CONTROLS ARE USED. PREFERABLY, AREAS REQUIRING CLEANING SHOULD BE SWEPT.

24. ANY REVISIONS OR ADDITIONAL WORK REQUIRED AS A RESULT OF FIELD CONDITIONS OR LOCAL GOVERNING AUTHORITIES SHALL BE BROUGHT TO THE ATTENTION OF THE OWNER'S REPRESENTATIVE BEFORE WORK PERFORMED BY THE CONTRACTOR WITHOUT WRITTEN AUTHORIZATION SHALL BE THE FULL RESPONSIBILITY OF THE CONTRACTOR WHO SHALL BEAR ALL COSTS ATTRIBUTABLE THERETO. ANY AND ALL REVISIONS SHALL BE IN WRITTEN CHANGE ORDER FORM AND APPROVED AND AUTHORIZED BY THE OWNER BEFORE BEGINNING WORK.

25. ALL LANDSCAPING AND ANY ARCHITECTURAL STRUCTURE/FEATURE SHALL BE NO MORE THAN 30 INCHES TALL INSIDE THE INTERSECTION VISIBILITY ZONES AS ESTABLISHED BY AN INTERSECTION VISIBILITY ANALYSIS INCORPORATING CORNER SIGHT DISTANCE CRITERIA AT ALL SIGNALIZED INTERSECTIONS FOR THIS SITE. CRITICAL SPEED FOR CALCULATING THE VISIBILITY ZONES SHALL BE 45 MPH.

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04.22.2025
P24-0532
CITY OF PLEASANTON
PLANNING DIVISION
EXHIBIT B




REFERENCE PLAN

N

## ACCESSIBILITY NOTES

1. ALL SITE WORK SHALL COMPLY WITH CURRENT CALIFORNIA BUILDING CODE (CALIFORNIA CODE OF REGULATIONS TITLE 24), CURRENT STANDARDS OF THE AMERICANS WITH DISABILITIES ACT (ADA), AND THE CURRENT FAIR HOUSING ACT DESIGN MANUAL.

2. ALL PAVING AREAS SHALL BE ACCESSIBLE PER TITLE 24. ALL PAVING SURFACES ARE TO BE STABLE, FIRM, AND SLIP RESISTANT WITH CROSS SLOPES NOT TO EXCEED 2% IN ANY DIRECTION, UNLESS OTHERWISE NOTED. ACCESSIBLE PATHS OF TRAVEL ARE BARRIER-FREE ACCESS ROUTES AT LEAST 48" CLEAR IN WIDTH AND WITHOUT ANY ABRUPT VERTICAL LEVEL CHANGES EXCEEDING 1/2" IF BEVELED AT 1:2 MAX SLOPE, OR VERTICAL LEVEL CHANGES NOT EXCEEDING 1/4" MAX. ALL ACCESSIBLE PATHWAYS SHALL BE SLOPED LESS THAN 5% IN THE DIRECTION OF TRAVEL, UNLESS OTHERWISE NOTED.

3. ALL ACCESSIBLE PATHS OF TRAVEL SHALL BE MAINTAINED FREE OF OVERHANGING OBSTRUCTIONS BELOW 80" ABOVE FINISH GRADE. OBJECTS WITH LEADING EDGES LOCATED BETWEEN 27" AND 80" ABOVE FINISH GRADE SHALL NOT PROTRUDE MORE THAN 4" HORIZONTALLY INTO THE PATH OF TRAVEL. EXCEPTIONS INCLUDE HANDRAILS, DOOR CLOSERS, AND DOOR STOPS. GUARDRAILS OR OTHER BARRIERS SHALL BE PROVIDED WHERE OBJECT PROTRUSION IS BEYOND THE LIMITS ALLOWED.

## ABBREVIATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| AL | ALIGN | DWGS | DRAWINGS | MAX | MAXIMUM | SCD | SEE CIVIL DRAWINGS |
| AC | ASPHALTIC CONCRETE | EJ | EXPANSION JOINT | MFG | MANUFACTURER | SD | STORM DRAIN |
| AD | AREA DRAIN | ELE TRANS | ELECTRICAL TRANSFORMER | MH | MANHOLE | SJ | SCORE JOINT |
| ADA | AMERICANS WITH DISABILITIES ACT | ELEV | ELEVATION | MIN | MINIMUM | SMD | SEE MECHANICAL DRAWINGS |
| AGG | AGGREGATE | EQ | EQUAL | (N) | NEW | SPCS | SPACES |
| APPX | APPROXIMATE | EQUIP | EQUIPMENT | NIC | NOT IN CONTRACT | SPEC'D | SPECIFIED |
| ARCH | ARCHITECTURE | ETWU | ESTIMATED TOTAL WATER USE | NO | NUMBER | SPECS | SPECIFICATIONS |
| BLDG | BUILDING | (E) | EXISTING | NTS | NOT TO SCALE | SQ | SQUARE |
| BS | BOTTOM OF STAIRS | FFE | FINISH FLOOR ELEVATION | OC | ON CENTER | SF | SQUARE FEET |
| CALDAG | CALIFORNIA DISABLED ACCESSIBILITY GUIDEBOOK | FG | FINISH GRADE | PA | PLANTING AREA | SS | STAINLESS STEEL |
| CB | CATCH BASIN | FOB | FACE OF BUILDING | PERF | PERFORATED | STD | STANDARD |
| CBC | CALIFORNIA BUILDING CODE | FOC | FACE OF CURB | PIP | POURED-IN-PLACE | STL | STEEL |
| CJ | CONTROL JOINT | FT | FOOT/FEET | PL | PROPERTY LINE | STPA | STORMWATER TREATMENT PLANTING AREA |
| CL | CENTERLINE | GAL | GALLON | POC | POINT OF CONNECTION | TBD | TO BE DETERMINED |
| CLF | CHAIN LINK FENCE | GALV | GALVANIZED | PROP | PROPOSED | TC | TOP OF CURB |
| CLR | CLEAR | GB | GRADE BREAK | PVC | POLYVINYL-CHLORIDE | TS | TOP OF STAIRS |
| CO | CLEAN OUT | GFRC | GLASS FIBER REINFORCED CONCRETE | QTY | QUANTITY | TW | TOP OF WALL |
| CONC | CONCRETE | GPM | GALLONS PER MINUTE | R | RADIUS | TYP | TYPICAL |
| CONST | CONSTRUCTION | HB | HOSE BIB | RB | ROOTBALL | UBC | UNIFORM BUILDING CODE |
| CONT | CONTINUOUS | HDPE | HIGH DENSITY POLYETHYLENE | REBAR | REINFORCING BAR | UON | UNLESS OTHERWISE NOTED |
| CTR | CENTER | HDR | HEADER | REC | RECOMMENDATION | V.I.F | VERIFY IN FIELD |
| DG | DECOMPOSED GRANITE | HT | HEIGHT | REQ'D | REQUIRED | VERT | VERTICAL |
| DI | DRAIN INLET | IRR | IRRIGATION | SAD | SEE ARCHITECTURAL DRAWINGS | WUCOLS | WATER USE CLASSIFICATION OF LANDSCAPE SPECIES |
| DIA | DIAMETER | MAWA | MAXIMUM APPLIED WATER ALLOWANCE | SED | SEE ELECTRICAL DRAWINGS | W/ | WITH |
| | | | | SPD | SEE PLUMBING DRAWINGS | @ | AT |
| | | | | SSD | SEE STRUCTURAL DRAWINGS | | |

## SHEET LIST


L-000 COVER SHEET
L-001 TREE DISPOSITION PLAN
L-002 TREE DISPOSITION PLAN - AREA B & C
L-003 TREE INVENTORY AND PROTECTION RECOMMENDATIONS 2
L-004 TREE INVENTORY AND PROTECTION RECOMMENDATIONS
L-005 SURFACE PARKING SHADING PLAN
L-006 HARDSCAPE SHADING PLAN
L-007 LANDSCAPE SHADING PLAN
L-100 ANNOTATED LANDSCAPE PLAN
L-101 ANNOTATED LANDSCAPE PLAN - PLAN AREA B & C
L-102 FURNISHINGS AND MATERIALS
L-200 PLANTING SCHEDULE AND NOTES
L-201 PLANTING PLAN
L-202 PLANTING PLAN - PLAN AREA B & C
L-203 PLANTING PALETTE



TAYLOR design

DESIGN PROFESSIONAL STAMP

CONSULTANT

rhaa
Landscape Architecture & Planning
225 Miller Avenue, Mill Valley, CA 94941
T 415 383 7900 rhaa.com


AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/06/2024 |
| 2 | BACKCHECK #02 | 02/06/2025 |

PROJECT INFORMATION

# STANFORD HEALTH CARE TRI-VALLEY
## East Wing Hospital Addition

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2022514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

## COVER SHEET

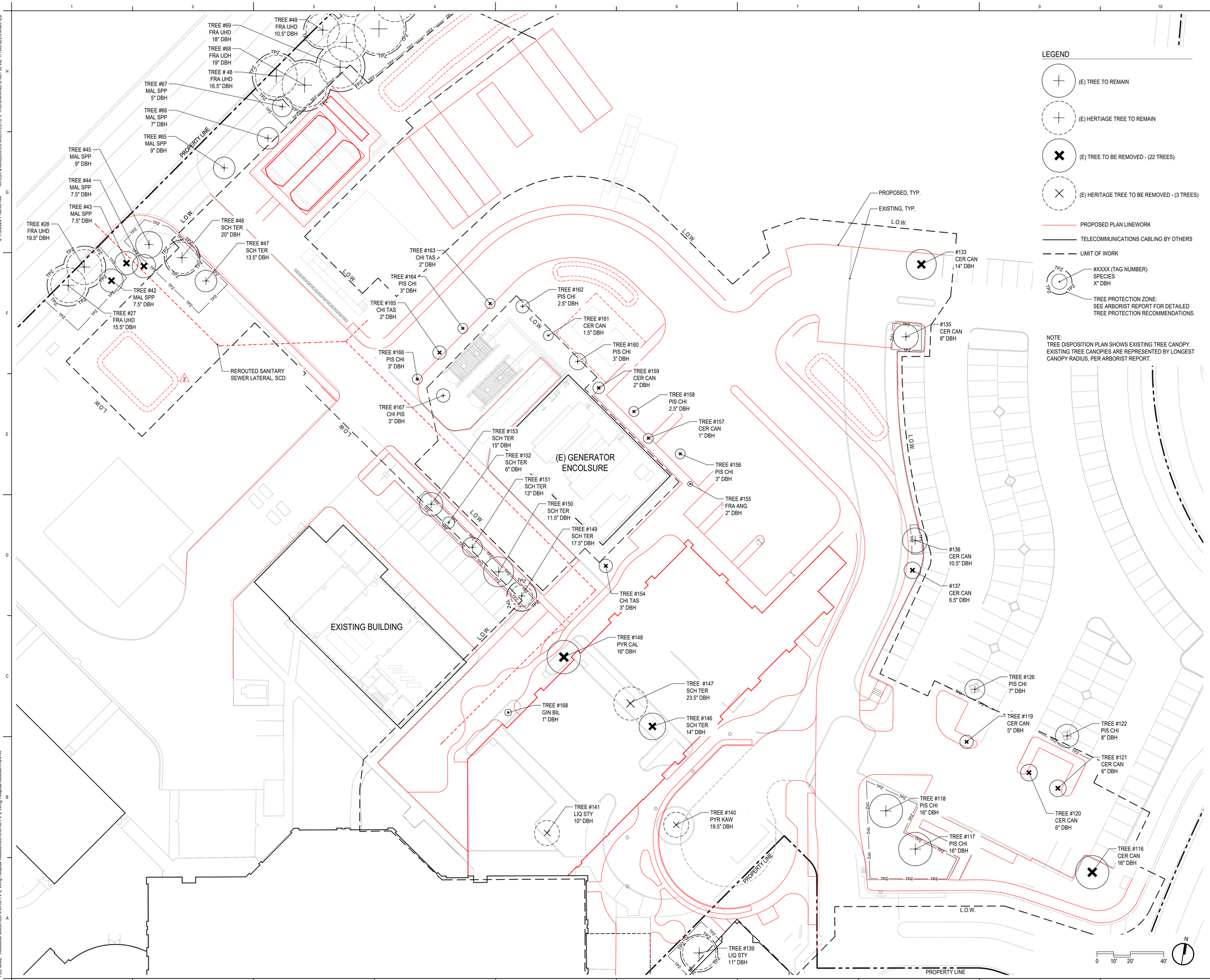
SHEET NUMBER — SCALE:

# L-000

PACKAGE ISSUANCE: DESIGN REVIEW SUBMITTAL

FILE NAME: Autodesk Docs://6370-SHC-TV E Wing Hospital Addition/6370-SHC-TV E Wing Hospital Addition-R24.rvt

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## LEGEND

- (E) TREE TO REMAIN
- (E) HERTIAGE TREE TO REMAIN
- (E) TREE TO BE REMOVED - (22 TREES)
- (E) HERITAGE TREE TO BE REMOVED - (3 TREES)
- PROPOSED PLAN LINEWORK
- TELECOMMUNICATIONS CABLING BY OTHERS
- LIMIT OF WORK
- #XXXX (TAG NUMBER)
  SPECIES
  X" DBH
- TREE PROTECTION ZONE:
  SEE ARBORIST REPORT FOR DETAILED
  TREE PROTECTION RECOMMENDATIONS.

NOTE:
TREE DISPOSITION PLAN SHOWS EXISTING TREE CANOPY. EXISTING TREE CANOPIES ARE REPRESENTED BY LONGEST CANOPY RADIUS, PER ARBORIST REPORT.

**TAYLOR design**

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**CONSULTANT**

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**AGENCY APPROVAL**

**REVISION SCHEDULE**

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/06/2024 |
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| ARCHITECT PROJECT NO: | 6370.101 |

**SHEET TITLE** ISSUE DATE: 08/23/2024

## TREE DISPOSITION PLAN

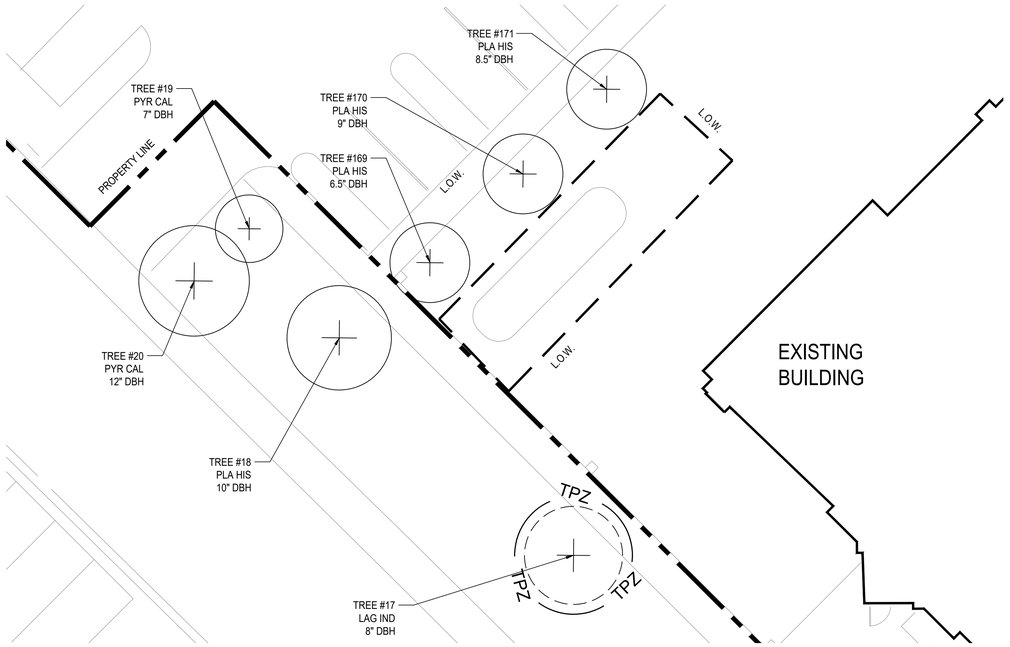
**SHEET NUMBER** SCALE:

# L-001

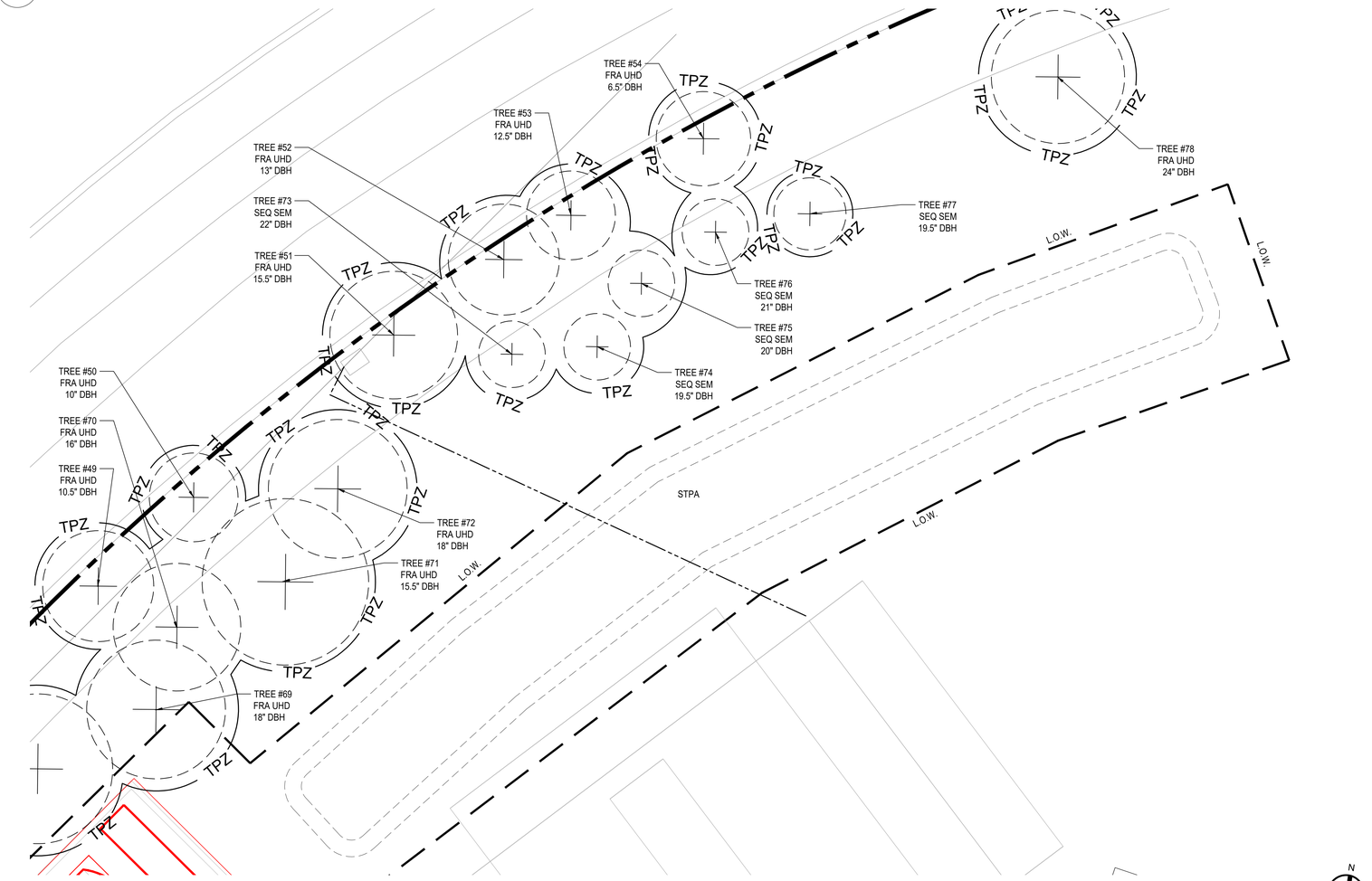
FILE NAME: Autodesk Docs://6370-SHC-TV E Wing Hospital Addition/6370-SHC-TV E Wing Hospital Addition-R24.rvt

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1 PLAN AREA B




2 PLAN AREA C

## LEGEND

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- (E) HERTIAGE TREE TO REMAIN
- (E) TREE TO BE REMOVED - (22 TREES)
- (E) HERITAGE TREE TO BE REMOVED - (3 TREES)
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  SPECIES
  X" DBH
- TREE PROTECTION ZONE:
  SEE ARBORIST REPORT FOR DETAILED
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AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/06/2024 |

PROJECT INFORMATION

**STANFORD HEALTH CARE TRI-VALLEY**
**East Wing Hospital Addition**

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| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

## TREE DISPOSITION PLAN - PLAN AREA B & C

SHEET NUMBER — SCALE:

# L-002

PACKAGE ISSUANCE: DESIGN REVIEW SUBMITTAL

FILE NAME: Autodesk Docs://6370-SHC-TV E Wing Hospital Addition/6370-SHC-TV E Wing Hospital Addition-R24.rvt

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March 14, 2025
Torrey Young
Dryad, LLC
Addendum: 24014-40021 Stanford Health Care- Tri-Valley (East Wing Addition)
Purchase order no.: 1000052827
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| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins) | Hgt. (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Comments | Appraisal value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem1 (DBH) | Stem1 (cir.) | Stem2 (DBH) | Stem2 (cir.) | Total (cir.) | | | N | E | S | W | | | | | | |
| **148** | Callery pear | *Pyrus calleryana* | 16.0 | 50.5 | | 0.0 | 50.5 | 16.0 | 30 | 20 | 18 | 20 | 15 | No | No | 4 | Remove | Overpruned (thinned, raised)<br>Poor structure & architecture<br>Severely restricted rooting space<br>Multiple underground utilities in close proximity<br>Foliage of good color & density | |
| 149 | Brazilian pepper | *Schinus terebinthifolia* | 17.5 | 55.0 | | 0.0 | 55.0 | 17.5 | 13 | 12 | 13 | 12 | 12 | Yes | No | 1 | Retain | Severely pruned (topped, raised)<br>Poor structure & architecture<br>Restricted rooting space<br>Foliage of good color & density | $2,600 |
| **150** | Brazilian pepper | *Schinus terebinthifolia* | 11.5 | 36.0 | | 0.0 | 36.0 | 11.5 | 19 | 12 | 18 | 13 | 12 | No | No | 1 | Retain | 10° lean<br>Severely pruned (topped, raised)<br>Poor structure & architecture<br>Restricted rooting space<br>Foliage of good color & density | **$2,500** |
| **151** | Brazilian pepper | *Schinus terebinthifolia* | 13.0 | 41.0 | | 0.0 | 41.0 | 13.0 | 21 | 12 | 11 | 12 | 12 | No | No | 1 | Retain | Severely pruned (topped, raised)<br>Poor structure & architecture<br>Restricted rooting space<br>Foliage of good color & density | **$2,700** |



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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem1 (DBH) | Stem1 (cir.) | Stem2 (DBH) | Stem2 (cir.) | Total (cir.) | | | N | E | S | W | | | | | | |
| **74** | Coast redwood | *Sequoia sempervirens* | 19.5 | 61.5 | | 0.0 | 61.5 | 19.5 | 42 | 10 | 10 | 11 | 12 | Yes | No | 1 | Retain | Overpruned (raised)<br>Foliage of good color & density<br>Outside of construction zone & unlikely to be affected by construction | **$7,900** |
| **75** | Coast redwood | *Sequoia sempervirens* | 20.0 | 63.0 | | 0.0 | 63.0 | 20.0 | 43 | 10 | 12 | 6 | 10 | Yes | No | 1 | Retain | Overpruned (raised)<br>Foliage of good color & density<br>Outside of construction zone & unlikely to be affected by construction | **$8,200** |
| **76** | Coast redwood | *Sequoia sempervirens* | 21.0 | 66.0 | | 0.0 | 66.0 | 21.0 | 40 | 12 | 11 | 12 | 10 | Yes | No | 1 | Retain | Overpruned (raised)<br>Foliage of good color & density<br>Outside of construction zone & unlikely to be affected by construction | **$8,800** |
| **77** | Coast redwood | *Sequoia sempervirens* | 19.5 | 61.5 | | 0.0 | 61.5 | 19.5 | 40 | 13 | 13 | 13 | 13 | Yes | No | 1 | Retain | Overpruned (raised)<br>Foliage of good color & density<br>& unlikely to be affected by construction | **$7,900** |
| **78** | Evergreen ash | *Fraxinus uhdeii* | 24.0 | 75.5 | | 0.0 | 75.5 | 24.0 | 51 | 16 | 24 | 33 | 25 | Yes | No | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Foliage of good color & density | **$8,000** |
| **116** | Eastern redbud | *Cercis canadensis* | 11.0 | 34.5 | | 0.0 | 34.5 | 11.0 | 21 | 20 | 16 | 12 | 10 | No | No | 2 | Remove | 15° lean<br>Significant tip & branch dieback<br>Thin, declining canopy<br>Major surface rooting in turf | **$0** |
| **117** | Chinese pistache | *Pistachia chinensis* | 5.5 | 17.5 | | 0.0 | 17.5 | 5.5 | 21 | 20 | 16 | 12 | 10 | No | No | 1 | Retain | Foliage of good color & density<br>Poor trunk taper | N/A |
| **118** | Chinese pistache | *Pistachia chinensis* | 8.0 | 25.0 | | 0.0 | 25.0 | 8.0 | 21 | 20 | 16 | 12 | 10 | No | No | 1 | Retain | Foliage of good color & density | **$3,200** |



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**TREE INVENTORY, DATA, EVALUATIONS AND PROTECTION RECOMMENDATIONS:**
Other than the added appraisal values (49, bolded) a few added comments to support appraisal values, all information in this table was gleaned from my previous report[2].

| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins) | Hgt. (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Comments | Appraisal value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem1 (DBH) | Stem1 (cir.) | Stem2 (DBH) | Stem2 (cir.) | Total (cir.) | | | N | E | S | W | | | | | | |
| 17 | Crepe myrtle | *Lagerstroemia indica* | 8.0 | 25.0 | | 0.0 | 25.0 | 8.0 | 38 | 15 | 5 | 15 | 16 | Yes | No | 1 | Retain | Overpruned (raising & thinning)<br>Canopy of good color & density | $3,000 |
| **18** | London plane | *Platanus x hispanica* | 10.0 | 31.5 | | 0.0 | 31.5 | 10.0 | 30 | 12 | 16 | 17 | 10 | No | No | 1 | Retain | Overpruned (raising & thinning)<br>Canopy of good color & density | **$3,500** |
| 27 | Evergreen ash | *Fraxinus uhdeii* | 15.5 | 48.5 | | 0.0 | 48.5 | 15.5 | 40 | 3 | 14 | 21 | 20 | Yes | No | 1 | Retain | Overpruned (raising & thinning)<br>Poor structure & architecture<br>Canopy of good color<br>Limited rooting space (conflicts inevitable) | $2,400 |
| 28 | Evergreen ash | *Fraxinus uhdeii* | 19.5 | 61.5 | | 0.0 | 61.5 | 19.5 | 43 | 21 | 21 | 21 | 20 | Yes | Yes | 1 | Retain | Poor structure & architecture<br>Canopy of good color | $2,700 |
| **42** | Crabapple | *Malus* sp. | 7.5 | 23.5 | | 0.0 | 23.5 | 7.5 | 13 | 10 | 13 | 14 | 10 | No | No | 4 | Remove | Crowded, overgrown by adjacent trees<br>Poor structure<br>Foliage of good color & density | **$2,600** |
| **43** | Crabapple | *Malus* sp. | 7.0 | 22.0 | | 0.0 | 22.0 | 7.0 | 15 | 15 | 6 | 7 | 7 | No | No | 4 | Remove | 15° lean<br>Poor structure & architecture<br>Foliage of good color & density | **$2,500** |
| **44** | Crabapple | *Malus* sp. | 7.5 | 23.5 | | 0.0 | 23.5 | 7.5 | 12 | 12 | 14 | 13 | 6 | No | No | 4 | Remove | Sound structure & architecture<br>Foliage of good color & density | **$2,800** |
| **45** | Crabapple | *Malus* sp. | 9.0 | 28.5 | | 0.0 | 28.5 | 9.0 | 13 | 16 | 5 | 5 | 11 | No | No | 1 | Retain | Sound structure & architecture<br>Foliage of good color & density | **$3,200** |



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Page 10 of 12

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem1 (DBH) | Stem1 (cir.) | Stem2 (DBH) | Stem2 (cir.) | Total (cir.) | | | N | E | S | W | | | | | | |
| **152** | Brazilian pepper | *Schinus terebinthifolia* | 6.0 | 19.0 | | 0.0 | 19.0 | 6.0 | 11 | 5 | 7 | 7 | 7 | No | No | 1 | Retain | 10° lean<br>Severely pruned (topped, raised)<br>Poor structure & architecture<br>Poor trunk taper<br>Restricted rooting space<br>Foliage of good color & density | **$2,200** |
| **153** | Brazilian pepper | *Schinus terebinthifolia* | 15.0 | 47.0 | | 0.0 | 47.0 | 15.0 | 20 | 11 | 14 | 7 | 9 | No | No | 1 | Retain | 10° lean<br>Severely pruned (topped, raised)<br>Poor structure & architecture<br>Restricted rooting space<br>Foliage of good color & density | **$2,800** |
| 154 | Chinese pistache | *Pistachia chinensis* | 3.0 | 9.5 | | 0.0 | 9.5 | 3.0 | 17 | 5 | 5 | 8 | 4 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A |
| 155 | Raywood ash | *Fraxinus angustifolia 'Raywood'* | 2.0 | 6.5 | | 0.0 | 6.5 | 2.0 | 14 | 2 | 3 | 3 | 3 | No | No | 3 | Remove | Dead | N/A |
| 156 | Chinese pistache | *Pistachia chinensis* | 3.0 | 9.5 | | 0.0 | 9.5 | 3.0 | 16 | 5 | 6 | 5 | 5 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A |
| 157 | Eastern redbud | *Cercis canadensis* | 1.0 | 3.0 | | 0.0 | 3.0 | 1.0 | 14 | 5 | 6 | 6 | 4 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A |
| 158 | Chinese pistache | *Pistachia chinensis* | 2.5 | 8.0 | | 0.0 | 8.0 | 2.5 | 16 | 7 | 5 | 6 | 3 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A |
| 159 | Eastern redbud | *Cercis canadensis* | 2.0 | 6.5 | | 0.0 | 6.5 | 2.0 | 14 | 7 | 6 | 6 | 6 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A |
| 160 | Chinese pistache | *Pistachia chinensis* | 3.0 | 9.5 | | 0.0 | 9.5 | 3.0 | 16 | 4 | 7 | 10 | 8 | No | No | 1 | Retain | Foliage of good color & density | N/A |



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| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins) | Hgt. (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Comments | Appraisal value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem1 (DBH) | Stem1 (cir.) | Stem2 (DBH) | Stem2 (cir.) | Total (cir.) | | | N | E | S | W | | | | | | |
| **120** | Eastern redbud | *Cercis canadensis* | 6.0 | 19.0 | | 0.0 | 19.0 | 6.0 | 19 | 8 | 10 | 10 | 10 | No | No | 1 | Remove | Poor trunk taper<br>Foliage of good color & density<br>Restricted rooting area | **$2,200** |
| **121** | Eastern redbud | *Cercis canadensis* | 6.0 | 19.0 | | 0.0 | 19.0 | 6.0 | 19 | 10 | 10 | 8 | 10 | No | No | 1 | Remove | Poor trunk taper<br>Foliage of good color & density<br>Restricted rooting area | **$2,200** |
| **122** | Chinese pistache | *Pistachia chinensis* | 8.0 | 25.0 | | 0.0 | 25.0 | 8.0 | 24 | 10 | 13 | 14 | 11 | No | No | 1 | Retain | Foliage of good color & density<br>Restricted rooting area | **$2,300** |
| **126** | Chinese pistache | *Pistachia chinensis* | 7.0 | 22.0 | | 0.0 | 22.0 | 7.0 | 17 | 10 | 12 | 10 | 8 | No | No | 1 | Retain | Foliage of good color & density<br>Restricted rooting area | **$2,800** |
| **133** | Eastern redbud | *Cercis canadensis* | 14.0 | 44.0 | | 0.0 | 44.0 | 14.0 | 22 | 16 | 16 | 18 | 16 | No | No | 1 | Remove | Some tip dieback<br>Foliage of good color & density | **$5,000** |
| **135** | Eastern redbud | *Cercis canadensis* | 8.0 | 25.0 | | 0.0 | 25.0 | 8.0 | 22 | 11 | 15 | 6 | 6 | No | No | 1 | Retain | 10° lean<br>Poor structure & architecture<br>String trimmer damage to root crown<br>Foliage of good color & density | **$2,800** |
| **136** | Eastern redbud | *Cercis canadensis* | 10.5 | 33.0 | | 0.0 | 33.0 | 10.5 | 23 | 10 | 15 | 8 | 13 | No | No | 1 | Retain | Some tip & branch dieback<br>Poor structure<br>Foliage of good color & density | **$3,100** |
| **137** | Eastern redbud | *Cercis canadensis* | 6.5 | 20.5 | | 0.0 | 20.5 | 6.5 | 16 | 6 | 10 | 8 | 6 | No | No | 3 | Remove | Very poor structure & architecture<br>Exposed column of trunk decay<br>Root crown decayed | **$0** |
| 139 | Sweetgum | *Liquidambar styraciflua* | 11.0 | 34.5 | | 0.0 | 34.5 | 11.0 | 54 | 15 | 6 | 10 | 20 | Yes | No | 2 | Retain | Overpruned (raised & thinned)<br>Poor architecture<br>Poor trunk taper<br>Foliage of good color & density | $3,100 |



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| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins) | Hgt. (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Comments | Appraisal value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem1 (DBH) | Stem1 (cir.) | Stem2 (DBH) | Stem2 (cir.) | Total (cir.) | | | N | E | S | W | | | | | | |
| 46 | Brazilian pepper | *Schinus terebinthifolia* | 20.0 | 63.0 | | 0.0 | 63.0 | 20.0 | 27 | 19 | 18 | 14 | 13 | Yes | No | 1 | Retain | Sound structure & architecture<br>Foliage of good color & density | $8,000 |
| **47** | Brazilian pepper | *Schinus terebinthifolia* | 13.5 | 42.5 | | 0.0 | 42.5 | 13.5 | 21 | 13 | 10 | 12 | 8 | No | No | 1 | Retain | Minor structural weaknesses, good architecture<br>Foliage of good color & density | **$4,600** |
| 48 | Evergreen ash | *Fraxinus uhdeii* | 16.5 | 52.0 | | 0.0 | 52.0 | 16.5 | 46 | 24 | 5 | 25 | 24 | Yes | No | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Root crown issues at graft<br>Foliage of good color & density<br>+S12 | $2,500 |
| 53 | Evergreen ash | *Fraxinus uhdeii* | 12.5 | 39.5 | | 0.0 | 39.5 | 12.5 | 40 | 16 | 11 | 10 | 16 | Yes | Yes | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Root crown issues at graft<br>Foliage of good color & density<br>Limited rooting space (conflicts inevitable) | $2,300 |
| **65** | Crabapple | *Malus* sp. | 9.0 | 28.5 | | 0.0 | 28.5 | 9.0 | 15 | 11 | 9 | 7 | 13 | No | No | 1 | Retain | Weak structure<br>Foliage of good color & density | **$2,600** |
| **66** | Crabapple | *Malus* sp. | 7.0 | 22.0 | | 0.0 | 22.0 | 7.0 | 11 | 13 | 9 | 10 | 10 | No | No | 1 | Retain | Overpruned<br>Poor structure & architecture<br>Foliage of good color & density | **$2,500** |
| 67 | Crabapple | *Malus* sp. | 5.0 | 15.5 | | 0.0 | 15.5 | 5.0 | 10 | 3 | 6 | 9 | 12 | No | No | 1 | Retain | Overpruned<br>15° lean<br>Poor structure & architecture<br>Foliage of good color & density | N/A |



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| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins) | Hgt. (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Comments | Appraisal value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem1 (DBH) | Stem1 (cir.) | Stem2 (DBH) | Stem2 (cir.) | Total (cir.) | | | N | E | S | W | | | | | | |
| | | | | | | | | | | | | | | | | | | Good structure & architecture | |
| 161 | Eastern redbud | *Cercis canadensis* | 1.5 | 4.5 | | 0.0 | 4.5 | 1.5 | 14 | 5 | 5 | 5 | 6 | No | No | 1 | Retain | Foliage of good color & density<br>Good structure & architecture | N/A |
| 162 | Chinese pistache | *Pistachia chinensis* | 2.5 | 8.0 | | 0.0 | 8.0 | 2.5 | 17 | 8 | 6 | 5 | 5 | No | No | 1 | Retain | Foliage of good color & density<br>Good structure & architecture | N/A |
| 163 | Chitalpa | *Chitalpa tashkentensis* | 2.0 | 6.5 | | 0.0 | 6.5 | 2.0 | 12 | 3 | 6 | 3 | 5 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A |
| 164 | Chinese pistache | *Pistachia chinensis* | 3.0 | 9.5 | | 0.0 | 9.5 | 3.0 | 17 | 6 | 5 | 5 | 3 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A |
| 165 | Chitalpa | *Chitalpa tashkentensis* | 2.0 | 6.5 | | 0.0 | 6.5 | 2.0 | 15 | 4 | 5 | 8 | 7 | No | No | 1 | Remove | Foliage of good color but thin canopy<br>Good structure & architecture | N/A |
| 166 | Chinese pistache | *Pistachia chinensis* | 3.0 | 9.5 | | 0.0 | 9.5 | 3.0 | 16 | 5 | 3 | 6 | 6 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A |
| **169** | London plane | *Platanus x hispanica* | 6.5 | 20.5 | | 0.0 | 20.5 | 6.5 | 26 | 11 | 10 | 10 | 7 | No | No | 1 | Retain | Foliage of good color & density<br>Good structure & architecture | **$2,600** |
| **170** | London plane | *Platanus x hispanica* | 9.0 | 28.5 | | 0.0 | 28.5 | 9.0 | 27 | 12 | 6 | 8 | 12 | No | No | 1 | Retain | 15° lean to N<br>Foliage of good color & density<br>Good structure & architecture | **$3,100** |
| **171** | London plane | *Platanus x hispanica* | 8.5 | 26.5 | | 0.0 | 26.5 | 8.5 | 32 | 9 | 14 | 12 | 12 | No | No | 1 | Retain | Foliage of good color & density<br>Good structure & architecture | **$2,900** |



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| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins) | Hgt. (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Comments | Appraisal value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem1 (DBH) | Stem1 (cir.) | Stem2 (DBH) | Stem2 (cir.) | Total (cir.) | | | N | E | S | W | | | | | | |
| 140 | Chinese evergreen pear | *Pyrus kawakamii* | 11.0 | 34.5 | 8.5 | 26.5 | 61.0 | 19.5 | 24 | 13 | 15 | 15 | 15 | Yes | No | 4 | Remove | Multiple codominant stems<br>Leaf spot infection (minor)<br>Some tip dieback<br>Canopy of good color and density (3 stems, 7.5-11" DBH) | $5,700 |
| 141 | Sweetgum | *Liquidambar styraciflua* | 10.0 | 31.5 | | 0.0 | 31.5 | 10.0 | 41 | 12 | 12 | 15 | 13 | Yes | No | 4 | Remove | Overpruned (raised & thinned)<br>Poor architecture<br>Surrounded with compacted soil, excess over root crown<br>Foliage of good color & density | $2,500 |
| 146 | Brazilian pepper | *Schinus terebinthifolia* | 14.0 | 44.0 | | 0.0 | 44.0 | 14.0 | 18 | 16 | 10 | 15 | 6 | No | No | 2 | Remove | Overpruned (thinned, raised)<br>Poor structure & architecture<br>Restricted rooting space | $0 |
| 147 | Brazilian pepper | *Schinus terebinthifolia* | 23.5 | 74.0 | | 0.0 | 74.0 | 23.5 | 36 | 20 | 17 | 20 | 17 | Yes | No | 4 | Remove | 15° lean<br>Overpruned (thinned, raised)<br>Poor structure & architecture<br>Thin, declining+S158 canopy<br>Restricted rooting space | $2,900 |



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Purchase order no.: 1000052827
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| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins) | Hgt. (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Comments | Appraisal value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem1 (DBH) | Stem1 (cir.) | Stem2 (DBH) | Stem2 (cir.) | Total (cir.) | | | N | E | S | W | | | | | | |
| 68 | Evergreen ash | *Fraxinus uhdeii* | 19.0 | 59.5 | | 0.0 | 59.5 | 19.0 | 58 | 23 | 27 | 24 | 17 | Yes | No | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Foliage of good color & density | $5,400 |
| 69 | Evergreen ash | *Fraxinus uhdeii* | 18.0 | 56.5 | | 0.0 | 56.5 | 18.0 | 58 | 9 | 25 | 24 | 22 | Yes | No | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Foliage of good color & density | $5,100 |
| 70 | Evergreen ash | *Fraxinus uhdeii* | 16.0 | 50.5 | | 0.0 | 50.5 | 16.0 | 60 | 19 | 19 | 11 | 23 | Yes | No | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Foliage of good color & density | $4,400 |
| **71** | Evergreen ash | *Fraxinus uhdeii* | 15.5 | 48.5 | | 0.0 | 48.5 | 15.5 | 45 | 10 | 30 | 15 | 21 | Yes | No | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Foliage of good color & density<br>Outside of construction zone & unlikely to be affected by construction | **$4,300** |
| **72** | Evergreen ash | *Fraxinus uhdeii* | 18.0 | 56.5 | | 0.0 | 56.5 | 18.0 | 46 | 19 | 25 | 20 | 23 | Yes | No | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Foliage of good color & density<br>Outside of construction zone & unlikely to be affected by construction | **$5,100** |
| 73 | Coast redwood | *Sequoia sempervirens* | 22.0 | 69.0 | | 0.0 | 69.0 | 22.0 | 48 | 10 | 12 | 12 | 11 | Yes | No | 1 | Retain | Overpruned (raised)<br>Foliage of good color & density<br>Outside of construction zone & unlikely to be affected by construction | **$9,500** |



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**AGENCY APPROVAL**

**REVISION SCHEDULE**

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/06/2024 |
| 2 | BACKCHECK #02 | 02/06/2025 |
| 3 | BACKCHECK #03 | 03/19/2025 |

**PROJECT INFORMATION**

**STANFORD HEALTH CARE TRI-VALLEY**
**East Wing Hospital Addition**

FACILITY NAME: STANFORD HEALTH CARE - TRI-VALLEY
FACILITY ADDRESS: 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588
OWNER PROJECT NUMBER: 2022514
AUTHORITY HAVING JURISDICTION: CITY OF PLEASANTON
AGENCY FACILITY NUMBER: 16632
AGENCY BUILDING NUMBER: TBD
AGENCY PROJECT NUMBER: TBD
ARCHITECT PROJECT NO: 6370.101

**SHEET TITLE** ISSUE DATE: 08/23/2024

**TREE INVENTORY AND PROTECTION RECOMMENDATIONS**

**SHEET NUMBER** SCALE:

**L-003**

**PACKAGE ISSUANCE: DESIGN REVIEW SUBMITTAL**

FILE NAME: Autodesk Docs://6370-SHC-TV E Wing Hospital Addition/6370-SHC-TV E Wing Hospital Addition-R24.rvt

© 7/5/2024 7:58:05 AM TAYLOR & ASSOCIATES ARCHITECTS. IF THIS DRAWING IS NOT 30"x42" IT HAS BEEN MODIFIED



2. Trees nos. 17, 18, 27, 28, 45-48, 65-78, 117, 118, 122, 126, 135, 136, 139 & 149-153, 169-171:
   A. Install protective fencing as required by the City of Pleasanton[1] and described and/or modified in this document.
   B. Adjacent trees can be grouped within continuous fencing (as described).
3. Trees nos.: 27, 28, 45-47, 68, 69, 117, 118, 135 & 136:
   A. Perform pre-trenching (selected trees) and root pruning as described (refer to TPG).
   B. Perform root pruning as described in this document, cutting cleanly and keeping severed or exposed roots covered and moist (refer to TPG).

✦ ✦ ✦

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   ii. For any trees root-pruned, maintain the soil moisture at near field capacity within the dripline areas or beyond, throughout construction (avoid saturation).
   iii. Continue irrigation to maintain soil moisture (as above) throughout the duration of construction, but adjust to account for rainfall.

B. Root pruning (for excavation):
   i. Pre-trench and root prune as described in the TPG.
   ii. As it is not possible to determine from which trees the roots originate, handle all encountered roots by following the TPG as closely as possible.
   iii. Limited, miscellaneous excavation (outside of the primary trench):
      a. When roots are encountered over 1" in diameter, prune cleanly and cover with an absorbent material and keep the material and adjacent soil moist until backfilled (refer to TPG).

C. Tree pruning:
   i. Avoid pruning that removes green foliage or live wood immediately before, during, or within 2-3 years after construction.
   ii. Prune to remove large deadwood only, or the minimum required for clearance purposes, in accordance with current pruning standards[2].
   iii. Achieve all pruning goals by removing the least amount of live tissue as possible,
   iv. All pruning must be performed by certified tree personnel and supervised by an ISA Certified Arborist.
   v. All pruning work must be performed as per current industry standards[2].

D. Install protective fencing, surrounding each/all trees to be retained, as described below and in the TPG.
   i. Fencing shall be 6' chain-link with posts embedded directly into the soil. Portable, concrete footings may be substituted where fencing conflicts with hardscape to remain.
   ii. Trees with overlapping canopies can be grouped for fencing purposes (refer to plan Sheet L-001).

E. Mulch: Install organic mulch to a settled depth of 4-6 inches within the protective fencing and throughout the dripline areas surrounding all trees to be retained wherever excavation will not occur. Mulching is not necessary where existing turf is to remain intact, and can later be removed to complete landscape installation, i.e., avoid leaving soil bare.

F. Tree Protection Zone (TPZ; fenced area)[3]:
   i. Tree protective fencing should be installed as described in the data table, diagrammed on Sheet L-001, or otherwise, as far from tree trunks as possible up to 1.5 times the longest canopy radius, or 1 ft. per 12" of trunk diameter (DBH).
   ii. Do not allow vehicles, equipment, pedestrian traffic, building materials, debris storage, or disposal of phytotoxic materials inside of the fenced-off areas (TPZ).

G. Landscape installation: Applicable to landscape work within the TPZ of any tree to be retained.
   i. Remove existing turf, plantlife and landscape components (irrigation, etc.) via hand only.
   ii. Do not rototill or otherwise cultivate soil surface.
   iii. Planting plants smaller than 5-gal size is preferred.
   iv. Excavate for planting and irrigation only by hand.
   v. When roots >1" in diameter are encountered, sever cleanly at the edge of the excavation and keep severed roots moist until backfilled.
   vi. Do not raise soil grade.
   vii. Do not excavate, or otherwise damage tree root crowns within 12" or more of tree trunks.

[2] **Current industry standards:** The most current and applicable publications of 1) Best *Management Practices,* International Society of Arboriculture; 2) American National Standards Institute, A300 and Z133 (all parts).
- 2024: American National Standards Institute, A300 and Z133 (all parts).
- 2024: American National Standards Institute, A300-2023 Tree Care Standards (all parts).
- American National Standards Institute, A300-2023 Tree Care Standards, Part 9, *Management of Trees and Shrubs during Site Development and Construction* (2017).

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**TREE PROTECTION REQUIREMENTS OF THE CITY OF PLEASANTON:** The protection measures described in this report are in some cases, lesser or more than the requirements of the City of Pleasanton[1]. Construction plans require encroachment into the dripline areas of some of the subject trees. The tree-protection measures described in this report support an effort to retain as many trees as possible, as requested by the client, within the limitations of required construction. Further, the client may choose not to remove all trees as recommended, or modify construction plans to preserve additional trees.

Excerpted from the City of Pleasanton Municipal Code, Title 17 Planning and Related Matters, Chapter 17.16 Tree Preservation (Revised: July, 2012):

"17.16.070 Protection of existing trees.
All persons shall comply with the following precautions:
A. Prior to the commencement of construction, install a sturdy fence at the dripline of any tree which will be affected by the construction and prohibit any storage of construction materials or other materials inside the fence. The dripline shall not be altered in any way so as to increase the encroachment of the construction.
B. Prohibit excavation, grading, drainage and leveling within the dripline of the tree unless approved by the director.
C. Prohibit disposal or depositing of oil, gasoline, chemicals or other harmful materials within the dripline or in drainage channels, swales or areas that may lead to the dripline.
D. Prohibit the attachment of wires, signs and ropes to any heritage tree.
E. Design utility services and irrigation lines to be located outside of the dripline when feasible.
F. Retain the services of a certified or consulting arborist for periodic monitoring of the project site and the health of those trees to be preserved. The certified or consulting arborist shall be present whenever activities occur which pose a potential threat to the health of the trees to be preserved.
G. The director shall be notified of any damage that occurs to a tree during construction so that proper treatment may be administered. (Ord. 1737 § 1, 1998)"

**TREE PRESERVATION RECOMMENDATIONS:**
1. I recommend that the guidelines in the most current revisions of the following publications be followed as closely as possible, within the limitations of the requirements of the City of Pleasanton[1].
   A. American National Standards Institute, *Tree, Shrub and Woody Plant Management Standard Practices*, *Management of Trees & Shrubs During Site Planning, Site Development and Construction*, American National Standards Institute (ANSI A300 - Part 5) (most current revision).
   B. Kelby Fite and E. Thomas Smiley, 2008, Best Management Practices, *Managing Trees During Construction*, International Society of Arboriculture (or most current revision).
   C. Matheny, Nelda P.; Clark, James R.; 1998. *Trees and Development*, International Society of Arboriculture.
2. Where excavation, grade changes or other encroachment will occur within the designated Tree Protection Zones (TPZ)[3] of the trees, call for arborist inspection and supervision, and follow the recommendations below and the General Construction Site Tree Preservation Guidelines (TPG; page 17) as closely as possible.

**Trees to be removed:**
1. Remove to grade only, where possible and within the TPZ of trees to be retained.
2. Stump grinding within the dripline area of adjacent trees to be retained should not exceed 4-6" below grade and only include the primary body of the stump (i.e., do not chase surface roots).
3. If surface root removal is required within the dripline areas of trees to be retained, only remove by hand[1].

**Trees to be retained:**
1. All trees to be retained:
   A. Irrigation:
      i. Before implementing root pruning or excavation, irrigate the dripline areas of all trees to be retained to wet the soil to near field capacity to a depth of approximately 18 inches.

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AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/06/2024 |
| 2 | BACKCHECK #02 | 02/06/2025 |

PROJECT INFORMATION

# STANFORD HEALTH CARE TRI-VALLEY
## East Wing Hospital Addition

FACILITY NAME: STANFORD HEALTH CARE - TRI-VALLEY
FACILITY ADDRESS: 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588
OWNER PROJECT NUMBER: 2022514

AUTHORITY HAVING JURISDICTION: CITY OF PLEASANTON
AGENCY FACILITY NUMBER: 16632
AGENCY BUILDING NUMBER: TBD
AGENCY PROJECT NUMBER: TBD

ARCHITECT PROJECT NO: 6370.101

SHEET TITLE — ISSUE DATE: 08/23/2024

2

## TREE INVENTORY AND PROTECTION RECOMMENDATIONS

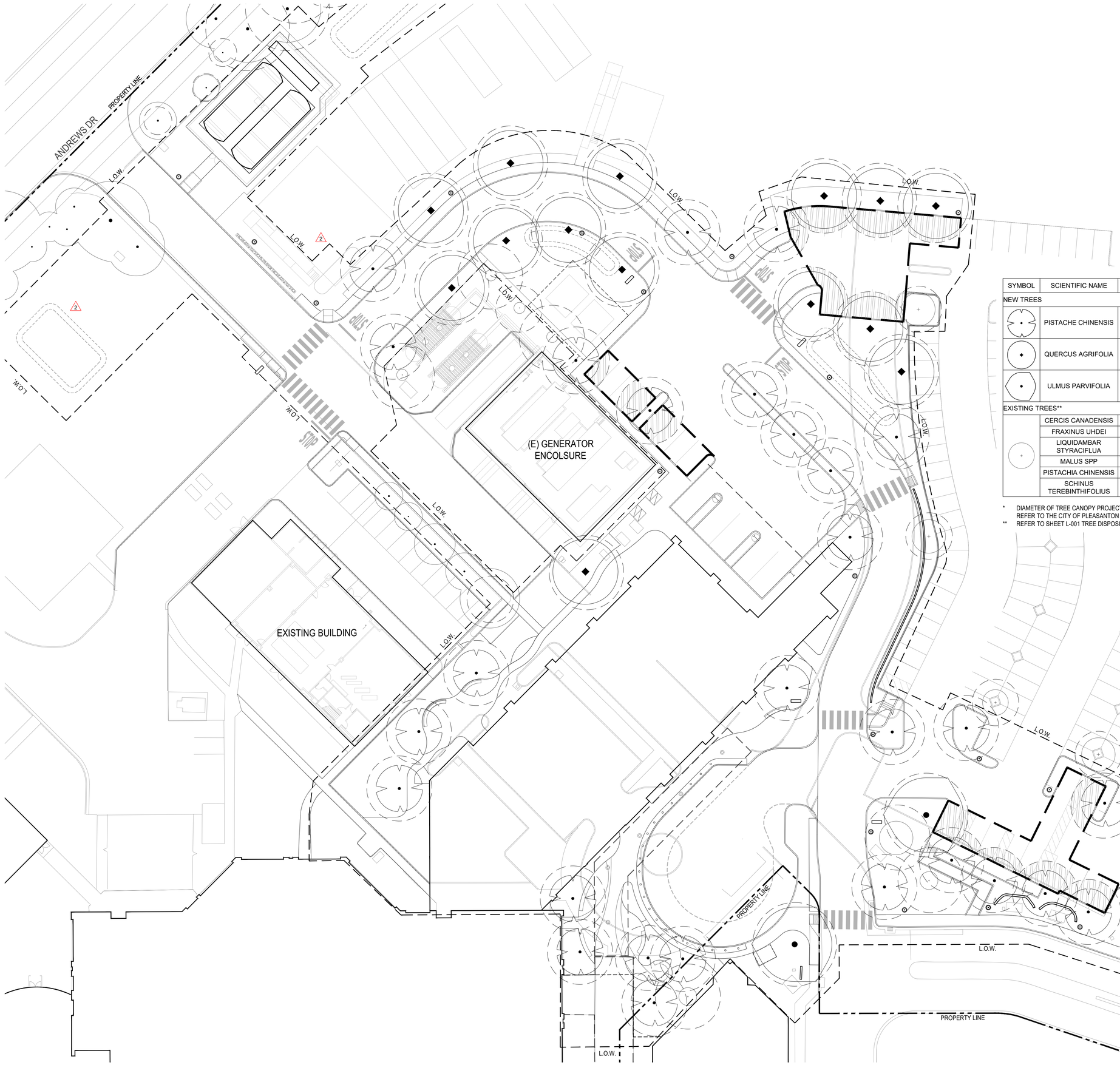
SHEET NUMBER — SCALE:

# L-004

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## TREE SHADING LEGEND

SURFACE PARKING AREA

SHADED PARKING AREA

| SURFACE PARKING CALCULATION TABLE | |
|---|---|
| | TOTAL |
| SURFACE PARKING AREA 1 | 3,666 SF |
| SHADED PARKING AREA | 1,989 SF |
| TOTAL COVERAGE (50% MIN) | 54% |
| 2 | |
| SURFACE PARKING AREA 2 | 1,294 SF |
| SHADED PARKING AREA | 647 SF |
| TOTAL COVERAGE (50% MIN) | 50% |
| | |
| SURFACE PARKING AREA 3 | 2,896 SF |
| SHADED PARKING AREA | 1,444 SF |
| TOTAL COVERAGE (50% MIN) | 50% |

| SYMBOL | SCIENTIFIC NAME | COMMON NAME | PROJECTED CANOPY* | QTY |
|---|---|---|---|---|
| NEW TREES | | | | |
| | PISTACHE CHINENSIS | CHINESE PISTACHE | 35' | 28 |
| | QUERCUS AGRIFOLIA | COAST LIVE OAK | 40' | 14 |
| | ULMUS PARVIFOLIA | CHINESE ELM | 45' | 2 |
| EXISTING TREES** | | | | |
| | CERCIS CANADENSIS | EASTERN REDBUD | 25' | |
| | FRAXINUS UHDEI | EVERGREEN ASH | 45' | |
| | LIQUIDAMBAR STYRACIFLUA | AMERAICAN SWEETGUM | 35' | |
| | MALUS SPP | CRABAPPLE TREE | 15' | |
| | PISTACHIA CHINENSIS | CHINESE PISTACHE | 25' | |
| | SCHINUS TEREBINTHIFOLIUS | BRAZILIAN PEPPER TREE | 25' | |

* DIAMETER OF TREE CANOPY PROJECTED AT 15 YEAR GROWTH. FOR APPROVED CANOPY SIZES REFER TO THE CITY OF PLEASANTON SHADE TREE GUIDELINES.

** REFER TO SHEET L-001 TREE DISPOSITION PLAN FOR EXISTING TREE LOCATION AND TYPE.

TAYLOR design

DESIGN PROFESSIONAL STAMP

CONSULTANT

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| NO. | REVISION NAME | DATE: |
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| 1 | BACKCHECK #01 | 11/06/2024 |
| 2 | BACKCHECK #02 | 02/06/2025 |

PROJECT INFORMATION

# STANFORD HEALTH CARE TRI-VALLEY
## East Wing Hospital Addition

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2022514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

## SURFACE PARKING SHADING PLAN

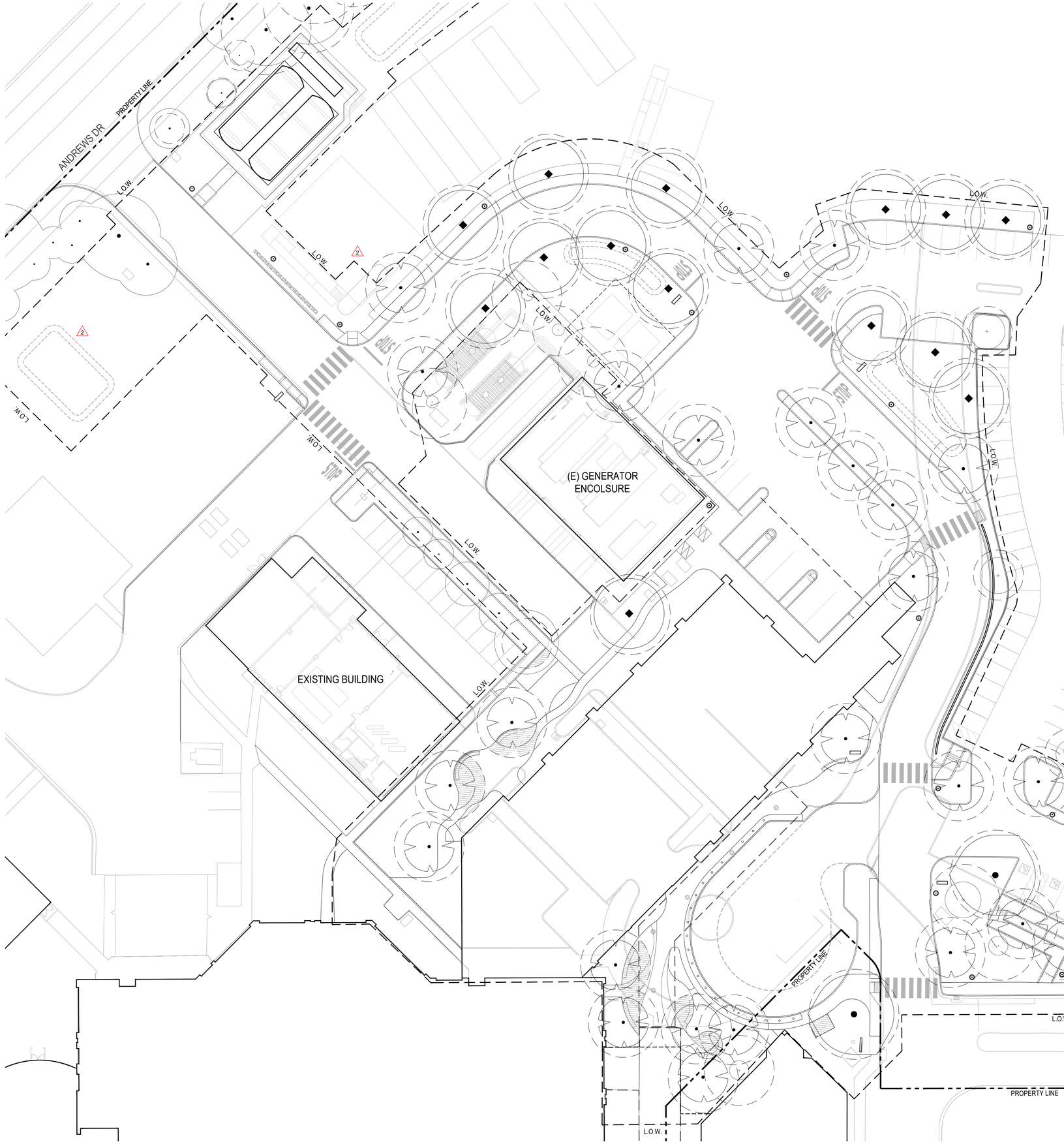
SHEET NUMBER — SCALE:

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## TREE SHADING LEGEND

SHADED HARDSCAPE AREA

| HARDSCAPE CALCULATION TABLE | |
|---|---|
| | TOTAL |
| HARDSCAPE AREA | 2,191 SF |
| SHADED HARDSCAPE AREA | 1,269 SF |
| TOTAL COVERAGE (20% MIN) | 58% |

| SYMBOL | SCIENTIFIC NAME | COMMON NAME | PROJECTED CANOPY* | QTY |
|---|---|---|---|---|
| NEW TREES | | | | |
| | PISTACHE CHINENSIS | CHINESE PISTACHE | 35' | 28 |
| | QUERCUS AGRIFOLIA | COAST LIVE OAK | 40' | 14 |
| | ULMUS PARVIFOLIA | CHINESE ELM | 45' | 2 |
| EXISTING TREES** | | | | |
| | CERCIS CANADENSIS | EASTERN REDBUD | 25' | |
| | FRAXINUS UHDEI | EVERGREEN ASH | 45' | |
| | LIQUIDAMBAR STYRACIFLUA | AMERAICAN SWEETGUM | 35' | |
| | MALUS SPP | CRABAPPLE TREE | 15' | |
| | PISTACHIA CHINENSIS | CHINESE PISTACHE | 25' | |
| | SCHINUS TEREBINTHIFOLIUS | BRAZILIAN PEPPER TREE | 25' | |

* DIAMETER OF TREE CANOPY PROJECTED AT 15 YEAR GROWTH. FOR APPROVED CANOPY SIZES REFER TO THE CITY OF PLEASANTON SHADE TREE GUIDELINES.

** REFER TO SHEET L-001 TREE DISPOSITION PLAN FOR EXISTING TREE LOCATION AND TYPE.

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PROJECT INFORMATION

# STANFORD HEALTH CARE TRI-VALLEY
## East Wing Hospital Addition

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2022514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16532 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

# HARDSCAPE SHADING PLAN

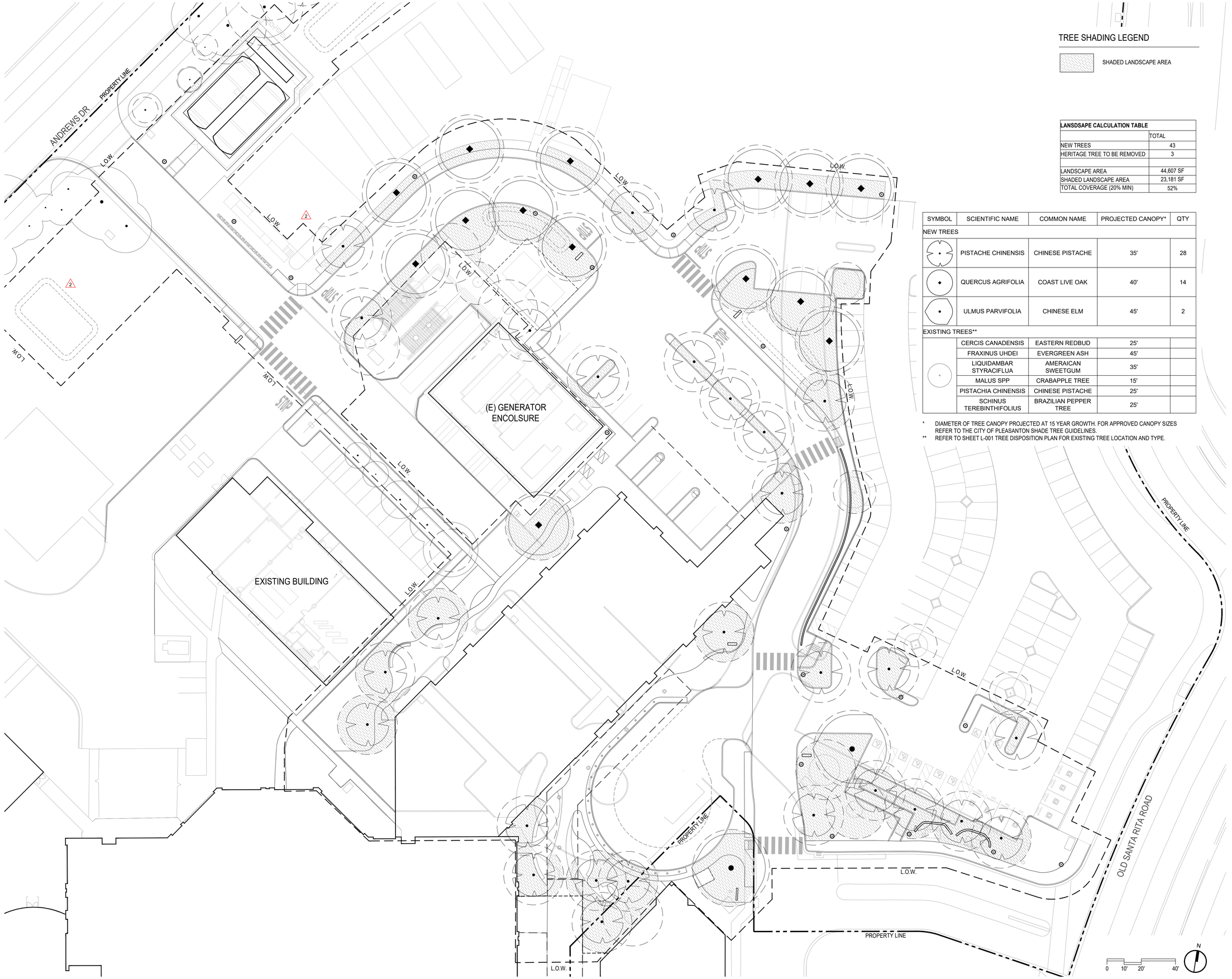
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## TREE SHADING LEGEND

SHADED LANDSCAPE AREA

| LANSDSAPE CALCULATION TABLE | |
|---|---|
| | TOTAL |
| NEW TREES | 43 |
| HERITAGE TREE TO BE REMOVED | 3 |
| | |
| LANDSCAPE AREA | 44,607 SF |
| SHADED LANDSCAPE AREA | 23,181 SF |
| TOTAL COVERAGE (20% MIN) | 52% |

| SYMBOL | SCIENTIFIC NAME | COMMON NAME | PROJECTED CANOPY* | QTY |
|---|---|---|---|---|
| NEW TREES | | | | |
| | PISTACHE CHINENSIS | CHINESE PISTACHE | 35' | 28 |
| | QUERCUS AGRIFOLIA | COAST LIVE OAK | 40' | 14 |
| | ULMUS PARVIFOLIA | CHINESE ELM | 45' | 2 |
| EXISTING TREES** | | | | |
| | CERCIS CANADENSIS | EASTERN REDBUD | 25' | |
| | FRAXINUS UHDEI | EVERGREEN ASH | 45' | |
| | LIQUIDAMBAR STYRACIFLUA | AMERAICAN SWEETGUM | 35' | |
| | MALUS SPP | CRABAPPLE TREE | 15' | |
| | PISTACHIA CHINENSIS | CHINESE PISTACHE | 25' | |
| | SCHINUS TEREBINTHIFOLIUS | BRAZILIAN PEPPER TREE | 25' | |

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** REFER TO SHEET L-001 TREE DISPOSITION PLAN FOR EXISTING TREE LOCATION AND TYPE.

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PROJECT INFORMATION

# STANFORD HEALTH CARE TRI-VALLEY
## East Wing Hospital Addition

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2022514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16532 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

# LANDSCAPE SHADING PLAN

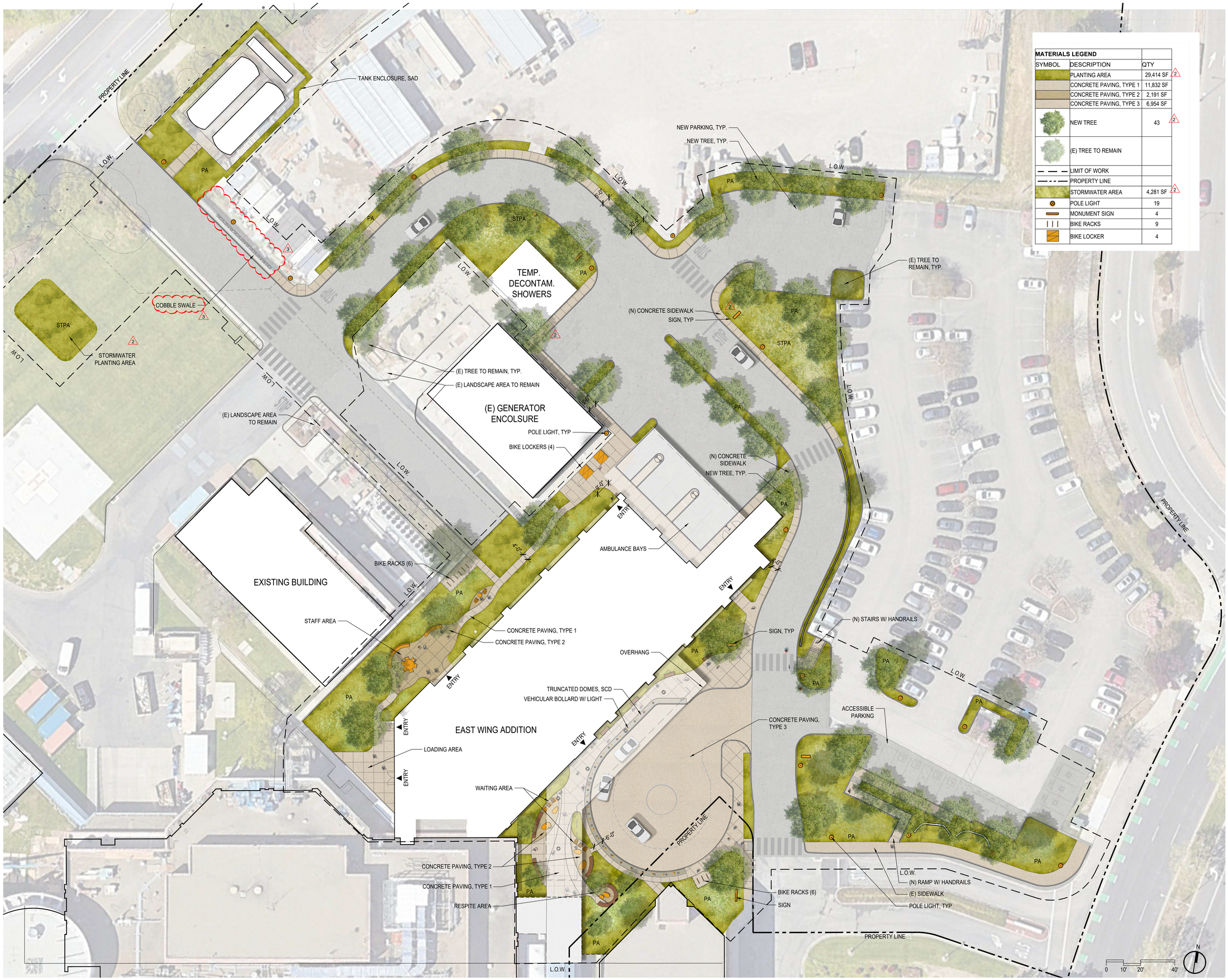
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| MATERIALS LEGEND | | | |
|---|---|---|---|
| SYMBOL | DESCRIPTION | QTY | |
| | PLANTING AREA | 29,414 SF | 2 |
| | CONCRETE PAVING, TYPE 1 | 11,832 SF | |
| | CONCRETE PAVING, TYPE 2 | 2,191 SF | |
| | CONCRETE PAVING, TYPE 3 | 6,954 SF | |
| | NEW TREE | 43 | 2 |
| | (E) TREE TO REMAIN | | |
| | LIMIT OF WORK | | |
| | PROPERTY LINE | | |
| | STORMWATER AREA | 4,281 SF | 2 |
| | POLE LIGHT | 19 | |
| | MONUMENT SIGN | 4 | |
| | BIKE RACKS | 9 | |
| | BIKE LOCKER | 4 | |

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| 2 | BACKCHECK #02 | 02/06/2025 |
| 3 | BACKCHECK #03 | 03/19/2025 |

PROJECT INFORMATION

# STANFORD HEALTH CARE TRI-VALLEY
## East Wing Hospital Addition

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 20225514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

## ANNOTATED LANDSCAPE PLAN

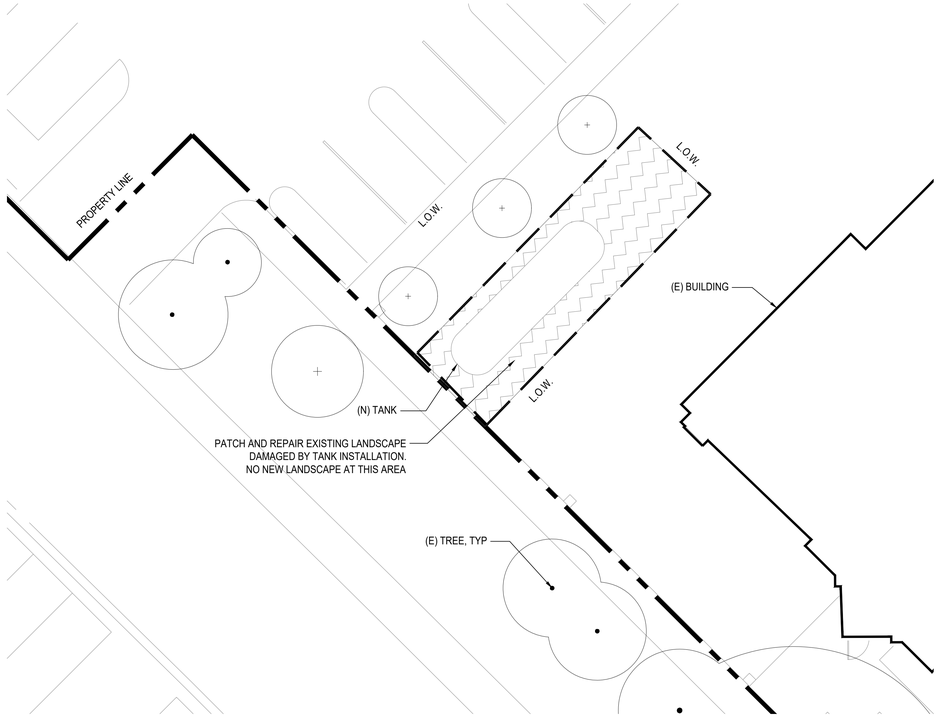
SHEET NUMBER — SCALE:

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1 PLAN AREA B




2 PLAN AREA C

| MATERIALS LEGEND | | |
|---|---|---|
| SYMBOL | DESCRIPTION | QTY |
| | PATCH AND REPAIR EXISTING LANDSCAPE | 875 SF |
| | STORMWATER PLANTING | 3,841 SF |
| | PLANTING AREA | 29,436 SF |
| | PIP CONCRETE | 21,009 SF |
| | NEW TREE | 43 |
| | (E) TREE TO REMAIN | |
| | LIMIT OF WORK | |
| | PROPERTY LINE | |

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PROJECT INFORMATION

**STANFORD HEALTH CARE TRI-VALLEY**
**East Wing Hospital Addition**

| | |
|---|---|
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| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

# ANNOTATED LANDSCAPE PLAN - PLAN AREA B & C

SHEET NUMBER — SCALE:

# L-101

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**PRODUCT:** 9' UMBRELLA
**MFR:** ULINE UMBRELLA W/ BASE
**COLOR:** TBD
**FINISH:** TBD
**NOTE:**



9 UMBRELLA

**PRODUCT:** BENCH SEAT
**MFR:** EMU STAR
**COLOR:** TBD
**FINISH:** POWDER COAT
**NOTE:**



5 MOVEABLE SEAT TYPE 2

**PRODUCT:** SIDEWALKS
**MFR:** CONCRETE STANDARD
**COLOR:** NA
**FINISH:** MEDIUM BROOM
**NOTE:** PROVIDE THIS CONCRTE FOR THE SITE SIDEWALKS AND CONNECTING PATHS



1 CONCRETE PAVING, TYPE 1

**PRODUCT:** TABLE
**MFR:** NOVA
**COLOR:** TBD
**FINISH:** POWDER COAT
**NOTE:**



6 GROUP TABLE

**PRODUCT:** AMENITY & SEATING AREAS
**MFR:** CONCRETE
**COLOR:** INTEGRAL COLOR TBD
**FINISH:** SANDBLAST FINISH W SURFACE RETARDER
**NOTE:** THIS IS ONE OF TWO PAVING FINISHES/COLORS USED AT THE AMENITY AND SEATING AREAS



2 CONCRETE PAVING, TYPE 2

**PRODUCT:** SWELL CURVED CONCRETE BENCH
**MFR:** STREETFORMS
**COLOR:** TBD
**FINISH:** TBD
**NOTE:**



7 BENCH, TYPE 1

**PRODUCT:** AMENITY & SEATING AREAS
**MFR:** CONCRETE
**COLOR:** INTEGRAL COLOR TBD
**FINISH:** EXPOSED AGGREGATE FINISH W SURFACE RETARDER
**NOTE:** THIS IS ONE OF TWO PAVING FINISHES/COLORS USED AT THE AMENITY AND SEATING AREAS



3 CONCRETE PAVING, TYPE 3

**PRODUCT:** BANCAL BENCH
**MFR:** LANDSCAPE FORMS
**COLOR:** TBD
**FINISH:** TBD
**NOTE:**



8 BENCH, TYPE 2

**PRODUCT:** **LOUNGE** CHAIR
**MFR:** EMU STAR
**COLOR:** TBD
**FINISH:** POWDER COAT
**NOTE:**



4 MOVEABLE SEAT, TYPE 1

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PROJECT INFORMATION

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**East Wing Hospital Addition**

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| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE ISSUE DATE: 08/23/2024

# FURNISHINGS AND MATERIALS

SHEET NUMBER SCALE:

# L-102

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## TREE PROTECTION NOTES:

1. PROTECT EXISTING TREES AND BRANCHES FROM DAMAGE DURING CONSTRUCTION. DAMAGED TREES TO BE REPLACED IN KIND WITH TREE OF EQUAL VALUE OR AS APPROVED BY OWNER. ALL WORK WITHIN TREE PROTECTION ZONE TO BE DONE BY HAND. TREE PROTECTION ZONE TO BE 1' FOR EVERY INCH IN DIAMETER OF BREAST HEIGHT.

## PLANTING NOTES:

1. CONTRACTOR TO REFER TO PLANT LIST FOR PLANT SIZE AND SPACING. USE TRIANGULAR SPACING UNLESS OTHERWISE NOTED.
2. PLANT QUANTITIES ARE PROVIDED FOR CONTRACTOR'S CONVENIENCE ONLY. CONTRACTOR TO VERIFY ALL PLANT QUANTITIES SHOWN IN PLANTING PLANS.
3. CONTRACTOR TO SUBMIT PLANT SAMPLES FOR APPROVAL BY LANDSCAPE ARCHITECT, SEE SPECS.
4. LANDSCAPE ARCHITECT TO INSPECT PLANTING LAYOUT PRIOR TO INSTALLATION. CONTRACTOR TO PROVIDE 10' X 10' MOCKUP OF ALL PLANT MIXES FOR APPROVAL BY LANDSCAPE ARCHITECT.
5. CONTRACTOR TO VERIFY LOCATION AND DEPTH OF ALL UTILITIES, STRUCTURES, AND IRRIGATION LINES BEFORE DIGGING.
6. GROUNDCOVERS ARE TO EXTEND UNDER TREE AND SHRUB PLANTINGS FOR FULL COVERAGE. SPACE GROUNDCOVER 18" AWAY FROM TREES AND 12" AWAY FROM SHRUBS.
7. SEE GRADING PLAN FOR FINISH GRADES. ALL FINISH GRADES REFER TO FINISH GRADE OF MULCHED LANDSCAPE.
8. ALL PLANTING AREAS, PLANTERS, AND POTS TO RECEIVE 3" OF MULCH, SEE SPECS.

## IRRIGATION NOTES

1. THE CONTRACTOR SHALL VERIFY FLOW RATE AND PRESSURE AT THE POINT OF CONNECTION PRIOR TO THE INSTALLATION OF THE IRRIGATION SYSTEM AND NOTIFY THE OWNER'S REPRESENTATIVE OF TEST RESULTS BEFORE CONSTRUCTION BEGINS. NOTIFY LANDSCAPE ARCHITECT IF PRESSURE IS GREATER OR LESS THAN THE STATIC PRESSURE STATED ON THE PLANS TO DETERMINE IF PRESSURE REGULATION OR A BOOSTER PUMP IS REQUIRED.
2. THE CONTRACTOR SHALL OBTAIN AS-BUILT IRRIGATION DRAWINGS OF ALL EXISTING IRRIGATION SYSTEM(S) FROM THE OWNER'S REPRESENTATIVE FOR REFERENCE DURING NEW AND RETROFIT WORK.
3. CONTRACTOR TO FIELD VERIFY CONDITION OF ALL EXISTING IRRIGATION EQUIPMENT IMPACTED BY NEW CONSTRUCTION AND REPAIR AND REPLACE AS NECESSARY.
4. THE CONTRACTOR SHALL PROVIDE THE OWNER'S REPRESENTATIVE WITH CLEAR AS-BUILT PLANS OF THE INSTALLED OF IRRIGATION SYSTEM.
5. AREAS LESS THAN 10 FEET IN WIDTH IN ANY DIRECTION SHALL BE IRRIGATED WITH SUBSURFACE OR DRIP IRRIGATION AND OVERHEAD IRRIGATION SHALL NOT BE PERMITTED WITHIN 24 INCHES OF ANY NON-PERMEABLE SURFACE.
6. PLANS SHALL COMPLY WITH LOCAL WATER DISTRICT PROCEDURES AND REQUIREMENTS AND THE STATE WATER EFFICIENT LANDSCAPE ORDINANCE. ORDINANCE CRITERIA TO BE APPLIED ACCORDINGLY FOR THE EFFICIENT USE OF WATER IN THE DESIGN PLAN. THE ESTIMATED TOTAL WATER USE (ETWU) SHALL NOT EXCEED THE MAXIMUM APPLIED WATER ALLOWANCE (MAWA).

PLANTING SCHEDULE

| QTY | SYMBOL | ABBR. | SCIENTIFIC NAME | COMMON NAME | SIZE | SPACING | HEIGHT | WIDTH | WUCOLS |
|---|---|---|---|---|---|---|---|---|---|
| TREES | | | | | | | | | |
| 2 43 | | PIS CHI | PISTACHE CHINENSIS | CHINESE PISTACHE | 24" BOX | SEE PLAN | 40' | 35' | L |
| | | QUE AGR | QUERCUS AGRIFOLIA | COAST LIVE OAK | 36" BOX | SEE PLAN | 60' | 60' | L |
| | | ULM PAR | ULMUS PARVIFOLIA | CHINESE ELM | 24" BOX | SEE PLAN | 50' | 60' | L |
| QTY | SYMBOL | ABBR. | SCIENTIFIC NAME | COMMON NAME | SIZE | SPACING | MATURE HEIGHT | MATURE WIDTH | WUCOLS |
| 2 33,695 SF | SHRUBS | | | | | | | | |
| | | ARC HOW | *ARCTOSTAPHYLOS 'HOWARD MCMINN'* | HOWARD MCMINN MANZANITA | 15 GAL | 4' O.C. | 5' | 7' | L |
| | | CAL LIT | CALLISTEMON VIMINALIS 'LITTLE JOHN' | DWARF WEEPING BOTTLEBRUSH | 15 GAL | 4' O.C. | 4' | 5' | L |
| | | CER CAN | *CERCIS CANADENSIS* | EASTERN REDBUD | 24" BOX | SEE PLAN | 40' | 35' | M |
| | | HET ARB | *HETEROMELES ARBUTIFOLIA* | TOYON | 15 GAL | 6' O.C. | 10' | 7' | L |
| | | MYR CAL | MYRICA CALIFORNICA | PACIFIC WAX MYRTLE | 15 GAL | 6' O.C. | 15' | 10' | L |
| | | PIT TOB | *PITTOSPORUM TOBIRA VARIEGATA* | VARIEGATED MOCK ORANGE | 15 GAL | 6' O.C. | 6' | 6' | L |
| | | RHA EVE | *RHAMNUS CALIFORNICA 'EVE CASE'* | EVE CASE COFFEE BERRY | 15 GAL | 5' O.C. | 6' | 6' | L |
| | | RHA IND | RHAPHIOLEPIS INDICA | INDIAN HAWTHORN | 15 GAL | 5' O.C. | 6' | 6' | L |
| | | ROS ICE | ROSA 'ICEBERG' | ICEBERG WHITE ROSE | 10 GAL | 4' O.C. | 4' | 4' | L |
| | PERENNIALS & GRASSES | | | | | | | | |
| | | ACH M IL | ACHILLEA MILLEFOLIUM | COMMON YARROW | 5 GAL | 18" O.C. | 4' | 2' | L |
| | | CAR TUM | CAREX TUMULICOLA | FOOTHILL SEDGE | 5 GAL | 1' O.C. | 1' | 1' | L |
| | | DIE IRI | DIETES IRIOIDES | FORTNIGHT LILY | 5 GAL | 4' O.C. | 4' | 4' | L |
| | | EPI CAN | EPILOBIUM CANUM | CALIFORNIA FUCHSIA | 5 GAL | 4' O.C. | 3' | 4' | L |
| | | FES CAL | FESTUCA CALIFORNICA | CALIFORNIA FESCUE | 5 GAL | 4' O.C. | 3' | 4' | L |
| | | LOM PLA | *LOMANDRA LONGIFOLIA 'PLATINUM BEAUTY'* | PLATINUM BEAUTY LOMANDRA | 1 GAL | 3' O.C. | 3' | 30" | L |
| | GROUNDCOVERS | | | | | | | | |
| | | ARC PAC | *ARCTOSTAPHYLOS 'PACIFIC MIST'* | PACIFIC MIST MANZANITA | 5 GAL | 3' O.C. | 2' | 8' | L |
| | | BAC PIL | *BACCHARIS PILULARIS 'PIGEON POINT'* | DWARF COYOTE BRUSH | 5 GAL | 18" O.C. | 18" | 8' | L |
| | | FRA VES | *FRAGARIA VESCA* | WILD STRAWBERRY | 5 GAL | 1' O.C. | 6" | 1' | L |
| | STORMWATER | | | | | | | | |
| | | CEP OCC | CEPHALANTHUS OCCIDENTALIS | BUTTONBUSH | 5 GAL | 5' O.C. | 7' | 5' | M |
| | | CHO TEC | CHONDROPETALUM TECTORUM | CAPE RUSH | 5 GAL | 4' O.C. | 8' | 8' | L |
| | | COR SER | CORNUS SERICEA | RED TWIG DOGWOOD | 5 GAL | 3' O.C. | 2' | 8' | M |
| | | JUN PAT | JUNCUS PATENS | CALIFORNIA GRAY RUSH | 5 GAL | 2' O.C. | 2' | 2' | M |
| | | RHA EVE | *RHAMNUS CALIFORNICA 'EVE CASE'* | EVE CASE COFFEEBERRY | 15 GAL | 5' O.C. | 6' | 6' | L |

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DESIGN PROFESSIONAL STAMP

CONSULTANT

rhaa
Landscape Architecture & Planning
225 Miller Avenue, Mill Valley, CA 94941
T 415 383 7900 rhaa.com

AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/06/2024 |
| 2 | BACKCHECK #02 | 02/06/2025 |

PROJECT INFORMATION

**STANFORD HEALTH CARE TRI-VALLEY**
**East Wing Hospital Addition**

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2022514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

# PLANTING SCHEDULE AND NOTES

SHEET NUMBER — SCALE:

# L-200

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| PLANTING LEGEND | | |
|---|---|---|
| SYMBOL | DESCRIPTION | QTY |
| | PLANTING AREA | 33,695 SF |
| | NEW TREE | 43 |
| | EXISTING TREE | |

**NOTES**:
1. ALL PLANTING TO MAKE USE OF NATIVE AND CLIMATE ADAPTIVE PLANTS.

ANDREWS DR
PROPERTY LINE
L.O.W.
PA
STPA
TEMP. DECONTAM. SHOWERS
(E) GENERATOR ENCOLSURE
(E) TREE TO REMAIN, TYP.
(E) LANDSCAPE TO BE PROTECTED IN PLACE
RELOCATED SANITARY SEWER LATERAL, SCD. PATCH AND REPAIR ANY EXISTING LANDSCAPE DAMAGED BY CONSTRUCTION
NEW TREE, TYP.
EXISTING BUILDING
EAST WING ADDITION
OLD SANTA RITA ROAD
0 10' 20' 40'
N

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| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/06/2024 |
| 2 | BACKCHECK #02 | 02/06/2025 |
| 3 | BACKCHECK #03 | 03/19/2025 |

PROJECT INFORMATION

# STANFORD HEALTH CARE TRI-VALLEY
## East Wing Hospital Addition

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| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

## PLANTING PLAN

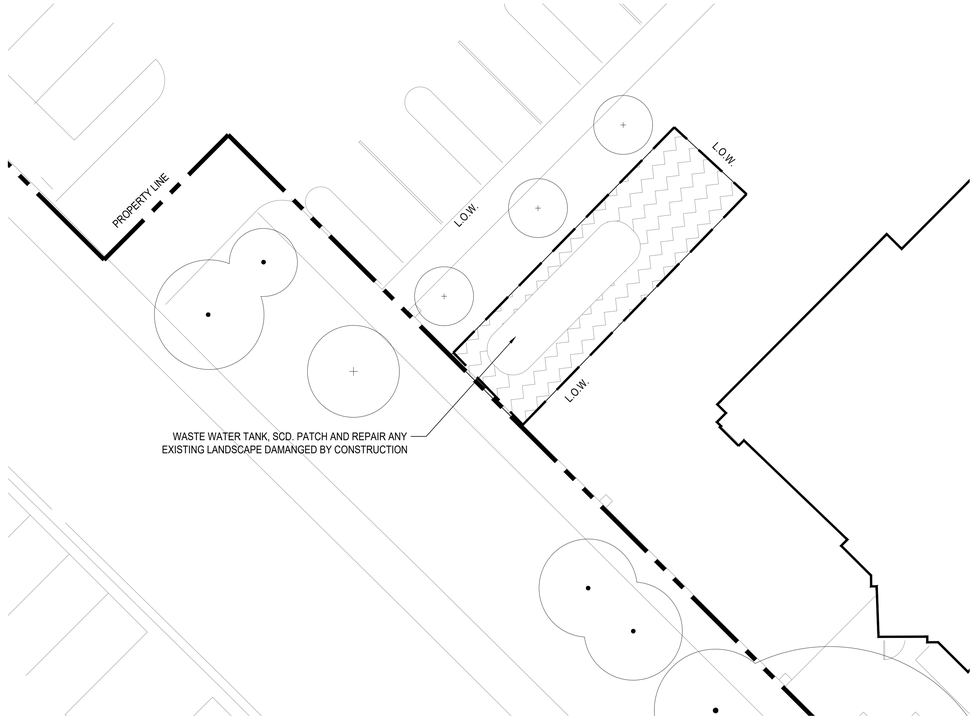
SHEET NUMBER — SCALE:

# L-201

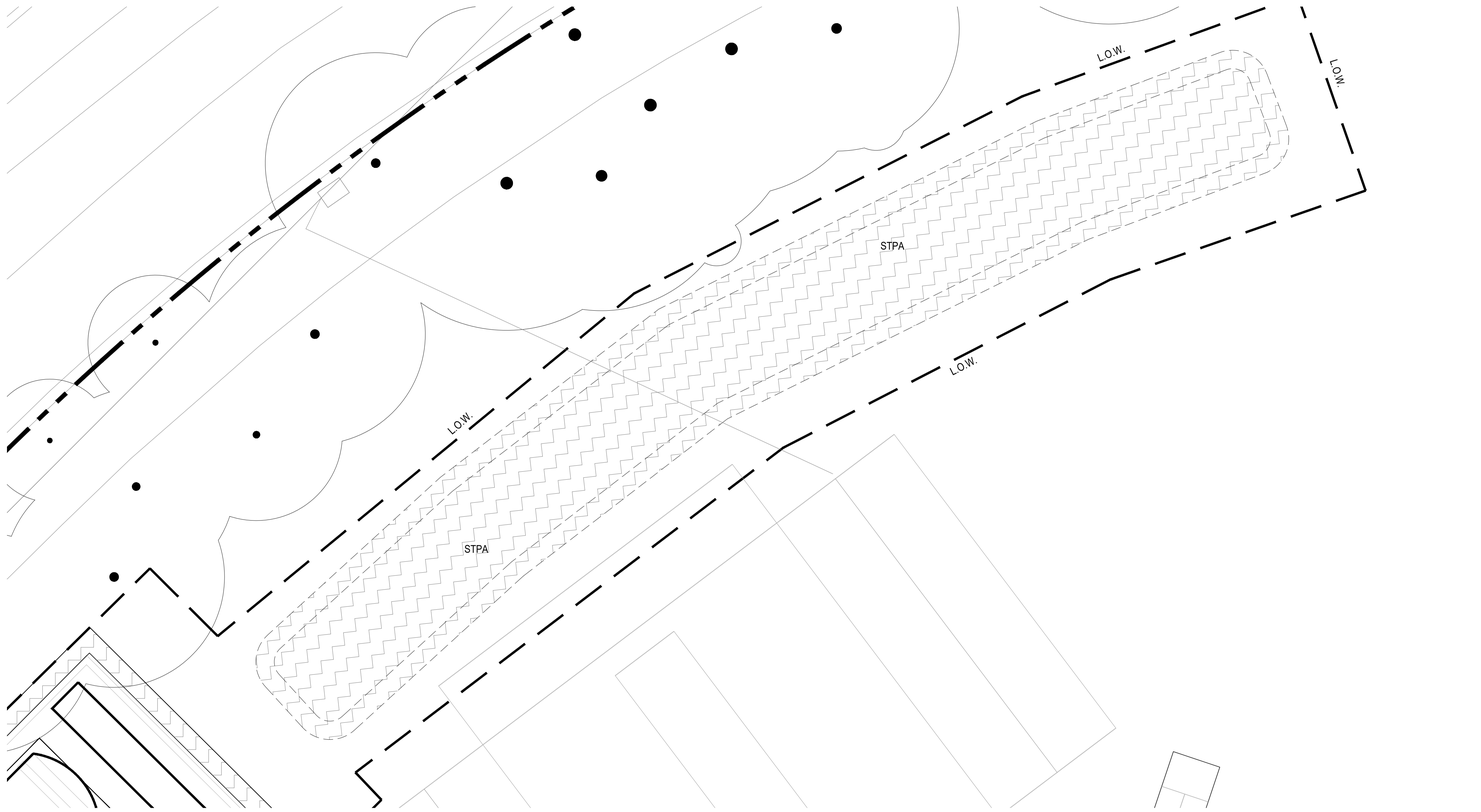
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1 PLAN AREA B




2 PLAN AREA C

| PLANTING LEGEND | | |
|---|---|---|
| SYMBOL | DESCRIPTION | QTY |
| | PLANTING AREA | 33,695 SF |
| | NEW TREE | 43 |
| | EXISTING TREE | |

**NOTES**:
1. ALL PLANTING TO MAKE USE OF NATIVE AND CLIMATE ADAPTIVE PLANTS.

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AGENCY APPROVAL

REVISION SCHEDULE

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|---|---|---|
| 1 | BACKCHECK #01 | 11/06/2024 |

PROJECT INFORMATION

**STANFORD HEALTH CARE TRI-VALLEY**
**East Wing Hospital Addition**

| | |
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| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
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| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

## PLANTING PLAN - PLAN AREA B & C

SHEET NUMBER — SCALE:

# L-202

PACKAGE ISSUANCE: DESIGN REVIEW SUBMITTAL

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## TREES



*ULMUS PARVIFOLIA*
*CHINESE ELM*



*QUERCUS AGRIFOLIA*
COAST LIVE OAK



*PISTACHE CHINENSIS*
CHINESE PISTACHE

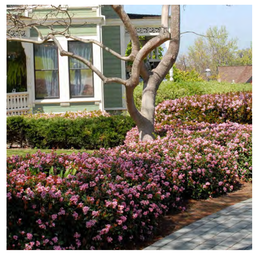


*CERCIS CANADENSIS*
EASTERN REDBUD

## SHRUBS



*ROSA 'ICEBERG'*
*ICEBERG WHITE ROSE*



*RHAPHIOLEPIS INDICA*
INDIAN HAWTHRON



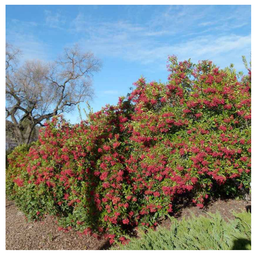
*RHAMNUS CALIFORNICA 'EVE CASE'*
*EVE CASE COFFEEBERRY*



*PITTOSPORUM TOBIRA VARIEGATA*
*VARIEGATED MOCK ORANGE*



*MYRICA CALIFORNICA*
*PACIFIC WAX MYRTLE*



*HETEROMELES ARBUTIFOLIA*
TOYON



*CALLISTEMON VIMINALIS 'LITTLE JOHN'*
DWARF WEEPING BOTTLEBRUSH



*ARCTOSTAPHYLOS 'HOWARD MCMINN'*
HOWARD MCMINN MANZANITA

## PERENNIALS AND GRASSES



*LOMANDRA LONGIFOLIA 'PLATINUM BEAUTY'*
*PLATINUM BEAUTFY LOMANDRA*



*FESTUCA CALIFORNICA*
CALIFORNIA FESCUE



*EPIOBIUM CANUM*
*CALIFORNIA FUCHSIA*



*DIETES IRIOIDES*
*FORTNIGHT LILY*



*CAREX TUMULICOLA*
FOOTHILL SEDGE



*ACHILLEA MILLEFOLIUM*
*COMMON YARROW*

## GROUNDCOVERS



*ARCTOSTAPHYLOS 'PACIFIC MIST'*
*PACIFIC MIST MANZANITA*

## STORMWATER



*RHAMNUS CALIFORNICA 'EVE CASE'*
*EVE CASE COFFEEBERRY*



*JUNCUS PATENS*
*CALIFORNIA GRAY RUSH*



*CORNUS SERICEA*
*RED TWIG DOGWOOD*



*CHONDROPETALUM TECTORUM*
*CAPE RUSH*



*CEPHALANTHUS OCCIDENTALIS*
*BUTTONBUSH*

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CONSULTANT

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AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
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| 1 | BACKCHECK #01 | 11/06/2024 |

PROJECT INFORMATION

# STANFORD HEALTH CARE TRI-VALLEY
## East Wing Hospital Addition

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 20225514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

## PLANTING PALETTE

SHEET NUMBER — SCALE:

# L-203

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EXHIBIT B

## SYMBOLS & LEGEND

EXISTING

- BENCHMARK
- VALVE
- FIRE HYDRANT
- BACKFLOW PREVENTION DEVICE
- FIRE DEPARTMENT CONNECTION
- POST INDICATOR VALVE
- RISER
- SIGN
- STREET LIGHT
- LIGHT POLE
- AREA LIGHT
- GUY ANCHOR
- UTILITY POLE
- TREE
- TREE CLUSTER
- PROPERTY LINE
- EASEMENT
- GRADE BREAK
- FLOW LINE
- FENCE
- STORM DRAIN
- SS — SANITARY SEWER
- W — WATER
- OVH — OVERHEAD UTILITY LINE
- UT — UNDERGROUND UTILITY LINE
- E — UNDERGROUND ELECTRIC LINE
- G — UNDERGROUND GAS LINE
- TC — UNDERGROUND TELECOM LINE
- STM — UNDERGROUND STEAM LINE
- O2 — UNDERGROUND OXYGEN LINE
- N2 — UNDERGROUND NITROGEN LINE
- CONCRETE
- DETECTABLE WARNING
- VALLEY GUTTER

## ABBREVIATIONS

| | |
|---|---|
| AC | ASPHALT CONCRETE |
| AD | AREA DRAIN |
| BFP | BACKFLOW PREVENTOR |
| BLRD | BOLLARD |
| CB | CATCH BASIN |
| DI | DROP INLET |
| E | ELECTRIC |
| EP | EDGE OF PAVEMENT |
| FF | FINISHED FLOOR |
| FL | CURB FLOWLINE |
| G | GAS |
| INV | BOTTOM INSIDE OF PIPE |
| IRR | IRRIGATION BOX |
| MH | MANHOLE |
| OVH | OVERHEAD UTILITY LINE |
| SD | STORM DRAIN |
| SDCO | STORM DRAIN CLEAN OUT |
| SDMH | STORM DRAIN MANHOLE |
| SLB | STREETLIGHT UTILITY BOX |
| SS | SANITARY SEWER |
| SSCO | SANITARY SEWER CLEAN OUT |
| SSMH | SANITARY SEWER MANHOLE |
| TB | TOP OF BOX |
| TC | TOP FACE OF CURB |
| TEL | TELECOMMUNICATION LINE |
| TF | TRANSFORMER |
| TV | TELEVISION |
| TW | TOP OF WALL |
| TYP | TYPICAL |
| UB | UTILITY BOX |
| VLT | VAULT |
| W | WATER |
| WM | WATER METER |




## SHEET LIST


| | |
|---|---|
| 06 CIVIL | |
| C1.0 | EXISTING CONDITIONS |
| C2.0 | SURFACE IMPROVEMENTS PLAN |
| C3.0 | GRADING PLAN |
| C4.0 | UTILITY PLAN |
| C4.1 | UTILITY PLAN |
| C5.0 | STORMWATER CONTROL PLAN |
| C6.0 | EMERGENCY VEHICLE ACCESS PLAN |
| C7.0 | EASEMENT RELOCATION SITE PLAN |
| C8.0 | SLOPE CLASSIFICATION |


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SACRAMENTO, CA 95814
(916) 556-5800
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BKF NO. 20221230-11

AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/06/2024 |
| 2 | BACKCHECK #02 | 02/06/2025 |
| 3 | BACKCHECK #03 | 03/19/2025 |

PROJECT INFORMATION

# STANFORD HEALTH CARE TRI-VALLEY
## East Wing Hospital Addition

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 20223514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/24

## EXISTING CONDITIONS

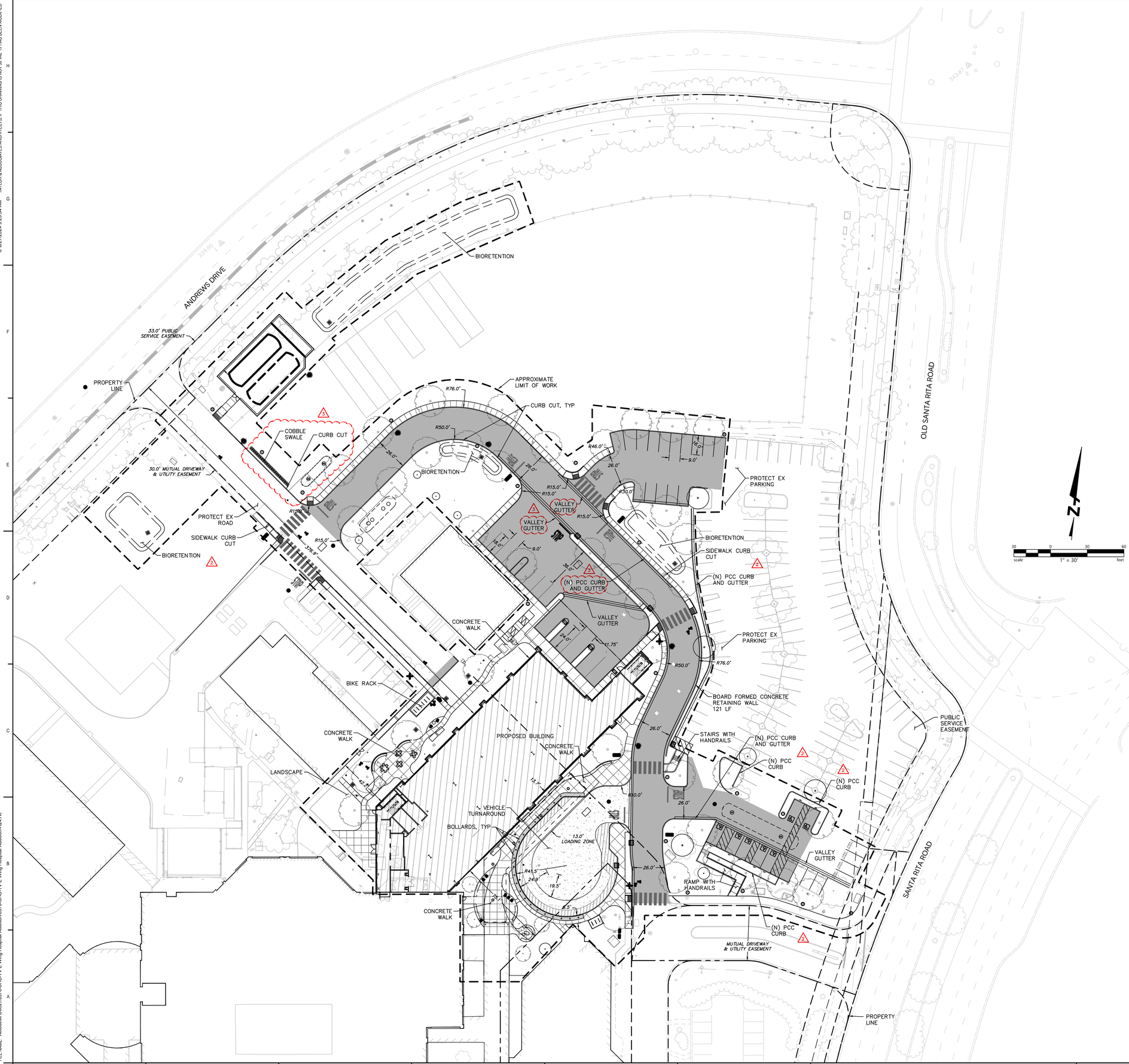
SHEET NUMBER — SCALE: SEE PLAN

# C1.0

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PROJECT INFORMATION

# STANFORD HEALTH CARE TRI-VALLEY
## East Wing Hospital Addition

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## SURFACE IMPROVEMENTS PLAN

SHEET NUMBER — SCALE: SEE PLAN

# C2.0

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## ESTIMATES OF PROBABLE EARTHWORK QUANTITIES:

| | |
|---|---|
| TOTAL CUT | 2,870 CY |
| TOTAL FILL | 793 CY |
| NET CUT | 2,077 CY |

NOTES:

EARTHWORK QUANTITIES ARE A COMPARISON BETWEEN FINISH AND EXISTING GRADES. THIS QUANTITY DOES NOT TAKE INTO ACCOUNT SUB SECTION REMOVAL FOR PAVEMENT SECTIONS OR STRIPPING OF TOP SOILS.

## GRADING LEGEND

| | |
|---|---|
| —100— | PROPOSED CONTOUR |
| —99— | EXISTING CONTOUR |
| - - - - | GRADE BREAK |
| | OVERLAND RELEASE |
| FF XX.XX | ELEVATION LABEL: |

| | |
|---|---|
| AC | ASPHALT |
| BW | BACK OF WALK |
| CC | CONCRETE |
| EG | EXISTING GRADE |
| EX | EXISTING |
| FF | FINISHED FLOOR |
| FS | FINISHED SURFACE |
| GND | GROUND |
| GR | GRATE ELEVATION |
| TFC | TOP FLUSH CURB |
| TH | THRESHOLD |
| TW | TOP OF WALL |

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**PROJECT INFORMATION**

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# East Wing Hospital Addition

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**SHEET TITLE** — **ISSUE DATE: 08/23/24**

## GRADING PLAN

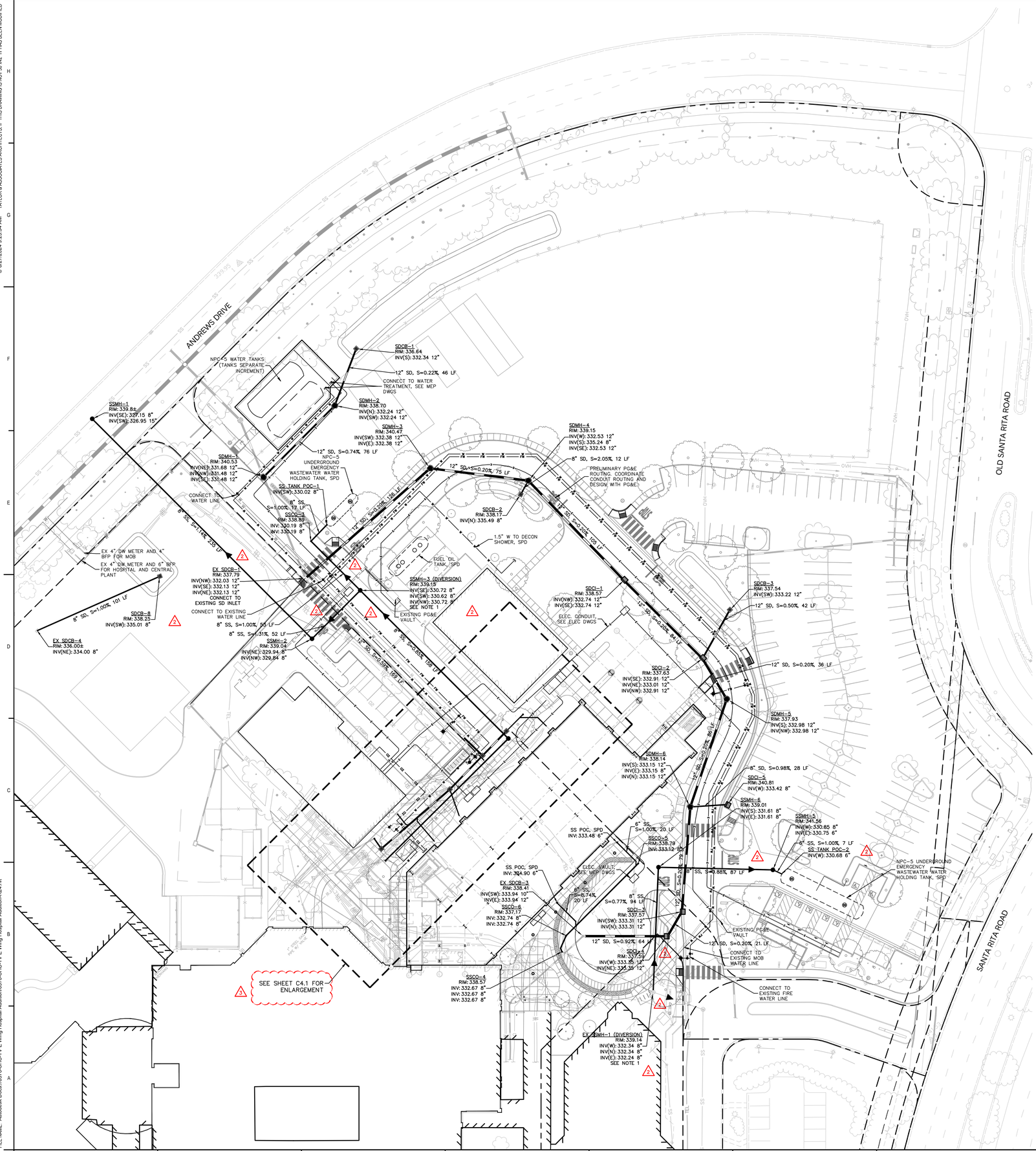
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# C3.0

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## UTILITY LEGEND

- STORM DRAIN LINE
- SANITARY SEWER LINE
- WATER LINE
- FIRE WATER LINE
- ELECTRICAL LINE (FOR REFERENCE ONLY)
- STORM DRAIN INLET
- STORM DRAIN MANHOLE
- SANITARY SEWER MANHOLE
- SANITARY SEWER CLEANOUT
- WATER VALVE
- FIRE HYDRANT
- POST INDICATOR VALVE
- FIRE DEPARTMENT CONNECTION

## NPC 5 EMERGENCY WASTEWATER NOTES

1. IN EACH DIVERTING MANHOLE, THE ISOLATION VALVE TO THE CITY SEWER SHALL BE NORMALLY OPENED AND THE ISOLATION VALVE TO THE EMERGENCY WASTE TANK SHALL BE NORMALLY CLOSED DURING NORMAL OPERATIONS. DURING AN EMERGENCY AND CITY SEWER SERVICE INTERRUPTION, THE ISOLATION VALVE ON THE CITY SEWER SHALL BE CLOSED AND EMERGENCY WASTEWATER PIPE SHALL BE OPENED TO ALLOW WASTEWATER DISCHARGE TO THE NPC 5 EMERGENCY WASTEWATER HOLDING TANKS.
2. DURING THE EMERGENCY, THE FACILITY SHALL MANUALLY CLOSE THE ISOLATION VALVE ON THE CITY SEWER PIPE, STOP WASTEWATER FLOW TO THE CITY SEWER, OPEN THE ISOLATION VALVE ON THE EMERGENCY SEWER PIPE, AND DISCHARGE TO THE UNDERGROUND NPC 5 EMERGENCY WASTE WATER HOLDING TANK IN A DISASTER EVENT. THE FACILITY WOULD SCHEDULE FOR THE WASTE WATER HOLDING TANK TO BE PUMPED EVERY COUPLE DAYS TO ALLOW FOR HOLDING CAPACITY DURING THE EMERGENCY EVENT.
3. DURING THE EMERGENCY, THE FACILITY SHALL ALSO MANUALLY CLOSE ISOLATION VALVES ON THE MOB SEWER PIPES. MOB WILL BE TEMPORARILY CLOSED DUE TO WATER INTERRUPTION AND SEWER BREAKS IN A DISASTER EVENT.

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**PROJECT INFORMATION**

# STANFORD HEALTH CARE TRI-VALLEY
## East Wing Hospital Addition

| | |
|---|---|
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| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2023514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

**SHEET TITLE** — ISSUE DATE: 08/23/24

## UTILITY PLAN

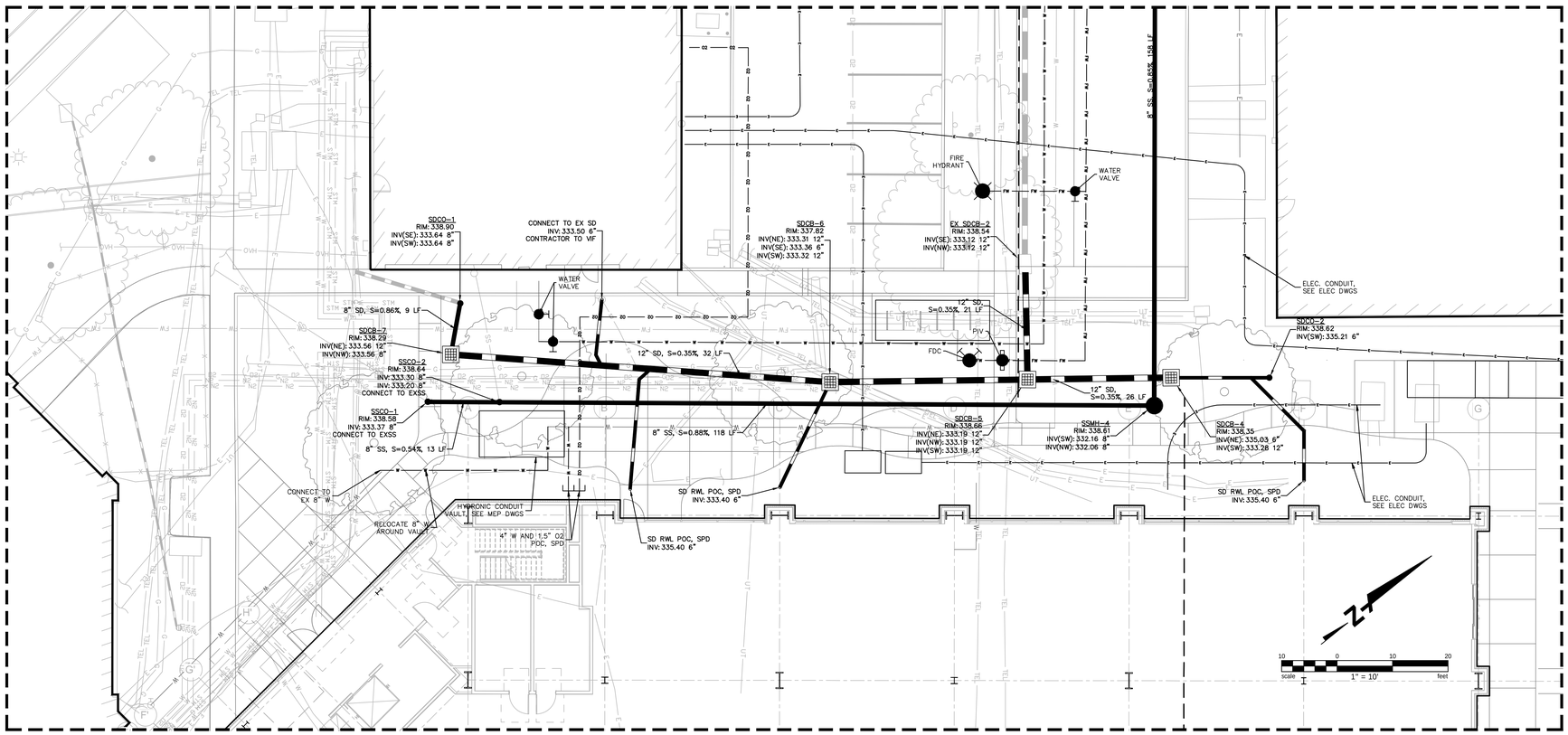
**SHEET NUMBER** — SCALE: SEE PLAN

# C4.0

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## UTILITY LEGEND

- STORM DRAIN LINE
- SANITARY SEWER LINE
- WATER LINE
- FIRE WATER LINE
- ELECTRICAL LINE (FOR REFERENCE ONLY)
- STORM DRAIN INLET
- STORM DRAIN MANHOLE
- SANITARY SEWER MANHOLE
- SANITARY SEWER CLEANOUT
- WATER VALVE
- FIRE HYDRANT
- POST INDICATOR VALVE
- FIRE DEPARTMENT CONNECTION

**TAYLOR** design

**DESIGN PROFESSIONAL STAMP**

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**AGENCY APPROVAL**

**REVISION SCHEDULE**

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/06/2024 |
| 2 | BACKCHECK #02 | 02/06/2025 |
| 3 | BACKCHECK #03 | 03/19/2025 |

**PROJECT INFORMATION**

# STANFORD HEALTH CARE TRI-VALLEY
## East Wing Hospital Addition

FACILITY NAME: **STANFORD HEALTH CARE - TRI-VALLEY**
FACILITY ADDRESS: **5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588**
OWNER PROJECT NUMBER: **2022514**

AUTHORITY HAVING JURISDICTION: **CITY OF PLEASANTON**
AGENCY FACILITY NUMBER: **16632**
AGENCY BUILDING NUMBER: **TBD**
AGENCY PROJECT NUMBER: **TBD**

ARCHITECT PROJECT NO: **6370.101**

**SHEET TITLE** **ISSUE DATE: 08/23/24**

# UTILITY PLAN

**SHEET NUMBER** **SCALE: SEE PLAN**

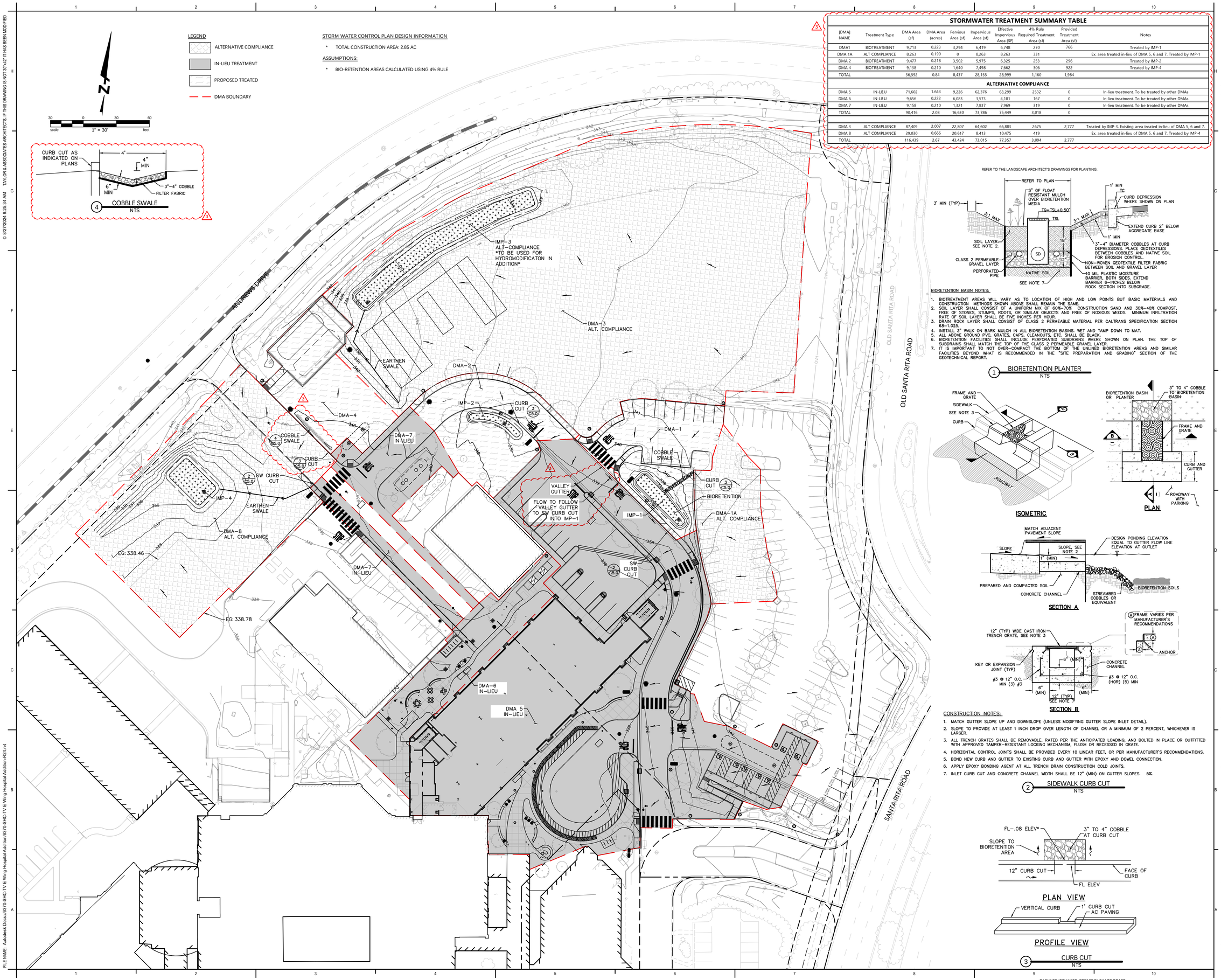
**C4.1**

1

**PACKAGE ISSUANCE: DESIGN REVIEW SUBMITTAL**

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| STORMWATER TREATMENT SUMMARY TABLE | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| [DMA] NAME | Treatment Type | DMA Area (sf) | DMA Area (acres) | Pervious Area (sf) | Impervious Area (sf) | Effective Impervious Area (SF) | 4% Rule Required Treatment Area (sf) | Provided Treatment Area (sf) | Notes |
| DMA1 | BIOTREATMENT | 9,713 | 0.223 | 3,294 | 6,419 | 6,748 | 270 | 766 | Treated by IMP-1 |
| DMA 1A | ALT COMPLIANCE | 8,263 | 0.190 | 0 | 8,263 | 8,263 | 331 | | Ex. area treated in-lieu of DMA 5, 6 and 7. Treated by IMP-1 |
| DMA 2 | BIOTREATMENT | 9,477 | 0.218 | 3,502 | 5,975 | 6,325 | 253 | 296 | Treated by IMP-2 |
| DMA 4 | BIOTREATMENT | 9,138 | 0.210 | 1,640 | 7,498 | 7,662 | 306 | 922 | Treated by IMP-4 |
| TOTAL | | 36,592 | 0.84 | 8,437 | 28,155 | 28,999 | 1,160 | 1,984 | |
| **ALTERNATIVE COMPLIANCE** | | | | | | | | | |
| DMA 5 | IN-LIEU | 71,602 | 1.644 | 9,226 | 62,376 | 63,299 | 2532 | 0 | In-lieu treatment. To be treated by other DMAs |
| DMA 6 | IN-LIEU | 9,656 | 0.222 | 6,083 | 3,573 | 4,181 | 167 | 0 | In-lieu treatment. To be treated by other DMAs |
| DMA 7 | IN-LIEU | 9,158 | 0.210 | 1,321 | 7,837 | 7,969 | 319 | 0 | In-lieu treatment. To be treated by other DMAs |
| TOTAL | | 90,416 | 2.08 | 16,630 | 73,786 | 75,449 | 3,018 | 0 | |
| | | | | | | | | | |
| DMA 3 | ALT COMPLIANCE | 87,409 | 2.007 | 22,807 | 64,602 | 66,883 | 2675 | 2,777 | Treated by IMP-3. Existing area treated in-lieu of DMA 5, 6 and 7. |
| DMA 8 | ALT COMPLIANCE | 29,030 | 0.666 | 20,617 | 8,413 | 10,475 | 419 | | Ex. area treated in-lieu of DMA 5, 6 and 7. Treated by IMP-4 |
| TOTAL | | 116,439 | 2.67 | 43,424 | 73,015 | 77,357 | 3,094 | 2,777 | |

REFER TO THE LANDSCAPE ARCHITECT'S DRAWINGS FOR PLANTING.




BIORETENTION BASIN NOTES:

1. BIOTREATMENT AREAS WILL VARY AS TO LOCATION OF HIGH AND LOW POINTS BUT BASIC MATERIALS AND CONSTRUCTION METHODS SHOWN ABOVE SHALL REMAIN THE SAME.
2. SOIL LAYER SHALL CONSIST OF A UNIFORM MIX OF 60%-70% CONSTRUCTION SAND AND 30%-40% COMPOST, FREE OF STONES, STUMPS, ROOTS, OR SIMILAR OBJECTS AND FREE OF NOXIOUS WEEDS. MINIMUM INFILTRATION RATE OF SOIL LAYER SHALL BE FIVE INCHES PER HOUR.
3. DRAIN ROCK LAYER SHALL CONSIST OF CLASS 2 PERMEABLE MATERIAL PER CALTRANS SPECIFICATION SECTION 68-1.025.
4. INSTALL 3" WALK ON BARK MULCH IN ALL BIORETENTION BASINS. WET AND TAMP DOWN TO MAT.
5. ALL ABOVE GROUND PVC, GRATES, CAPS, CLEANOUTS, ETC. SHALL BE BLACK.
6. BIORETENTION FACILITIES SHALL INCLUDE PERFORATED SUBDRAINS WHERE SHOWN ON PLAN. THE TOP OF SUBDRAINS SHALL MATCH THE TOP OF THE CLASS 2 PERMEABLE GRAVEL LAYER.
7. IT IS IMPORTANT TO NOT OVER-COMPACT THE BOTTOM OF THE UNLINED BIORETENTION AREAS AND SIMILAR FACILITIES BEYOND WHAT IS RECOMMENDED IN THE "SITE PREPARATION AND GRADING" SECTION OF THE GEOTECHNICAL REPORT.

1 BIORETENTION PLANTER
NTS







SECTION A




SECTION B

CONSTRUCTION NOTES:

1. MATCH GUTTER SLOPE UP AND DOWNSLOPE (UNLESS MODIFYING GUTTER SLOPE INLET DETAIL).
2. SLOPE TO PROVIDE AT LEAST 1 INCH DROP OVER LENGTH OF CHANNEL OR A MINIMUM OF 2 PERCENT, WHICHEVER IS LARGER.
3. ALL TRENCH GRATES SHALL BE REMOVABLE, RATED PER THE ANTICIPATED LOADING, AND BOLTED IN PLACE OR OUTFITTED WITH APPROVED TAMPER-RESISTANT LOCKING MECHANISM. FLUSH OR RECESSED IN GRATE.
4. HORIZONTAL CONTROL JOINTS SHALL BE PROVIDED EVERY 10 LINEAR FEET, OR PER MANUFACTURER'S RECOMMENDATIONS.
5. BOND NEW CURB AND GUTTER TO EXISTING CURB AND GUTTER WITH EPOXY AND DOWEL CONNECTION.
6. APPLY EPOXY BONDING AGENT AT ALL TRENCH DRAIN CONSTRUCTION COLD JOINTS.
7. INLET CURB CUT AND CONCRETE CHANNEL WIDTH SHALL BE 12" (MIN) ON GUTTER SLOPES 5%.

2 SIDEWALK CURB CUT
NTS




3 CURB CUT
NTS

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TAYLOR design

DESIGN PROFESSIONAL STAMP

PRELIMINARY: NOT FOR CONSTRUCTION

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AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 2 | BACKCHECK #02 | 02/06/2025 |

PROJECT INFORMATION

**STANFORD HEALTH CARE TRI-VALLEY**
**East Wing Hospital Addition**

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - TRI-VALLEY |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2022514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 03/24/25

# STORMWATER CONTROL PLAN

SHEET NUMBER — SCALE: SEE PLAN

# C5.0

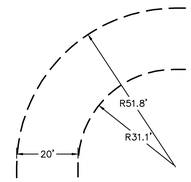
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LEGEND

FIRE ACCESS LANE, 20' MINIMUM WIDTH

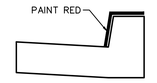
FIRE HYDRANT COVERAGE AREA




FIRE TRUCK TURN

NOTES

1. FIRE TURN RADIUS PER LIVERMORE–PLEASANTON FIRE DEPARTMENT STANDARDS.
2. ALL RAISED CURBS ADJACENT TO FIRE ACCESS ROAD SHALL BE PAINTED RED. SEE DETAIL 1, THIS SHEET.
3. KNOX BOX SHALL BE PROVIDED AT ALL GATES.
4. ALL GATES SHALL BE SIGNED ON EACH SIDE. "NO PARKING–FIRE LANE" LETTERS SHALL BE 1–INCH IN HEIGHT WITH 1/4 INCH STROKE. CA MUTCD SIGN R7–94.
5. ALL FIRE ACCESS LANE GATES SHALL OPEN 20 FT CLEAR CENTERED ON FIRE LANE.
6. THERE ARE NO VERTICAL CLEARANCE CONFLICTS ALONG FIRE ACCESS PLAN.
7. PLEASE SEE SHEET C2.0 – SURFACE IMPROVEMENTS PLAN FOR FIRE ACCESS SURFACE TYPES AND ADDITIONAL DIMENSIONS.
8. PLEASE SEE SHEET C3.0 – GRADING AND DRAINAGE PLAN FOR FIRE ACCESS SURFACE SLOPES.
9. ALL FIRE ACCESS ROADS CAN SUPPORT 80,000 LBS GROSS WEIGHT.




STANDARD CURB AND GUTTER

3"

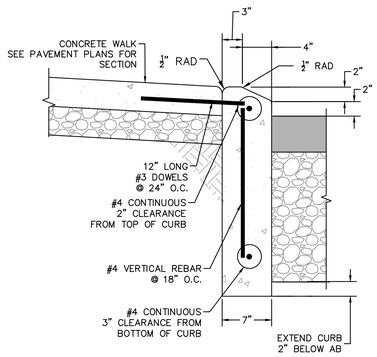
**FIRE LANE NO PARKING**

FIRE LANE LETTERING

NOTES:

1. FIRE LANE MARKING SHALL BE ON PAVEMENT OR CURB WHERE SPECIFIED ON PLAN.
2. RED PAVEMENT STRIPE SHALL BE 6 INCHES WIDE AND COLOR SHALL BE TRAFFIC RED.
3. RED CURB SHALL BE PAINTED TRAFFIC RED AS SHOWN ABOVE.
4. LETTERING SHALL BE 3 INCHES HIGH, WHITE AND HAVE 3/4 INCH STROKE PAINTED ON CENTER OF PAVEMENT STRIPE OR FACE OF CURB.
5. MARKINGS TO BE LOCATED EVERY 25 FEET.

1 FIRE LANE MARKING
NTS




NOTES:

1. CONSTRUCT 1" SCORED JOINTS AT 10' O.C.
2. AT EACH END OF BATTERED CURB, PROVIDE A 5' LONG TRANSITION FROM 4" TALL BATTERED CURB TO 6" TALL VERTICAL CURB.

2 MOUNTABLE CURB
NTS

# TAYLOR design

**DESIGN PROFESSIONAL STAMP**

**CONSULTANT**

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BKF NO. 20221230-11

**AGENCY APPROVAL**

**REVISION SCHEDULE**

| NO. | REVISION NAME | DATE: |
|---|---|---|
| 1 | BACKCHECK #01 | 11/06/2024 |
| 2 | BACKCHECK #02 | 02/06/2025 |
| 3 | BACKCHECK #03 | 03/19/2025 |

**PROJECT INFORMATION**

## STANFORD HEALTH CARE TRI-VALLEY
## East Wing Hospital Addition

| | |
|---|---|
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| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
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| ARCHITECT PROJECT NO: | 6370.101 |

**SHEET TITLE** **ISSUE DATE: 08/23/24**

## EMERGENCY VEHICLE ACCESS PLAN

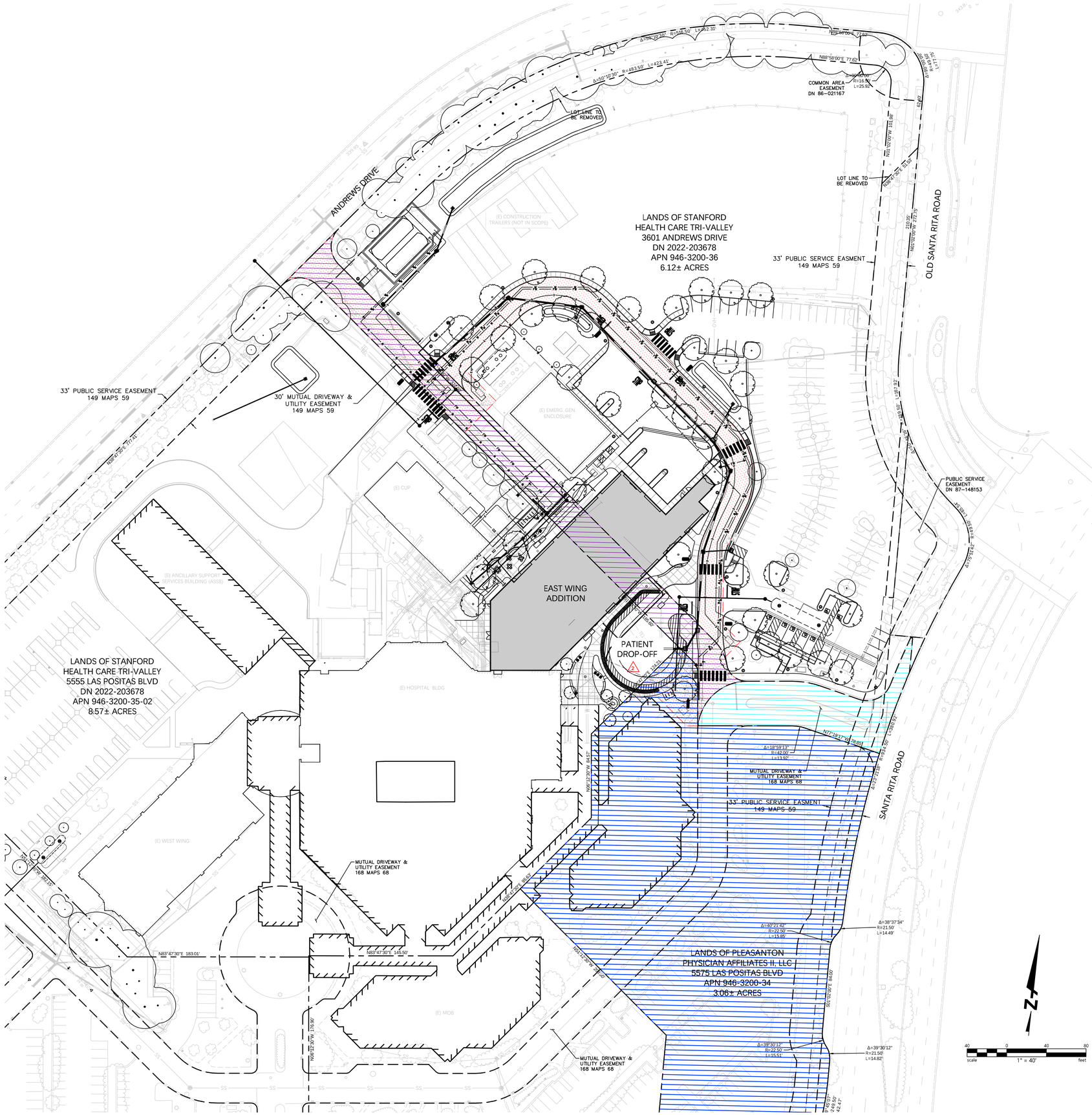
**SHEET NUMBER** **SCALE: SEE PLAN**

# C6.0

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ANDREWS DRIVE
LANDS OF STANFORD
HEALTH CARE TRI-VALLEY
3601 ANDREWS DRIVE
DN 2022-203678
APN 946-3200-36
6.12± ACRES
(E) CONSTRUCTION TRAILERS (NOT IN SCOPE)
(E) EMERG. GEN. ENCLOSURE
(E) CUP
(E) ANCILLARY SUPPORT SERVICES BUILDING (ASSB)
EAST WING ADDITION
PATIENT DROP-OFF
(E) HOSPITAL BLDG
(E) WEST WING
(E) MOB
LANDS OF STANFORD
HEALTH CARE TRI-VALLEY
5555 LAS POSITAS BLVD
DN 2022-203678
APN 946-3200-35-02
8.57± ACRES
LANDS OF PLEASANTON
PHYSICIAN AFFILIATES II, LLC
5575 LAS POSITAS BLVD
APN 946-3200-34
3.06± ACRES
OLD SANTA RITA ROAD
SANTA RITA ROAD
LOT LINE TO BE REMOVED
COMMON AREA EASEMENT DN 86-021167
33' PUBLIC SERVICE EASEMENT 149 MAPS 59
30' MUTUAL DRIVEWAY & UTILITY EASEMENT 149 MAPS 59
MUTUAL DRIVEWAY & UTILITY EASEMENT 168 MAPS 68
PUBLIC SERVICE EASEMENT DN 87-148153
N83°47'30"E 177.41'
N83°47'30"E 183.01'
N83°47'30"E 145.50'
N06°12'30"W 319.90'
N06°12'30"W 84.65'
N06°12'30"W 84.65'
N06°12'30"W 84.65'
N01°05'00"W 101.48'
N01°02'00"W 272.75'
N27°19'21"W 28.85'
S83°47'30"W 145.50'
S06°12'30"E 84.65'
S06°12'30"E 84.65'
S06°12'30"E 84.65

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PROJECT INFORMATION

# STANFORD HEALTH CARE TRI-VALLEY
## East Wing Hospital Addition

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| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/24

## SLOPE CLASSIFICATION

SHEET NUMBER — SCALE: SEE PLAN

# C8.0

# Dryad, LLC

November 22, 2024

Stanford Health Care
Sandra Zajkowska, MS, PMP
Project Manager | Planning, Design & Construction
66 Willow Place, MC 5536
Menlo Park, CA 94025

Contact: Tran Le & Liz Bochner, Sr. Project Managers | Planning, Design & Construction
Site: Stanford Health Care Tri-Valley
Project: SHC Tri-Valley East Wing Addition
Purchase order no.: 1000052827
Project no.: 202514
Work Order no.: WO239003
MA no.: WO239

Ms. Zajkowska, et al;

I am writing in response to your request for a report of my recent inspections, inventory and evaluations of trees on this site, and development of a Tree Protection Plan. This letter comprises my Tree Protection Plan.

I inspected various trees on site on three occasions, and have reviewed related site plans. I tagged, measured (diameter), identified as to genus-species, evaluated, GPS-located and photographed all trees within the immediate construction zone.

The intent of my inspections, document reviews and this report is to assist with your tree protection planning during construction and with your compliance with the requirements of the City of Pleasanton[1].

**SUMMARY:** I identified 64 trees as being located within or adjacent to construction zones. Of these 64 trees, 22 are Heritage trees as defined by the City of Pleasanton[1] and thus require permitting and specific protection measures. I identified 10 trees to remove, due to either existing condition or conflict with construction. Nineteen trees can be retained via implementation of the protective measures described in this report and as required by the City of Pleasanton[1].

I developed appraisal values for the subject trees employing methods developed by the Council of Tree and Landscape Appraisers (CTLA) and described in the publication, Council of Tree and Landscape Appraisers, 2019, *Guide for Plant Appraisal*, Tenth Edition, Second Printing, International Society of Arboriculture. I selected the Cost Approach, Reproduction Method, Trunk Formula Technique as appropriate for the trees of this project. The total value for the 22 Heritage trees is $52,600.00, which is an average value of $2,391.00. Adjusting values not to exceed $5,000.00 per tree, as per the City of Pleasanton[1], leaves a total value for all 22 Heritage Trees of $48,400.00

Some trees less than six inches in diameter have been included in the data table and plans in this report due to their proximity to protected trees. Not all trees on site <6” diameter have been so addressed.

It is my opinion that all of the 19 Heritage Trees planned to be retained, can be preserved with no discernible effect from construction activities by following the recommendations in this report and the requirements of the City of Pleasanton[1].

✦ ✦ ✦

[1] City of Pleasanton Municipal Code, Title 17 Planning and Related Matters, Chapter 17.16 Tree Preservation.


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**TREE PROTECTION REQUIREMENTS OF THE CITY OF PLEASANTON:** The protection measures described in this report are in some cases, lesser or more than the requirements of the City of Pleasanton[1]. Construction plans require encroachment into the dripline areas of some of the subject trees. The tree-protection measures described in this report support an effort to retain as many trees as possible, as requested by the client, within the limitations of required construction. Further, the client may choose not to remove all trees as recommended, or modify construction plans to preserve additional trees.

Excerpted from the City of Pleasanton Municipal Code, Title 17 Planning and Related Matters, Chapter 17.16 Tree Preservation (Revised: July, 2012):

"17.16.070 Protection of existing trees.
All persons shall comply with the following precautions:
A. Prior to the commencement of construction, install a sturdy fence at the dripline of any tree which will be affected by the construction and prohibit any storage of construction materials or other materials inside the fence. The dripline shall not be altered in any way so as to increase the encroachment of the construction.
B. Prohibit excavation, grading, drainage and leveling within the dripline of the tree unless approved by the director.
C. Prohibit disposal or depositing of oil, gasoline, chemicals or other harmful materials within the dripline or in drainage channels, swales or areas that may lead to the dripline.
D. Prohibit the attachment of wires, signs and ropes to any heritage tree.
E. Design utility services and irrigation lines to be located outside of the dripline when feasible.
F. Retain the services of a certified or consulting arborist for periodic monitoring of the project site and the health of those trees to be preserved. The certified or consulting arborist shall be present whenever activities occur which pose a potential threat to the health of the trees to be preserved.
G. The director shall be notified of any damage that occurs to a tree during construction so that proper treatment may be administered. (Ord. 1737 § 1, 1998)"

**TREE PRESERVATION RECOMMENDATIONS:**

1. I recommend that the guidelines in the most current revisions of the following publications be followed as closely as possible, within the limitations of the requirements of the City of Pleasanton[1].
   A. American National Standards Institute*, Tree, Shrub and Woody Plant Management Standard Practices*, *Management of Trees & Shrubs During Site Planning, Site Development and Construction*, American National Standards Institute (ANSI A300 - Part 5) (most current revision).
   B. Kelby Fite and E. Thomas Smiley, 2008, Best Management Practices, *Managing Trees During Construction*, International Society of Arboriculture (or most current revision).
   C. Matheny, Nelda P.; Clark, James R.; 1998. *Trees and Development*, International Society of Arboriculture.
2. Where excavation, grade changes or other encroachment will occur within the designated Tree Protection Zones (TPZ)[3] of the trees, call for arborist inspection and supervision, and follow the recommendations below and the General Construction Site Tree Preservation Guidelines (TPG; page 17) as closely as possible.

**Trees to be removed:**

1. Remove to grade only, where possible and within the TPZ of trees to be retained.
2. Stump grinding within the dripline area of adjacent trees to be retained should not exceed 4-6" below grade and only include the primary body of the stump (i.e., do not chase surface roots).
3. If surface root removal is required within the dripline areas of trees to be retained, only remove by hand[1].

**Trees to be retained:**

1. <u>All trees to be retained</u>:
   A. Irrigation:
      i. Before implementing root pruning or excavation, irrigate the dripline areas of all trees to be retained to wet the soil to near field capacity to a depth of approximately 18 inches.

ii. For any trees root-pruned, maintain the soil moisture at near field capacity within the dripline areas or beyond, throughout construction (avoid saturation).
iii. Continue irrigation to maintain soil moisture (as above) throughout the duration of construction, but adjust to account for rainfall.

B. Root pruning (for excavation):
i. Pre-trench and root prune as described in the TPG.
ii. As it is not possible to determine from which trees the roots originate, handle all encountered roots by following the TPG as closely as possible.
iii. Limited, miscellaneous excavation (outside of the primary trench):
a. When roots are encountered over 1" in diameter, prune cleanly and cover with an absorbent material and keep the material and adjacent soil moist until backfilled (refer to TPG).

C. Tree pruning:
i. Avoid pruning that removes green foliage or live wood immediately before, during, or within 2-3 years after construction.
ii. Prune to remove large deadwood only, or the minimum required for clearance purposes, in accordance with current pruning standards[2].
iii. Achieve all pruning goals by removing the least amount of live tissue as possible,
iv. All pruning must be performed by certified tree personnel and supervised by an ISA Certified Arborist.
v. All pruning work must be performed as per current industry standards[2].

D. Install protective fencing, surrounding each/all trees to be retained, as described below and in the TPG.
i. Fencing shall be 6' chain-link with posts embedded directly into the soil. Portable, concrete footings may be substituted where fencing conflicts with hardscape to remain.
ii. Trees with overlapping canopies can be grouped for fencing purposes (refer to plan Sheet L-001).

E. Mulch: Install organic mulch to a settled depth of 4-6 inches within the protective fencing and throughout the dripline areas surrounding all trees to be retained wherever excavation will not occur. Mulching is not necessary where existing turf is to remain intact, and can later be removed to complete landscape installation, i.e., avoid leaving soil bare.

F. Tree Protection Zone (TPZ; fenced area)[3]:
i. Tree protective fencing should be installed as described in the data table, diagrammed on Sheet L-001, or otherwise, as far from tree trunks as possible up to 1.5 times the longest canopy radius, or 1 ft. per 12" of trunk diameter (DBH).
ii. Do not allow vehicles, equipment, pedestrian traffic, building materials, debris storage, or disposal of phytotoxic materials inside of the fenced-off areas (TPZ).

G. Landscape installation: Applicable to landscape work within the TPZ of any tree to be retained.
i. Remove existing turf, plantlife and landscape components (irrigation, etc.) via hand only.
ii. Do not rototill or otherwise cultivate soil surface.
iii. Planting plants smaller than 5-gal size is preferred.
iv. Excavate for planting and irrigation only by hand.
v. When roots >1" in diameter are encountered, sever cleanly at the edge of the excavation and keep severed roots moist until backfilled.
vi. Do not raise soil grade.
vii. Do not excavate, or otherwise damage tree root crowns within 12" or more of tree trunks.

[2] **Current industry standards:** The most current and applicable publications of 1) B*est Management Practices,* International Society of Arboriculture; 2) American National Standards Institute, A300 and Z133 (all parts).
• 2024: American National Standards Institute, A300 and Z133 (all parts).
• 2024: American National Standards Institute, A300-2023 Tree Care Standards (all parts).
• American National Standards Institute, A300-2023 Tree Care Standards, Part 9, *Management of Trees and Shrubs during Site Development and Construction* (2017).


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2. Trees nos. 17, 18, 27, 28, 45-48, 65-78, 117, 118, 122, 126, 135, 136, 139 & 149-153, 169-171:
   A. Install protective fencing as required by the City of Pleasanton[1] and described and/or modified in this document.
   B. Adjacent trees can be grouped within continuous fencing (as described).
3. Trees nos.: 27, 28, 45-47, 68, 69, 117, 118, 135 & 136:
   A. Perform pre-trenching (selected trees) and root pruning as described (refer to TPG).
   B. Perform root pruning as described in this document, cutting cleanly and keeping severed or exposed roots covered and moist (refer to TPG).

✦ ✦ ✦

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**TREE DATA[3]: SUMMARIES:**

| Description | Quantity | Ratio (all trees) | Comments |
|---|---|---|---|
| Trees included | 64 | 100% | All trees ≥6" diameter (within or about construction zone) |
| Total trees to retain | 43 | 67% | All trees ≥6" diameter |
| Heritage trees | 22 | 34% | As defined by the City of Pleasanton |
| Heritage trees to retain | 19 | 30% | As defined by the City of Pleasanton |
| Heritage trees to remove | 3 | 5% | Requires City of Pleasanton permitting (Tree nos. 140, 141 & 147) |
| Total trees to remove | 21 | 33% | All trees ≥6" diameter |
| Trees not protected | 42 | 66% | As defined by the City of Pleasanton |

| Description | Values | Ratio (Heritage Trees) | Comments |
|---|---|---|---|
| Total of Heritage Tree appraisal values | $52,600 | 100% | Full value; 22 trees; CTLA *Guide for Plant Appraisa*l, 10th Edition, (Second Printing) |
| Heritage Tree values >$5,000.00 | 4 | 9% | Tree nos. 46, 68, 69 & 140. |
| Total adjusted Heritage Tree values | $48,400 | 92% | Tree values limited to $5,000.00/ea. |
| Average value per Heritage Tree | $2,390.91 | N/A | 22 Heritage Trees, averaging of full value. |

**Species distribution:**

| Common name | Quantity | Ratio (all trees) | Genus-species |
|---|---|---|---|
| Brazilian pepper | 9 | 14% | *Schinus terebinthifolia* |
| Callery pear | 1 | 2% | *Pyrus calleryana* |
| Chinese evergreen pear | 1 | 2% | *Pyrus kawakamii* |
| Chinese pistache | 11 | 17% | *Pistachia chinensis* |
| Chitalpa | 4 | 6% | *Chitalpa tashkentensis* |
| Coast redwood | 2 | 3% | *Sequoia sempervirens* |
| Crabapple | 5 | 8% | *Malus* sp. |
| Crepe myrtle | 7 | 11% | *Lagerstroemia indica* |
| Eastern redbud | 1 | 2% | *Cercis canadensis* |
| Evergreen ash | 10 | 16% | *Fraxinus uhdeii* |
| London plane | 10 | 16% | *Platanus x hispanica* |
| Raywood ash | 1 | 2% | *Fraxinus angustifolia 'Raywood'* |
| Sweetgum | 2 | 3% | *Liquidambar styraciflua* |

[3] References the data table beginning on page 7.


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| Management Category | Quantity | Ratio (all trees) | Description |
|---|---|---|---|
| 1 | 43 | 67% | Preserve, condition & location warrant long-term preservation. |
| 2 | 11 | 17% | Preservable, but existing condition does not warrant extensive protection measures. |
| 3 | 2 | 3% | Remove due to existing condition (#137 & 155). |
| 4 | 8 | 13% | Remove due to conflict with construction (#42-44, 133, 140, 141, 147 & 148) |



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## TREE INVENTORY, DATA, EVALUATIONS AND PROTECTION RECOMMENDATIONS:

| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins.) | Height (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Observations | Appraisal value | Tree Protection Recommendations (overview) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem 1 (DBH) | Stem 1 (Cir.) | Stem 2 (DBH) | Stem 2 (Cir.) | Total (Cir.) | | | N | E | S | W | | | | | | | |
| 17 | Crepe myrtle | *Lagerstroemia indica* | 8.0 | 25.0 | | 0.0 | 25.0 | 8.0 | 38 | 15 | 5 | 15 | 16 | Yes | No | 1 | Retain | Overpruned (raised & thinned)<br>Canopy of good color & density | $3,000 | Install protective fencing to S at sidewalk, and E-running continuously N at edge of driplines (#169-171) and the edge of the construction zone. |
| 18 | London plane | *Platanus* x *hispanica* | 10.0 | 31.5 | | 0.0 | 31.5 | 10.0 | 30 | 12 | 16 | 17 | 10 | No | No | 1 | Retain | Overpruned (raised & thinned)<br>Canopy of good color & density | $0 | Install protective fencing on 3 sides, W & along sidewalks to N & S. |
| 27 | Evergreen ash | *Fraxinus uhdeii* | 15.5 | 48.5 | | 0.0 | 48.5 | 15.5 | 40 | 3 | 14 | 21 | 20 | Yes | Yes | 1 | Retain | Overpruned (raised & thinned)<br>Poor structure & architecture<br>Canopy of good color<br>Limited rooting space (conflicts inevitable) | $2,400 | Install protective fencing surrounding (at curb to west) 2 trees.<br>Prune roots as described along the trench adjacent to the TPZ. |
| 28 | Evergreen ash | *Fraxinus uhdeii* | 19.5 | 61.5 | | 0.0 | 61.5 | 19.5 | 43 | 21 | 21 | 21 | 20 | Yes | Yes | 1 | Retain | Poor structure & architecture<br>Canopy of good color | $2,700 | |
| 42 | Crabapple | *Malus* sp. | 7.5 | 23.5 | | 0.0 | 23.5 | 7.5 | 13 | 10 | 13 | 14 | 10 | No | No | 4 | Remove | Crowded, overgrown by adjacent trees<br>Poor structure<br>Foliage of good color & density | $0 | N/A |
| 43 | Crabapple | *Malus* sp. | 7.0 | 22.0 | | 0.0 | 22.0 | 7.0 | 15 | 15 | 6 | 7 | 7 | No | No | 4 | Remove | 15º lean<br>Poor structure & architecture<br>Foliage of good color & density | $0 | N/A |
| 44 | Crabapple | *Malus* sp. | 7.5 | 23.5 | | 0.0 | 23.5 | 7.5 | 12 | 12 | 14 | 13 | 6 | No | No | 4 | Remove | Sound structure & architecture<br>Foliage of good color & density | $0 | N/A |
| 45 | Crabapple | *Malus* sp. | 9.0 | 28.5 | | 0.0 | 28.5 | 9.0 | 13 | 16 | 5 | 5 | 11 | No | No | 1 | Retain | Sound structure & architecture<br>Foliage of good color & density | $0 | Install protective fencing surrounding (at curb to north) 3 trees.<br>Prune roots as described along the trench adjacent to the TPZ. |
| 46 | Brazilian pepper | *Schinus terebinthifolia* | 20.0 | 63.0 | | 0.0 | 63.0 | 20.0 | 27 | 19 | 18 | 14 | 13 | Yes | No | 1 | Retain | Sound structure & architecture<br>Foliage of good color & density | $8,000 | |
| 47 | Brazilian pepper | *Schinus terebinthifolia* | 13.5 | 42.5 | | 0.0 | 42.5 | 13.5 | 21 | 13 | 10 | 12 | 8 | No | No | 1 | Retain | Minor structural weaknesses, good architecture<br>Foliage of good color & density | $0 | |



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| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins.) | Height (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Observations | Appraisal value | Tree Protection Recommendations (overview) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem 1 (DBH) | Stem 1 (Cir.) | Stem 2 (DBH) | Stem 2 (Cir.) | Total (Cir.) | | | N | E | S | W | | | | | | | |
| 48 | Evergreen ash | *Fraxinus uhdeii* | 16.5 | 52.0 | | 0.0 | 52.0 | 16.5 | 46 | 24 | 5 | 25 | 24 | Yes | No | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Root crown issues at graft<br>Foliage of good color & density | $2,500 | No construction impact anticipated. |
| 53 | Evergreen ash | *Fraxinus uhdeii* | 12.5 | 39.5 | | 0.0 | 39.5 | 12.5 | 40 | 16 | 11 | 10 | 16 | Yes | Yes | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Root crown issues at graft<br>Foliage of good color & density<br>Limited rooting space (conflicts inevitable) | $2,300 | No construction impact anticipated. |
| 65 | Crabapple | *Malus* sp. | 9.0 | 28.5 | | 0.0 | 28.5 | 9.0 | 15 | 11 | 9 | 7 | 13 | No | No | 1 | Retain | Weak structure<br>Foliage of good color & density | $0 | Construction zone fencing to the E shall comply with tree fencing requirements and serve as tree protection fencing.<br>(No construction impact anticipated.) |
| 66 | Crabapple | *Malus* sp. | 7.0 | 22.0 | | 0.0 | 22.0 | 7.0 | 11 | 13 | 9 | 10 | 10 | No | No | 1 | Retain | Overpruned<br>Poor structure & architecture<br>Foliage of good color & density | $0 | |
| 67 | Crabapple | *Malus* sp. | 5.0 | 15.5 | | 0.0 | 15.5 | 5.0 | 10 | 3 | 6 | 9 | 12 | No | No | 1 | Retain | Overpruned<br>15º lean<br>Poor structure & architecture<br>Foliage of good color & density | $0 | |
| 68 | Evergreen ash | *Fraxinus uhdeii* | 19.0 | 59.5 | | 0.0 | 59.5 | 19.0 | 58 | 23 | 27 | 24 | 17 | Yes | No | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Foliage of good color & density | $5,400 | Construction zone fencing to the E shall comply with tree fencing requirements and serve as tree protection fencing.<br>If excavation is to occur, pre-trench and prune roots along the TPZ edge to the E. |
| 69 | Evergreen ash | *Fraxinus uhdeii* | 18.0 | 56.5 | | 0.0 | 56.5 | 18.0 | 58 | 9 | 25 | 24 | 22 | Yes | No | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Foliage of good color & density | $5,100 | |
| 70 | Evergreen ash | *Fraxinus uhdeii* | 16.0 | 50.5 | | 0.0 | 50.5 | 16.0 | 60 | 19 | 19 | 11 | 23 | Yes | No | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Foliage of good color & density | $4,400 | Construction zone fencing to the E shall comply with tree fencing requirements and serve as tree protection fencing. |
| 71 | Evergreen ash | *Fraxinus uhdeii* | 15.5 | 48.5 | | 0.0 | 48.5 | 15.5 | 45 | 10 | 30 | 15 | 21 | Yes | No | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Foliage of good color & density | N/A | |
| 72 | Evergreen ash | *Fraxinus uhdeii* | 18.0 | 56.5 | | 0.0 | 56.5 | 18.0 | 46 | 19 | 25 | 20 | 23 | Yes | No | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Foliage of good color & density | N/A | |



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| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins.) | Height (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Observations | Appraisal value | Tree Protection Recommendations (overview) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem 1 (DBH) | Stem 1 (Cir.) | Stem 2 (DBH) | Stem 2 (Cir.) | Total (Cir.) | | | N | E | S | W | | | | | | | |
| 73 | Coast redwood | *Sequoia sempervirens* | 22.0 | 69.0 | | 0.0 | 69.0 | 22.0 | 48 | 10 | 12 | 12 | 11 | Yes | No | 1 | Retain | Overpruned (raised)<br>Foliage of good color & density | N/A | |
| 74 | Coast redwood | *Sequoia sempervirens* | 19.5 | 61.5 | | 0.0 | 61.5 | 19.5 | 42 | 10 | 10 | 11 | 12 | Yes | No | 1 | Retain | Overpruned (raised)<br>Foliage of good color & density | N/A | |
| 75 | Coast redwood | *Sequoia sempervirens* | 20.0 | 63.0 | | 0.0 | 63.0 | 20.0 | 43 | 10 | 12 | 6 | 10 | Yes | No | 1 | Retain | Overpruned (raised)<br>Foliage of good color & density | N/A | |
| 76 | Coast redwood | *Sequoia sempervirens* | 21.0 | 66.0 | | 0.0 | 66.0 | 21.0 | 40 | 12 | 11 | 12 | 10 | Yes | No | 1 | Retain | Overpruned (raised)<br>Foliage of good color & density | N/A | |
| 77 | Coast redwood | *Sequoia sempervirens* | 19.5 | 61.5 | | 0.0 | 61.5 | 19.5 | 40 | 13 | 13 | 13 | 13 | Yes | No | 1 | Retain | Overpruned (raised)<br>Foliage of good color & density | N/A | |
| 78 | Evergreen ash | *Fraxinus uhdeii* | 24.0 | 75.5 | | 0.0 | 75.5 | 24.0 | 51 | 16 | 24 | 33 | 25 | Yes | No | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Foliage of good color & density | N/A | |
| 116 | Eastern redbud | *Cercis canadensis* | 11.0 | 34.5 | | 0.0 | 50.0 | 16.0 | 21 | 20 | 16 | 12 | 10 | No | No | 2 | Remove | 15° lean<br>Significant tip & branch dieback<br>Thin, declining canopy<br>Major surface rooting in turf | $0 | N/A |
| 117 | Chinese pistache | *Pistachia chinensis* | 5.5 | 17.5 | | 0.0 | 50.0 | 16.0 | 21 | 20 | 16 | 12 | 10 | No | No | 1 | Retain | Foliage of good color & density<br>Poor trunk taper | $0 | Install protective fencing completely surrounding these 2 trees.<br>Pre-trench and prune roots at all edges of the TPZ. |
| 118 | Chinese pistache | *Pistachia chinensis* | 8.0 | 25.0 | | 0.0 | 50.0 | 16.0 | 21 | 20 | 16 | 12 | 10 | No | No | 1 | Retain | Foliage of good color & density | $0 | |
| 120 | Eastern redbud | *Cercis canadensis* | 6.0 | 19.0 | | 0.0 | 19.0 | 6.0 | 19 | 8 | 10 | 10 | 10 | No | No | 1 | Remove | Poor trunk taper<br>Foliage of good color & density<br>Restricted rooting area | $0 | N/A |
| 121 | Eastern redbud | *Cercis canadensis* | 6.0 | 19.0 | | 0.0 | 19.0 | 6.0 | 19 | 10 | 10 | 8 | 10 | No | No | 1 | Remove | Poor trunk taper<br>Foliage of good color & density<br>Restricted rooting area | $0 | N/A |
| 122 | Chinese pistache | *Pistachia chinensis* | 8.0 | 25.0 | | 0.0 | 25.0 | 8.0 | 24 | 10 | 13 | 14 | 11 | No | No | 1 | Retain | Foliage of good color & density<br>Restricted rooting area | $0 | Install protective fencing at the edge of the construction zone, S of these 2 trees. |
| 126 | Chinese pistache | *Pistachia chinensis* | 7.0 | 22.0 | | 0.0 | 22.0 | 7.0 | 17 | 10 | 12 | 10 | 8 | No | No | 1 | Retain | Foliage of good color & density<br>Restricted rooting area | $0 | |



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| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins.) | Height (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Observations | Appraisal value | Tree Protection Recommendations (overview) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem 1 (DBH) | Stem 1 (Cir.) | Stem 2 (DBH) | Stem 2 (Cir.) | Total (Cir.) | | | N | E | S | W | | | | | | | |
| 133 | Eastern redbud | *Cercis canadensis* | 14.0 | 44.0 | | 0.0 | 44.0 | 14.0 | 22 | 16 | 16 | 18 | 16 | No | No | 4 | Remove | Some tip dieback<br>Foliage of good color & density | $0 | N/A |
| 135 | Eastern redbud | *Cercis canadensis* | 8.0 | 25.0 | | 0.0 | 25.0 | 8.0 | 22 | 11 | 15 | 6 | 6 | No | No | 1 | Retain | 10º lean<br>Poor structure & architecture<br>String trimmer damage to root crown<br>Foliage of good color & density | $0 | Install protective fencing surrounding the tree immediately adjacent to existing curb.<br>If curb demo will occur, pre-trench and prune roots along all edges of the TPZ (new curb line). |
| 136 | Eastern redbud | *Cercis canadensis* | 10.5 | 33.0 | | 0.0 | 33.0 | 10.5 | 23 | 10 | 15 | 8 | 13 | No | No | 1 | Retain | Some tip & branch dieback<br>Poor structure<br>Foliage of good color & density | $0 | Install protective fencing surrounding the tree immediately adjacent to existing curb to the E, & just within the new curb to the W.<br>Pre-trench and prune roots at the west edge of the TPZ. |
| 137 | Eastern redbud | *Cercis canadensis* | 6.5 | 20.5 | | 0.0 | 20.5 | 6.5 | 16 | 6 | 10 | 8 | 6 | No | No | 3 | Remove | Very poor structure & architecture<br>Exposed column of trunk decay<br>Root crown decayed | $0 | N/A |
| 139 | Sweetgum | *Liquidambar styraciflua* | 11.0 | 34.5 | | 0.0 | 34.5 | 11.0 | 54 | 15 | 6 | 10 | 20 | Yes | No | 2 | Retain | Overpruned (raised & thinned)<br>Poor architecture<br>Poor trunk taper<br>Foliage of good color & density | $3,100 | Install protective fencing on 3 sides. |
| 140 | Chinese evergreen pear | *Pyrus kawakamii* | 11.0 | 34.5 | 8.5 | 26.5 | 61.0 | 19.5 | 24 | 13 | 15 | 15 | 15 | Yes | No | 4 | Remove | Multiple codominant stems<br>Leaf spot infection (minor)<br>Some tip dieback<br>Canopy of good color and density (3 stems, 7.5-11" DBH) | $5,700 | N/A |
| 141 | Sweetgum | *Liquidambar styraciflua* | 10.0 | 31.5 | | 0.0 | 31.5 | 10.0 | 41 | 12 | 12 | 15 | 13 | Yes | No | 4 | Remove | Overpruned (raised & thinned)<br>Poor architecture<br>Surrounded with compacted soil, excess over root crown<br>Foliage of good color & density | $2,500 | N/A |
| 146 | Brazilian pepper | *Schinus terebinthifolia* | 14.0 | 44.0 | | 0.0 | 44.0 | 14.0 | 18 | 16 | 10 | 15 | 6 | No | No | 2 | Remove | Overpruned (thinned, raised)<br>Poor structure & architecture<br>Restricted rooting space | $0 | N/A |



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| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins.) | Height (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Observations | Appraisal value | Tree Protection Recommendations (overview) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem 1 (DBH) | Stem 1 (Cir.) | Stem 2 (DBH) | Stem 2 (Cir.) | Total (Cir.) | | | N | E | S | W | | | | | | | |
| 147 | Brazilian pepper | *Schinus terebinthifolia* | 23.5 | 74.0 | | 0.0 | 74.0 | 23.5 | 36 | 20 | 17 | 20 | 17 | Yes | No | 4 | Remove | 15º lean<br>Overpruned (thinned, raised)<br>Poor structure & architecture<br>Thin, declining+S158 canopy<br>Restricted rooting space | $2,900 | N/A |
| 148 | Callery pear | *Pyrus calleryana* | 16.0 | 50.5 | | 0.0 | 50.5 | 16.0 | 30 | 20 | 18 | 20 | 15 | No | No | 4 | Remove | Overpruned (thinned, raised)<br>Poor structure & architecture<br>Restricted rooting space<br>Foliage of good color & density | $0 | N/A |
| 149 | Brazilian pepper | *Schinus terebinthifolia* | 17.5 | 55.0 | | 0.0 | 55.0 | 17.5 | 13 | 12 | 13 | 12 | 12 | Yes | No | 1 | Retain | Severely pruned (topped, raised)<br>Poor structure & architecture<br>Restricted rooting space<br>Foliage of good color & density | $2,600 | Install protective fencing immediately adjacent to existing curbs and completely surround the stand of 5 trees. |
| 150 | Brazilian pepper | *Schinus terebinthifolia* | 11.5 | 36.0 | | 0.0 | 36.0 | 11.5 | 19 | 12 | 18 | 13 | 12 | No | No | 1 | Retain | 10º lean<br>Severely pruned (topped, raised)<br>Poor structure & architecture<br>Restricted rooting space<br>Foliage of good color & density | $0 | |
| 151 | Brazilian pepper | *Schinus terebinthifolia* | 13.0 | 41.0 | | 0.0 | 41.0 | 13.0 | 21 | 12 | 11 | 12 | 12 | No | No | 1 | Retain | Severely pruned (topped, raised)<br>Poor structure & architecture<br>Restricted rooting space<br>Foliage of good color & density | $0 | |
| 152 | Brazilian pepper | *Schinus terebinthifolia* | 6.0 | 19.0 | | 0.0 | 19.0 | 6.0 | 11 | 5 | 7 | 7 | 7 | No | No | 1 | Retain | 10º lean<br>Severely pruned (topped, raised)<br>Poor structure & architecture<br>Poor trunk taper<br>Restricted rooting space<br>Foliage of good color & density | $0 | |

| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins.) | Height (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Observations | Appraisal value | Tree Protection Recommendations (overview) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem 1 (DBH) | Stem 1 (Cir.) | Stem 2 (DBH) | Stem 2 (Cir.) | Total (Cir.) | | | N | E | S | W | | | | | | | |
| 153 | Brazilian pepper | *Schinus terebinthifolia* | 15.0 | 47.0 | | 0.0 | 47.0 | 15.0 | 20 | 11 | 14 | 7 | 9 | No | No | 1 | Retain | 10º lean<br>Severely pruned (topped, raised)<br>Poor structure & architecture<br>Restricted rooting space<br>Foliage of good color & density | $0 | |
| 154 | Chinese pistache | *Pistachia chinensis* | 3.0 | 9.5 | | 0.0 | 9.5 | 3.0 | 17 | 5 | 5 | 8 | 4 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A | N/A |
| 155 | Raywood ash | *Fraxinus angustifolia 'Raywood'* | 2.0 | 6.5 | | 0.0 | 6.5 | 2.0 | 14 | 2 | 3 | 3 | 3 | No | No | 3 | Remove | Dead | N/A | N/A |
| 156 | Chinese pistache | *Pistachia chinensis* | 3.0 | 9.5 | | 0.0 | 9.5 | 3.0 | 16 | 5 | 6 | 5 | 5 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A | N/A |
| 157 | Eastern redbud | *Cercis canadensis* | 1.0 | 3.0 | | 0.0 | 3.0 | 1.0 | 14 | 5 | 6 | 6 | 4 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A | N/A |
| 158 | Chinese pistache | *Pistachia chinensis* | 2.5 | 8.0 | | 0.0 | 8.0 | 2.5 | 16 | 7 | 5 | 6 | 3 | No | No | 1 | Retain | Foliage of good color & density<br>Good structure & architecture | N/A | N/A |
| 159 | Eastern redbud | *Cercis canadensis* | 2.0 | 6.5 | | 0.0 | 6.5 | 2.0 | 14 | 7 | 6 | 6 | 6 | No | No | 1 | Retain | Foliage of good color & density<br>Good structure & architecture | N/A | N/A |
| 160 | Chinese pistache | *Pistachia chinensis* | 3.0 | 9.5 | | 0.0 | 9.5 | 3.0 | 16 | 4 | 7 | 10 | 8 | No | No | 1 | Retain | Foliage of good color & density<br>Good structure & architecture | N/A | Not protected and not anticipated to be effected by current construction. |
| 161 | Eastern redbud | *Cercis canadensis* | 1.5 | 4.5 | | 0.0 | 4.5 | 1.5 | 14 | 5 | 5 | 5 | 6 | No | No | 1 | Retain | Foliage of good color & density<br>Good structure & architecture | N/A | Not protected and not anticipated to be effected by current construction. |
| 162 | Chinese pistache | *Pistachia chinensis* | 2.5 | 8.0 | | 0.0 | 8.0 | 2.5 | 17 | 8 | 6 | 5 | 5 | No | No | 1 | Retain | Foliage of good color & density<br>Good structure & architecture | N/A | Not protected and not anticipated to be effected by current construction. |
| 163 | Chitalpa | *Chitalpa tashkentensis* | 2.0 | 6.5 | | 0.0 | 6.5 | 2.0 | 12 | 3 | 6 | 3 | 5 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A | N/A |
| 164 | Chinese pistache | *Pistachia chinensis* | 3.0 | 9.5 | | 0.0 | 9.5 | 3.0 | 17 | 6 | 5 | 5 | 3 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A | N/A |
| 165 | Chitalpa | Chitalpa tashkentensis | 2.0 | 6.5 | | 0.0 | 6.5 | 2.0 | 15 | 4 | 5 | 8 | 7 | No | No | 1 | Remove | Foliage of good color but thin canopy<br>Good structure & architecture | N/A | N/A |



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| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins.) | Height (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Observations | Appraisal value | Tree Protection Recommendations (overview) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem 1 (DBH) | Stem 1 (Cir.) | Stem 2 (DBH) | Stem 2 (Cir.) | Total (Cir.) | | | N | E | S | W | | | | | | | |
| 166 | Chinese pistache | *Pistachia chinensis* | 3.0 | 9.5 | | 0.0 | 9.5 | 3.0 | 16 | 5 | 3 | 6 | 6 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A | N/A |
| 169 | London plane | *Platanus x hispanica* | 6.5 | 20.5 | | 0.0 | 20.5 | 6.5 | 26 | 11 | 10 | 10 | 7 | No | No | 1 | Retain | Foliage of good color & density<br>Good structure & architecture | N/A | Install protective fencing to E, continuous from #18, at the edge of driplines (#169-171) and just W of the construction zone. |
| 170 | London plane | *Platanus x hispanica* | 9.0 | 28.5 | | 0.0 | 28.5 | 9.0 | 27 | 12 | 6 | 8 | 12 | No | No | 1 | Retain | 15º lean to N<br>Foliage of good color & density<br>Good structure & architecture | N/A | |
| 171 | London plane | *Platanus x hispanica* | 8.5 | 26.5 | | 0.0 | 26.5 | 8.5 | 32 | 9 | 14 | 12 | 12 | No | No | 1 | Retain | Foliage of good color & density<br>Good structure & architecture | N/A | |

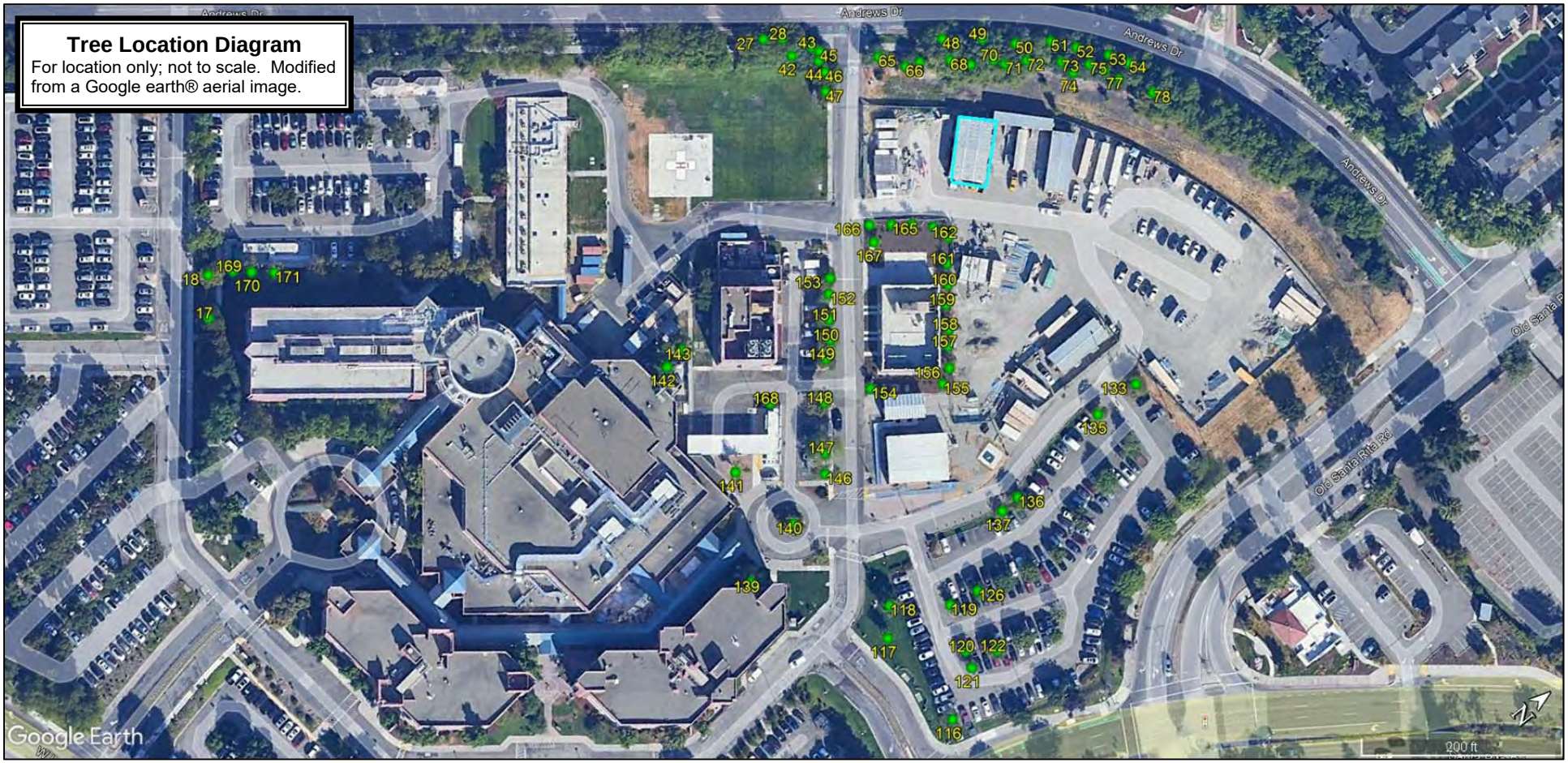
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Note: This aerial image includes some trees that are <6" in diameter and not protected by the City of Pleasanton. Not all such trees may be included in the inventory table or related calculations. A few tree numbers may not be visible due to formatting limitations.



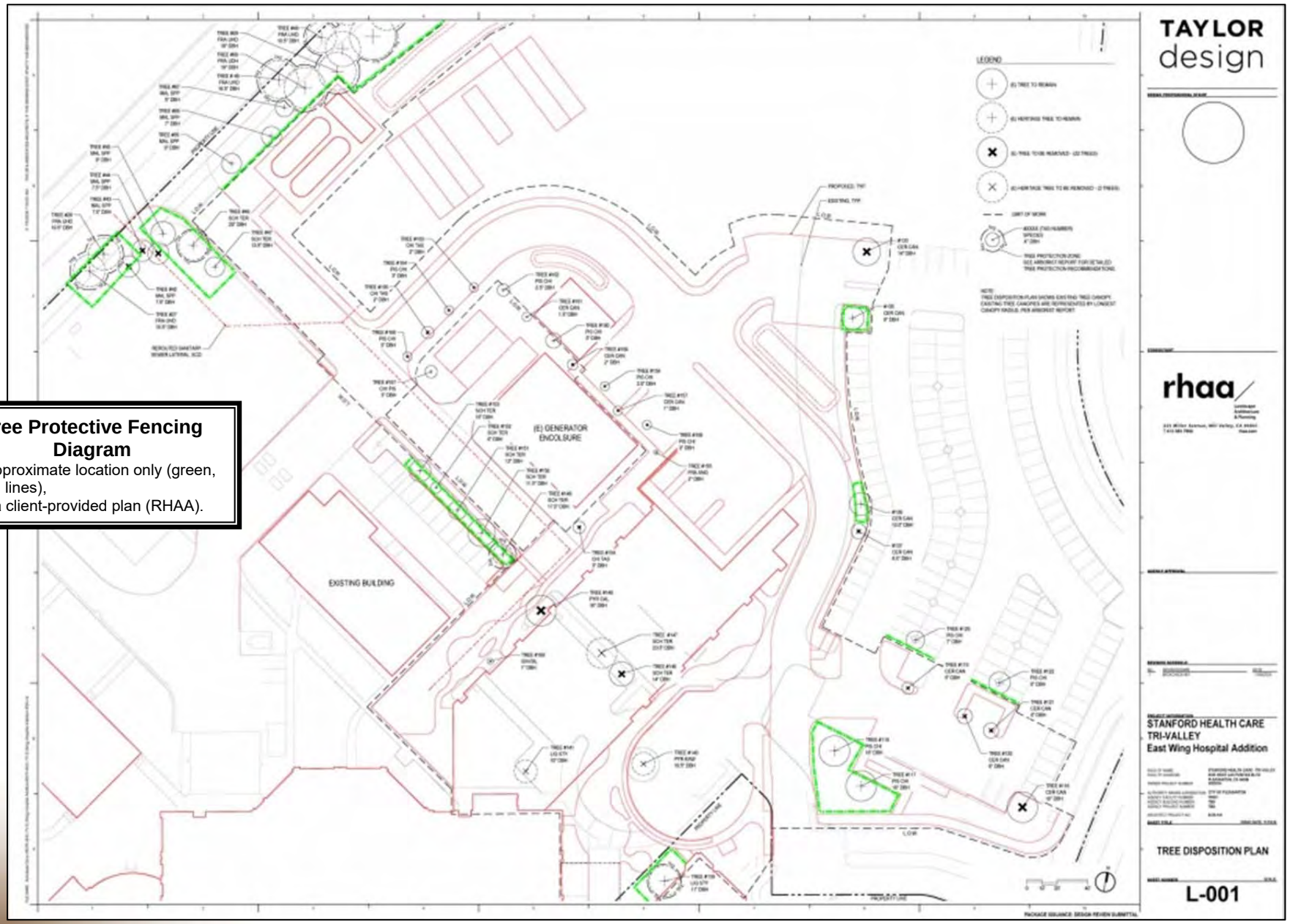

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**Tree Protective Fencing Diagram**

For approximate location only (green, dotted lines),
from a client-provided plan (RHAA).



**Tree Protective Fencing Diagram**
For approximate location only (green, dotted lines),
from a client-provided plan (RHAA).






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## GENERAL CONSTRUCTION SITE TREE PRESERVATION GUIDELINES[4]

(Not site or entity-specific, nor explicitly required by the City of Pleasanton[1])

1. **Tree Protection Zone[3]:**
   a. The Tree Protection Zone (TPZ) should consist of the largest possible area surrounding trees to be preserved that can remain undisturbed. Ideally, an area of 1.5 times the longest dripline radius (measured from the trunk). Alternatively, follow the TPZ guidelines as described in the most recent version of current industry standards and best management practices publications[4]. The TPZ can be continuous for trees with overlapping driplines.
   b. Surround the TPZ with protective fencing.
      i. Fencing should consist of chain link, at least 6 feet in height, surrounding the perimeter of the TPZ designated distance or beyond.
      ii. Anchor fence posts into the soil (i.e., do not use portable footings).
      iii. Protective fencing should remain in place until all grading and construction is complete.
   c. Do not allow vehicles, equipment, pedestrian traffic, building materials, debris storage, or disposal of phytotoxic[5] materials inside of the fenced-off areas (TPZ).
2. **Mulching[6] and irrigation:**
   a. Soil moisture:
      i. Determine the status of soil moisture to a depth of 18-24” below grade within the dripline of all (each) trees to be preserved, via tensiometer, granular matrix sensor or manual soil probing.
      ii. Irrigate as/if necessary, via slow-application (drip) irrigation, to achieve approximately field capacity[7] to a depth of 12-18”.
   b. Mulch: Cover exposed soil within all TPZ's with an organic mulch to a settled depth of no less than 3-4 inches.
3. **Excavation, root pruning & repair:**
   a. Excavation and root pruning should be performed by a Tree Worker currently certified by the International Society of Arboriculture (ISA). Excavation and root pruning should be directly supervised by an arborist currently credentialed as at least one of the following:
      i. Certified Arborist by the ISA,
      ii. Board Certified Master Arborist by the ISA,
      iii. Registered Consulting Arborist by the American Society of Consulting Arborists (ASCA).
   b. Determine and mark (marking paint and stakes) the outside edge (towards trees) of required excavation, and adjacent to/surrounding any excavations within an area 1.5 times the dripline radius of trees to be preserved (or as large an area as feasible).
   c. Excavate a trench approximately 6-12" beyond the area to be disturbed (towards tree), or where roots have been damaged, to a depth of at least 18”, by hand excavation[8] or with specialized hydraulic[9] or pneumatic[10] equipment.
      i. Wherever possible, relocate excavations or tunnel beneath encountered roots >1” in diameter.
      ii. Cut encountered roots cleanly with hand pruners or power saw. Avoid tearing, dislodging of bark (or epidermis) or otherwise disturbing that portion of the root(s) to remain.
      iii. Immediately backfill with soil to cover, and moisten.
      iv. If backfilling cannot be completed immediately, cover exposed roots with several layers of untreated burlap (or other similar absorbent material) or sand, mulch, or soil and keep moist until permanent backfilling can be completed.
   c. Future excavations within the TPZ:
      i. If possible, relocate any future excavations (irrigation, landscape features, etc.) outside the TPZ and perimeter of previously pruned roots.
      ii. If encroachment is required within the TPZ, endeavor to avoid pruning roots by tunneling beneath.
      iii. If relocation or tunneling is not possible, handle any required root pruning as previously described.
4. **Tree care and maintenance work:** (pruning, cabling/bracing[11], root pruning, etc.)
   a. All tree care or maintenance work:
      i. All tree care work should be performed by a Tree Worker currently certified by the International Society of Arboriculture (ISA) or a current ISA Certified Arborist.

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ii. All tree care work should be directly supervised by an arborist currently credentialed as at least one of the following:
(1) Certified Arborist by the ISA,
(2) Board Certified Master Arborist by the ISA,
(3) Registered Consulting Arborist by the American Society of Consulting Arborists (ASCA).

b. All tree care or maintenance work should be performed in accordance with current industry standards[12].

c. Tree pruning:
i. Avoid pruning that removes green foliage or live wood immediately before, during or within 2-3 years after construction.
ii. Prune to remove large deadwood only, or the minimum required for clearance purposes, in accordance with current pruning standards[13].

5. **Post-construction:**
a. Avoid pruning that removes live foliage for several years after construction. Perform only that pruning that is necessary for clearance purposes.
b. Arrange for periodic (biannual) inspection of the condition of the trees by a competent Consulting Arborist, and treatment of damaging conditions (insects, diseases, nutrient deficiencies, soil moisture, etc.), as they occur, or as deemed appropriate by the consultant for effective management.

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Please feel free to contact me for further discussion.

Respectfully,

Torrey Young
Registered Consulting Arborist®

ASCA Registered Consulting Arborist, no. 282
ISA Board Certified Master Arborist, no. WE-0131BM
ISA Certified Urban Forest Professional, no. WE-0131BM
CUFC Certified Urban Forester, no. 121
ISA Tree Risk Assessment Qualified
ASCA Tree & Plant Appraisal Qualified
CA P.C. Qualified License, no. 104772
CA Contractors License no. 363372 (C-27 & D-49; inactive)




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## ENDNOTES:

[1] Hand excavation: Manual soil excavation via the use of hand tools only. Use of hand tools for initial excavation should be avoided. Hand tools shall not be used in a manner that results in breakage of roots, bark penetration or separation of bark from roots. Hand tool use should be limited to small tools (e.g., spade, trowel) for minor excavations or in restricted spaces. Picks, mattocks, digging bars or similar implements requiring striking the earth shall not be used for excavation. Hand shovels may be used for minor excavations, or where access is limited for vacuum equipment, or hydraulic slurry cannot be flushed out of the excavation. Such usage shall not result in breakage of roots, bark penetration or separation of bark from roots.

[2] Pruning standards: The following standards were developed by a consensus of representatives from various industry professional organizations; ✦ American National Standards Institute, *Standard Practices for Tree, Shrub and other Woody Plant Maintenance (Pruning)*, American National Standards Institute (ANSI A300 Part 1-current revision) ✦ International Society of Arboriculture, *Best Management Practices, Tree Pruning,* International Society of Arboriculture (current revision) ✦

[3] Tree Protection Zone: (TPZ) a delineated area of the rooting zone of a tree or group of trees to be protected from encroachment by construction activities. Such activities may include excavation or grading, vehicle, equipment and pedestrian traffic; storage of vehicles, building materials, soil or debris; or disposal of phytotoxic materials.

[4] American National Standards Institute, 2012. *Standard Practices for Tree Care Operations - Management of Trees and Shrubs During Site Planning, Site Development and Construction* (ANSI A300, Part 5, current revision); International Society of Arboriculture, Best Management Practices, *Managing Trees During Site Planning, Site Development and Construction* (current revision).

[5] Phytotoxic: (phytotoxin) any substance or material capable of killing plant cells, parts, plants in their entirety.

[6] Mulch: Organic materials (e.g., brush chips, fir bark) spread upon the soil for a variety of benefits: aesthetics, retains soil moisture, moderates soil temperatures, improves soil structure and increases fertility, protects against compaction, suppresses weeds, etc. (Note: Elsewhere, definition may include non-organic materials.)

[7] Field capacity: The maximum volume of moisture a soil can hold after drainage has occurred. An expression of the water-holding capacity and moisture status of soils.

[8] Hand excavation: Manual soil excavation via the use of hand tools only. Use of hand tools for initial excavation should be avoided. Hand tools shall not be used in a manner that results in breakage of roots, bark penetration or separation of bark from roots. Hand tool use should be limited to small tools (e.g., spade, trowel) for minor excavations or in restricted spaces. Picks, mattocks, digging bars or similar implements requiring striking the earth shall not be used for excavation. Hand shovels may be used for minor excavations, or where access is limited for vacuum equipment, or hydraulic slurry cannot be flushed out of the excavation. Such usage shall not result in breakage of roots, bark penetration or separation of bark from roots.

[9] Hydraulic excavation: Soil excavation performed using pressurized, focused water via 1) pressure washer, portable fire pump, or similar equipment or 2) hydraulic truck-mounted equipment (Hydra-vac). Equipment should be used at the minimum pressure required to remove the soil from around roots and out of the resulting excavation void, without causing breakage of roots, bark penetration or separation of bark from roots.

[10] Pneumatic excavation: Soil excavation performed via supersonic compressed air excavation with a tool called an air spade. This tool removes soil from roots (or pipes, wires, etc.) with little or no damage to the roots (or utilities). Soil is separated and blown away via highly focused, supersonic velocity compressed air, which separates the soil particles without penetrating roots.

[11] Cabling & Bracing: The installation of hardware in and/or about trees for the purpose of providing supplemental support of weak, defective or otherwise suspect limbs and/or stems; supporting of newly planted trees; bracing cracks; propping trees or limbs, or otherwise providing support. The installation of cables, bolts and other hardware in trees is intended to reduce the potential for failure (breakage/uprooting). Such bracing does not permanently remedy structural weaknesses, and is not a guarantee against failure. The trees and hardware must be inspected periodically for hardware deterioration, adequacy and changes in the tree's and site condition.

[12] Current industry standards: The most current and applicable publications of 1) B*est Management Practices,* International Society of Arboriculture; 2) American National Standards Institute, A300 and Z133 (all parts).

[13] Pruning standards: The following standards were developed by a consensus of representatives from various industry professional organizations; ✦ American National Standards Institute, *Standard Practices for Tree, Shrub and other Woody Plant Maintenance (Pruning)*, American National Standards Institute (ANSI A300 Part 1-current revision) ✦ International Society of Arboriculture, *Best Management Practices, Tree Pruning,* International Society of Arboriculture (current revision) ✦

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# Dryad, LLC

RECEIVED
03.25.25
P24-0532
CITY OF PLEASANTON
PLANNING DIVISION
EXHIBIT B

March 14, 2025
Stanford Health Care
Sandra Zajkowska, MS, PMP
Project Manager | Planning, Design & Construction
66 Willow Place, MC 5536
Menlo Park, CA 94025

Re.: Addendum to Dryad, LLC report dated 11/22/2024, adding appraisals for 34 trees.

Contact: Tran Le, Sr. Project Manager | Planning, Design & Construction
Site: Standard Health Care Tri-Valley
Project: SHC Tri-Valley East Wing Addition
Purchase order no.: 1000052827
Project no.: 202514
Work Order no.: WO239003
MA no.: WO239

Ms. Zajkowska, et al;

I am writing in response to your request to comply with a requirement from the City of Pleasanton to provide appraisals for all trees affected by construction on the site, including those that don't qualify as Heritage Trees[1] but are ≥ six inches diameter (previously excluded[2]).

The data and observations included in this addendum report were gleaned from the original inspections and inventory, as reported[2]. I developed twenty-six additional tree appraisals referencing the condition of trees at the time of their original inspection and as described in my previous report[2].

**SUMMARY:** I have included in this report, twenty-six trees not previously appraised[2]. These are trees that are not categorized as Heritage Trees[1], but are ≥6 inches in diameter[2]. Sixty-four trees[3] are included in both this and my previous report. Forty-nine trees were assigned appraisal values. Four trees (nos. 116, 137, 148 & 155) were of such poor condition and/or growing condition that they were assigned a value of $0.00[4]. Eight included trees (nos. 71-18) are outside the construction zone, but are behind protective fencing (as proposed) and are Heritage Trees so were also appraised in both reports.

I did not appraise fifteen trees, as they were smaller than the minimum criteria of six inches in diameter[1].

I developed appraisal values for the subject trees employing methods developed by the Council of Tree and Landscape Appraisers (CTLA) and described in the publication, Council of Tree and Landscape Appraisers, 2019, *Guide for Plant Appraisal*, Tenth Edition, Second Printing, International Society of Arboriculture. I selected the Cost Approach, Reproduction Method, Trunk Formula Technique as appropriate for the trees of this project.

The total value for all forty-nine trees appraised is $179,600.00, which is an average value of $3,653.00 per each of the 49 trees appraised.

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[1] City of Pleasanton Municipal Code, Title 17 Planning and Related Matters, Chapter 17.16 Tree Preservation (effective thru 01/16/2025).
[2] Dryad, LLC report dated 11/22/2024.
[3] Photographs of all sixty-four trees are on file at the office of Dryad, LLC.
[4] Trees may be valued at $0.00 when their condition or growing conditions are extremely poor, or are dead or near death and/or the cost of removal exceeds any marginal value. Negative values, which deemed not useful for the purposes of this report, are an option for such trees.


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**TREE DATA[5]: SUMMARIES:**

| Description | Quantity | Ratio | Comments |
|---|---|---|---|
| Trees inventoried | 64 | 100% | All trees inventoried (including <6" diameter) |
| Protected trees | 49 | 77% | All trees ≥6" diameter and/or 35' height |
| Trees not protected | 15 | 23% | Trees <6" diameter |
| Total trees to retain | 41 | 64% | All trees inventoried |
| Total trees to remove | 23 | 36% | All trees inventoried |
| Heritage trees | 22 | 34% | As defined by the City of Pleasanton |
| Heritage trees to retain | 19 | 30% | As defined by the City of Pleasanton |
| Heritage trees to remove | 3 | 5% | Requires City of Pleasanton permits (#140, 141 & 147) |
| **Description** | **Values/Quantity** | **Ratio** | **Comments** |
| Total appraisal values | $179,000 | 100% | CTLA Guide for Plant Appraisal, 10th Edition, (Second Printing); trees ≥6" diameter only |
| Average appraisal value/tree | $3,653 | N/A | Trees ≥6" diameter only (49) |
| Total tree appraisals | 49 | 100% | All trees ≥6" diameter and/or 35' height |
| Added tree appraisals (not in previous report) | 34 | N/A | Trees ≥6" diameter but not Heritage Trees[1] (15) and 8 specific trees (nos. 71-78) |
| Trees assigned a value of $0.00 | 4 | 8% | Within trees ≥6" diameter and/or 35' height; $0.00 value assigned for trees in poor condition and/or a problematic location (#116, 137, 146 & 148) |
| Trees with N/A in the value column | 15 | 23% | Within all 64 trees inventoried, trees <6" diameter |
| **Species distribution:** | **Quantity** | **Ratio** | **Genus-species** |
| Brazilian pepper | 9 | 14% | *Schinus terebinthifolia* |
| Callery pear | 1 | 2% | *Pyrus calleryana* |
| Chinese evergreen pear | 1 | 2% | *Pyrus kawakamii* |
| Chinese pistache | 11 | 17% | *Pistachia chinensis* |
| Chitalpa | 2 | 3% | *Chitalpa tashkentensis* |
| Coast redwood | 5 | 8% | *Sequoia sempervirens* |
| Crabapple | 7 | 11% | *Malus* sp. |
| Crepe myrtle | 1 | 2% | *Lagerstroemia indica* |
| Eastern redbud | 10 | 16% | *Cercis canadensis* |
| Evergreen ash | 10 | 16% | *Fraxinus uhdeii* |
| London plane | 4 | 6% | *Platanus* x *hispanica* |
| Raywood ash | 1 | 2% | *Fraxinus angustifolia 'Raywood'* |
| Sweetgum | 2 | 3% | *Liquidambar styraciflua* |
| **Category** | **Quantity** | **Ratio** | **Description** |
| 1 | 44 | 69% | Preserve - condition & location warrants long-term preservation. |
| 2 | 11 | 17% | Preservable, but existing condition does not warrant extensive protection measures. |
| 3 | 2 | 3% | Remove due to existing condition. |
| 4 | 7 | 11% | Remove due to conflict with construction |

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[5] References the data table beginning on page 3.



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**TREE INVENTORY, DATA, EVALUATIONS AND PROTECTION RECOMMENDATIONS:**

Other than the added appraisal values (49, bolded) a few added comments to support appraisal values, all information in this table was gleaned from my previous report[2].

| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins) | Hgt. (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Comments | Appraisal value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem1 (DBH) | Stem1 (cir.) | Stem2 (DBH) | Stem2 (cir.) | Total (cir.) | | | N | E | S | W | | | | | | |
| 17 | Crepe myrtle | *Lagerstroemia indica* | 8.0 | 25.0 | | 0.0 | 25.0 | 8.0 | 38 | 15 | 5 | 15 | 16 | Yes | No | 1 | Retain | Overpruned (raising & thinning)<br>Canopy of good color & density | $3,000 |
| **18** | London plane | *Platanus* x *hispanica* | 10.0 | 31.5 | | 0.0 | 31.5 | 10.0 | 30 | 12 | 16 | 17 | 10 | No | No | 1 | Retain | Overpruned (raising & thinning)<br>Canopy of good color & density | **$3,500** |
| 27 | Evergreen ash | *Fraxinus uhdeii* | 15.5 | 48.5 | | 0.0 | 48.5 | 15.5 | 40 | 3 | 14 | 21 | 20 | Yes | No | 1 | Retain | Overpruned (raising & thinning)<br>Poor structure & architecture<br>Canopy of good color<br>Limited rooting space (conflicts inevitable) | $2,400 |
| 28 | Evergreen ash | *Fraxinus uhdeii* | 19.5 | 61.5 | | 0.0 | 61.5 | 19.5 | 43 | 21 | 21 | 21 | 20 | Yes | Yes | 1 | Retain | Poor structure & architecture<br>Canopy of good color | $2,700 |
| **42** | Crabapple | *Malus* sp. | 7.5 | 23.5 | | 0.0 | 23.5 | 7.5 | 13 | 10 | 13 | 14 | 10 | No | No | 4 | Remove | Crowded, overgrown by adjacent trees<br>Poor structure<br>Foliage of good color & density | **$2,600** |
| **43** | Crabapple | *Malus* sp. | 7.0 | 22.0 | | 0.0 | 22.0 | 7.0 | 15 | 15 | 6 | 7 | 7 | No | No | 4 | Remove | 15º lean<br>Poor structure & architecture<br>Foliage of good color & density | **$2,500** |
| **44** | Crabapple | *Malus* sp. | 7.5 | 23.5 | | 0.0 | 23.5 | 7.5 | 12 | 12 | 14 | 13 | 6 | No | No | 4 | Remove | Sound structure & architecture<br>Foliage of good color & density | **$2,800** |
| **45** | Crabapple | *Malus* sp. | 9.0 | 28.5 | | 0.0 | 28.5 | 9.0 | 13 | 16 | 5 | 5 | 11 | No | No | 1 | Retain | Sound structure & architecture<br>Foliage of good color & density | **$3,200** |



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| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins) | Hgt. (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Comments | Appraisal value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem1 (DBH) | Stem1 (cir.) | Stem2 (DBH) | Stem2 (cir.) | Total (cir.) | | | N | E | S | W | | | | | | |
| 46 | Brazilian pepper | *Schinus terebinthifolia* | 20.0 | 63.0 | | 0.0 | 63.0 | 20.0 | 27 | 19 | 18 | 14 | 13 | Yes | No | 1 | Retain | Sound structure & architecture<br>Foliage of good color & density | $8,000 |
| **47** | Brazilian pepper | *Schinus terebinthifolia* | 13.5 | 42.5 | | 0.0 | 42.5 | 13.5 | 21 | 13 | 10 | 12 | 8 | No | No | 1 | Retain | Minor structural weaknesses, good architecture<br>Foliage of good color & density | **$4,600** |
| 48 | Evergreen ash | *Fraxinus uhdeii* | 16.5 | 52.0 | | 0.0 | 52.0 | 16.5 | 46 | 24 | 5 | 25 | 24 | Yes | No | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Root crown issues at graft<br>Foliage of good color & density<br>+S12 | $2,500 |
| 53 | Evergreen ash | *Fraxinus uhdeii* | 12.5 | 39.5 | | 0.0 | 39.5 | 12.5 | 40 | 16 | 11 | 10 | 16 | Yes | Yes | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Root crown issues at graft<br>Foliage of good color & density<br>Limited rooting space (conflicts inevitable) | $2,300 |
| **65** | Crabapple | *Malus* sp. | 9.0 | 28.5 | | 0.0 | 28.5 | 9.0 | 15 | 11 | 9 | 7 | 13 | No | No | 1 | Retain | Weak structure<br>Foliage of good color & density | **$2,600** |
| **66** | Crabapple | *Malus* sp. | 7.0 | 22.0 | | 0.0 | 22.0 | 7.0 | 11 | 13 | 9 | 10 | 10 | No | No | 1 | Retain | Overpruned<br>Poor structure & architecture<br>Foliage of good color & density | **$2,500** |
| 67 | Crabapple | *Malus* sp. | 5.0 | 15.5 | | 0.0 | 15.5 | 5.0 | 10 | 3 | 6 | 9 | 12 | No | No | 1 | Retain | Overpruned<br>15º lean<br>Poor structure & architecture<br>Foliage of good color & density | N/A |



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| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins) | Hgt. (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Comments | Appraisal value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem1 (DBH) | Stem1 (cir.) | Stem2 (DBH) | Stem2 (cir.) | Total (cir.) | | | N | E | S | W | | | | | | |
| 68 | Evergreen ash | *Fraxinus uhdeii* | 19.0 | 59.5 | | 0.0 | 59.5 | 19.0 | 58 | 23 | 27 | 24 | 17 | Yes | No | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Foliage of good color & density | $5,400 |
| 69 | Evergreen ash | *Fraxinus uhdeii* | 18.0 | 56.5 | | 0.0 | 56.5 | 18.0 | 58 | 9 | 25 | 24 | 22 | Yes | No | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Foliage of good color & density | $5,100 |
| 70 | Evergreen ash | *Fraxinus uhdeii* | 16.0 | 50.5 | | 0.0 | 50.5 | 16.0 | 60 | 19 | 19 | 11 | 23 | Yes | No | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Foliage of good color & density | $4,400 |
| **71** | Evergreen ash | *Fraxinus uhdeii* | 15.5 | 48.5 | | 0.0 | 48.5 | 15.5 | 45 | 10 | 30 | 15 | 21 | Yes | No | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Foliage of good color & density<br>Outside of construction zone & unlikely to be affected by construction | **$4,300** |
| **72** | Evergreen ash | *Fraxinus uhdeii* | 18.0 | 56.5 | | 0.0 | 56.5 | 18.0 | 46 | 19 | 25 | 20 | 23 | Yes | No | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Foliage of good color & density<br>Outside of construction zone & unlikely to be affected by construction | **$5,100** |
| **73** | Coast redwood | *Sequoia sempervirens* | 22.0 | 69.0 | | 0.0 | 69.0 | 22.0 | 48 | 10 | 12 | 12 | 11 | Yes | No | 1 | Retain | Overpruned (raised)<br>Foliage of good color & density<br>Outside of construction zone & unlikely to be affected by construction | **$9,500** |



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| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins) | Hgt. (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Comments | Appraisal value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem1 (DBH) | Stem1 (cir.) | Stem2 (DBH) | Stem2 (cir.) | Total (cir.) | | | N | E | S | W | | | | | | |
| **74** | Coast redwood | *Sequoia sempervirens* | 19.5 | 61.5 | | 0.0 | 61.5 | 19.5 | 42 | 10 | 10 | 11 | 12 | Yes | No | 1 | Retain | Overpruned (raised)<br>Foliage of good color & density<br>Outside of construction zone & unlikely to be affected by construction | **$7,900** |
| **75** | Coast redwood | *Sequoia sempervirens* | 20.0 | 63.0 | | 0.0 | 63.0 | 20.0 | 43 | 10 | 12 | 6 | 10 | Yes | No | 1 | Retain | Overpruned (raised)<br>Foliage of good color & density<br>Outside of construction zone & unlikely to be affected by construction | **$8,200** |
| **76** | Coast redwood | *Sequoia sempervirens* | 21.0 | 66.0 | | 0.0 | 66.0 | 21.0 | 40 | 12 | 11 | 12 | 10 | Yes | No | 1 | Retain | Overpruned (raised)<br>Foliage of good color & density<br>Outside of construction zone & unlikely to be affected by construction | **$8,800** |
| **77** | Coast redwood | *Sequoia sempervirens* | 19.5 | 61.5 | | 0.0 | 61.5 | 19.5 | 40 | 13 | 13 | 13 | 13 | Yes | No | 1 | Retain | Overpruned (raised)<br>Foliage of good color & density<br>& unlikely to be affected by construction | **$7,900** |
| **78** | Evergreen ash | *Fraxinus uhdeii* | 24.0 | 75.5 | | 0.0 | 75.5 | 24.0 | 51 | 16 | 24 | 33 | 25 | Yes | No | 2 | Retain | Overpruned<br>Weak structure, poor branch taper<br>Foliage of good color & density | **$8,000** |
| **116** | Eastern redbud | *Cercis canadensis* | 11.0 | 34.5 | | 0.0 | 34.5 | 11.0 | 21 | 20 | 16 | 12 | 10 | No | No | 2 | Remove | 15º lean<br>Significant tip & branch dieback<br>Thin, declining canopy<br>Major surface rooting in turf | **$0** |
| **117** | Chinese pistache | *Pistachia chinensis* | 5.5 | 17.5 | | 0.0 | 17.5 | 5.5 | 21 | 20 | 16 | 12 | 10 | No | No | 1 | Retain | Foliage of good color & density<br>Poor trunk taper | N/A |
| **118** | Chinese pistache | *Pistachia chinensis* | 8.0 | 25.0 | | 0.0 | 25.0 | 8.0 | 21 | 20 | 16 | 12 | 10 | No | No | 1 | Retain | Foliage of good color & density | **$3,200** |



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| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins) | Hgt. (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Comments | Appraisal value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem1 (DBH) | Stem1 (cir.) | Stem2 (DBH) | Stem2 (cir.) | Total (cir.) | | | N | E | S | W | | | | | | |
| **120** | Eastern redbud | *Cercis canadensis* | 6.0 | 19.0 | | 0.0 | 19.0 | 6.0 | 19 | 8 | 10 | 10 | 10 | No | No | 1 | Remove | Poor trunk taper<br>Foliage of good color & density<br>Restricted rooting area | **$2,200** |
| **121** | Eastern redbud | *Cercis canadensis* | 6.0 | 19.0 | | 0.0 | 19.0 | 6.0 | 19 | 10 | 10 | 8 | 10 | No | No | 1 | Remove | Poor trunk taper<br>Foliage of good color & density<br>Restricted rooting area | **$2,200** |
| **122** | Chinese pistache | *Pistachia chinensis* | 8.0 | 25.0 | | 0.0 | 25.0 | 8.0 | 24 | 10 | 13 | 14 | 11 | No | No | 1 | Retain | Foliage of good color & density<br>Restricted rooting area | **$2,300** |
| **126** | Chinese pistache | *Pistachia chinensis* | 7.0 | 22.0 | | 0.0 | 22.0 | 7.0 | 17 | 10 | 12 | 10 | 8 | No | No | 1 | Retain | Foliage of good color & density<br>Restricted rooting area | **$2,800** |
| **133** | Eastern redbud | *Cercis canadensis* | 14.0 | 44.0 | | 0.0 | 44.0 | 14.0 | 22 | 16 | 16 | 18 | 16 | No | No | 1 | Remove | Some tip dieback<br>Foliage of good color & density | **$5,000** |
| **135** | Eastern redbud | *Cercis canadensis* | 8.0 | 25.0 | | 0.0 | 25.0 | 8.0 | 22 | 11 | 15 | 6 | 6 | No | No | 1 | Retain | 10º lean<br>Poor structure & architecture<br>String trimmer damage to root crown<br>Foliage of good color & density | **$2,800** |
| **136** | Eastern redbud | *Cercis canadensis* | 10.5 | 33.0 | | 0.0 | 33.0 | 10.5 | 23 | 10 | 15 | 8 | 13 | No | No | 1 | Retain | Some tip & branch dieback<br>Poor structure<br>Foliage of good color & density | **$3,100** |
| **137** | Eastern redbud | *Cercis canadensis* | 6.5 | 20.5 | | 0.0 | 20.5 | 6.5 | 16 | 6 | 10 | 8 | 6 | No | No | 3 | Remove | Very poor structure & architecture<br>Exposed column of trunk decay<br>Root crown decayed | **$0** |
| 139 | Sweetgum | *Liquidambar styraciflua* | 11.0 | 34.5 | | 0.0 | 34.5 | 11.0 | 54 | 15 | 6 | 10 | 20 | Yes | No | 2 | Retain | Overpruned (raised & thinned)<br>Poor architecture<br>Poor trunk taper<br>Foliage of good color & density | $3,100 |



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| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins) | Hgt. (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Comments | Appraisal value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem1 (DBH) | Stem1 (cir.) | Stem2 (DBH) | Stem2 (cir.) | Total (cir.) | | | N | E | S | W | | | | | | |
| 140 | Chinese evergreen pear | *Pyrus kawakamii* | 11.0 | 34.5 | 8.5 | 26.5 | 61.0 | 19.5 | 24 | 13 | 15 | 15 | 15 | Yes | No | 4 | Remove | Multiple codominant stems<br>Leaf spot infection (minor)<br>Some tip dieback<br>Canopy of good color and density<br>(3 stems, 7.5-11" DBH) | $5,700 |
| 141 | Sweetgum | *Liquidambar styraciflua* | 10.0 | 31.5 | | 0.0 | 31.5 | 10.0 | 41 | 12 | 12 | 15 | 13 | Yes | No | 4 | Remove | Overpruned (raised & thinned)<br>Poor architecture<br>Surrounded with compacted soil, excess over root crown<br>Foliage of good color & density | $2,500 |
| 146 | Brazilian pepper | *Schinus terebinthifolia* | 14.0 | 44.0 | | 0.0 | 44.0 | 14.0 | 18 | 16 | 10 | 15 | 6 | No | No | 2 | Remove | Overpruned (thinned, raised)<br>Poor structure & architecture<br>Restricted rooting space | $0 |
| 147 | Brazilian pepper | *Schinus terebinthifolia* | 23.5 | 74.0 | | 0.0 | 74.0 | 23.5 | 36 | 20 | 17 | 20 | 17 | Yes | No | 4 | Remove | 15º lean<br>Overpruned (thinned, raised)<br>Poor structure & architecture<br>Thin, declining+S158 canopy<br>Restricted rooting space | $2,900 |



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| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins) | Hgt. (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Comments | Appraisal value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem1 (DBH) | Stem1 (cir.) | Stem2 (DBH) | Stem2 (cir.) | Total (cir.) | | | N | E | S | W | | | | | | |
| **148** | Callery pear | *Pyrus calleryana* | 16.0 | 50.5 | | 0.0 | 50.5 | 16.0 | 30 | 20 | 18 | 20 | 15 | No | No | 4 | Remove | Overpruned (thinned, raised)<br>Poor structure & architecture<br>Severely restricted rooting space<br>Multiple underground utilities in close proximity<br>Foliage of good color & density | **$0** |
| 149 | Brazilian pepper | *Schinus terebinthifolia* | 17.5 | 55.0 | | 0.0 | 55.0 | 17.5 | 13 | 12 | 13 | 12 | 12 | Yes | No | 1 | Retain | Severely pruned (topped, raised)<br>Poor structure & architecture<br>Restricted rooting space<br>Foliage of good color & density | $2,600 |
| **150** | Brazilian pepper | *Schinus terebinthifolia* | 11.5 | 36.0 | | 0.0 | 36.0 | 11.5 | 19 | 12 | 18 | 13 | 12 | No | No | 1 | Retain | 10º lean<br>Severely pruned (topped, raised)<br>Poor structure & architecture<br>Restricted rooting space<br>Foliage of good color & density | **$2,500** |
| **151** | Brazilian pepper | *Schinus terebinthifolia* | 13.0 | 41.0 | | 0.0 | 41.0 | 13.0 | 21 | 12 | 11 | 12 | 12 | No | No | 1 | Retain | Severely pruned (topped, raised)<br>Poor structure & architecture<br>Restricted rooting space<br>Foliage of good color & density | **$2,700** |



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| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins) | Hgt. (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Comments | Appraisal value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem1 (DBH) | Stem1 (cir.) | Stem2 (DBH) | Stem2 (cir.) | Total (cir.) | | | N | E | S | W | | | | | | |
| **152** | Brazilian pepper | *Schinus terebinthifolia* | 6.0 | 19.0 | | 0.0 | 19.0 | 6.0 | 11 | 5 | 7 | 7 | 7 | No | No | 1 | Retain | 10º lean<br>Severely pruned (topped, raised)<br>Poor structure & architecture<br>Poor trunk taper<br>Restricted rooting space<br>Foliage of good color & density | **$2,200** |
| **153** | Brazilian pepper | *Schinus terebinthifolia* | 15.0 | 47.0 | | 0.0 | 47.0 | 15.0 | 20 | 11 | 14 | 7 | 9 | No | No | 1 | Retain | 10º lean<br>Severely pruned (topped, raised)<br>Poor structure & architecture<br>Restricted rooting space<br>Foliage of good color & density | **$2,800** |
| 154 | Chinese pistache | *Pistachia chinensis* | 3.0 | 9.5 | | 0.0 | 9.5 | 3.0 | 17 | 5 | 5 | 8 | 4 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A |
| 155 | Raywood ash | *Fraxinus angustifolia 'Raywood'* | 2.0 | 6.5 | | 0.0 | 6.5 | 2.0 | 14 | 2 | 3 | 3 | 3 | No | No | 3 | Remove | Dead | N/A |
| 156 | Chinese pistache | *Pistachia chinensis* | 3.0 | 9.5 | | 0.0 | 9.5 | 3.0 | 16 | 5 | 6 | 5 | 5 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A |
| 157 | Eastern redbud | *Cercis canadensis* | 1.0 | 3.0 | | 0.0 | 3.0 | 1.0 | 14 | 5 | 6 | 6 | 4 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A |
| 158 | Chinese pistache | *Pistachia chinensis* | 2.5 | 8.0 | | 0.0 | 8.0 | 2.5 | 16 | 7 | 5 | 6 | 3 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A |
| 159 | Eastern redbud | *Cercis canadensis* | 2.0 | 6.5 | | 0.0 | 6.5 | 2.0 | 14 | 7 | 6 | 6 | 6 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A |
| 160 | Chinese pistache | *Pistachia chinensis* | 3.0 | 9.5 | | 0.0 | 9.5 | 3.0 | 16 | 4 | 7 | 10 | 8 | No | No | 1 | Retain | Foliage of good color & density | N/A |



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| No. | Common name | Genus-species | Trunk/stem size (ins.) | | | | | Total trunk diameter (DBH; ins) | Hgt. (ft.) | Canopy radius (ft.) | | | | Heritage tree status | Street tree | Management category | Disposition | Comments | Appraisal value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Stem1 (DBH) | Stem1 (cir.) | Stem2 (DBH) | Stem2 (cir.) | Total (cir.) | | | N | E | S | W | | | | | | |
| | | | | | | | | | | | | | | | | | | Good structure & architecture | |
| 161 | Eastern redbud | *Cercis canadensis* | 1.5 | 4.5 | | 0.0 | 4.5 | 1.5 | 14 | 5 | 5 | 5 | 6 | No | No | 1 | Retain | Foliage of good color & density<br>Good structure & architecture | N/A |
| 162 | Chinese pistache | *Pistachia chinensis* | 2.5 | 8.0 | | 0.0 | 8.0 | 2.5 | 17 | 8 | 6 | 5 | 5 | No | No | 1 | Retain | Foliage of good color & density<br>Good structure & architecture | N/A |
| 163 | Chitalpa | *Chitalpa tashkentensis* | 2.0 | 6.5 | | 0.0 | 6.5 | 2.0 | 12 | 3 | 6 | 3 | 5 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A |
| 164 | Chinese pistache | *Pistachia chinensis* | 3.0 | 9.5 | | 0.0 | 9.5 | 3.0 | 17 | 6 | 5 | 5 | 3 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A |
| 165 | Chitalpa | *Chitalpa tashkentensis* | 2.0 | 6.5 | | 0.0 | 6.5 | 2.0 | 15 | 4 | 5 | 8 | 7 | No | No | 1 | Remove | Foliage of good color but thin canopy<br>Good structure & architecture | N/A |
| 166 | Chinese pistache | *Pistachia chinensis* | 3.0 | 9.5 | | 0.0 | 9.5 | 3.0 | 16 | 5 | 3 | 6 | 6 | No | No | 1 | Remove | Foliage of good color & density<br>Good structure & architecture | N/A |
| **169** | London plane | *Platanus x hispanica* | 6.5 | 20.5 | | 0.0 | 20.5 | 6.5 | 26 | 11 | 10 | 10 | 7 | No | No | 1 | Retain | Foliage of good color & density<br>Good structure & architecture | **$2,600** |
| **170** | London plane | *Platanus x hispanica* | 9.0 | 28.5 | | 0.0 | 28.5 | 9.0 | 27 | 12 | 6 | 8 | 12 | No | No | 1 | Retain | 15º lean to N<br>Foliage of good color & density<br>Good structure & architecture | **$3,100** |
| **171** | London plane | *Platanus x hispanica* | 8.5 | 26.5 | | 0.0 | 26.5 | 8.5 | 32 | 9 | 14 | 12 | 12 | No | No | 1 | Retain | Foliage of good color & density<br>Good structure & architecture | **$2,900** |



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ASCA Tree & Plant Appraisal Qualified
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EXHIBIT B

# Stanford Health Care Tri-Valley East Wing

## Transportation Impact Analysis

Prepared for:
Stanford Health Care
The City of Pleasanton

January 31, 2025

WC24-4090.00

FEHR PEERS

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# 1. Introduction

This report presents the results of the Transportation Impact Analysis (TIA) prepared for the proposed Stanford Health Care Tri-Valley East Wing project in Pleasanton, California. This chapter discusses the study's purpose, report organization, criteria used to identify significant impacts, study area, and analysis methods. It should be noted that the proposed improvements at the site have already undergone environmental review and received California Environmental Quality Act (CEQA) approvals (negative declaration). As a City of Pleasanton Condition of Approval (COA), phases of development on the site are required to prepare traffic analyses; this report presents the transportation study for the East Wing phase of the project.

## Study Purpose and Project Description

The project site, located at 5555 West Las Positas Boulevard in Pleasanton, would make improvements to Stanford Health Care's (SHC) Tri-Valley Hospital. The East Wing improvement project would build a new three-story, approximately 66,000 square foot hospital addition on the east side of the existing SHC Tri-Valley Hospital. **Figure 1A** illustrates the project site and its access points in relation to the local transportation network. **Figure 1B** presents the project's conceptual site plan.

The purpose of this analysis is to identify the transportation impacts of the project, including potential impacts on pedestrian facilities, transit services, bicycle facilities, potential hazards, and emergency vehicle access. In addition, intersection levels of service (LOS) were calculated to assess the project's consistency with City General Plan operational thresholds.

## Study Locations and Analysis Scenarios

Project consistency with General Plan roadway operational standards at study area roadway facilities were determined by measuring the effect project traffic would have on intersections during the morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) peak periods. A total of 13 intersections were selected as study locations in consultation with City of Pleasanton staff, based on the amount of vehicle traffic the project could add to the intersection and projected intersection levels of service presented in the Pleasanton General Plan. The project's potential effects were assessed at the following 13 locations:

- Andrews Drive/Owens Drive
- Andrews Drive/Project Loop Road North
- Andrews Drive/Project Loop Road South
- Owens Drive/Project Driveway
- Andrews Drive/Old Santa Rita Road
- West Las Positas Boulevard/Project Driveway
- Santa Rita Road/Project Driveway
- Santa Rita Road/West Las Positas Boulevard
- Santa Rita Road/Old Santa Rita Road
- Santa Rita Road/I-580 Westbound Ramps
- Santa Rita Road/I-580 Eastbound Ramps
- Owens Drive/Hacienda Drive
- Santa Rita Road/Stoneridge Drive

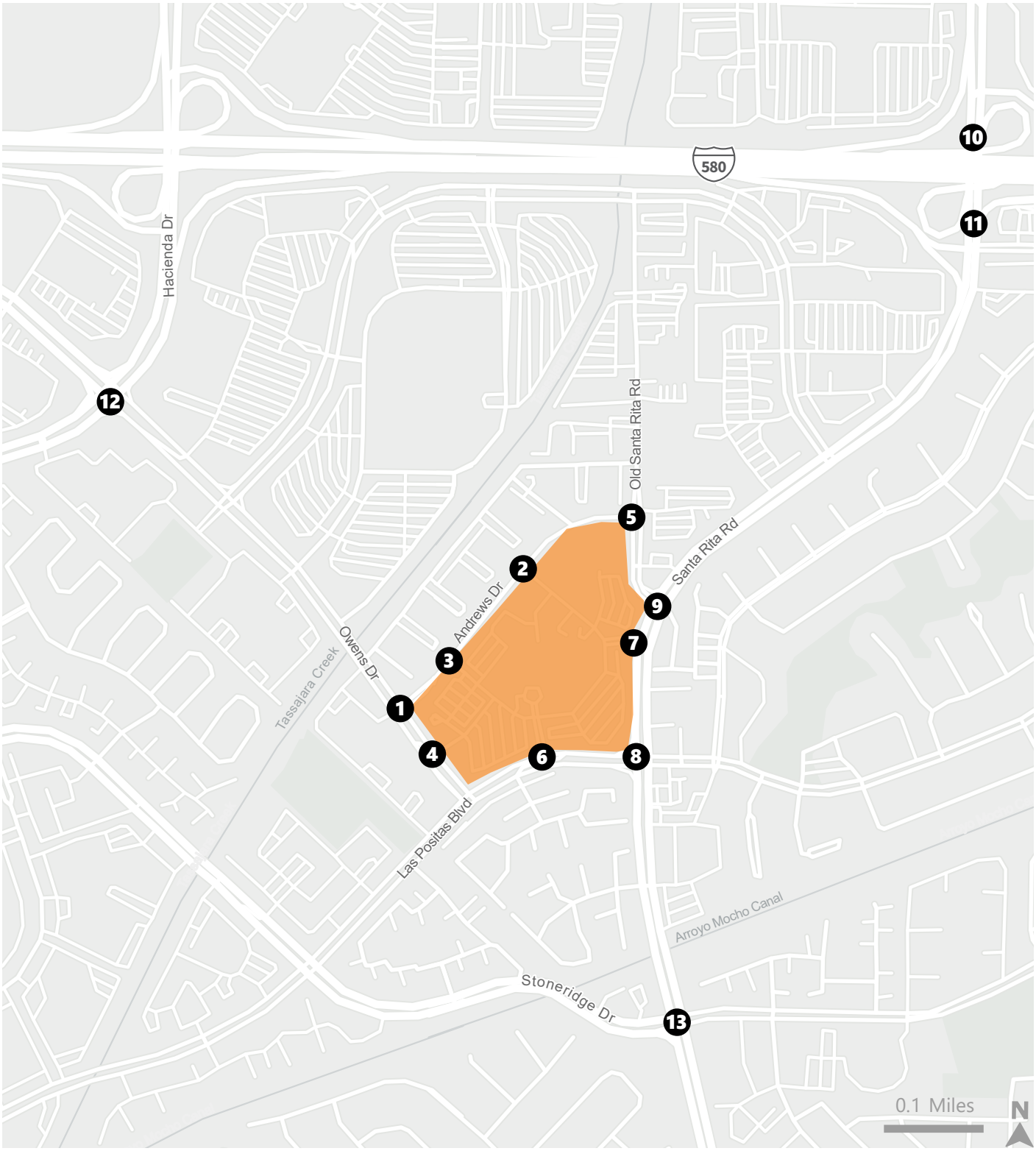
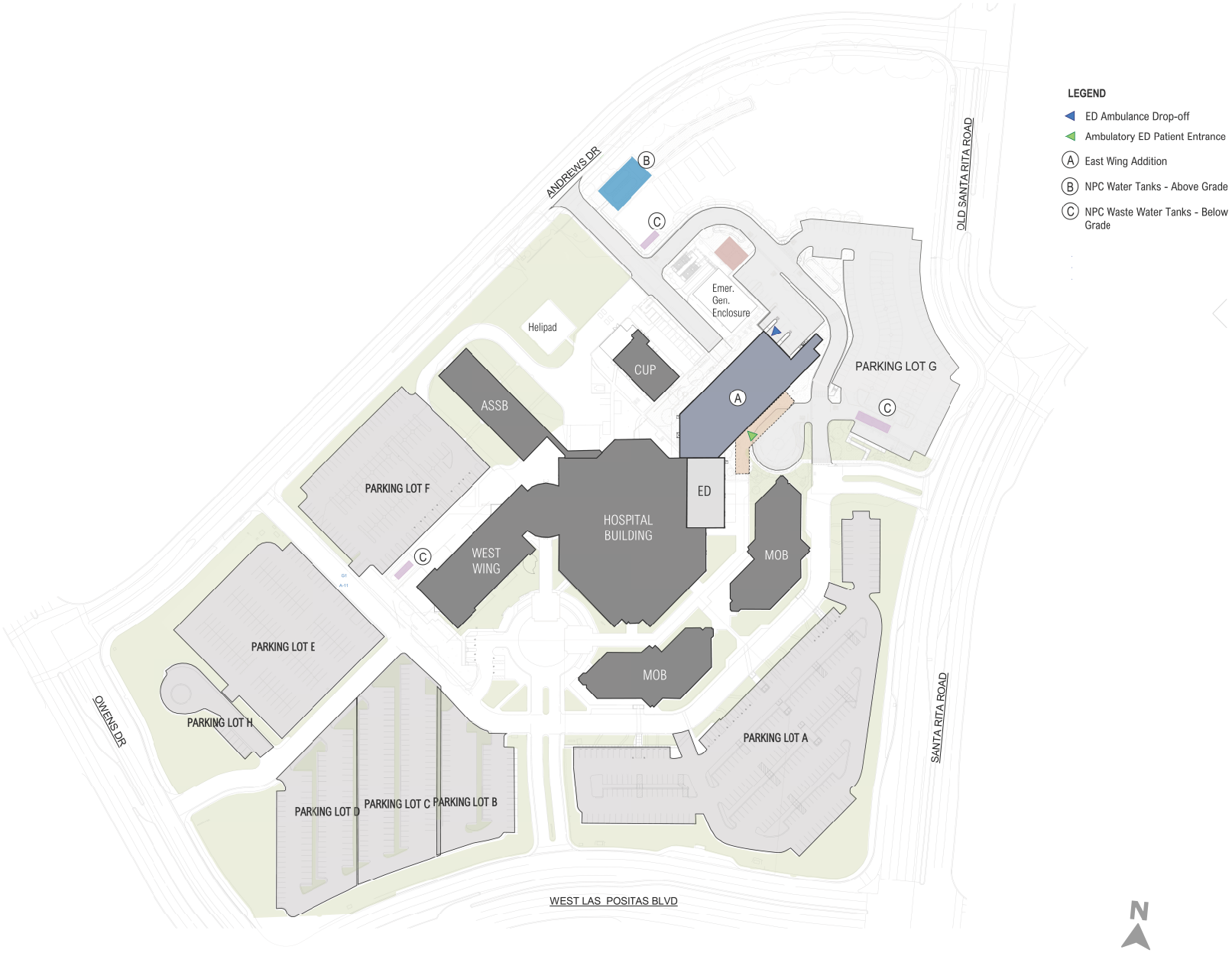



Figure 1A

## Project Site Vicinity and Study Intersections




*Site Plan Source: Taylor Design, 11/19/24*

Figure 1B

# Project Site Plan

# Analysis Methods

## Level of Service

The operations of roadway facilities are described with the term "level of service" (LOS). LOS is a qualitative description of traffic flow from a vehicle driver's perspective based on factors such as speed, travel time, delay, and freedom to maneuver. Six levels of service are defined, ranging from LOS A (free-flow conditions) to LOS F (over capacity conditions). LOS E corresponds to operations "at capacity." When volumes exceed capacity, stop-and-go conditions result, and operations are designated LOS F.

### *Signalized Intersections*

Traffic conditions at signalized intersections were evaluated using methods developed by the Transportation Research Board (TRB), as documented in the *Highway Capacity Manual 2000 Edition* for vehicles using the analysis software Synchro 12.0. The HCM method calculates control delay at an intersection based on inputs such as traffic volumes, lane geometry, signal phasing and timing, pedestrian crossing times, and peak hour factors. Control delay is defined as the delay directly associated with the traffic control device (i.e., a stop sign or a traffic signal) and specifically includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. The relationship between LOS and control delay is summarized in **Table 1**.

### *Unsignalized Intersections*

For unsignalized (all-way stop controlled and side-street stop controlled) intersections, the *Highway Capacity Manual 2000 Edition* method for unsignalized intersections was used. With this method, operations are defined by the average control delay per vehicle (measured in seconds). The control delay incorporates delay associated with deceleration, acceleration, stopping, and moving up in queue. **Table 2** summarizes the relationship between LOS and delay for unsignalized intersections. At side-street stop-controlled intersections, the delay is calculated for each stop-controlled movement, the left turn movement from the major street, as well as the intersection average. The intersection average delay and highest movement/approach delay are reported for side-street stop-controlled intersections.

**Table 1: Signalized Intersection LOS Criteria**

| Level of Service | Description | Delay in Seconds |
|---|---|---|
| A | Progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay. | ≤ 10.0 |
| B | Progression is good, cycle lengths are short, or both. More vehicles stop than with LOS A, causing higher levels of average delay. | > 10.0 to 20.0 |
| C | Higher congestion may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level, though many still pass through the intersection without stopping. | > 20.0 to 35.0 |
| D | The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable. | > 35.0 to 55.0 |
| E | This level is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences. | > 55.0 to 80.0 |
| F | This level is considered unacceptable with oversaturation, which is when arrival flow rates exceed the capacity of the intersection. This level may also occur at high V/C ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be contributing factors to such delay levels. | > 80.0 |

Source: *Highway Capacity Manual 2000 Edition* (Transportation Research Board).

**Table 2: Unsignalized Intersection LOS Criteria**

| Level of Service | Description | Delay in Seconds |
|---|---|---|
| A | Little or no delays | ≤ 10.0 |
| B | Short traffic delays | > 10.0 to 15.0 |
| C | Average traffic delays | > 15.0 to 25.0 |
| D | Long traffic delays | > 25.0 to 35.0 |
| E | Very long traffic delays | > 35.0 to 50.0 |
| F | Extreme traffic, delays where intersection capacity exceeded | > 50.0 |

Source: *Highway Capacity Manual 2000 Edition* (Transportation Research Board).

## Regulatory Setting and Significance Criteria

As previously noted, the proposed improvements at the site have already undergone environmental review and received California Environmental Quality Act approval (a negative declaration). As a City of Pleasanton Condition of Approval phases of development on the site are required to prepare traffic analyses; this report presents the transportation study for the East Wing phase of the project.

Significance criteria are used to determine whether a project's impact on the environment is considered significant and therefore requires mitigation under the requirements of the California Environmental



Quality Act (CEQA). CEQA guidelines were recently updated to eliminate use of vehicle-delay based metrics, such as intersection level of service, in environmental documents with vehicle miles of travel identified as the most appropriate metric to evaluate a project's transportation impacts. This change promotes the reduction of greenhouse gas emissions, the development of multimodal transportation networks, and a diversity of land uses. As the project is within the development envelope that was previously studied and for which a negative declaration was issued, this report does not evaluate project related vehicle miles traveled (VMT). As required by the City's COA, the traffic analysis focuses on project trip generation and distribution, and the potential effects of project traffic on local intersections. The project's site plan is also assessed relative to pedestrians, bicycles, transit and the adequacy of parking.

In addition to the CEQA significance criteria, the City of Pleasanton strives to maintain a balanced transportation system, which includes maintaining traffic operations within a certain delay range, based on policies contained in the General Plan. Therefore, the project is also evaluated against a set of General Plan thresholds, as described below.

*General Plan/Operational Thresholds*

Although vehicle level of service, and other delay-based metrics cannot be used to determine significant impacts under CEQA, the City of Pleasanton strives to maintain a balanced transportation system, which includes maintaining traffic operations within a certain delay range, based on policies contained in the General Plan. Additionally, a project's effect on overall travel operations provides decision makers with additional information to consider in the entitlement process and allows for the identification of potential improvements or project changes that could minimize the overall transportation system effect of a project on the surrounding community.

The following criteria are applied to develop recommendations designed to enhance mobility for all travel modes, including transit vehicles, without degrading or precluding the provision of planned bicycle, pedestrian, and transit facilities. Intersection or roadway improvements may be recommended under the following circumstances:

- The project deteriorates the operations of a signalized intersection from acceptable to unacceptable based on the level of service standard established in the General Plan.
- The project adds ten or more trips to an intersection projected to operate at an unacceptable level E or F prior to the addition of project traffic.
- The project deteriorates the operations of a controlled movement at an unsignalized intersection from LOS E or better to LOS F, or at intersections where a controlled movement already operates at LOS F, one of the following:
    - Project traffic results in satisfaction at the peak hour volume traffic signal warrant;
    - Project traffic increases minor movement delay by more than 30 seconds; or
    - Where the peak hour volume signal warrant is met without Project traffic and delay cannot be measured, Project increases traffic by 10 or more vehicles per lane on the controlled approach.



There are a few exceptions to the LOS standard within Pleasanton. The exceptions are in the Downtown Area and at the City of Pleasanton gateway intersections (i.e. constrained gateways). These intersections may have a level of service below the level-of-service standard D if no reasonable mitigation measure exists or if the necessary mitigation is contrary to other goals or policies of the City.

The addition of project traffic at a study intersection would result in the 95th percentile vehicle queue exceeding the available storage or would increase 95th percentile queue where the queue already exceeds the available storage space (for example, vehicle queues spilling back from ramp terminal intersections to the freeway mainline, or vehicle queues extending beyond the available turn pocket length, impeding travel in the adjacent lanes).

## Report Organization

This report is organized into five chapters as described below:

- **Chapter 1 – Introduction** discusses the purpose and organization of the report.
- **Chapter 2 – Existing Conditions** describes the transportation system in the project vicinity, including the surrounding roadway network morning, existing bicycle, pedestrian, and transit facilities.
- **Chapter 3 – Project Characteristics** presents relevant project information, such as the project components and project trip generation, distribution, and assignment.
- **Chapter 4 – Site Plan Review** describes project access and circulation for all travel modes.
- **Chapter 5 – Traffic Operations** addresses the existing, existing plus approved projects (EPAP), and cumulative conditions in the vicinity of the project site without and with the project, including intersection levels of service and vehicle queues.
- **Chapter 6 – Summary of Findings**

# 2. Existing Conditions

This chapter describes the existing transportation conditions in the study area, including the roadway network and the transit, pedestrian, and bicycle facilities in the vicinity of the project site.

## Roadway System

Regional access to the project site is provided by SR-84, I-680 and I-580. Local access to the site is provided by Santa Rita Road, West Las Positas Boulevard, Owens Drive, Andrews Drive, and Old Santa Rita Road.

### Regional Roadways

**Interstate 680 (I-680)** is a major north-south freeway that connects Fairfield to San Jose via Concord, Walnut Creek, and Pleasanton. I-680 is located west of the project site. Project traffic would access I-680 to and from the east using the signalized ramp terminal intersections at Stoneridge Drive or Bernal Avenue. Within the study area, I-680 has three to four general purpose travel lanes. Express Lanes are provided in each direction for vehicles with two or more people, or people driving who pay a toll north of the I-580 interchange. The posted speed limit adjacent to the City of Pleasanton is 65 miles-per-hour.

**Interstate 580 (I-580)** is an east-west freeway that forms the northern boundary of the City of Pleasanton and extends from the City of San Rafael in the west through the City of Tracy in the east. I-580 is located north of the project site. The most direct access to I-580 from the site is at the Santa Rita Road/Tassajara Road. Secondary access is provided from Hacienda Drive. In Pleasanton, four to five travel lanes per direction are provided and the facility carries approximately 200,000 to 225,000 vehicles per day through the tri-valley, based on information provided by Caltrans. Express lanes are also provided on I-580 east of Hopyard Road.

### Local Roadways

**West Las Positas Boulevard** is an east/west minor arterial roadway that forms the southern boundary of the project site. To the east of Santa Rita Road, West Las Positas serves as a local connector road. The boulevard features three lanes of travel in each direction west of Santa Rita Road, two lanes between Santa Rita Road and Weymouth Court, and one lane east of Weymouth Court. It provides connectivity to the Hacienda Business Park and residential neighborhoods to the east and west of the project site. Sidewalks are present on both sides of the street along its entire length. The posted speed limit is 40 mph west of Santa Rita Road and 35 mph east of Santa Rita Road. Parking is not permitted west of Santa Rita Road but is available east of Santa Rita Road.

**Santa Rita Road** is a north/south major arterial that forms the eastern boundary of the project site. Santa Rita Road provides three lanes of travel in each direction, with turn pockets at intersections. The road connects to downtown Pleasanton to the south and I-580 and the City of Dublin to the north, where it continues as Tassajara Road. Sidewalks are provided on both sides of the street along its entire length.

The posted speed limit is 45 mph north of Mohr Avenue and 35 mph south of Mohr Avenue. Parking is not provided on Santa Rita Road.

**Owens Drive** is an east/west connector through the Hacienda Business Park. Owens Drive forms the southwestern boundary of the project site. The roadway provides two lanes of travel in each direction. Owens Drive connects to Hacienda Drive and facilitates access to the Hacienda Business Park. Sidewalks and Class II unbuffered bike lanes are provided on both sides of the street along its length. The posted speed limit is 40 mph. Parking is not permitted on Owens Drive.

**Old Santa Rita Road** is a north/south local street forming the northeastern boundary of the project site. It has one lane of travel in each direction and a two-way center left turn lane, with pocket lanes for turns at intersections. The roadway connects to Santa Rita Road and Rosewood Drive. Sidewalks are provided discontinuously along the road. The posted speed limit is 30 mph. Parking is allowed on the east side of the street south of Andrews Drive and on both sides north of Andrews Drive.

**Andrews Drive** is a 2,000-foot-long local street running southwest/northeast that forms the northwestern boundary of the project site. It provides one lane of travel in each direction and a two-way center left turn lane. The roadway connects to Owens Drive and Old Santa Rita Road. Sidewalks and Class II bike lanes are provided on both sides of the street, with a two-foot buffer in the center. The posted speed limit is 35 mph. Parking is not permitted on Andrews Drive.

**Hacienda Drive** is a north/south major arterial located about 0.6 miles northwest of the project site. It is accessed via Owens Drive or Stoneridge Drive. The roadway has three lanes of travel in each direction and connects to the Hacienda Business Park, I-580, and the City of Dublin to the north. Sidewalks and Class II unbuffered bike lanes are provided on each side of the street. The posted speed limit is 40 mph. Parking is not permitted on Hacienda Drive.

**Stoneridge Drive** is an east/west major arterial located about 0.3 miles southwest of the project site. It is accessed via Santa Rita Road. The roadway has two lanes of travel in each direction and provides connectivity to the Hacienda Business Park, I-680, Stoneridge Mall, and Hacienda Drive to the west, and residential areas and the City of Livermore to the east. Sidewalks are provided on each side of the street. Class II unbuffered bike lanes are present along the roadway between the I-680 Off/On-Ramps and the east end, where it continues as W Jack London Blvd in Livermore. The posted speed limit is 40 mph west of Santa Rita Road and 35 mph east of Santa Rita Road. Parking is not permitted on Stoneridge Drive.

## Existing Transit Service

Transit service in the area is provided by Wheels, Pleasanton Rides (Pleasanton Paratransit Service), Bay Area Rapid Transit (BART), and Altamont Commuter Express (ACE), as illustrated on **Figure 2**.

***Wheels*** (Livermore Amador Valley Transit [LAVTA]) provides fixed-route and paratransit service throughout the Cities of Dublin, Pleasanton, and Livermore, and provides connections to other transit service providers. Wheels buses connect major destinations within the Cities of Dublin, Pleasanton, and Livermore, including Downtown areas, employment centers and destinations such as the Hacienda

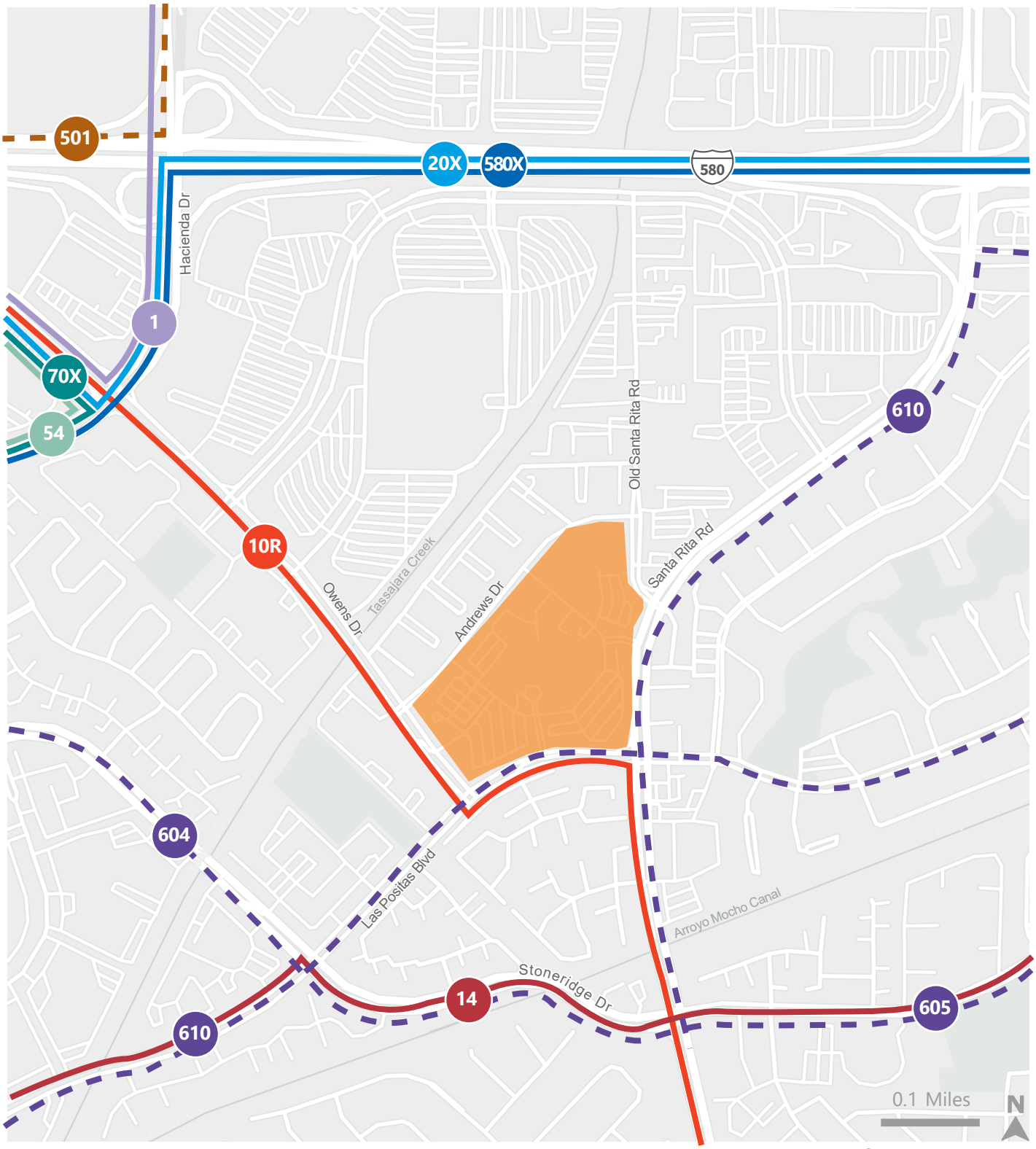
Business Park, Bernal Corporate Park, Stoneridge Mall, and transit hubs, including BART and ACE stations. Wheels bus schedules are also coordinated with ACE and BART trains during peak commute hours.

Wheels Routes stops are located south, east, and west of the project site on Santa Rita Road, West Las Positas Boulevard, and Owens Drive. Wheels Routes that run within a one-mile vicinity of the project cite include Route 1, 3, 10R, 14, and 54. These routes provide access to facilities including the Dublin/Pleasanton BART, the Stoneridge Mall, the Livermore Transit Center, and the ACE station south of the project site. The frequency of these lines varies from 30 to 60-minute headways. Additionally, Routes 604, 605, 608, and 610 provide local access to Pleasanton Unified school District schools in the area during the morning and evening peak hours.

***Pleasanton Rides*** provides scheduled door-to-door shared ride services for registered residents of Pleasanton and Sunol who are age 70 and over. Transportation is provided between 8:00 AM and 5:00 PM, Monday, Wednesday, and Friday. Rides can be scheduled up to 7 days in advance and no later than 24 hours before the desired ride time. Destinations include all locations in Pleasanton, and select locations in Dublin and Livermore, like Kaiser and the VA Medical Center.

***BART*** provides regional transportation connections to much of the Bay Area and the Dublin/Pleasanton line provides direct access to the Daly City Station. It provides connections across the Bay Area, notably to Oakland, OAK Airport, San Francisco, and SFO Airport. The closest BART station is the Dublin/Pleasanton Station located about 1.3 miles northwest of the project site. Currently, BART trains run on 20-minute headways through the East Pleasanton station from approximately 5:00 AM to 12:00 AM.

The ***Altamont Commuter Express*** (ACE) operates weekday train service between Stockton and San Jose with a stop in Downtown Pleasanton. During the morning commute period only westbound service from the Central Valley to San Jose is provided, while only eastbound service is provided in the afternoon/evening commute period. Pre COVID-19, there were typically four morning trains through Pleasanton between 5:33 AM and 8:18 AM, and four evening trains between 4:28 PM and 7:31 PM. Travel time from Stockton to Pleasanton is approximately one hour and fifteen minutes, while travel time from Pleasanton to San Jose is approximately one hour. ACE Service is currently reduced with two trains in each direction, and no weekend service. The Pleasanton ACE station is located just under two miles south of the study area on Pleasanton Avenue at Bernal Avenue. Wheels provides shuttle services between the ACE and BART stations, which serve the transit stops near the project site.




Source: LAVTA System Map, 2024

**LAVTA Routes**

- Project Location
- Route 1
- Route 10R
- Route 14
- Route 20X
- Route 54
- Route 70X
- Route 580X
- Routes 501-504
- Routes 601-611

Figure 2

## Existing Transit Facilities

# Existing Pedestrian and Bicycle Facilities

This section describes the existing pedestrian and bicycle facilities in the vicinity of the project site.

## Pedestrian Facilities

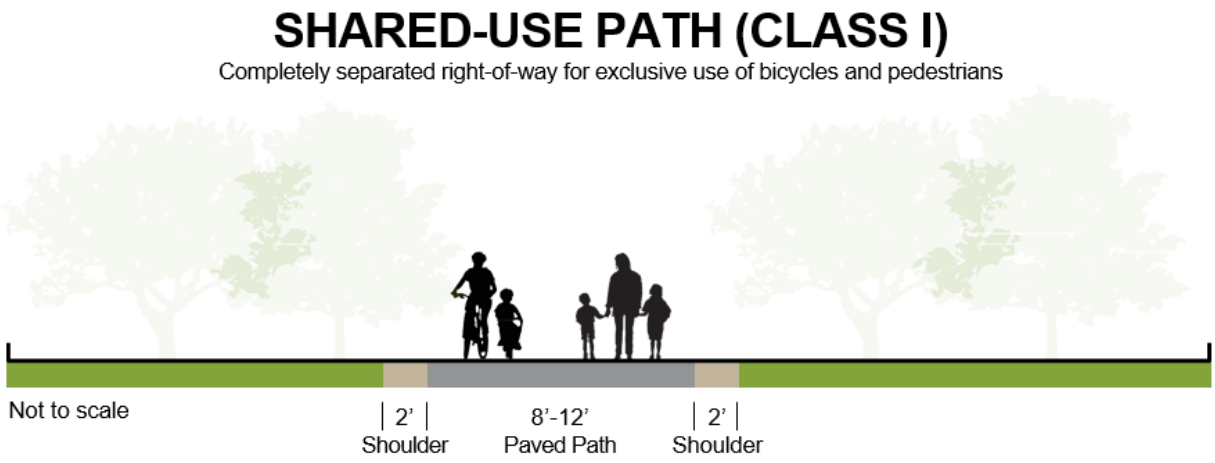
***Pedestrian facilities*** include sidewalks, pathways, crosswalks, and pedestrian signals. Pedestrian facilities are provided on most of the roadways in the vicinity of the project site. Exceptions include the south side of West Las Positas Boulevard, Santa Rita Road and Owens Drive and some portions of Old Santa Rita Road north of Andrews Drive.

The most direct route with pedestrian facilities for people walking from the project site to/from the Dublin/Pleasanton BART station is via pedestrian facilities on Owens Drive west of the project site and the Ironhorse Trail, leading to the BART station transit hub.

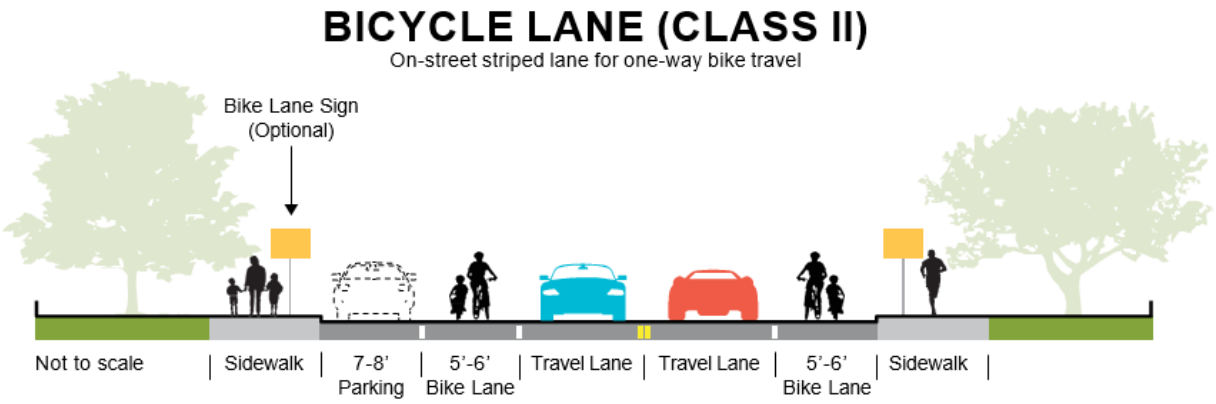
## Bicycle Facilities

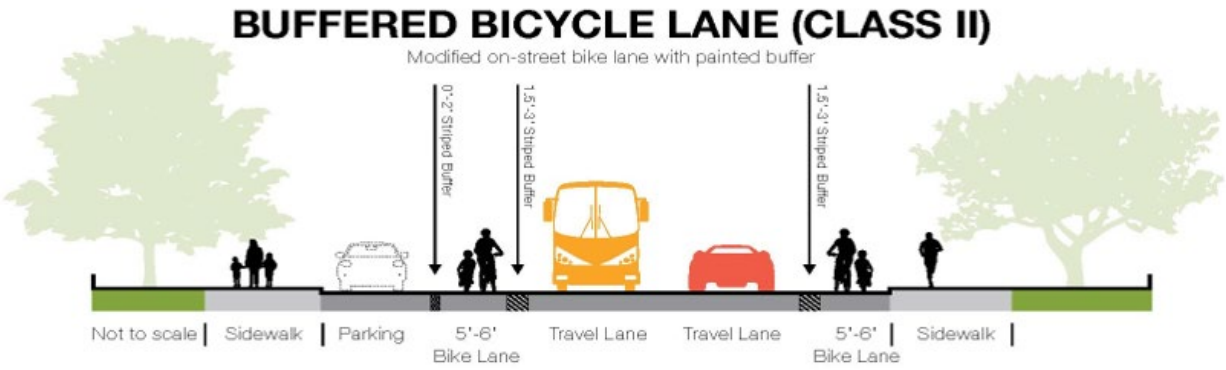
***Bicycle facilities*** in Pleasanton include the general types described below. The graphics following the description of each type of bicycle facility are the minimum American Association of State Highway and Transportation Officials (AASHTO) standards for each type of bike facility to provide a general depiction of each type of bicycle facility. Within the City of Pleasanton, these standards provide a framework for future implementation but depending on the circumstances and where feasible, the City of Pleasanton has chosen to go above and beyond AASHTO standards.

- Bike paths (Class I) – Bike paths provide a separate right-of-way and are designated for the exclusive use of people riding bicycles and walking, with minimal crossflow traffic. Such paths can be well situated along creeks, canals, and rail lines. These facilities are typically shared with pedestrians, although bicycles must yield to pedestrians. Vehicle crossflow is minimized.

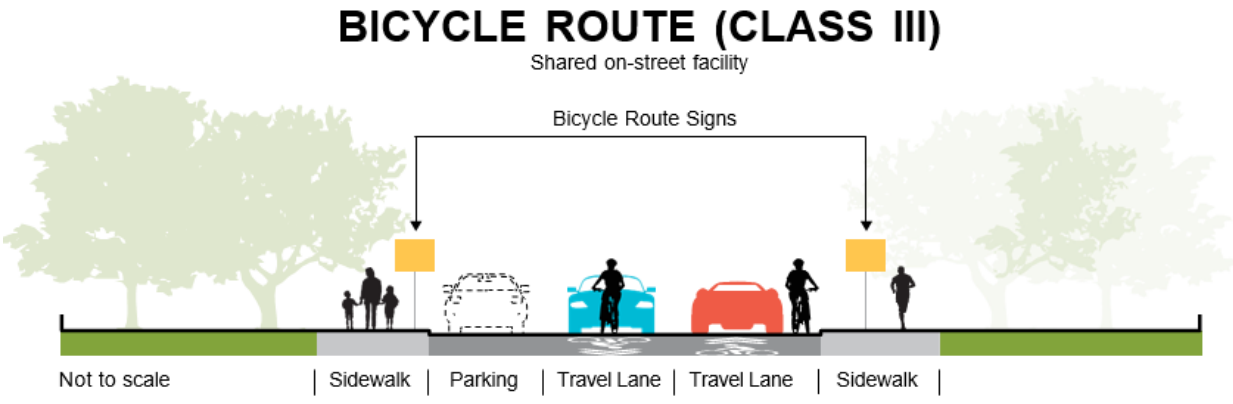


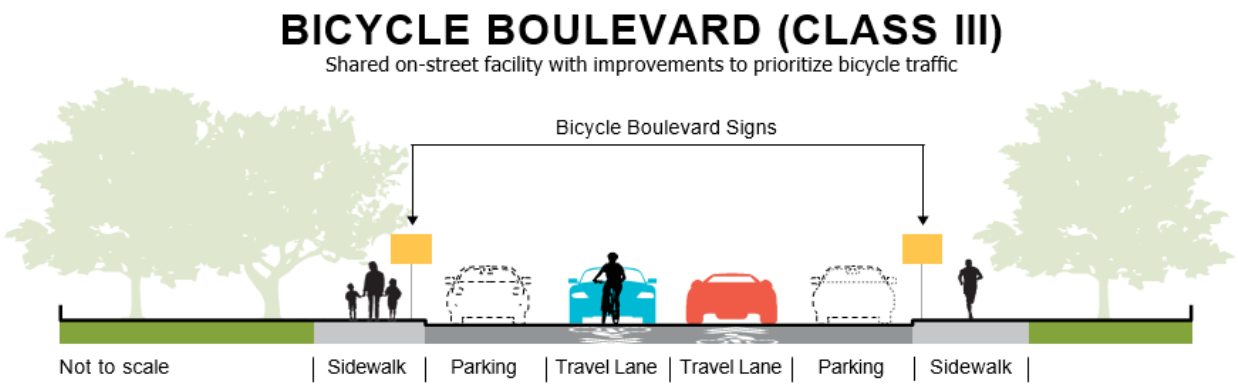
- Bike lanes (Class II) provide restricted right-of-way and are designated for the use of people bicycling with a striped lane on a street. Bicycle lanes are generally five feet wide. Adjacent vehicle parking and vehicle/pedestrian crossflow are permitted. Bike lanes may also provide a painted buffer between the bike lane and the vehicle travel lane.



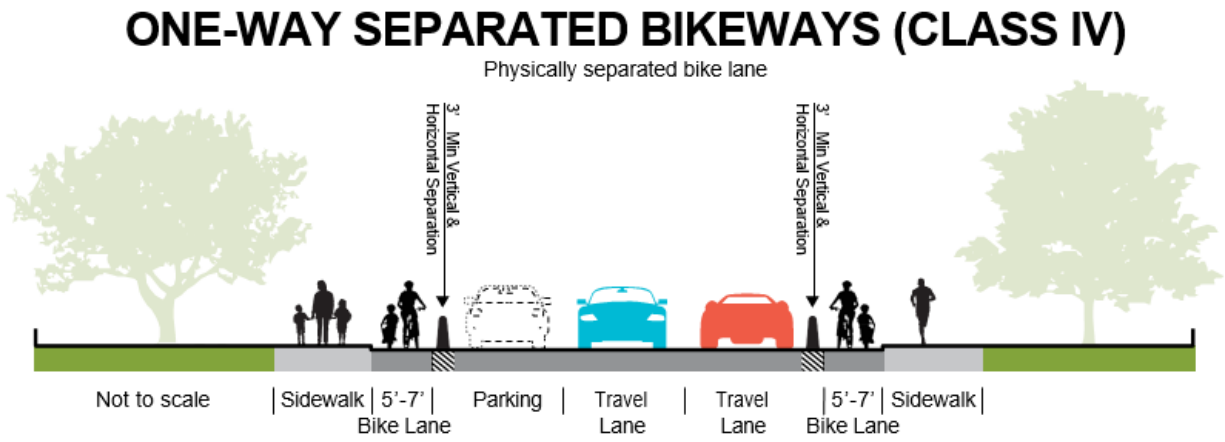



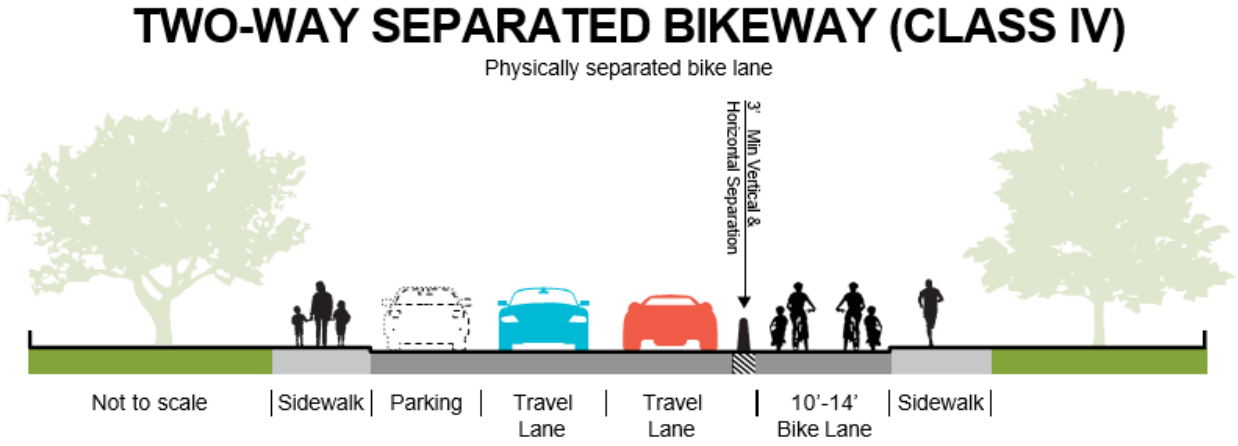

- Bike routes (Class III) are streets including a shared right-of-way for vehicles and bicycles, with traffic calming measures and bicycle-specific enhancements that make them safer for bicycle users. These upgrades often include signage, pavement markings, and intersection treatments to prioritize bicycle traffic.





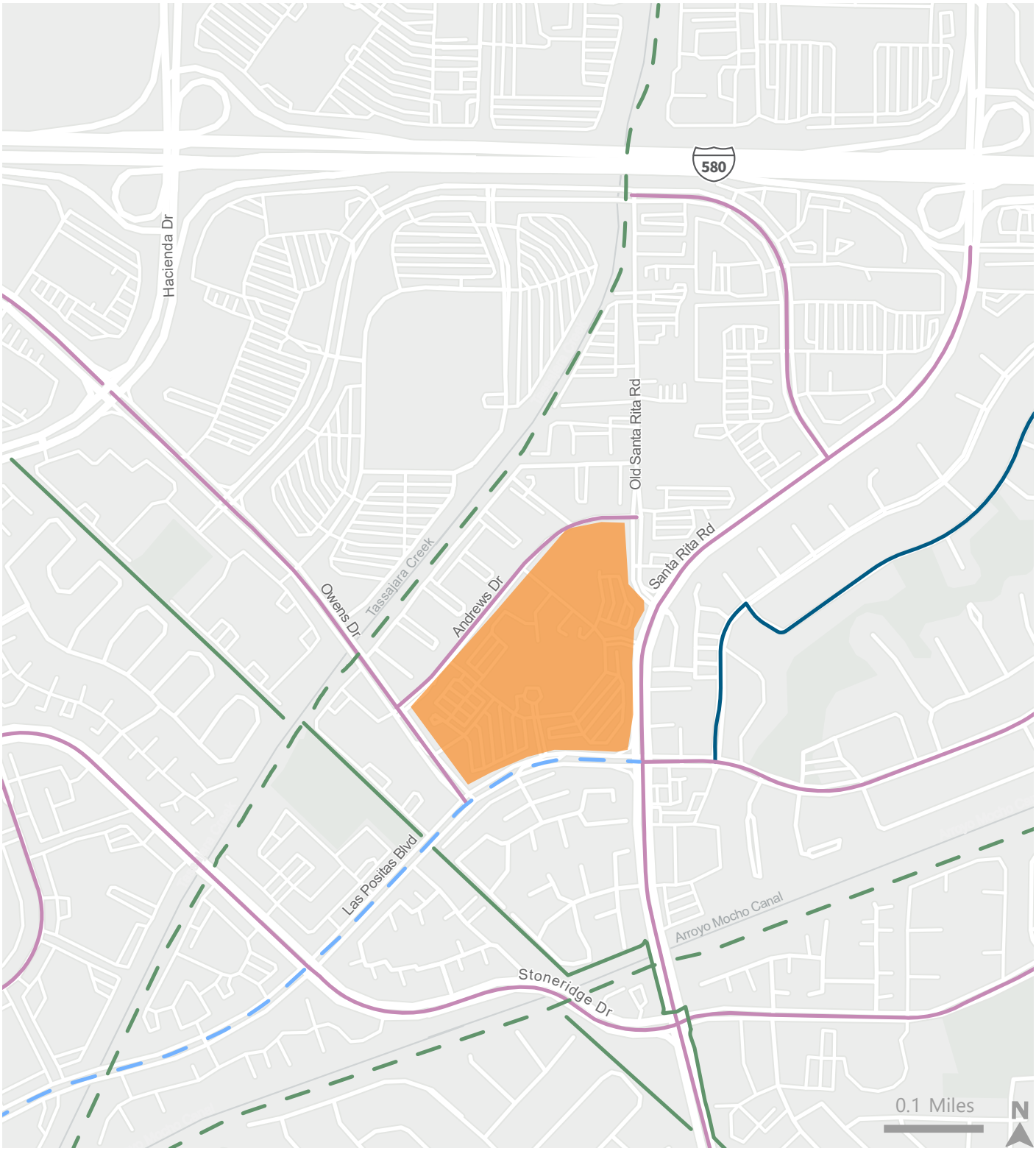

- Side Paths – An off-street facility located adjacent to a roadway that is shared with pedestrians. These paths may be paved or unpaved.
- Separated Bikeways (Class IV) - Separated bikeways, also referred to as cycle tracks or protected bikeways, are bikeways for the exclusive use of bicycles which are physically separated from vehicle traffic. Separated Bikeways were adopted by Caltrans in 2015. Types of separation may include, but are not limited to, grade separation, flexible posts, physical barriers, or on-street parking.



In the immediate study area, there are **Class II** bike lanes along Santa Rita Road, Owens Drive, Andrews Drive, Hacienda Drive, and Stoneridge Drive. While there are no bicycle facilities on West Las Positas Boulevard abutting the project site, it is the highest ranked bicycle and pedestrian improvement corridor in the City's Bicycle and Pedestrian Master Plan. The Iron Horse Trail is a **Class I** shared-use bicycle path, spanning from Concord to Livermore. The Iron Horse Trail is approximately 200 feet southwest of the project site, accessed via Owens Drive or West Las Positas Boulevard.

**Figure 3** shows the extent of existing and planned bicycle facilities in Pleasanton near the project site.




Data Source: City of Pleasanton

| | Existing | Proposed | Bikeways |
|---|---|---|---|
| Project Location | | | |
| | | | Shared Use Path (Class I) |
| | | | Bicycle Lane (Class II) |
| | | | Bicycle Routes (Class III) |
| | | | Separated Bikeway (Class IV) |

Figure 3

## Existing and Proposed Bicycle Facilities

# Existing Intersection Volumes

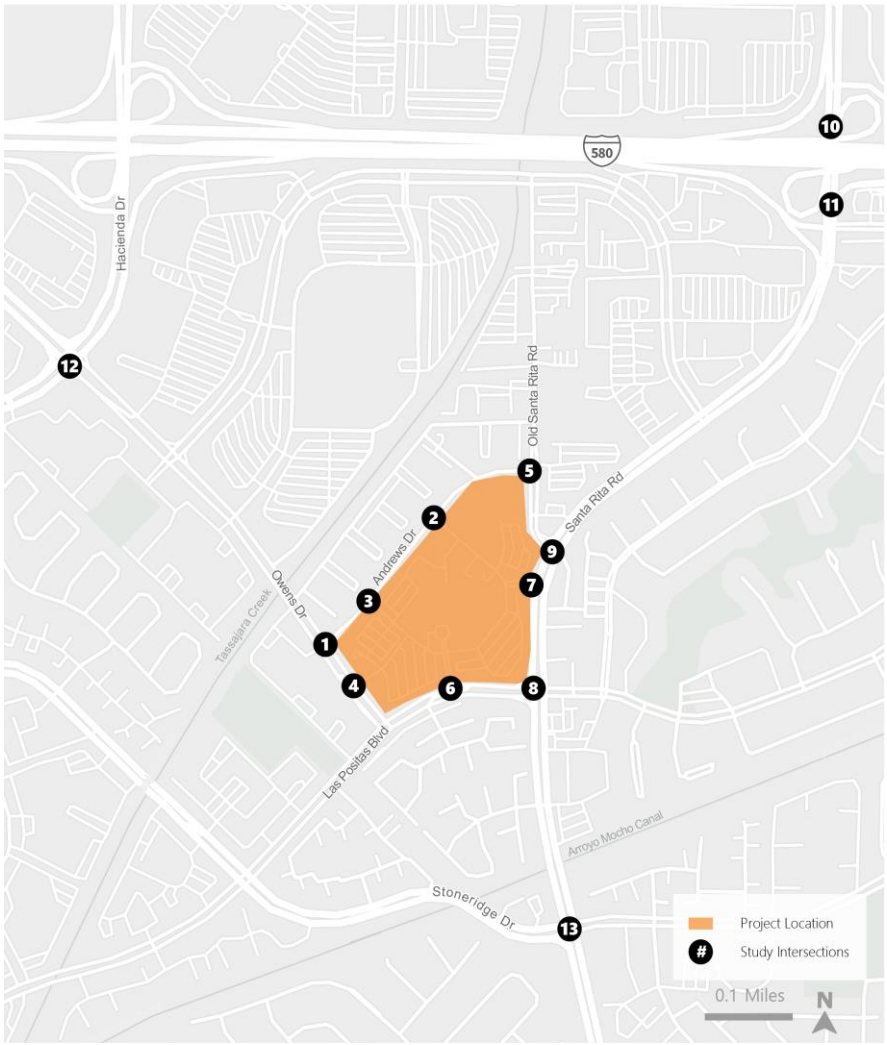
Weekday morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) peak period intersection turning movement counts were conducted at the study intersections in May of 2024 including separate counts of trucks, pedestrians, and bicyclists. For the study intersections, the single hour with the highest traffic volumes during the count periods was identified and evaluated in the traffic analysis. The peak hour volumes are presented on **Figure 4** along with the existing lane configuration and traffic control. Traffic count worksheets are provided in **Appendix A**.

# Existing Intersection Operations

## Level of Service

Existing intersection operations were evaluated using the methodology described in Chapter 1. The analysis was based on the volumes, lane configurations and traffic control shown on **Figure 4**. Observed peak hour factors[1] were used at all intersections for the existing conditions analysis. Truck, pedestrian, and bicycle activity was factored into the analysis. The intersection operations results are summarized in **Table 3**. Detailed intersection LOS calculation worksheets are provided in **Appendix B**.

[1] The relationship between the peak 15-minute flow rate and the full hourly volume is given by the peak-hour factor (PHF) as shown in the following equation: PHF=Hourly volume/(4* volume during the peak 15 minutes of flow). The analysis of level of service is based on peak rates of flow occurring within the peak hour because substantial short-term fluctuations typically occur during an hour.



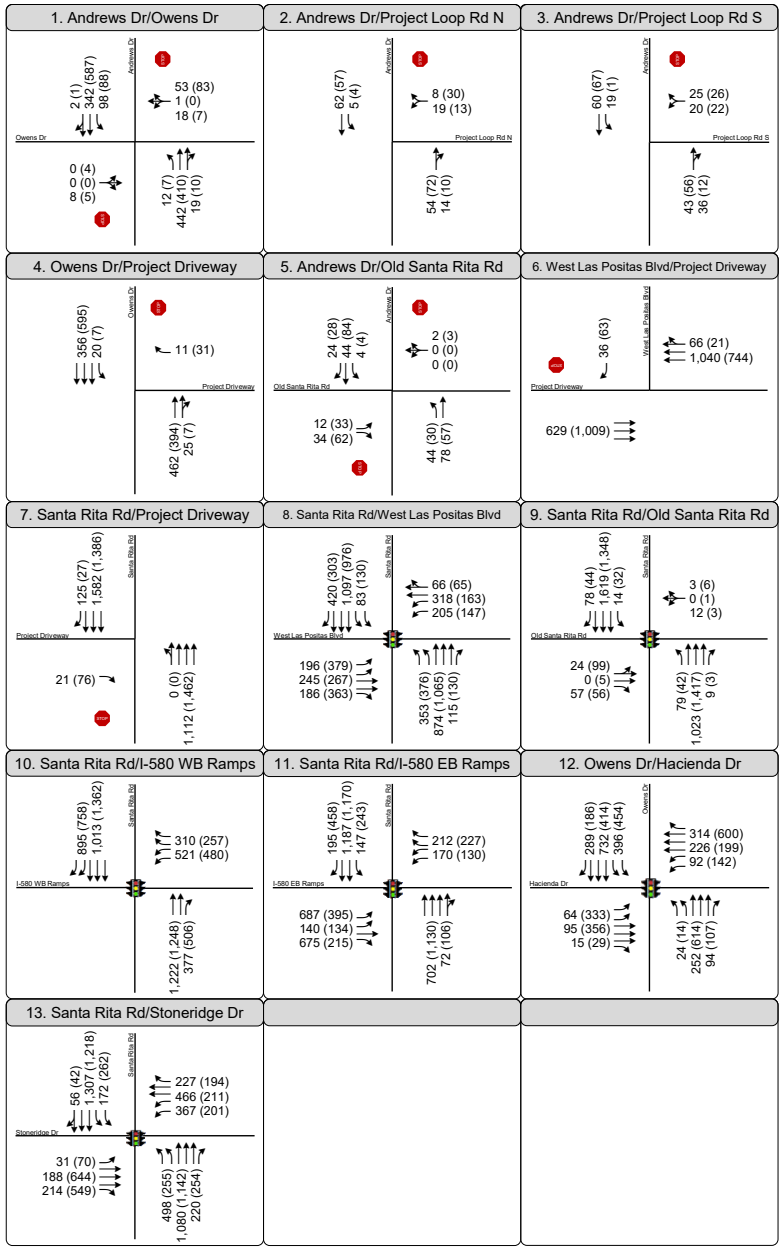




Figure 4
Peak Hour Intersection Traffic Volumes, Lane Configurations, and Traffic Controls

**Table 3: Existing Conditions – Intersection Operations**

| Intersection | Control[1] | Peak Hour[2] | LOS Standard | Existing Conditions | |
|---|---|---|---|---|---|
| | | | | Delay[3] | LOS |
| 1. Andrews Drive/Owens Drive | Side-Street Stop | AM<br>PM | D | 2.3 (16.9)<br>1.7 (22.4) | A (C)<br>A (C) |
| 2. Andrews Drive/Project Loop Road North | Side-Street Stop | AM<br>PM | D | 1.8 (9.4)<br>2.4 (9.4) | A (A)<br>A (A) |
| 3. Andrews Drive/Project Loop Road South | Side-Street Stop | AM<br>PM | D | 2.8 (9.4)<br>2.5 (9.4) | A (A)<br>A (A) |
| 4. Owens Drive/Project Driveway | Side-Street Stop | AM<br>PM | D | 0.3 (10.5)<br>0.4 (9.9) | A (B)<br>A (A) |
| 5. Andrews Drive/Old Santa Rita Road | Side-Street Stop | AM<br>PM | D | 3.4 (9.5)<br>3.9 (9.5) | A (A)<br>A (A) |
| 6. West Las Positas Boulevard/Project Driveway | Side-Street Stop | AM<br>PM | D | 0.2 (12)<br>0.4 (10.7) | A (B)<br>A (B) |
| 7. Santa Rita Road/Project Driveway | Side-Street Stop | AM<br>PM | D | 0.1 (9.2)<br>0.2 (9.3) | A (A)<br>A (A) |
| 8. Santa Rita Road/West Las Positas Boulevard | Signal | AM<br>PM | D | 31.1<br>32.1 | C<br>C |
| 9. Santa Rita Road/Old Santa Rita Road | Signal | AM<br>PM | D | 11.3<br>13.0 | B<br>B |
| 10. Santa Rita Road/I-580 Westbound Ramps[5] | Signal | AM<br>PM | D | 8.0<br>8.3 | A<br>A |
| 11. Santa Rita Road/I-580 Eastbound Ramps[5] | Signal | AM<br>PM | D | 25.7<br>23.9 | C<br>C |
| 12. Owens Drive/Hacienda Drive[5] | Signal | AM<br>PM | D | 13.6<br>20.3 | B<br>C |
| 13. Santa Rita Road/Stoneridge Drive | Signal | AM<br>PM | D | 42.1<br>35.1 | D<br>D |

Notes:
1. Existing intersection traffic control type (Signal = Signalized, Side-Street Stop = Side-Street Stop control)
2. AM = Weekday morning peak hour; PM = Weekday evening peak hour
3. Whole intersection average delay reported for signalized intersections. Side-Street Stop-Controlled intersection delay presented as Whole Intersection Average Delay (Worst Movement Delay).
4. Delay calculated per HCM 2000 methodologies.
5. Intersections 10, 11 and 12 are designated as "gateway intersections" in the City's General Plan. The LOS standard is D at these locations; however, they may have an LOS below D if no reasonable mitigation exists or if the necessary mitigation is contrary to the other goals and policies of the City.

Source: Fehr & Peers, January 2025.

As shown in **Table 3**, the study intersections operate acceptably during existing conditions.

## Queues

Although the intersections currently operate within the standards set by the City of Pleasanton, there may be periodic vehicle queue spillback and delays greater than shown in **Table 3** for some movements. Ninety-fifth percentile vehicle queues were evaluated at signalized intersections, and detailed queue worksheets are provided in **Appendix C**. This analysis found no vehicular queues extending beyond the available storage in existing conditions at the study intersections.

# 3. Project Characteristics

This chapter provides a review of the trip generation, distribution and assignment analysis completed for the project. The proposed project trip generation, trip distribution, and trip assignment allow for an evaluation of project effects on the surrounding roadway network. The amount of project traffic estimated to be added to the transportation system after completion of the project was estimated using a three-step process:

1. **Trip Generation** – The amount of vehicle traffic entering/exiting the site was estimated.
2. **Trip Distribution** – The directions of trips to compatible land uses and their general routes of approach/departure to the project site were identified.
3. **Trip Assignment** – Trips were then assigned to specific roadway segments and intersection turning movements based on likely paths of travel.

## Project Description

Stanford Health Care (SHC) Tri-Valley Hospital is a medical center complex at the northwest corner of the intersection of West Las Positas Boulevard and Santa Rita Road. This project's (the East Wing project) purpose is to build a new three-story, approximately 66,000 square foot hospital addition at the east side of the existing SHC Tri-Valley Hospital. With the addition the facility in total will have 24 net additional beds and house approximately 122 additional employees (daily) once fully built out.

Development on the project site is a Planned Unit Development (PUD) – Public and Institutional District. The original PUD application for SHC Tri-Valley (formerly Valleycare Medical Center) was approved in 1986. The approved PUD allows for a total of 488,000 square feet of medical facilities (the existing facilities are 282,235 square feet in total and the East Wing project would add 66,000 square feet of new space).

### *Project Details*

To address the growing demands for emergency services, the first-floor level will expand the existing Emergency Department to a total of 42 examination and treatment locations including new waiting, registration, triage, security vestibule, ambulance parking, staff lounge with outdoor staff patio, and support spaces. Approximately 1/3 of the existing Emergency Department will also be renovated with the remainder of the Emergency Department cosmetically refreshed. The second-floor level will be designed as a shell space to accommodate a potential future 24-bed nursing unit to support future inpatient volume. In addition to the potential nursing unit, the second-floor level will include two Labor and Delivery rooms that will replace two existing rooms displaced by the new hospital addition. The existing Lab, Pharmacy and Sterile Processing Department are undersized relative to current needs and SHC Tri-Valley intends to combine code required space with functional needs housed in the existing Ancillary Support Services Building (ASSB). Currently there is a deficiency of approximately 14,000 DGSF for these key support services. The third-floor level will include a new Laboratory, Pharmacy and Sterile Processing



Department (SPD) to help resolve these capacity shortfalls and support the greater Emergency Department objectives. After activation of the new SPD space on the third-floor level, the existing SPD on the first-floor level with be backfilled with storage. The roof level will include an enclosed mechanical penthouse approximately 3,500 square feet in area and a screened mechanical enclosure for the remainder of the new roof area. In preparation for construction of the new hospital addition several make-ready projects will be required. These include re-routing of existing underground utilities within the footprint of the new hospital addition, reconfiguration of the existing loop drive, demolition of the existing ambulance canopy, construction of a new temporary ambulance canopy/parking area and new surface parking to replace existing parking spaces displaced by the new work.

Emergency water and wastewater storage tanks are required for the hospital to meet the 2030 State of California deadline for seismic resiliency. The project's scope includes installation of new NPC-5 compliant potable water and wastewater storage tanks for the entire hospital and SPC 4D and NPC4 evaluation and upgrades to the existing arcade canopy near the emergency department.

## Project Trip Generation

Trip generation refers to the process of estimating the amount of vehicular traffic a project would add to the surrounding roadway system. Project trip generation estimates are prepared for the one-hour peak period during the weekday morning and evening commute when traffic volumes on the adjacent streets are typically the highest, as well as for the 24-hour weekday period. To estimate the level of traffic that could be generated by the project, trip generation estimates were developed based on trip generation rates presented in the Institute of Transportation Engineers (ITE) *Trip Generation Manual, 11th Edition* for the hospital land use. Driveway counts of vehicles have found that ITE's Hospital data (Land Use Code 610) best represents on site activity. The ITE manual presents trip generation rates using three independent variables – square footage, employees and beds. **Table 4** presents the trip generation results using each of the three available independent variables. As the amount of "square feet" being added by a project represents the most conservative result, it is used in the assessment.

**Table 4: Project Trip Generation**

| Independent Variable | Units | AM Peak Hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|---|
| | | In | Out | Total | In | Out | Total |
| Square feet | 66 ksf | 36 | 18 | 54 | 20 | 37 | 57 |
| Employees | 122 | 25 | 7 | 34 | 10 | 24 | 34 |
| Beds | 24 | 31 | 12 | 43 | 13 | 27 | 41 |
| **Net New Project Trips** | | **36** | **18** | **54** | **20** | **37** | **57** |

Notes:
1. Based on *Trip Generation* (11th Edition) trip generation rates for land use 610, Hospital.
2. Note that the detailed traffic analysis is based on a slightly smaller project (62,000 s.f.) with the same number of employees and beds. The 62,000 s.f. project generates three fewer AM peak hour trips and four fewer PM peak hour trips, which would not materially affect the analysis.

Source: Fehr & Peers, January 2025

As presented in Table 4, the project is expected to generate approximately 54 new AM peak hour vehicle trips and 57 new PM peak hour vehicle trips.

## Project Trip Distribution & Assignment

Project trip distribution refers to the directions of approach and departure that vehicles would take to access and leave the site. The project trip distribution was estimated based on a select zone analysis using the City of Pleasanton model, project site access, existing traffic count data, existing travel patterns, and the location of complementary land uses. The resulting trip distribution is shown on **Figure 5**. Project trip assignment refers to project trip loading on specific roadway segments and intersection turning movements in the study area, as shown on **Figure 6**.

As the proposed improvements occur on the north side of the project site, new trips are expected to be predisposed to park in the northern and northeastern portions of the project site. Some vehicles accessing the site from the south via Santa Rita Road are expected to make a U-turn at the Santa Rita Road/Old Santa Rita Road intersection. This movement will be the quickest way for them to access the portions of the site they are seeking to access. These U-turns are reflected in the project's trip assignment and traffic analysis.

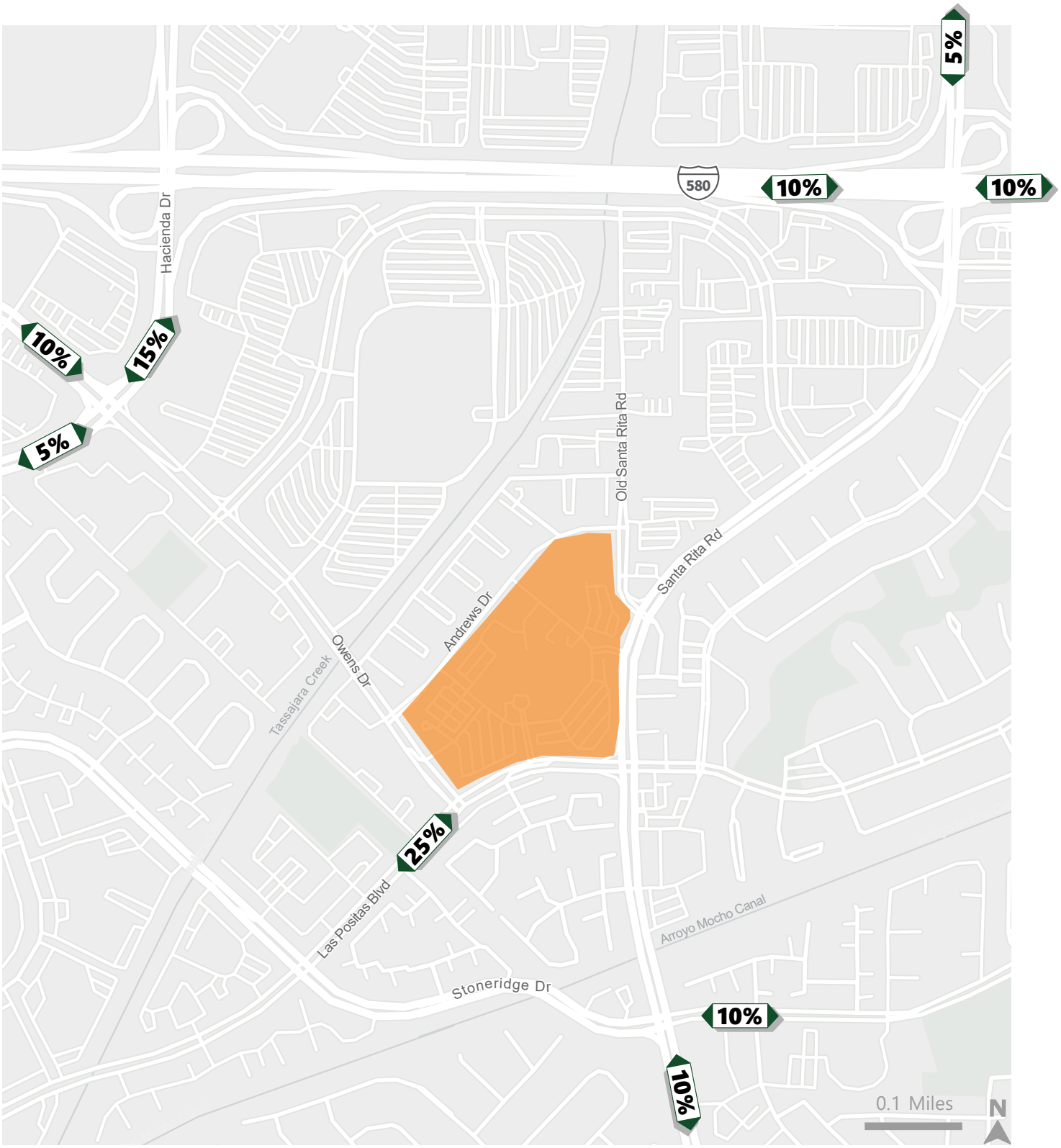
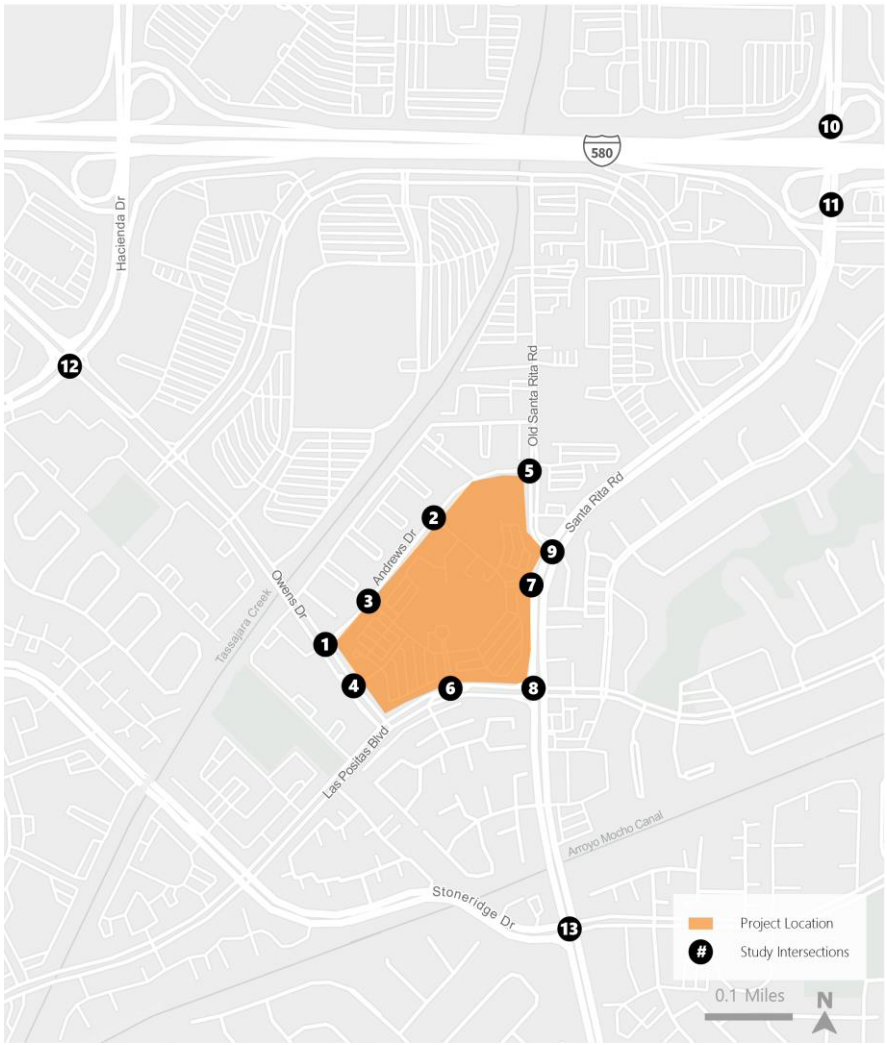



Figure 5

## Project Trip Distribution

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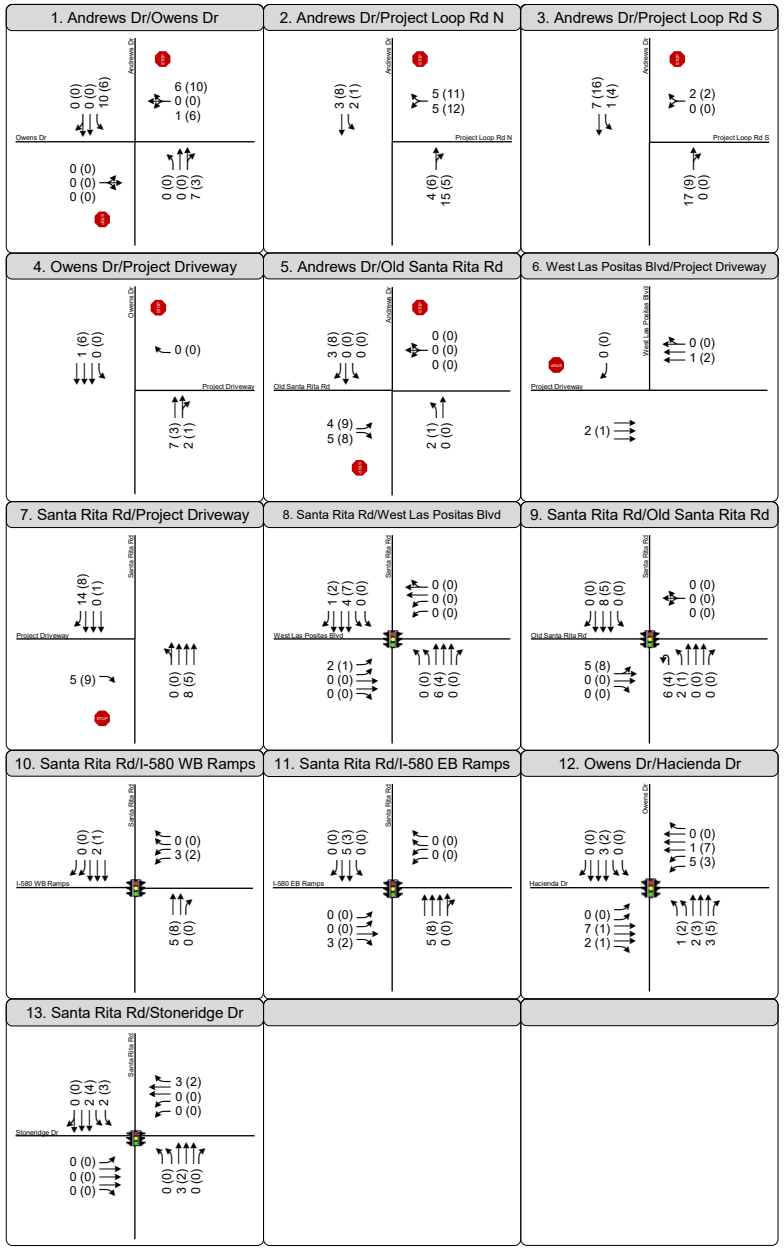




Figure 6
Project Trip Assignment

# 4. Site Plan Review

This chapter analyzes site access and internal circulation for vehicles, pedestrians, bicycles, and emergency vehicles based on the site plan presented previously on **Figure 1B.**

## Vehicular Site Access and Circulation

The proposed East Wing project would not substantially alter the site's overall access and circulation. Vehicular access would continue to be provided via access points on West Las Positas Boulevard, Owens Drive, Santa Rita Road and two connections to Andrews Drive. Figure 1B illustrates these access points and the site's overall internal circulation. Given the East Wing project's location, most new trips accessing the site are expected to use the northern Andrews Drive access, Old Santa Rita Road, and West Las Positas Boulevard. The project would modestly realign the existing two-way loop roadway through the site, pushing it to the northeast to create space for the East Wing addition. The patient drop-off and ambulance parking areas would be reconfigured, as illustrated on the site plan.

Turning templates for passenger vehicles and ambulances were checked for all the internal movements that would be created by the proposed site plan modifications. This analysis found that adequate space for turning maneuvers is provided by the proposed design. **Figure 7A** presents the sidewalks, roadway markings, crosswalks and intersection controls proposed by the project in the area of the East Wing modifications. Stop signs, stop markings and stop bars would be installed at the affected intersections. An all-way stop would be installed at the intersection of the loop road and the ambulance drop off. All of the affected internal intersections would operate effectively with low levels of vehicle delay under the proposed configuration and control.

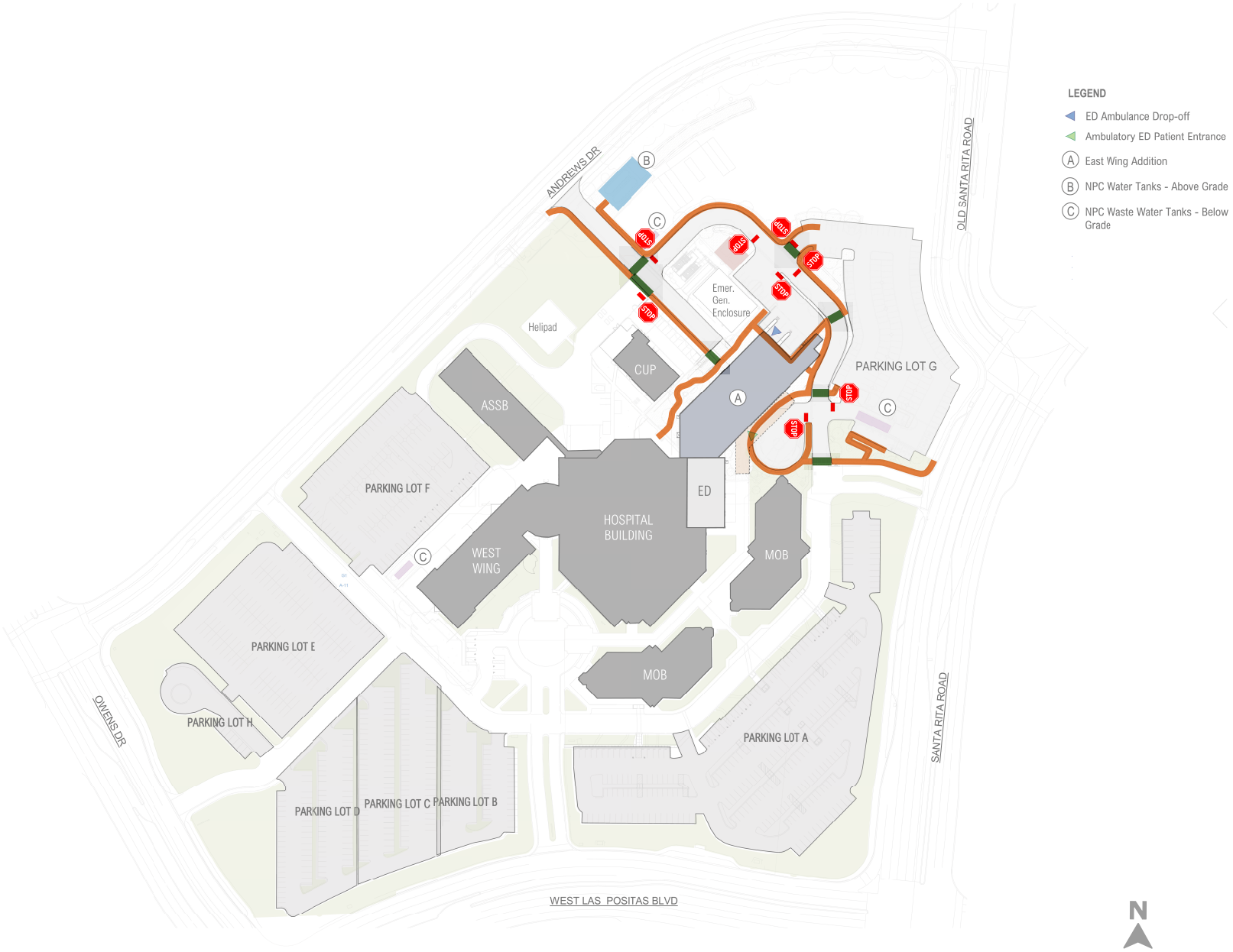
> ***Improvement Recommendation 1*** – Install the internal signage, striping and markings illustrated on Figure 7A. Figure 7A illustrates the stop signs, stop markings, crosswalks and other delineation for internal intersection control.

## Emergency Vehicle Access

Several factors determine whether a project has sufficient access for emergency vehicles, including:

1. Number of access points (both public and emergency access only)
2. Width of access points
3. Width of internal roadways

The East Wing project would not materially affect emergency vehicle access to the site. Five connections to the external roadway network would be provided, as described above. The site's internal roadway network provides access to all sides of the facility and the roadways are of sufficient width to accommodate the design fire vehicle.




*Site Plan Source: Taylor Design, 10/25/24*

East Wing Sidewalk Locations

Crosswalks

Stop Bar, Stop Marking and Stop Sign

Figure 7A

# East Wing Sidewalks and Roadway Markings




*Site Plan Source: Taylor Design, 10/25/24*

- Patient, Visitor and Staff Parking
- Patient and Visitor Parking
- Emergency Department and Staff Parking
- Staff and Physician Parking
- Physician Parking

Figure 7B

## Site Parking Delineation

## Pedestrian Access and Circulation

The proposed project would not modify the site's pedestrian connections to the external transportation network. Sidewalk connections from the hospital to the external roadway network are provided on all five access points. In addition, city standard sidewalks are provided along the full length of the project's frontages on West Las Positas Road, Andrews Drive, Old Santa Rita Road, Santa Rita Road and Owens Drive. **Figure 7A** presents the sidewalks, roadway markings, crosswalks and intersection controls proposed by the project in the area of the East Wing modifications. Sidewalks and crosswalks are proposed connecting the East Wing's main entrance and the ambulance drop off area with the neighboring parking lot G and the existing pedestrian facilities connecting to Santa Rita Road.

## Bike Access and Circulation

In the immediate study area, there are Class II bike lanes along Santa Rita Road, Owens Drive, Andrews Drive, Hacienda Drive, and Stoneridge Drive. While there are no bicycle facilities on West Las Positas Boulevard abutting the project site, it is the highest ranked bicycle and pedestrian improvement corridor in the City's Bicycle and Pedestrian Master Plan. The Iron Horse Trail is a Class I shared-use bicycle path, spanning from Concord to Livermore. The Iron Horse Trail is approximately 200 feet southwest of the project site, accessed via Owens Drive or West Las Positas Boulevard. The East Wing project is not expected to materially alter bike access or circulation at the site.

Per the City of Pleasanton's Climate Action Plan 2.0 (P8) new construction non-residential projects should provide two (2) short-term bicycle parking spaces (e.g. bicycle racks) for each 9,000 SF of gross floor area (minimum 2 spaces) and one long-term bicycle parking space (i.e. bicycle locker, enclosed storage, or racks within building) for each 9,000 SF of gross floor area. The site landscape and hardscape design will provide approximately fourteen (14) bicycle parking spaces at the exterior of the building and an enclosed space to accommodate seven (7) bicycle parking spaces.

## Transit Facilities

The project site is not directly served by Wheels. The closest bus stop to the site is served by the eastbound Route 10R bus on Santa Rita Road located roughly 0.2 miles east. The second closest transit stop to the site also serves the 10R bus on West Las Positas Boulevard and Owens Drive, which is about 0.3 miles south of the project site. Both transit stops would be accessed via existing pedestrian facilities on Santa Rita Road and Andrews Drive. As existing transit stations are approximately less than one half-mile from the project site, some future residents may choose to use a shared mobility device, such as a scooter or bike share to access transit.

## Parking

Existing surface parking lots at the south, west and east sides of the site will not be modified and are not a part of the East Wing project. Six existing Emergency Department parking spaces and four existing Staff / Emergency Department spaces will be displaced by the new east wing hospital addition and ring road

reconfiguration. The existing staff and emergency department parking lot east of the hospital addition will be expanded to accommodate the displaced parking spaces.

### Parking Supply and Demand

The site currently provides a total of 989 on-site parking spaces. With the completion of the East Wing project, the total would remain unchanged. **Figure 7B** illustrates the project's proposed delineation of parking by user type. With the project, the following spaces would be provided:

- Physician – 81
- Staff - 469
- Patient and Visitor – 365
- Other - 74

Observations of site parking lot occupancy have found that on-site parking peaks in the 8 to 9 AM hour on a weekday. A maximum observed occupancy of 909 spaces has been noted at the site, which nets a total of 80 available parking spaces during periods of peak parking to support the East Wing project.

#### *Buildout Parking Demand*

Based on rates from the Institute of Transportation Engineers, *Parking Generation Manual, 6th Edition*, the proposed East Wing project's total parking demand at buildout is expected to be as follows:

- Beds – 24 x 3.89 spaces/bed = 93 spaces
- Square footage – 66 ksf x 2.25 spaces/ksf = 149 spaces
- Employees – 122 x 0.74 spaces/employee = 90 spaces
- Average Across All Independent Variables = 111 spaces

The *Parking Generation Manual, 6th Edition* provides parking demand statistics for the "hospital" land use for three different independent variables – beds, square footage and employees. The proposed project is forecast to increase parking demand at the site by approximately 111 spaces based on the average forecasts of the three available independent variables. The 80 available parking spaces during observed periods of peak occupancy are not sufficient to meet this new demand.

#### *East Wing Hospital Addition Parking Demand*

The East Wing Hospital Addition project does not include the buildout or occupancy of the facility's second floor, which is currently planned as shell space. Buildout and occupancy of the second floor will be done in the future as a separate project and is not anticipated for several years. In the current East Wing project, only the first and third floors will be built out and occupied. Those floors will include 44,200 square feet and 61 total employees (no beds). The predicted parking demand for the East Wing Hospital Addition project is as follows:

- Square footage – 44.2 x 2.25/ksf = 99 spaces
- Employees – 61 x 0.74 spaces/employee = 45 spaces
- Average Across All Independent Variables = 72 spaces

The 80 available parking spaces during observed periods of peak occupancy are sufficient to accommodate the forecast East Wing Hospital addition parking demand of 72 spaces. While parking is not considered to be an issue within CEQA, the lack of sufficient parking can hinder the project's functionality.

> ***Improvement Recommendation 2*** – While the existing parking supply would accommodate current project, it is not forecast to accommodate the parking demand when the 2nd floor is built out. When the East Wing's second floor is built out and occupied, the applicant shall provide additional on-site parking. A total of 31 additional parking spaces will be needed on site to accommodate this excess demand.

# 5. Traffic Operations

This chapter evaluates off-site traffic operations under Existing, Existing Plus Approved Project (EPAP) and Cumulative conditions without and with the project.

## Existing with Project Conditions

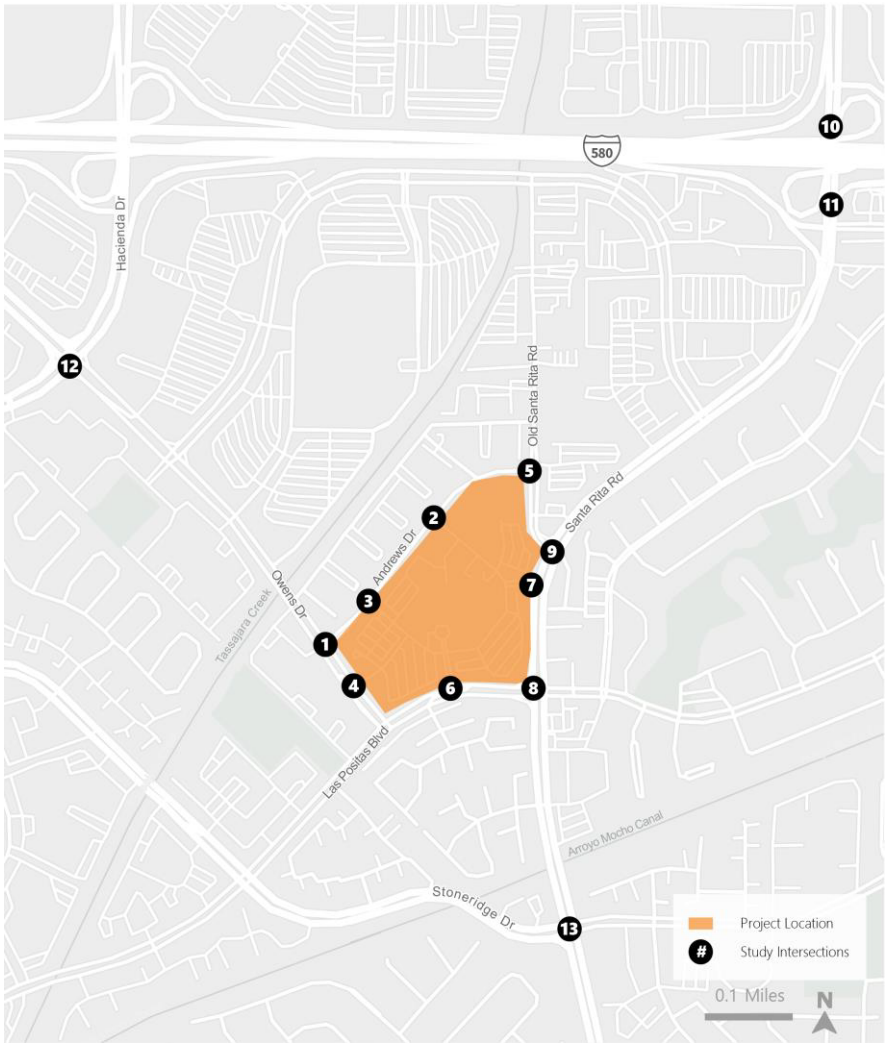
### Existing with Project Traffic Volumes

The project traffic volumes on **Figure 6** were added to the existing traffic volumes from **Figure 4** to estimate the Existing with Project traffic volumes, as shown on **Figure 8**. No improvements were assumed at any of the study intersections in this scenario. As the proposed project's improvements occur on the north side of the site, new trips are expected to be predisposed to park in the northern and northeastern portions of the project site. Some vehicles accessing the site from the south via Santa Rita Road are expected to make a U-turn at the Santa Rita Road/Old Santa Rita Road intersection. This movement would be the quickest way for them to access the portions of the site they are seeking to access. These U-turns are reflected in the project's trip assignment and traffic analysis.

### Analysis of Existing with Project Conditions

*Intersection Operations*

Intersections were evaluated under Existing with Project conditions using the methods described in Chapter 1. The Existing with Project analysis results are presented in **Table 5**, based on the traffic volumes and intersection configurations presented on **Figure 8**, along with the results for Existing conditions.



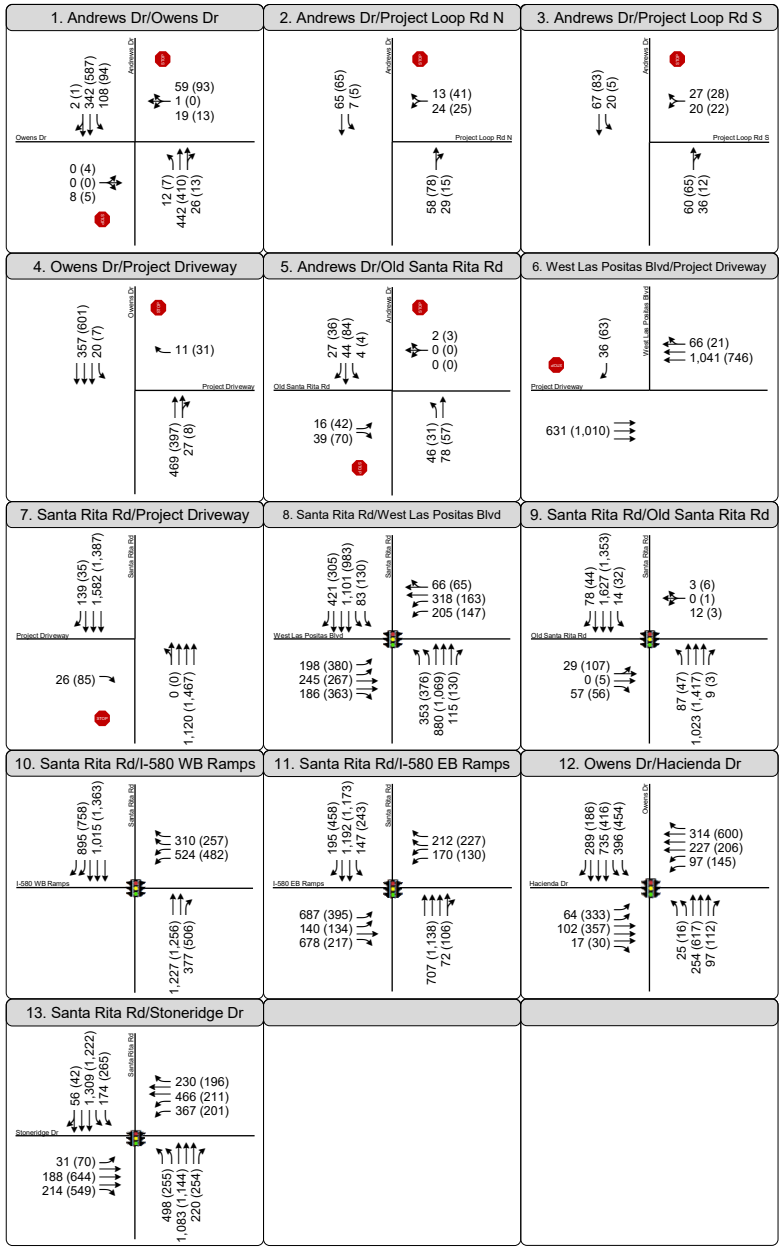




Figure 8
Existing With Project Peak Hour Traffic Volumes, Lane Configurations and Traffic Control

**Table 5: Existing with Project Conditions – Intersection Operations**

| Intersection | Control[1] | Peak Hour[2] | LOS Standard | Existing | | Existing with Project | |
|---|---|---|---|---|---|---|---|
| | | | | Delay[3] | LOS | Delay | LOS |
| 1. Andrews Drive/Owens Drive | Side-Street Stop | AM<br>PM | D | 2.3 (16.9)<br>1.7 (22.4) | A (C)<br>A (C) | 2.5 (17.5)<br>2.0 (23.3) | A (C)<br>A (C) |
| 2. Andrews Drive/Project Loop Road North | Side-Street Stop | AM<br>PM | D | 1.8 (9.4)<br>2.4 (9.4) | A (A)<br>A (A) | 2.1 (9.5)<br>3.0 (9.7) | A (A)<br>A (A) |
| 3. Andrews Drive/Project Loop Road South | Side-Street Stop | AM<br>PM | D | 2.8 (9.4)<br>2.5 (9.4) | A (A)<br>A (A) | 2.6 (9.6)<br>2.4 (9.5) | A (A)<br>A (A) |
| 4. Owens Drive/Project Driveway | Side-Street Stop | AM<br>PM | D | 0.3 (10.5)<br>0.4 (9.9) | A (B)<br>A (A) | 0.3 (10.5)<br>0.4 (10.2) | A (B)<br>A (B) |
| 5. Andrews Drive/Old Santa Rita Road | Side-Street Stop | AM<br>PM | D | 3.4 (9.5)<br>3.9 (9.5) | A (A)<br>A (A) | 3.6 (9.6)<br>4.2 (9.6) | A (A)<br>A (A) |
| 6. West Las Positas Boulevard/Project Driveway | Side-Street Stop | AM<br>PM | D | 0.2 (12)<br>0.4 (10.7) | A (B)<br>A (B) | 0.2 (12.0)<br>0.4 (10.7) | A (B)<br>A (B) |
| 7. Santa Rita Road/Project Driveway | Side-Street Stop | AM<br>PM | D | 0.1 (9.2)<br>0.2 (9.3) | A (A)<br>A (A) | 0.1 (9.3)<br>0.3 (9.4) | A (B)<br>A (A) |
| 8. Santa Rita Road/West Las Positas Boulevard | Signal | AM<br>PM | D | 31.1<br>32.1 | C<br>C | 31.1<br>32.1 | C<br>C |
| 9. Santa Rita Road/Old Santa Rita Road | Signal | AM<br>PM | D | 11.3<br>13.0 | B<br>B | 12.2<br>13.4 | B<br>B |
| 10. Santa Rita Road/I-580 Westbound Ramps[4] | Signal | AM<br>PM | D | 8.0<br>8.3 | A<br>A | 8.7<br>8.6 | A<br>A |
| 11. Santa Rita Road/I-580 Eastbound Ramps[4] | Signal | AM<br>PM | D | 25.7<br>23.9 | C<br>C | 25.9<br>24.5 | C<br>C |
| 12. Owens Drive/Hacienda Drive[4] | Signal | AM<br>PM | D | 13.6<br>20.3 | B<br>C | 13.6<br>20.3 | B<br>C |
| 13. Santa Rita Road/Stoneridge Drive | Signal | AM<br>PM | D | 42.1<br>35.1 | D<br>D | 42.1<br>35.0 | D<br>D |

Notes:
1. AM = Weekday morning peak hour; PM = Weekday evening peak hour
2. Whole intersection average delay reported for signalized intersections. TWSC delay presented as Whole Intersection Average Delay (Worst Movement Delay).
3. Delay calculated per HCM 2000 methodologies.
4. Intersections 10, 11 and 12 are designated as "gateway intersections" in the City's General Plan. The LOS standard is D at these locations; however, they may have an LOS below D if no reasonable mitigation exists or if the necessary mitigation is contrary to the other goals and policies of the City.

**Bold** indicates unacceptable operations.
Source: Fehr & Peers, January 2025

As shown in **Table 5**, the study intersections were found to operate acceptably in the Existing plus Project scenario.



*Vehicle Queues*

Although the study intersections generally operate within the standards set by the City of Pleasanton, there can be periodic vehicle queue spillback and delays greater than shown in **Table 5** for some movements. Ninety-fifth percentile vehicle queues were evaluated at signalized intersections, and detailed queue worksheets are provided in **Appendix C**. This analysis found no vehicular queues extending beyond the available storage in existing plus project conditions at the study intersections.

# Existing Plus Approved Project (EPAP) Conditions

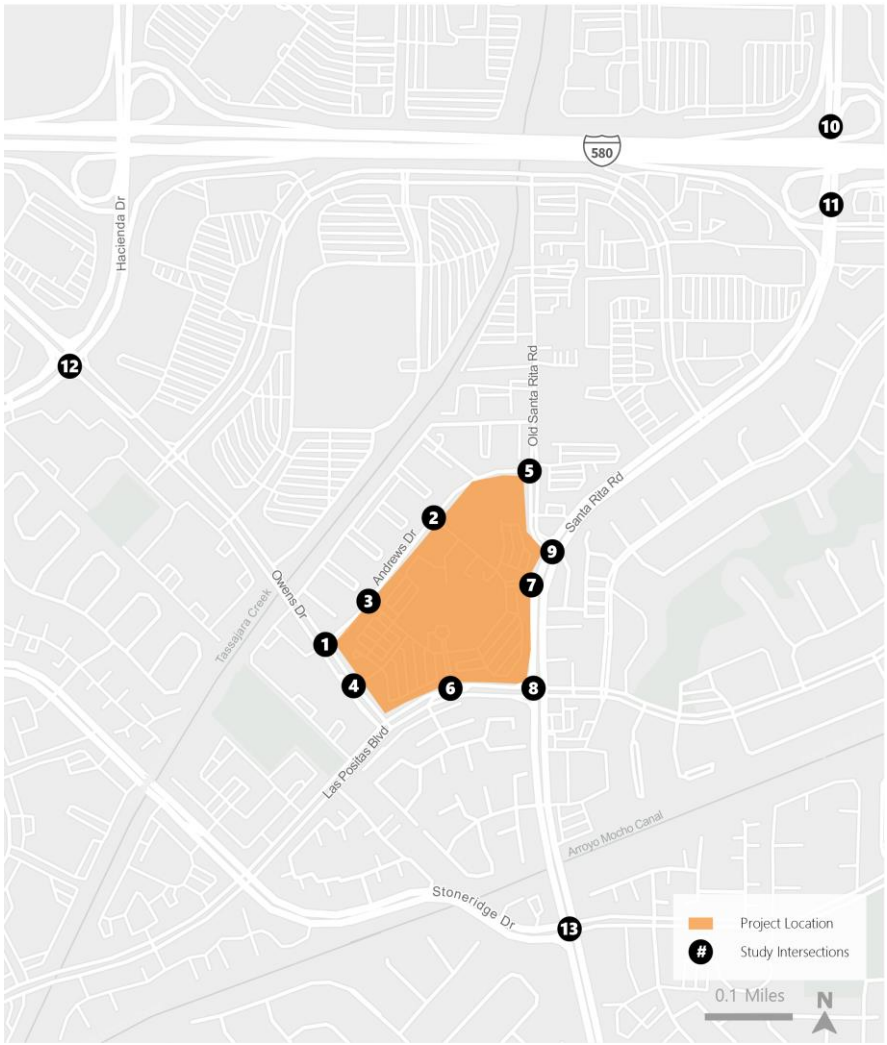
## EPAP Traffic Volumes

This section discusses near-term traffic conditions both without and with the project. The near-term conditions analysis considers approved projects within the study area that are expected to be constructed and occupied in the next five to ten years. The project traffic volumes on **Figure 6** were added to the existing traffic volumes from **Figure 4** to estimate the EPAP traffic volumes, as shown on **Figure 9A** and **Figure 9B**. No improvements were assumed at any of the study intersections.

## Analysis of EPAP Conditions

*Intersection Operations*

Intersections were evaluated under EPAP conditions using the methods described in Chapter 1. The EPAP analysis results are presented in **Table 6**, based on the traffic volumes and intersection configurations presented on **Figure 9A** and **Figure 9B**, along with the results for EPAP conditions.



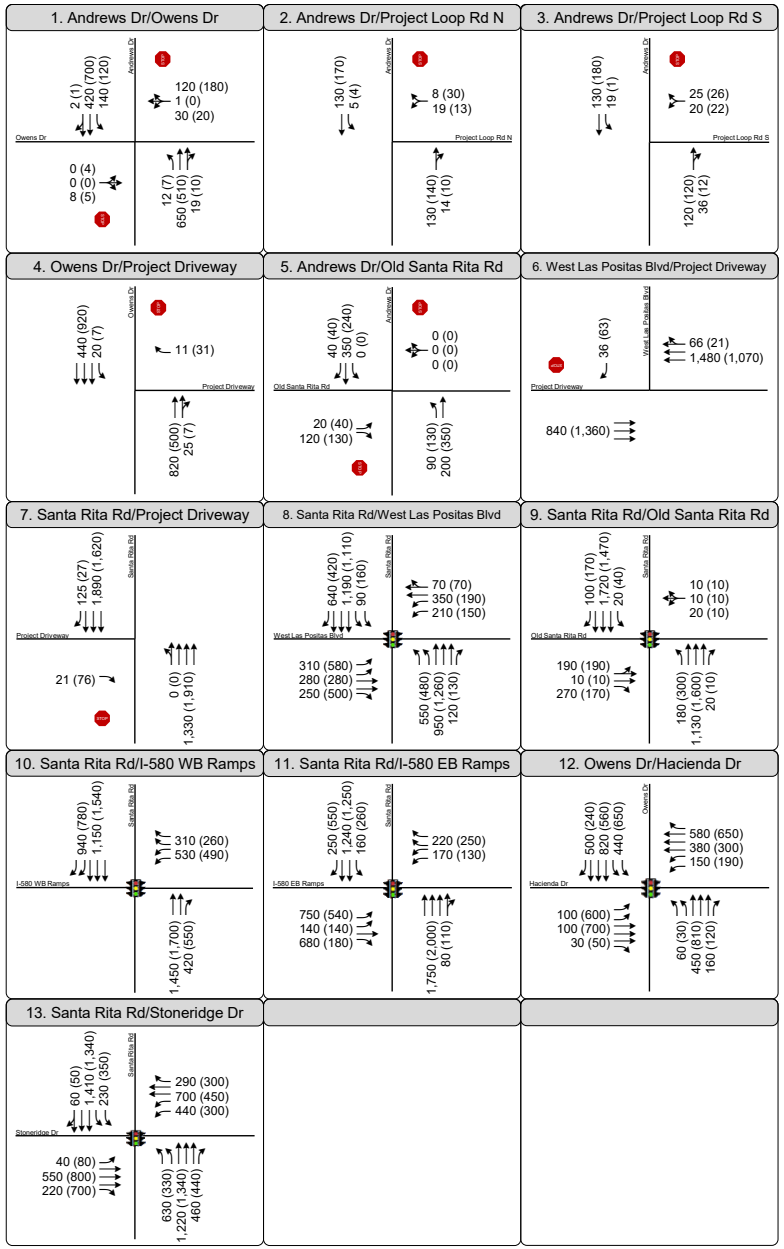
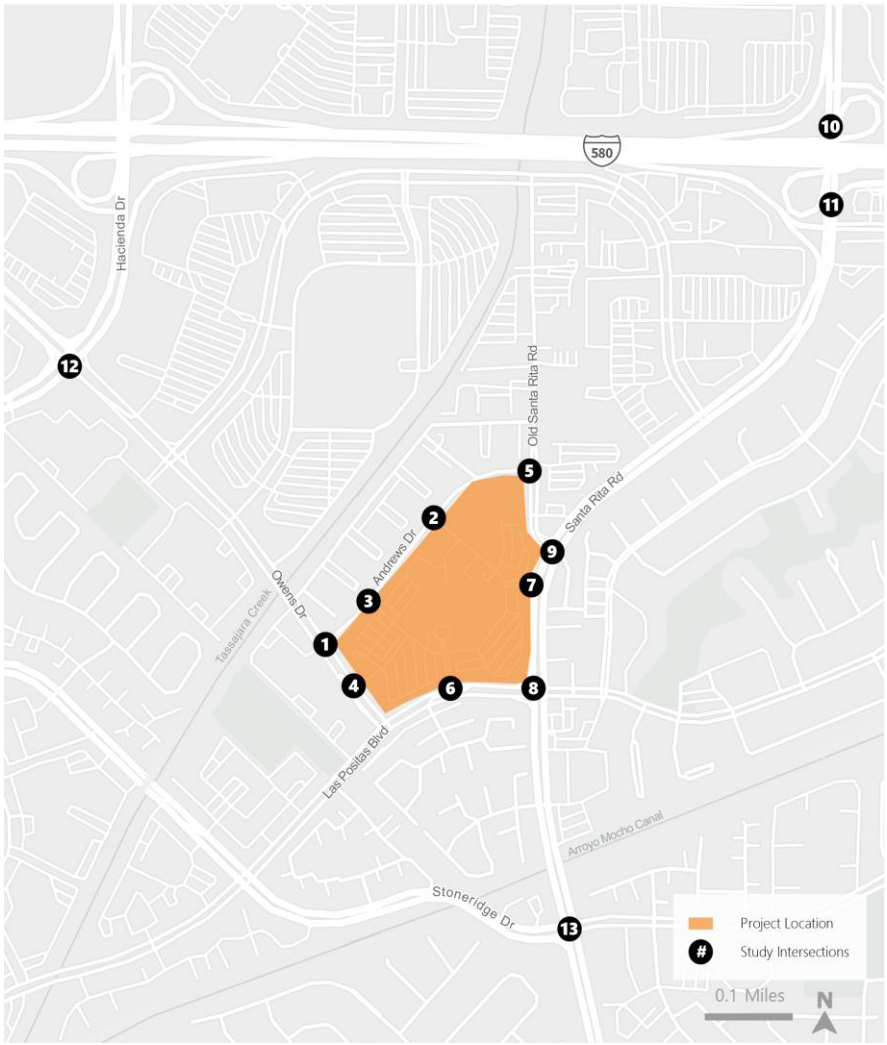




Figure 9a
EPAP Peak Hour Traffic Volumes, Lane Configurations and Traffic Control



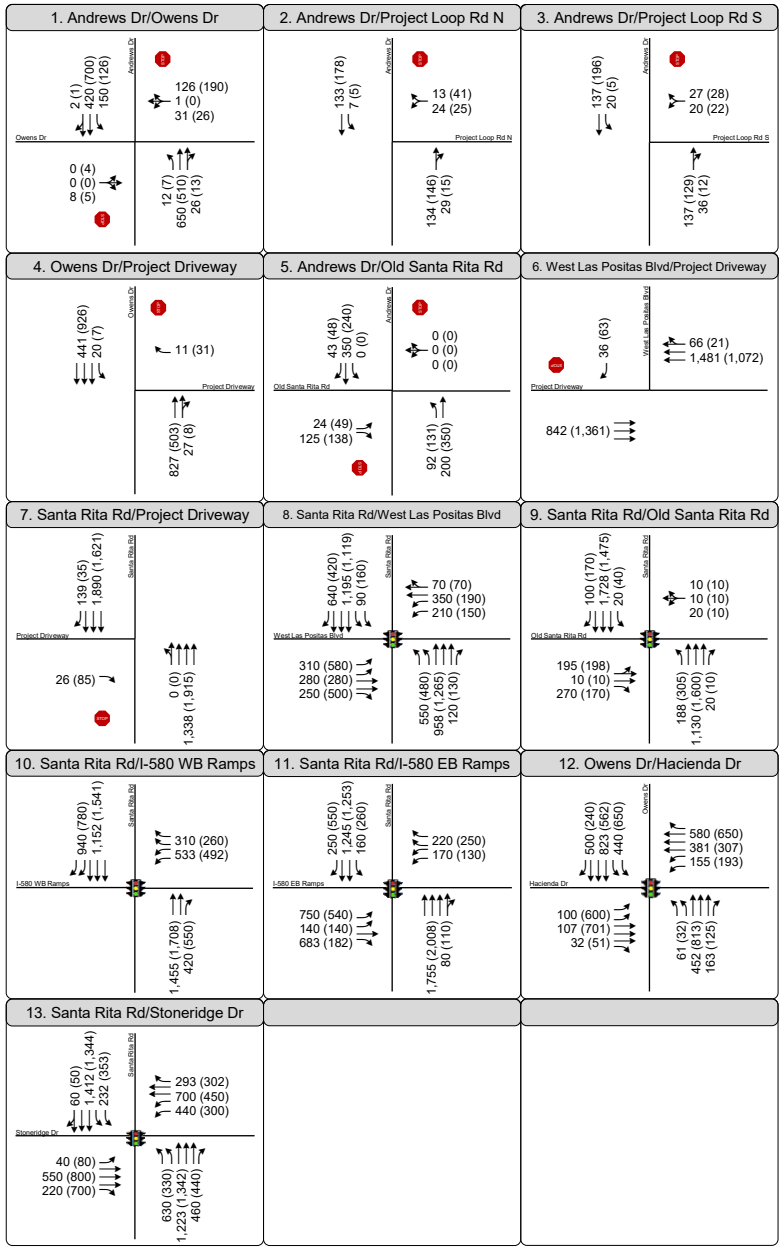




Figure 9b
EPAP With Project Peak Hour Traffic Volumes, Lane Configurations and Traffic Control

**Table 6: EPAP Conditions – Intersection Operations**

| Intersection | Control[1] | Peak Hour[2] | LOS Standard | Without Project | | With Project | |
|---|---|---|---|---|---|---|---|
| | | | | Delay[3] | LOS | Delay | LOS |
| 1. Andrews Drive/Owens Drive | Side-Street Stop | AM<br>PM | D | 5.9 (43.9)<br>**3.4 (42.8)** | A (E)<br>**A (E)** | 6.8 (50.4)<br>**4.1 (45.5)** | B (F)<br>**A (E)** |
| 2. Andrews Drive/Project Loop Road North | Side-Street Stop | AM<br>PM | D | 1.0 (10.3)<br>1.3 (10.3) | A (B)<br>A (B) | 1.3 (10.4)<br>1.8 (10.8) | A (B)<br>A (B) |
| 3. Andrews Drive/Project Loop Road South | Side-Street Stop | AM<br>PM | D | 1.7 (10.3)<br>1.4 (10.4) | A (B)<br>A (B) | 1.7 (10.5)<br>1.4 (10.6) | A (B)<br>A (B) |
| 4. Owens Drive/Project Driveway | Side-Street Stop | AM<br>PM | D | 0.3 (12.6)<br>0.3 (10.3) | A (B)<br>A (B) | 0.3 (12.7)<br>0.3 (10.8) | A (B)<br>A (B) |
| 5. Andrews Drive/Old Santa Rita Road | Side-Street Stop | AM<br>PM | D | 3.5 (14.7)<br>3.7 (13.9) | A (C)<br>A (B) | 3.7 (15.1)<br>4.0 (14.5) | A (C)<br>A (B) |
| 6. West Las Positas Boulevard/Project Driveway | Side-Street Stop | AM<br>PM | D | 0.2 (14.1)<br>0.3 (11.9) | A (B)<br>A (B) | 0.2 (14.1)<br>0.3 (11.9) | A (B)<br>A (B) |
| 7. Santa Rita Road/Project Driveway | Side-Street Stop | AM<br>PM | D | 0.1 (9.7)<br>0.2 (9.7) | A (A)<br>A (A) | 0.1 (9.7)<br>0.2 (9.8) | A (A)<br>A (A) |
| 8. Santa Rita Road/West Las Positas Boulevard | Signal | AM<br>PM | D | 33.9<br>36.0 | C<br>D | 33.9<br>36.0 | C<br>D |
| 9. Santa Rita Road/Old Santa Rita Road | Signal | AM<br>PM | D | 21.5<br>32.3 | C<br>C | 21.7<br>33.0 | C<br>C |
| 10. Santa Rita Road/I-580 Westbound Ramps[5] | Signal | AM<br>PM | D | 9.4<br>10.4 | A<br>B | 9.4<br>10.5 | A<br>B |
| 11. Santa Rita Road/I-580 Eastbound Ramps[5] | Signal | AM<br>PM | D | 30.9<br>33.0 | C<br>C | 31.0<br>33.2 | C<br>C |
| 12. Owens Drive/Hacienda Drive[5] | Signal | AM<br>PM | D | 15.4<br>31.8 | B<br>C | 15.4<br>32.0 | B<br>C |
| 13. Santa Rita Road/Stoneridge Drive | Signal | AM<br>PM | D | 52.3<br>40.6 | D<br>D | 52.4<br>40.7 | D<br>D |

Notes:
1. AM = Weekday morning peak hour; PM = Weekday evening peak hour
2. Whole intersection average delay reported for signalized intersections. TWSC delay presented as Whole Intersection Average Delay (Worst Movement Delay).
3. Delay calculated per HCM 2000 methodologies.
4. **Bold** indicates a violation of the City's LOS policies.
5. Intersections 10, 11 and 12 are designated as "gateway intersections" in the City's General Plan. The LOS standard is D at these locations; however, they may have an LOS below D if no reasonable mitigation exists or if the necessary mitigation is contrary to the other goals and policies of the City.

Source: Fehr & Peers, January 2025

As shown in Table 6, most of the study intersections were found to operate acceptably during EPAP conditions. The minor street movement at the intersection of Owens Drive and Andrews Drive would experience relatively high levels of vehicle delay during both the morning and evening peak hour in this scenario. During the PM peak hour, the intersection would meet warrants for the installation of a traffic

signal. This is a violation of the City's established level of service policies. The following improvement is recommended to mitigate this violation.

> ***Improvement Recommendation 3*** – Current traffic volumes with the addition of traffic generated by the East Wing project do not necessitate the installation of a traffic signal at the Andrews Drive/Owens Drive intersection. However, the analysis shows that a traffic signal may be necessary at this location in the future. As future phases of development at the site are considered, additional analysis, counts and monitoring shall be performed to assess when/if the improvement is warranted. When warranted the applicant shall work with the city to install the traffic signal and associated modifications. It should be noted that this improvement was Condition of Approval #32 (Exhibit B – Case Z-98-104) as part of prior approvals by the City of Pleasanton for construction on the site.

*Vehicle Queues*

Although most intersections generally operate within the standards set by the City of Pleasanton, there can be periodic vehicle queue spillback and delays greater than shown in **Table 6** for some movements. For signalized intersections, **Table 7** presents the 95th percentile vehicle queue results where queues are expected to exceed the available storage. Queue worksheets are provided in **Appendix C**.

**Table 7: EPAP Conditions – 95th Percentile Queues**

| Intersection | Movement | Storage Length (ft)[1] | AM Peak Period | | PM Peak Period | |
|---|---|---|---|---|---|---|
| | | | No Project | With Project | No Project | With Project |
| 8. Santa Rita Road/West Las Positas Boulevard | EBL | 305[2] | 175 | 175 | **375** | **375** |
| 9. Santa Rita Road/Old Santa Rita Road | NBL | 250 | 250 | 250 | **450** | **450** |
| 13. Santa Rita Road/Stoneridge Drive | NBL | 330[2] | **425** | **425** | 200 | 200 |

Notes:
1. An additional 60 to 90 feet of storage is typically provided in the taper area outside of the through lane, which is not reflected in the storage length above.
2. At these locations there are two left turn lanes, each of the length indicated. The queue lengths reported are also per lane.

**Bold** indicates queue potentially extends beyond available storage.
Source: Fehr & Peers, January 2025.

The 95th percentile queue exceeds the available storage at the following movements:

- Santa Rita Road/West Las Positas Boulevard – Eastbound Left Turn – PM peak hour
- Santa Rita Road/ Old Santa Rita Road – Northbound Left Turn – PM peak hour
- Santa Rita Road/Stoneridge Drive – Northbound Left Turn – AM peak hour

Traffic associated with the project would not increase the peak hour queue length at these movements. The project would add traffic to some of these movements, including the northbound left turn movement

at Santa Rita Road/Old Santa Rita Road (U-turn movements as well). However, the amount of additional traffic added to these movements was not found to increase the 95th percentile queue lengths.

# Cumulative Conditions

## Cumulative Traffic Volumes

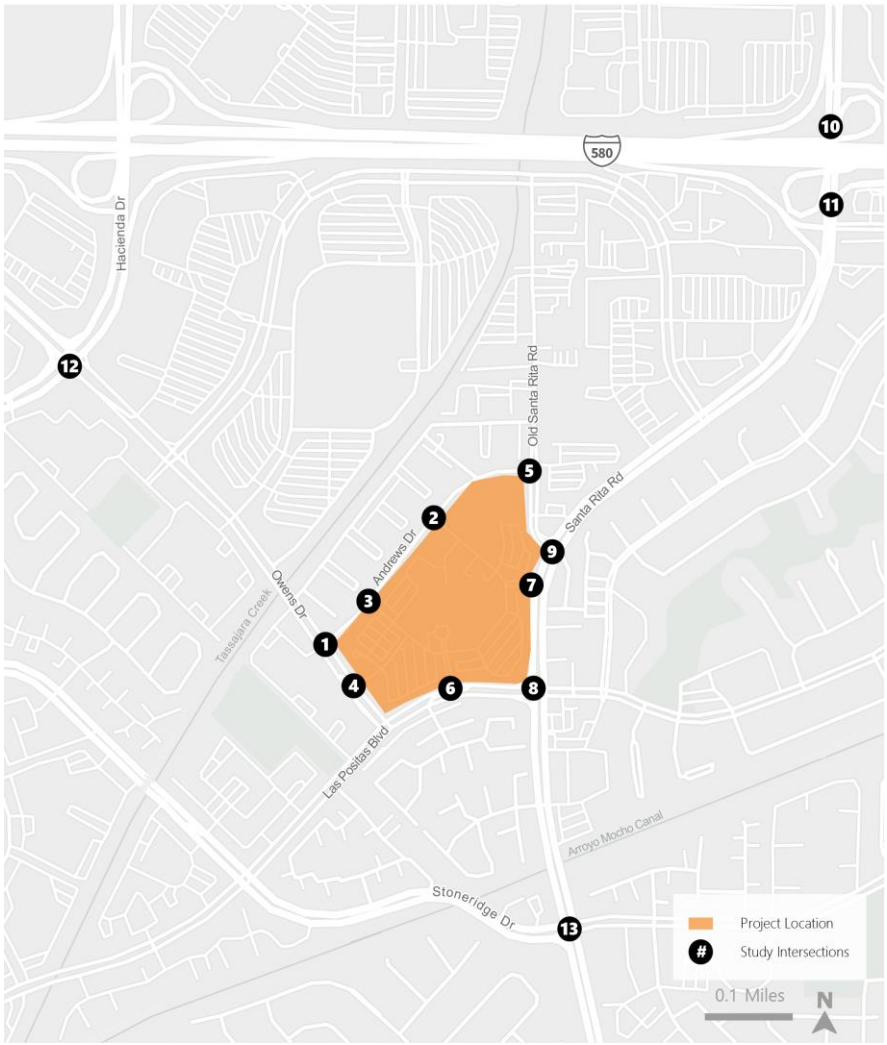
This section discusses cumulative traffic conditions both without and with the project. The cumulative conditions analysis considers development within the City of Pleasanton as described in the General Plan. Traffic volumes for the Cumulative condition were developed using the City of Pleasanton's travel demand model and represent likely traffic conditions in the area assuming General Plan buildout.

The project traffic volumes on **Figure 6** were added to the existing traffic volumes from **Figure 4** to estimate the Cumulative traffic volumes, as shown on **Figure 10A** and **Figure 10B**. Consistent with the city's travel demand model, cumulative improvements were assumed at the Santa Rita Road/I-580 Eastbound Ramps intersection (additional southbound left turn lane).

## Analysis of Cumulative Conditions

### *Intersection Operations*

Intersections were evaluated under Cumulative conditions using the methods described in Chapter 1. The Cumulative analysis results are presented in **Table 8**, based on the traffic volumes and intersection configurations presented on **Figure 10A** and **Figure 10B**, along with the results for Cumulative conditions.



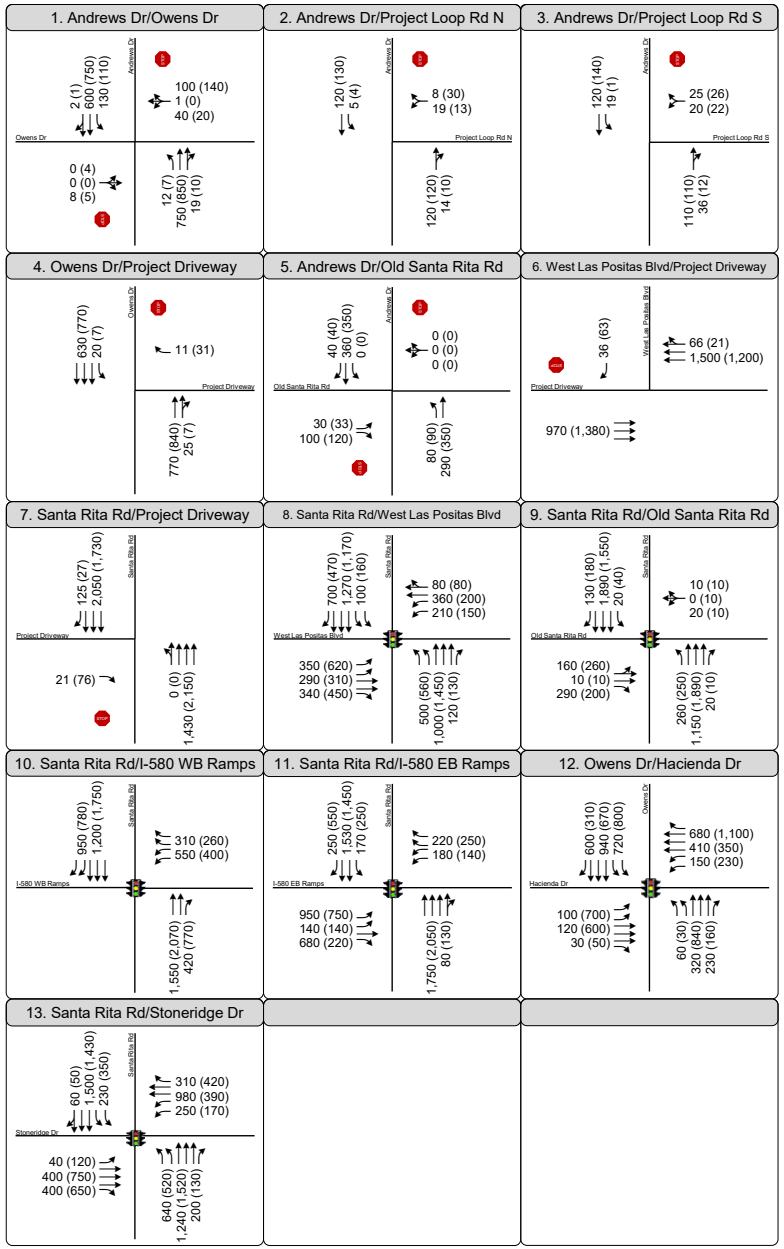
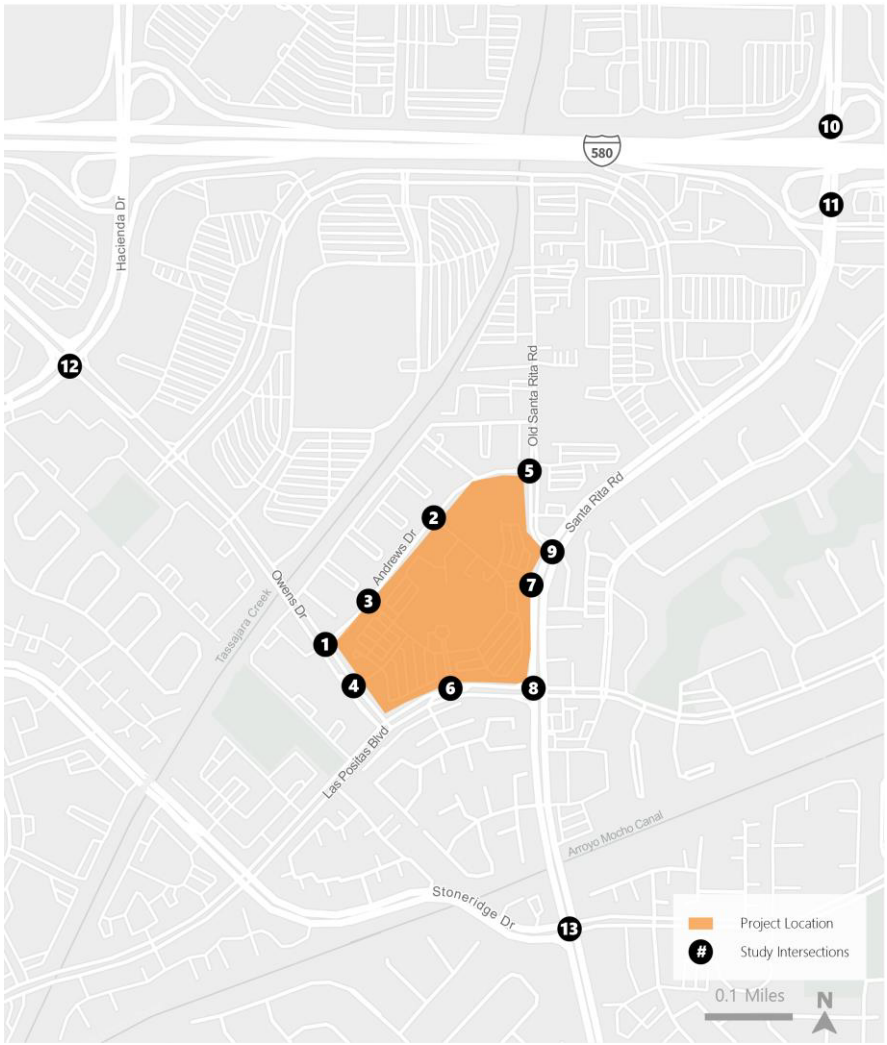




Figure 10a
Cumulative Peak Hour Traffic Volumes, Lane Configurations and Traffic Control



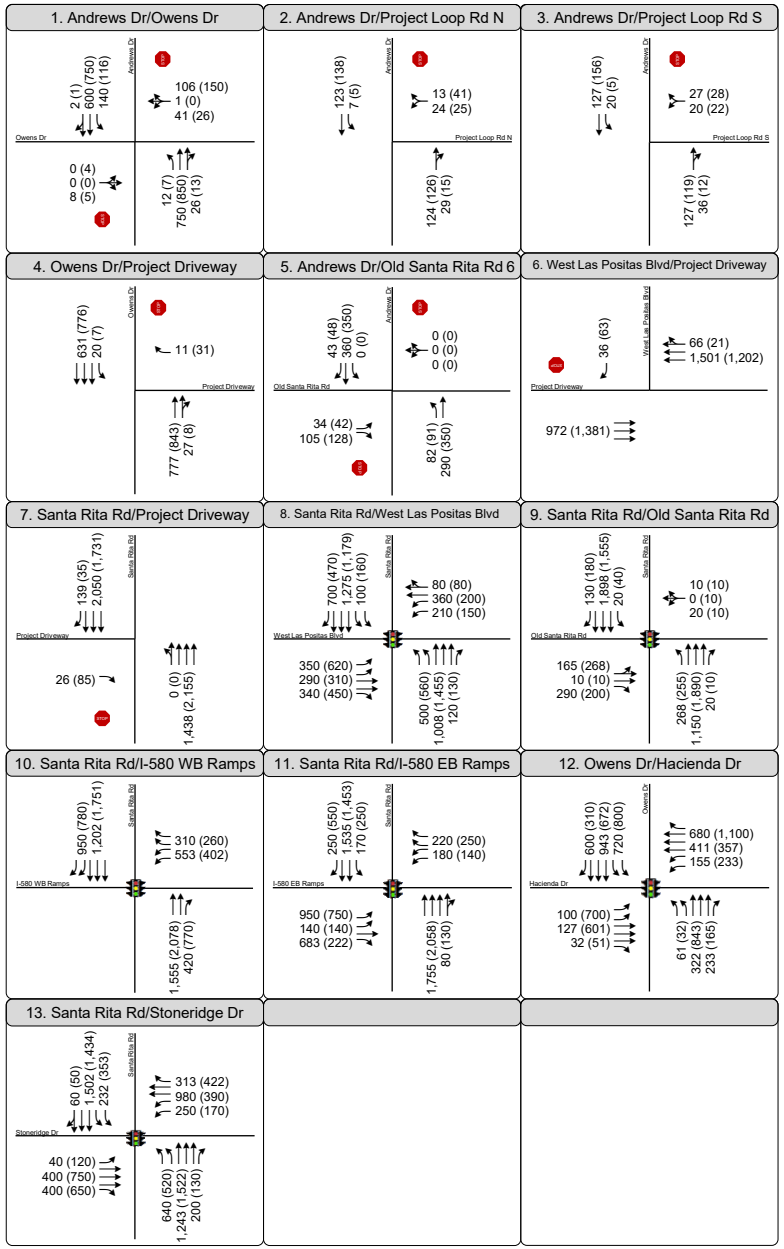




Figure 10b
Cumulative With Project Peak Hour Traffic Volumes, Lane Configurations and Traffic Control

**Table 8: Cumulative Conditions – Intersection Operations**

| Intersection | Control[1] | Peak Hour[2] | LOS Standard | Without Project | | With Project | |
|---|---|---|---|---|---|---|---|
| | | | | Delay[3] | LOS | Delay | LOS |
| 1. Andrews Drive/Owens Drive | Side-Street Stop | AM<br>PM | D | **13.1 (142.5)**<br>**4.1 (58.1)** | **B (F)**<br>**A (F)** | **16.2 (172.9)**<br>**6.1 (62.6)** | **C (F)**<br>**A (F)** |
| 2. Andrews Drive/Project Loop Road North | Side-Street Stop | AM<br>PM | D | 1.1 (10.1)<br>1.5 (10.0) | A (B)<br>A (A) | 1.4 (10.3)<br>2.1 (10.4) | A (B)<br>A (B) |
| 3. Andrews Drive/Project Loop Road South | Side-Street Stop | AM<br>PM | D | 1.8 (10.2)<br>1.6 (10.1) | A (B)<br>A (B) | 1.8 (10.3)<br>1.6 (10.3) | A (B)<br>A (B) |
| 4. Owens Drive/Project Driveway | Side-Street Stop | AM<br>PM | D | 0.2 (13.8)<br>0.2 (13.2) | A (B)<br>A (B) | 0.2 (13.9)<br>0.3 (14.8) | A (B)<br>A (B) |
| 5. Andrews Drive/Old Santa Rita Road | Side-Street Stop | AM<br>PM | D | 3.2 (16.5)<br>3.0 (14.4) | A (C)<br>A (B) | 3.4 (17.1)<br>3.3 (15.2) | A (C)<br>A (B) |
| 6. West Las Positas Boulevard/Project Driveway | Side-Street Stop | AM<br>PM | D | 0.2 (14.2)<br>0.3 (12.5) | A (B)<br>A (B) | 0.2 (14.2)<br>0.3 (12.5) | A (B)<br>A (B) |
| 7. Santa Rita Road/Project Driveway | Side-Street Stop | AM<br>PM | D | 0.1 (9.9)<br>0.2 (9.9) | A (A)<br>A (A) | 0.1 (9.9)<br>0.2 (10.0) | A (A)<br>A (A) |
| 8. Santa Rita Road/West Las Positas Boulevard | Signal | AM<br>PM | D | 32.9<br>41.8 | C<br>D | 32.9<br>41.8 | C<br>D |
| 9. Santa Rita Road/Old Santa Rita Road | Signal | AM<br>PM | D | 21.3<br>27.3 | C<br>C | 22.0<br>27.9 | C<br>C |
| 10. Santa Rita Road/I-580 Westbound Ramps[5] | Signal | AM<br>PM | D | 9.9<br>16.3 | A<br>B | 10.0<br>16.6 | B<br>B |
| 11. Santa Rita Road/I-580 Eastbound Ramps[5] | Signal | AM<br>PM | D | 36.4<br>32.1 | D<br>C | 36.5<br>32.2 | D<br>C |
| 12. Owens Drive/Hacienda Drive[5] | Signal | AM<br>PM | D | 16.3<br>37.8 | B<br>D | 16.3<br>38.1 | B<br>D |
| 13. Santa Rita Road/Stoneridge Drive | Signal | AM<br>PM | D | 52.7<br>42.2 | D<br>D | 52.8<br>42.4 | D<br>D |

Notes:
1. AM = Weekday morning peak hour; PM = Weekday evening peak hour
2. Whole intersection average delay reported for signalized intersections. TWSC delay presented as Whole Intersection Average Delay (Worst Movement Delay).
3. Delay calculated per HCM 2000 methodologies.
4. **Bold** indicates a violation of the City's LOS policies.
5. Intersections 10, 11 and 12 are designated as "gateway intersections" in the City's General Plan. The LOS standard is D at these locations; however, they may have an LOS below D if no reasonable mitigation exists or if the necessary mitigation is contrary to the other goals and policies of the City.

Source: Fehr & Peers, January 2025

As shown in Table 8, most of the study intersections were found to operate acceptably during Cumulative conditions. The minor street movement at the intersection of Owens Drive and Andrews Drive would experience relatively high levels of vehicle delay during both the morning and evening peak hour in this scenario. During both the cumulative AM and PM peak hours, the intersection would meet warrants for

the installation of a traffic signal. This is a violation of the City's established level of service policies. The following improvement is recommended to mitigate this violation.

> ***Improvement Recommendation 3*** – Current traffic volumes with the addition of traffic generated by the East Wing project do not necessitate the installation of a traffic signal at the Andrews Drive/Owens Drive intersection. However, the analysis shows that a traffic signal may be necessary at this location in the future. As future phases of development at the site are considered, additional analysis, counts and monitoring shall be performed to assess when/if the improvement is warranted. When warranted the applicant shall work with the city to install the traffic signal and associated modifications. It should be noted that this improvement was Condition of Approval #32 (Exhibit B – Case Z-98-104) as part of prior approvals by the City of Pleasanton for construction on the site.

*Vehicle Queues*

Although most intersections generally operate within the standards set by the City of Pleasanton, there can be periodic vehicle queue spillback and delays greater than shown in **Table 8** for some movements. For signalized intersections, **Table 9** presents the 95th percentile vehicle queue results where queues are expected to exceed the available storage. Queue worksheets are provided in **Appendix C**.

**Table 9: Cumulative Conditions – 95th Percentile Queues**

| Intersection | Movement | Storage Length (ft)[1] | AM Peak Period | | PM Peak Period | |
|---|---|---|---|---|---|---|
| | | | No Project | With Project | No Project | With Project |
| 8. Santa Rita Road/West Las Positas Boulevard | EBL | 305[2] | 200 | 200 | **425** | **425** |
| 9. Santa Rita Road/Old Santa Rita Road | NBL | 250 | **400** | **425** | **350** | **350** |
| 12. Owens Drive/Hacienda Drive | EBL | 370[2] | 100 | 100 | **550** | **550** |
| | SBL | 450[2] | 500 | 500 | **675** | **675** |
| 13. Santa Rita Road/Stoneridge Drive | WBT | 440[2] | **500** | **500** | 175 | 175 |
| | WBR | 200 | 150 | 150 | **250** | **250** |
| | NBL | 290[2] | **425** | **425** | **375** | **375** |

Notes:
1. An additional 60 to 90 feet of storage is typically provided in the taper area outside of the through lane, which is not reflected in the storage length above.
2. At these locations there are multiple lanes, each of the length indicated. The queue lengths reported are also per lane.

**Bold** indicates queue potentially extends beyond available storage.
Source: Fehr & Peers, January 2025.

The 95th percentile queue exceeds the available storage at the following movements:

- Santa Rita Road/West Las Positas Boulevard – Eastbound Left Turn – PM peak hour

- Santa Rita Road/ Old Santa Rita Road – Northbound Left Turn – AM peak hour
- Santa Rita Road/ Old Santa Rita Road – Northbound Left Turn – PM peak hour
- Owens Drive/Hacienda Drive – Eastbound Left Turn – PM peak hour
- Owens Drive/Hacienda Drive – Southbound Left Turn – PM peak hour
- Santa Rita Road/Stoneridge Drive – Westbound Through Turn – AM peak hour
- Santa Rita Road/Stoneridge Drive – Westbound Right Turn – PM peak hour
- Santa Rita Road/Stoneridge Drive – Northbound Left Turn – AM and PM peak hours

Traffic associated with the project would not increase the peak hour queue length at most of these movements. However, the northbound left movement at Santa Rita Road/Old Santa Road would increase the PM peak hour queue length by 25 feet (1 vehicle), which is a violation of the city's established policies.

> ***Improvement Recommendation 4*** – The cumulative analysis identified that the storage length for the northbound left turn movement at the Santa Rita Road/Old Santa Rita Road intersection may need to be increased to 425 feet to accommodate future demand. The northbound left turn at this intersection is forecast to exceed the available storage in the EPAP and Cumulative plus Project scenarios. As future phases of development at the site are considered, additional analysis, counts and monitoring shall be performed to assess when/if the improvement is warranted. When warranted the applicant shall work with the city to provide fair share funding for the implementation of the improvement. The project would increase the 95$^{th}$ percentile queue for this movement by 25 feet in the Cumulative plus Project scenario which is a violation of the city's policies.



# 6. Summary of Findings

This report presents the results of the Transportation Impact Analysis (TIA) prepared for the proposed Stanford Health Care Tri-Valley East Wing project in Pleasanton, California. The project site, located at 5555 West Las Positas Boulevard in Pleasanton, would make improvements to Stanford Health Care's (SHC) Tri-Valley Hospital. The East Wing improvement project would build a new three-story, approximately 66,000 square foot hospital addition on the east side of the existing SHC Tri-Valley Hospital. In total, the project is expected to generate approximately 54 new AM peak hour vehicle trips and 57 new PM peak hour vehicle trips.

Traffic operations were assessed at thirteen intersections surrounding the project site providing key points of access. Intersection operations were evaluated under Existing, Near Term and Cumulative conditions both with and without project traffic. Project generated traffic was found to result in a violation of the City's level of service policies in the Near Term and Cumulative scenarios. The project's effects on pedestrian facilities, bicycle facilities, transit facilities, emergency vehicle access, and parking were also assessed. The following recommendations were identified as a result of the assessment.

***Improvement Recommendation 1*** – Install the internal signage, striping and markings illustrated on Figure 7A. Figure 7A illustrates the stop signs, stop markings, crosswalks and other delineation for internal intersection control.

***Improvement Recommendation 2*** – While the existing parking supply would accommodate current project, it is not forecast to accommodate the parking demand when the 2nd floor is built out. When the East Wing's second floor is built out and occupied, the applicant shall provide additional on-site parking. A total of 31 additional parking spaces will be needed on site to accommodate this excess demand.

***Improvement Recommendation 3*** – Current traffic volumes with the addition of traffic generated by the East Wing project do not necessitate the installation of a traffic signal at the Andrews Drive/Owens Drive intersection. However, the analysis shows that a traffic signal may be necessary at this location in the future. As future phases of development at the site are considered, additional analysis, counts and monitoring shall be performed to assess when/if the improvement is warranted. When warranted the applicant shall work with the city to install the traffic signal and associated modifications. It should be noted that this improvement was Condition of Approval #32 (Exhibit B – Case Z-98-104) as part of prior approvals by the City of Pleasanton for construction on the site.

***Improvement Recommendation 4*** – The cumulative analysis identified that the storage length for the northbound left turn movement at the Santa Rita Road/Old Santa Rita Road intersection may need to be increased to 425 feet to accommodate future demand. The northbound left turn at this intersection is forecast to exceed the available storage in the EPAP and Cumulative plus Project scenarios. As future phases of development at the site are considered, additional analysis,

counts and monitoring shall be performed to assess when/if the improvement is warranted. When warranted the applicant shall work with the city to provide fair share funding for the implementation of the improvement. The project would increase the 95th percentile queue for this movement by 25 feet in the Cumulative plus Project scenario which is a violation of the city's policies.



# Appendix A:
# Traffic Count Worksheets

## National Data & Surveying Services

# Intersection Turning Movement Count

**Location:** Owens Dr & Andrews Dr
**City:** Pleasanton
**Control:** 1-Way Stop(WB)

**Project ID:** 24-080139-001
**Date:** 5/16/2024

## Data - Total

| NS/EW Streets: | Owens Dr | | | | Owens Dr | | | | Andrews Dr | | | | Andrews Dr | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AM** | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
| | 1 | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| 7:00 AM | 0 | 46 | 2 | 0 | 22 | 41 | 0 | 4 | 1 | 0 | 1 | 0 | 0 | 0 | 6 | 0 | 123 |
| 7:15 AM | 0 | 68 | 3 | 0 | 9 | 35 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 126 |
| 7:30 AM | 0 | 62 | 2 | 1 | 11 | 54 | 0 | 5 | 1 | 0 | 0 | 0 | 2 | 1 | 18 | 0 | 157 |
| 7:45 AM | 1 | 81 | 3 | 1 | 19 | 85 | 0 | 7 | 0 | 0 | 3 | 0 | 6 | 0 | 17 | 0 | 223 |
| 8:00 AM | 2 | 106 | 4 | 2 | 16 | 125 | 0 | 9 | 0 | 0 | 4 | 0 | 11 | 0 | 11 | 0 | 290 |
| 8:15 AM | 2 | 117 | 4 | 0 | 19 | 74 | 1 | 6 | 0 | 0 | 2 | 0 | 2 | 0 | 12 | 0 | 239 |
| 8:30 AM | 0 | 107 | 5 | 1 | 13 | 75 | 1 | 9 | 0 | 0 | 1 | 0 | 5 | 0 | 12 | 0 | 229 |
| 8:45 AM | 2 | 112 | 6 | 3 | 11 | 68 | 0 | 15 | 0 | 0 | 1 | 0 | 0 | 1 | 18 | 0 | 237 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 7 | 699 | 29 | 8 | 120 | 557 | 2 | 58 | 3 | 0 | 12 | 0 | 26 | 2 | 101 | 0 | 1624 |
| **APPROACH %'s :** | 0.94% | 94.08% | 3.90% | 1.08% | 16.28% | 75.58% | 0.27% | 7.87% | 20.00% | 0.00% | 80.00% | 0.00% | 20.16% | 1.55% | 78.29% | 0.00% | |
| **PEAK HR :** | 08:00 AM - 09:00 AM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 6 | 442 | 19 | 6 | 59 | 342 | 2 | 39 | 0 | 0 | 8 | 0 | 18 | 1 | 53 | 0 | 995 |
| **PEAK HR FACTOR :** | 0.750 | 0.944 | 0.792 | 0.500 | 0.776 | 0.684 | 0.500 | 0.650 | 0.000 | 0.000 | 0.500 | 0.000 | 0.409 | 0.250 | 0.736 | 0.000 | 0.858 |
| | 0.961 | | | | 0.737 | | | | 0.500 | | | | 0.818 | | | | |

| PM | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| 4:00 PM | 1 | 104 | 3 | 2 | 12 | 116 | 2 | 6 | 0 | 1 | 0 | 0 | 4 | 0 | 18 | 0 | 269 |
| 4:15 PM | 2 | 93 | 1 | 4 | 16 | 111 | 1 | 5 | 1 | 0 | 2 | 0 | 2 | 0 | 12 | 0 | 250 |
| 4:30 PM | 1 | 113 | 4 | 1 | 10 | 137 | 0 | 8 | 1 | 0 | 1 | 0 | 5 | 1 | 25 | 0 | 307 |
| 4:45 PM | 2 | 98 | 2 | 0 | 14 | 114 | 0 | 13 | 1 | 0 | 3 | 0 | 2 | 0 | 19 | 0 | 268 |
| 5:00 PM | 0 | 111 | 5 | 1 | 18 | 129 | 1 | 7 | 0 | 0 | 1 | 0 | 1 | 0 | 21 | 0 | 295 |
| 5:15 PM | 2 | 88 | 3 | 1 | 8 | 160 | 0 | 7 | 1 | 0 | 0 | 0 | 2 | 0 | 16 | 0 | 288 |
| 5:30 PM | 1 | 116 | 2 | 0 | 18 | 142 | 0 | 6 | 0 | 0 | 2 | 0 | 3 | 0 | 28 | 0 | 318 |
| 5:45 PM | 2 | 95 | 0 | 0 | 12 | 156 | 0 | 12 | 3 | 0 | 2 | 0 | 1 | 0 | 18 | 0 | 301 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 11 | 818 | 20 | 9 | 108 | 1065 | 4 | 64 | 7 | 1 | 11 | 0 | 20 | 1 | 157 | 0 | 2296 |
| **APPROACH %'s :** | 1.28% | 95.34% | 2.33% | 1.05% | 8.70% | 85.82% | 0.32% | 5.16% | 36.84% | 5.26% | 57.89% | 0.00% | 11.24% | 0.56% | 88.20% | 0.00% | |
| **PEAK HR :** | 05:00 PM - 06:00 PM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 5 | 410 | 10 | 2 | 56 | 587 | 1 | 32 | 4 | 0 | 5 | 0 | 7 | 0 | 83 | 0 | 1202 |
| **PEAK HR FACTOR :** | 0.625 | 0.884 | 0.500 | 0.500 | 0.778 | 0.917 | 0.250 | 0.667 | 0.333 | 0.000 | 0.625 | 0.000 | 0.583 | 0.000 | 0.741 | 0.000 | 0.945 |
| | 0.897 | | | | 0.939 | | | | 0.450 | | | | 0.726 | | | | |

National Data & Surveying Services

# Intersection Turning Movement Count

**Location:** 5555 Las Positas Blvd E Dwy & Andrews Dr
**City:** Pleasanton
**Control:** 1-Way Stop(NB)

**Project ID:** 24-080139-002
**Date:** 5/16/2024

## Data - Total

| NS/EW Streets: | 5555 Las Positas Blvd E Dwy | | | | 5555 Las Positas Blvd E Dwy | | | | Andrews Dr | | | | Andrews Dr | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AM** | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
| | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| 7:00 AM | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 7 | 0 | 1 | 5 | 0 | 0 | 25 |
| 7:15 AM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 4 | 0 | 0 | 9 | 0 | 0 | 20 |
| 7:30 AM | 6 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 8 | 0 | 1 | 12 | 0 | 1 | 44 |
| 7:45 AM | 5 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 2 | 0 | 2 | 14 | 0 | 0 | 44 |
| 8:00 AM | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 2 | 1 | 1 | 18 | 0 | 0 | 40 |
| 8:15 AM | 4 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 8 | 2 | 0 | 0 | 18 | 0 | 0 | 34 |
| 8:30 AM | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 1 | 0 | 2 | 17 | 0 | 0 | 32 |
| 8:45 AM | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 5 | 0 | 0 | 15 | 0 | 0 | 32 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 24 | 0 | 13 | 1 | 0 | 0 | 0 | 0 | 0 | 85 | 31 | 1 | 7 | 108 | 0 | 1 | 271 |
| **APPROACH %'s :** | 63.16% | 0.00% | 34.21% | 2.63% | | | | | 0.00% | 72.65% | 26.50% | 0.85% | 6.03% | 93.10% | 0.00% | 0.86% | |
| **PEAK HR :** | 07:30 AM - 08:30 AM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 18 | 0 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 53 | 14 | 1 | 4 | 62 | 0 | 1 | 162 |
| **PEAK HR FACTOR :** | 0.750 | 0.000 | 0.500 | 0.250 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.779 | 0.438 | 0.250 | 0.500 | 0.861 | 0.000 | 0.250 | 0.920 |
| | 0.750 | | | | | | | | 0.810 | | | | 0.882 | | | | |

| PM | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| 4:00 PM | 7 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 3 | 0 | 2 | 11 | 0 | 1 | 46 |
| 4:15 PM | 3 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 2 | 0 | 1 | 9 | 0 | 1 | 40 |
| 4:30 PM | 6 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 2 | 0 | 1 | 17 | 0 | 0 | 48 |
| 4:45 PM | 2 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 4 | 0 | 0 | 15 | 0 | 0 | 42 |
| 5:00 PM | 6 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 3 | 0 | 0 | 13 | 0 | 0 | 53 |
| 5:15 PM | 1 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 1 | 0 | 0 | 11 | 0 | 1 | 34 |
| 5:30 PM | 4 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 2 | 0 | 2 | 18 | 0 | 1 | 57 |
| 5:45 PM | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 14 | 0 | 0 | 32 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 31 | 0 | 53 | 0 | 0 | 0 | 0 | 0 | 0 | 133 | 17 | 0 | 6 | 108 | 0 | 4 | 352 |
| **APPROACH %'s :** | 36.90% | 0.00% | 63.10% | 0.00% | | | | | 0.00% | 88.67% | 11.33% | 0.00% | 5.08% | 91.53% | 0.00% | 3.39% | |
| **PEAK HR :** | 04:45 PM - 05:45 PM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 13 | 0 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 72 | 10 | 0 | 2 | 57 | 0 | 2 | 186 |
| **PEAK HR FACTOR :** | 0.542 | 0.000 | 0.682 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.750 | 0.625 | 0.000 | 0.250 | 0.792 | 0.000 | 0.500 | 0.816 |
| | 0.632 | | | | | | | | 0.788 | | | | 0.726 | | | | |

National Data & Surveying Services

# Intersection Turning Movement Count

**Location:** 5555 Las Positas Blvd W Dwy & Andrews Dr
**City:** Pleasanton
**Control:** 1-Way Stop(NB)

**Project ID:** 24-080139-003
**Date:** 5/16/2024

## Data - Total

| NS/EW Streets: | 5555 Las Positas Blvd W Dwy | | | | 5555 Las Positas Blvd W Dwy | | | | Andrews Dr | | | | Andrews Dr | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AM** | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
| | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| 7:00 AM | 2 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 13 | 0 | 4 | 3 | 0 | 0 | 37 |
| 7:15 AM | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 4 | 0 | 3 | 6 | 0 | 0 | 24 |
| 7:30 AM | 9 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 4 | 0 | 4 | 13 | 0 | 0 | 51 |
| 7:45 AM | 7 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 13 | 0 | 5 | 15 | 0 | 0 | 59 |
| 8:00 AM | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 6 | 0 | 4 | 18 | 0 | 0 | 50 |
| 8:15 AM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 13 | 0 | 6 | 14 | 0 | 0 | 43 |
| 8:30 AM | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 8 | 0 | 5 | 15 | 0 | 0 | 42 |
| 8:45 AM | 5 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 6 | 1 | 3 | 14 | 0 | 0 | 42 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 30 | 0 | 37 | 0 | 0 | 0 | 0 | 0 | 0 | 81 | 67 | 1 | 34 | 98 | 0 | 0 | 348 |
| **APPROACH %'s :** | 44.78% | 0.00% | 55.22% | 0.00% | | | | | 0.00% | 54.36% | 44.97% | 0.67% | 25.76% | 74.24% | 0.00% | 0.00% | |
| **PEAK HR :** | 07:30 AM - 08:30 AM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 20 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 36 | 0 | 19 | 60 | 0 | 0 | 203 |
| **PEAK HR FACTOR :** | 0.556 | 0.000 | 0.568 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.768 | 0.692 | 0.000 | 0.792 | 0.833 | 0.000 | 0.000 | 0.860 |
| | 0.563 | | | | | | | | 0.859 | | | | 0.898 | | | | |

| PM | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| 4:00 PM | 6 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 3 | 0 | 2 | 16 | 0 | 0 | 43 |
| 4:15 PM | 5 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 5 | 0 | 1 | 11 | 0 | 0 | 42 |
| 4:30 PM | 7 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 4 | 0 | 0 | 23 | 0 | 0 | 54 |
| 4:45 PM | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 1 | 0 | 0 | 17 | 0 | 0 | 39 |
| 5:00 PM | 7 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 2 | 1 | 0 | 16 | 0 | 0 | 49 |
| 5:15 PM | 7 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 1 | 14 | 0 | 0 | 36 |
| 5:30 PM | 7 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 3 | 0 | 1 | 19 | 0 | 0 | 56 |
| 5:45 PM | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 2 | 0 | 0 | 17 | 0 | 0 | 34 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 44 | 0 | 42 | 0 | 0 | 0 | 0 | 0 | 0 | 108 | 20 | 1 | 5 | 133 | 0 | 0 | 353 |
| **APPROACH %'s :** | 51.16% | 0.00% | 48.84% | 0.00% | | | | | 0.00% | 83.72% | 15.50% | 0.78% | 3.62% | 96.38% | 0.00% | 0.00% | |
| **PEAK HR :** | 04:15 PM - 05:15 PM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 22 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 55 | 12 | 1 | 1 | 67 | 0 | 0 | 184 |
| **PEAK HR FACTOR :** | 0.786 | 0.000 | 0.650 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.764 | 0.600 | 0.250 | 0.250 | 0.728 | 0.000 | 0.000 | 0.852 |
| | 0.706 | | | | | | | | 0.810 | | | | 0.739 | | | | |

## National Data & Surveying Services

# Intersection Turning Movement Count

**Location:** Owens Dr & 5555 Las Positas Blvd Dwy
**City:** Pleasanton
**Control:** 1-Way Stop(WB)

**Project ID:** 24-080139-004
**Date:** 5/16/2024

## Data - Total

| NS/EW Streets: | Owens Dr | | | | Owens Dr | | | | 5555 Las Positas Blvd Dwy | | | | 5555 Las Positas Blvd Dwy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AM** | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
| | 0 | 2 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| 7:00 AM | 0 | 45 | 0 | 0 | 4 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 86 |
| 7:15 AM | 0 | 71 | 3 | 0 | 1 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 113 |
| 7:30 AM | 0 | 57 | 4 | 0 | 8 | 48 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 123 |
| 7:45 AM | 0 | 82 | 7 | 0 | 4 | 90 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 188 |
| 8:00 AM | 0 | 112 | 8 | 0 | 4 | 140 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 265 |
| 8:15 AM | 0 | 119 | 6 | 0 | 9 | 69 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 207 |
| 8:30 AM | 0 | 115 | 5 | 0 | 5 | 77 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 203 |
| 8:45 AM | 0 | 116 | 6 | 0 | 2 | 70 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 199 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 0 | 717 | 39 | 0 | 37 | 566 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 1384 |
| **APPROACH %'s :** | 0.00% | 94.84% | 5.16% | 0.00% | 6.14% | 93.86% | 0.00% | 0.00% | | | | | 0.00% | 0.00% | 100.00% | 0.00% | |
| **PEAK HR :** | 08:00 AM - 09:00 AM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 0 | 462 | 25 | 0 | 20 | 356 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 874 |
| **PEAK HR FACTOR :** | 0.000 | 0.971 | 0.781 | 0.000 | 0.556 | 0.636 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.550 | 0.000 | 0.825 |
| | | 0.974 | | | | 0.653 | | | | | | | | 0.550 | | | |

| **PM** | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 2 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| 4:00 PM | 0 | 104 | 3 | 0 | 2 | 120 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 235 |
| 4:15 PM | 0 | 91 | 2 | 0 | 1 | 118 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 222 |
| 4:30 PM | 0 | 107 | 5 | 0 | 2 | 142 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 267 |
| 4:45 PM | 0 | 96 | 0 | 0 | 2 | 115 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 220 |
| 5:00 PM | 0 | 101 | 4 | 0 | 1 | 132 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 253 |
| 5:15 PM | 0 | 89 | 2 | 0 | 2 | 160 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 260 |
| 5:30 PM | 0 | 111 | 0 | 0 | 1 | 146 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 264 |
| 5:45 PM | 0 | 93 | 1 | 0 | 2 | 157 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 257 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 0 | 792 | 17 | 0 | 13 | 1090 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 64 | 0 | 1978 |
| **APPROACH %'s :** | 0.00% | 97.90% | 2.10% | 0.00% | 1.18% | 98.64% | 0.00% | 0.18% | | | | | 0.00% | 0.00% | 100.00% | 0.00% | |
| **PEAK HR :** | 05:00 PM - 06:00 PM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 0 | 394 | 7 | 0 | 6 | 595 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 0 | 1034 |
| **PEAK HR FACTOR :** | 0.000 | 0.887 | 0.438 | 0.000 | 0.750 | 0.930 | 0.000 | 0.250 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.517 | 0.000 | 0.979 |
| | | 0.903 | | | | 0.923 | | | | | | | | 0.517 | | | |

## National Data & Surveying Services

# Intersection Turning Movement Count

**Location:** Old Santa Rita Rd & Andrews Dr
**City:** Pleasanton
**Control:** 1-Way Stop(EB)

**Project ID:** 24-080139-005
**Date:** 5/16/2024

## Data - Total

| NS/EW Streets: | Old Santa Rita Rd | | | | Old Santa Rita Rd | | | | Andrews Dr | | | | Andrews Dr | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AM** | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
| | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| 7:00 AM | 7 | 14 | 0 | 0 | 0 | 9 | 3 | 0 | 4 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 45 |
| 7:15 AM | 5 | 14 | 0 | 0 | 0 | 7 | 3 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 32 |
| 7:30 AM | 10 | 15 | 0 | 0 | 0 | 5 | 4 | 0 | 2 | 0 | 20 | 1 | 0 | 0 | 0 | 0 | 57 |
| 7:45 AM | 10 | 23 | 0 | 1 | 0 | 8 | 5 | 0 | 2 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 57 |
| 8:00 AM | 13 | 19 | 0 | 0 | 0 | 9 | 6 | 0 | 3 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 57 |
| 8:15 AM | 11 | 17 | 0 | 0 | 0 | 11 | 5 | 2 | 2 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 53 |
| 8:30 AM | 7 | 19 | 1 | 0 | 1 | 11 | 6 | 0 | 4 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 58 |
| 8:45 AM | 12 | 23 | 0 | 1 | 1 | 13 | 7 | 0 | 3 | 0 | 13 | 0 | 0 | 0 | 2 | 0 | 75 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 75 | 144 | 1 | 2 | 2 | 73 | 39 | 2 | 22 | 1 | 70 | 1 | 0 | 0 | 2 | 0 | 434 |
| **APPROACH %'s :** | 33.78% | 64.86% | 0.45% | 0.90% | 1.72% | 62.93% | 33.62% | 1.72% | 23.40% | 1.06% | 74.47% | 1.06% | 0.00% | 0.00% | 100.00% | 0.00% | |
| **PEAK HR :** | 08:00 AM - 09:00 AM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 43 | 78 | 1 | 1 | 2 | 44 | 24 | 2 | 12 | 0 | 34 | 0 | 0 | 0 | 2 | 0 | 243 |
| **PEAK HR FACTOR :** | 0.827 | 0.848 | 0.250 | 0.250 | 0.500 | 0.846 | 0.857 | 0.250 | 0.750 | 0.000 | 0.654 | 0.000 | 0.000 | 0.000 | 0.250 | 0.000 | 0.810 |
| | 0.854 | | | | 0.857 | | | | 0.719 | | | | 0.250 | | | | |

| PM | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| 4:00 PM | 6 | 13 | 0 | 0 | 0 | 26 | 10 | 1 | 5 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 76 |
| 4:15 PM | 7 | 18 | 0 | 0 | 0 | 17 | 9 | 0 | 13 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 76 |
| 4:30 PM | 9 | 17 | 0 | 0 | 0 | 28 | 5 | 0 | 3 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 77 |
| 4:45 PM | 6 | 12 | 0 | 1 | 1 | 14 | 8 | 1 | 10 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 68 |
| 5:00 PM | 5 | 10 | 0 | 2 | 0 | 25 | 6 | 2 | 7 | 0 | 20 | 0 | 0 | 0 | 3 | 0 | 80 |
| 5:15 PM | 11 | 11 | 0 | 0 | 2 | 24 | 3 | 0 | 11 | 0 | 12 | 0 | 0 | 0 | 2 | 0 | 76 |
| 5:30 PM | 7 | 14 | 0 | 0 | 0 | 22 | 7 | 2 | 9 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 73 |
| 5:45 PM | 5 | 11 | 1 | 1 | 0 | 25 | 3 | 0 | 5 | 0 | 14 | 0 | 0 | 0 | 1 | 0 | 66 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 56 | 106 | 1 | 4 | 3 | 181 | 51 | 6 | 63 | 0 | 115 | 0 | 0 | 0 | 6 | 0 | 592 |
| **APPROACH %'s :** | 33.53% | 63.47% | 0.60% | 2.40% | 1.24% | 75.10% | 21.16% | 2.49% | 35.39% | 0.00% | 64.61% | 0.00% | 0.00% | 0.00% | 100.00% | 0.00% | |
| **PEAK HR :** | 04:30 PM - 05:30 PM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 31 | 50 | 0 | 3 | 3 | 91 | 22 | 3 | 31 | 0 | 62 | 0 | 0 | 0 | 5 | 0 | 301 |
| **PEAK HR FACTOR :** | 0.705 | 0.735 | 0.000 | 0.375 | 0.375 | 0.813 | 0.688 | 0.375 | 0.705 | 0.000 | 0.775 | 0.000 | 0.000 | 0.000 | 0.417 | 0.000 | 0.941 |
| | 0.808 | | | | 0.902 | | | | 0.861 | | | | 0.417 | | | | |

## National Data & Surveying Services

# Intersection Turning Movement Count

**Location:** 5555 Las Positas Blvd Dwy & W Las Positas Blvd
**City:** Pleasanton
**Control:** 1-Way Stop(SB)

**Project ID:** 24-080139-006
**Date:** 5/16/2024

## Data - Total

| **NS/EW Streets:** | 5555 Las Positas Blvd Dwy | | | | 5555 Las Positas Blvd Dwy | | | | W Las Positas Blvd | | | | W Las Positas Blvd | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AM** | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 4 | 0 | 0 | 0 | 4 | 0 | 0 | |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| 7:00 AM | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 54 | 0 | 0 | 0 | 111 | 7 | 0 | 177 |
| 7:15 AM | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 52 | 0 | 0 | 0 | 142 | 10 | 0 | 209 |
| 7:30 AM | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 75 | 0 | 0 | 0 | 176 | 16 | 0 | 278 |
| 7:45 AM | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 147 | 0 | 0 | 0 | 179 | 24 | 0 | 365 |
| 8:00 AM | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 196 | 0 | 0 | 0 | 252 | 16 | 0 | 474 |
| 8:15 AM | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 114 | 0 | 0 | 0 | 344 | 21 | 0 | 483 |
| 8:30 AM | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 183 | 0 | 0 | 0 | 236 | 7 | 0 | 438 |
| 8:45 AM | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 136 | 0 | 0 | 0 | 208 | 22 | 0 | 376 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 0 | 0 | 0 | 0 | 0 | 0 | 72 | 0 | 0 | 957 | 0 | 0 | 0 | 1648 | 123 | 0 | 2800 |
| **APPROACH %'s :** | | | | | 0.00% | 0.00% | 100.00% | 0.00% | 0.00% | 100.00% | 0.00% | 0.00% | 0.00% | 93.05% | 6.95% | 0.00% | |
| **PEAK HR :** | 08:00 AM - 09:00 AM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 0 | 0 | 629 | 0 | 0 | 0 | 1040 | 66 | 0 | 1771 |
| **PEAK HR FACTOR :** | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.750 | 0.000 | 0.000 | 0.802 | 0.000 | 0.000 | 0.000 | 0.756 | 0.750 | 0.000 | 0.917 |
| | | | | | 0.750 | | | | 0.802 | | | | 0.758 | | | | |

| **PM** | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 4 | 0 | 0 | 0 | 4 | 0 | 0 | |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| 4:00 PM | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 0 | 0 | 188 | 0 | 0 | 0 | 160 | 7 | 0 | 371 |
| 4:15 PM | 0 | 0 | 0 | 0 | 0 | 0 | 32 | 0 | 0 | 241 | 0 | 0 | 0 | 149 | 2 | 0 | 424 |
| 4:30 PM | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 204 | 0 | 0 | 0 | 144 | 2 | 0 | 362 |
| 4:45 PM | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 189 | 0 | 0 | 0 | 177 | 3 | 0 | 384 |
| 5:00 PM | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 247 | 0 | 0 | 0 | 164 | 6 | 0 | 440 |
| 5:15 PM | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 255 | 0 | 0 | 0 | 210 | 5 | 0 | 487 |
| 5:30 PM | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 256 | 0 | 0 | 0 | 193 | 6 | 0 | 467 |
| 5:45 PM | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 251 | 0 | 0 | 0 | 177 | 4 | 0 | 443 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 0 | 0 | 0 | 0 | 0 | 0 | 138 | 0 | 0 | 1831 | 0 | 0 | 0 | 1374 | 35 | 0 | 3378 |
| **APPROACH %'s :** | | | | | 0.00% | 0.00% | 100.00% | 0.00% | 0.00% | 100.00% | 0.00% | 0.00% | 0.00% | 97.52% | 2.48% | 0.00% | |
| **PEAK HR :** | 05:00 PM - 06:00 PM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 0 | 0 | 0 | 0 | 0 | 0 | 63 | 0 | 0 | 1009 | 0 | 0 | 0 | 744 | 21 | 0 | 1837 |
| **PEAK HR FACTOR :** | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.685 | 0.000 | 0.000 | 0.985 | 0.000 | 0.000 | 0.000 | 0.886 | 0.875 | 0.000 | 0.943 |
| | | | | | 0.685 | | | | 0.985 | | | | 0.890 | | | | |

## National Data & Surveying Services

# Intersection Turning Movement Count

**Location:** Santa Rita Rd & 5555 W Las Positas Blvd Project Dwy
**City:** Pleasanton
**Control:** 1-Way Stop(EB)

**Project ID:** 24-080139-007
**Date:** 5/16/2024

## Data - Total

| NS/EW Streets: | Santa Rita Rd | | | | Santa Rita Rd | | | | 5555 W Las Positas Blvd Project Dwy | | | | 5555 W Las Positas Blvd Project Dwy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AM** | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
| | 0 | 4 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| 7:00 AM | 0 | 114 | 0 | 0 | 0 | 342 | 23 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 481 |
| 7:15 AM | 0 | 140 | 0 | 0 | 0 | 357 | 14 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 516 |
| 7:30 AM | 0 | 169 | 0 | 0 | 0 | 419 | 28 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 623 |
| 7:45 AM | 0 | 236 | 0 | 0 | 0 | 341 | 36 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 618 |
| 8:00 AM | 0 | 245 | 0 | 0 | 0 | 396 | 32 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 680 |
| 8:15 AM | 0 | 281 | 0 | 0 | 0 | 405 | 34 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 726 |
| 8:30 AM | 0 | 278 | 0 | 0 | 0 | 404 | 29 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 715 |
| 8:45 AM | 0 | 308 | 0 | 0 | 0 | 377 | 30 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 719 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 0 | 1771 | 0 | 0 | 0 | 3041 | 226 | 0 | 0 | 0 | 40 | 0 | 0 | 0 | 0 | 0 | 5078 |
| **APPROACH %'s :** | 0.00% | 100.00% | 0.00% | 0.00% | 0.00% | 93.08% | 6.92% | 0.00% | 0.00% | 0.00% | 100.00% | 0.00% | | | | | |
| **PEAK HR :** | 08:00 AM - 09:00 AM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 0 | 1112 | 0 | 0 | 0 | 1582 | 125 | 0 | 0 | 0 | 21 | 0 | 0 | 0 | 0 | 0 | 2840 |
| **PEAK HR FACTOR :** | 0.000 | 0.903 | 0.000 | 0.000 | 0.000 | 0.977 | 0.919 | 0.000 | 0.000 | 0.000 | 0.750 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.978 |
| | 0.903 | | | | 0.972 | | | | 0.750 | | | | | | | | |

| **PM** | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 4 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| 4:00 PM | 0 | 389 | 0 | 0 | 0 | 314 | 9 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 724 |
| 4:15 PM | 0 | 371 | 0 | 0 | 0 | 303 | 8 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 693 |
| 4:30 PM | 0 | 452 | 0 | 0 | 0 | 287 | 11 | 0 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 765 |
| 4:45 PM | 0 | 335 | 0 | 0 | 0 | 337 | 7 | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 702 |
| 5:00 PM | 0 | 390 | 0 | 0 | 0 | 317 | 6 | 0 | 0 | 0 | 24 | 0 | 0 | 0 | 0 | 0 | 737 |
| 5:15 PM | 0 | 387 | 0 | 0 | 0 | 337 | 3 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 740 |
| 5:30 PM | 0 | 350 | 0 | 0 | 0 | 395 | 11 | 0 | 0 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 772 |
| 5:45 PM | 0 | 364 | 0 | 0 | 0 | 285 | 11 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 671 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 0 | 3038 | 0 | 0 | 0 | 2575 | 66 | 0 | 0 | 0 | 125 | 0 | 0 | 0 | 0 | 0 | 5804 |
| **APPROACH %'s :** | 0.00% | 100.00% | 0.00% | 0.00% | 0.00% | 97.50% | 2.50% | 0.00% | 0.00% | 0.00% | 100.00% | 0.00% | | | | | |
| **PEAK HR :** | 04:45 PM - 05:45 PM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 0 | 1462 | 0 | 0 | 0 | 1386 | 27 | 0 | 0 | 0 | 76 | 0 | 0 | 0 | 0 | 0 | 2951 |
| **PEAK HR FACTOR :** | 0.000 | 0.937 | 0.000 | 0.000 | 0.000 | 0.877 | 0.614 | 0.000 | 0.000 | 0.000 | 0.792 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.956 |
| | 0.937 | | | | 0.870 | | | | 0.792 | | | | | | | | |

## National Data & Surveying Services

# Intersection Turning Movement Count

**Location:** Santa Rita Rd & W Las Positas Blvd
**City:** Pleasanton
**Control:** Signalized

**Project ID:** 24-080139-008
**Date:** 5/16/2024

## Data - Total

| **NS/EW Streets:** | Santa Rita Rd | | | | Santa Rita Rd | | | | W Las Positas Blvd | | | | W Las Positas Blvd | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AM** | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
| | 2 NL | 3 NT | 1 NR | 0 NU | 2 SL | 3 ST | 1 SR | 0 SU | 2 EL | 2 ET | 1 ER | 0 EU | 2 WL | 2 WT | 0 WR | 0 WU | TOTAL |
| 7:00 AM | 32 | 102 | 11 | 2 | 9 | 275 | 53 | 2 | 15 | 13 | 21 | 3 | 21 | 30 | 4 | 0 | 593 |
| 7:15 AM | 62 | 107 | 9 | 4 | 5 | 303 | 58 | 2 | 12 | 16 | 22 | 4 | 27 | 29 | 6 | 0 | 666 |
| 7:30 AM | 53 | 135 | 9 | 4 | 20 | 325 | 78 | 3 | 23 | 14 | 26 | 5 | 37 | 57 | 13 | 0 | 802 |
| 7:45 AM | 71 | 183 | 22 | 3 | 21 | 257 | 68 | 0 | 35 | 49 | 64 | 6 | 42 | 56 | 7 | 0 | 884 |
| 8:00 AM | 70 | 194 | 33 | 2 | 27 | 261 | 100 | 3 | 26 | 105 | 51 | 3 | 59 | 95 | 27 | 0 | 1056 |
| 8:15 AM | 99 | 225 | 20 | 3 | 12 | 282 | 125 | 3 | 30 | 41 | 40 | 14 | 66 | 127 | 15 | 0 | 1102 |
| 8:30 AM | 69 | 207 | 16 | 5 | 18 | 280 | 107 | 2 | 58 | 57 | 59 | 9 | 56 | 61 | 10 | 0 | 1014 |
| 8:45 AM | 97 | 248 | 46 | 8 | 16 | 274 | 88 | 2 | 48 | 42 | 36 | 8 | 24 | 35 | 14 | 0 | 986 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 553 | 1401 | 166 | 31 | 128 | 2257 | 677 | 17 | 247 | 337 | 319 | 52 | 332 | 490 | 96 | 0 | 7103 |
| **APPROACH %'s :** | 25.71% | 65.13% | 7.72% | 1.44% | 4.16% | 73.30% | 21.99% | 0.55% | 25.86% | 35.29% | 33.40% | 5.45% | 36.17% | 53.38% | 10.46% | 0.00% | |
| **PEAK HR :** | 08:00 AM - 09:00 AM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 335 | 874 | 115 | 18 | 73 | 1097 | 420 | 10 | 162 | 245 | 186 | 34 | 205 | 318 | 66 | 0 | 4158 |
| **PEAK HR FACTOR :** | 0.846 | 0.881 | 0.625 | 0.563 | 0.676 | 0.973 | 0.840 | 0.833 | 0.698 | 0.583 | 0.788 | 0.607 | 0.777 | 0.626 | 0.611 | 0.000 | 0.943 |
| | 0.841 | | | | 0.948 | | | | 0.847 | | | | 0.708 | | | | |

| **PM** | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 NL | 3 NT | 1 NR | 0 NU | 2 SL | 3 ST | 1 SR | 0 SU | 2 EL | 2 ET | 1 ER | 0 EU | 2 WL | 2 WT | 0 WR | 0 WU | TOTAL |
| 4:00 PM | 75 | 282 | 31 | 17 | 23 | 236 | 67 | 3 | 59 | 32 | 67 | 0 | 38 | 23 | 26 | 1 | 980 |
| 4:15 PM | 57 | 278 | 36 | 17 | 22 | 224 | 65 | 3 | 77 | 47 | 91 | 8 | 27 | 24 | 11 | 1 | 988 |
| 4:30 PM | 67 | 360 | 28 | 20 | 27 | 215 | 53 | 7 | 80 | 56 | 93 | 4 | 29 | 22 | 21 | 1 | 1083 |
| 4:45 PM | 67 | 233 | 37 | 21 | 36 | 230 | 76 | 7 | 58 | 59 | 86 | 5 | 52 | 29 | 25 | 0 | 1021 |
| 5:00 PM | 61 | 278 | 32 | 21 | 29 | 245 | 72 | 6 | 97 | 54 | 82 | 4 | 35 | 40 | 9 | 0 | 1065 |
| 5:15 PM | 63 | 289 | 30 | 26 | 31 | 223 | 94 | 2 | 81 | 75 | 105 | 4 | 40 | 48 | 15 | 0 | 1126 |
| 5:30 PM | 76 | 235 | 39 | 28 | 31 | 286 | 81 | 6 | 98 | 57 | 92 | 6 | 43 | 37 | 20 | 1 | 1136 |
| 5:45 PM | 78 | 263 | 29 | 23 | 21 | 222 | 56 | 4 | 82 | 81 | 84 | 7 | 28 | 38 | 21 | 0 | 1037 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 544 | 2218 | 262 | 173 | 220 | 1881 | 564 | 38 | 632 | 461 | 700 | 38 | 292 | 261 | 148 | 4 | 8436 |
| **APPROACH %'s :** | 17.02% | 69.38% | 8.20% | 5.41% | 8.14% | 69.59% | 20.87% | 1.41% | 34.52% | 25.18% | 38.23% | 2.08% | 41.42% | 37.02% | 20.99% | 0.57% | |
| **PEAK HR :** | 05:00 PM - 06:00 PM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 278 | 1065 | 130 | 98 | 112 | 976 | 303 | 18 | 358 | 267 | 363 | 21 | 146 | 163 | 65 | 1 | 4364 |
| **PEAK HR FACTOR :** | 0.891 | 0.921 | 0.833 | 0.875 | 0.903 | 0.853 | 0.806 | 0.750 | 0.913 | 0.824 | 0.864 | 0.750 | 0.849 | 0.849 | 0.774 | 0.250 | 0.960 |
| | 0.963 | | | | 0.872 | | | | 0.952 | | | | 0.910 | | | | |

National Data & Surveying Services

# Intersection Turning Movement Count

**Location:** Santa Rita Rd & Old Santa Rita Rd
**City:** Pleasanton
**Control:** Signalized

**Project ID:** 24-080139-009
**Date:** 5/16/2024

## Data - Total

| NS/EW Streets: | Santa Rita Rd | | | | Santa Rita Rd | | | | Old Santa Rita Rd | | | | Old Santa Rita Rd | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AM** | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
| | 1 | 3 | 1 | 0 | 1 | 3 | 1 | 0 | 1.5 | 0.5 | 1 | 0 | 0 | 1 | 0 | 0 | |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| 7:00 AM | 2 | 115 | 0 | 0 | 0 | 353 | 17 | 5 | 10 | 0 | 7 | 0 | 0 | 1 | 1 | 0 | 511 |
| 7:15 AM | 5 | 131 | 0 | 0 | 0 | 365 | 13 | 4 | 7 | 0 | 9 | 0 | 0 | 0 | 1 | 0 | 535 |
| 7:30 AM | 5 | 163 | 0 | 5 | 0 | 427 | 19 | 1 | 18 | 0 | 8 | 0 | 4 | 1 | 1 | 0 | 652 |
| 7:45 AM | 7 | 223 | 2 | 4 | 0 | 367 | 19 | 3 | 19 | 0 | 15 | 0 | 2 | 0 | 0 | 0 | 661 |
| 8:00 AM | 18 | 217 | 3 | 0 | 0 | 389 | 17 | 2 | 5 | 0 | 25 | 0 | 3 | 0 | 1 | 0 | 680 |
| 8:15 AM | 20 | 261 | 1 | 5 | 0 | 416 | 16 | 4 | 5 | 0 | 13 | 0 | 5 | 0 | 1 | 0 | 747 |
| 8:30 AM | 12 | 261 | 2 | 2 | 1 | 423 | 24 | 3 | 2 | 0 | 9 | 0 | 3 | 0 | 0 | 0 | 742 |
| 8:45 AM | 19 | 284 | 3 | 3 | 1 | 391 | 21 | 3 | 12 | 0 | 10 | 0 | 1 | 0 | 1 | 0 | 749 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 88 | 1655 | 11 | 19 | 2 | 3131 | 146 | 25 | 78 | 0 | 96 | 0 | 18 | 2 | 6 | 0 | 5277 |
| **APPROACH %'s :** | 4.96% | 93.34% | 0.62% | 1.07% | 0.06% | 94.76% | 4.42% | 0.76% | 44.83% | 0.00% | 55.17% | 0.00% | 69.23% | 7.69% | 23.08% | 0.00% | |
| **PEAK HR :** | 08:00 AM - 09:00 AM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 69 | 1023 | 9 | 10 | 2 | 1619 | 78 | 12 | 24 | 0 | 57 | 0 | 12 | 0 | 3 | 0 | 2918 |
| **PEAK HR FACTOR :** | 0.863 | 0.901 | 0.750 | 0.500 | 0.500 | 0.957 | 0.813 | 0.750 | 0.500 | 0.000 | 0.570 | 0.000 | 0.600 | 0.000 | 0.750 | 0.000 | 0.974 |
| | 0.899 | | | | 0.948 | | | | 0.675 | | | | 0.625 | | | | |

| PM | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 3 | 1 | 0 | 1 | 3 | 1 | 0 | 1.5 | 0.5 | 1 | 0 | 0 | 1 | 0 | 0 | |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| 4:00 PM | 8 | 376 | 2 | 5 | 0 | 301 | 17 | 8 | 29 | 0 | 19 | 0 | 1 | 0 | 0 | 0 | 766 |
| 4:15 PM | 15 | 350 | 2 | 3 | 1 | 294 | 7 | 8 | 17 | 1 | 10 | 0 | 2 | 0 | 1 | 0 | 711 |
| 4:30 PM | 10 | 439 | 1 | 3 | 2 | 282 | 16 | 5 | 31 | 0 | 11 | 0 | 1 | 1 | 0 | 0 | 802 |
| 4:45 PM | 10 | 319 | 0 | 3 | 1 | 333 | 7 | 10 | 19 | 0 | 15 | 0 | 0 | 0 | 2 | 0 | 719 |
| 5:00 PM | 5 | 386 | 1 | 1 | 0 | 296 | 16 | 3 | 21 | 0 | 18 | 0 | 1 | 0 | 0 | 0 | 748 |
| 5:15 PM | 9 | 376 | 0 | 0 | 1 | 333 | 11 | 6 | 30 | 3 | 8 | 0 | 1 | 0 | 0 | 0 | 778 |
| 5:30 PM | 12 | 336 | 2 | 2 | 2 | 386 | 10 | 9 | 29 | 2 | 15 | 0 | 1 | 1 | 4 | 0 | 811 |
| 5:45 PM | 8 | 352 | 1 | 2 | 1 | 283 | 7 | 6 | 17 | 0 | 13 | 0 | 1 | 0 | 1 | 0 | 692 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 77 | 2934 | 9 | 19 | 8 | 2508 | 91 | 55 | 193 | 6 | 109 | 0 | 8 | 2 | 8 | 0 | 6027 |
| **APPROACH %'s :** | 2.53% | 96.54% | 0.30% | 0.63% | 0.30% | 94.21% | 3.42% | 2.07% | 62.66% | 1.95% | 35.39% | 0.00% | 44.44% | 11.11% | 44.44% | 0.00% | |
| **PEAK HR :** | 04:45 PM - 05:45 PM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 36 | 1417 | 3 | 6 | 4 | 1348 | 44 | 28 | 99 | 5 | 56 | 0 | 3 | 1 | 6 | 0 | 3056 |
| **PEAK HR FACTOR :** | 0.750 | 0.918 | 0.375 | 0.500 | 0.500 | 0.873 | 0.688 | 0.700 | 0.825 | 0.417 | 0.778 | 0.000 | 0.750 | 0.250 | 0.375 | 0.000 | 0.942 |
| | 0.930 | | | | 0.875 | | | | 0.870 | | | | 0.417 | | | | |

National Data & Surveying Services

# Intersection Turning Movement Count

**Location:** Santa Rita Rd & I-580 WB Ramps
**City:** Pleasanton
**Control:** Signalized

**Project ID:** 24-080139-010
**Date:** 5/16/2024

## Data - Total

| NS/EW Streets: | Santa Rita Rd | | | | Santa Rita Rd | | | | I-580 WB Ramps | | | | I-580 WB Ramps | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AM** | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
| | 0 | 2 | 1 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| 7:00 AM | 0 | 130 | 79 | 0 | 0 | 142 | 99 | 0 | 0 | 0 | 0 | 0 | 187 | 0 | 63 | 0 | 700 |
| 7:15 AM | 0 | 189 | 80 | 0 | 0 | 144 | 142 | 0 | 0 | 0 | 0 | 0 | 190 | 0 | 80 | 0 | 825 |
| 7:30 AM | 0 | 203 | 86 | 0 | 0 | 198 | 160 | 0 | 0 | 0 | 0 | 0 | 170 | 0 | 79 | 0 | 896 |
| 7:45 AM | 0 | 294 | 96 | 0 | 0 | 186 | 248 | 0 | 0 | 0 | 0 | 0 | 148 | 0 | 87 | 0 | 1059 |
| 8:00 AM | 0 | 282 | 97 | 0 | 0 | 219 | 277 | 0 | 0 | 0 | 0 | 0 | 124 | 0 | 82 | 0 | 1081 |
| 8:15 AM | 0 | 312 | 93 | 0 | 0 | 298 | 235 | 0 | 0 | 0 | 0 | 0 | 112 | 0 | 74 | 0 | 1124 |
| 8:30 AM | 0 | 281 | 75 | 0 | 0 | 244 | 176 | 0 | 0 | 0 | 0 | 0 | 148 | 0 | 79 | 0 | 1003 |
| 8:45 AM | 0 | 347 | 112 | 0 | 0 | 252 | 207 | 0 | 0 | 0 | 0 | 0 | 137 | 0 | 75 | 0 | 1130 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 0 | 2038 | 718 | 0 | 0 | 1683 | 1544 | 0 | 0 | 0 | 0 | 0 | 1216 | 0 | 619 | 0 | 7818 |
| **APPROACH %'s :** | 0.00% | 73.95% | 26.05% | 0.00% | 0.00% | 52.15% | 47.85% | 0.00% | | | | | 66.27% | 0.00% | 33.73% | 0.00% | |
| **PEAK HR :** | 08:00 AM - 09:00 AM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 0 | 1222 | 377 | 0 | 0 | 1013 | 895 | 0 | 0 | 0 | 0 | 0 | 521 | 0 | 310 | 0 | 4338 |
| **PEAK HR FACTOR :** | 0.000 | 0.880 | 0.842 | 0.000 | 0.000 | 0.850 | 0.808 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.880 | 0.000 | 0.945 | 0.000 | 0.960 |
| | | 0.871 | | | | 0.895 | | | | | | | | 0.915 | | | |

| **PM** | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 2 | 1 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| 4:00 PM | 0 | 280 | 152 | 0 | 0 | 280 | 195 | 0 | 0 | 0 | 0 | 0 | 118 | 0 | 53 | 0 | 1078 |
| 4:15 PM | 0 | 264 | 137 | 0 | 0 | 319 | 209 | 0 | 0 | 0 | 0 | 0 | 118 | 0 | 60 | 0 | 1107 |
| 4:30 PM | 0 | 276 | 181 | 0 | 0 | 323 | 171 | 0 | 0 | 0 | 0 | 0 | 102 | 0 | 47 | 0 | 1100 |
| 4:45 PM | 0 | 318 | 129 | 0 | 0 | 345 | 169 | 0 | 0 | 0 | 0 | 0 | 123 | 0 | 47 | 0 | 1131 |
| 5:00 PM | 0 | 294 | 143 | 0 | 0 | 351 | 213 | 0 | 0 | 0 | 0 | 0 | 96 | 0 | 63 | 0 | 1160 |
| 5:15 PM | 0 | 292 | 137 | 0 | 0 | 327 | 191 | 0 | 0 | 0 | 0 | 0 | 142 | 0 | 69 | 0 | 1158 |
| 5:30 PM | 0 | 344 | 97 | 0 | 0 | 339 | 185 | 0 | 0 | 0 | 0 | 0 | 119 | 0 | 78 | 0 | 1162 |
| 5:45 PM | 0 | 342 | 100 | 0 | 0 | 293 | 121 | 0 | 0 | 0 | 0 | 0 | 126 | 0 | 49 | 0 | 1031 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 0 | 2410 | 1076 | 0 | 0 | 2577 | 1454 | 0 | 0 | 0 | 0 | 0 | 944 | 0 | 466 | 0 | 8927 |
| **APPROACH %'s :** | 0.00% | 69.13% | 30.87% | 0.00% | 0.00% | 63.93% | 36.07% | 0.00% | | | | | 66.95% | 0.00% | 33.05% | 0.00% | |
| **PEAK HR :** | 04:45 PM - 05:45 PM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 0 | 1248 | 506 | 0 | 0 | 1362 | 758 | 0 | 0 | 0 | 0 | 0 | 480 | 0 | 257 | 0 | 4611 |
| **PEAK HR FACTOR :** | 0.000 | 0.907 | 0.885 | 0.000 | 0.000 | 0.970 | 0.890 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.845 | 0.000 | 0.824 | 0.000 | 0.992 |
| | | 0.981 | | | | 0.940 | | | | | | | | 0.873 | | | |

National Data & Surveying Services

# Intersection Turning Movement Count

**Location:** Santa Rita Rd & I-580 EB Ramps
**City:** Pleasanton
**Control:** Signalized

**Project ID:** 24-080139-011
**Date:** 5/16/2024

## Data - Total

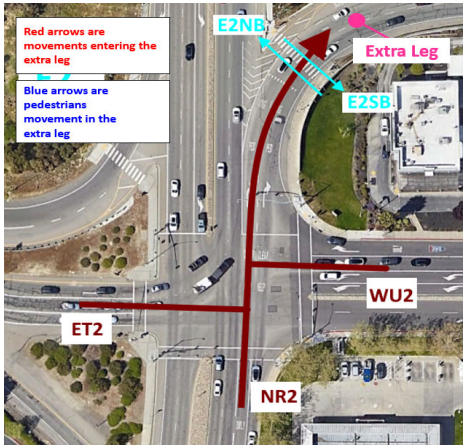
| NS/EW Streets: | Santa Rita Rd | | | | | Santa Rita Rd | | | | I-580 EB Ramps | | | | | I-580 EB Ramps | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AM** | NORTHBOUND | | | | | SOUTHBOUND | | | | EASTBOUND | | | | | WESTBOUND | | | | | |
| | 0 | 3.5 | 0.5 | 0 | 0 | 1 | 2 | 1 | 0 | 2 | 1 | 1 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | |
| | NL | NT | NR | NU | NR2 | SL | ST | SR | SU | EL | ET | ER | EU | ET2 | WL | WT | WR | WU | WU2 | TOTAL |
| 7:00 AM | 0 | 91 | 18 | 0 | 40 | 22 | 262 | 27 | 0 | 90 | 16 | 99 | 0 | 0 | 18 | 0 | 33 | 0 | 14 | 730 |
| 7:15 AM | 0 | 103 | 6 | 0 | 40 | 27 | 298 | 28 | 0 | 118 | 21 | 136 | 0 | 0 | 18 | 0 | 43 | 0 | 22 | 860 |
| 7:30 AM | 0 | 116 | 17 | 0 | 42 | 29 | 293 | 42 | 0 | 139 | 30 | 173 | 0 | 0 | 30 | 0 | 39 | 0 | 17 | 967 |
| 7:45 AM | 0 | 169 | 17 | 0 | 72 | 36 | 259 | 43 | 0 | 165 | 20 | 177 | 0 | 0 | 23 | 0 | 51 | 0 | 29 | 1061 |
| 8:00 AM | 0 | 152 | 19 | 0 | 52 | 33 | 273 | 37 | 0 | 183 | 36 | 154 | 0 | 0 | 50 | 0 | 44 | 0 | 23 | 1056 |
| 8:15 AM | 0 | 173 | 18 | 0 | 72 | 27 | 332 | 51 | 0 | 163 | 39 | 166 | 0 | 0 | 56 | 0 | 71 | 0 | 19 | 1187 |
| 8:30 AM | 0 | 148 | 19 | 0 | 74 | 46 | 282 | 48 | 1 | 179 | 34 | 166 | 0 | 0 | 28 | 0 | 39 | 0 | 28 | 1092 |
| 8:45 AM | 0 | 229 | 16 | 0 | 72 | 40 | 300 | 59 | 0 | 162 | 31 | 189 | 0 | 2 | 36 | 0 | 58 | 0 | 25 | 1219 |
| | NL | NT | NR | NU | NR2 | SL | ST | SR | SU | EL | ET | ER | EU | ET2 | WL | WT | WR | WU | WU2 | TOTAL |
| **TOTAL VOLUMES :** | 0 | 1181 | 130 | 0 | 464 | 260 | 2299 | 335 | 1 | 1199 | 227 | 1260 | 0 | 2 | 259 | 0 | 378 | 0 | 177 | 8172 |
| **APPROACH %'s :** | 0.00% | 66.54% | 7.32% | 0.00% | 26.14% | 8.98% | 79.41% | 11.57% | 0.03% | 44.61% | 8.44% | 46.88% | 0.00% | 0.07% | 31.82% | 0.00% | 46.44% | 0.00% | 21.74% | |
| **PEAK HR :** | 08:00 AM - 09:00 AM | | | | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 0 | 702 | 72 | 0 | 270 | 146 | 1187 | 195 | 1 | 687 | 140 | 675 | 0 | 2 | 170 | 0 | 212 | 0 | 95 | 4554 |
| **PEAK HR FACTOR :** | 0.000 | 0.766 | 0.947 | 0.000 | 0.912 | 0.793 | 0.894 | 0.826 | 0.250 | 0.939 | 0.897 | 0.893 | 0.000 | 0.250 | 0.759 | 0.000 | 0.746 | 0.000 | 0.848 | 0.934 |
| | | | 0.823 | | | | | 0.932 | | | | 0.979 | | | | | 0.817 | | | |

| PM | NORTHBOUND | | | | | SOUTHBOUND | | | | EASTBOUND | | | | | WESTBOUND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 3.5 | 0.5 | 0 | 0 | 1 | 2 | 1 | 0 | 2 | 1 | 1 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | |
| | NL | NT | NR | NU | NR2 | SL | ST | SR | SU | EL | ET | ER | EU | ET2 | WL | WT | WR | WU | WU2 | TOTAL |
| 4:00 PM | 0 | 268 | 23 | 0 | 129 | 45 | 245 | 93 | 1 | 104 | 28 | 58 | 0 | 3 | 19 | 0 | 66 | 0 | 33 | 1115 |
| 4:15 PM | 0 | 267 | 21 | 0 | 138 | 65 | 287 | 99 | 0 | 69 | 37 | 43 | 0 | 0 | 32 | 0 | 58 | 0 | 34 | 1150 |
| 4:30 PM | 0 | 312 | 16 | 0 | 149 | 52 | 220 | 123 | 0 | 98 | 28 | 38 | 0 | 4 | 26 | 0 | 54 | 0 | 31 | 1151 |
| 4:45 PM | 0 | 313 | 26 | 0 | 123 | 90 | 297 | 111 | 0 | 86 | 36 | 47 | 0 | 1 | 29 | 0 | 46 | 0 | 38 | 1243 |
| 5:00 PM | 0 | 267 | 34 | 0 | 144 | 47 | 244 | 132 | 0 | 101 | 37 | 51 | 0 | 0 | 37 | 0 | 66 | 0 | 35 | 1195 |
| 5:15 PM | 0 | 300 | 31 | 0 | 148 | 62 | 325 | 107 | 0 | 73 | 25 | 48 | 0 | 1 | 34 | 0 | 69 | 1 | 43 | 1267 |
| 5:30 PM | 0 | 250 | 15 | 0 | 135 | 44 | 304 | 108 | 0 | 135 | 36 | 69 | 0 | 1 | 28 | 0 | 46 | 1 | 27 | 1199 |
| 5:45 PM | 0 | 267 | 17 | 0 | 124 | 64 | 263 | 93 | 1 | 106 | 28 | 63 | 0 | 0 | 29 | 0 | 66 | 0 | 38 | 1159 |
| | NL | NT | NR | NU | NR2 | SL | ST | SR | SU | EL | ET | ER | EU | ET2 | WL | WT | WR | WU | WU2 | TOTAL |
| **TOTAL VOLUMES :** | 0 | 2244 | 183 | 0 | 1090 | 469 | 2185 | 866 | 2 | 772 | 255 | 417 | 0 | 10 | 234 | 0 | 471 | 2 | 279 | 9479 |
| **APPROACH %'s :** | 0.00% | 63.80% | 5.20% | 0.00% | 30.99% | 13.32% | 62.04% | 24.59% | 0.06% | 53.09% | 17.54% | 28.68% | 0.00% | 0.69% | 23.73% | 0.00% | 47.77% | 0.20% | 28.30% | |
| **PEAK HR :** | 04:45 PM - 05:45 PM | | | | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 0 | 1130 | 106 | 0 | 550 | 243 | 1170 | 458 | 0 | 395 | 134 | 215 | 0 | 3 | 128 | 0 | 227 | 2 | 143 | 4904 |
| **PEAK HR FACTOR :** | 0.000 | 0.903 | 0.779 | 0.000 | 0.929 | 0.675 | 0.900 | 0.867 | 0.000 | 0.731 | 0.905 | 0.779 | 0.000 | 0.750 | 0.865 | 0.000 | 0.822 | 0.500 | 0.831 | 0.968 |
| | | | 0.932 | | | | | 0.939 | | | | 0.775 | | | | | 0.850 | | | |

**Explanation for extra leg movements**

**Movement entering the extra leg**

| | |
|---|---|
| ET2 | Movements coming from EB on I-580 EB Ramps entering into the extra leg |
| NR2 | Movements coming from NB on Santa Rita Rd entering into the extra leg |
| WU2 | Movements coming from WB on Pimlico Dr entering into the extra leg |



National Data & Surveying Services

# Intersection Turning Movement Count

**Location:** Owens Dr & Hacienda Dr
**City:** Pleasanton
**Control:** Signalized

**Project ID:** 24-080139-012
**Date:** 5/16/2024

## Data - Total

| NS/EW Streets: | Owens Dr | | | | Owens Dr | | | | Hacienda Dr | | | | Hacienda Dr | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AM** | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
| | 2 NL | 3 NT | 1 NR | 0 NU | 2 SL | 3 ST | 1 SR | 0 SU | 2 EL | 3 ET | 1 ER | 0 EU | 2 WL | 3 WT | 1 WR | 0 WU | TOTAL |
| 7:00 AM | 6 | 38 | 47 | 2 | 13 | 23 | 2 | 0 | 2 | 17 | 7 | 0 | 59 | 61 | 42 | 0 | 319 |
| 7:15 AM | 11 | 51 | 51 | 0 | 12 | 16 | 2 | 2 | 7 | 28 | 5 | 0 | 64 | 88 | 50 | 0 | 387 |
| 7:30 AM | 10 | 41 | 61 | 0 | 14 | 22 | 1 | 0 | 1 | 30 | 12 | 0 | 95 | 109 | 60 | 0 | 456 |
| 7:45 AM | 21 | 60 | 74 | 1 | 14 | 17 | 2 | 0 | 3 | 31 | 10 | 0 | 95 | 139 | 68 | 0 | 535 |
| 8:00 AM | 19 | 51 | 75 | 0 | 15 | 21 | 2 | 0 | 3 | 53 | 23 | 1 | 88 | 150 | 54 | 0 | 555 |
| 8:15 AM | 14 | 61 | 68 | 0 | 8 | 20 | 4 | 0 | 5 | 71 | 22 | 0 | 103 | 187 | 65 | 0 | 628 |
| 8:30 AM | 25 | 51 | 81 | 2 | 20 | 28 | 1 | 0 | 8 | 76 | 33 | 0 | 99 | 195 | 90 | 0 | 709 |
| 8:45 AM | 30 | 63 | 90 | 2 | 21 | 26 | 8 | 0 | 7 | 52 | 16 | 0 | 106 | 200 | 80 | 0 | 701 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 136 | 416 | 547 | 7 | 117 | 173 | 22 | 2 | 36 | 358 | 128 | 1 | 709 | 1129 | 509 | 0 | 4290 |
| **APPROACH %'s :** | 12.30% | 37.61% | 49.46% | 0.63% | 37.26% | 55.10% | 7.01% | 0.64% | 6.88% | 68.45% | 24.47% | 0.19% | 30.21% | 48.10% | 21.69% | 0.00% | |
| **PEAK HR :** | 08:00 AM - 09:00 AM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 88 | 226 | 314 | 4 | 64 | 95 | 15 | 0 | 23 | 252 | 94 | 1 | 396 | 732 | 289 | 0 | 2593 |
| **PEAK HR FACTOR :** | 0.733 | 0.897 | 0.872 | 0.500 | 0.762 | 0.848 | 0.469 | 0.000 | 0.719 | 0.829 | 0.712 | 0.250 | 0.934 | 0.915 | 0.803 | 0.000 | 0.914 |
| | 0.854 | | | | 0.791 | | | | 0.791 | | | | 0.918 | | | | |

| NS/EW Streets: | Owens Dr | | | | Owens Dr | | | | Hacienda Dr | | | | Hacienda Dr | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PM** | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
| | 2 NL | 3 NT | 1 NR | 0 NU | 2 SL | 3 ST | 1 SR | 0 SU | 2 EL | 3 ET | 1 ER | 0 EU | 2 WL | 3 WT | 1 WR | 0 WU | TOTAL |
| 4:00 PM | 26 | 49 | 164 | 2 | 80 | 96 | 11 | 0 | 2 | 143 | 31 | 0 | 87 | 54 | 26 | 0 | 771 |
| 4:15 PM | 26 | 46 | 147 | 5 | 68 | 68 | 4 | 0 | 2 | 159 | 42 | 0 | 81 | 72 | 47 | 0 | 767 |
| 4:30 PM | 18 | 62 | 144 | 7 | 78 | 95 | 5 | 1 | 6 | 122 | 41 | 0 | 101 | 61 | 39 | 0 | 780 |
| 4:45 PM | 33 | 37 | 159 | 9 | 65 | 83 | 12 | 0 | 2 | 142 | 37 | 0 | 86 | 89 | 39 | 0 | 793 |
| 5:00 PM | 40 | 47 | 173 | 5 | 89 | 71 | 8 | 0 | 4 | 209 | 30 | 0 | 117 | 88 | 44 | 0 | 925 |
| 5:15 PM | 19 | 54 | 146 | 6 | 71 | 112 | 8 | 1 | 4 | 149 | 33 | 0 | 124 | 110 | 59 | 0 | 896 |
| 5:30 PM | 25 | 51 | 143 | 1 | 90 | 95 | 10 | 0 | 2 | 136 | 17 | 0 | 110 | 107 | 41 | 0 | 828 |
| 5:45 PM | 41 | 47 | 138 | 5 | 81 | 78 | 3 | 1 | 4 | 120 | 27 | 0 | 103 | 109 | 42 | 0 | 799 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 228 | 393 | 1214 | 40 | 622 | 698 | 61 | 3 | 26 | 1180 | 258 | 0 | 809 | 690 | 337 | 0 | 6559 |
| **APPROACH %'s :** | 12.16% | 20.96% | 64.75% | 2.13% | 44.94% | 50.43% | 4.41% | 0.22% | 1.78% | 80.60% | 17.62% | 0.00% | 44.06% | 37.58% | 18.36% | 0.00% | |
| **PEAK HR :** | 05:00 PM - 06:00 PM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 125 | 199 | 600 | 17 | 331 | 356 | 29 | 2 | 14 | 614 | 107 | 0 | 454 | 414 | 186 | 0 | 3448 |
| **PEAK HR FACTOR :** | 0.762 | 0.921 | 0.867 | 0.708 | 0.919 | 0.795 | 0.725 | 0.500 | 0.875 | 0.734 | 0.811 | 0.000 | 0.915 | 0.941 | 0.788 | 0.000 | 0.932 |
| | 0.888 | | | | 0.921 | | | | 0.756 | | | | 0.899 | | | | |

National Data & Surveying Services

# Intersection Turning Movement Count

**Location:** Santa Rita Rd & Stoneridge Dr
**City:** Pleasanton
**Control:** Signalized

**Project ID:** 24-080139-013
**Date:** 5/16/2024

## Data - Total

| NS/EW Streets: | Santa Rita Rd | | | | Santa Rita Rd | | | | Stoneridge Dr | | | | Stoneridge Dr | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AM** | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
| | 2 | 3 | 1 | 0 | 2 | 3 | 0 | 0 | 1 | 3 | 1 | 0 | 2 | 2 | 1 | 0 | |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| 7:00 AM | 51 | 127 | 10 | 0 | 12 | 283 | 8 | 2 | 1 | 17 | 27 | 0 | 33 | 35 | 19 | 0 | 625 |
| 7:15 AM | 40 | 142 | 18 | 0 | 27 | 308 | 5 | 1 | 3 | 15 | 27 | 1 | 34 | 36 | 27 | 0 | 684 |
| 7:30 AM | 77 | 175 | 26 | 0 | 32 | 343 | 5 | 0 | 1 | 15 | 17 | 0 | 46 | 52 | 28 | 0 | 817 |
| 7:45 AM | 90 | 214 | 62 | 0 | 46 | 312 | 7 | 4 | 4 | 32 | 57 | 0 | 77 | 74 | 43 | 0 | 1022 |
| 8:00 AM | 125 | 259 | 52 | 0 | 52 | 292 | 13 | 8 | 3 | 71 | 48 | 0 | 62 | 104 | 60 | 0 | 1149 |
| 8:15 AM | 119 | 254 | 24 | 0 | 33 | 317 | 19 | 5 | 7 | 36 | 50 | 1 | 114 | 153 | 75 | 0 | 1207 |
| 8:30 AM | 121 | 263 | 55 | 0 | 34 | 375 | 11 | 3 | 10 | 39 | 55 | 0 | 110 | 114 | 41 | 0 | 1231 |
| 8:45 AM | 132 | 304 | 89 | 1 | 36 | 323 | 13 | 1 | 10 | 42 | 61 | 0 | 81 | 95 | 51 | 0 | 1239 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 755 | 1738 | 336 | 1 | 272 | 2553 | 81 | 24 | 39 | 267 | 342 | 2 | 557 | 663 | 344 | 0 | 7974 |
| **APPROACH %'s :** | 26.68% | 61.41% | 11.87% | 0.04% | 9.28% | 87.13% | 2.76% | 0.82% | 6.00% | 41.08% | 52.62% | 0.31% | 35.61% | 42.39% | 21.99% | 0.00% | |
| **PEAK HR :** | 08:00 AM - 09:00 AM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 497 | 1080 | 220 | 1 | 155 | 1307 | 56 | 17 | 30 | 188 | 214 | 1 | 367 | 466 | 227 | 0 | 4826 |
| **PEAK HR FACTOR :** | 0.941 | 0.888 | 0.618 | 0.250 | 0.745 | 0.871 | 0.737 | 0.531 | 0.750 | 0.662 | 0.877 | 0.250 | 0.805 | 0.761 | 0.757 | 0.000 | 0.974 |
| | 0.855 | | | | 0.907 | | | | 0.887 | | | | 0.775 | | | | |

| **PM** | NORTHBOUND | | | | SOUTHBOUND | | | | EASTBOUND | | | | WESTBOUND | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | 3 | 1 | 0 | 2 | 3 | 0 | 0 | 1 | 3 | 1 | 0 | 2 | 2 | 1 | 0 | |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| 4:00 PM | 65 | 337 | 62 | 0 | 46 | 283 | 5 | 1 | 18 | 115 | 121 | 0 | 64 | 36 | 59 | 0 | 1212 |
| 4:15 PM | 63 | 282 | 47 | 0 | 68 | 272 | 8 | 1 | 21 | 148 | 127 | 0 | 64 | 50 | 57 | 0 | 1208 |
| 4:30 PM | 63 | 410 | 66 | 3 | 52 | 264 | 11 | 1 | 11 | 136 | 121 | 0 | 46 | 44 | 56 | 0 | 1284 |
| 4:45 PM | 59 | 232 | 57 | 0 | 63 | 305 | 10 | 3 | 21 | 149 | 126 | 0 | 57 | 47 | 47 | 0 | 1176 |
| 5:00 PM | 64 | 312 | 60 | 0 | 49 | 282 | 7 | 2 | 13 | 155 | 136 | 1 | 62 | 55 | 65 | 0 | 1263 |
| 5:15 PM | 60 | 286 | 50 | 0 | 53 | 316 | 8 | 4 | 24 | 182 | 137 | 1 | 60 | 57 | 44 | 0 | 1282 |
| 5:30 PM | 67 | 293 | 66 | 0 | 62 | 325 | 14 | 1 | 11 | 155 | 153 | 0 | 37 | 45 | 43 | 0 | 1272 |
| 5:45 PM | 64 | 251 | 78 | 0 | 86 | 295 | 13 | 5 | 20 | 152 | 123 | 0 | 42 | 54 | 42 | 0 | 1225 |
| | NL | NT | NR | NU | SL | ST | SR | SU | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL |
| **TOTAL VOLUMES :** | 505 | 2403 | 486 | 3 | 479 | 2342 | 76 | 18 | 139 | 1192 | 1044 | 2 | 432 | 388 | 413 | 0 | 9922 |
| **APPROACH %'s :** | 14.87% | 70.74% | 14.31% | 0.09% | 16.43% | 80.34% | 2.61% | 0.62% | 5.85% | 50.15% | 43.92% | 0.08% | 35.04% | 31.47% | 33.50% | 0.00% | |
| **PEAK HR :** | 05:00 PM - 06:00 PM | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 255 | 1142 | 254 | 0 | 250 | 1218 | 42 | 12 | 68 | 644 | 549 | 2 | 201 | 211 | 194 | 0 | 5042 |
| **PEAK HR FACTOR :** | 0.951 | 0.915 | 0.814 | 0.000 | 0.727 | 0.937 | 0.750 | 0.600 | 0.708 | 0.885 | 0.897 | 0.500 | 0.810 | 0.925 | 0.746 | 0.000 | 0.983 |
| | 0.947 | | | | 0.947 | | | | 0.918 | | | | 0.832 | | | | |

# Appendix B:
# Detailed Intersection LOS Calculation Worksheets

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 0 | 0 | 8 | 18 | 1 | 53 | 12 | 442 | 19 | 98 | 342 | 2 |
| Future Volume (Veh/h) | 0 | 0 | 8 | 18 | 1 | 53 | 12 | 442 | 19 | 98 | 342 | 2 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 |
| Hourly flow rate (vph) | 0 | 0 | 9 | 21 | 1 | 62 | 14 | 514 | 22 | 114 | 398 | 2 |
| Pedestrians | | 9 | | | 10 | | | | | | 11 | |
| Lane Width (ft) | | 12.0 | | | 12.0 | | | | | | 13.0 | |
| Walking Speed (ft/s) | | 4.0 | | | 4.0 | | | | | | 4.0 | |
| Percent Blockage | | 1 | | | 1 | | | | | | 1 | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 995 | 1210 | 209 | 999 | 1200 | 289 | 409 | | | 546 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 995 | 1210 | 209 | 999 | 1200 | 289 | 409 | | | 546 | | |
| tC, single (s) | 7.6 | 6.6 | 7.0 | 7.6 | 6.6 | 7.0 | 4.2 | | | 4.2 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 100 | 100 | 99 | 88 | 99 | 91 | 99 | | | 89 | | |
| cM capacity (veh/h) | 157 | 155 | 788 | 172 | 157 | 692 | 1131 | | | 1004 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|
| Volume Total | 9 | 84 | 14 | 343 | 193 | 114 | 265 | 135 |
| Volume Left | 0 | 21 | 14 | 0 | 0 | 114 | 0 | 0 |
| Volume Right | 9 | 62 | 0 | 0 | 22 | 0 | 0 | 2 |
| cSH | 788 | 385 | 1131 | 1700 | 1700 | 1004 | 1700 | 1700 |
| Volume to Capacity | 0.01 | 0.22 | 0.01 | 0.20 | 0.11 | 0.11 | 0.16 | 0.08 |
| Queue Length 95th (ft) | 1 | 20 | 1 | 0 | 0 | 10 | 0 | 0 |
| Control Delay (s/veh) | 9.6 | 16.9 | 8.2 | 0.0 | 0.0 | 9.0 | 0.0 | 0.0 |
| Lane LOS | A | C | A | | | A | | |
| Approach Delay (s/veh) | 9.6 | 16.9 | 0.2 | | | 2.0 | | |
| Approach LOS | A | C | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 2.3 | | | |
| Intersection Capacity Utilization | 40.7% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 54 | 14 | 5 | 62 | 19 | 8 |
| Future Volume (Veh/h) | 54 | 14 | 5 | 62 | 19 | 8 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 59 | 15 | 5 | 67 | 21 | 9 |
| Pedestrians | 1 | | | 2 | 10 | |
| Lane Width (ft) | 12.0 | | | 12.0 | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | 4.0 | 4.0 | |
| Percent Blockage | 0 | | | 0 | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 84 | | 155 | 79 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 84 | | 155 | 79 |
| tC, single (s) | | | 4.2 | | 6.5 | 6.3 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.3 | | 3.6 | 3.4 |
| p0 queue free % | | | 100 | | 97 | 99 |
| cM capacity (veh/h) | | | 1475 | | 817 | 961 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 74 | 5 | 67 | 30 |
| Volume Left | 0 | 5 | 0 | 21 |
| Volume Right | 15 | 0 | 0 | 9 |
| cSH | 1700 | 1475 | 1700 | 856 |
| Volume to Capacity | 0.04 | 0.00 | 0.04 | 0.04 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 3 |
| Control Delay (s/veh) | 0.0 | 7.4 | 0.0 | 9.4 |
| Lane LOS | | A | | A |
| Approach Delay (s/veh) | 0.0 | 0.5 | | 9.4 |
| Approach LOS | | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.8 | | |
| Intersection Capacity Utilization | 17.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 43 | 36 | 19 | 60 | 20 | 25 |
| Future Volume (Veh/h) | 43 | 36 | 19 | 60 | 20 | 25 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 |
| Hourly flow rate (vph) | 50 | 42 | 22 | 70 | 23 | 29 |
| Pedestrians | 2 | | | 6 | 4 | |
| Lane Width (ft) | 12.0 | | | 12.0 | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | 4.0 | 4.0 | |
| Percent Blockage | 0 | | | 1 | 0 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 96 | | 191 | 81 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 96 | | 191 | 81 |
| tC, single (s) | | | 4.1 | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.2 | | 3.5 | 3.3 |
| p0 queue free % | | | 99 | | 97 | 97 |
| cM capacity (veh/h) | | | 1474 | | 775 | 963 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 92 | 22 | 70 | 52 |
| Volume Left | 0 | 22 | 0 | 23 |
| Volume Right | 42 | 0 | 0 | 29 |
| cSH | 1700 | 1474 | 1700 | 870 |
| Volume to Capacity | 0.05 | 0.01 | 0.04 | 0.06 |
| Queue Length 95th (ft) | 0 | 1 | 0 | 5 |
| Control Delay (s/veh) | 0.0 | 7.5 | 0.0 | 9.4 |
| Lane LOS | | A | | A |
| Approach Delay (s/veh) | 0.0 | 1.8 | | 9.4 |
| Approach LOS | | | | A |

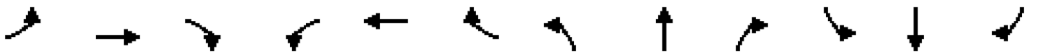
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.8 | | |
| Intersection Capacity Utilization | 19.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 11 | 462 | 25 | 20 | 356 |
| Future Volume (Veh/h) | 0 | 11 | 462 | 25 | 20 | 356 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 |
| Hourly flow rate (vph) | 0 | 13 | 563 | 30 | 24 | 434 |
| Pedestrians | 14 | | | | | 1 |
| Lane Width (ft) | 12.0 | | | | | 12.0 |
| Walking Speed (ft/s) | 4.0 | | | | | 4.0 |
| Percent Blockage | 1 | | | | | 0 |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 785 | 312 | | | 607 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 785 | 312 | | | 607 | |
| tC, single (s) | 6.9 | 7.0 | | | 4.2 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 100 | 98 | | | 97 | |
| cM capacity (veh/h) | 316 | 673 | | | 949 | |

| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|
| Volume Total | 13 | 375 | 218 | 24 | 145 | 145 | 145 |
| Volume Left | 0 | 0 | 0 | 24 | 0 | 0 | 0 |
| Volume Right | 13 | 0 | 30 | 0 | 0 | 0 | 0 |
| cSH | 673 | 1700 | 1700 | 949 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.02 | 0.22 | 0.13 | 0.03 | 0.09 | 0.09 | 0.09 |
| Queue Length 95th (ft) | 1 | 0 | 0 | 2 | 0 | 0 | 0 |
| Control Delay (s/veh) | 10.5 | 0.0 | 0.0 | 8.9 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | | | A | | | |
| Approach Delay (s/veh) | 10.5 | 0.0 | | 0.5 | | | |
| Approach LOS | B | | | | | | |

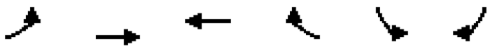
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.3 | | |
| Intersection Capacity Utilization | 26.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 12 | 0 | 34 | 0 | 0 | 2 | 44 | 78 | 1 | 4 | 44 | 24 |
| Future Volume (Veh/h) | 12 | 0 | 34 | 0 | 0 | 2 | 44 | 78 | 1 | 4 | 44 | 24 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 |
| Hourly flow rate (vph) | 15 | 0 | 42 | 0 | 0 | 2 | 54 | 96 | 1 | 5 | 54 | 30 |
| Pedestrians | | 21 | | | 1 | | | 1 | | | | |
| Lane Width (ft) | | 13.0 | | | 12.0 | | | 13.0 | | | | |
| Walking Speed (ft/s) | | 4.0 | | | 4.0 | | | 4.0 | | | | |
| Percent Blockage | | 2 | | | 0 | | | 0 | | | | |
| Right turn flare (veh) | | | 8 | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | 144 | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 291 | 291 | 76 | 271 | 321 | 98 | 105 | | | 98 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 291 | 291 | 76 | 271 | 321 | 98 | 105 | | | 98 | | |
| tC, single (s) | 7.2 | 6.6 | 6.2 | 7.2 | 6.6 | 6.2 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 98 | 100 | 96 | 100 | 100 | 100 | 96 | | | 100 | | |
| cM capacity (veh/h) | 612 | 578 | 958 | 616 | 556 | 950 | 1440 | | | 1475 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|
| Volume Total | 57 | 2 | 54 | 97 | 5 | 54 | 30 |
| Volume Left | 15 | 0 | 54 | 0 | 5 | 0 | 0 |
| Volume Right | 42 | 2 | 0 | 1 | 0 | 0 | 30 |
| cSH | 1299 | 950 | 1440 | 1700 | 1475 | 1700 | 1700 |
| Volume to Capacity | 0.04 | 0.00 | 0.04 | 0.06 | 0.00 | 0.03 | 0.02 |
| Queue Length 95th (ft) | 3 | 0 | 3 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 9.5 | 8.8 | 7.6 | 0.0 | 7.4 | 0.0 | 0.0 |
| Lane LOS | A | A | A | | A | | |
| Approach Delay (s/veh) | 9.5 | 8.8 | 2.7 | | 0.4 | | |
| Approach LOS | A | A | | | | | |

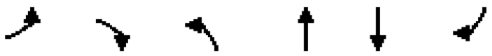
| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 3.4 | | | |
| Intersection Capacity Utilization | 25.4% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 629 | 1040 | 66 | 0 | 36 |
| Future Volume (Veh/h) | 0 | 629 | 1040 | 66 | 0 | 36 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 0 | 684 | 1130 | 72 | 0 | 39 |
| Pedestrians | | | | | 24 | |
| Lane Width (ft) | | | | | 12.0 | |
| Walking Speed (ft/s) | | | | | 4.0 | |
| Percent Blockage | | | | | 2 | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | 526 | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1226 | | | | 1418 | 437 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 1226 | | | | 1418 | 437 |
| tC, single (s) | 4.2 | | | | 6.9 | 7.0 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 100 | 93 |
| cM capacity (veh/h) | 548 | | | | 124 | 554 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | SB 1 |
|---|---|---|---|---|---|---|---|
| Volume Total | 228 | 228 | 228 | 452 | 452 | 298 | 39 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 72 | 39 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 554 |
| Volume to Capacity | 0.13 | 0.13 | 0.13 | 0.27 | 0.27 | 0.18 | 0.07 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| Control Delay (s/veh) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12.0 |
| Lane LOS | | | | | | | B |
| Approach Delay (s/veh) | 0.0 | | | 0.0 | | | 12.0 |
| Approach LOS | | | | | | | B |

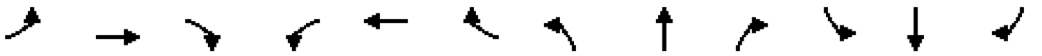
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.2 | | |
| Intersection Capacity Utilization | 31.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 21 | 0 | 1112 | 1582 | 125 |
| Future Volume (Veh/h) | 0 | 21 | 0 | 1112 | 1582 | 125 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Hourly flow rate (vph) | 0 | 21 | 0 | 1135 | 1614 | 128 |
| Pedestrians | 21 | | | | | |
| Lane Width (ft) | 12.0 | | | | | |
| Walking Speed (ft/s) | 4.0 | | | | | |
| Percent Blockage | 2 | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | 647 | 189 | |
| pX, platoon unblocked | 0.86 | 0.82 | 0.82 | | | |
| vC, conflicting volume | 1919 | 559 | 1763 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 695 | 0 | 1162 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 100 | 98 | 100 | | | |
| cM capacity (veh/h) | 321 | 876 | 485 | | | |

| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | NB 4 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 21 | 162 | 324 | 324 | 324 | 538 | 538 | 538 | 128 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 128 |
| cSH | 876 | 485 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.02 | 0.00 | 0.19 | 0.19 | 0.19 | 0.32 | 0.32 | 0.32 | 0.08 |
| Queue Length 95th (ft) | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 9.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | | | | | | | |
| Approach Delay (s/veh) | 9.2 | 0.0 | | | | 0.0 | | | |
| Approach LOS | A | | | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 0.1 | | | |
| Intersection Capacity Utilization | 40.6% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |

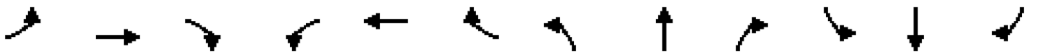


| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 196 | 245 | 186 | 205 | 318 | 66 | 353 | 874 | 115 | 83 | 1097 | 420 |
| Future Volume (vph) | 196 | 245 | 186 | 205 | 318 | 66 | 353 | 874 | 115 | 83 | 1097 | 420 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.95 | 1.00 | 0.97 | 0.95 | | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.91 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.94 | 1.00 | 1.00 | 0.98 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 3505 | 1429 | 3400 | 3396 | | 3400 | 5036 | 1480 | 3400 | 5036 | 1544 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 3505 | 1429 | 3400 | 3396 | | 3400 | 5036 | 1480 | 3400 | 5036 | 1544 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 209 | 261 | 198 | 218 | 338 | 70 | 376 | 930 | 122 | 88 | 1167 | 447 |
| RTOR Reduction (vph) | 0 | 0 | 146 | 0 | 15 | 0 | 0 | 0 | 68 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 209 | 261 | 52 | 218 | 393 | 0 | 376 | 930 | 54 | 88 | 1167 | 447 |
| Confl. Peds. (#/hr) | | | 74 | | | 15 | | | 40 | | | 12 |
| Confl. Bikes (#/hr) | | | 3 | | | 5 | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Prot | NA | Perm | Prot | NA | Free |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | 8 | | | | | | 6 | | | Free |
| Actuated Green, G (s) | 11.6 | 29.9 | 29.9 | 12.6 | 30.9 | | 21.0 | 51.4 | 51.4 | 7.3 | 37.7 | 120.0 |
| Effective Green, g (s) | 11.6 | 31.3 | 31.3 | 12.6 | 32.3 | | 21.0 | 52.8 | 52.8 | 7.3 | 39.1 | 120.0 |
| Actuated g/C Ratio | 0.10 | 0.26 | 0.26 | 0.11 | 0.27 | | 0.18 | 0.44 | 0.44 | 0.06 | 0.33 | 1.00 |
| Clearance Time (s) | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 328 | 914 | 372 | 357 | 914 | | 595 | 2215 | 651 | 206 | 1640 | 1544 |
| v/s Ratio Prot | c0.06 | 0.07 | | c0.06 | c0.12 | | c0.11 | 0.18 | | 0.03 | c0.23 | |
| v/s Ratio Perm | | | 0.04 | | | | | | 0.04 | | | 0.29 |
| v/c Ratio | 0.64 | 0.29 | 0.14 | 0.61 | 0.43 | | 0.63 | 0.42 | 0.08 | 0.43 | 0.71 | 0.29 |
| Uniform Delay, d1 | 52.2 | 35.4 | 34.0 | 51.4 | 36.2 | | 45.9 | 23.1 | 19.5 | 54.3 | 35.5 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.02 | 0.93 | 3.55 | 0.81 | 0.71 | 1.00 |
| Incremental Delay, d2 | 3.0 | 0.1 | 0.1 | 2.2 | 0.1 | | 1.4 | 0.5 | 0.2 | 0.5 | 2.4 | 0.4 |
| Delay (s) | 55.1 | 35.5 | 34.1 | 53.5 | 36.4 | | 48.5 | 22.1 | 69.6 | 44.5 | 27.6 | 0.4 |
| Level of Service | E | D | C | D | D | | D | C | E | D | C | A |
| Approach Delay (s/veh) | | 41.2 | | | 42.3 | | | 33.1 | | | 21.4 | |
| Approach LOS | | D | | | D | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 31.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.61 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 77.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

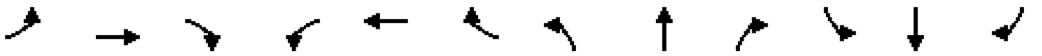
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 24 | 0 | 57 | 12 | 0 | 3 | 79 | 1023 | 9 | 14 | 1619 | 78 |
| Future Volume (vph) | 24 | 0 | 57 | 12 | 0 | 3 | 79 | 1023 | 9 | 14 | 1619 | 78 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 5.4 |
| Lane Util. Factor | 0.95 | 0.95 | 1.00 | | 1.00 | | 1.00 | 0.91 | 1.00 | 1.00 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 0.98 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 0.95 | 1.00 | | 0.96 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1665 | 1665 | 1513 | | 1695 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1524 |
| Flt Permitted | 0.75 | 0.75 | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1310 | 1310 | 1513 | | 1763 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1524 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 25 | 0 | 59 | 12 | 0 | 3 | 81 | 1055 | 9 | 14 | 1669 | 80 |
| RTOR Reduction (vph) | 0 | 0 | 54 | 0 | 15 | 0 | 0 | 0 | 2 | 0 | 0 | 30 |
| Lane Group Flow (vph) | 12 | 13 | 5 | 0 | 0 | 0 | 81 | 1055 | 7 | 14 | 1669 | 50 |
| Confl. Peds. (#/hr) | | | 22 | 22 | | | | | 1 | | | 9 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 4 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | 3 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 3 | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 10.1 | 10.1 | 10.1 | | 2.0 | | 15.2 | 87.0 | 87.0 | 2.6 | 74.4 | 74.4 |
| Effective Green, g (s) | 10.8 | 10.8 | 10.8 | | 2.2 | | 15.2 | 88.4 | 88.4 | 2.6 | 75.8 | 74.4 |
| Actuated g/C Ratio | 0.09 | 0.09 | 0.09 | | 0.02 | | 0.13 | 0.74 | 0.74 | 0.02 | 0.63 | 0.62 |
| Clearance Time (s) | 4.7 | 4.7 | 4.7 | | 4.2 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 117 | 117 | 136 | | 32 | | 221 | 3709 | 1127 | 37 | 3181 | 944 |
| v/s Ratio Prot | | | | | | | c0.05 | 0.21 | | 0.01 | c0.33 | |
| v/s Ratio Perm | 0.01 | c0.01 | 0.00 | | c0.00 | | | | 0.00 | | | 0.03 |
| v/c Ratio | 0.10 | 0.11 | 0.04 | | 0.01 | | 0.37 | 0.28 | 0.01 | 0.38 | 0.52 | 0.05 |
| Uniform Delay, d1 | 50.1 | 50.2 | 49.9 | | 57.8 | | 48.0 | 5.3 | 4.2 | 57.9 | 12.2 | 9.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.09 | 1.95 | 1.00 | 1.15 | 0.56 | 0.37 |
| Incremental Delay, d2 | 0.1 | 0.2 | 0.0 | | 0.0 | | 0.4 | 0.2 | 0.0 | 2.0 | 0.5 | 0.1 |
| Delay (s) | 50.3 | 50.3 | 49.9 | | 57.9 | | 52.5 | 10.4 | 4.2 | 68.5 | 7.4 | 3.4 |
| Level of Service | D | D | D | | E | | D | B | A | E | A | A |
| Approach Delay (s/veh) | | 50.0 | | | 57.9 | | | 13.4 | | | 7.7 | |
| Approach LOS | | D | | | E | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 11.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.45 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 62.9% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



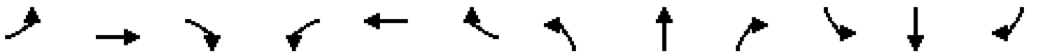
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 0 | 521 | 0 | 310 | 0 | 1222 | 377 | 0 | 1013 | 895 |
| Future Volume (vph) | 0 | 0 | 0 | 521 | 0 | 310 | 0 | 1222 | 377 | 0 | 1013 | 895 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 4.0 | | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | | | | 0.97 | | 0.88 | | 0.95 | 1.00 | | 0.91 | 0.88 |
| Frpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 0.98 | | 1.00 | 0.98 |
| Flpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | | | 1.00 | | 0.85 | | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | 3400 | | 2760 | | 3505 | 1533 | | 5036 | 2698 |
| Flt Permitted | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | 3400 | | 2760 | | 3505 | 1533 | | 5036 | 2698 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 0 | 0 | 0 | 543 | 0 | 323 | 0 | 1273 | 393 | 0 | 1055 | 932 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 67 | 0 | 0 | 166 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 543 | 0 | 256 | 0 | 1273 | 227 | 0 | 1055 | 932 |
| Confl. Peds. (#/hr) | | | | | | | 3 | | | | | 3 |
| Confl. Bikes (#/hr) | | | | | | | | | 4 | | | 2 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | | | | Prot | | Perm | | NA | Perm | | NA | Free |
| Protected Phases | | | | 4 | | | | 6 | | | 2 | |
| Permitted Phases | | | | 4 | | 4 | | | 6 | | | Free |
| Actuated Green, G (s) | | | | 16.0 | | 16.0 | | 32.7 | 32.7 | | 32.7 | 60.0 |
| Effective Green, g (s) | | | | 17.4 | | 17.4 | | 34.6 | 34.6 | | 34.6 | 60.0 |
| Actuated g/C Ratio | | | | 0.29 | | 0.29 | | 0.58 | 0.58 | | 0.58 | 1.00 |
| Clearance Time (s) | | | | 5.4 | | 5.4 | | 5.9 | 5.9 | | 5.9 | |
| Vehicle Extension (s) | | | | 5.0 | | 5.0 | | 5.0 | 5.0 | | 5.0 | |
| Lane Grp Cap (vph) | | | | 986 | | 800 | | 2021 | 884 | | 2904 | 2698 |
| v/s Ratio Prot | | | | c0.16 | | | | c0.36 | | | 0.21 | |
| v/s Ratio Perm | | | | | | 0.09 | | | 0.15 | | | 0.35 |
| v/c Ratio | | | | 0.55 | | 0.32 | | 0.63 | 0.26 | | 0.36 | 0.35 |
| Uniform Delay, d1 | | | | 18.0 | | 16.7 | | 8.4 | 6.3 | | 6.8 | 0.0 |
| Progression Factor | | | | 1.00 | | 1.00 | | 0.80 | 0.65 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | | | 1.1 | | 0.5 | | 1.5 | 0.7 | | 0.4 | 0.4 |
| Delay (s) | | | | 19.1 | | 17.2 | | 8.2 | 4.8 | | 7.2 | 0.4 |
| Level of Service | | | | B | | B | | A | A | | A | A |
| Approach Delay (s/veh) | | 0.0 | | | 18.4 | | | 7.4 | | | 4.0 | |
| Approach LOS | | A | | | B | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 8.0 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.60 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 55.3% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



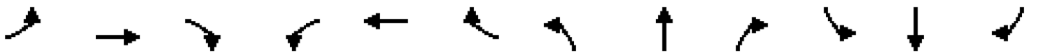
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 687 | 140 | 675 | 170 | 0 | 212 | 0 | 702 | 72 | 147 | 1187 | 195 |
| Future Volume (vph) | 687 | 140 | 675 | 170 | 0 | 212 | 0 | 702 | 72 | 147 | 1187 | 195 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | | 3.1 | | 4.0 | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 0.97 | | 0.88 | | 0.86 | | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | | 0.85 | | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6249 | | 1752 | 3505 | 1513 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6249 | | 1752 | 3505 | 1513 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 739 | 151 | 726 | 183 | 0 | 228 | 0 | 755 | 77 | 158 | 1276 | 210 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 95 |
| Lane Group Flow (vph) | 739 | 151 | 726 | 183 | 0 | 228 | 0 | 820 | 0 | 158 | 1276 | 115 |
| Confl. Peds. (#/hr) | | | 5 | | | | 3 | | | | | 3 |
| Confl. Bikes (#/hr) | | | | | | | | | 4 | | | 2 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | | pt+ov | | NA | | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | | 4 5 | | 6 | | 5 | 2 | |
| Permitted Phases | | | Free | | | | | | | | | 2 |
| Actuated Green, G (s) | 29.8 | 16.1 | 120.0 | 24.3 | | 30.1 | | 45.3 | | 15.0 | 64.3 | 64.3 |
| Effective Green, g (s) | 31.2 | 17.5 | 120.0 | 24.8 | | 31.5 | | 46.7 | | 15.0 | 65.7 | 65.7 |
| Actuated g/C Ratio | 0.26 | 0.15 | 1.00 | 0.21 | | 0.26 | | 0.39 | | 0.13 | 0.55 | 0.55 |
| Clearance Time (s) | 5.4 | 5.4 | | 4.5 | | | | 5.4 | | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | | 1.8 | | | | 5.0 | | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 884 | 269 | 1547 | 702 | | 724 | | 2431 | | 219 | 1918 | 828 |
| v/s Ratio Prot | c0.22 | 0.08 | | 0.05 | | 0.08 | | 0.13 | | 0.09 | c0.36 | |
| v/s Ratio Perm | | | c0.47 | | | | | | | | | 0.08 |
| v/c Ratio | 0.84 | 0.56 | 0.47 | 0.26 | | 0.31 | | 0.34 | | 0.72 | 0.67 | 0.14 |
| Uniform Delay, d1 | 42.0 | 47.7 | 0.0 | 39.9 | | 35.6 | | 25.8 | | 50.5 | 19.3 | 13.3 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.82 | | 1.04 | 0.92 | 1.25 |
| Incremental Delay, d2 | 6.6 | 1.6 | 1.0 | 0.1 | | 0.1 | | 0.4 | | 9.1 | 1.8 | 0.3 |
| Delay (s) | 48.6 | 49.3 | 1.0 | 40.0 | | 35.7 | | 21.5 | | 61.7 | 19.5 | 17.0 |
| Level of Service | D | D | A | D | | D | | C | | E | B | B |
| Approach Delay (s/veh) | | 27.3 | | | 37.6 | | | 21.5 | | | 23.2 | |
| Approach LOS | | C | | | D | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 25.7 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.74 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 59.1% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



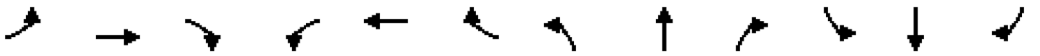
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 64 | 95 | 15 | 92 | 226 | 314 | 24 | 252 | 94 | 396 | 732 | 289 |
| Future Volume (vph) | 64 | 95 | 15 | 92 | 226 | 314 | 24 | 252 | 94 | 396 | 732 | 289 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 5036 | 1545 | 3400 | 5036 | 1546 | 3400 | 5036 | 1547 | 3400 | 5036 | 1549 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 5036 | 1545 | 3400 | 5036 | 1546 | 3400 | 5036 | 1547 | 3400 | 5036 | 1549 |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 70 | 104 | 16 | 101 | 248 | 345 | 26 | 277 | 103 | 435 | 804 | 318 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 70 | 104 | 16 | 101 | 248 | 345 | 26 | 277 | 103 | 435 | 804 | 318 |
| Confl. Peds. (#/hr) | | | 7 | | | 7 | | | 5 | | | 1 |
| Confl. Bikes (#/hr) | | | 3 | | | | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 4 | | 3 | 8 | |
| Permitted Phases | | | Free | | | Free | | | Free | | | Free |
| Actuated Green, G (s) | 5.1 | 11.0 | 64.4 | 5.7 | 11.6 | 64.4 | 1.9 | 14.8 | 64.4 | 13.9 | 26.8 | 64.4 |
| Effective Green, g (s) | 5.1 | 12.7 | 64.4 | 5.7 | 13.3 | 64.4 | 1.9 | 16.1 | 64.4 | 13.9 | 28.1 | 64.4 |
| Actuated g/C Ratio | 0.08 | 0.20 | 1.00 | 0.09 | 0.21 | 1.00 | 0.03 | 0.25 | 1.00 | 0.22 | 0.44 | 1.00 |
| Clearance Time (s) | 4.0 | 5.7 | | 4.0 | 5.7 | | 4.0 | 5.3 | | 4.0 | 5.3 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 269 | 993 | 1545 | 300 | 1040 | 1546 | 100 | 1259 | 1547 | 733 | 2197 | 1549 |
| v/s Ratio Prot | 0.02 | 0.02 | | 0.03 | 0.05 | | 0.01 | 0.06 | | c0.13 | c0.16 | |
| v/s Ratio Perm | | | 0.01 | | | c0.22 | | | 0.07 | | | 0.21 |
| v/c Ratio | 0.26 | 0.10 | 0.01 | 0.34 | 0.24 | 0.22 | 0.26 | 0.22 | 0.07 | 0.59 | 0.37 | 0.21 |
| Uniform Delay, d1 | 27.9 | 21.2 | 0.0 | 27.6 | 21.3 | 0.0 | 30.6 | 19.2 | 0.0 | 22.7 | 12.2 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.3 | 0.5 | 0.0 | 0.1 | 0.9 | 0.0 | 0.3 |
| Delay (s) | 28.1 | 21.2 | 0.0 | 27.8 | 21.4 | 0.3 | 31.1 | 19.2 | 0.1 | 23.6 | 12.2 | 0.3 |
| Level of Service | C | C | A | C | C | A | C | B | A | C | B | A |
| Approach Delay (s/veh) | | 21.9 | | | 11.8 | | | 15.1 | | | 13.0 | |
| Approach LOS | | C | | | B | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 13.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.43 | | |
| Actuated Cycle Length (s) | 64.4 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 46.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 31 | 188 | 214 | 367 | 466 | 227 | 498 | 1080 | 220 | 172 | 1307 | 56 |
| Future Volume (vph) | 31 | 188 | 214 | 367 | 466 | 227 | 498 | 1080 | 220 | 172 | 1307 | 56 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1752 | 5036 | 1547 | 3400 | 3505 | 1539 | 3400 | 5036 | 1541 | 3400 | 4997 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1752 | 5036 | 1547 | 3400 | 3505 | 1539 | 3400 | 5036 | 1541 | 3400 | 4997 | |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 32 | 194 | 221 | 378 | 480 | 234 | 513 | 1113 | 227 | 177 | 1347 | 58 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 162 | 0 | 0 | 135 | 0 | 4 | 0 |
| Lane Group Flow (vph) | 32 | 194 | 221 | 378 | 480 | 72 | 513 | 1113 | 92 | 177 | 1401 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 6 | | | 5 | | | 6 |
| Confl. Bikes (#/hr) | | | 2 | | | 1 | | | | | | 26 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Perm | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | Free | | | 8 | | | 2 | | | |
| Actuated Green, G (s) | 4.6 | 16.1 | 120.0 | 23.9 | 35.4 | 35.4 | 23.3 | 47.1 | 47.1 | 14.1 | 37.9 | |
| Effective Green, g (s) | 4.6 | 17.5 | 120.0 | 23.9 | 36.8 | 36.8 | 23.3 | 48.5 | 48.5 | 14.1 | 39.3 | |
| Actuated g/C Ratio | 0.04 | 0.15 | 1.00 | 0.20 | 0.31 | 0.31 | 0.19 | 0.40 | 0.40 | 0.12 | 0.33 | |
| Clearance Time (s) | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 5.0 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 67 | 734 | 1547 | 677 | 1074 | 471 | 660 | 2035 | 622 | 399 | 1636 | |
| v/s Ratio Prot | c0.02 | 0.04 | | c0.11 | c0.14 | | c0.15 | 0.22 | | 0.05 | c0.28 | |
| v/s Ratio Perm | | | 0.14 | | | 0.05 | | | 0.06 | | | |
| v/c Ratio | 0.48 | 0.26 | 0.14 | 0.56 | 0.45 | 0.15 | 0.78 | 0.55 | 0.15 | 0.44 | 0.86 | |
| Uniform Delay, d1 | 56.5 | 45.5 | 0.0 | 43.3 | 33.4 | 30.3 | 45.9 | 27.3 | 22.7 | 49.3 | 37.7 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.39 | 1.45 | |
| Incremental Delay, d2 | 1.9 | 0.4 | 0.2 | 0.6 | 0.6 | 0.3 | 5.2 | 1.1 | 0.5 | 0.2 | 4.7 | |
| Delay (s) | 58.5 | 45.9 | 0.2 | 43.9 | 34.0 | 30.6 | 51.1 | 28.4 | 23.2 | 68.8 | 59.3 | |
| Level of Service | E | D | A | D | C | C | D | C | C | E | E | |
| Approach Delay (s/veh) | | 24.2 | | | 36.7 | | | 34.1 | | | 60.4 | |
| Approach LOS | | C | | | D | | | C | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 42.1 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.69 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 77.5% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 4 | 0 | 5 | 7 | 0 | 83 | 7 | 410 | 10 | 88 | 587 | 1 |
| Future Volume (Veh/h) | 4 | 0 | 5 | 7 | 0 | 83 | 7 | 410 | 10 | 88 | 587 | 1 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 4 | 0 | 5 | 7 | 0 | 88 | 7 | 436 | 11 | 94 | 624 | 1 |
| Pedestrians | | 16 | | | 6 | | | | | | 13 | |
| Lane Width (ft) | | 12.0 | | | 12.0 | | | | | | 13.0 | |
| Walking Speed (ft/s) | | 4.0 | | | 4.0 | | | | | | 4.0 | |
| Percent Blockage | | 1 | | | 1 | | | | | | 1 | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 1162 | 1296 | 329 | 967 | 1291 | 243 | 641 | | | 453 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 1162 | 1296 | 329 | 967 | 1291 | 243 | 641 | | | 453 | | |
| tC, single (s) | 7.6 | 6.6 | 7.0 | 7.6 | 6.6 | 7.0 | 4.2 | | | 4.2 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 97 | 100 | 99 | 96 | 100 | 88 | 99 | | | 91 | | |
| cM capacity (veh/h) | 117 | 142 | 655 | 188 | 143 | 743 | 920 | | | 1091 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|
| Volume Total | 9 | 95 | 7 | 291 | 156 | 94 | 416 | 209 |
| Volume Left | 4 | 7 | 7 | 0 | 0 | 94 | 0 | 0 |
| Volume Right | 5 | 88 | 0 | 0 | 11 | 0 | 0 | 1 |
| cSH | 216 | 610 | 920 | 1700 | 1700 | 1091 | 1700 | 1700 |
| Volume to Capacity | 0.04 | 0.16 | 0.01 | 0.17 | 0.09 | 0.09 | 0.24 | 0.12 |
| Queue Length 95th (ft) | 3 | 14 | 1 | 0 | 0 | 7 | 0 | 0 |
| Control Delay (s/veh) | 22.4 | 12.0 | 8.9 | 0.0 | 0.0 | 8.6 | 0.0 | 0.0 |
| Lane LOS | C | B | A | | | A | | |
| Approach Delay (s/veh) | 22.4 | 12.0 | 0.1 | | | 1.1 | | |
| Approach LOS | C | B | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 1.7 | | | |
| Intersection Capacity Utilization | 38.7% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 72 | 10 | 4 | 57 | 13 | 30 |
| Future Volume (Veh/h) | 72 | 10 | 4 | 57 | 13 | 30 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 |
| Hourly flow rate (vph) | 88 | 12 | 5 | 70 | 16 | 37 |
| Pedestrians | 3 | | | 1 | 8 | |
| Lane Width (ft) | 12.0 | | | 12.0 | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | 4.0 | 4.0 | |
| Percent Blockage | 0 | | | 0 | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 108 | | 185 | 103 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 108 | | 185 | 103 |
| tC, single (s) | | | 4.2 | | 6.5 | 6.3 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.3 | | 3.6 | 3.4 |
| p0 queue free % | | | 100 | | 98 | 96 |
| cM capacity (veh/h) | | | 1419 | | 774 | 921 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 100 | 5 | 70 | 53 |
| Volume Left | 0 | 5 | 0 | 16 |
| Volume Right | 12 | 0 | 0 | 37 |
| cSH | 1700 | 1419 | 1700 | 871 |
| Volume to Capacity | 0.06 | 0.00 | 0.04 | 0.06 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 5 |
| Control Delay (s/veh) | 0.0 | 7.5 | 0.0 | 9.4 |
| Lane LOS | | A | | A |
| Approach Delay (s/veh) | 0.0 | 0.5 | | 9.4 |
| Approach LOS | | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.4 | | |
| Intersection Capacity Utilization | 16.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 56 | 12 | 1 | 67 | 22 | 26 |
| Future Volume (Veh/h) | 56 | 12 | 1 | 67 | 22 | 26 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Hourly flow rate (vph) | 66 | 14 | 1 | 79 | 26 | 31 |
| Pedestrians | 1 | | | | 10 | |
| Lane Width (ft) | 12.0 | | | | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | | 4.0 | |
| Percent Blockage | 0 | | | | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 90 | | 165 | 83 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 90 | | 165 | 83 |
| tC, single (s) | | | 4.2 | | 6.5 | 6.3 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.3 | | 3.6 | 3.4 |
| p0 queue free % | | | 100 | | 97 | 97 |
| cM capacity (veh/h) | | | 1462 | | 806 | 955 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 80 | 1 | 79 | 57 |
| Volume Left | 0 | 1 | 0 | 26 |
| Volume Right | 14 | 0 | 0 | 31 |
| cSH | 1700 | 1462 | 1700 | 881 |
| Volume to Capacity | 0.05 | 0.00 | 0.05 | 0.06 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 5 |
| Control Delay (s/veh) | 0.0 | 7.5 | 0.0 | 9.4 |
| Lane LOS | | A | | A |
| Approach Delay (s/veh) | 0.0 | 0.1 | | 9.4 |
| Approach LOS | | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.5 | | |
| Intersection Capacity Utilization | 16.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 31 | 394 | 7 | 7 | 595 |
| Future Volume (Veh/h) | 0 | 31 | 394 | 7 | 7 | 595 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Hourly flow rate (vph) | 0 | 32 | 402 | 7 | 7 | 607 |
| Pedestrians | 15 | | | | | |
| Lane Width (ft) | 12.0 | | | | | |
| Walking Speed (ft/s) | 4.0 | | | | | |
| Percent Blockage | 1 | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 637 | 220 | | | 424 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 637 | 220 | | | 424 | |
| tC, single (s) | 6.9 | 7.0 | | | 4.2 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 100 | 96 | | | 99 | |
| cM capacity (veh/h) | 400 | 772 | | | 1111 | |

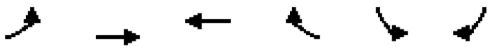
| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|
| Volume Total | 32 | 268 | 141 | 7 | 202 | 202 | 202 |
| Volume Left | 0 | 0 | 0 | 7 | 0 | 0 | 0 |
| Volume Right | 32 | 0 | 7 | 0 | 0 | 0 | 0 |
| cSH | 772 | 1700 | 1700 | 1111 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.04 | 0.16 | 0.08 | 0.01 | 0.12 | 0.12 | 0.12 |
| Queue Length 95th (ft) | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 9.9 | 0.0 | 0.0 | 8.3 | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | | A | | | |
| Approach Delay (s/veh) | 9.9 | 0.0 | | 0.1 | | | |
| Approach LOS | A | | | | | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.4 | | |
| Intersection Capacity Utilization | 22.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 33 | 0 | 62 | 0 | 0 | 3 | 30 | 57 | 0 | 4 | 84 | 28 |
| Future Volume (Veh/h) | 33 | 0 | 62 | 0 | 0 | 3 | 30 | 57 | 0 | 4 | 84 | 28 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 35 | 0 | 66 | 0 | 0 | 3 | 32 | 61 | 0 | 4 | 89 | 30 |
| Pedestrians | | 3 | | | | | | 1 | | | | |
| Lane Width (ft) | | 13.0 | | | | | | 13.0 | | | | |
| Walking Speed (ft/s) | | 4.0 | | | | | | 4.0 | | | | |
| Percent Blockage | | 0 | | | | | | 0 | | | | |
| Right turn flare (veh) | | | 8 | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | 144 | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 228 | 225 | 93 | 223 | 255 | 61 | 122 | | | 61 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 228 | 225 | 93 | 223 | 255 | 61 | 122 | | | 61 | | |
| tC, single (s) | 7.2 | 6.6 | 6.2 | 7.2 | 6.6 | 6.2 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 95 | 100 | 93 | 100 | 100 | 100 | 98 | | | 100 | | |
| cM capacity (veh/h) | 702 | 651 | 952 | 661 | 626 | 996 | 1443 | | | 1523 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|
| Volume Total | 101 | 3 | 32 | 61 | 4 | 89 | 30 |
| Volume Left | 35 | 0 | 32 | 0 | 4 | 0 | 0 |
| Volume Right | 66 | 3 | 0 | 0 | 0 | 0 | 30 |
| cSH | 1458 | 996 | 1443 | 1700 | 1523 | 1700 | 1700 |
| Volume to Capacity | 0.07 | 0.00 | 0.02 | 0.04 | 0.00 | 0.05 | 0.02 |
| Queue Length 95th (ft) | 6 | 0 | 2 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 9.5 | 8.6 | 7.6 | 0.0 | 7.4 | 0.0 | 0.0 |
| Lane LOS | A | A | A | | A | | |
| Approach Delay (s/veh) | 9.5 | 8.6 | 2.6 | | 0.2 | | |
| Approach LOS | A | A | | | | | |

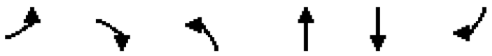
| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 3.9 | | | |
| Intersection Capacity Utilization | 23.6% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 1009 | 744 | 21 | 0 | 63 |
| Future Volume (Veh/h) | 0 | 1009 | 744 | 21 | 0 | 63 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 0 | 1073 | 791 | 22 | 0 | 67 |
| Pedestrians | | | | | 14 | |
| Lane Width (ft) | | | | | 12.0 | |
| Walking Speed (ft/s) | | | | | 4.0 | |
| Percent Blockage | | | | | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | 526 | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 827 | | | | 1174 | 289 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 827 | | | | 1174 | 289 |
| tC, single (s) | 4.2 | | | | 6.9 | 7.0 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 100 | 90 |
| cM capacity (veh/h) | 784 | | | | 181 | 697 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | SB 1 |
|---|---|---|---|---|---|---|---|
| Volume Total | 358 | 358 | 358 | 316 | 316 | 180 | 67 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 22 | 67 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 697 |
| Volume to Capacity | 0.21 | 0.21 | 0.21 | 0.19 | 0.19 | 0.11 | 0.10 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| Control Delay (s/veh) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 10.7 |
| Lane LOS | | | | | | | B |
| Approach Delay (s/veh) | 0.0 | | | 0.0 | | | 10.7 |
| Approach LOS | | | | | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.4 | | |
| Intersection Capacity Utilization | 25.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 76 | 0 | 1462 | 1386 | 27 |
| Future Volume (Veh/h) | 0 | 76 | 0 | 1462 | 1386 | 27 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Hourly flow rate (vph) | 0 | 79 | 0 | 1523 | 1444 | 28 |
| Pedestrians | 17 | | | | | |
| Lane Width (ft) | 12.0 | | | | | |
| Walking Speed (ft/s) | 4.0 | | | | | |
| Percent Blockage | 1 | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | 647 | 189 | |
| pX, platoon unblocked | 0.91 | 0.85 | 0.85 | | | |
| vC, conflicting volume | 1842 | 498 | 1489 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 499 | 0 | 969 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 100 | 91 | 100 | | | |
| cM capacity (veh/h) | 453 | 914 | 600 | | | |

| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | NB 4 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 79 | 218 | 435 | 435 | 435 | 481 | 481 | 481 | 28 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 |
| cSH | 914 | 600 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.09 | 0.00 | 0.26 | 0.26 | 0.26 | 0.28 | 0.28 | 0.28 | 0.02 |
| Queue Length 95th (ft) | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 9.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | | | | | | | |
| Approach Delay (s/veh) | 9.3 | 0.0 | | | | 0.0 | | | |
| Approach LOS | A | | | | | | | | |

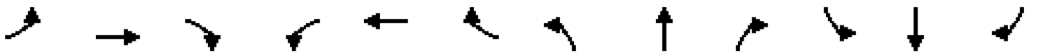
| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 0.2 | | | |
| Intersection Capacity Utilization | 38.2% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 379 | 267 | 363 | 147 | 163 | 65 | 376 | 1065 | 130 | 130 | 976 | 303 |
| Future Volume (vph) | 379 | 267 | 363 | 147 | 163 | 65 | 376 | 1065 | 130 | 130 | 976 | 303 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.95 | 1.00 | 0.97 | 0.95 | | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 3505 | 1529 | 3400 | 3341 | | 3400 | 5036 | 1544 | 3400 | 5036 | 1545 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 3505 | 1529 | 3400 | 3341 | | 3400 | 5036 | 1544 | 3400 | 5036 | 1545 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 395 | 278 | 378 | 153 | 170 | 68 | 392 | 1109 | 135 | 135 | 1017 | 316 |
| RTOR Reduction (vph) | 0 | 0 | 279 | 0 | 39 | 0 | 0 | 0 | 75 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 395 | 278 | 99 | 153 | 199 | 0 | 392 | 1109 | 60 | 135 | 1017 | 316 |
| Confl. Peds. (#/hr) | | | 13 | | | 1 | | | 3 | | | 10 |
| Confl. Bikes (#/hr) | | | | | | 1 | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Prot | NA | Perm | Prot | NA | Free |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | 8 | | | | | | 6 | | | Free |
| Actuated Green, G (s) | 17.7 | 29.9 | 29.9 | 10.5 | 22.7 | | 21.0 | 51.9 | 51.9 | 8.9 | 39.8 | 120.0 |
| Effective Green, g (s) | 17.7 | 31.3 | 31.3 | 10.5 | 24.1 | | 21.0 | 53.3 | 53.3 | 8.9 | 41.2 | 120.0 |
| Actuated g/C Ratio | 0.15 | 0.26 | 0.26 | 0.09 | 0.20 | | 0.18 | 0.44 | 0.44 | 0.07 | 0.34 | 1.00 |
| Clearance Time (s) | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 501 | 914 | 398 | 297 | 670 | | 595 | 2236 | 685 | 252 | 1729 | 1545 |
| v/s Ratio Prot | c0.12 | c0.08 | | c0.05 | 0.06 | | c0.12 | 0.22 | | 0.04 | c0.20 | |
| v/s Ratio Perm | | | 0.06 | | | | | | 0.04 | | | 0.20 |
| v/c Ratio | 0.79 | 0.30 | 0.25 | 0.52 | 0.30 | | 0.66 | 0.50 | 0.09 | 0.54 | 0.59 | 0.20 |
| Uniform Delay, d1 | 49.3 | 35.6 | 35.0 | 52.3 | 40.7 | | 46.2 | 23.8 | 19.3 | 53.6 | 32.4 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.93 | 2.33 | 0.87 | 0.73 | 1.00 |
| Incremental Delay, d2 | 7.5 | 0.1 | 0.1 | 0.6 | 0.1 | | 1.8 | 0.7 | 0.2 | 1.0 | 1.4 | 0.3 |
| Delay (s) | 56.8 | 35.7 | 35.2 | 52.9 | 40.8 | | 47.9 | 22.9 | 45.1 | 47.6 | 25.1 | 0.3 |
| Level of Service | E | D | D | D | D | | D | C | D | D | C | A |
| Approach Delay (s/veh) | | 43.4 | | | 45.6 | | | 30.7 | | | 21.9 | |
| Approach LOS | | D | | | D | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 32.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.59 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 64.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 99 | 5 | 56 | 3 | 1 | 6 | 42 | 1417 | 3 | 32 | 1348 | 44 |
| Future Volume (vph) | 99 | 5 | 56 | 3 | 1 | 6 | 42 | 1417 | 3 | 32 | 1348 | 44 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 5.4 |
| Lane Util. Factor | 0.95 | 0.95 | 1.00 | | 1.00 | | 1.00 | 0.91 | 1.00 | 1.00 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.96 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | | 0.92 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 0.96 | 1.00 | | 0.99 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1665 | 1676 | 1546 | | 1669 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1510 |
| Flt Permitted | 0.75 | 0.74 | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1316 | 1294 | 1546 | | 1694 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1510 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 105 | 5 | 60 | 3 | 1 | 6 | 45 | 1507 | 3 | 34 | 1434 | 47 |
| RTOR Reduction (vph) | 0 | 0 | 54 | 0 | 6 | 0 | 0 | 0 | 1 | 0 | 0 | 18 |
| Lane Group Flow (vph) | 55 | 55 | 7 | 0 | 4 | 0 | 45 | 1507 | 2 | 34 | 1434 | 29 |
| Confl. Peds. (#/hr) | | | 2 | 2 | | | | | 1 | | | 14 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 7 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | 3 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 3 | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 12.3 | 12.3 | 12.3 | | 1.4 | | 14.4 | 83.3 | 83.3 | 4.7 | 73.6 | 73.6 |
| Effective Green, g (s) | 13.0 | 13.0 | 13.0 | | 1.6 | | 14.4 | 84.7 | 84.7 | 4.7 | 75.0 | 73.6 |
| Actuated g/C Ratio | 0.11 | 0.11 | 0.11 | | 0.01 | | 0.12 | 0.71 | 0.71 | 0.04 | 0.63 | 0.61 |
| Clearance Time (s) | 4.7 | 4.7 | 4.7 | | 4.2 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 142 | 140 | 167 | | 22 | | 210 | 3554 | 1079 | 68 | 3147 | 926 |
| v/s Ratio Prot | | | | | | | 0.03 | c0.30 | | 0.02 | c0.28 | |
| v/s Ratio Perm | 0.04 | c0.04 | 0.00 | | c0.00 | | | | 0.00 | | | 0.02 |
| v/c Ratio | 0.39 | 0.39 | 0.04 | | 0.19 | | 0.21 | 0.42 | 0.00 | 0.50 | 0.46 | 0.03 |
| Uniform Delay, d1 | 49.8 | 49.8 | 47.9 | | 58.6 | | 47.7 | 7.4 | 5.2 | 56.5 | 11.8 | 9.1 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.20 | 1.70 | 1.00 | 1.12 | 0.46 | 1.00 |
| Incremental Delay, d2 | 0.6 | 0.7 | 0.0 | | 1.5 | | 0.2 | 0.3 | 0.0 | 1.9 | 0.4 | 0.1 |
| Delay (s) | 50.4 | 50.5 | 47.9 | | 60.0 | | 57.6 | 12.9 | 5.2 | 65.0 | 5.8 | 9.2 |
| Level of Service | D | D | D | | E | | E | B | A | E | A | A |
| Approach Delay (s/veh) | | 49.6 | | | 60.0 | | | 14.2 | | | 7.3 | |
| Approach LOS | | D | | | E | | | B | | | A | |

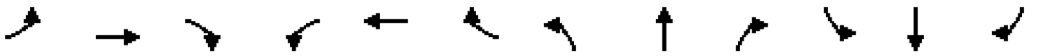
| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 13.0 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.45 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 50.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 0 | 480 | 0 | 257 | 0 | 1248 | 506 | 0 | 1362 | 758 |
| Future Volume (vph) | 0 | 0 | 0 | 480 | 0 | 257 | 0 | 1248 | 506 | 0 | 1362 | 758 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 4.0 | | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | | | | 0.97 | | 0.88 | | 0.95 | 1.00 | | 0.91 | 0.88 |
| Frpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 0.98 | | 1.00 | 0.98 |
| Flpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | | | 1.00 | | 0.85 | | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | 3400 | | 2760 | | 3505 | 1535 | | 5036 | 2703 |
| Flt Permitted | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | 3400 | | 2760 | | 3505 | 1535 | | 5036 | 2703 |
| Peak-hour factor, PHF | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 |
| Adj. Flow (vph) | 0 | 0 | 0 | 485 | 0 | 260 | 0 | 1261 | 511 | 0 | 1376 | 766 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 71 | 0 | 0 | 211 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 485 | 0 | 189 | 0 | 1261 | 300 | 0 | 1376 | 766 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | 1 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | | | | Prot | | Perm | | NA | Perm | | NA | Free |
| Protected Phases | | | | 4 | | | | 6 | | | 2 | |
| Permitted Phases | | | | 4 | | 4 | | | 6 | | | Free |
| Actuated Green, G (s) | | | | 15.4 | | 15.4 | | 33.3 | 33.3 | | 33.3 | 60.0 |
| Effective Green, g (s) | | | | 16.8 | | 16.8 | | 35.2 | 35.2 | | 35.2 | 60.0 |
| Actuated g/C Ratio | | | | 0.28 | | 0.28 | | 0.59 | 0.59 | | 0.59 | 1.00 |
| Clearance Time (s) | | | | 5.4 | | 5.4 | | 5.9 | 5.9 | | 5.9 | |
| Vehicle Extension (s) | | | | 5.0 | | 5.0 | | 5.0 | 5.0 | | 5.0 | |
| Lane Grp Cap (vph) | | | | 952 | | 772 | | 2056 | 900 | | 2954 | 2703 |
| v/s Ratio Prot | | | | c0.14 | | | | c0.36 | | | 0.27 | |
| v/s Ratio Perm | | | | | | 0.07 | | | 0.20 | | | 0.28 |
| v/c Ratio | | | | 0.51 | | 0.25 | | 0.61 | 0.33 | | 0.47 | 0.28 |
| Uniform Delay, d1 | | | | 18.1 | | 16.7 | | 8.0 | 6.4 | | 7.1 | 0.0 |
| Progression Factor | | | | 1.00 | | 1.00 | | 0.83 | 1.15 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | | | 0.9 | | 0.3 | | 1.3 | 1.0 | | 0.5 | 0.3 |
| Delay (s) | | | | 19.0 | | 17.0 | | 8.0 | 8.3 | | 7.6 | 0.3 |
| Level of Service | | | | B | | B | | A | A | | A | A |
| Approach Delay (s/veh) | | 0.0 | | | 18.3 | | | 8.1 | | | 5.0 | |
| Approach LOS | | A | | | B | | | A | | | A | |

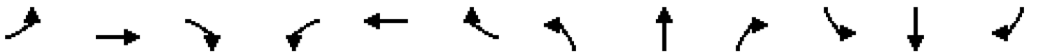
| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 8.3 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 54.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



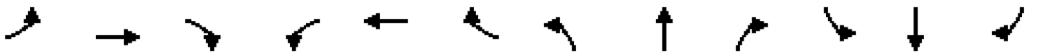
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 395 | 134 | 215 | 130 | 0 | 227 | 0 | 1130 | 106 | 243 | 1170 | 458 |
| Future Volume (vph) | 395 | 134 | 215 | 130 | 0 | 227 | 0 | 1130 | 106 | 243 | 1170 | 458 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | | 3.1 | | 4.0 | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 0.97 | | 0.88 | | 0.86 | | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 0.96 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | | 0.85 | | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6257 | | 1752 | 3505 | 1500 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6257 | | 1752 | 3505 | 1500 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 407 | 138 | 222 | 134 | 0 | 234 | 0 | 1165 | 109 | 251 | 1206 | 472 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 177 |
| Lane Group Flow (vph) | 407 | 138 | 222 | 134 | 0 | 234 | 0 | 1264 | 0 | 251 | 1206 | 295 |
| Confl. Peds. (#/hr) | | | 5 | | | 2 | 5 | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | 1 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | | pt+ov | | NA | | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | | 4 5 | | 6 | | 5 | 2 | |
| Permitted Phases | | | Free | | | | | | | | | 2 |
| Actuated Green, G (s) | 18.7 | 15.5 | 120.0 | 15.7 | | 37.9 | | 48.6 | | 20.9 | 73.5 | 73.5 |
| Effective Green, g (s) | 20.1 | 16.9 | 120.0 | 16.2 | | 39.3 | | 50.0 | | 20.9 | 74.9 | 74.9 |
| Actuated g/C Ratio | 0.17 | 0.14 | 1.00 | 0.13 | | 0.33 | | 0.42 | | 0.17 | 0.62 | 0.62 |
| Clearance Time (s) | 5.4 | 5.4 | | 4.5 | | | | 5.4 | | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | | 1.8 | | | | 5.0 | | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 569 | 259 | 1547 | 459 | | 903 | | 2607 | | 305 | 2187 | 936 |
| v/s Ratio Prot | c0.12 | 0.07 | | c0.04 | | 0.08 | | 0.20 | | c0.14 | c0.34 | |
| v/s Ratio Perm | | | c0.14 | | | | | | | | | 0.20 |
| v/c Ratio | 0.72 | 0.53 | 0.14 | 0.29 | | 0.26 | | 0.48 | | 0.82 | 0.55 | 0.31 |
| Uniform Delay, d1 | 47.2 | 47.9 | 0.0 | 46.7 | | 29.7 | | 25.6 | | 47.8 | 12.9 | 10.5 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.82 | | 0.98 | 0.85 | 1.03 |
| Incremental Delay, d2 | 3.6 | 1.1 | 0.2 | 0.1 | | 0.1 | | 0.6 | | 14.3 | 0.9 | 0.8 |
| Delay (s) | 50.8 | 48.9 | 0.2 | 46.9 | | 29.7 | | 21.7 | | 61.3 | 11.9 | 11.7 |
| Level of Service | D | D | A | D | | C | | C | | E | B | B |
| Approach Delay (s/veh) | | 35.8 | | | 36.0 | | | 21.7 | | | 18.3 | |
| Approach LOS | | D | | | D | | | C | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 23.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.62 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 58.9% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



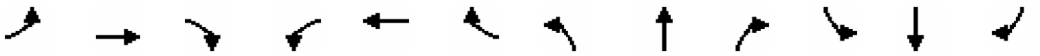
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 333 | 356 | 29 | 142 | 199 | 600 | 14 | 614 | 107 | 454 | 414 | 186 |
| Future Volume (vph) | 333 | 356 | 29 | 142 | 199 | 600 | 14 | 614 | 107 | 454 | 414 | 186 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 5036 | 1544 | 3400 | 5036 | 1549 | 3400 | 5036 | 1547 | 3400 | 5036 | 1547 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 5036 | 1544 | 3400 | 5036 | 1549 | 3400 | 5036 | 1547 | 3400 | 5036 | 1547 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 358 | 383 | 31 | 153 | 214 | 645 | 15 | 660 | 115 | 488 | 445 | 200 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 358 | 383 | 31 | 153 | 214 | 645 | 15 | 660 | 115 | 488 | 445 | 200 |
| Confl. Peds. (#/hr) | | | 10 | | | 1 | | | 5 | | | 4 |
| Confl. Bikes (#/hr) | | | 2 | | | | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 4 | | 3 | 8 | |
| Permitted Phases | | | Free | | | Free | | | Free | | | Free |
| Actuated Green, G (s) | 14.7 | 17.2 | 84.7 | 9.1 | 11.6 | 84.7 | 0.7 | 21.6 | 84.7 | 17.8 | 38.7 | 84.7 |
| Effective Green, g (s) | 14.7 | 18.9 | 84.7 | 9.1 | 13.3 | 84.7 | 0.7 | 22.9 | 84.7 | 17.8 | 40.0 | 84.7 |
| Actuated g/C Ratio | 0.17 | 0.22 | 1.00 | 0.11 | 0.16 | 1.00 | 0.01 | 0.27 | 1.00 | 0.21 | 0.47 | 1.00 |
| Clearance Time (s) | 4.0 | 5.7 | | 4.0 | 5.7 | | 4.0 | 5.3 | | 4.0 | 5.3 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 590 | 1123 | 1544 | 365 | 790 | 1549 | 28 | 1361 | 1547 | 714 | 2378 | 1547 |
| v/s Ratio Prot | c0.11 | 0.08 | | 0.05 | 0.04 | | 0.00 | 0.13 | | c0.14 | 0.09 | |
| v/s Ratio Perm | | | 0.02 | | | c0.42 | | | 0.07 | | | 0.13 |
| v/c Ratio | 0.61 | 0.34 | 0.02 | 0.42 | 0.27 | 0.42 | 0.54 | 0.48 | 0.07 | 0.68 | 0.19 | 0.13 |
| Uniform Delay, d1 | 32.3 | 27.7 | 0.0 | 35.3 | 31.4 | 0.0 | 41.8 | 25.9 | 0.0 | 30.9 | 12.9 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 1.2 | 0.1 | 0.0 | 0.3 | 0.1 | 0.8 | 9.5 | 0.1 | 0.1 | 2.2 | 0.0 | 0.2 |
| Delay (s) | 33.5 | 27.7 | 0.0 | 35.6 | 31.5 | 0.8 | 51.3 | 26.0 | 0.1 | 33.0 | 13.0 | 0.2 |
| Level of Service | C | C | A | D | C | A | D | C | A | C | B | A |
| Approach Delay (s/veh) | | 29.3 | | | 12.6 | | | 22.7 | | | 19.3 | |
| Approach LOS | | C | | | B | | | C | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 20.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 84.7 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 57.5% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 70 | 644 | 549 | 201 | 211 | 194 | 255 | 1142 | 254 | 262 | 1218 | 42 |
| Future Volume (vph) | 70 | 644 | 549 | 201 | 211 | 194 | 255 | 1142 | 254 | 262 | 1218 | 42 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1752 | 5036 | 1547 | 3400 | 3505 | 1537 | 3400 | 5036 | 1541 | 3400 | 5007 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1752 | 5036 | 1547 | 3400 | 3505 | 1537 | 3400 | 5036 | 1541 | 3400 | 5007 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 71 | 657 | 560 | 205 | 215 | 198 | 260 | 1165 | 259 | 267 | 1243 | 43 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 146 | 0 | 0 | 130 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 71 | 657 | 560 | 205 | 215 | 52 | 260 | 1165 | 129 | 267 | 1284 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 7 | | | 5 | | | 5 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | | | | 9 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Perm | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | Free | | | 8 | | | 2 | | | |
| Actuated Green, G (s) | 7.3 | 25.7 | 120.0 | 11.8 | 30.2 | 30.2 | 13.3 | 49.7 | 49.7 | 14.0 | 50.4 | |
| Effective Green, g (s) | 7.3 | 27.1 | 120.0 | 11.8 | 31.6 | 31.6 | 13.3 | 51.1 | 51.1 | 14.0 | 51.8 | |
| Actuated g/C Ratio | 0.06 | 0.23 | 1.00 | 0.10 | 0.26 | 0.26 | 0.11 | 0.43 | 0.43 | 0.12 | 0.43 | |
| Clearance Time (s) | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 5.0 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 106 | 1137 | 1547 | 334 | 922 | 404 | 376 | 2144 | 656 | 396 | 2161 | |
| v/s Ratio Prot | 0.04 | c0.13 | | c0.06 | 0.06 | | c0.08 | 0.23 | | 0.08 | c0.26 | |
| v/s Ratio Perm | | | 0.36 | | | 0.03 | | | 0.08 | | | |
| v/c Ratio | 0.67 | 0.58 | 0.36 | 0.61 | 0.23 | 0.13 | 0.69 | 0.54 | 0.20 | 0.67 | 0.59 | |
| Uniform Delay, d1 | 55.2 | 41.4 | 0.0 | 51.9 | 34.7 | 33.7 | 51.4 | 25.7 | 21.6 | 50.8 | 26.1 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.27 | 1.53 | |
| Incremental Delay, d2 | 11.7 | 1.1 | 0.7 | 2.3 | 0.3 | 0.3 | 4.4 | 1.0 | 0.7 | 3.0 | 1.0 | |
| Delay (s) | 66.9 | 42.5 | 0.7 | 54.3 | 35.0 | 34.0 | 55.8 | 26.7 | 22.3 | 67.4 | 40.8 | |
| Level of Service | E | D | A | D | C | C | E | C | C | E | D | |
| Approach Delay (s/veh) | | 25.7 | | | 41.1 | | | 30.5 | | | 45.4 | |
| Approach LOS | | C | | | D | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 35.1 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.60 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 70.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 0 | 0 | 8 | 19 | 1 | 59 | 12 | 442 | 26 | 108 | 342 | 2 |
| Future Volume (Veh/h) | 0 | 0 | 8 | 19 | 1 | 59 | 12 | 442 | 26 | 108 | 342 | 2 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 |
| Hourly flow rate (vph) | 0 | 0 | 9 | 22 | 1 | 69 | 14 | 514 | 30 | 126 | 398 | 2 |
| Pedestrians | | 9 | | | 10 | | | | | | 11 | |
| Lane Width (ft) | | 12.0 | | | 12.0 | | | | | | 13.0 | |
| Walking Speed (ft/s) | | 4.0 | | | 4.0 | | | | | | 4.0 | |
| Percent Blockage | | 1 | | | 1 | | | | | | 1 | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 1026 | 1242 | 209 | 1027 | 1228 | 293 | 409 | | | 554 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 1026 | 1242 | 209 | 1027 | 1228 | 293 | 409 | | | 554 | | |
| tC, single (s) | 7.6 | 6.6 | 7.0 | 7.6 | 6.6 | 7.0 | 4.2 | | | 4.2 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 100 | 100 | 99 | 86 | 99 | 90 | 99 | | | 87 | | |
| cM capacity (veh/h) | 146 | 146 | 788 | 162 | 149 | 688 | 1131 | | | 997 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|
| Volume Total | 9 | 92 | 14 | 343 | 201 | 126 | 265 | 135 |
| Volume Left | 0 | 22 | 14 | 0 | 0 | 126 | 0 | 0 |
| Volume Right | 9 | 69 | 0 | 0 | 30 | 0 | 0 | 2 |
| cSH | 788 | 379 | 1131 | 1700 | 1700 | 997 | 1700 | 1700 |
| Volume to Capacity | 0.01 | 0.24 | 0.01 | 0.20 | 0.12 | 0.13 | 0.16 | 0.08 |
| Queue Length 95th (ft) | 1 | 23 | 1 | 0 | 0 | 11 | 0 | 0 |
| Control Delay (s/veh) | 9.6 | 17.5 | 8.2 | 0.0 | 0.0 | 9.1 | 0.0 | 0.0 |
| Lane LOS | A | C | A | | | A | | |
| Approach Delay (s/veh) | 9.6 | 17.5 | 0.2 | | | 2.2 | | |
| Approach LOS | A | C | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 2.5 | | | |
| Intersection Capacity Utilization | 41.7% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 58 | 29 | 7 | 65 | 24 | 13 |
| Future Volume (Veh/h) | 58 | 29 | 7 | 65 | 24 | 13 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 63 | 32 | 8 | 71 | 26 | 14 |
| Pedestrians | 1 | | | 2 | 10 | |
| Lane Width (ft) | 12.0 | | | 12.0 | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | 4.0 | 4.0 | |
| Percent Blockage | 0 | | | 0 | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 105 | | 177 | 91 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 105 | | 177 | 91 |
| tC, single (s) | | | 4.2 | | 6.5 | 6.3 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.3 | | 3.6 | 3.4 |
| p0 queue free % | | | 99 | | 97 | 99 |
| cM capacity (veh/h) | | | 1449 | | 792 | 946 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 95 | 8 | 71 | 40 |
| Volume Left | 0 | 8 | 0 | 26 |
| Volume Right | 32 | 0 | 0 | 14 |
| cSH | 1700 | 1449 | 1700 | 840 |
| Volume to Capacity | 0.06 | 0.01 | 0.04 | 0.05 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 4 |
| Control Delay (s/veh) | 0.0 | 7.5 | 0.0 | 9.5 |
| Lane LOS | | A | | A |
| Approach Delay (s/veh) | 0.0 | 0.8 | | 9.5 |
| Approach LOS | | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.1 | | |
| Intersection Capacity Utilization | 18.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 60 | 36 | 20 | 67 | 20 | 27 |
| Future Volume (Veh/h) | 60 | 36 | 20 | 67 | 20 | 27 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 |
| Hourly flow rate (vph) | 70 | 42 | 23 | 78 | 23 | 31 |
| Pedestrians | 2 | | | 6 | 4 | |
| Lane Width (ft) | 12.0 | | | 12.0 | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | 4.0 | 4.0 | |
| Percent Blockage | 0 | | | 1 | 0 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 116 | | 221 | 101 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 116 | | 221 | 101 |
| tC, single (s) | | | 4.1 | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.2 | | 3.5 | 3.3 |
| p0 queue free % | | | 98 | | 97 | 97 |
| cM capacity (veh/h) | | | 1449 | | 745 | 938 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 112 | 23 | 78 | 54 |
| Volume Left | 0 | 23 | 0 | 23 |
| Volume Right | 42 | 0 | 0 | 31 |
| cSH | 1700 | 1449 | 1700 | 845 |
| Volume to Capacity | 0.07 | 0.02 | 0.05 | 0.06 |
| Queue Length 95th (ft) | 0 | 1 | 0 | 5 |
| Control Delay (s/veh) | 0.0 | 7.5 | 0.0 | 9.6 |
| Lane LOS | | A | | A |
| Approach Delay (s/veh) | 0.0 | 1.7 | | 9.6 |
| Approach LOS | | | | A |

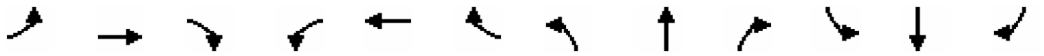
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.6 | | |
| Intersection Capacity Utilization | 19.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 11 | 469 | 27 | 20 | 357 |
| Future Volume (Veh/h) | 0 | 11 | 469 | 27 | 20 | 357 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 |
| Hourly flow rate (vph) | 0 | 13 | 572 | 33 | 24 | 435 |
| Pedestrians | 14 | | | | | 1 |
| Lane Width (ft) | 12.0 | | | | | 12.0 |
| Walking Speed (ft/s) | 4.0 | | | | | 4.0 |
| Percent Blockage | 1 | | | | | 0 |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 796 | 318 | | | 619 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 796 | 318 | | | 619 | |
| tC, single (s) | 6.9 | 7.0 | | | 4.2 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 100 | 98 | | | 97 | |
| cM capacity (veh/h) | 311 | 667 | | | 939 | |

| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|
| Volume Total | 13 | 381 | 224 | 24 | 145 | 145 | 145 |
| Volume Left | 0 | 0 | 0 | 24 | 0 | 0 | 0 |
| Volume Right | 13 | 0 | 33 | 0 | 0 | 0 | 0 |
| cSH | 667 | 1700 | 1700 | 939 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.02 | 0.22 | 0.13 | 0.03 | 0.09 | 0.09 | 0.09 |
| Queue Length 95th (ft) | 1 | 0 | 0 | 2 | 0 | 0 | 0 |
| Control Delay (s/veh) | 10.5 | 0.0 | 0.0 | 8.9 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | | | A | | | |
| Approach Delay (s/veh) | 10.5 | 0.0 | | 0.5 | | | |
| Approach LOS | B | | | | | | |

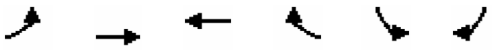
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.3 | | |
| Intersection Capacity Utilization | 26.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 16 | 0 | 39 | 0 | 0 | 2 | 46 | 78 | 0 | 4 | 44 | 27 |
| Future Volume (Veh/h) | 16 | 0 | 39 | 0 | 0 | 2 | 46 | 78 | 0 | 4 | 44 | 27 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 |
| Hourly flow rate (vph) | 20 | 0 | 48 | 0 | 0 | 2 | 57 | 96 | 0 | 5 | 54 | 33 |
| Pedestrians | | 21 | | | 1 | | | 1 | | | | |
| Lane Width (ft) | | 13.0 | | | 12.0 | | | 13.0 | | | | |
| Walking Speed (ft/s) | | 4.0 | | | 4.0 | | | 4.0 | | | | |
| Percent Blockage | | 2 | | | 0 | | | 0 | | | | |
| Right turn flare (veh) | | | 8 | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | 144 | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 297 | 296 | 76 | 276 | 329 | 97 | 108 | | | 97 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 297 | 296 | 76 | 276 | 329 | 97 | 108 | | | 97 | | |
| tC, single (s) | 7.2 | 6.6 | 6.2 | 7.2 | 6.6 | 6.2 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 97 | 100 | 95 | 100 | 100 | 100 | 96 | | | 100 | | |
| cM capacity (veh/h) | 606 | 573 | 958 | 606 | 549 | 950 | 1436 | | | 1476 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|
| Volume Total | 68 | 2 | 57 | 96 | 5 | 54 | 33 |
| Volume Left | 20 | 0 | 57 | 0 | 5 | 0 | 0 |
| Volume Right | 48 | 2 | 0 | 0 | 0 | 0 | 33 |
| cSH | 1356 | 950 | 1436 | 1700 | 1476 | 1700 | 1700 |
| Volume to Capacity | 0.05 | 0.00 | 0.04 | 0.06 | 0.00 | 0.03 | 0.02 |
| Queue Length 95th (ft) | 4 | 0 | 3 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 9.6 | 8.8 | 7.6 | 0.0 | 7.4 | 0.0 | 0.0 |
| Lane LOS | A | A | A | | A | | |
| Approach Delay (s/veh) | 9.6 | 8.8 | 2.8 | | 0.4 | | |
| Approach LOS | A | A | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 3.6 | | | |
| Intersection Capacity Utilization | 25.4% | ICU Level of Service | A | |
| Analysis Period (min) | 15 | | | |



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 631 | 1041 | 66 | 0 | 36 |
| Future Volume (Veh/h) | 0 | 631 | 1041 | 66 | 0 | 36 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 0 | 686 | 1132 | 72 | 0 | 39 |
| Pedestrians | | | | | 24 | |
| Lane Width (ft) | | | | | 12.0 | |
| Walking Speed (ft/s) | | | | | 4.0 | |
| Percent Blockage | | | | | 2 | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | 526 | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1228 | | | | 1421 | 437 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 1228 | | | | 1421 | 437 |
| tC, single (s) | 4.2 | | | | 6.9 | 7.0 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 100 | 93 |
| cM capacity (veh/h) | 547 | | | | 124 | 553 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | SB 1 |
|---|---|---|---|---|---|---|---|
| Volume Total | 229 | 229 | 229 | 453 | 453 | 298 | 39 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 72 | 39 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 553 |
| Volume to Capacity | 0.13 | 0.13 | 0.13 | 0.27 | 0.27 | 0.18 | 0.07 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| Control Delay (s/veh) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12.0 |
| Lane LOS | | | | | | | B |
| Approach Delay (s/veh) | 0.0 | | | 0.0 | | | 12.0 |
| Approach LOS | | | | | | | B |

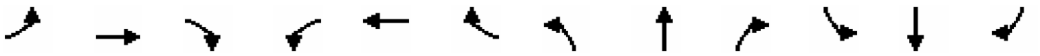
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.2 | | |
| Intersection Capacity Utilization | 31.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 26 | 0 | 1120 | 1582 | 139 |
| Future Volume (Veh/h) | 0 | 26 | 0 | 1120 | 1582 | 139 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Hourly flow rate (vph) | 0 | 27 | 0 | 1143 | 1614 | 142 |
| Pedestrians | 21 | | | | | |
| Lane Width (ft) | 12.0 | | | | | |
| Walking Speed (ft/s) | 4.0 | | | | | |
| Percent Blockage | 2 | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | 647 | 189 | |
| pX, platoon unblocked | 0.84 | 0.80 | 0.80 | | | |
| vC, conflicting volume | 1921 | 559 | 1777 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 604 | 0 | 1101 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 100 | 97 | 100 | | | |
| cM capacity (veh/h) | 358 | 856 | 500 | | | |

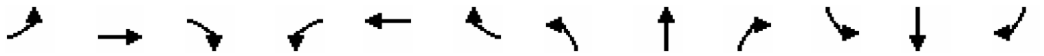
| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | NB 4 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 27 | 163 | 327 | 327 | 327 | 538 | 538 | 538 | 142 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 142 |
| cSH | 856 | 500 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.03 | 0.00 | 0.19 | 0.19 | 0.19 | 0.32 | 0.32 | 0.32 | 0.08 |
| Queue Length 95th (ft) | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 9.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | | | | | | | |
| Approach Delay (s/veh) | 9.3 | 0.0 | | | | 0.0 | | | |
| Approach LOS | A | | | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 0.1 | | | |
| Intersection Capacity Utilization | 40.6% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



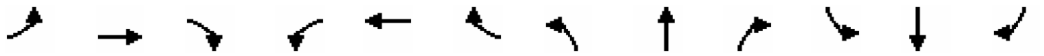
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 198 | 245 | 186 | 205 | 318 | 66 | 353 | 880 | 115 | 83 | 1101 | 421 |
| Future Volume (vph) | 198 | 245 | 186 | 205 | 318 | 66 | 353 | 880 | 115 | 83 | 1101 | 421 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.95 | 1.00 | 0.97 | 0.95 | | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.91 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.94 | 1.00 | 1.00 | 0.98 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 3505 | 1429 | 3400 | 3396 | | 3400 | 5036 | 1480 | 3400 | 5036 | 1544 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 3505 | 1429 | 3400 | 3396 | | 3400 | 5036 | 1480 | 3400 | 5036 | 1544 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 211 | 261 | 198 | 218 | 338 | 70 | 376 | 936 | 122 | 88 | 1171 | 448 |
| RTOR Reduction (vph) | 0 | 0 | 146 | 0 | 15 | 0 | 0 | 0 | 68 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 211 | 261 | 52 | 218 | 393 | 0 | 376 | 936 | 54 | 88 | 1171 | 448 |
| Confl. Peds. (#/hr) | | | 74 | | | 15 | | | 40 | | | 12 |
| Confl. Bikes (#/hr) | | | 3 | | | 5 | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Prot | NA | Perm | Prot | NA | Free |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | 8 | | | | | | 6 | | | Free |
| Actuated Green, G (s) | 11.6 | 29.9 | 29.9 | 12.6 | 30.9 | | 21.0 | 51.4 | 51.4 | 7.3 | 37.7 | 120.0 |
| Effective Green, g (s) | 11.6 | 31.3 | 31.3 | 12.6 | 32.3 | | 21.0 | 52.8 | 52.8 | 7.3 | 39.1 | 120.0 |
| Actuated g/C Ratio | 0.10 | 0.26 | 0.26 | 0.11 | 0.27 | | 0.18 | 0.44 | 0.44 | 0.06 | 0.33 | 1.00 |
| Clearance Time (s) | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 328 | 914 | 372 | 357 | 914 | | 595 | 2215 | 651 | 206 | 1640 | 1544 |
| v/s Ratio Prot | c0.06 | 0.07 | | c0.06 | c0.12 | | c0.11 | 0.19 | | 0.03 | c0.23 | |
| v/s Ratio Perm | | | 0.04 | | | | | | 0.04 | | | 0.29 |
| v/c Ratio | 0.64 | 0.29 | 0.14 | 0.61 | 0.43 | | 0.63 | 0.42 | 0.08 | 0.43 | 0.71 | 0.29 |
| Uniform Delay, d1 | 52.2 | 35.4 | 34.0 | 51.4 | 36.2 | | 45.9 | 23.1 | 19.5 | 54.3 | 35.5 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.02 | 0.93 | 3.53 | 0.77 | 0.71 | 1.00 |
| Incremental Delay, d2 | 3.2 | 0.1 | 0.1 | 2.2 | 0.1 | | 1.4 | 0.5 | 0.2 | 0.5 | 2.4 | 0.4 |
| Delay (s) | 55.4 | 35.5 | 34.1 | 53.5 | 36.4 | | 48.5 | 22.1 | 69.2 | 42.5 | 27.7 | 0.4 |
| Level of Service | E | D | C | D | D | | D | C | E | D | C | A |
| Approach Delay (s/veh) | | 41.3 | | | 42.3 | | | 33.0 | | | 21.3 | |
| Approach LOS | | D | | | D | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 31.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.61 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 77.8% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



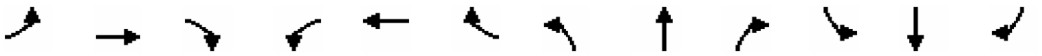
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 29 | 0 | 57 | 12 | 0 | 3 | 87 | 1023 | 9 | 14 | 1627 | 78 |
| Future Volume (vph) | 29 | 0 | 57 | 12 | 0 | 3 | 87 | 1023 | 9 | 14 | 1627 | 78 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 5.4 |
| Lane Util. Factor | 0.95 | 0.95 | 1.00 | | 1.00 | | 1.00 | 0.91 | 1.00 | 1.00 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 0.98 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 0.95 | 1.00 | | 0.96 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1665 | 1665 | 1513 | | 1695 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1524 |
| Flt Permitted | 0.75 | 0.75 | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1310 | 1310 | 1513 | | 1763 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1524 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 30 | 0 | 59 | 12 | 0 | 3 | 90 | 1055 | 9 | 14 | 1677 | 80 |
| RTOR Reduction (vph) | 0 | 0 | 54 | 0 | 15 | 0 | 0 | 0 | 2 | 0 | 0 | 33 |
| Lane Group Flow (vph) | 15 | 15 | 5 | 0 | 0 | 0 | 90 | 1055 | 7 | 14 | 1677 | 47 |
| Confl. Peds. (#/hr) | | | 22 | 22 | | | | | 1 | | | 9 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 4 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | 3 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 3 | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 10.2 | 10.2 | 10.2 | | 2.0 | | 19.4 | 86.9 | 86.9 | 2.6 | 70.1 | 70.1 |
| Effective Green, g (s) | 10.9 | 10.9 | 10.9 | | 2.2 | | 19.4 | 88.3 | 88.3 | 2.6 | 71.5 | 70.1 |
| Actuated g/C Ratio | 0.09 | 0.09 | 0.09 | | 0.02 | | 0.16 | 0.74 | 0.74 | 0.02 | 0.60 | 0.58 |
| Clearance Time (s) | 4.7 | 4.7 | 4.7 | | 4.2 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 118 | 118 | 137 | | 32 | | 283 | 3705 | 1125 | 37 | 3000 | 890 |
| v/s Ratio Prot | | | | | | | 0.05 | c0.21 | | 0.01 | c0.33 | |
| v/s Ratio Perm | c0.01 | 0.01 | 0.00 | | c0.00 | | | | 0.00 | | | 0.03 |
| v/c Ratio | 0.13 | 0.13 | 0.04 | | 0.01 | | 0.32 | 0.28 | 0.01 | 0.38 | 0.56 | 0.05 |
| Uniform Delay, d1 | 50.2 | 50.2 | 49.8 | | 57.8 | | 44.5 | 5.3 | 4.2 | 57.9 | 14.7 | 10.7 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.09 | 1.95 | 1.00 | 1.15 | 0.56 | 0.36 |
| Incremental Delay, d2 | 0.2 | 0.2 | 0.0 | | 0.0 | | 0.2 | 0.2 | 0.0 | 1.9 | 0.6 | 0.1 |
| Delay (s) | 50.4 | 50.4 | 49.8 | | 57.9 | | 48.5 | 10.5 | 4.2 | 68.6 | 8.8 | 4.0 |
| Level of Service | D | D | D | | E | | D | B | A | E | A | A |
| Approach Delay (s/veh) | | 50.0 | | | 57.9 | | | 13.4 | | | 9.1 | |
| Approach LOS | | D | | | E | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 12.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.46 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 63.0% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



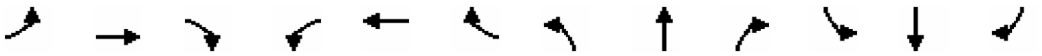
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 0 | 524 | 0 | 310 | 0 | 1227 | 377 | 0 | 1015 | 895 |
| Future Volume (vph) | 0 | 0 | 0 | 524 | 0 | 310 | 0 | 1227 | 377 | 0 | 1015 | 895 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 4.0 | | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | | | | 0.97 | | 0.88 | | 0.95 | 1.00 | | 0.91 | 0.88 |
| Frpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 0.98 | | 1.00 | 0.98 |
| Flpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | | | 1.00 | | 0.85 | | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | 3400 | | 2760 | | 3505 | 1533 | | 5036 | 2698 |
| Flt Permitted | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | 3400 | | 2760 | | 3505 | 1533 | | 5036 | 2698 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 0 | 0 | 0 | 546 | 0 | 323 | 0 | 1278 | 393 | 0 | 1057 | 932 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 66 | 0 | 0 | 166 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 546 | 0 | 257 | 0 | 1278 | 227 | 0 | 1057 | 932 |
| Confl. Peds. (#/hr) | | | | | | | 3 | | | | | 3 |
| Confl. Bikes (#/hr) | | | | | | | | | 4 | | | 2 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | | | | Prot | | Perm | | NA | Perm | | NA | Free |
| Protected Phases | | | | 4 | | | | 6 | | | 2 | |
| Permitted Phases | | | | 4 | | 4 | | | 6 | | | Free |
| Actuated Green, G (s) | | | | 16.0 | | 16.0 | | 32.7 | 32.7 | | 32.7 | 60.0 |
| Effective Green, g (s) | | | | 17.4 | | 17.4 | | 34.6 | 34.6 | | 34.6 | 60.0 |
| Actuated g/C Ratio | | | | 0.29 | | 0.29 | | 0.58 | 0.58 | | 0.58 | 1.00 |
| Clearance Time (s) | | | | 5.4 | | 5.4 | | 5.9 | 5.9 | | 5.9 | |
| Vehicle Extension (s) | | | | 5.0 | | 5.0 | | 5.0 | 5.0 | | 5.0 | |
| Lane Grp Cap (vph) | | | | 986 | | 800 | | 2021 | 884 | | 2904 | 2698 |
| v/s Ratio Prot | | | | c0.16 | | | | c0.36 | | | 0.21 | |
| v/s Ratio Perm | | | | | | 0.09 | | | 0.15 | | | 0.35 |
| v/c Ratio | | | | 0.55 | | 0.32 | | 0.63 | 0.26 | | 0.36 | 0.35 |
| Uniform Delay, d1 | | | | 18.0 | | 16.7 | | 8.5 | 6.3 | | 6.8 | 0.0 |
| Progression Factor | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | | | 1.1 | | 0.5 | | 1.5 | 0.7 | | 0.4 | 0.4 |
| Delay (s) | | | | 19.2 | | 17.2 | | 10.0 | 7.0 | | 7.2 | 0.4 |
| Level of Service | | | | B | | B | | A | A | | A | A |
| Approach Delay (s/veh) | | 0.0 | | | 18.4 | | | 9.3 | | | 4.0 | |
| Approach LOS | | A | | | B | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 8.7 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.61 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 55.5% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



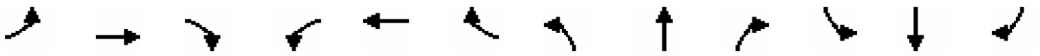
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 687 | 140 | 678 | 170 | 0 | 212 | 0 | 707 | 72 | 147 | 1192 | 195 |
| Future Volume (vph) | 687 | 140 | 678 | 170 | 0 | 212 | 0 | 707 | 72 | 147 | 1192 | 195 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | | 3.1 | | 4.0 | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 0.97 | | 0.88 | | 0.86 | | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | | 0.85 | | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6250 | | 1752 | 3505 | 1513 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6250 | | 1752 | 3505 | 1513 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 739 | 151 | 729 | 183 | 0 | 228 | 0 | 760 | 77 | 158 | 1282 | 210 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 95 |
| Lane Group Flow (vph) | 739 | 151 | 729 | 183 | 0 | 228 | 0 | 825 | 0 | 158 | 1282 | 115 |
| Confl. Peds. (#/hr) | | | 5 | | | | 3 | | | | | 3 |
| Confl. Bikes (#/hr) | | | | | | | | | 4 | | | 2 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | | pt+ov | | NA | | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | | 4 5 | | 6 | | 5 | 2 | |
| Permitted Phases | | | Free | | | | | | | | | 2 |
| Actuated Green, G (s) | 29.8 | 16.1 | 120.0 | 24.3 | | 30.1 | | 45.3 | | 15.0 | 64.3 | 64.3 |
| Effective Green, g (s) | 31.2 | 17.5 | 120.0 | 24.8 | | 31.5 | | 46.7 | | 15.0 | 65.7 | 65.7 |
| Actuated g/C Ratio | 0.26 | 0.15 | 1.00 | 0.21 | | 0.26 | | 0.39 | | 0.13 | 0.55 | 0.55 |
| Clearance Time (s) | 5.4 | 5.4 | | 4.5 | | | | 5.4 | | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | | 1.8 | | | | 5.0 | | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 884 | 269 | 1547 | 702 | | 724 | | 2432 | | 219 | 1918 | 828 |
| v/s Ratio Prot | c0.22 | 0.08 | | 0.05 | | 0.08 | | 0.13 | | 0.09 | c0.37 | |
| v/s Ratio Perm | | | c0.47 | | | | | | | | | 0.08 |
| v/c Ratio | 0.84 | 0.56 | 0.47 | 0.26 | | 0.31 | | 0.34 | | 0.72 | 0.67 | 0.14 |
| Uniform Delay, d1 | 42.0 | 47.7 | 0.0 | 39.9 | | 35.6 | | 25.8 | | 50.5 | 19.4 | 13.3 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.82 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 6.6 | 1.6 | 1.0 | 0.1 | | 0.1 | | 0.4 | | 9.5 | 1.9 | 0.4 |
| Delay (s) | 48.6 | 49.3 | 1.0 | 40.0 | | 35.7 | | 21.6 | | 60.0 | 21.2 | 13.6 |
| Level of Service | D | D | A | D | | D | | C | | E | C | B |
| Approach Delay (s/veh) | | 27.2 | | | 37.6 | | | 21.6 | | | 24.0 | |
| Approach LOS | | C | | | D | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 25.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.74 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 59.2% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



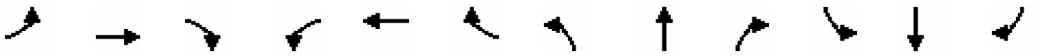
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 64 | 102 | 17 | 97 | 227 | 314 | 25 | 254 | 97 | 396 | 735 | 289 |
| Future Volume (vph) | 64 | 102 | 17 | 97 | 227 | 314 | 25 | 254 | 97 | 396 | 735 | 289 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 5036 | 1545 | 3400 | 5036 | 1546 | 3400 | 5036 | 1547 | 3400 | 5036 | 1549 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 5036 | 1545 | 3400 | 5036 | 1546 | 3400 | 5036 | 1547 | 3400 | 5036 | 1549 |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 70 | 112 | 19 | 107 | 249 | 345 | 27 | 279 | 107 | 435 | 808 | 318 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 70 | 112 | 19 | 107 | 249 | 345 | 27 | 279 | 107 | 435 | 808 | 318 |
| Confl. Peds. (#/hr) | | | 7 | | | 7 | | | 5 | | | 1 |
| Confl. Bikes (#/hr) | | | 3 | | | | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 4 | | 3 | 8 | |
| Permitted Phases | | | Free | | | Free | | | Free | | | Free |
| Actuated Green, G (s) | 5.1 | 11.0 | 64.5 | 5.8 | 11.7 | 64.5 | 1.9 | 14.7 | 64.5 | 14.0 | 26.8 | 64.5 |
| Effective Green, g (s) | 5.1 | 12.7 | 64.5 | 5.8 | 13.4 | 64.5 | 1.9 | 16.0 | 64.5 | 14.0 | 28.1 | 64.5 |
| Actuated g/C Ratio | 0.08 | 0.20 | 1.00 | 0.09 | 0.21 | 1.00 | 0.03 | 0.25 | 1.00 | 0.22 | 0.44 | 1.00 |
| Clearance Time (s) | 4.0 | 5.7 | | 4.0 | 5.7 | | 4.0 | 5.3 | | 4.0 | 5.3 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 268 | 991 | 1545 | 305 | 1046 | 1546 | 100 | 1249 | 1547 | 737 | 2193 | 1549 |
| v/s Ratio Prot | 0.02 | 0.02 | | 0.03 | 0.05 | | 0.01 | 0.06 | | c0.13 | c0.16 | |
| v/s Ratio Perm | | | 0.01 | | | c0.22 | | | 0.07 | | | 0.21 |
| v/c Ratio | 0.26 | 0.11 | 0.01 | 0.35 | 0.24 | 0.22 | 0.27 | 0.22 | 0.07 | 0.59 | 0.37 | 0.21 |
| Uniform Delay, d1 | 27.9 | 21.3 | 0.0 | 27.6 | 21.3 | 0.0 | 30.6 | 19.3 | 0.0 | 22.7 | 12.2 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.2 | 0.0 | 0.0 | 0.3 | 0.0 | 0.3 | 0.5 | 0.0 | 0.1 | 0.8 | 0.0 | 0.3 |
| Delay (s) | 28.1 | 21.3 | 0.0 | 27.8 | 21.3 | 0.3 | 31.2 | 19.3 | 0.1 | 23.5 | 12.3 | 0.3 |
| Level of Service | C | C | A | C | C | A | C | B | A | C | B | A |
| Approach Delay (s/veh) | | 21.7 | | | 12.0 | | | 15.1 | | | 13.0 | |
| Approach LOS | | C | | | B | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 13.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.43 | | |
| Actuated Cycle Length (s) | 64.5 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 46.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 31 | 188 | 214 | 367 | 466 | 230 | 498 | 1083 | 220 | 174 | 1309 | 56 |
| Future Volume (vph) | 31 | 188 | 214 | 367 | 466 | 230 | 498 | 1083 | 220 | 174 | 1309 | 56 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1752 | 5036 | 1547 | 3400 | 3505 | 1539 | 3400 | 5036 | 1541 | 3400 | 4997 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1752 | 5036 | 1547 | 3400 | 3505 | 1539 | 3400 | 5036 | 1541 | 3400 | 4997 | |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 32 | 194 | 221 | 378 | 480 | 237 | 513 | 1116 | 227 | 179 | 1349 | 58 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 164 | 0 | 0 | 135 | 0 | 4 | 0 |
| Lane Group Flow (vph) | 32 | 194 | 221 | 378 | 480 | 73 | 513 | 1116 | 92 | 179 | 1403 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 6 | | | 5 | | | 6 |
| Confl. Bikes (#/hr) | | | 2 | | | 1 | | | | | | 26 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Perm | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | Free | | | 8 | | | 2 | | | |
| Actuated Green, G (s) | 4.6 | 16.1 | 120.0 | 23.9 | 35.4 | 35.4 | 23.3 | 47.1 | 47.1 | 14.1 | 37.9 | |
| Effective Green, g (s) | 4.6 | 17.5 | 120.0 | 23.9 | 36.8 | 36.8 | 23.3 | 48.5 | 48.5 | 14.1 | 39.3 | |
| Actuated g/C Ratio | 0.04 | 0.15 | 1.00 | 0.20 | 0.31 | 0.31 | 0.19 | 0.40 | 0.40 | 0.12 | 0.33 | |
| Clearance Time (s) | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 5.0 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 67 | 734 | 1547 | 677 | 1074 | 471 | 660 | 2035 | 622 | 399 | 1636 | |
| v/s Ratio Prot | c0.02 | 0.04 | | c0.11 | c0.14 | | c0.15 | 0.22 | | 0.05 | c0.28 | |
| v/s Ratio Perm | | | 0.14 | | | 0.05 | | | 0.06 | | | |
| v/c Ratio | 0.48 | 0.26 | 0.14 | 0.56 | 0.45 | 0.15 | 0.78 | 0.55 | 0.15 | 0.45 | 0.86 | |
| Uniform Delay, d1 | 56.5 | 45.5 | 0.0 | 43.3 | 33.4 | 30.3 | 45.9 | 27.4 | 22.7 | 49.3 | 37.7 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.38 | 1.44 | |
| Incremental Delay, d2 | 1.9 | 0.4 | 0.2 | 0.6 | 0.6 | 0.3 | 5.2 | 1.1 | 0.5 | 0.2 | 4.7 | |
| Delay (s) | 58.5 | 45.9 | 0.2 | 43.9 | 34.0 | 30.6 | 51.1 | 28.4 | 23.2 | 68.5 | 59.1 | |
| Level of Service | E | D | A | D | C | C | D | C | C | E | E | |
| Approach Delay (s/veh) | | 24.2 | | | 36.7 | | | 34.1 | | | 60.1 | |
| Approach LOS | | C | | | D | | | C | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 42.1 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.69 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 77.5% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 4 | 0 | 5 | 13 | 0 | 93 | 7 | 410 | 13 | 94 | 587 | 1 |
| Future Volume (Veh/h) | 4 | 0 | 5 | 13 | 0 | 93 | 7 | 410 | 13 | 94 | 587 | 1 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 4 | 0 | 5 | 14 | 0 | 99 | 7 | 436 | 14 | 100 | 624 | 1 |
| Pedestrians | | 16 | | | 6 | | | | | | 13 | |
| Lane Width (ft) | | 12.0 | | | 12.0 | | | | | | 13.0 | |
| Walking Speed (ft/s) | | 4.0 | | | 4.0 | | | | | | 4.0 | |
| Percent Blockage | | 1 | | | 1 | | | | | | 1 | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 1185 | 1311 | 329 | 980 | 1304 | 244 | 641 | | | 456 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 1185 | 1311 | 329 | 980 | 1304 | 244 | 641 | | | 456 | | |
| tC, single (s) | 7.6 | 6.6 | 7.0 | 7.6 | 6.6 | 7.0 | 4.2 | | | 4.2 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 96 | 100 | 99 | 92 | 100 | 87 | 99 | | | 91 | | |
| cM capacity (veh/h) | 110 | 138 | 655 | 182 | 140 | 741 | 920 | | | 1089 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|
| Volume Total | 9 | 113 | 7 | 291 | 159 | 100 | 416 | 209 |
| Volume Left | 4 | 14 | 7 | 0 | 0 | 100 | 0 | 0 |
| Volume Right | 5 | 99 | 0 | 0 | 14 | 0 | 0 | 1 |
| cSH | 205 | 537 | 920 | 1700 | 1700 | 1089 | 1700 | 1700 |
| Volume to Capacity | 0.04 | 0.21 | 0.01 | 0.17 | 0.09 | 0.09 | 0.24 | 0.12 |
| Queue Length 95th (ft) | 3 | 20 | 1 | 0 | 0 | 8 | 0 | 0 |
| Control Delay (s/veh) | 23.3 | 13.5 | 8.9 | 0.0 | 0.0 | 8.6 | 0.0 | 0.0 |
| Lane LOS | C | B | A | | | A | | |
| Approach Delay (s/veh) | 23.3 | 13.5 | 0.1 | | | 1.2 | | |
| Approach LOS | C | B | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 2.0 | | | |
| Intersection Capacity Utilization | 39.3% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 78 | 15 | 5 | 65 | 25 | 41 |
| Future Volume (Veh/h) | 78 | 15 | 5 | 65 | 25 | 41 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 |
| Hourly flow rate (vph) | 95 | 18 | 6 | 79 | 30 | 50 |
| Pedestrians | 3 | | | 1 | 8 | |
| Lane Width (ft) | 12.0 | | | 12.0 | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | 4.0 | 4.0 | |
| Percent Blockage | 0 | | | 0 | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 121 | | 206 | 113 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 121 | | 206 | 113 |
| tC, single (s) | | | 4.2 | | 6.5 | 6.3 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.3 | | 3.6 | 3.4 |
| p0 queue free % | | | 100 | | 96 | 95 |
| cM capacity (veh/h) | | | 1403 | | 752 | 909 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 113 | 6 | 79 | 80 |
| Volume Left | 0 | 6 | 0 | 30 |
| Volume Right | 18 | 0 | 0 | 50 |
| cSH | 1700 | 1403 | 1700 | 843 |
| Volume to Capacity | 0.07 | 0.00 | 0.05 | 0.09 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 8 |
| Control Delay (s/veh) | 0.0 | 7.6 | 0.0 | 9.7 |
| Lane LOS | | A | | A |
| Approach Delay (s/veh) | 0.0 | 0.5 | | 9.7 |
| Approach LOS | | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 3.0 | | |
| Intersection Capacity Utilization | 18.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 65 | 12 | 5 | 83 | 22 | 28 |
| Future Volume (Veh/h) | 65 | 12 | 5 | 83 | 22 | 28 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Hourly flow rate (vph) | 76 | 14 | 6 | 98 | 26 | 33 |
| Pedestrians | 1 | | | | 10 | |
| Lane Width (ft) | 12.0 | | | | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | | 4.0 | |
| Percent Blockage | 0 | | | | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 100 | | 204 | 93 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 100 | | 204 | 93 |
| tC, single (s) | | | 4.2 | | 6.5 | 6.3 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.3 | | 3.6 | 3.4 |
| p0 queue free % | | | 100 | | 97 | 96 |
| cM capacity (veh/h) | | | 1450 | | 763 | 943 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 90 | 6 | 98 | 59 |
| Volume Left | 0 | 6 | 0 | 26 |
| Volume Right | 14 | 0 | 0 | 33 |
| cSH | 1700 | 1450 | 1700 | 854 |
| Volume to Capacity | 0.05 | 0.00 | 0.06 | 0.07 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 6 |
| Control Delay (s/veh) | 0.0 | 7.5 | 0.0 | 9.5 |
| Lane LOS | | A | | A |
| Approach Delay (s/veh) | 0.0 | 0.4 | | 9.5 |
| Approach LOS | | | | A |

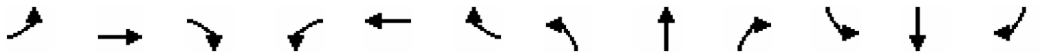
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.4 | | |
| Intersection Capacity Utilization | 16.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 2 | 31 | 397 | 8 | 7 | 601 |
| Future Volume (Veh/h) | 2 | 31 | 397 | 8 | 7 | 601 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Hourly flow rate (vph) | 2 | 32 | 405 | 8 | 7 | 613 |
| Pedestrians | 15 | | | | | |
| Lane Width (ft) | 12.0 | | | | | |
| Walking Speed (ft/s) | 4.0 | | | | | |
| Percent Blockage | 1 | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 642 | 222 | | | 428 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 642 | 222 | | | 428 | |
| tC, single (s) | 6.9 | 7.0 | | | 4.2 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 99 | 96 | | | 99 | |
| cM capacity (veh/h) | 397 | 769 | | | 1107 | |

| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|
| Volume Total | 34 | 270 | 143 | 7 | 204 | 204 | 204 |
| Volume Left | 2 | 0 | 0 | 7 | 0 | 0 | 0 |
| Volume Right | 32 | 0 | 8 | 0 | 0 | 0 | 0 |
| cSH | 729 | 1700 | 1700 | 1107 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.05 | 0.16 | 0.08 | 0.01 | 0.12 | 0.12 | 0.12 |
| Queue Length 95th (ft) | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 10.2 | 0.0 | 0.0 | 8.3 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | | | A | | | |
| Approach Delay (s/veh) | 10.2 | 0.0 | | 0.1 | | | |
| Approach LOS | B | | | | | | |

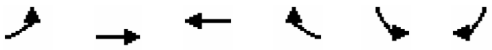
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.4 | | |
| Intersection Capacity Utilization | Err% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 42 | 0 | 70 | 0 | 0 | 3 | 31 | 57 | 0 | 4 | 84 | 36 |
| Future Volume (Veh/h) | 42 | 0 | 70 | 0 | 0 | 3 | 31 | 57 | 0 | 4 | 84 | 36 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 45 | 0 | 74 | 0 | 0 | 3 | 33 | 61 | 0 | 4 | 89 | 38 |
| Pedestrians | | 3 | | | | | | 1 | | | | |
| Lane Width (ft) | | 13.0 | | | | | | 13.0 | | | | |
| Walking Speed (ft/s) | | 4.0 | | | | | | 4.0 | | | | |
| Percent Blockage | | 0 | | | | | | 0 | | | | |
| Right turn flare (veh) | | | 8 | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | 144 | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 230 | 227 | 93 | 225 | 265 | 61 | 130 | | | 61 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 230 | 227 | 93 | 225 | 265 | 61 | 130 | | | 61 | | |
| tC, single (s) | 7.2 | 6.6 | 6.2 | 7.2 | 6.6 | 6.2 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 94 | 100 | 92 | 100 | 100 | 100 | 98 | | | 100 | | |
| cM capacity (veh/h) | 699 | 648 | 952 | 653 | 617 | 996 | 1433 | | | 1523 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|
| Volume Total | 119 | 3 | 33 | 61 | 4 | 89 | 38 |
| Volume Left | 45 | 0 | 33 | 0 | 4 | 0 | 0 |
| Volume Right | 74 | 3 | 0 | 0 | 0 | 0 | 38 |
| cSH | 1532 | 996 | 1433 | 1700 | 1523 | 1700 | 1700 |
| Volume to Capacity | 0.08 | 0.00 | 0.02 | 0.04 | 0.00 | 0.05 | 0.02 |
| Queue Length 95th (ft) | 6 | 0 | 2 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 9.6 | 8.6 | 7.6 | 0.0 | 7.4 | 0.0 | 0.0 |
| Lane LOS | A | A | A | | A | | |
| Approach Delay (s/veh) | 9.6 | 8.6 | 2.7 | | 0.2 | | |
| Approach LOS | A | A | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 4.2 | | | |
| Intersection Capacity Utilization | 24.2% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 1010 | 746 | 21 | 0 | 63 |
| Future Volume (Veh/h) | 0 | 1010 | 746 | 21 | 0 | 63 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 0 | 1074 | 794 | 22 | 0 | 67 |
| Pedestrians | | | | | 14 | |
| Lane Width (ft) | | | | | 12.0 | |
| Walking Speed (ft/s) | | | | | 4.0 | |
| Percent Blockage | | | | | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | 526 | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 830 | | | | 1177 | 290 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 830 | | | | 1177 | 290 |
| tC, single (s) | 4.2 | | | | 6.9 | 7.0 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 100 | 90 |
| cM capacity (veh/h) | 782 | | | | 180 | 696 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | SB 1 |
|---|---|---|---|---|---|---|---|
| Volume Total | 358 | 358 | 358 | 318 | 318 | 181 | 67 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 22 | 67 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 696 |
| Volume to Capacity | 0.21 | 0.21 | 0.21 | 0.19 | 0.19 | 0.11 | 0.10 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| Control Delay (s/veh) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 10.7 |
| Lane LOS | | | | | | | B |
| Approach Delay (s/veh) | 0.0 | | | 0.0 | | | 10.7 |
| Approach LOS | | | | | | | B |

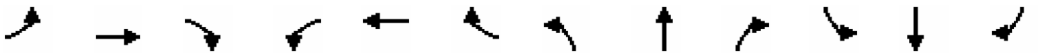
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.4 | | |
| Intersection Capacity Utilization | 25.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 85 | 0 | 1467 | 1387 | 35 |
| Future Volume (Veh/h) | 0 | 85 | 0 | 1467 | 1387 | 35 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Hourly flow rate (vph) | 0 | 89 | 0 | 1528 | 1445 | 36 |
| Pedestrians | 17 | | | | | |
| Lane Width (ft) | 12.0 | | | | | |
| Walking Speed (ft/s) | 4.0 | | | | | |
| Percent Blockage | 1 | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | 647 | 189 | |
| pX, platoon unblocked | 0.91 | 0.85 | 0.85 | | | |
| vC, conflicting volume | 1844 | 499 | 1498 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 489 | 0 | 972 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 100 | 90 | 100 | | | |
| cM capacity (veh/h) | 459 | 912 | 596 | | | |

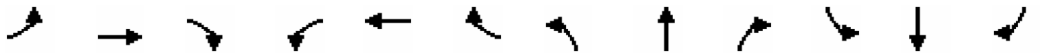
| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | NB 4 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 89 | 218 | 437 | 437 | 437 | 482 | 482 | 482 | 36 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 89 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 |
| cSH | 912 | 596 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.10 | 0.00 | 0.26 | 0.26 | 0.26 | 0.28 | 0.28 | 0.28 | 0.02 |
| Queue Length 95th (ft) | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 9.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | | | | | | | |
| Approach Delay (s/veh) | 9.4 | 0.0 | | | | 0.0 | | | |
| Approach LOS | A | | | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 0.3 | | | |
| Intersection Capacity Utilization | 38.7% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



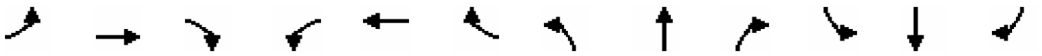
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 380 | 267 | 363 | 147 | 163 | 65 | 376 | 1069 | 130 | 130 | 983 | 305 |
| Future Volume (vph) | 380 | 267 | 363 | 147 | 163 | 65 | 376 | 1069 | 130 | 130 | 983 | 305 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.95 | 1.00 | 0.97 | 0.95 | | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 3505 | 1529 | 3400 | 3341 | | 3400 | 5036 | 1544 | 3400 | 5036 | 1545 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 3505 | 1529 | 3400 | 3341 | | 3400 | 5036 | 1544 | 3400 | 5036 | 1545 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 396 | 278 | 378 | 153 | 170 | 68 | 392 | 1114 | 135 | 135 | 1024 | 318 |
| RTOR Reduction (vph) | 0 | 0 | 279 | 0 | 39 | 0 | 0 | 0 | 75 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 396 | 278 | 99 | 153 | 199 | 0 | 392 | 1114 | 60 | 135 | 1024 | 318 |
| Confl. Peds. (#/hr) | | | 13 | | | 1 | | | 3 | | | 10 |
| Confl. Bikes (#/hr) | | | | | | 1 | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Prot | NA | Perm | Prot | NA | Free |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | 8 | | | | | | 6 | | | Free |
| Actuated Green, G (s) | 17.7 | 29.9 | 29.9 | 10.5 | 22.7 | | 21.0 | 51.9 | 51.9 | 8.9 | 39.8 | 120.0 |
| Effective Green, g (s) | 17.7 | 31.3 | 31.3 | 10.5 | 24.1 | | 21.0 | 53.3 | 53.3 | 8.9 | 41.2 | 120.0 |
| Actuated g/C Ratio | 0.15 | 0.26 | 0.26 | 0.09 | 0.20 | | 0.18 | 0.44 | 0.44 | 0.07 | 0.34 | 1.00 |
| Clearance Time (s) | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 501 | 914 | 398 | 297 | 670 | | 595 | 2236 | 685 | 252 | 1729 | 1545 |
| v/s Ratio Prot | c0.12 | c0.08 | | c0.05 | 0.06 | | c0.12 | 0.22 | | 0.04 | c0.20 | |
| v/s Ratio Perm | | | 0.06 | | | | | | 0.04 | | | 0.21 |
| v/c Ratio | 0.79 | 0.30 | 0.25 | 0.52 | 0.30 | | 0.66 | 0.50 | 0.09 | 0.54 | 0.59 | 0.21 |
| Uniform Delay, d1 | 49.4 | 35.6 | 35.0 | 52.3 | 40.7 | | 46.2 | 23.8 | 19.3 | 53.6 | 32.5 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.93 | 2.32 | 0.79 | 0.76 | 1.00 |
| Incremental Delay, d2 | 7.8 | 0.1 | 0.1 | 0.6 | 0.1 | | 1.8 | 0.7 | 0.2 | 1.0 | 1.4 | 0.3 |
| Delay (s) | 57.1 | 35.7 | 35.2 | 52.9 | 40.8 | | 47.9 | 22.9 | 45.0 | 43.4 | 26.0 | 0.3 |
| Level of Service | E | D | D | D | D | | D | C | D | D | C | A |
| Approach Delay (s/veh) | | 43.6 | | | 45.6 | | | 30.7 | | | 22.0 | |
| Approach LOS | | D | | | D | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 32.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.59 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 64.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 107 | 5 | 56 | 3 | 1 | 6 | 47 | 1417 | 3 | 32 | 1353 | 44 |
| Future Volume (vph) | 107 | 5 | 56 | 3 | 1 | 6 | 47 | 1417 | 3 | 32 | 1353 | 44 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 5.4 |
| Lane Util. Factor | 0.95 | 0.95 | 1.00 | | 1.00 | | 1.00 | 0.91 | 1.00 | 1.00 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.96 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | | 0.92 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 0.96 | 1.00 | | 0.99 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1665 | 1676 | 1546 | | 1669 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1510 |
| Flt Permitted | 0.75 | 0.74 | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1316 | 1291 | 1546 | | 1694 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1510 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 114 | 5 | 60 | 3 | 1 | 6 | 50 | 1507 | 3 | 34 | 1439 | 47 |
| RTOR Reduction (vph) | 0 | 0 | 53 | 0 | 6 | 0 | 0 | 0 | 1 | 0 | 0 | 18 |
| Lane Group Flow (vph) | 59 | 60 | 7 | 0 | 4 | 0 | 50 | 1507 | 2 | 34 | 1439 | 29 |
| Confl. Peds. (#/hr) | | | 2 | 2 | | | | | 1 | | | 14 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 7 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | 3 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 3 | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 12.6 | 12.6 | 12.6 | | 1.4 | | 14.4 | 83.0 | 83.0 | 4.7 | 73.3 | 73.3 |
| Effective Green, g (s) | 13.3 | 13.3 | 13.3 | | 1.6 | | 14.4 | 84.4 | 84.4 | 4.7 | 74.7 | 73.3 |
| Actuated g/C Ratio | 0.11 | 0.11 | 0.11 | | 0.01 | | 0.12 | 0.70 | 0.70 | 0.04 | 0.62 | 0.61 |
| Clearance Time (s) | 4.7 | 4.7 | 4.7 | | 4.2 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 145 | 143 | 171 | | 22 | | 210 | 3541 | 1076 | 68 | 3134 | 922 |
| v/s Ratio Prot | | | | | | | 0.03 | c0.30 | | 0.02 | c0.29 | |
| v/s Ratio Perm | 0.04 | c0.05 | 0.00 | | c0.00 | | | | 0.00 | | | 0.02 |
| v/c Ratio | 0.41 | 0.42 | 0.04 | | 0.19 | | 0.24 | 0.43 | 0.00 | 0.50 | 0.46 | 0.03 |
| Uniform Delay, d1 | 49.7 | 49.8 | 47.6 | | 58.6 | | 47.8 | 7.5 | 5.3 | 56.5 | 12.0 | 9.3 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.20 | 1.70 | 1.00 | 1.13 | 0.47 | 1.00 |
| Incremental Delay, d2 | 0.7 | 0.7 | 0.0 | | 1.5 | | 0.2 | 0.3 | 0.0 | 1.9 | 0.4 | 0.1 |
| Delay (s) | 50.4 | 50.5 | 47.7 | | 60.0 | | 57.4 | 13.2 | 5.3 | 65.8 | 6.1 | 9.3 |
| Level of Service | D | D | D | | E | | E | B | A | E | A | A |
| Approach Delay (s/veh) | | 49.5 | | | 60.0 | | | 14.6 | | | 7.6 | |
| Approach LOS | | D | | | E | | | B | | | A | |

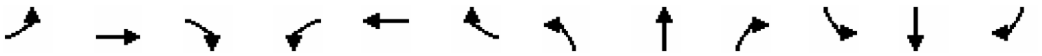
| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 13.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.46 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 51.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 0 | 482 | 0 | 257 | 0 | 1256 | 506 | 0 | 1363 | 758 |
| Future Volume (vph) | 0 | 0 | 0 | 482 | 0 | 257 | 0 | 1256 | 506 | 0 | 1363 | 758 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 4.0 | | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | | | | 0.97 | | 0.88 | | 0.95 | 1.00 | | 0.91 | 0.88 |
| Frpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 0.98 | | 1.00 | 0.98 |
| Flpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | | | 1.00 | | 0.85 | | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | 3400 | | 2760 | | 3505 | 1535 | | 5036 | 2703 |
| Flt Permitted | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | 3400 | | 2760 | | 3505 | 1535 | | 5036 | 2703 |
| Peak-hour factor, PHF | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 |
| Adj. Flow (vph) | 0 | 0 | 0 | 487 | 0 | 260 | 0 | 1269 | 511 | 0 | 1377 | 766 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 68 | 0 | 0 | 212 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 487 | 0 | 192 | 0 | 1269 | 299 | 0 | 1377 | 766 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | 1 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | | | | Prot | | Perm | | NA | Perm | | NA | Free |
| Protected Phases | | | | 4 | | | | 6 | | | 2 | |
| Permitted Phases | | | | 4 | | 4 | | | 6 | | | Free |
| Actuated Green, G (s) | | | | 15.5 | | 15.5 | | 33.2 | 33.2 | | 33.2 | 60.0 |
| Effective Green, g (s) | | | | 16.9 | | 16.9 | | 35.1 | 35.1 | | 35.1 | 60.0 |
| Actuated g/C Ratio | | | | 0.28 | | 0.28 | | 0.59 | 0.59 | | 0.59 | 1.00 |
| Clearance Time (s) | | | | 5.4 | | 5.4 | | 5.9 | 5.9 | | 5.9 | |
| Vehicle Extension (s) | | | | 5.0 | | 5.0 | | 5.0 | 5.0 | | 5.0 | |
| Lane Grp Cap (vph) | | | | 957 | | 777 | | 2050 | 897 | | 2946 | 2703 |
| v/s Ratio Prot | | | | c0.14 | | | | c0.36 | | | 0.27 | |
| v/s Ratio Perm | | | | | | 0.07 | | | 0.19 | | | 0.28 |
| v/c Ratio | | | | 0.51 | | 0.25 | | 0.62 | 0.33 | | 0.47 | 0.28 |
| Uniform Delay, d1 | | | | 18.1 | | 16.6 | | 8.1 | 6.4 | | 7.1 | 0.0 |
| Progression Factor | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | | | 0.9 | | 0.3 | | 1.4 | 1.0 | | 0.5 | 0.3 |
| Delay (s) | | | | 19.0 | | 17.0 | | 9.5 | 7.4 | | 7.6 | 0.3 |
| Level of Service | | | | B | | B | | A | A | | A | A |
| Approach Delay (s/veh) | | 0.0 | | | 18.3 | | | 8.9 | | | 5.0 | |
| Approach LOS | | A | | | B | | | A | | | A | |

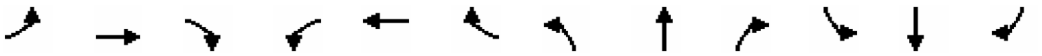
| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 8.6 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 55.1% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



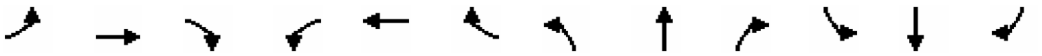
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 395 | 134 | 217 | 130 | 0 | 227 | 0 | 1138 | 106 | 243 | 1173 | 458 |
| Future Volume (vph) | 395 | 134 | 217 | 130 | 0 | 227 | 0 | 1138 | 106 | 243 | 1173 | 458 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | | 3.1 | | 4.0 | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 0.97 | | 0.88 | | 0.86 | | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 0.96 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | | 0.85 | | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6258 | | 1752 | 3505 | 1500 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6258 | | 1752 | 3505 | 1500 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 407 | 138 | 224 | 134 | 0 | 234 | 0 | 1173 | 109 | 251 | 1209 | 472 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 177 |
| Lane Group Flow (vph) | 407 | 138 | 224 | 134 | 0 | 234 | 0 | 1272 | 0 | 251 | 1209 | 295 |
| Confl. Peds. (#/hr) | | | 5 | | | 2 | 5 | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | 1 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | | pt+ov | | NA | | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | | 4 5 | | 6 | | 5 | 2 | |
| Permitted Phases | | | Free | | | | | | | | | 2 |
| Actuated Green, G (s) | 18.7 | 15.5 | 120.0 | 15.7 | | 37.9 | | 48.6 | | 20.9 | 73.5 | 73.5 |
| Effective Green, g (s) | 20.1 | 16.9 | 120.0 | 16.2 | | 39.3 | | 50.0 | | 20.9 | 74.9 | 74.9 |
| Actuated g/C Ratio | 0.17 | 0.14 | 1.00 | 0.13 | | 0.33 | | 0.42 | | 0.17 | 0.62 | 0.62 |
| Clearance Time (s) | 5.4 | 5.4 | | 4.5 | | | | 5.4 | | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | | 1.8 | | | | 5.0 | | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 569 | 259 | 1547 | 459 | | 903 | | 2607 | | 305 | 2187 | 936 |
| v/s Ratio Prot | c0.12 | 0.07 | | c0.04 | | 0.08 | | 0.20 | | c0.14 | c0.34 | |
| v/s Ratio Perm | | | c0.14 | | | | | | | | | 0.20 |
| v/c Ratio | 0.72 | 0.53 | 0.14 | 0.29 | | 0.26 | | 0.49 | | 0.82 | 0.55 | 0.31 |
| Uniform Delay, d1 | 47.2 | 47.9 | 0.0 | 46.7 | | 29.7 | | 25.6 | | 47.8 | 12.9 | 10.5 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.83 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 3.6 | 1.1 | 0.2 | 0.1 | | 0.1 | | 0.6 | | 15.5 | 1.0 | 0.9 |
| Delay (s) | 50.8 | 48.9 | 0.2 | 46.9 | | 29.7 | | 21.8 | | 63.3 | 14.0 | 11.4 |
| Level of Service | D | D | A | D | | C | | C | | E | B | B |
| Approach Delay (s/veh) | | 35.7 | | | 36.0 | | | 21.8 | | | 19.7 | |
| Approach LOS | | D | | | D | | | C | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 24.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.62 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 59.0% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 333 | 357 | 30 | 145 | 206 | 600 | 16 | 617 | 112 | 454 | 416 | 186 |
| Future Volume (vph) | 333 | 357 | 30 | 145 | 206 | 600 | 16 | 617 | 112 | 454 | 416 | 186 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 5036 | 1544 | 3400 | 5036 | 1549 | 3400 | 5036 | 1547 | 3400 | 5036 | 1547 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 5036 | 1544 | 3400 | 5036 | 1549 | 3400 | 5036 | 1547 | 3400 | 5036 | 1547 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 358 | 384 | 32 | 156 | 222 | 645 | 17 | 663 | 120 | 488 | 447 | 200 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 358 | 384 | 32 | 156 | 222 | 645 | 17 | 663 | 120 | 488 | 447 | 200 |
| Confl. Peds. (#/hr) | | | 10 | | | 1 | | | 5 | | | 4 |
| Confl. Bikes (#/hr) | | | 2 | | | | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 4 | | 3 | 8 | |
| Permitted Phases | | | Free | | | Free | | | Free | | | Free |
| Actuated Green, G (s) | 14.7 | 17.2 | 84.1 | 9.2 | 11.7 | 84.1 | 1.8 | 20.8 | 84.1 | 17.9 | 36.9 | 84.1 |
| Effective Green, g (s) | 14.7 | 18.9 | 84.1 | 9.2 | 13.4 | 84.1 | 1.8 | 22.1 | 84.1 | 17.9 | 38.2 | 84.1 |
| Actuated g/C Ratio | 0.17 | 0.22 | 1.00 | 0.11 | 0.16 | 1.00 | 0.02 | 0.26 | 1.00 | 0.21 | 0.45 | 1.00 |
| Clearance Time (s) | 4.0 | 5.7 | | 4.0 | 5.7 | | 4.0 | 5.3 | | 4.0 | 5.3 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 594 | 1131 | 1544 | 371 | 802 | 1549 | 72 | 1323 | 1547 | 723 | 2287 | 1547 |
| v/s Ratio Prot | c0.11 | 0.08 | | 0.05 | 0.04 | | 0.01 | c0.13 | | c0.14 | 0.09 | |
| v/s Ratio Perm | | | 0.02 | | | c0.42 | | | 0.08 | | | 0.13 |
| v/c Ratio | 0.60 | 0.34 | 0.02 | 0.42 | 0.28 | 0.42 | 0.24 | 0.50 | 0.08 | 0.67 | 0.20 | 0.13 |
| Uniform Delay, d1 | 32.0 | 27.4 | 0.0 | 35.0 | 31.1 | 0.0 | 40.5 | 26.3 | 0.0 | 30.4 | 13.7 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 1.2 | 0.1 | 0.0 | 0.3 | 0.1 | 0.8 | 0.6 | 0.1 | 0.1 | 2.0 | 0.0 | 0.2 |
| Delay (s) | 33.2 | 27.4 | 0.0 | 35.2 | 31.2 | 0.8 | 41.1 | 26.4 | 0.1 | 32.4 | 13.8 | 0.2 |
| Level of Service | C | C | A | D | C | A | D | C | A | C | B | A |
| Approach Delay (s/veh) | | 29.0 | | | 12.7 | | | 22.8 | | | 19.4 | |
| Approach LOS | | C | | | B | | | C | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 20.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 84.1 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 57.6% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 70 | 644 | 549 | 201 | 211 | 196 | 255 | 1144 | 254 | 265 | 1222 | 42 |
| Future Volume (vph) | 70 | 644 | 549 | 201 | 211 | 196 | 255 | 1144 | 254 | 265 | 1222 | 42 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1752 | 5036 | 1547 | 3400 | 3505 | 1537 | 3400 | 5036 | 1541 | 3400 | 5007 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1752 | 5036 | 1547 | 3400 | 3505 | 1537 | 3400 | 5036 | 1541 | 3400 | 5007 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 71 | 657 | 560 | 205 | 215 | 200 | 260 | 1167 | 259 | 270 | 1247 | 43 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 147 | 0 | 0 | 130 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 71 | 657 | 560 | 205 | 215 | 53 | 260 | 1167 | 129 | 270 | 1288 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 7 | | | 5 | | | 5 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | | | | 9 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Perm | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | Free | | | 8 | | | 2 | | | |
| Actuated Green, G (s) | 7.3 | 25.7 | 120.0 | 11.8 | 30.2 | 30.2 | 13.3 | 49.7 | 49.7 | 14.0 | 50.4 | |
| Effective Green, g (s) | 7.3 | 27.1 | 120.0 | 11.8 | 31.6 | 31.6 | 13.3 | 51.1 | 51.1 | 14.0 | 51.8 | |
| Actuated g/C Ratio | 0.06 | 0.23 | 1.00 | 0.10 | 0.26 | 0.26 | 0.11 | 0.43 | 0.43 | 0.12 | 0.43 | |
| Clearance Time (s) | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 5.0 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 106 | 1137 | 1547 | 334 | 922 | 404 | 376 | 2144 | 656 | 396 | 2161 | |
| v/s Ratio Prot | 0.04 | c0.13 | | c0.06 | 0.06 | | c0.08 | 0.23 | | 0.08 | c0.26 | |
| v/s Ratio Perm | | | 0.36 | | | 0.03 | | | 0.08 | | | |
| v/c Ratio | 0.67 | 0.58 | 0.36 | 0.61 | 0.23 | 0.13 | 0.69 | 0.54 | 0.20 | 0.68 | 0.60 | |
| Uniform Delay, d1 | 55.2 | 41.4 | 0.0 | 51.9 | 34.7 | 33.7 | 51.4 | 25.7 | 21.6 | 50.9 | 26.1 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.26 | 1.52 | |
| Incremental Delay, d2 | 11.7 | 1.1 | 0.7 | 2.3 | 0.3 | 0.3 | 4.4 | 1.0 | 0.7 | 3.3 | 1.0 | |
| Delay (s) | 66.9 | 42.5 | 0.7 | 54.3 | 35.0 | 34.0 | 55.8 | 26.7 | 22.3 | 67.3 | 40.6 | |
| Level of Service | E | D | A | D | C | C | E | C | C | E | D | |
| Approach Delay (s/veh) | | 25.7 | | | 41.0 | | | 30.5 | | | 45.2 | |
| Approach LOS | | C | | | D | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 35.0 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.61 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 70.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 0 | 0 | 8 | 30 | 1 | 120 | 12 | 650 | 19 | 140 | 420 | 2 |
| Future Volume (Veh/h) | 0 | 0 | 8 | 30 | 1 | 120 | 12 | 650 | 19 | 140 | 420 | 2 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 |
| Hourly flow rate (vph) | 0 | 0 | 9 | 35 | 1 | 140 | 14 | 756 | 22 | 163 | 488 | 2 |
| Pedestrians | | 9 | | | 10 | | | | | | 11 | |
| Lane Width (ft) | | 12.0 | | | 12.0 | | | | | | 13.0 | |
| Walking Speed (ft/s) | | 4.0 | | | 4.0 | | | | | | 4.0 | |
| Percent Blockage | | 1 | | | 1 | | | | | | 1 | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 1382 | 1640 | 254 | 1384 | 1630 | 410 | 499 | | | 788 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 1382 | 1640 | 254 | 1384 | 1630 | 410 | 499 | | | 788 | | |
| tC, single (s) | 7.6 | 6.6 | 7.0 | 7.6 | 6.6 | 7.0 | 4.2 | | | 4.2 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 100 | 100 | 99 | 58 | 99 | 76 | 99 | | | 80 | | |
| cM capacity (veh/h) | 62 | 76 | 737 | 83 | 77 | 577 | 1046 | | | 814 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|
| Volume Total | 9 | 176 | 14 | 504 | 274 | 163 | 325 | 165 |
| Volume Left | 0 | 35 | 14 | 0 | 0 | 163 | 0 | 0 |
| Volume Right | 9 | 140 | 0 | 0 | 22 | 0 | 0 | 2 |
| cSH | 737 | 259 | 1046 | 1700 | 1700 | 814 | 1700 | 1700 |
| Volume to Capacity | 0.01 | 0.68 | 0.01 | 0.30 | 0.16 | 0.20 | 0.19 | 0.10 |
| Queue Length 95th (ft) | 1 | 111 | 1 | 0 | 0 | 19 | 0 | 0 |
| Control Delay (s/veh) | 9.9 | 43.9 | 8.5 | 0.0 | 0.0 | 10.5 | 0.0 | 0.0 |
| Lane LOS | A | E | A | | | B | | |
| Approach Delay (s/veh) | 9.9 | 43.9 | 0.2 | | | 2.6 | | |
| Approach LOS | A | E | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 5.9 | | | |
| Intersection Capacity Utilization | 53.0% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 130 | 14 | 5 | 130 | 19 | 8 |
| Future Volume (Veh/h) | 130 | 14 | 5 | 130 | 19 | 8 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 141 | 15 | 5 | 141 | 21 | 9 |
| Pedestrians | 1 | | | 2 | 10 | |
| Lane Width (ft) | 12.0 | | | 12.0 | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | 4.0 | 4.0 | |
| Percent Blockage | 0 | | | 0 | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 166 | | 311 | 161 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 166 | | 311 | 161 |
| tC, single (s) | | | 4.2 | | 6.5 | 6.3 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.3 | | 3.6 | 3.4 |
| p0 queue free % | | | 100 | | 97 | 99 |
| cM capacity (veh/h) | | | 1377 | | 665 | 865 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 156 | 5 | 141 | 30 |
| Volume Left | 0 | 5 | 0 | 21 |
| Volume Right | 15 | 0 | 0 | 9 |
| cSH | 1700 | 1377 | 1700 | 715 |
| Volume to Capacity | 0.09 | 0.00 | 0.08 | 0.04 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 3 |
| Control Delay (s/veh) | 0.0 | 7.6 | 0.0 | 10.3 |
| Lane LOS | | A | | B |
| Approach Delay (s/veh) | 0.0 | 0.3 | | 10.3 |
| Approach LOS | | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.0 | | |
| Intersection Capacity Utilization | 20.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 120 | 36 | 19 | 130 | 20 | 25 |
| Future Volume (Veh/h) | 120 | 36 | 19 | 130 | 20 | 25 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 |
| Hourly flow rate (vph) | 140 | 42 | 22 | 151 | 23 | 29 |
| Pedestrians | 2 | | | 6 | 4 | |
| Lane Width (ft) | 12.0 | | | 12.0 | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | 4.0 | 4.0 | |
| Percent Blockage | 0 | | | 1 | 0 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 186 | | 362 | 171 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 186 | | 362 | 171 |
| tC, single (s) | | | 4.1 | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.2 | | 3.5 | 3.3 |
| p0 queue free % | | | 98 | | 96 | 97 |
| cM capacity (veh/h) | | | 1366 | | 618 | 858 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 182 | 22 | 151 | 52 |
| Volume Left | 0 | 22 | 0 | 23 |
| Volume Right | 42 | 0 | 0 | 29 |
| cSH | 1700 | 1366 | 1700 | 732 |
| Volume to Capacity | 0.11 | 0.02 | 0.09 | 0.07 |
| Queue Length 95th (ft) | 0 | 1 | 0 | 6 |
| Control Delay (s/veh) | 0.0 | 7.7 | 0.0 | 10.3 |
| Lane LOS | | A | | B |
| Approach Delay (s/veh) | 0.0 | 1.0 | | 10.3 |
| Approach LOS | | | | B |

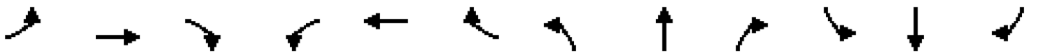
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.7 | | |
| Intersection Capacity Utilization | 27.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 11 | 820 | 25 | 20 | 440 |
| Future Volume (Veh/h) | 0 | 11 | 820 | 25 | 20 | 440 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 |
| Hourly flow rate (vph) | 0 | 13 | 1000 | 30 | 24 | 537 |
| Pedestrians | 14 | | | | | 1 |
| Lane Width (ft) | 12.0 | | | | | 12.0 |
| Walking Speed (ft/s) | 4.0 | | | | | 4.0 |
| Percent Blockage | 1 | | | | | 0 |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1256 | 530 | | | 1044 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 1256 | 530 | | | 1044 | |
| tC, single (s) | 6.9 | 7.0 | | | 4.2 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 100 | 97 | | | 96 | |
| cM capacity (veh/h) | 154 | 485 | | | 648 | |

| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|
| Volume Total | 13 | 667 | 363 | 24 | 179 | 179 | 179 |
| Volume Left | 0 | 0 | 0 | 24 | 0 | 0 | 0 |
| Volume Right | 13 | 0 | 30 | 0 | 0 | 0 | 0 |
| cSH | 485 | 1700 | 1700 | 648 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.03 | 0.39 | 0.21 | 0.04 | 0.11 | 0.11 | 0.11 |
| Queue Length 95th (ft) | 2 | 0 | 0 | 3 | 0 | 0 | 0 |
| Control Delay (s/veh) | 12.6 | 0.0 | 0.0 | 10.8 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | | | B | | | |
| Approach Delay (s/veh) | 12.6 | 0.0 | | 0.5 | | | |
| Approach LOS | B | | | | | | |

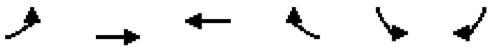
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.3 | | |
| Intersection Capacity Utilization | 33.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 20 | 0 | 120 | 0 | 0 | 0 | 90 | 200 | 0 | 0 | 350 | 40 |
| Future Volume (Veh/h) | 20 | 0 | 120 | 0 | 0 | 0 | 90 | 200 | 0 | 0 | 350 | 40 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 |
| Hourly flow rate (vph) | 25 | 0 | 148 | 0 | 0 | 0 | 111 | 247 | 0 | 0 | 432 | 49 |
| Pedestrians | | 21 | | | 1 | | | 1 | | | | |
| Lane Width (ft) | | 13.0 | | | 12.0 | | | 13.0 | | | | |
| Walking Speed (ft/s) | | 4.0 | | | 4.0 | | | 4.0 | | | | |
| Percent Blockage | | 2 | | | 0 | | | 0 | | | | |
| Right turn flare (veh) | | | 8 | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | 144 | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 922 | 923 | 454 | 903 | 972 | 248 | 502 | | | 248 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 922 | 923 | 454 | 903 | 972 | 248 | 502 | | | 248 | | |
| tC, single (s) | 7.2 | 6.6 | 6.2 | 7.2 | 6.6 | 6.2 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 89 | 100 | 75 | 100 | 100 | 100 | 89 | | | 100 | | |
| cM capacity (veh/h) | 219 | 233 | 588 | 172 | 218 | 783 | 1027 | | | 1299 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|
| Volume Total | 173 | 0 | 111 | 247 | 0 | 432 | 49 |
| Volume Left | 25 | 0 | 111 | 0 | 0 | 0 | 0 |
| Volume Right | 148 | 0 | 0 | 0 | 0 | 0 | 49 |
| cSH | 687 | 1700 | 1027 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.25 | 0.00 | 0.11 | 0.15 | 0.00 | 0.25 | 0.03 |
| Queue Length 95th (ft) | 25 | 0 | 9 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 14.7 | 0.0 | 8.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | A | A | | | | |
| Approach Delay (s/veh) | 14.7 | 0.0 | 2.8 | | 0.0 | | |
| Approach LOS | B | A | | | | | |

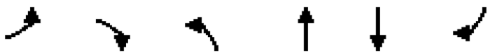
| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 3.5 | | | |
| Intersection Capacity Utilization | 37.1% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | ↑↑↑ | | | ↱ |
| Traffic Volume (veh/h) | 0 | 840 | 1480 | 66 | 0 | 36 |
| Future Volume (Veh/h) | 0 | 840 | 1480 | 66 | 0 | 36 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 0 | 913 | 1609 | 72 | 0 | 39 |
| Pedestrians | | | | | 24 | |
| Lane Width (ft) | | | | | 12.0 | |
| Walking Speed (ft/s) | | | | | 4.0 | |
| Percent Blockage | | | | | 2 | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | 526 | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1705 | | | | 1973 | 596 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 1705 | | | | 1973 | 596 |
| tC, single (s) | 4.2 | | | | 6.9 | 7.0 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 100 | 91 |
| cM capacity (veh/h) | 357 | | | | 53 | 435 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | SB 1 |
|---|---|---|---|---|---|---|---|
| Volume Total | 304 | 304 | 304 | 644 | 644 | 394 | 39 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 72 | 39 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 435 |
| Volume to Capacity | 0.18 | 0.18 | 0.18 | 0.38 | 0.38 | 0.23 | 0.09 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| Control Delay (s/veh) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14.1 |
| Lane LOS | | | | | | | B |
| Approach Delay (s/veh) | 0.0 | | | 0.0 | | | 14.1 |
| Approach LOS | | | | | | | B |

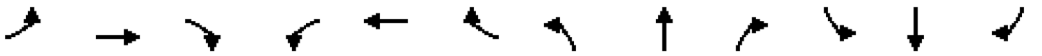
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.2 | | |
| Intersection Capacity Utilization | 40.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 21 | 0 | 1330 | 1890 | 125 |
| Future Volume (Veh/h) | 0 | 21 | 0 | 1330 | 1890 | 125 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Hourly flow rate (vph) | 0 | 21 | 0 | 1357 | 1929 | 128 |
| Pedestrians | 21 | | | | | |
| Lane Width (ft) | 12.0 | | | | | |
| Walking Speed (ft/s) | 4.0 | | | | | |
| Percent Blockage | 2 | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | 647 | 189 | |
| pX, platoon unblocked | 0.79 | 0.74 | 0.74 | | | |
| vC, conflicting volume | 2289 | 664 | 2078 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 607 | 0 | 1219 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 100 | 97 | 100 | | | |
| cM capacity (veh/h) | 334 | 789 | 416 | | | |

| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | NB 4 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 21 | 194 | 388 | 388 | 388 | 643 | 643 | 643 | 128 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 128 |
| cSH | 789 | 416 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.03 | 0.00 | 0.23 | 0.23 | 0.23 | 0.38 | 0.38 | 0.38 | 0.08 |
| Queue Length 95th (ft) | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 9.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | | | | | | | |
| Approach Delay (s/veh) | 9.7 | 0.0 | | | | 0.0 | | | |
| Approach LOS | A | | | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 0.1 | | | |
| Intersection Capacity Utilization | 46.5% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |

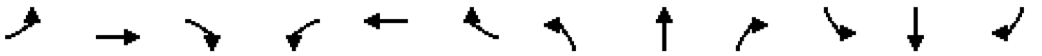


| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 310 | 280 | 250 | 210 | 350 | 70 | 550 | 950 | 120 | 90 | 1190 | 640 |
| Future Volume (vph) | 310 | 280 | 250 | 210 | 350 | 70 | 550 | 950 | 120 | 90 | 1190 | 640 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.95 | 1.00 | 0.97 | 0.95 | | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.91 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.94 | 1.00 | 1.00 | 0.98 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 3505 | 1429 | 3400 | 3398 | | 3400 | 5036 | 1480 | 3400 | 5036 | 1544 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 3505 | 1429 | 3400 | 3398 | | 3400 | 5036 | 1480 | 3400 | 5036 | 1544 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 330 | 298 | 266 | 223 | 372 | 74 | 585 | 1011 | 128 | 96 | 1266 | 681 |
| RTOR Reduction (vph) | 0 | 0 | 196 | 0 | 14 | 0 | 0 | 0 | 73 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 330 | 298 | 70 | 223 | 432 | 0 | 585 | 1011 | 55 | 96 | 1266 | 681 |
| Confl. Peds. (#/hr) | | | 74 | | | 15 | | | 40 | | | 12 |
| Confl. Bikes (#/hr) | | | 3 | | | 5 | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Prot | NA | Perm | Prot | NA | Free |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | 8 | | | | | | 6 | | | Free |
| Actuated Green, G (s) | 15.8 | 30.1 | 30.1 | 13.4 | 27.7 | | 21.0 | 50.1 | 50.1 | 7.6 | 36.7 | 120.0 |
| Effective Green, g (s) | 15.8 | 31.5 | 31.5 | 13.4 | 29.1 | | 21.0 | 51.5 | 51.5 | 7.6 | 38.1 | 120.0 |
| Actuated g/C Ratio | 0.13 | 0.26 | 0.26 | 0.11 | 0.24 | | 0.18 | 0.43 | 0.43 | 0.06 | 0.32 | 1.00 |
| Clearance Time (s) | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 447 | 920 | 375 | 379 | 824 | | 595 | 2161 | 635 | 215 | 1598 | 1544 |
| v/s Ratio Prot | c0.10 | 0.09 | | 0.07 | c0.13 | | c0.17 | 0.20 | | 0.03 | c0.25 | |
| v/s Ratio Perm | | | 0.05 | | | | | | 0.04 | | | c0.44 |
| v/c Ratio | 0.74 | 0.32 | 0.19 | 0.59 | 0.52 | | 0.98 | 0.47 | 0.09 | 0.45 | 0.79 | 0.44 |
| Uniform Delay, d1 | 50.1 | 35.7 | 34.3 | 50.7 | 39.4 | | 49.3 | 24.5 | 20.3 | 54.2 | 37.3 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 0.97 | 0.85 | 2.41 | 0.74 | 0.67 | 1.00 |
| Incremental Delay, d2 | 5.4 | 0.1 | 0.1 | 1.5 | 0.3 | | 29.2 | 0.6 | 0.2 | 0.4 | 3.4 | 0.8 |
| Delay (s) | 55.5 | 35.7 | 34.4 | 52.2 | 39.7 | | 77.0 | 21.4 | 49.3 | 40.3 | 28.3 | 0.8 |
| Level of Service | E | D | C | D | D | | E | C | D | D | C | A |
| Approach Delay (s/veh) | | 42.7 | | | 43.9 | | | 42.3 | | | 19.7 | |
| Approach LOS | | D | | | D | | | D | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 33.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.75 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 85.4% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

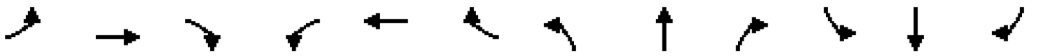
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 190 | 10 | 270 | 20 | 10 | 10 | 180 | 1130 | 20 | 20 | 1720 | 100 |
| Future Volume (vph) | 190 | 10 | 270 | 20 | 10 | 10 | 180 | 1130 | 20 | 20 | 1720 | 100 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 5.4 |
| Lane Util. Factor | 0.95 | 0.95 | 1.00 | | 1.00 | | 1.00 | 0.91 | 1.00 | 1.00 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 0.99 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 0.96 | 1.00 | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1665 | 1677 | 1513 | | 1723 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1524 |
| Flt Permitted | 0.73 | 0.72 | 1.00 | | 0.54 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1280 | 1256 | 1513 | | 954 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1524 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 196 | 10 | 278 | 21 | 10 | 10 | 186 | 1165 | 21 | 21 | 1773 | 103 |
| RTOR Reduction (vph) | 0 | 0 | 238 | 0 | 10 | 0 | 0 | 0 | 7 | 0 | 0 | 51 |
| Lane Group Flow (vph) | 102 | 104 | 40 | 0 | 31 | 0 | 186 | 1165 | 14 | 21 | 1773 | 52 |
| Confl. Peds. (#/hr) | | | 22 | 22 | | | | | 1 | | | 9 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 4 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | 3 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 3 | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 16.6 | 16.6 | 16.6 | | 5.4 | | 19.4 | 76.8 | 76.8 | 2.9 | 60.3 | 60.3 |
| Effective Green, g (s) | 17.3 | 17.3 | 17.3 | | 5.6 | | 19.4 | 78.2 | 78.2 | 2.9 | 61.7 | 60.3 |
| Actuated g/C Ratio | 0.14 | 0.14 | 0.14 | | 0.05 | | 0.16 | 0.65 | 0.65 | 0.02 | 0.51 | 0.50 |
| Clearance Time (s) | 4.7 | 4.7 | 4.7 | | 4.2 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 184 | 181 | 218 | | 44 | | 283 | 3281 | 997 | 42 | 2589 | 765 |
| v/s Ratio Prot | | | | | | | c0.11 | 0.23 | | 0.01 | c0.35 | |
| v/s Ratio Perm | 0.08 | c0.08 | 0.03 | | c0.03 | | | | 0.01 | | | 0.03 |
| v/c Ratio | 0.55 | 0.57 | 0.18 | | 0.72 | | 0.66 | 0.36 | 0.01 | 0.50 | 0.68 | 0.07 |
| Uniform Delay, d1 | 47.8 | 47.9 | 45.1 | | 56.4 | | 47.2 | 9.5 | 7.3 | 57.8 | 21.9 | 15.4 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.08 | 1.69 | 1.00 | 1.14 | 0.55 | 0.30 |
| Incremental Delay, d2 | 2.0 | 2.7 | 0.1 | | 36.7 | | 3.7 | 0.3 | 0.0 | 2.7 | 1.2 | 0.1 |
| Delay (s) | 49.8 | 50.6 | 45.3 | | 93.1 | | 54.5 | 16.3 | 7.4 | 68.8 | 13.3 | 4.7 |
| Level of Service | D | D | D | | F | | D | B | A | E | B | A |
| Approach Delay (s/veh) | | 47.4 | | | 93.1 | | | 21.3 | | | 13.4 | |
| Approach LOS | | D | | | F | | | C | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 21.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 72.5% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



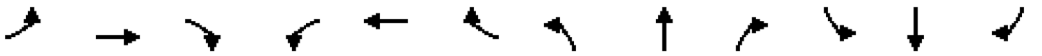
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 0 | 530 | 0 | 310 | 0 | 1450 | 420 | 0 | 1150 | 940 |
| Future Volume (vph) | 0 | 0 | 0 | 530 | 0 | 310 | 0 | 1450 | 420 | 0 | 1150 | 940 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 4.0 | | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | | | | 0.97 | | 0.88 | | 0.95 | 1.00 | | 0.91 | 0.88 |
| Frpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 0.98 | | 1.00 | 0.98 |
| Flpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | | | 1.00 | | 0.85 | | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | 3400 | | 2760 | | 3505 | 1533 | | 5036 | 2698 |
| Flt Permitted | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | 3400 | | 2760 | | 3505 | 1533 | | 5036 | 2698 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 0 | 0 | 0 | 552 | 0 | 323 | 0 | 1510 | 438 | 0 | 1198 | 979 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 38 | 0 | 0 | 185 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 552 | 0 | 285 | 0 | 1510 | 253 | 0 | 1198 | 979 |
| Confl. Peds. (#/hr) | | | | | | | 3 | | | | | 3 |
| Confl. Bikes (#/hr) | | | | | | | | | 4 | | | 2 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | | | | Prot | | Perm | | NA | Perm | | NA | Free |
| Protected Phases | | | | 4 | | | | 6 | | | 2 | |
| Permitted Phases | | | | 4 | | 4 | | | 6 | | | Free |
| Actuated Green, G (s) | | | | 16.0 | | 16.0 | | 32.7 | 32.7 | | 32.7 | 60.0 |
| Effective Green, g (s) | | | | 17.4 | | 17.4 | | 34.6 | 34.6 | | 34.6 | 60.0 |
| Actuated g/C Ratio | | | | 0.29 | | 0.29 | | 0.58 | 0.58 | | 0.58 | 1.00 |
| Clearance Time (s) | | | | 5.4 | | 5.4 | | 5.9 | 5.9 | | 5.9 | |
| Vehicle Extension (s) | | | | 5.0 | | 5.0 | | 5.0 | 5.0 | | 5.0 | |
| Lane Grp Cap (vph) | | | | 986 | | 800 | | 2021 | 884 | | 2904 | 2698 |
| v/s Ratio Prot | | | | c0.16 | | | | c0.43 | | | 0.24 | |
| v/s Ratio Perm | | | | | | 0.10 | | | 0.16 | | | 0.36 |
| v/c Ratio | | | | 0.56 | | 0.36 | | 0.75 | 0.29 | | 0.41 | 0.36 |
| Uniform Delay, d1 | | | | 18.1 | | 16.9 | | 9.4 | 6.4 | | 7.1 | 0.0 |
| Progression Factor | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | | | 1.2 | | 0.6 | | 2.6 | 0.8 | | 0.4 | 0.4 |
| Delay (s) | | | | 19.2 | | 17.4 | | 12.0 | 7.2 | | 7.5 | 0.4 |
| Level of Service | | | | B | | B | | B | A | | A | A |
| Approach Delay (s/veh) | | 0.0 | | | 18.6 | | | 10.9 | | | 4.3 | |
| Approach LOS | | A | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 9.4 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.68 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 61.9% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



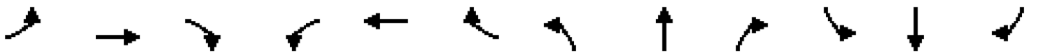
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 750 | 140 | 680 | 170 | 0 | 220 | 0 | 1750 | 80 | 160 | 1240 | 250 |
| Future Volume (vph) | 750 | 140 | 680 | 170 | 0 | 220 | 0 | 1750 | 80 | 160 | 1240 | 250 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | | 3.1 | | 4.0 | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 0.97 | | 0.88 | | 0.86 | | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | | 0.85 | | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6300 | | 1752 | 3505 | 1513 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6300 | | 1752 | 3505 | 1513 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 806 | 151 | 731 | 183 | 0 | 237 | 0 | 1882 | 86 | 172 | 1333 | 269 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 121 |
| Lane Group Flow (vph) | 806 | 151 | 731 | 183 | 0 | 237 | 0 | 1963 | 0 | 172 | 1333 | 148 |
| Confl. Peds. (#/hr) | | | 5 | | | | 3 | | | | | 3 |
| Confl. Bikes (#/hr) | | | | | | | | | 4 | | | 2 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | | pt+ov | | NA | | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | | 4 5 | | 6 | | 5 | 2 | |
| Permitted Phases | | | Free | | | | | | | | | 2 |
| Actuated Green, G (s) | 31.5 | 16.1 | 120.0 | 25.6 | | 30.4 | | 43.3 | | 15.7 | 63.0 | 63.0 |
| Effective Green, g (s) | 32.9 | 17.5 | 120.0 | 26.1 | | 31.8 | | 44.7 | | 15.7 | 64.4 | 64.4 |
| Actuated g/C Ratio | 0.27 | 0.15 | 1.00 | 0.22 | | 0.27 | | 0.37 | | 0.13 | 0.54 | 0.54 |
| Clearance Time (s) | 5.4 | 5.4 | | 4.5 | | | | 5.4 | | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | | 1.8 | | | | 5.0 | | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 932 | 269 | 1547 | 739 | | 731 | | 2346 | | 229 | 1881 | 811 |
| v/s Ratio Prot | c0.24 | 0.08 | | 0.05 | | 0.09 | | c0.31 | | 0.10 | c0.38 | |
| v/s Ratio Perm | | | c0.47 | | | | | | | | | 0.10 |
| v/c Ratio | 0.86 | 0.56 | 0.47 | 0.25 | | 0.32 | | 0.84 | | 0.75 | 0.71 | 0.18 |
| Uniform Delay, d1 | 41.4 | 47.7 | 0.0 | 38.8 | | 35.5 | | 34.3 | | 50.3 | 20.8 | 14.3 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.96 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 8.1 | 1.6 | 1.0 | 0.1 | | 0.1 | | 3.7 | | 11.6 | 2.3 | 0.5 |
| Delay (s) | 49.6 | 49.3 | 1.0 | 38.9 | | 35.6 | | 36.5 | | 61.9 | 23.1 | 14.8 |
| Level of Service | D | D | A | D | | D | | D | | E | C | B |
| Approach Delay (s/veh) | | 28.5 | | | 37.0 | | | 36.5 | | | 25.6 | |
| Approach LOS | | C | | | D | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 30.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.82 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 67.0% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



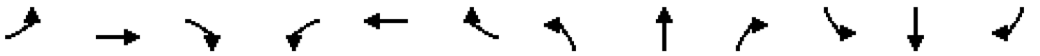
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 100 | 100 | 30 | 150 | 380 | 580 | 60 | 450 | 160 | 440 | 820 | 500 |
| Future Volume (vph) | 100 | 100 | 30 | 150 | 380 | 580 | 60 | 450 | 160 | 440 | 820 | 500 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 5036 | 1545 | 3400 | 5036 | 1546 | 3400 | 5036 | 1547 | 3400 | 5036 | 1549 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 5036 | 1545 | 3400 | 5036 | 1546 | 3400 | 5036 | 1547 | 3400 | 5036 | 1549 |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 110 | 110 | 33 | 165 | 418 | 637 | 66 | 495 | 176 | 484 | 901 | 549 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 110 | 110 | 33 | 165 | 418 | 637 | 66 | 495 | 176 | 484 | 901 | 549 |
| Confl. Peds. (#/hr) | | | 7 | | | 7 | | | 5 | | | 1 |
| Confl. Bikes (#/hr) | | | 3 | | | | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 4 | | 3 | 8 | |
| Permitted Phases | | | Free | | | Free | | | Free | | | Free |
| Actuated Green, G (s) | 7.7 | 12.5 | 72.7 | 9.1 | 13.9 | 72.7 | 5.2 | 15.8 | 72.7 | 16.3 | 26.9 | 72.7 |
| Effective Green, g (s) | 7.7 | 14.2 | 72.7 | 9.1 | 15.6 | 72.7 | 5.2 | 17.1 | 72.7 | 16.3 | 28.2 | 72.7 |
| Actuated g/C Ratio | 0.11 | 0.20 | 1.00 | 0.13 | 0.21 | 1.00 | 0.07 | 0.24 | 1.00 | 0.22 | 0.39 | 1.00 |
| Clearance Time (s) | 4.0 | 5.7 | | 4.0 | 5.7 | | 4.0 | 5.3 | | 4.0 | 5.3 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 360 | 983 | 1545 | 425 | 1080 | 1546 | 243 | 1184 | 1547 | 762 | 1953 | 1549 |
| v/s Ratio Prot | 0.03 | 0.02 | | 0.05 | 0.08 | | 0.02 | 0.10 | | c0.14 | c0.18 | |
| v/s Ratio Perm | | | 0.02 | | | c0.41 | | | 0.11 | | | 0.35 |
| v/c Ratio | 0.31 | 0.11 | 0.02 | 0.39 | 0.39 | 0.41 | 0.27 | 0.42 | 0.11 | 0.64 | 0.46 | 0.35 |
| Uniform Delay, d1 | 30.0 | 24.1 | 0.0 | 29.2 | 24.5 | 0.0 | 32.0 | 23.6 | 0.0 | 25.5 | 16.6 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.2 | 0.0 | 0.0 | 0.2 | 0.1 | 0.8 | 0.2 | 0.1 | 0.1 | 1.3 | 0.1 | 0.6 |
| Delay (s) | 30.2 | 24.1 | 0.0 | 29.5 | 24.5 | 0.8 | 32.2 | 23.7 | 0.1 | 26.8 | 16.7 | 0.6 |
| Level of Service | C | C | A | C | C | A | C | C | A | C | B | A |
| Approach Delay (s/veh) | | 23.6 | | | 12.8 | | | 18.8 | | | 14.6 | |
| Approach LOS | | C | | | B | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 15.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.57 | | |
| Actuated Cycle Length (s) | 72.7 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 52.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 40 | 550 | 220 | 440 | 700 | 290 | 630 | 1220 | 460 | 230 | 1410 | 60 |
| Future Volume (vph) | 40 | 550 | 220 | 440 | 700 | 290 | 630 | 1220 | 460 | 230 | 1410 | 60 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1752 | 5036 | 1547 | 3400 | 3505 | 1539 | 3400 | 5036 | 1541 | 3400 | 4998 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1752 | 5036 | 1547 | 3400 | 3505 | 1539 | 3400 | 5036 | 1541 | 3400 | 4998 | |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 41 | 567 | 227 | 454 | 722 | 299 | 649 | 1258 | 474 | 237 | 1454 | 62 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 179 | 0 | 0 | 135 | 0 | 4 | 0 |
| Lane Group Flow (vph) | 41 | 567 | 227 | 454 | 722 | 120 | 649 | 1258 | 339 | 237 | 1512 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 6 | | | 5 | | | 6 |
| Confl. Bikes (#/hr) | | | 2 | | | 1 | | | | | | 26 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Perm | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | Free | | | 8 | | | 2 | | | |
| Actuated Green, G (s) | 4.0 | 23.4 | 120.0 | 20.4 | 39.8 | 39.8 | 21.0 | 43.4 | 43.4 | 14.0 | 36.4 | |
| Effective Green, g (s) | 4.0 | 24.8 | 120.0 | 20.4 | 41.2 | 41.2 | 21.0 | 44.8 | 44.8 | 14.0 | 37.8 | |
| Actuated g/C Ratio | 0.03 | 0.21 | 1.00 | 0.17 | 0.34 | 0.34 | 0.18 | 0.37 | 0.37 | 0.12 | 0.32 | |
| Clearance Time (s) | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 5.0 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 58 | 1040 | 1547 | 578 | 1203 | 528 | 595 | 1880 | 575 | 396 | 1574 | |
| v/s Ratio Prot | 0.02 | c0.11 | | c0.13 | c0.21 | | c0.19 | 0.25 | | 0.07 | c0.30 | |
| v/s Ratio Perm | | | 0.15 | | | 0.08 | | | 0.22 | | | |
| v/c Ratio | 0.71 | 0.55 | 0.15 | 0.79 | 0.60 | 0.23 | 1.09 | 0.67 | 0.59 | 0.60 | 0.96 | |
| Uniform Delay, d1 | 57.4 | 42.6 | 0.0 | 47.7 | 32.6 | 28.1 | 49.5 | 31.4 | 30.2 | 50.3 | 40.4 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.36 | 1.39 | |
| Incremental Delay, d2 | 27.3 | 1.0 | 0.2 | 6.4 | 1.2 | 0.5 | 64.0 | 1.9 | 4.4 | 1.1 | 11.8 | |
| Delay (s) | 84.7 | 43.6 | 0.2 | 54.1 | 33.8 | 28.5 | 113.5 | 33.3 | 34.6 | 69.4 | 68.0 | |
| Level of Service | F | D | A | D | C | C | F | C | C | E | E | |
| Approach Delay (s/veh) | | 33.8 | | | 39.0 | | | 55.4 | | | 68.2 | |
| Approach LOS | | C | | | D | | | E | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 52.3 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.86 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 86.6% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 4 | 0 | 5 | 20 | 0 | 180 | 7 | 510 | 10 | 120 | 700 | 1 |
| Future Volume (Veh/h) | 4 | 0 | 5 | 20 | 0 | 180 | 7 | 510 | 10 | 120 | 700 | 1 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 4 | 0 | 5 | 21 | 0 | 191 | 7 | 543 | 11 | 128 | 745 | 1 |
| Pedestrians | | 16 | | | 6 | | | | | | 13 | |
| Lane Width (ft) | | 12.0 | | | 12.0 | | | | | | 13.0 | |
| Walking Speed (ft/s) | | 4.0 | | | 4.0 | | | | | | 4.0 | |
| Percent Blockage | | 1 | | | 1 | | | | | | 1 | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 1507 | 1592 | 389 | 1202 | 1587 | 296 | 762 | | | 560 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 1507 | 1592 | 389 | 1202 | 1587 | 296 | 762 | | | 560 | | |
| tC, single (s) | 7.6 | 6.6 | 7.0 | 7.6 | 6.6 | 7.0 | 4.2 | | | 4.2 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 92 | 100 | 99 | 83 | 100 | 72 | 99 | | | 87 | | |
| cM capacity (veh/h) | 51 | 89 | 599 | 121 | 90 | 686 | 828 | | | 995 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|
| Volume Total | 9 | 212 | 7 | 362 | 192 | 128 | 497 | 249 |
| Volume Left | 4 | 21 | 7 | 0 | 0 | 128 | 0 | 0 |
| Volume Right | 5 | 191 | 0 | 0 | 11 | 0 | 0 | 1 |
| cSH | 104 | 469 | 828 | 1700 | 1700 | 995 | 1700 | 1700 |
| Volume to Capacity | 0.09 | 0.45 | 0.01 | 0.21 | 0.11 | 0.13 | 0.29 | 0.15 |
| Queue Length 95th (ft) | 7 | 58 | 1 | 0 | 0 | 11 | 0 | 0 |
| Control Delay (s/veh) | 42.8 | 18.8 | 9.4 | 0.0 | 0.0 | 9.2 | 0.0 | 0.0 |
| Lane LOS | E | C | A | | | A | | |
| Approach Delay (s/veh) | 42.8 | 18.8 | 0.1 | | | 1.3 | | |
| Approach LOS | E | C | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 3.4 | | | |
| Intersection Capacity Utilization | 46.4% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 140 | 10 | 4 | 170 | 13 | 30 |
| Future Volume (Veh/h) | 140 | 10 | 4 | 170 | 13 | 30 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 |
| Hourly flow rate (vph) | 171 | 12 | 5 | 207 | 16 | 37 |
| Pedestrians | 3 | | | 1 | 8 | |
| Lane Width (ft) | 12.0 | | | 12.0 | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | 4.0 | 4.0 | |
| Percent Blockage | 0 | | | 0 | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 191 | | 405 | 186 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 191 | | 405 | 186 |
| tC, single (s) | | | 4.2 | | 6.5 | 6.3 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.3 | | 3.6 | 3.4 |
| p0 queue free % | | | 100 | | 97 | 96 |
| cM capacity (veh/h) | | | 1322 | | 577 | 827 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 183 | 5 | 207 | 53 |
| Volume Left | 0 | 5 | 0 | 16 |
| Volume Right | 12 | 0 | 0 | 37 |
| cSH | 1700 | 1322 | 1700 | 732 |
| Volume to Capacity | 0.11 | 0.00 | 0.12 | 0.07 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 6 |
| Control Delay (s/veh) | 0.0 | 7.7 | 0.0 | 10.3 |
| Lane LOS | | A | | B |
| Approach Delay (s/veh) | 0.0 | 0.2 | | 10.3 |
| Approach LOS | | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.3 | | |
| Intersection Capacity Utilization | 19.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 120 | 12 | 1 | 180 | 22 | 26 |
| Future Volume (Veh/h) | 120 | 12 | 1 | 180 | 22 | 26 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Hourly flow rate (vph) | 141 | 14 | 1 | 212 | 26 | 31 |
| Pedestrians | 1 | | | | 10 | |
| Lane Width (ft) | 12.0 | | | | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | | 4.0 | |
| Percent Blockage | 0 | | | | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 165 | | 373 | 158 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 165 | | 373 | 158 |
| tC, single (s) | | | 4.2 | | 6.5 | 6.3 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.3 | | 3.6 | 3.4 |
| p0 queue free % | | | 100 | | 96 | 96 |
| cM capacity (veh/h) | | | 1372 | | 612 | 867 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 155 | 1 | 212 | 57 |
| Volume Left | 0 | 1 | 0 | 26 |
| Volume Right | 14 | 0 | 0 | 31 |
| cSH | 1700 | 1372 | 1700 | 729 |
| Volume to Capacity | 0.09 | 0.00 | 0.12 | 0.08 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 6 |
| Control Delay (s/veh) | 0.0 | 7.6 | 0.0 | 10.4 |
| Lane LOS | | A | | B |
| Approach Delay (s/veh) | 0.0 | 0.0 | | 10.4 |
| Approach LOS | | | | B |

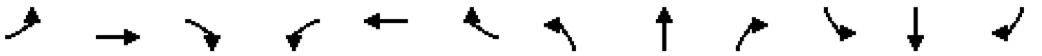
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.4 | | |
| Intersection Capacity Utilization | 19.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 31 | 500 | 7 | 7 | 920 |
| Future Volume (Veh/h) | 0 | 31 | 500 | 7 | 7 | 920 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Hourly flow rate (vph) | 0 | 32 | 510 | 7 | 7 | 939 |
| Pedestrians | 15 | | | | | |
| Lane Width (ft) | 12.0 | | | | | |
| Walking Speed (ft/s) | 4.0 | | | | | |
| Percent Blockage | 1 | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 856 | 274 | | | 532 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 856 | 274 | | | 532 | |
| tC, single (s) | 6.9 | 7.0 | | | 4.2 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 100 | 96 | | | 99 | |
| cM capacity (veh/h) | 289 | 712 | | | 1012 | |

| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|
| Volume Total | 32 | 340 | 177 | 7 | 313 | 313 | 313 |
| Volume Left | 0 | 0 | 0 | 7 | 0 | 0 | 0 |
| Volume Right | 32 | 0 | 7 | 0 | 0 | 0 | 0 |
| cSH | 712 | 1700 | 1700 | 1012 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.04 | 0.20 | 0.10 | 0.01 | 0.18 | 0.18 | 0.18 |
| Queue Length 95th (ft) | 4 | 0 | 0 | 1 | 0 | 0 | 0 |
| Control Delay (s/veh) | 10.3 | 0.0 | 0.0 | 8.6 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | | | A | | | |
| Approach Delay (s/veh) | 10.3 | 0.0 | | 0.1 | | | |
| Approach LOS | B | | | | | | |

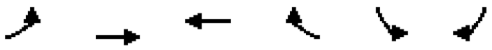
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.3 | | |
| Intersection Capacity Utilization | 24.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 40 | 0 | 130 | 0 | 0 | 0 | 130 | 350 | 0 | 0 | 240 | 40 |
| Future Volume (Veh/h) | 40 | 0 | 130 | 0 | 0 | 0 | 130 | 350 | 0 | 0 | 240 | 40 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 43 | 0 | 138 | 0 | 0 | 0 | 138 | 372 | 0 | 0 | 255 | 43 |
| Pedestrians | | 3 | | | | | | 1 | | | | |
| Lane Width (ft) | | 13.0 | | | | | | 13.0 | | | | |
| Walking Speed (ft/s) | | 4.0 | | | | | | 4.0 | | | | |
| Percent Blockage | | 0 | | | | | | 0 | | | | |
| Right turn flare (veh) | | | 8 | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | 144 | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 906 | 906 | 259 | 904 | 949 | 372 | 301 | | | 372 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 906 | 906 | 259 | 904 | 949 | 372 | 301 | | | 372 | | |
| tC, single (s) | 7.2 | 6.6 | 6.2 | 7.2 | 6.6 | 6.2 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 81 | 100 | 82 | 100 | 100 | 100 | 89 | | | 100 | | |
| cM capacity (veh/h) | 231 | 242 | 770 | 191 | 228 | 667 | 1240 | | | 1170 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|
| Volume Total | 181 | 0 | 138 | 372 | 0 | 255 | 43 |
| Volume Left | 43 | 0 | 138 | 0 | 0 | 0 | 0 |
| Volume Right | 138 | 0 | 0 | 0 | 0 | 0 | 43 |
| cSH | 973 | 1700 | 1240 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.19 | 0.00 | 0.11 | 0.22 | 0.00 | 0.15 | 0.03 |
| Queue Length 95th (ft) | 17 | 0 | 9 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 13.9 | 0.0 | 8.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | A | A | | | | |
| Approach Delay (s/veh) | 13.9 | 0.0 | 2.2 | | 0.0 | | |
| Approach LOS | B | A | | | | | |

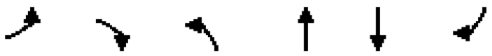
| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 3.7 | | | |
| Intersection Capacity Utilization | 35.4% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | ↑↑↑ | | | ↱ |
| Traffic Volume (veh/h) | 0 | 1360 | 1070 | 21 | 0 | 63 |
| Future Volume (Veh/h) | 0 | 1360 | 1070 | 21 | 0 | 63 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 0 | 1447 | 1138 | 22 | 0 | 67 |
| Pedestrians | | | | | 14 | |
| Lane Width (ft) | | | | | 12.0 | |
| Walking Speed (ft/s) | | | | | 4.0 | |
| Percent Blockage | | | | | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | 526 | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1174 | | | | 1645 | 404 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 1174 | | | | 1645 | 404 |
| tC, single (s) | 4.2 | | | | 6.9 | 7.0 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 100 | 89 |
| cM capacity (veh/h) | 578 | | | | 88 | 586 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | SB 1 |
|---|---|---|---|---|---|---|---|
| Volume Total | 482 | 482 | 482 | 455 | 455 | 250 | 67 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 22 | 67 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 586 |
| Volume to Capacity | 0.28 | 0.28 | 0.28 | 0.27 | 0.27 | 0.15 | 0.11 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| Control Delay (s/veh) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 11.9 |
| Lane LOS | | | | | | | B |
| Approach Delay (s/veh) | 0.0 | | | 0.0 | | | 11.9 |
| Approach LOS | | | | | | | B |

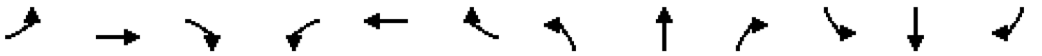
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.3 | | |
| Intersection Capacity Utilization | 31.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 76 | 0 | 1910 | 1620 | 27 |
| Future Volume (Veh/h) | 0 | 76 | 0 | 1910 | 1620 | 27 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Hourly flow rate (vph) | 0 | 79 | 0 | 1990 | 1688 | 28 |
| Pedestrians | 17 | | | | | |
| Lane Width (ft) | 12.0 | | | | | |
| Walking Speed (ft/s) | 4.0 | | | | | |
| Percent Blockage | 1 | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | 647 | 189 | |
| pX, platoon unblocked | 0.87 | 0.79 | 0.79 | | | |
| vC, conflicting volume | 2203 | 580 | 1733 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 241 | 0 | 989 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 100 | 91 | 100 | | | |
| cM capacity (veh/h) | 629 | 845 | 544 | | | |

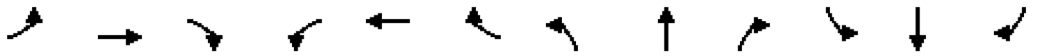
| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | NB 4 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 79 | 284 | 569 | 569 | 569 | 563 | 563 | 563 | 28 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 |
| cSH | 845 | 544 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.09 | 0.00 | 0.33 | 0.33 | 0.33 | 0.33 | 0.33 | 0.33 | 0.02 |
| Queue Length 95th (ft) | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 9.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | | | | | | | |
| Approach Delay (s/veh) | 9.7 | 0.0 | | | | 0.0 | | | |
| Approach LOS | A | | | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 0.2 | | | |
| Intersection Capacity Utilization | 42.7% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



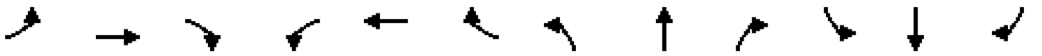
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 580 | 280 | 500 | 150 | 190 | 70 | 480 | 1260 | 130 | 160 | 1110 | 420 |
| Future Volume (vph) | 580 | 280 | 500 | 150 | 190 | 70 | 480 | 1260 | 130 | 160 | 1110 | 420 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.95 | 1.00 | 0.97 | 0.95 | | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 3505 | 1529 | 3400 | 3350 | | 3400 | 5036 | 1544 | 3400 | 5036 | 1545 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 3505 | 1529 | 3400 | 3350 | | 3400 | 5036 | 1544 | 3400 | 5036 | 1545 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 604 | 292 | 521 | 156 | 198 | 73 | 500 | 1312 | 135 | 167 | 1156 | 438 |
| RTOR Reduction (vph) | 0 | 0 | 312 | 0 | 35 | 0 | 0 | 0 | 78 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 604 | 292 | 209 | 156 | 236 | 0 | 500 | 1313 | 57 | 167 | 1156 | 438 |
| Confl. Peds. (#/hr) | | | 13 | | | 1 | | | 3 | | | 10 |
| Confl. Bikes (#/hr) | | | | | | 1 | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Prot | NA | Perm | Prot | NA | Free |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | 8 | | | | | | 6 | | | Free |
| Actuated Green, G (s) | 21.0 | 30.0 | 30.0 | 12.2 | 21.2 | | 21.0 | 49.0 | 49.0 | 10.0 | 38.0 | 120.0 |
| Effective Green, g (s) | 21.0 | 31.4 | 31.4 | 12.2 | 22.6 | | 21.0 | 50.4 | 50.4 | 10.0 | 39.4 | 120.0 |
| Actuated g/C Ratio | 0.18 | 0.26 | 0.26 | 0.10 | 0.19 | | 0.18 | 0.42 | 0.42 | 0.08 | 0.33 | 1.00 |
| Clearance Time (s) | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 595 | 917 | 400 | 345 | 630 | | 595 | 2115 | 648 | 283 | 1653 | 1545 |
| v/s Ratio Prot | c0.18 | 0.08 | | c0.05 | 0.07 | | c0.15 | 0.26 | | 0.05 | c0.23 | |
| v/s Ratio Perm | | | c0.14 | | | | | | 0.04 | | | 0.28 |
| v/c Ratio | 1.02 | 0.32 | 0.52 | 0.45 | 0.37 | | 0.84 | 0.62 | 0.09 | 0.59 | 0.70 | 0.28 |
| Uniform Delay, d1 | 49.5 | 35.7 | 37.9 | 50.8 | 42.5 | | 47.9 | 27.3 | 21.0 | 53.0 | 35.1 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 0.90 | 0.80 | 1.52 | 0.72 | 0.64 | 1.00 |
| Incremental Delay, d2 | 40.7 | 0.1 | 0.6 | 0.3 | 0.1 | | 8.0 | 1.1 | 0.2 | 1.9 | 2.2 | 0.4 |
| Delay (s) | 90.2 | 35.8 | 38.4 | 51.1 | 42.7 | | 51.1 | 22.9 | 32.0 | 40.2 | 24.8 | 0.4 |
| Level of Service | F | D | D | D | D | | D | C | C | D | C | A |
| Approach Delay (s/veh) | | 60.0 | | | 45.7 | | | 30.8 | | | 20.2 | |
| Approach LOS | | E | | | D | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 36.0 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.74 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 72.5% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 190 | 10 | 170 | 10 | 10 | 10 | 300 | 1600 | 10 | 40 | 1470 | 170 |
| Future Volume (vph) | 190 | 10 | 170 | 10 | 10 | 10 | 300 | 1600 | 10 | 40 | 1470 | 170 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 5.4 |
| Lane Util. Factor | 0.95 | 0.95 | 1.00 | | 1.00 | | 1.00 | 0.91 | 1.00 | 1.00 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.96 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 0.96 | 1.00 | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1665 | 1677 | 1546 | | 1732 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1509 |
| Flt Permitted | 0.74 | 0.72 | 1.00 | | 0.48 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1289 | 1269 | 1546 | | 838 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1509 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 202 | 11 | 181 | 11 | 11 | 11 | 319 | 1702 | 11 | 43 | 1564 | 181 |
| RTOR Reduction (vph) | 0 | 0 | 155 | 0 | 10 | 0 | 0 | 0 | 4 | 0 | 0 | 50 |
| Lane Group Flow (vph) | 107 | 106 | 26 | 0 | 23 | 0 | 319 | 1702 | 7 | 43 | 1564 | 131 |
| Confl. Peds. (#/hr) | | | 2 | 2 | | | | | 1 | | | 14 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 7 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | 3 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 3 | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 16.8 | 16.8 | 16.8 | | 5.4 | | 17.8 | 73.1 | 73.1 | 6.4 | 61.7 | 61.7 |
| Effective Green, g (s) | 17.5 | 17.5 | 17.5 | | 5.6 | | 17.8 | 74.5 | 74.5 | 6.4 | 63.1 | 61.7 |
| Actuated g/C Ratio | 0.15 | 0.15 | 0.15 | | 0.05 | | 0.15 | 0.62 | 0.62 | 0.05 | 0.53 | 0.51 |
| Clearance Time (s) | 4.7 | 4.7 | 4.7 | | 4.2 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 187 | 185 | 225 | | 39 | | 259 | 3126 | 949 | 93 | 2648 | 775 |
| v/s Ratio Prot | | | | | | | c0.18 | 0.34 | | 0.02 | c0.31 | |
| v/s Ratio Perm | 0.08 | c0.08 | 0.02 | | c0.03 | | | | 0.00 | | | 0.09 |
| v/c Ratio | 0.57 | 0.57 | 0.12 | | 0.58 | | 1.23 | 0.54 | 0.01 | 0.46 | 0.59 | 0.17 |
| Uniform Delay, d1 | 47.8 | 47.8 | 44.5 | | 56.0 | | 51.1 | 13.0 | 8.7 | 55.1 | 19.6 | 15.5 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.12 | 1.63 | 1.00 | 1.05 | 0.52 | 0.24 |
| Incremental Delay, d2 | 2.6 | 2.7 | 0.1 | | 12.2 | | 125.3 | 0.5 | 0.0 | 1.2 | 0.9 | 0.4 |
| Delay (s) | 50.4 | 50.4 | 44.6 | | 68.2 | | 182.4 | 21.7 | 8.7 | 59.3 | 11.1 | 4.2 |
| Level of Service | D | D | D | | E | | F | C | A | E | B | A |
| Approach Delay (s/veh) | | 47.7 | | | 68.2 | | | 46.9 | | | 11.6 | |
| Approach LOS | | D | | | E | | | D | | | B | |

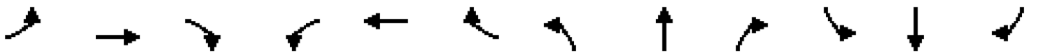
| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 32.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.70 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 68.3% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 0 | 490 | 0 | 260 | 0 | 1700 | 550 | 0 | 1540 | 780 |
| Future Volume (vph) | 0 | 0 | 0 | 490 | 0 | 260 | 0 | 1700 | 550 | 0 | 1540 | 780 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 4.0 | | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | | | | 0.97 | | 0.88 | | 0.95 | 1.00 | | 0.91 | 0.88 |
| Frpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 0.98 | | 1.00 | 0.98 |
| Flpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | | | 1.00 | | 0.85 | | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | 3400 | | 2760 | | 3505 | 1535 | | 5036 | 2703 |
| Flt Permitted | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | 3400 | | 2760 | | 3505 | 1535 | | 5036 | 2703 |
| Peak-hour factor, PHF | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 |
| Adj. Flow (vph) | 0 | 0 | 0 | 495 | 0 | 263 | 0 | 1717 | 556 | 0 | 1556 | 788 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 38 | 0 | 0 | 231 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 495 | 0 | 225 | 0 | 1717 | 325 | 0 | 1556 | 788 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | 1 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | | | | Prot | | Perm | | NA | Perm | | NA | Free |
| Protected Phases | | | | 4 | | | | 6 | | | 2 | |
| Permitted Phases | | | | 4 | | 4 | | | 6 | | | Free |
| Actuated Green, G (s) | | | | 15.5 | | 15.5 | | 33.2 | 33.2 | | 33.2 | 60.0 |
| Effective Green, g (s) | | | | 16.9 | | 16.9 | | 35.1 | 35.1 | | 35.1 | 60.0 |
| Actuated g/C Ratio | | | | 0.28 | | 0.28 | | 0.59 | 0.59 | | 0.59 | 1.00 |
| Clearance Time (s) | | | | 5.4 | | 5.4 | | 5.9 | 5.9 | | 5.9 | |
| Vehicle Extension (s) | | | | 5.0 | | 5.0 | | 5.0 | 5.0 | | 5.0 | |
| Lane Grp Cap (vph) | | | | 957 | | 777 | | 2050 | 897 | | 2946 | 2703 |
| v/s Ratio Prot | | | | c0.15 | | | | c0.49 | | | 0.31 | |
| v/s Ratio Perm | | | | | | 0.08 | | | 0.21 | | | 0.29 |
| v/c Ratio | | | | 0.52 | | 0.29 | | 0.84 | 0.36 | | 0.53 | 0.29 |
| Uniform Delay, d1 | | | | 18.1 | | 16.9 | | 10.1 | 6.6 | | 7.5 | 0.0 |
| Progression Factor | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | | | 0.9 | | 0.4 | | 4.3 | 1.1 | | 0.7 | 0.3 |
| Delay (s) | | | | 19.1 | | 17.3 | | 14.4 | 7.7 | | 8.2 | 0.3 |
| Level of Service | | | | B | | B | | B | A | | A | A |
| Approach Delay (s/veh) | | 0.0 | | | 18.4 | | | 12.8 | | | 5.5 | |
| Approach LOS | | A | | | B | | | B | | | A | |

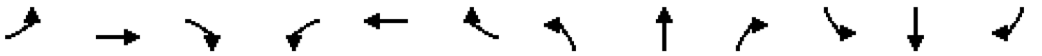
| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 10.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.73 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 67.6% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



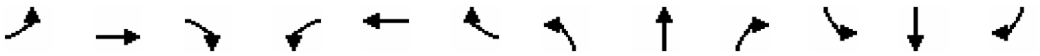
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 540 | 140 | 180 | 130 | 0 | 250 | 0 | 2000 | 110 | 260 | 1250 | 550 |
| Future Volume (vph) | 540 | 140 | 180 | 130 | 0 | 250 | 0 | 2000 | 110 | 260 | 1250 | 550 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | | 3.1 | | 4.0 | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 0.97 | | 0.88 | | 0.86 | | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 0.96 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | | 0.85 | | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6292 | | 1752 | 3505 | 1500 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6292 | | 1752 | 3505 | 1500 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 557 | 144 | 186 | 134 | 0 | 258 | 0 | 2062 | 113 | 268 | 1289 | 567 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 237 |
| Lane Group Flow (vph) | 557 | 144 | 186 | 134 | 0 | 258 | 0 | 2169 | 0 | 268 | 1289 | 330 |
| Confl. Peds. (#/hr) | | | 5 | | | 2 | 5 | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | 1 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | | pt+ov | | NA | | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | | 4 5 | | 6 | | 5 | 2 | |
| Permitted Phases | | | Free | | | | | | | | | 2 |
| Actuated Green, G (s) | 24.0 | 15.8 | 120.0 | 20.5 | | 38.4 | | 42.8 | | 21.6 | 68.4 | 68.4 |
| Effective Green, g (s) | 25.4 | 17.2 | 120.0 | 21.0 | | 39.8 | | 44.2 | | 21.6 | 69.8 | 69.8 |
| Actuated g/C Ratio | 0.21 | 0.14 | 1.00 | 0.18 | | 0.33 | | 0.37 | | 0.18 | 0.58 | 0.58 |
| Clearance Time (s) | 5.4 | 5.4 | | 4.5 | | | | 5.4 | | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | | 1.8 | | | | 5.0 | | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 719 | 264 | 1547 | 595 | | 915 | | 2317 | | 315 | 2038 | 872 |
| v/s Ratio Prot | c0.16 | 0.08 | | 0.04 | | c0.09 | | c0.34 | | c0.15 | 0.37 | |
| v/s Ratio Perm | | | 0.12 | | | | | | | | | 0.22 |
| v/c Ratio | 0.77 | 0.55 | 0.12 | 0.23 | | 0.28 | | 0.94 | | 0.85 | 0.63 | 0.38 |
| Uniform Delay, d1 | 44.6 | 47.8 | 0.0 | 42.5 | | 29.6 | | 36.5 | | 47.6 | 16.6 | 13.5 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.87 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 4.8 | 1.2 | 0.2 | 0.1 | | 0.1 | | 8.1 | | 18.6 | 1.5 | 1.3 |
| Delay (s) | 49.4 | 49.0 | 0.2 | 42.6 | | 29.6 | | 39.9 | | 66.3 | 18.1 | 14.7 |
| Level of Service | D | D | A | D | | C | | D | | E | B | B |
| Approach Delay (s/veh) | | 39.0 | | | 34.1 | | | 39.9 | | | 23.3 | |
| Approach LOS | | D | | | C | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 33.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.80 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 72.8% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 600 | 700 | 50 | 190 | 300 | 650 | 30 | 810 | 120 | 650 | 560 | 240 |
| Future Volume (vph) | 600 | 700 | 50 | 190 | 300 | 650 | 30 | 810 | 120 | 650 | 560 | 240 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 5036 | 1544 | 3400 | 5036 | 1549 | 3400 | 5036 | 1547 | 3400 | 5036 | 1547 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 5036 | 1544 | 3400 | 5036 | 1549 | 3400 | 5036 | 1547 | 3400 | 5036 | 1547 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 645 | 753 | 54 | 204 | 323 | 699 | 32 | 871 | 129 | 699 | 602 | 258 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 645 | 753 | 54 | 204 | 323 | 699 | 32 | 871 | 129 | 699 | 602 | 258 |
| Confl. Peds. (#/hr) | | | 10 | | | 1 | | | 5 | | | 4 |
| Confl. Bikes (#/hr) | | | 2 | | | | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 4 | | 3 | 8 | |
| Permitted Phases | | | Free | | | Free | | | Free | | | Free |
| Actuated Green, G (s) | 25.9 | 28.8 | 114.5 | 11.7 | 14.6 | 114.5 | 3.4 | 26.8 | 114.5 | 28.2 | 51.6 | 114.5 |
| Effective Green, g (s) | 25.9 | 30.5 | 114.5 | 11.7 | 16.3 | 114.5 | 3.4 | 28.1 | 114.5 | 28.2 | 52.9 | 114.5 |
| Actuated g/C Ratio | 0.23 | 0.27 | 1.00 | 0.10 | 0.14 | 1.00 | 0.03 | 0.25 | 1.00 | 0.25 | 0.46 | 1.00 |
| Clearance Time (s) | 4.0 | 5.7 | | 4.0 | 5.7 | | 4.0 | 5.3 | | 4.0 | 5.3 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 769 | 1341 | 1544 | 347 | 716 | 1549 | 100 | 1235 | 1547 | 837 | 2326 | 1547 |
| v/s Ratio Prot | c0.19 | c0.15 | | 0.06 | 0.06 | | 0.01 | c0.17 | | c0.21 | 0.12 | |
| v/s Ratio Perm | | | 0.03 | | | 0.45 | | | 0.08 | | | 0.17 |
| v/c Ratio | 0.84 | 0.56 | 0.03 | 0.59 | 0.45 | 0.45 | 0.32 | 0.71 | 0.08 | 0.84 | 0.26 | 0.17 |
| Uniform Delay, d1 | 42.3 | 36.2 | 0.0 | 49.1 | 45.0 | 0.0 | 54.4 | 39.4 | 0.0 | 40.9 | 18.8 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 7.6 | 0.3 | 0.0 | 1.6 | 0.2 | 1.0 | 0.7 | 1.5 | 0.1 | 6.9 | 0.0 | 0.2 |
| Delay (s) | 50.0 | 36.6 | 0.0 | 50.7 | 45.2 | 1.0 | 55.1 | 40.9 | 0.1 | 47.9 | 18.8 | 0.2 |
| Level of Service | D | D | A | D | D | A | E | D | A | D | B | A |
| Approach Delay (s/veh) | | 41.1 | | | 20.9 | | | 36.3 | | | 28.8 | |
| Approach LOS | | D | | | C | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 31.8 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.77 | | |
| Actuated Cycle Length (s) | 114.5 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 73.1% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 0 | 0 | 8 | 31 | 1 | 126 | 12 | 650 | 26 | 150 | 420 | 2 |
| Future Volume (Veh/h) | 0 | 0 | 8 | 31 | 1 | 126 | 12 | 650 | 26 | 150 | 420 | 2 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 |
| Hourly flow rate (vph) | 0 | 0 | 9 | 36 | 1 | 147 | 14 | 756 | 30 | 174 | 488 | 2 |
| Pedestrians | | 9 | | | 10 | | | | | | 11 | |
| Lane Width (ft) | | 12.0 | | | 12.0 | | | | | | 13.0 | |
| Walking Speed (ft/s) | | 4.0 | | | 4.0 | | | | | | 4.0 | |
| Percent Blockage | | 1 | | | 1 | | | | | | 1 | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 1411 | 1670 | 254 | 1410 | 1656 | 414 | 499 | | | 796 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 1411 | 1670 | 254 | 1410 | 1656 | 414 | 499 | | | 796 | | |
| tC, single (s) | 7.6 | 6.6 | 7.0 | 7.6 | 6.6 | 7.0 | 4.2 | | | 4.2 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 100 | 100 | 99 | 54 | 99 | 74 | 99 | | | 78 | | |
| cM capacity (veh/h) | 58 | 72 | 737 | 78 | 73 | 574 | 1046 | | | 808 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|
| Volume Total | 9 | 184 | 14 | 504 | 282 | 174 | 325 | 165 |
| Volume Left | 0 | 36 | 14 | 0 | 0 | 174 | 0 | 0 |
| Volume Right | 9 | 147 | 0 | 0 | 30 | 0 | 0 | 2 |
| cSH | 737 | 251 | 1046 | 1700 | 1700 | 808 | 1700 | 1700 |
| Volume to Capacity | 0.01 | 0.73 | 0.01 | 0.30 | 0.17 | 0.22 | 0.19 | 0.10 |
| Queue Length 95th (ft) | 1 | 127 | 1 | 0 | 0 | 20 | 0 | 0 |
| Control Delay (s/veh) | 9.9 | 50.4 | 8.5 | 0.0 | 0.0 | 10.7 | 0.0 | 0.0 |
| Lane LOS | A | F | A | | | B | | |
| Approach Delay (s/veh) | 9.9 | 50.4 | 0.1 | | | 2.8 | | |
| Approach LOS | A | F | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 6.8 | | | |
| Intersection Capacity Utilization | 54.3% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 134 | 29 | 7 | 133 | 24 | 13 |
| Future Volume (Veh/h) | 134 | 29 | 7 | 133 | 24 | 13 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 146 | 32 | 8 | 145 | 26 | 14 |
| Pedestrians | 1 | | | 2 | 10 | |
| Lane Width (ft) | 12.0 | | | 12.0 | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | 4.0 | 4.0 | |
| Percent Blockage | 0 | | | 0 | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 188 | | 334 | 174 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 188 | | 334 | 174 |
| tC, single (s) | | | 4.2 | | 6.5 | 6.3 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.3 | | 3.6 | 3.4 |
| p0 queue free % | | | 99 | | 96 | 98 |
| cM capacity (veh/h) | | | 1351 | | 643 | 851 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 178 | 8 | 145 | 40 |
| Volume Left | 0 | 8 | 0 | 26 |
| Volume Right | 32 | 0 | 0 | 14 |
| cSH | 1700 | 1351 | 1700 | 703 |
| Volume to Capacity | 0.10 | 0.01 | 0.09 | 0.06 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 5 |
| Control Delay (s/veh) | 0.0 | 7.7 | 0.0 | 10.4 |
| Lane LOS | | A | | B |
| Approach Delay (s/veh) | 0.0 | 0.4 | | 10.4 |
| Approach LOS | | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.3 | | |
| Intersection Capacity Utilization | 20.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 137 | 36 | 20 | 137 | 20 | 27 |
| Future Volume (Veh/h) | 137 | 36 | 20 | 137 | 20 | 27 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 |
| Hourly flow rate (vph) | 159 | 42 | 23 | 159 | 23 | 31 |
| Pedestrians | 2 | | | 6 | 4 | |
| Lane Width (ft) | 12.0 | | | 12.0 | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | 4.0 | 4.0 | |
| Percent Blockage | 0 | | | 1 | 0 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 205 | | 391 | 190 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 205 | | 391 | 190 |
| tC, single (s) | | | 4.1 | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.2 | | 3.5 | 3.3 |
| p0 queue free % | | | 98 | | 96 | 96 |
| cM capacity (veh/h) | | | 1344 | | 594 | 837 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 201 | 23 | 159 | 54 |
| Volume Left | 0 | 23 | 0 | 23 |
| Volume Right | 42 | 0 | 0 | 31 |
| cSH | 1700 | 1344 | 1700 | 713 |
| Volume to Capacity | 0.12 | 0.02 | 0.09 | 0.08 |
| Queue Length 95th (ft) | 0 | 1 | 0 | 6 |
| Control Delay (s/veh) | 0.0 | 7.7 | 0.0 | 10.5 |
| Lane LOS | | A | | B |
| Approach Delay (s/veh) | 0.0 | 1.0 | | 10.5 |
| Approach LOS | | | | B |

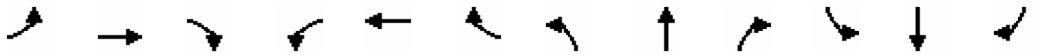
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.7 | | |
| Intersection Capacity Utilization | 28.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 11 | 827 | 27 | 20 | 441 |
| Future Volume (Veh/h) | 0 | 11 | 827 | 27 | 20 | 441 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 |
| Hourly flow rate (vph) | 0 | 13 | 1009 | 33 | 24 | 538 |
| Pedestrians | 14 | | | | | 1 |
| Lane Width (ft) | 12.0 | | | | | 12.0 |
| Walking Speed (ft/s) | 4.0 | | | | | 4.0 |
| Percent Blockage | 1 | | | | | 0 |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1267 | 536 | | | 1056 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 1267 | 536 | | | 1056 | |
| tC, single (s) | 6.9 | 7.0 | | | 4.2 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 100 | 97 | | | 96 | |
| cM capacity (veh/h) | 152 | 480 | | | 642 | |

| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|
| Volume Total | 13 | 673 | 369 | 24 | 179 | 179 | 179 |
| Volume Left | 0 | 0 | 0 | 24 | 0 | 0 | 0 |
| Volume Right | 13 | 0 | 33 | 0 | 0 | 0 | 0 |
| cSH | 480 | 1700 | 1700 | 642 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.03 | 0.40 | 0.22 | 0.04 | 0.11 | 0.11 | 0.11 |
| Queue Length 95th (ft) | 2 | 0 | 0 | 3 | 0 | 0 | 0 |
| Control Delay (s/veh) | 12.7 | 0.0 | 0.0 | 10.8 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | | | B | | | |
| Approach Delay (s/veh) | 12.7 | 0.0 | | 0.5 | | | |
| Approach LOS | B | | | | | | |

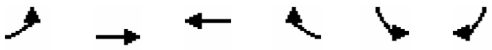
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.3 | | |
| Intersection Capacity Utilization | 34.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 24 | 0 | 125 | 0 | 0 | 0 | 92 | 200 | 0 | 0 | 350 | 43 |
| Future Volume (Veh/h) | 24 | 0 | 125 | 0 | 0 | 0 | 92 | 200 | 0 | 0 | 350 | 43 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 |
| Hourly flow rate (vph) | 30 | 0 | 154 | 0 | 0 | 0 | 114 | 247 | 0 | 0 | 432 | 53 |
| Pedestrians | | 21 | | | 1 | | | 1 | | | | |
| Lane Width (ft) | | 13.0 | | | 12.0 | | | 13.0 | | | | |
| Walking Speed (ft/s) | | 4.0 | | | 4.0 | | | 4.0 | | | | |
| Percent Blockage | | 2 | | | 0 | | | 0 | | | | |
| Right turn flare (veh) | | | 8 | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | 144 | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 928 | 929 | 454 | 909 | 982 | 248 | 506 | | | 248 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 928 | 929 | 454 | 909 | 982 | 248 | 506 | | | 248 | | |
| tC, single (s) | 7.2 | 6.6 | 6.2 | 7.2 | 6.6 | 6.2 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 86 | 100 | 74 | 100 | 100 | 100 | 89 | | | 100 | | |
| cM capacity (veh/h) | 217 | 230 | 588 | 168 | 214 | 783 | 1024 | | | 1299 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|
| Volume Total | 184 | 0 | 114 | 247 | 0 | 432 | 53 |
| Volume Left | 30 | 0 | 114 | 0 | 0 | 0 | 0 |
| Volume Right | 154 | 0 | 0 | 0 | 0 | 0 | 53 |
| cSH | 702 | 1700 | 1024 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.26 | 0.00 | 0.11 | 0.15 | 0.00 | 0.25 | 0.03 |
| Queue Length 95th (ft) | 26 | 0 | 9 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 15.1 | 0.0 | 9.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | C | A | A | | | | |
| Approach Delay (s/veh) | 15.1 | 0.0 | 2.8 | | 0.0 | | |
| Approach LOS | C | A | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 3.7 | | | |
| Intersection Capacity Utilization | 37.2% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 842 | 1481 | 66 | 0 | 36 |
| Future Volume (Veh/h) | 0 | 842 | 1481 | 66 | 0 | 36 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 0 | 915 | 1610 | 72 | 0 | 39 |
| Pedestrians | | | | | 24 | |
| Lane Width (ft) | | | | | 12.0 | |
| Walking Speed (ft/s) | | | | | 4.0 | |
| Percent Blockage | | | | | 2 | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | 526 | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1706 | | | | 1975 | 597 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 1706 | | | | 1975 | 597 |
| tC, single (s) | 4.2 | | | | 6.9 | 7.0 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 100 | 91 |
| cM capacity (veh/h) | 357 | | | | 52 | 435 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | SB 1 |
|---|---|---|---|---|---|---|---|
| Volume Total | 305 | 305 | 305 | 644 | 644 | 394 | 39 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 72 | 39 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 435 |
| Volume to Capacity | 0.18 | 0.18 | 0.18 | 0.38 | 0.38 | 0.23 | 0.09 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| Control Delay (s/veh) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14.1 |
| Lane LOS | | | | | | | B |
| Approach Delay (s/veh) | 0.0 | | | 0.0 | | | 14.1 |
| Approach LOS | | | | | | | B |

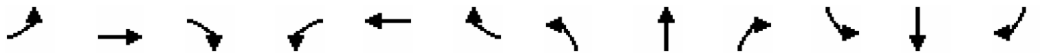
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.2 | | |
| Intersection Capacity Utilization | 40.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 26 | 0 | 1338 | 1890 | 139 |
| Future Volume (Veh/h) | 0 | 26 | 0 | 1338 | 1890 | 139 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Hourly flow rate (vph) | 0 | 27 | 0 | 1365 | 1929 | 142 |
| Pedestrians | 21 | | | | | |
| Lane Width (ft) | 12.0 | | | | | |
| Walking Speed (ft/s) | 4.0 | | | | | |
| Percent Blockage | 2 | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | 647 | 189 | |
| pX, platoon unblocked | 0.79 | 0.74 | 0.74 | | | |
| vC, conflicting volume | 2291 | 664 | 2092 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 588 | 0 | 1226 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 100 | 97 | 100 | | | |
| cM capacity (veh/h) | 343 | 786 | 412 | | | |

| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | NB 4 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 27 | 195 | 390 | 390 | 390 | 643 | 643 | 643 | 142 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 142 |
| cSH | 786 | 412 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.03 | 0.00 | 0.23 | 0.23 | 0.23 | 0.38 | 0.38 | 0.38 | 0.08 |
| Queue Length 95th (ft) | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 9.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | | | | | | | |
| Approach Delay (s/veh) | 9.7 | 0.0 | | | | 0.0 | | | |
| Approach LOS | A | | | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 0.1 | | | |
| Intersection Capacity Utilization | 46.5% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |

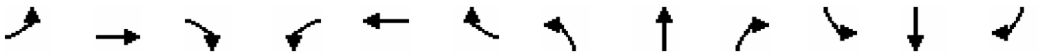


| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 312 | 280 | 250 | 210 | 350 | 70 | 550 | 956 | 120 | 90 | 1194 | 641 |
| Future Volume (vph) | 312 | 280 | 250 | 210 | 350 | 70 | 550 | 956 | 120 | 90 | 1194 | 641 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.95 | 1.00 | 0.97 | 0.95 | | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.91 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.94 | 1.00 | 1.00 | 0.98 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 3505 | 1429 | 3400 | 3398 | | 3400 | 5036 | 1480 | 3400 | 5036 | 1544 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 3505 | 1429 | 3400 | 3398 | | 3400 | 5036 | 1480 | 3400 | 5036 | 1544 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 332 | 298 | 266 | 223 | 372 | 74 | 585 | 1017 | 128 | 96 | 1270 | 682 |
| RTOR Reduction (vph) | 0 | 0 | 196 | 0 | 14 | 0 | 0 | 0 | 73 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 332 | 298 | 70 | 223 | 432 | 0 | 585 | 1017 | 55 | 96 | 1270 | 682 |
| Confl. Peds. (#/hr) | | | 74 | | | 15 | | | 40 | | | 12 |
| Confl. Bikes (#/hr) | | | 3 | | | 5 | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Prot | NA | Perm | Prot | NA | Free |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | 8 | | | | | | 6 | | | Free |
| Actuated Green, G (s) | 15.9 | 30.1 | 30.1 | 13.4 | 27.6 | | 21.0 | 50.1 | 50.1 | 7.6 | 36.7 | 120.0 |
| Effective Green, g (s) | 15.9 | 31.5 | 31.5 | 13.4 | 29.0 | | 21.0 | 51.5 | 51.5 | 7.6 | 38.1 | 120.0 |
| Actuated g/C Ratio | 0.13 | 0.26 | 0.26 | 0.11 | 0.24 | | 0.18 | 0.43 | 0.43 | 0.06 | 0.32 | 1.00 |
| Clearance Time (s) | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 450 | 920 | 375 | 379 | 821 | | 595 | 2161 | 635 | 215 | 1598 | 1544 |
| v/s Ratio Prot | c0.10 | 0.09 | | 0.07 | c0.13 | | c0.17 | 0.20 | | 0.03 | c0.25 | |
| v/s Ratio Perm | | | 0.05 | | | | | | 0.04 | | | c0.44 |
| v/c Ratio | 0.74 | 0.32 | 0.19 | 0.59 | 0.53 | | 0.98 | 0.47 | 0.09 | 0.45 | 0.79 | 0.44 |
| Uniform Delay, d1 | 50.0 | 35.7 | 34.3 | 50.7 | 39.5 | | 49.3 | 24.5 | 20.3 | 54.2 | 37.4 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 0.97 | 0.85 | 2.40 | 0.73 | 0.66 | 1.00 |
| Incremental Delay, d2 | 5.4 | 0.1 | 0.1 | 1.5 | 0.3 | | 29.1 | 0.6 | 0.2 | 0.4 | 3.4 | 0.8 |
| Delay (s) | 55.4 | 35.7 | 34.4 | 52.2 | 39.8 | | 77.0 | 21.4 | 48.9 | 40.2 | 28.3 | 0.8 |
| Level of Service | E | D | C | D | D | | E | C | D | D | C | A |
| Approach Delay (s/veh) | | 42.6 | | | 43.9 | | | 42.2 | | | 19.7 | |
| Approach LOS | | D | | | D | | | D | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 33.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.75 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 85.4% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

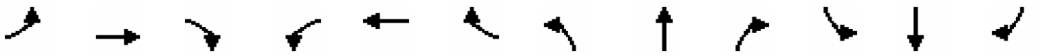
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 195 | 10 | 270 | 20 | 10 | 10 | 188 | 1130 | 20 | 20 | 1728 | 100 |
| Future Volume (vph) | 195 | 10 | 270 | 20 | 10 | 10 | 188 | 1130 | 20 | 20 | 1728 | 100 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 5.4 |
| Lane Util. Factor | 0.95 | 0.95 | 1.00 | | 1.00 | | 1.00 | 0.91 | 1.00 | 1.00 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 0.99 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 0.96 | 1.00 | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1665 | 1677 | 1513 | | 1723 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1524 |
| Flt Permitted | 0.73 | 0.72 | 1.00 | | 0.54 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1280 | 1256 | 1513 | | 954 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1524 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 201 | 10 | 278 | 21 | 10 | 10 | 194 | 1165 | 21 | 21 | 1781 | 103 |
| RTOR Reduction (vph) | 0 | 0 | 237 | 0 | 10 | 0 | 0 | 0 | 7 | 0 | 0 | 51 |
| Lane Group Flow (vph) | 105 | 106 | 41 | 0 | 31 | 0 | 194 | 1165 | 14 | 21 | 1781 | 52 |
| Confl. Peds. (#/hr) | | | 22 | 22 | | | | | 1 | | | 9 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 4 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | 3 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 3 | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 16.8 | 16.8 | 16.8 | | 5.4 | | 19.4 | 76.6 | 76.6 | 2.9 | 60.1 | 60.1 |
| Effective Green, g (s) | 17.5 | 17.5 | 17.5 | | 5.6 | | 19.4 | 78.0 | 78.0 | 2.9 | 61.5 | 60.1 |
| Actuated g/C Ratio | 0.15 | 0.15 | 0.15 | | 0.05 | | 0.16 | 0.65 | 0.65 | 0.02 | 0.51 | 0.50 |
| Clearance Time (s) | 4.7 | 4.7 | 4.7 | | 4.2 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 186 | 183 | 220 | | 44 | | 283 | 3273 | 994 | 42 | 2580 | 763 |
| v/s Ratio Prot | | | | | | | c0.11 | 0.23 | | 0.01 | c0.35 | |
| v/s Ratio Perm | 0.08 | c0.08 | 0.03 | | c0.03 | | | | 0.01 | | | 0.03 |
| v/c Ratio | 0.56 | 0.58 | 0.18 | | 0.72 | | 0.69 | 0.36 | 0.01 | 0.50 | 0.69 | 0.07 |
| Uniform Delay, d1 | 47.7 | 47.8 | 45.0 | | 56.4 | | 47.4 | 9.6 | 7.4 | 57.8 | 22.1 | 15.5 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.07 | 1.69 | 1.00 | 1.14 | 0.55 | 0.29 |
| Incremental Delay, d2 | 2.3 | 2.7 | 0.1 | | 36.7 | | 4.8 | 0.3 | 0.0 | 2.7 | 1.2 | 0.1 |
| Delay (s) | 50.0 | 50.6 | 45.1 | | 93.1 | | 55.7 | 16.4 | 7.4 | 68.9 | 13.5 | 4.7 |
| Level of Service | D | D | D | | F | | E | B | A | E | B | A |
| Approach Delay (s/veh) | | 47.4 | | | 93.1 | | | 21.8 | | | 13.6 | |
| Approach LOS | | D | | | F | | | C | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 21.7 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.67 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 73.2% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 0 | 533 | 0 | 310 | 0 | 1455 | 420 | 0 | 1152 | 940 |
| Future Volume (vph) | 0 | 0 | 0 | 533 | 0 | 310 | 0 | 1455 | 420 | 0 | 1152 | 940 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 4.0 | | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | | | | 0.97 | | 0.88 | | 0.95 | 1.00 | | 0.91 | 0.88 |
| Frpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 0.98 | | 1.00 | 0.98 |
| Flpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | | | 1.00 | | 0.85 | | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | 3400 | | 2760 | | 3505 | 1533 | | 5036 | 2698 |
| Flt Permitted | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | 3400 | | 2760 | | 3505 | 1533 | | 5036 | 2698 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 0 | 0 | 0 | 555 | 0 | 323 | 0 | 1516 | 438 | 0 | 1200 | 979 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 38 | 0 | 0 | 185 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 555 | 0 | 285 | 0 | 1516 | 253 | 0 | 1200 | 979 |
| Confl. Peds. (#/hr) | | | | | | | 3 | | | | | 3 |
| Confl. Bikes (#/hr) | | | | | | | | | 4 | | | 2 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | | | | Prot | | Perm | | NA | Perm | | NA | Free |
| Protected Phases | | | | 4 | | | | 6 | | | 2 | |
| Permitted Phases | | | | 4 | | 4 | | | 6 | | | Free |
| Actuated Green, G (s) | | | | 16.0 | | 16.0 | | 32.7 | 32.7 | | 32.7 | 60.0 |
| Effective Green, g (s) | | | | 17.4 | | 17.4 | | 34.6 | 34.6 | | 34.6 | 60.0 |
| Actuated g/C Ratio | | | | 0.29 | | 0.29 | | 0.58 | 0.58 | | 0.58 | 1.00 |
| Clearance Time (s) | | | | 5.4 | | 5.4 | | 5.9 | 5.9 | | 5.9 | |
| Vehicle Extension (s) | | | | 5.0 | | 5.0 | | 5.0 | 5.0 | | 5.0 | |
| Lane Grp Cap (vph) | | | | 986 | | 800 | | 2021 | 884 | | 2904 | 2698 |
| v/s Ratio Prot | | | | c0.16 | | | | c0.43 | | | 0.24 | |
| v/s Ratio Perm | | | | | | 0.10 | | | 0.16 | | | 0.36 |
| v/c Ratio | | | | 0.56 | | 0.36 | | 0.75 | 0.29 | | 0.41 | 0.36 |
| Uniform Delay, d1 | | | | 18.1 | | 16.9 | | 9.5 | 6.4 | | 7.1 | 0.0 |
| Progression Factor | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | | | 1.2 | | 0.6 | | 2.6 | 0.8 | | 0.4 | 0.4 |
| Delay (s) | | | | 19.3 | | 17.4 | | 12.1 | 7.2 | | 7.5 | 0.4 |
| Level of Service | | | | B | | B | | B | A | | A | A |
| Approach Delay (s/veh) | | 0.0 | | | 18.6 | | | 11.0 | | | 4.3 | |
| Approach LOS | | A | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 9.4 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.69 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 62.1% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

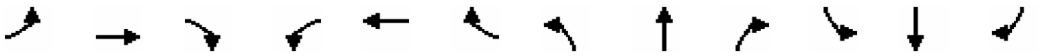


| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 750 | 140 | 683 | 170 | 0 | 220 | 0 | 1755 | 80 | 160 | 1245 | 250 |
| Future Volume (vph) | 750 | 140 | 683 | 170 | 0 | 220 | 0 | 1755 | 80 | 160 | 1245 | 250 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | | 3.1 | | 4.0 | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 0.97 | | 0.88 | | 0.86 | | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | | 0.85 | | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6300 | | 1752 | 3505 | 1513 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6300 | | 1752 | 3505 | 1513 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 806 | 151 | 734 | 183 | 0 | 237 | 0 | 1887 | 86 | 172 | 1339 | 269 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 121 |
| Lane Group Flow (vph) | 806 | 151 | 734 | 183 | 0 | 237 | 0 | 1968 | 0 | 172 | 1339 | 148 |
| Confl. Peds. (#/hr) | | | 5 | | | | 3 | | | | | 3 |
| Confl. Bikes (#/hr) | | | | | | | | | 4 | | | 2 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | | pt+ov | | NA | | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | | 4 5 | | 6 | | 5 | 2 | |
| Permitted Phases | | | Free | | | | | | | | | 2 |
| Actuated Green, G (s) | 31.5 | 16.1 | 120.0 | 25.6 | | 30.4 | | 43.3 | | 15.7 | 63.0 | 63.0 |
| Effective Green, g (s) | 32.9 | 17.5 | 120.0 | 26.1 | | 31.8 | | 44.7 | | 15.7 | 64.4 | 64.4 |
| Actuated g/C Ratio | 0.27 | 0.15 | 1.00 | 0.22 | | 0.27 | | 0.37 | | 0.13 | 0.54 | 0.54 |
| Clearance Time (s) | 5.4 | 5.4 | | 4.5 | | | | 5.4 | | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | | 1.8 | | | | 5.0 | | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 932 | 269 | 1547 | 739 | | 731 | | 2346 | | 229 | 1881 | 811 |
| v/s Ratio Prot | c0.24 | 0.08 | | 0.05 | | 0.09 | | c0.31 | | 0.10 | c0.38 | |
| v/s Ratio Perm | | | c0.47 | | | | | | | | | 0.10 |
| v/c Ratio | 0.86 | 0.56 | 0.47 | 0.25 | | 0.32 | | 0.84 | | 0.75 | 0.71 | 0.18 |
| Uniform Delay, d1 | 41.4 | 47.7 | 0.0 | 38.8 | | 35.5 | | 34.4 | | 50.3 | 20.8 | 14.3 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.96 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 8.1 | 1.6 | 1.0 | 0.1 | | 0.1 | | 3.7 | | 11.6 | 2.3 | 0.5 |
| Delay (s) | 49.6 | 49.3 | 1.0 | 38.9 | | 35.6 | | 36.6 | | 61.9 | 23.2 | 14.8 |
| Level of Service | D | D | A | D | | D | | D | | E | C | B |
| Approach Delay (s/veh) | | 28.5 | | | 37.0 | | | 36.6 | | | 25.6 | |
| Approach LOS | | C | | | D | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 31.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.82 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 67.0% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 100 | 107 | 32 | 155 | 381 | 580 | 61 | 452 | 163 | 440 | 823 | 500 |
| Future Volume (vph) | 100 | 107 | 32 | 155 | 381 | 580 | 61 | 452 | 163 | 440 | 823 | 500 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 5036 | 1545 | 3400 | 5036 | 1546 | 3400 | 5036 | 1547 | 3400 | 5036 | 1549 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 5036 | 1545 | 3400 | 5036 | 1546 | 3400 | 5036 | 1547 | 3400 | 5036 | 1549 |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 110 | 118 | 35 | 170 | 419 | 637 | 67 | 497 | 179 | 484 | 904 | 549 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 110 | 118 | 35 | 170 | 419 | 637 | 67 | 497 | 179 | 484 | 904 | 549 |
| Confl. Peds. (#/hr) | | | 7 | | | 7 | | | 5 | | | 1 |
| Confl. Bikes (#/hr) | | | 3 | | | | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 4 | | 3 | 8 | |
| Permitted Phases | | | Free | | | Free | | | Free | | | Free |
| Actuated Green, G (s) | 7.7 | 12.4 | 72.7 | 9.2 | 13.9 | 72.7 | 5.2 | 15.8 | 72.7 | 16.3 | 26.9 | 72.7 |
| Effective Green, g (s) | 7.7 | 14.1 | 72.7 | 9.2 | 15.6 | 72.7 | 5.2 | 17.1 | 72.7 | 16.3 | 28.2 | 72.7 |
| Actuated g/C Ratio | 0.11 | 0.19 | 1.00 | 0.13 | 0.21 | 1.00 | 0.07 | 0.24 | 1.00 | 0.22 | 0.39 | 1.00 |
| Clearance Time (s) | 4.0 | 5.7 | | 4.0 | 5.7 | | 4.0 | 5.3 | | 4.0 | 5.3 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 360 | 976 | 1545 | 430 | 1080 | 1546 | 243 | 1184 | 1547 | 762 | 1953 | 1549 |
| v/s Ratio Prot | 0.03 | 0.02 | | 0.05 | 0.08 | | 0.02 | 0.10 | | c0.14 | c0.18 | |
| v/s Ratio Perm | | | 0.02 | | | c0.41 | | | 0.12 | | | 0.35 |
| v/c Ratio | 0.31 | 0.12 | 0.02 | 0.40 | 0.39 | 0.41 | 0.28 | 0.42 | 0.12 | 0.64 | 0.46 | 0.35 |
| Uniform Delay, d1 | 30.0 | 24.2 | 0.0 | 29.2 | 24.5 | 0.0 | 32.0 | 23.6 | 0.0 | 25.5 | 16.6 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.2 | 0.0 | 0.0 | 0.2 | 0.1 | 0.8 | 0.2 | 0.1 | 0.2 | 1.3 | 0.1 | 0.6 |
| Delay (s) | 30.2 | 24.2 | 0.0 | 29.4 | 24.5 | 0.8 | 32.2 | 23.7 | 0.2 | 26.8 | 16.7 | 0.6 |
| Level of Service | C | C | A | C | C | A | C | C | A | C | B | A |
| Approach Delay (s/veh) | | 23.5 | | | 12.9 | | | 18.8 | | | 14.7 | |
| Approach LOS | | C | | | B | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 15.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.57 | | |
| Actuated Cycle Length (s) | 72.7 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 52.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 40 | 550 | 220 | 440 | 700 | 293 | 630 | 1223 | 460 | 232 | 1412 | 60 |
| Future Volume (vph) | 40 | 550 | 220 | 440 | 700 | 293 | 630 | 1223 | 460 | 232 | 1412 | 60 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1752 | 5036 | 1547 | 3400 | 3505 | 1539 | 3400 | 5036 | 1541 | 3400 | 4998 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1752 | 5036 | 1547 | 3400 | 3505 | 1539 | 3400 | 5036 | 1541 | 3400 | 4998 | |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 41 | 567 | 227 | 454 | 722 | 302 | 649 | 1261 | 474 | 239 | 1456 | 62 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 179 | 0 | 0 | 135 | 0 | 4 | 0 |
| Lane Group Flow (vph) | 41 | 567 | 227 | 454 | 722 | 123 | 649 | 1261 | 339 | 239 | 1514 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 6 | | | 5 | | | 6 |
| Confl. Bikes (#/hr) | | | 2 | | | 1 | | | | | | 26 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Perm | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | Free | | | 8 | | | 2 | | | |
| Actuated Green, G (s) | 4.0 | 23.4 | 120.0 | 20.4 | 39.8 | 39.8 | 21.0 | 43.4 | 43.4 | 14.0 | 36.4 | |
| Effective Green, g (s) | 4.0 | 24.8 | 120.0 | 20.4 | 41.2 | 41.2 | 21.0 | 44.8 | 44.8 | 14.0 | 37.8 | |
| Actuated g/C Ratio | 0.03 | 0.21 | 1.00 | 0.17 | 0.34 | 0.34 | 0.18 | 0.37 | 0.37 | 0.12 | 0.32 | |
| Clearance Time (s) | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 5.0 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 58 | 1040 | 1547 | 578 | 1203 | 528 | 595 | 1880 | 575 | 396 | 1574 | |
| v/s Ratio Prot | 0.02 | c0.11 | | c0.13 | c0.21 | | c0.19 | 0.25 | | 0.07 | c0.30 | |
| v/s Ratio Perm | | | 0.15 | | | 0.08 | | | 0.22 | | | |
| v/c Ratio | 0.71 | 0.55 | 0.15 | 0.79 | 0.60 | 0.23 | 1.09 | 0.67 | 0.59 | 0.60 | 0.96 | |
| Uniform Delay, d1 | 57.4 | 42.6 | 0.0 | 47.7 | 32.6 | 28.1 | 49.5 | 31.4 | 30.2 | 50.4 | 40.4 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.36 | 1.39 | |
| Incremental Delay, d2 | 27.3 | 1.0 | 0.2 | 6.4 | 1.2 | 0.5 | 64.0 | 1.9 | 4.4 | 1.3 | 11.9 | |
| Delay (s) | 84.7 | 43.6 | 0.2 | 54.1 | 33.8 | 28.6 | 113.5 | 33.4 | 34.6 | 69.6 | 68.1 | |
| Level of Service | F | D | A | D | C | C | F | C | C | E | E | |
| Approach Delay (s/veh) | | 33.8 | | | 39.0 | | | 55.4 | | | 68.3 | |
| Approach LOS | | C | | | D | | | E | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 52.4 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.86 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 86.6% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 4 | 0 | 5 | 26 | 0 | 190 | 7 | 510 | 13 | 126 | 700 | 1 |
| Future Volume (Veh/h) | 4 | 0 | 5 | 26 | 0 | 190 | 7 | 510 | 13 | 126 | 700 | 1 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 4 | 0 | 5 | 28 | 0 | 202 | 7 | 543 | 14 | 134 | 745 | 1 |
| Pedestrians | | 16 | | | 6 | | | | | | 13 | |
| Lane Width (ft) | | 12.0 | | | 12.0 | | | | | | 13.0 | |
| Walking Speed (ft/s) | | 4.0 | | | 4.0 | | | | | | 4.0 | |
| Percent Blockage | | 1 | | | 1 | | | | | | 1 | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 1530 | 1607 | 389 | 1216 | 1600 | 298 | 762 | | | 563 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 1530 | 1607 | 389 | 1216 | 1600 | 298 | 762 | | | 563 | | |
| tC, single (s) | 7.6 | 6.6 | 7.0 | 7.6 | 6.6 | 7.0 | 4.2 | | | 4.2 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 92 | 100 | 99 | 76 | 100 | 70 | 99 | | | 87 | | |
| cM capacity (veh/h) | 48 | 87 | 599 | 118 | 88 | 684 | 828 | | | 993 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|
| Volume Total | 9 | 230 | 7 | 362 | 195 | 134 | 497 | 249 |
| Volume Left | 4 | 28 | 7 | 0 | 0 | 134 | 0 | 0 |
| Volume Right | 5 | 202 | 0 | 0 | 14 | 0 | 0 | 1 |
| cSH | 98 | 432 | 828 | 1700 | 1700 | 993 | 1700 | 1700 |
| Volume to Capacity | 0.09 | 0.53 | 0.01 | 0.21 | 0.11 | 0.13 | 0.29 | 0.15 |
| Queue Length 95th (ft) | 7 | 76 | 1 | 0 | 0 | 12 | 0 | 0 |
| Control Delay (s/veh) | 45.5 | 22.5 | 9.4 | 0.0 | 0.0 | 9.2 | 0.0 | 0.0 |
| Lane LOS | E | C | A | | | A | | |
| Approach Delay (s/veh) | 45.5 | 22.5 | 0.1 | | | 1.4 | | |
| Approach LOS | E | C | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 4.1 | | | |
| Intersection Capacity Utilization | 47.4% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 146 | 15 | 5 | 178 | 25 | 41 |
| Future Volume (Veh/h) | 146 | 15 | 5 | 178 | 25 | 41 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 |
| Hourly flow rate (vph) | 178 | 18 | 6 | 217 | 30 | 50 |
| Pedestrians | 3 | | | 1 | 8 | |
| Lane Width (ft) | 12.0 | | | 12.0 | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | 4.0 | 4.0 | |
| Percent Blockage | 0 | | | 0 | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 204 | | 427 | 196 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 204 | | 427 | 196 |
| tC, single (s) | | | 4.2 | | 6.5 | 6.3 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.3 | | 3.6 | 3.4 |
| p0 queue free % | | | 100 | | 95 | 94 |
| cM capacity (veh/h) | | | 1307 | | 560 | 817 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 196 | 6 | 217 | 80 |
| Volume Left | 0 | 6 | 0 | 30 |
| Volume Right | 18 | 0 | 0 | 50 |
| cSH | 1700 | 1307 | 1700 | 697 |
| Volume to Capacity | 0.12 | 0.00 | 0.13 | 0.11 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 10 |
| Control Delay (s/veh) | 0.0 | 7.8 | 0.0 | 10.8 |
| Lane LOS | | A | | B |
| Approach Delay (s/veh) | 0.0 | 0.2 | | 10.8 |
| Approach LOS | | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.8 | | |
| Intersection Capacity Utilization | 20.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 129 | 12 | 5 | 196 | 22 | 28 |
| Future Volume (Veh/h) | 129 | 12 | 5 | 196 | 22 | 28 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Hourly flow rate (vph) | 152 | 14 | 6 | 231 | 26 | 33 |
| Pedestrians | 1 | | | | 10 | |
| Lane Width (ft) | 12.0 | | | | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | | 4.0 | |
| Percent Blockage | 0 | | | | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 176 | | 413 | 169 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 176 | | 413 | 169 |
| tC, single (s) | | | 4.2 | | 6.5 | 6.3 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.3 | | 3.6 | 3.4 |
| p0 queue free % | | | 100 | | 96 | 96 |
| cM capacity (veh/h) | | | 1359 | | 578 | 855 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 166 | 6 | 231 | 59 |
| Volume Left | 0 | 6 | 0 | 26 |
| Volume Right | 14 | 0 | 0 | 33 |
| cSH | 1700 | 1359 | 1700 | 706 |
| Volume to Capacity | 0.10 | 0.00 | 0.14 | 0.08 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 7 |
| Control Delay (s/veh) | 0.0 | 7.7 | 0.0 | 10.6 |
| Lane LOS | | A | | B |
| Approach Delay (s/veh) | 0.0 | 0.2 | | 10.6 |
| Approach LOS | | | | B |

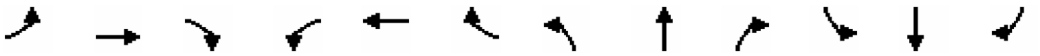
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.4 | | |
| Intersection Capacity Utilization | 20.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 2 | 31 | 503 | 8 | 7 | 926 |
| Future Volume (Veh/h) | 2 | 31 | 503 | 8 | 7 | 926 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Hourly flow rate (vph) | 2 | 32 | 513 | 8 | 7 | 945 |
| Pedestrians | 15 | | | | | |
| Lane Width (ft) | 12.0 | | | | | |
| Walking Speed (ft/s) | 4.0 | | | | | |
| Percent Blockage | 1 | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 861 | 276 | | | 536 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 861 | 276 | | | 536 | |
| tC, single (s) | 6.9 | 7.0 | | | 4.2 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 99 | 95 | | | 99 | |
| cM capacity (veh/h) | 287 | 710 | | | 1008 | |

| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|
| Volume Total | 34 | 342 | 179 | 7 | 315 | 315 | 315 |
| Volume Left | 2 | 0 | 0 | 7 | 0 | 0 | 0 |
| Volume Right | 32 | 0 | 8 | 0 | 0 | 0 | 0 |
| cSH | 653 | 1700 | 1700 | 1008 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.05 | 0.20 | 0.11 | 0.01 | 0.19 | 0.19 | 0.19 |
| Queue Length 95th (ft) | 4 | 0 | 0 | 1 | 0 | 0 | 0 |
| Control Delay (s/veh) | 10.8 | 0.0 | 0.0 | 8.6 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | | | A | | | |
| Approach Delay (s/veh) | 10.8 | 0.0 | | 0.1 | | | |
| Approach LOS | B | | | | | | |

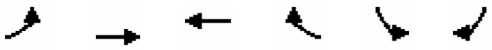
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.3 | | |
| Intersection Capacity Utilization | Err% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 49 | 0 | 138 | 0 | 0 | 0 | 131 | 350 | 0 | 0 | 240 | 48 |
| Future Volume (Veh/h) | 49 | 0 | 138 | 0 | 0 | 0 | 131 | 350 | 0 | 0 | 240 | 48 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 52 | 0 | 147 | 0 | 0 | 0 | 139 | 372 | 0 | 0 | 255 | 51 |
| Pedestrians | | 3 | | | | | | 1 | | | | |
| Lane Width (ft) | | 13.0 | | | | | | 13.0 | | | | |
| Walking Speed (ft/s) | | 4.0 | | | | | | 4.0 | | | | |
| Percent Blockage | | 0 | | | | | | 0 | | | | |
| Right turn flare (veh) | | | 8 | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | 144 | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 908 | 908 | 259 | 906 | 959 | 372 | 309 | | | 372 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 908 | 908 | 259 | 906 | 959 | 372 | 309 | | | 372 | | |
| tC, single (s) | 7.2 | 6.6 | 6.2 | 7.2 | 6.6 | 6.2 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 77 | 100 | 81 | 100 | 100 | 100 | 89 | | | 100 | | |
| cM capacity (veh/h) | 230 | 241 | 770 | 187 | 225 | 667 | 1231 | | | 1170 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|
| Volume Total | 199 | 0 | 139 | 372 | 0 | 255 | 51 |
| Volume Left | 52 | 0 | 139 | 0 | 0 | 0 | 0 |
| Volume Right | 147 | 0 | 0 | 0 | 0 | 0 | 51 |
| cSH | 881 | 1700 | 1231 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.23 | 0.00 | 0.11 | 0.22 | 0.00 | 0.15 | 0.03 |
| Queue Length 95th (ft) | 22 | 0 | 10 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 14.5 | 0.0 | 8.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | A | A | | | | |
| Approach Delay (s/veh) | 14.5 | 0.0 | 2.3 | | 0.0 | | |
| Approach LOS | B | A | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 4.0 | | | |
| Intersection Capacity Utilization | 35.4% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | ↑↑↑ | | | ↱ |
| Traffic Volume (veh/h) | 0 | 1361 | 1072 | 21 | 0 | 63 |
| Future Volume (Veh/h) | 0 | 1361 | 1072 | 21 | 0 | 63 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 0 | 1448 | 1140 | 22 | 0 | 67 |
| Pedestrians | | | | | 14 | |
| Lane Width (ft) | | | | | 12.0 | |
| Walking Speed (ft/s) | | | | | 4.0 | |
| Percent Blockage | | | | | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | 526 | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1176 | | | | 1648 | 405 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 1176 | | | | 1648 | 405 |
| tC, single (s) | 4.2 | | | | 6.9 | 7.0 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 100 | 89 |
| cM capacity (veh/h) | 577 | | | | 88 | 585 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | SB 1 |
|---|---|---|---|---|---|---|---|
| Volume Total | 483 | 483 | 483 | 456 | 456 | 250 | 67 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 22 | 67 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 585 |
| Volume to Capacity | 0.28 | 0.28 | 0.28 | 0.27 | 0.27 | 0.15 | 0.11 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| Control Delay (s/veh) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 11.9 |
| Lane LOS | | | | | | | B |
| Approach Delay (s/veh) | 0.0 | | | 0.0 | | | 11.9 |
| Approach LOS | | | | | | | B |

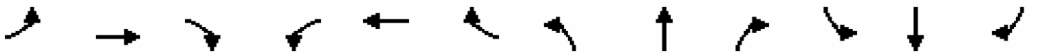
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.3 | | |
| Intersection Capacity Utilization | 31.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 85 | 0 | 1915 | 1621 | 35 |
| Future Volume (Veh/h) | 0 | 85 | 0 | 1915 | 1621 | 35 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Hourly flow rate (vph) | 0 | 89 | 0 | 1995 | 1689 | 36 |
| Pedestrians | 17 | | | | | |
| Lane Width (ft) | 12.0 | | | | | |
| Walking Speed (ft/s) | 4.0 | | | | | |
| Percent Blockage | 1 | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | 647 | 189 | |
| pX, platoon unblocked | 0.87 | 0.79 | 0.79 | | | |
| vC, conflicting volume | 2205 | 580 | 1742 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 224 | 0 | 988 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 100 | 89 | 100 | | | |
| cM capacity (veh/h) | 643 | 842 | 543 | | | |

| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | NB 4 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 89 | 285 | 570 | 570 | 570 | 563 | 563 | 563 | 36 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 89 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 |
| cSH | 842 | 543 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.11 | 0.00 | 0.34 | 0.34 | 0.34 | 0.33 | 0.33 | 0.33 | 0.02 |
| Queue Length 95th (ft) | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 9.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | | | | | | | |
| Approach Delay (s/veh) | 9.8 | 0.0 | | | | 0.0 | | | |
| Approach LOS | A | | | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 0.2 | | | |
| Intersection Capacity Utilization | 43.2% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |

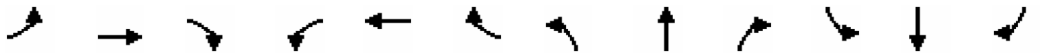


| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 581 | 280 | 500 | 150 | 190 | 70 | 480 | 1264 | 130 | 160 | 1117 | 422 |
| Future Volume (vph) | 581 | 280 | 500 | 150 | 190 | 70 | 480 | 1264 | 130 | 160 | 1117 | 422 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.95 | 1.00 | 0.97 | 0.95 | | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 3505 | 1529 | 3400 | 3350 | | 3400 | 5036 | 1544 | 3400 | 5036 | 1545 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 3505 | 1529 | 3400 | 3350 | | 3400 | 5036 | 1544 | 3400 | 5036 | 1545 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 605 | 292 | 521 | 156 | 198 | 73 | 500 | 1317 | 135 | 167 | 1164 | 440 |
| RTOR Reduction (vph) | 0 | 0 | 312 | 0 | 35 | 0 | 0 | 0 | 78 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 605 | 292 | 209 | 156 | 236 | 0 | 500 | 1317 | 57 | 167 | 1164 | 440 |
| Confl. Peds. (#/hr) | | | 13 | | | 1 | | | 3 | | | 10 |
| Confl. Bikes (#/hr) | | | | | | 1 | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Prot | NA | Perm | Prot | NA | Free |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | 8 | | | | | | 6 | | | Free |
| Actuated Green, G (s) | 21.0 | 30.0 | 30.0 | 12.2 | 21.2 | | 21.0 | 49.0 | 49.0 | 10.0 | 38.0 | 120.0 |
| Effective Green, g (s) | 21.0 | 31.4 | 31.4 | 12.2 | 22.6 | | 21.0 | 50.4 | 50.4 | 10.0 | 39.4 | 120.0 |
| Actuated g/C Ratio | 0.18 | 0.26 | 0.26 | 0.10 | 0.19 | | 0.18 | 0.42 | 0.42 | 0.08 | 0.33 | 1.00 |
| Clearance Time (s) | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 595 | 917 | 400 | 345 | 630 | | 595 | 2115 | 648 | 283 | 1653 | 1545 |
| v/s Ratio Prot | c0.18 | 0.08 | | c0.05 | 0.07 | | c0.15 | 0.26 | | 0.05 | c0.23 | |
| v/s Ratio Perm | | | c0.14 | | | | | | 0.04 | | | 0.28 |
| v/c Ratio | 1.02 | 0.32 | 0.52 | 0.45 | 0.37 | | 0.84 | 0.62 | 0.09 | 0.59 | 0.70 | 0.28 |
| Uniform Delay, d1 | 49.5 | 35.7 | 37.9 | 50.8 | 42.5 | | 47.9 | 27.3 | 21.0 | 53.0 | 35.2 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 0.90 | 0.80 | 1.51 | 0.72 | 0.64 | 1.00 |
| Incremental Delay, d2 | 41.2 | 0.1 | 0.6 | 0.3 | 0.1 | | 8.0 | 1.1 | 0.2 | 1.9 | 2.2 | 0.4 |
| Delay (s) | 90.7 | 35.8 | 38.4 | 51.1 | 42.7 | | 51.1 | 22.9 | 31.8 | 40.0 | 24.8 | 0.4 |
| Level of Service | F | D | D | D | D | | D | C | C | D | C | A |
| Approach Delay (s/veh) | | 60.2 | | | 45.7 | | | 30.8 | | | 20.2 | |
| Approach LOS | | E | | | D | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 36.0 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.74 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 72.7% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 198 | 10 | 170 | 10 | 10 | 10 | 305 | 1600 | 10 | 40 | 1475 | 170 |
| Future Volume (vph) | 198 | 10 | 170 | 10 | 10 | 10 | 305 | 1600 | 10 | 40 | 1475 | 170 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 5.4 |
| Lane Util. Factor | 0.95 | 0.95 | 1.00 | | 1.00 | | 1.00 | 0.91 | 1.00 | 1.00 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.96 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 0.96 | 1.00 | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1665 | 1677 | 1546 | | 1732 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1509 |
| Flt Permitted | 0.74 | 0.72 | 1.00 | | 0.48 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1289 | 1267 | 1546 | | 838 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1509 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 211 | 11 | 181 | 11 | 11 | 11 | 324 | 1702 | 11 | 43 | 1569 | 181 |
| RTOR Reduction (vph) | 0 | 0 | 154 | 0 | 10 | 0 | 0 | 0 | 4 | 0 | 0 | 50 |
| Lane Group Flow (vph) | 110 | 112 | 27 | 0 | 23 | 0 | 324 | 1702 | 7 | 43 | 1569 | 131 |
| Confl. Peds. (#/hr) | | | 2 | 2 | | | | | 1 | | | 14 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 7 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | 3 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 3 | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 17.2 | 17.2 | 17.2 | | 5.4 | | 17.9 | 72.7 | 72.7 | 6.4 | 61.2 | 61.2 |
| Effective Green, g (s) | 17.9 | 17.9 | 17.9 | | 5.6 | | 17.9 | 74.1 | 74.1 | 6.4 | 62.6 | 61.2 |
| Actuated g/C Ratio | 0.15 | 0.15 | 0.15 | | 0.05 | | 0.15 | 0.62 | 0.62 | 0.05 | 0.52 | 0.51 |
| Clearance Time (s) | 4.7 | 4.7 | 4.7 | | 4.2 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 192 | 188 | 230 | | 39 | | 261 | 3109 | 944 | 93 | 2627 | 769 |
| v/s Ratio Prot | | | | | | | c0.18 | 0.34 | | 0.02 | c0.31 | |
| v/s Ratio Perm | 0.09 | c0.09 | 0.02 | | c0.03 | | | | 0.00 | | | 0.09 |
| v/c Ratio | 0.57 | 0.60 | 0.12 | | 0.58 | | 1.24 | 0.55 | 0.01 | 0.46 | 0.60 | 0.17 |
| Uniform Delay, d1 | 47.5 | 47.7 | 44.2 | | 56.0 | | 51.1 | 13.3 | 8.8 | 55.1 | 19.9 | 15.8 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.12 | 1.63 | 1.00 | 1.05 | 0.53 | 0.24 |
| Incremental Delay, d2 | 2.6 | 3.4 | 0.1 | | 12.2 | | 129.0 | 0.5 | 0.0 | 1.2 | 0.9 | 0.4 |
| Delay (s) | 50.1 | 51.0 | 44.3 | | 68.2 | | 186.1 | 22.1 | 8.8 | 59.0 | 11.4 | 4.3 |
| Level of Service | D | D | D | | E | | F | C | A | E | B | A |
| Approach Delay (s/veh) | | 47.7 | | | 68.2 | | | 48.1 | | | 11.9 | |
| Approach LOS | | D | | | E | | | D | | | B | |

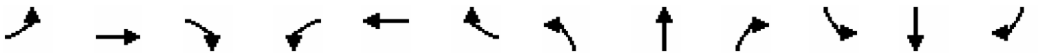
| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 33.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.71 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 68.8% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 0 | 492 | 0 | 260 | 0 | 1708 | 550 | 0 | 1541 | 780 |
| Future Volume (vph) | 0 | 0 | 0 | 492 | 0 | 260 | 0 | 1708 | 550 | 0 | 1541 | 780 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 4.0 | | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | | | | 0.97 | | 0.88 | | 0.95 | 1.00 | | 0.91 | 0.88 |
| Frpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 0.98 | | 1.00 | 0.98 |
| Flpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | | | 1.00 | | 0.85 | | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | 3400 | | 2760 | | 3505 | 1535 | | 5036 | 2703 |
| Flt Permitted | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | 3400 | | 2760 | | 3505 | 1535 | | 5036 | 2703 |
| Peak-hour factor, PHF | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 |
| Adj. Flow (vph) | 0 | 0 | 0 | 497 | 0 | 263 | 0 | 1725 | 556 | 0 | 1557 | 788 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 38 | 0 | 0 | 231 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 497 | 0 | 225 | 0 | 1725 | 325 | 0 | 1557 | 788 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | 1 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | | | | Prot | | Perm | | NA | Perm | | NA | Free |
| Protected Phases | | | | 4 | | | | 6 | | | 2 | |
| Permitted Phases | | | | 4 | | 4 | | | 6 | | | Free |
| Actuated Green, G (s) | | | | 15.5 | | 15.5 | | 33.2 | 33.2 | | 33.2 | 60.0 |
| Effective Green, g (s) | | | | 16.9 | | 16.9 | | 35.1 | 35.1 | | 35.1 | 60.0 |
| Actuated g/C Ratio | | | | 0.28 | | 0.28 | | 0.59 | 0.59 | | 0.59 | 1.00 |
| Clearance Time (s) | | | | 5.4 | | 5.4 | | 5.9 | 5.9 | | 5.9 | |
| Vehicle Extension (s) | | | | 5.0 | | 5.0 | | 5.0 | 5.0 | | 5.0 | |
| Lane Grp Cap (vph) | | | | 957 | | 777 | | 2050 | 897 | | 2946 | 2703 |
| v/s Ratio Prot | | | | c0.15 | | | | c0.49 | | | 0.31 | |
| v/s Ratio Perm | | | | | | 0.08 | | | 0.21 | | | 0.29 |
| v/c Ratio | | | | 0.52 | | 0.29 | | 0.84 | 0.36 | | 0.53 | 0.29 |
| Uniform Delay, d1 | | | | 18.1 | | 16.9 | | 10.2 | 6.6 | | 7.5 | 0.0 |
| Progression Factor | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | | | 1.0 | | 0.4 | | 4.4 | 1.1 | | 0.7 | 0.3 |
| Delay (s) | | | | 19.1 | | 17.3 | | 14.6 | 7.7 | | 8.2 | 0.3 |
| Level of Service | | | | B | | B | | B | A | | A | A |
| Approach Delay (s/veh) | | 0.0 | | | 18.5 | | | 12.9 | | | 5.5 | |
| Approach LOS | | A | | | B | | | B | | | A | |

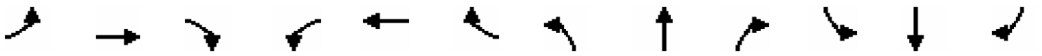
| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 10.5 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.74 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 67.9% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



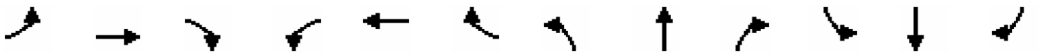
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 540 | 140 | 182 | 130 | 0 | 250 | 0 | 2008 | 110 | 260 | 1253 | 550 |
| Future Volume (vph) | 540 | 140 | 182 | 130 | 0 | 250 | 0 | 2008 | 110 | 260 | 1253 | 550 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | | 3.1 | | 4.0 | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 0.97 | | 0.88 | | 0.86 | | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 0.96 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | | 0.85 | | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6292 | | 1752 | 3505 | 1500 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6292 | | 1752 | 3505 | 1500 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 557 | 144 | 188 | 134 | 0 | 258 | 0 | 2070 | 113 | 268 | 1292 | 567 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 237 |
| Lane Group Flow (vph) | 557 | 144 | 188 | 134 | 0 | 258 | 0 | 2177 | 0 | 268 | 1292 | 330 |
| Confl. Peds. (#/hr) | | | 5 | | | 2 | 5 | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | 1 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | | pt+ov | | NA | | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | | 4 5 | | 6 | | 5 | 2 | |
| Permitted Phases | | | Free | | | | | | | | | 2 |
| Actuated Green, G (s) | 24.0 | 15.8 | 120.0 | 20.5 | | 38.4 | | 42.8 | | 21.6 | 68.4 | 68.4 |
| Effective Green, g (s) | 25.4 | 17.2 | 120.0 | 21.0 | | 39.8 | | 44.2 | | 21.6 | 69.8 | 69.8 |
| Actuated g/C Ratio | 0.21 | 0.14 | 1.00 | 0.18 | | 0.33 | | 0.37 | | 0.18 | 0.58 | 0.58 |
| Clearance Time (s) | 5.4 | 5.4 | | 4.5 | | | | 5.4 | | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | | 1.8 | | | | 5.0 | | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 719 | 264 | 1547 | 595 | | 915 | | 2317 | | 315 | 2038 | 872 |
| v/s Ratio Prot | c0.16 | 0.08 | | 0.04 | | c0.09 | | c0.35 | | c0.15 | 0.37 | |
| v/s Ratio Perm | | | 0.12 | | | | | | | | | 0.22 |
| v/c Ratio | 0.77 | 0.55 | 0.12 | 0.23 | | 0.28 | | 0.94 | | 0.85 | 0.63 | 0.38 |
| Uniform Delay, d1 | 44.6 | 47.8 | 0.0 | 42.5 | | 29.6 | | 36.6 | | 47.6 | 16.6 | 13.5 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.87 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 4.8 | 1.2 | 0.2 | 0.1 | | 0.1 | | 8.4 | | 18.6 | 1.5 | 1.3 |
| Delay (s) | 49.4 | 49.0 | 0.2 | 42.6 | | 29.6 | | 40.3 | | 66.3 | 18.1 | 14.7 |
| Level of Service | D | D | A | D | | C | | D | | E | B | B |
| Approach Delay (s/veh) | | 38.9 | | | 34.1 | | | 40.3 | | | 23.3 | |
| Approach LOS | | D | | | C | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 33.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.80 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 72.9% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 600 | 701 | 51 | 193 | 307 | 650 | 32 | 813 | 125 | 650 | 562 | 240 |
| Future Volume (vph) | 600 | 701 | 51 | 193 | 307 | 650 | 32 | 813 | 125 | 650 | 562 | 240 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 5036 | 1544 | 3400 | 5036 | 1549 | 3400 | 5036 | 1547 | 3400 | 5036 | 1547 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 5036 | 1544 | 3400 | 5036 | 1549 | 3400 | 5036 | 1547 | 3400 | 5036 | 1547 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 645 | 754 | 55 | 208 | 330 | 699 | 34 | 874 | 134 | 699 | 604 | 258 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 645 | 754 | 55 | 208 | 330 | 699 | 34 | 874 | 134 | 699 | 604 | 258 |
| Confl. Peds. (#/hr) | | | 10 | | | 1 | | | 5 | | | 4 |
| Confl. Bikes (#/hr) | | | 2 | | | | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 4 | | 3 | 8 | |
| Permitted Phases | | | Free | | | Free | | | Free | | | Free |
| Actuated Green, G (s) | 25.9 | 28.9 | 114.8 | 11.8 | 14.8 | 114.8 | 3.5 | 26.9 | 114.8 | 28.2 | 51.6 | 114.8 |
| Effective Green, g (s) | 25.9 | 30.6 | 114.8 | 11.8 | 16.5 | 114.8 | 3.5 | 28.2 | 114.8 | 28.2 | 52.9 | 114.8 |
| Actuated g/C Ratio | 0.23 | 0.27 | 1.00 | 0.10 | 0.14 | 1.00 | 0.03 | 0.25 | 1.00 | 0.25 | 0.46 | 1.00 |
| Clearance Time (s) | 4.0 | 5.7 | | 4.0 | 5.7 | | 4.0 | 5.3 | | 4.0 | 5.3 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 767 | 1342 | 1544 | 349 | 723 | 1549 | 103 | 1237 | 1547 | 835 | 2320 | 1547 |
| v/s Ratio Prot | c0.19 | c0.15 | | 0.06 | 0.07 | | 0.01 | c0.17 | | c0.21 | 0.12 | |
| v/s Ratio Perm | | | 0.04 | | | 0.45 | | | 0.09 | | | 0.17 |
| v/c Ratio | 0.84 | 0.56 | 0.04 | 0.60 | 0.46 | 0.45 | 0.33 | 0.71 | 0.09 | 0.84 | 0.26 | 0.17 |
| Uniform Delay, d1 | 42.5 | 36.3 | 0.0 | 49.2 | 45.0 | 0.0 | 54.5 | 39.5 | 0.0 | 41.1 | 19.0 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 8.0 | 0.3 | 0.0 | 1.8 | 0.2 | 1.0 | 0.7 | 1.5 | 0.1 | 7.0 | 0.0 | 0.2 |
| Delay (s) | 50.4 | 36.6 | 0.0 | 51.0 | 45.2 | 1.0 | 55.2 | 41.0 | 0.1 | 48.1 | 19.0 | 0.2 |
| Level of Service | D | D | A | D | D | A | E | D | A | D | B | A |
| Approach Delay (s/veh) | | 41.4 | | | 21.2 | | | 36.2 | | | 28.9 | |
| Approach LOS | | D | | | C | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 32.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.77 | | |
| Actuated Cycle Length (s) | 114.8 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 73.3% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 80 | 800 | 700 | 300 | 450 | 302 | 330 | 1342 | 440 | 353 | 1344 | 50 |
| Future Volume (vph) | 80 | 800 | 700 | 300 | 450 | 302 | 330 | 1342 | 440 | 353 | 1344 | 50 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1752 | 5036 | 1547 | 3400 | 3505 | 1537 | 3400 | 5036 | 1541 | 3400 | 5005 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1752 | 5036 | 1547 | 3400 | 3505 | 1537 | 3400 | 5036 | 1541 | 3400 | 5005 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 82 | 816 | 714 | 306 | 459 | 308 | 337 | 1369 | 449 | 360 | 1371 | 51 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 191 | 0 | 0 | 128 | 0 | 3 | 0 |
| Lane Group Flow (vph) | 82 | 816 | 714 | 306 | 459 | 117 | 337 | 1369 | 321 | 360 | 1419 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 7 | | | 5 | | | 5 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | | | | 9 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Perm | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | Free | | | 8 | | | 2 | | | |
| Actuated Green, G (s) | 7.6 | 29.5 | 120.0 | 16.5 | 38.4 | 38.4 | 15.1 | 41.2 | 41.2 | 14.0 | 40.1 | |
| Effective Green, g (s) | 7.6 | 30.9 | 120.0 | 16.5 | 39.8 | 39.8 | 15.1 | 42.6 | 42.6 | 14.0 | 41.5 | |
| Actuated g/C Ratio | 0.06 | 0.26 | 1.00 | 0.14 | 0.33 | 0.33 | 0.13 | 0.36 | 0.36 | 0.12 | 0.35 | |
| Clearance Time (s) | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 5.0 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 110 | 1296 | 1547 | 467 | 1162 | 509 | 427 | 1787 | 547 | 396 | 1730 | |
| v/s Ratio Prot | 0.05 | c0.16 | | c0.09 | 0.13 | | 0.10 | c0.27 | | 0.11 | c0.28 | |
| v/s Ratio Perm | | | 0.46 | | | 0.08 | | | 0.21 | | | |
| v/c Ratio | 0.75 | 0.63 | 0.46 | 0.66 | 0.40 | 0.23 | 0.79 | 0.77 | 0.59 | 0.91 | 0.82 | |
| Uniform Delay, d1 | 55.2 | 39.5 | 0.0 | 49.1 | 30.8 | 29.0 | 50.9 | 34.3 | 31.5 | 52.4 | 35.8 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.22 | 1.33 | |
| Incremental Delay, d2 | 21.1 | 1.4 | 1.0 | 2.5 | 0.5 | 0.5 | 8.7 | 3.2 | 4.6 | 18.8 | 3.4 | |
| Delay (s) | 76.3 | 40.8 | 1.0 | 51.6 | 31.3 | 29.5 | 59.6 | 37.5 | 36.1 | 82.8 | 51.2 | |
| Level of Service | E | D | A | D | C | C | E | D | D | F | D | |
| Approach Delay (s/veh) | | 25.0 | | | 36.6 | | | 40.7 | | | 57.6 | |
| Approach LOS | | C | | | D | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 40.7 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.74 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 78.1% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 0 | 0 | 8 | 40 | 1 | 100 | 12 | 750 | 19 | 130 | 600 | 2 |
| Future Volume (Veh/h) | 0 | 0 | 8 | 40 | 1 | 100 | 12 | 750 | 19 | 130 | 600 | 2 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 |
| Hourly flow rate (vph) | 0 | 0 | 9 | 47 | 1 | 116 | 14 | 872 | 22 | 151 | 698 | 2 |
| Pedestrians | | 9 | | | 10 | | | | | | 11 | |
| Lane Width (ft) | | 12.0 | | | 12.0 | | | | | | 13.0 | |
| Walking Speed (ft/s) | | 4.0 | | | 4.0 | | | | | | 4.0 | |
| Percent Blockage | | 1 | | | 1 | | | | | | 1 | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 1602 | 1942 | 359 | 1581 | 1932 | 468 | 709 | | | 904 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 1602 | 1942 | 359 | 1581 | 1932 | 468 | 709 | | | 904 | | |
| tC, single (s) | 7.6 | 6.6 | 7.0 | 7.6 | 6.6 | 7.0 | 4.2 | | | 4.2 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 100 | 100 | 99 | 19 | 98 | 78 | 98 | | | 79 | | |
| cM capacity (veh/h) | 44 | 49 | 630 | 58 | 50 | 529 | 873 | | | 736 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|
| Volume Total | 9 | 164 | 14 | 581 | 313 | 151 | 465 | 235 |
| Volume Left | 0 | 47 | 14 | 0 | 0 | 151 | 0 | 0 |
| Volume Right | 9 | 116 | 0 | 0 | 22 | 0 | 0 | 2 |
| cSH | 630 | 157 | 873 | 1700 | 1700 | 736 | 1700 | 1700 |
| Volume to Capacity | 0.01 | 1.05 | 0.02 | 0.34 | 0.18 | 0.21 | 0.27 | 0.14 |
| Queue Length 95th (ft) | 1 | 207 | 1 | 0 | 0 | 19 | 0 | 0 |
| Control Delay (s/veh) | 10.8 | 142.5 | 9.2 | 0.0 | 0.0 | 11.2 | 0.0 | 0.0 |
| Lane LOS | B | F | A | | | B | | |
| Approach Delay (s/veh) | 10.8 | 142.5 | 0.1 | | | 2.0 | | |
| Approach LOS | B | F | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 13.1 | | | |
| Intersection Capacity Utilization | 54.5% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 120 | 14 | 5 | 120 | 19 | 8 |
| Future Volume (Veh/h) | 120 | 14 | 5 | 120 | 19 | 8 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 130 | 15 | 5 | 130 | 21 | 9 |
| Pedestrians | 1 | | | 2 | 10 | |
| Lane Width (ft) | 12.0 | | | 12.0 | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | 4.0 | 4.0 | |
| Percent Blockage | 0 | | | 0 | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 155 | | 289 | 150 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 155 | | 289 | 150 |
| tC, single (s) | | | 4.2 | | 6.5 | 6.3 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.3 | | 3.6 | 3.4 |
| p0 queue free % | | | 100 | | 97 | 99 |
| cM capacity (veh/h) | | | 1389 | | 685 | 878 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 145 | 5 | 130 | 30 |
| Volume Left | 0 | 5 | 0 | 21 |
| Volume Right | 15 | 0 | 0 | 9 |
| cSH | 1700 | 1389 | 1700 | 733 |
| Volume to Capacity | 0.09 | 0.00 | 0.08 | 0.04 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 3 |
| Control Delay (s/veh) | 0.0 | 7.6 | 0.0 | 10.1 |
| Lane LOS | | A | | B |
| Approach Delay (s/veh) | 0.0 | 0.3 | | 10.1 |
| Approach LOS | | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.1 | | |
| Intersection Capacity Utilization | 19.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 110 | 36 | 19 | 120 | 20 | 25 |
| Future Volume (Veh/h) | 110 | 36 | 19 | 120 | 20 | 25 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 |
| Hourly flow rate (vph) | 128 | 42 | 22 | 140 | 23 | 29 |
| Pedestrians | 2 | | | 6 | 4 | |
| Lane Width (ft) | 12.0 | | | 12.0 | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | 4.0 | 4.0 | |
| Percent Blockage | 0 | | | 1 | 0 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 174 | | 339 | 159 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 174 | | 339 | 159 |
| tC, single (s) | | | 4.1 | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.2 | | 3.5 | 3.3 |
| p0 queue free % | | | 98 | | 96 | 97 |
| cM capacity (veh/h) | | | 1380 | | 637 | 871 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 170 | 22 | 140 | 52 |
| Volume Left | 0 | 22 | 0 | 23 |
| Volume Right | 42 | 0 | 0 | 29 |
| cSH | 1700 | 1380 | 1700 | 749 |
| Volume to Capacity | 0.10 | 0.02 | 0.08 | 0.07 |
| Queue Length 95th (ft) | 0 | 1 | 0 | 6 |
| Control Delay (s/veh) | 0.0 | 7.7 | 0.0 | 10.2 |
| Lane LOS | | A | | B |
| Approach Delay (s/veh) | 0.0 | 1.0 | | 10.2 |
| Approach LOS | | | | B |

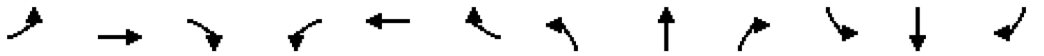
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.8 | | |
| Intersection Capacity Utilization | 27.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 11 | 970 | 25 | 20 | 830 |
| Future Volume (Veh/h) | 0 | 11 | 970 | 25 | 20 | 830 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 |
| Hourly flow rate (vph) | 0 | 13 | 1183 | 30 | 24 | 1012 |
| Pedestrians | 14 | | | | | 1 |
| Lane Width (ft) | 12.0 | | | | | 12.0 |
| Walking Speed (ft/s) | 4.0 | | | | | 4.0 |
| Percent Blockage | 1 | | | | | 0 |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1597 | 622 | | | 1227 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 1597 | 622 | | | 1227 | |
| tC, single (s) | 6.9 | 7.0 | | | 4.2 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 100 | 97 | | | 96 | |
| cM capacity (veh/h) | 91 | 422 | | | 552 | |

| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|
| Volume Total | 13 | 789 | 424 | 24 | 337 | 337 | 337 |
| Volume Left | 0 | 0 | 0 | 24 | 0 | 0 | 0 |
| Volume Right | 13 | 0 | 30 | 0 | 0 | 0 | 0 |
| cSH | 422 | 1700 | 1700 | 552 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.03 | 0.46 | 0.25 | 0.04 | 0.20 | 0.20 | 0.20 |
| Queue Length 95th (ft) | 2 | 0 | 0 | 3 | 0 | 0 | 0 |
| Control Delay (s/veh) | 13.8 | 0.0 | 0.0 | 11.8 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | | | B | | | |
| Approach Delay (s/veh) | 13.8 | 0.0 | | 0.3 | | | |
| Approach LOS | B | | | | | | |

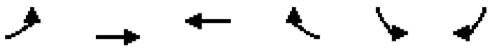
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.2 | | |
| Intersection Capacity Utilization | 38.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 30 | 0 | 100 | 0 | 0 | 0 | 80 | 290 | 0 | 0 | 360 | 40 |
| Future Volume (Veh/h) | 30 | 0 | 100 | 0 | 0 | 0 | 80 | 290 | 0 | 0 | 360 | 40 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 |
| Hourly flow rate (vph) | 37 | 0 | 123 | 0 | 0 | 0 | 99 | 358 | 0 | 0 | 444 | 49 |
| Pedestrians | | 21 | | | 1 | | | 1 | | | | |
| Lane Width (ft) | | 13.0 | | | 12.0 | | | 13.0 | | | | |
| Walking Speed (ft/s) | | 4.0 | | | 4.0 | | | 4.0 | | | | |
| Percent Blockage | | 2 | | | 0 | | | 0 | | | | |
| Right turn flare (veh) | | | 8 | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | 144 | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 1021 | 1022 | 466 | 1002 | 1071 | 359 | 514 | | | 359 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 1021 | 1022 | 466 | 1002 | 1071 | 359 | 514 | | | 359 | | |
| tC, single (s) | 7.2 | 6.6 | 6.2 | 7.2 | 6.6 | 6.2 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 80 | 100 | 79 | 100 | 100 | 100 | 90 | | | 100 | | |
| cM capacity (veh/h) | 190 | 206 | 579 | 157 | 193 | 678 | 1017 | | | 1182 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|
| Volume Total | 160 | 0 | 99 | 358 | 0 | 444 | 49 |
| Volume Left | 37 | 0 | 99 | 0 | 0 | 0 | 0 |
| Volume Right | 123 | 0 | 0 | 0 | 0 | 0 | 49 |
| cSH | 753 | 1700 | 1017 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.21 | 0.00 | 0.10 | 0.21 | 0.00 | 0.26 | 0.03 |
| Queue Length 95th (ft) | 20 | 0 | 8 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 16.5 | 0.0 | 8.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | C | A | A | | | | |
| Approach Delay (s/veh) | 16.5 | 0.0 | 1.9 | | 0.0 | | |
| Approach LOS | C | A | | | | | |

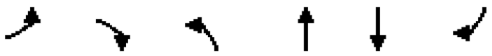
| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 3.2 | | | |
| Intersection Capacity Utilization | 37.0% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 970 | 1500 | 66 | 0 | 36 |
| Future Volume (Veh/h) | 0 | 970 | 1500 | 66 | 0 | 36 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 0 | 1054 | 1630 | 72 | 0 | 39 |
| Pedestrians | | | | | 24 | |
| Lane Width (ft) | | | | | 12.0 | |
| Walking Speed (ft/s) | | | | | 4.0 | |
| Percent Blockage | | | | | 2 | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | 526 | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1726 | | | | 2041 | 603 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 1726 | | | | 2041 | 603 |
| tC, single (s) | 4.2 | | | | 6.9 | 7.0 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 100 | 91 |
| cM capacity (veh/h) | 351 | | | | 47 | 431 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | SB 1 |
|---|---|---|---|---|---|---|---|
| Volume Total | 351 | 351 | 351 | 652 | 652 | 398 | 39 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 72 | 39 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 431 |
| Volume to Capacity | 0.21 | 0.21 | 0.21 | 0.38 | 0.38 | 0.23 | 0.09 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| Control Delay (s/veh) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14.2 |
| Lane LOS | | | | | | | B |
| Approach Delay (s/veh) | 0.0 | | | 0.0 | | | 14.2 |
| Approach LOS | | | | | | | B |

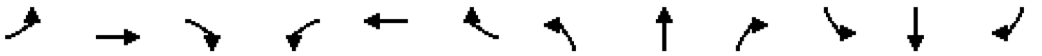
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.2 | | |
| Intersection Capacity Utilization | 40.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 21 | 0 | 1430 | 2050 | 125 |
| Future Volume (Veh/h) | 0 | 21 | 0 | 1430 | 2050 | 125 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Hourly flow rate (vph) | 0 | 21 | 0 | 1459 | 2092 | 128 |
| Pedestrians | 21 | | | | | |
| Lane Width (ft) | 12.0 | | | | | |
| Walking Speed (ft/s) | 4.0 | | | | | |
| Percent Blockage | 2 | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | 647 | 189 | |
| pX, platoon unblocked | 0.77 | 0.71 | 0.71 | | | |
| vC, conflicting volume | 2478 | 718 | 2241 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 637 | 0 | 1332 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 100 | 97 | 100 | | | |
| cM capacity (veh/h) | 312 | 762 | 364 | | | |

| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | NB 4 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 21 | 208 | 417 | 417 | 417 | 697 | 697 | 697 | 128 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 128 |
| cSH | 762 | 364 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.03 | 0.00 | 0.25 | 0.25 | 0.25 | 0.41 | 0.41 | 0.41 | 0.08 |
| Queue Length 95th (ft) | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 9.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | | | | | | | |
| Approach Delay (s/veh) | 9.9 | 0.0 | | | | 0.0 | | | |
| Approach LOS | A | | | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 0.1 | | | |
| Intersection Capacity Utilization | 49.6% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |

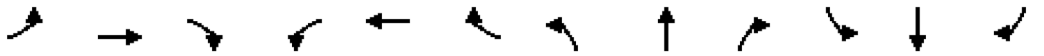


| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 350 | 290 | 340 | 210 | 360 | 80 | 500 | 1000 | 120 | 100 | 1270 | 700 |
| Future Volume (vph) | 350 | 290 | 340 | 210 | 360 | 80 | 500 | 1000 | 120 | 100 | 1270 | 700 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.95 | 1.00 | 0.97 | 0.95 | | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.91 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.94 | 1.00 | 1.00 | 0.98 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 3505 | 1429 | 3400 | 3387 | | 3400 | 5036 | 1480 | 3400 | 5036 | 1544 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 3505 | 1429 | 3400 | 3387 | | 3400 | 5036 | 1480 | 3400 | 5036 | 1544 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 372 | 309 | 362 | 223 | 383 | 85 | 532 | 1064 | 128 | 106 | 1351 | 745 |
| RTOR Reduction (vph) | 0 | 0 | 267 | 0 | 17 | 0 | 0 | 0 | 74 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 372 | 309 | 95 | 223 | 451 | 0 | 532 | 1064 | 54 | 106 | 1351 | 745 |
| Confl. Peds. (#/hr) | | | 74 | | | 15 | | | 40 | | | 12 |
| Confl. Bikes (#/hr) | | | 3 | | | 5 | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Prot | NA | Perm | Prot | NA | Free |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | 8 | | | | | | 6 | | | Free |
| Actuated Green, G (s) | 17.0 | 30.1 | 30.1 | 13.7 | 26.8 | | 21.0 | 49.6 | 49.6 | 7.8 | 36.4 | 120.0 |
| Effective Green, g (s) | 17.0 | 31.5 | 31.5 | 13.7 | 28.2 | | 21.0 | 51.0 | 51.0 | 7.8 | 37.8 | 120.0 |
| Actuated g/C Ratio | 0.14 | 0.26 | 0.26 | 0.11 | 0.24 | | 0.18 | 0.43 | 0.43 | 0.07 | 0.32 | 1.00 |
| Clearance Time (s) | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 481 | 920 | 375 | 388 | 795 | | 595 | 2140 | 629 | 221 | 1586 | 1544 |
| v/s Ratio Prot | c0.11 | 0.09 | | 0.07 | c0.13 | | c0.16 | 0.21 | | 0.03 | c0.27 | |
| v/s Ratio Perm | | | 0.07 | | | | | | 0.04 | | | c0.48 |
| v/c Ratio | 0.77 | 0.34 | 0.25 | 0.57 | 0.57 | | 0.89 | 0.50 | 0.09 | 0.48 | 0.85 | 0.48 |
| Uniform Delay, d1 | 49.6 | 35.8 | 35.0 | 50.4 | 40.5 | | 48.4 | 25.2 | 20.6 | 54.1 | 38.5 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.01 | 0.93 | 2.40 | 0.80 | 0.65 | 1.00 |
| Incremental Delay, d2 | 6.9 | 0.1 | 0.1 | 1.3 | 0.6 | | 13.1 | 0.7 | 0.2 | 0.5 | 4.9 | 0.9 |
| Delay (s) | 56.6 | 35.9 | 35.1 | 51.7 | 41.1 | | 61.9 | 24.0 | 49.6 | 43.8 | 30.0 | 0.9 |
| Level of Service | E | D | D | D | D | | E | C | D | D | C | A |
| Approach Delay (s/veh) | | 43.0 | | | 44.5 | | | 37.6 | | | 20.8 | |
| Approach LOS | | D | | | D | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 32.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.77 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 85.5% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 160 | 10 | 290 | 20 | 0 | 10 | 260 | 1150 | 20 | 20 | 1890 | 130 |
| Future Volume (vph) | 160 | 10 | 290 | 20 | 0 | 10 | 260 | 1150 | 20 | 20 | 1890 | 130 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 5.4 |
| Lane Util. Factor | 0.95 | 0.95 | 1.00 | | 1.00 | | 1.00 | 0.91 | 1.00 | 1.00 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 0.99 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 0.96 | 1.00 | | 0.97 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1665 | 1678 | 1513 | | 1684 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1524 |
| Flt Permitted | 0.74 | 0.73 | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1291 | 1276 | 1513 | | 1741 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1524 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 165 | 10 | 299 | 21 | 0 | 10 | 268 | 1186 | 21 | 21 | 1948 | 134 |
| RTOR Reduction (vph) | 0 | 0 | 259 | 0 | 30 | 0 | 0 | 0 | 7 | 0 | 0 | 48 |
| Lane Group Flow (vph) | 87 | 88 | 40 | 0 | 1 | 0 | 268 | 1186 | 14 | 21 | 1948 | 86 |
| Confl. Peds. (#/hr) | | | 22 | 22 | | | | | 1 | | | 9 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 4 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | 3 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 3 | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 15.5 | 15.5 | 15.5 | | 3.0 | | 19.5 | 80.3 | 80.3 | 2.9 | 63.7 | 63.7 |
| Effective Green, g (s) | 16.2 | 16.2 | 16.2 | | 3.2 | | 19.5 | 81.7 | 81.7 | 2.9 | 65.1 | 63.7 |
| Actuated g/C Ratio | 0.13 | 0.13 | 0.13 | | 0.03 | | 0.16 | 0.68 | 0.68 | 0.02 | 0.54 | 0.53 |
| Clearance Time (s) | 4.7 | 4.7 | 4.7 | | 4.2 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 174 | 172 | 204 | | 46 | | 284 | 3428 | 1041 | 42 | 2732 | 808 |
| v/s Ratio Prot | | | | | | | c0.15 | 0.24 | | 0.01 | c0.39 | |
| v/s Ratio Perm | 0.07 | c0.07 | 0.03 | | c0.00 | | | | 0.01 | | | 0.06 |
| v/c Ratio | 0.50 | 0.51 | 0.20 | | 0.02 | | 0.94 | 0.35 | 0.01 | 0.50 | 0.71 | 0.11 |
| Uniform Delay, d1 | 48.1 | 48.2 | 46.1 | | 56.9 | | 49.7 | 8.0 | 6.2 | 57.8 | 20.5 | 14.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.06 | 1.83 | 1.00 | 1.18 | 0.44 | 0.21 |
| Incremental Delay, d2 | 0.8 | 1.1 | 0.2 | | 0.1 | | 34.6 | 0.2 | 0.0 | 2.2 | 1.1 | 0.2 |
| Delay (s) | 49.0 | 49.3 | 46.3 | | 56.9 | | 87.4 | 14.9 | 6.2 | 70.6 | 10.1 | 3.0 |
| Level of Service | D | D | D | | E | | F | B | A | E | B | A |
| Approach Delay (s/veh) | | 47.3 | | | 56.9 | | | 27.9 | | | 10.2 | |
| Approach LOS | | D | | | E | | | C | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 21.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.70 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 78.6% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

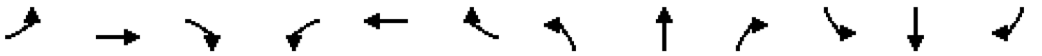


| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 0 | 550 | 0 | 310 | 0 | 1550 | 420 | 0 | 1200 | 950 |
| Future Volume (vph) | 0 | 0 | 0 | 550 | 0 | 310 | 0 | 1550 | 420 | 0 | 1200 | 950 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 4.0 | | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | | | | 0.97 | | 0.88 | | 0.95 | 1.00 | | 0.91 | 0.88 |
| Frpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 0.98 | | 1.00 | 0.98 |
| Flpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | | | 1.00 | | 0.85 | | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | 3400 | | 2760 | | 3505 | 1533 | | 5036 | 2698 |
| Flt Permitted | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | 3400 | | 2760 | | 3505 | 1533 | | 5036 | 2698 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 0 | 0 | 0 | 573 | 0 | 323 | 0 | 1615 | 438 | 0 | 1250 | 990 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 38 | 0 | 0 | 185 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 573 | 0 | 285 | 0 | 1615 | 253 | 0 | 1250 | 990 |
| Confl. Peds. (#/hr) | | | | | | | 3 | | | | | 3 |
| Confl. Bikes (#/hr) | | | | | | | | | 4 | | | 2 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | | | | Prot | | Perm | | NA | Perm | | NA | Free |
| Protected Phases | | | | 4 | | | | 6 | | | 2 | |
| Permitted Phases | | | | 4 | | 4 | | | 6 | | | Free |
| Actuated Green, G (s) | | | | 16.0 | | 16.0 | | 32.7 | 32.7 | | 32.7 | 60.0 |
| Effective Green, g (s) | | | | 17.4 | | 17.4 | | 34.6 | 34.6 | | 34.6 | 60.0 |
| Actuated g/C Ratio | | | | 0.29 | | 0.29 | | 0.58 | 0.58 | | 0.58 | 1.00 |
| Clearance Time (s) | | | | 5.4 | | 5.4 | | 5.9 | 5.9 | | 5.9 | |
| Vehicle Extension (s) | | | | 5.0 | | 5.0 | | 5.0 | 5.0 | | 5.0 | |
| Lane Grp Cap (vph) | | | | 986 | | 800 | | 2021 | 884 | | 2904 | 2698 |
| v/s Ratio Prot | | | | c0.17 | | | | c0.46 | | | 0.25 | |
| v/s Ratio Perm | | | | | | 0.10 | | | 0.16 | | | 0.37 |
| v/c Ratio | | | | 0.58 | | 0.36 | | 0.80 | 0.29 | | 0.43 | 0.37 |
| Uniform Delay, d1 | | | | 18.2 | | 16.9 | | 10.0 | 6.4 | | 7.2 | 0.0 |
| Progression Factor | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | | | 1.4 | | 0.6 | | 3.4 | 0.8 | | 0.5 | 0.4 |
| Delay (s) | | | | 19.5 | | 17.4 | | 13.4 | 7.2 | | 7.6 | 0.4 |
| Level of Service | | | | B | | B | | B | A | | A | A |
| Approach Delay (s/veh) | | 0.0 | | | 18.8 | | | 12.1 | | | 4.4 | |
| Approach LOS | | A | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 9.9 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.73 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 65.2% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

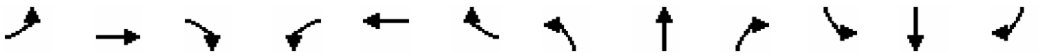
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 950 | 140 | 680 | 180 | 0 | 220 | 0 | 1750 | 80 | 170 | 1530 | 250 |
| Future Volume (vph) | 950 | 140 | 680 | 180 | 0 | 220 | 0 | 1750 | 80 | 170 | 1530 | 250 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | | 3.1 | | 4.0 | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 0.97 | | 0.88 | | 0.86 | | 0.97 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | | 0.85 | | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6300 | | 3400 | 3505 | 1513 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6300 | | 3400 | 3505 | 1513 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 1022 | 151 | 731 | 194 | 0 | 237 | 0 | 1882 | 86 | 183 | 1645 | 269 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 102 |
| Lane Group Flow (vph) | 1022 | 151 | 731 | 194 | 0 | 237 | 0 | 1963 | 0 | 183 | 1645 | 167 |
| Confl. Peds. (#/hr) | | | 5 | | | | 3 | | | | | 3 |
| Confl. Bikes (#/hr) | | | | | | | | | 4 | | | 2 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | | pt+ov | | NA | | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | | 4 5 | | 6 | | 5 | 2 | |
| Permitted Phases | | | Free | | | | | | | | | 2 |
| Actuated Green, G (s) | 34.6 | 16.1 | 120.0 | 27.9 | | 24.5 | | 46.1 | | 10.6 | 60.7 | 60.7 |
| Effective Green, g (s) | 36.0 | 17.5 | 120.0 | 28.4 | | 25.9 | | 47.5 | | 10.6 | 62.1 | 62.1 |
| Actuated g/C Ratio | 0.30 | 0.15 | 1.00 | 0.24 | | 0.22 | | 0.40 | | 0.09 | 0.52 | 0.52 |
| Clearance Time (s) | 5.4 | 5.4 | | 4.5 | | | | 5.4 | | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | | 1.8 | | | | 5.0 | | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 1020 | 269 | 1547 | 804 | | 595 | | 2493 | | 300 | 1813 | 782 |
| v/s Ratio Prot | c0.30 | 0.08 | | 0.06 | | 0.09 | | 0.31 | | 0.05 | c0.47 | |
| v/s Ratio Perm | | | c0.47 | | | | | | | | | 0.11 |
| v/c Ratio | 1.00 | 0.56 | 0.47 | 0.24 | | 0.40 | | 0.79 | | 0.61 | 0.91 | 0.21 |
| Uniform Delay, d1 | 42.0 | 47.7 | 0.0 | 37.1 | | 40.4 | | 31.8 | | 52.7 | 26.3 | 15.7 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.95 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 28.7 | 1.6 | 1.0 | 0.1 | | 0.2 | | 2.6 | | 2.6 | 8.1 | 0.6 |
| Delay (s) | 70.7 | 49.3 | 1.0 | 37.1 | | 40.5 | | 32.8 | | 55.3 | 34.5 | 16.3 |
| Level of Service | E | D | A | D | | D | | C | | E | C | B |
| Approach Delay (s/veh) | | 42.2 | | | 39.0 | | | 32.8 | | | 34.0 | |
| Approach LOS | | D | | | D | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 36.4 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.95 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 76.1% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



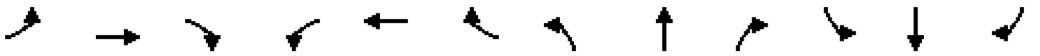
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 100 | 120 | 30 | 150 | 410 | 680 | 60 | 320 | 230 | 720 | 940 | 600 |
| Future Volume (vph) | 100 | 120 | 30 | 150 | 410 | 680 | 60 | 320 | 230 | 720 | 940 | 600 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 5036 | 1545 | 3400 | 5036 | 1546 | 3400 | 5036 | 1547 | 3400 | 5036 | 1549 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 5036 | 1545 | 3400 | 5036 | 1546 | 3400 | 5036 | 1547 | 3400 | 5036 | 1549 |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 110 | 132 | 33 | 165 | 451 | 747 | 66 | 352 | 253 | 791 | 1033 | 659 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 110 | 132 | 33 | 165 | 451 | 747 | 66 | 352 | 253 | 791 | 1033 | 659 |
| Confl. Peds. (#/hr) | | | 7 | | | 7 | | | 5 | | | 1 |
| Confl. Bikes (#/hr) | | | 3 | | | | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 4 | | 3 | 8 | |
| Permitted Phases | | | Free | | | Free | | | Free | | | Free |
| Actuated Green, G (s) | 7.6 | 13.3 | 86.7 | 9.0 | 14.7 | 86.7 | 5.3 | 14.3 | 86.7 | 31.1 | 40.1 | 86.7 |
| Effective Green, g (s) | 7.6 | 15.0 | 86.7 | 9.0 | 16.4 | 86.7 | 5.3 | 15.6 | 86.7 | 31.1 | 41.4 | 86.7 |
| Actuated g/C Ratio | 0.09 | 0.17 | 1.00 | 0.10 | 0.19 | 1.00 | 0.06 | 0.18 | 1.00 | 0.36 | 0.48 | 1.00 |
| Clearance Time (s) | 4.0 | 5.7 | | 4.0 | 5.7 | | 4.0 | 5.3 | | 4.0 | 5.3 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 298 | 871 | 1545 | 352 | 952 | 1546 | 207 | 906 | 1547 | 1219 | 2404 | 1549 |
| v/s Ratio Prot | 0.03 | 0.03 | | 0.05 | 0.09 | | 0.02 | 0.07 | | c0.23 | 0.21 | |
| v/s Ratio Perm | | | 0.02 | | | c0.48 | | | 0.16 | | | 0.43 |
| v/c Ratio | 0.37 | 0.15 | 0.02 | 0.47 | 0.47 | 0.48 | 0.32 | 0.39 | 0.16 | 0.65 | 0.43 | 0.43 |
| Uniform Delay, d1 | 37.3 | 30.4 | 0.0 | 36.6 | 31.3 | 0.0 | 39.0 | 31.3 | 0.0 | 23.2 | 14.9 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.3 | 0.0 | 0.0 | 0.4 | 0.1 | 1.1 | 0.3 | 0.1 | 0.2 | 0.9 | 0.0 | 0.9 |
| Delay (s) | 37.6 | 30.5 | 0.0 | 37.0 | 31.4 | 1.1 | 39.3 | 31.4 | 0.2 | 24.1 | 14.9 | 0.9 |
| Level of Service | D | C | A | D | C | A | D | C | A | C | B | A |
| Approach Delay (s/veh) | | 29.7 | | | 15.5 | | | 20.4 | | | 14.1 | |
| Approach LOS | | C | | | B | | | C | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 16.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.64 | | |
| Actuated Cycle Length (s) | 86.7 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 58.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 40 | 400 | 400 | 250 | 980 | 310 | 640 | 1240 | 200 | 230 | 1500 | 60 |
| Future Volume (vph) | 40 | 400 | 400 | 250 | 980 | 310 | 640 | 1240 | 200 | 230 | 1500 | 60 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1752 | 5036 | 1547 | 3400 | 3505 | 1539 | 3400 | 5036 | 1541 | 3400 | 5000 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1752 | 5036 | 1547 | 3400 | 3505 | 1539 | 3400 | 5036 | 1541 | 3400 | 5000 | |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 41 | 412 | 412 | 258 | 1010 | 320 | 660 | 1278 | 206 | 237 | 1546 | 62 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 152 | 0 | 0 | 126 | 0 | 3 | 0 |
| Lane Group Flow (vph) | 41 | 412 | 412 | 258 | 1010 | 168 | 660 | 1278 | 80 | 237 | 1605 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 6 | | | 5 | | | 6 |
| Confl. Bikes (#/hr) | | | 2 | | | 1 | | | | | | 26 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Perm | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | Free | | | 8 | | | 2 | | | |
| Actuated Green, G (s) | 4.0 | 20.1 | 120.0 | 22.0 | 38.1 | 38.1 | 22.7 | 45.1 | 45.1 | 14.0 | 36.4 | |
| Effective Green, g (s) | 4.0 | 21.5 | 120.0 | 22.0 | 39.5 | 39.5 | 22.7 | 46.5 | 46.5 | 14.0 | 37.8 | |
| Actuated g/C Ratio | 0.03 | 0.18 | 1.00 | 0.18 | 0.33 | 0.33 | 0.19 | 0.39 | 0.39 | 0.12 | 0.32 | |
| Clearance Time (s) | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 5.0 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 58 | 902 | 1547 | 623 | 1153 | 506 | 643 | 1951 | 597 | 396 | 1575 | |
| v/s Ratio Prot | c0.02 | 0.08 | | 0.08 | c0.29 | | c0.19 | 0.25 | | 0.07 | c0.32 | |
| v/s Ratio Perm | | | 0.27 | | | 0.11 | | | 0.05 | | | |
| v/c Ratio | 0.71 | 0.46 | 0.27 | 0.41 | 0.88 | 0.33 | 1.03 | 0.66 | 0.13 | 0.60 | 1.02 | |
| Uniform Delay, d1 | 57.4 | 44.0 | 0.0 | 43.3 | 37.9 | 30.3 | 48.7 | 30.2 | 23.7 | 50.3 | 41.1 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.35 | 1.37 | |
| Incremental Delay, d2 | 27.3 | 0.8 | 0.4 | 0.2 | 8.3 | 0.8 | 42.4 | 1.7 | 0.5 | 1.0 | 23.1 | |
| Delay (s) | 84.7 | 44.8 | 0.4 | 43.5 | 46.2 | 31.1 | 91.0 | 31.9 | 24.2 | 68.9 | 79.3 | |
| Level of Service | F | D | A | D | D | C | F | C | C | E | E | |
| Approach Delay (s/veh) | | 25.6 | | | 42.7 | | | 49.4 | | | 77.9 | |
| Approach LOS | | C | | | D | | | D | | | E | |

| Intersection Summary | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 52.7 | HCM 2000 Level of Service | D | | |
| HCM 2000 Volume to Capacity ratio | 0.95 | | | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 | | |
| Intersection Capacity Utilization | 93.6% | ICU Level of Service | F | | |
| Analysis Period (min) | 15 | | | | |
| c Critical Lane Group | | | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 4 | 0 | 5 | 20 | 0 | 140 | 7 | 850 | 10 | 110 | 750 | 1 |
| Future Volume (Veh/h) | 4 | 0 | 5 | 20 | 0 | 140 | 7 | 850 | 10 | 110 | 750 | 1 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 4 | 0 | 5 | 21 | 0 | 149 | 7 | 904 | 11 | 117 | 798 | 1 |
| Pedestrians | | 16 | | | 6 | | | | | | 13 | |
| Lane Width (ft) | | 12.0 | | | 12.0 | | | | | | 13.0 | |
| Walking Speed (ft/s) | | 4.0 | | | 4.0 | | | | | | 4.0 | |
| Percent Blockage | | 1 | | | 1 | | | | | | 1 | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 1677 | 1984 | 416 | 1568 | 1979 | 477 | 815 | | | 921 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 1677 | 1984 | 416 | 1568 | 1979 | 477 | 815 | | | 921 | | |
| tC, single (s) | 7.6 | 6.6 | 7.0 | 7.6 | 6.6 | 7.0 | 4.2 | | | 4.2 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 89 | 100 | 99 | 67 | 100 | 72 | 99 | | | 84 | | |
| cM capacity (veh/h) | 37 | 49 | 575 | 63 | 49 | 523 | 791 | | | 727 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|
| Volume Total | 9 | 170 | 7 | 603 | 312 | 117 | 532 | 267 |
| Volume Left | 4 | 21 | 7 | 0 | 0 | 117 | 0 | 0 |
| Volume Right | 5 | 149 | 0 | 0 | 11 | 0 | 0 | 1 |
| cSH | 77 | 275 | 791 | 1700 | 1700 | 727 | 1700 | 1700 |
| Volume to Capacity | 0.12 | 0.62 | 0.01 | 0.35 | 0.18 | 0.16 | 0.31 | 0.16 |
| Queue Length 95th (ft) | 10 | 94 | 1 | 0 | 0 | 14 | 0 | 0 |
| Control Delay (s/veh) | 58.1 | 37.2 | 9.6 | 0.0 | 0.0 | 10.9 | 0.0 | 0.0 |
| Lane LOS | F | E | A | | | B | | |
| Approach Delay (s/veh) | 58.1 | 37.2 | 0.1 | | | 1.4 | | |
| Approach LOS | F | E | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 4.1 | | | |
| Intersection Capacity Utilization | 51.9% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 120 | 10 | 4 | 130 | 13 | 30 |
| Future Volume (Veh/h) | 120 | 10 | 4 | 130 | 13 | 30 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 |
| Hourly flow rate (vph) | 146 | 12 | 5 | 159 | 16 | 37 |
| Pedestrians | 3 | | | 1 | 8 | |
| Lane Width (ft) | 12.0 | | | 12.0 | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | 4.0 | 4.0 | |
| Percent Blockage | 0 | | | 0 | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 166 | | 332 | 161 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 166 | | 332 | 161 |
| tC, single (s) | | | 4.2 | | 6.5 | 6.3 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.3 | | 3.6 | 3.4 |
| p0 queue free % | | | 100 | | 97 | 96 |
| cM capacity (veh/h) | | | 1350 | | 637 | 855 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 158 | 5 | 159 | 53 |
| Volume Left | 0 | 5 | 0 | 16 |
| Volume Right | 12 | 0 | 0 | 37 |
| cSH | 1700 | 1350 | 1700 | 774 |
| Volume to Capacity | 0.09 | 0.00 | 0.09 | 0.07 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 5 |
| Control Delay (s/veh) | 0.0 | 7.7 | 0.0 | 10.0 |
| Lane LOS | | A | | A |
| Approach Delay (s/veh) | 0.0 | 0.2 | | 10.0 |
| Approach LOS | | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.5 | | |
| Intersection Capacity Utilization | 18.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 110 | 12 | 1 | 140 | 22 | 26 |
| Future Volume (Veh/h) | 110 | 12 | 1 | 140 | 22 | 26 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Hourly flow rate (vph) | 129 | 14 | 1 | 165 | 26 | 31 |
| Pedestrians | 1 | | | | 10 | |
| Lane Width (ft) | 12.0 | | | | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | | 4.0 | |
| Percent Blockage | 0 | | | | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 153 | | 314 | 146 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 153 | | 314 | 146 |
| tC, single (s) | | | 4.2 | | 6.5 | 6.3 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.3 | | 3.6 | 3.4 |
| p0 queue free % | | | 100 | | 96 | 96 |
| cM capacity (veh/h) | | | 1386 | | 662 | 881 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 143 | 1 | 165 | 57 |
| Volume Left | 0 | 1 | 0 | 26 |
| Volume Right | 14 | 0 | 0 | 31 |
| cSH | 1700 | 1386 | 1700 | 765 |
| Volume to Capacity | 0.08 | 0.00 | 0.10 | 0.07 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 6 |
| Control Delay (s/veh) | 0.0 | 7.6 | 0.0 | 10.1 |
| Lane LOS | | A | | B |
| Approach Delay (s/veh) | 0.0 | 0.0 | | 10.1 |
| Approach LOS | | | | B |

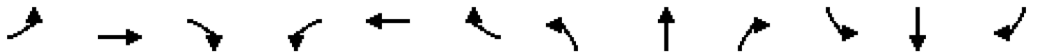
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.6 | | |
| Intersection Capacity Utilization | 18.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 31 | 1040 | 7 | 7 | 1020 |
| Future Volume (Veh/h) | 0 | 31 | 1040 | 7 | 7 | 1020 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Hourly flow rate (vph) | 0 | 32 | 1061 | 7 | 7 | 1041 |
| Pedestrians | 15 | | | | | |
| Lane Width (ft) | 12.0 | | | | | |
| Walking Speed (ft/s) | 4.0 | | | | | |
| Percent Blockage | 1 | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1441 | 549 | | | 1083 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 1441 | 549 | | | 1083 | |
| tC, single (s) | 6.9 | 7.0 | | | 4.2 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 100 | 93 | | | 99 | |
| cM capacity (veh/h) | 119 | 471 | | | 626 | |

| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|
| Volume Total | 32 | 707 | 361 | 7 | 347 | 347 | 347 |
| Volume Left | 0 | 0 | 0 | 7 | 0 | 0 | 0 |
| Volume Right | 32 | 0 | 7 | 0 | 0 | 0 | 0 |
| cSH | 471 | 1700 | 1700 | 626 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.07 | 0.42 | 0.21 | 0.01 | 0.20 | 0.20 | 0.20 |
| Queue Length 95th (ft) | 5 | 0 | 0 | 1 | 0 | 0 | 0 |
| Control Delay (s/veh) | 13.2 | 0.0 | 0.0 | 10.8 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | | | B | | | |
| Approach Delay (s/veh) | 13.2 | 0.0 | | 0.1 | | | |
| Approach LOS | B | | | | | | |

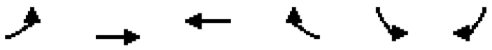
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.2 | | |
| Intersection Capacity Utilization | 39.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 33 | 0 | 120 | 0 | 0 | 0 | 90 | 350 | 0 | 0 | 350 | 40 |
| Future Volume (Veh/h) | 33 | 0 | 120 | 0 | 0 | 0 | 90 | 350 | 0 | 0 | 350 | 40 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 35 | 0 | 128 | 0 | 0 | 0 | 96 | 372 | 0 | 0 | 372 | 43 |
| Pedestrians | | 3 | | | | | | 1 | | | | |
| Lane Width (ft) | | 13.0 | | | | | | 13.0 | | | | |
| Walking Speed (ft/s) | | 4.0 | | | | | | 4.0 | | | | |
| Percent Blockage | | 0 | | | | | | 0 | | | | |
| Right turn flare (veh) | | | 8 | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | 144 | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 939 | 939 | 376 | 937 | 982 | 372 | 418 | | | 372 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 939 | 939 | 376 | 937 | 982 | 372 | 418 | | | 372 | | |
| tC, single (s) | 7.2 | 6.6 | 6.2 | 7.2 | 6.6 | 6.2 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 84 | 100 | 81 | 100 | 100 | 100 | 91 | | | 100 | | |
| cM capacity (veh/h) | 224 | 238 | 661 | 182 | 224 | 667 | 1122 | | | 1170 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|
| Volume Total | 163 | 0 | 96 | 372 | 0 | 372 | 43 |
| Volume Left | 35 | 0 | 96 | 0 | 0 | 0 | 0 |
| Volume Right | 128 | 0 | 0 | 0 | 0 | 0 | 43 |
| cSH | 842 | 1700 | 1122 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.19 | 0.00 | 0.09 | 0.22 | 0.00 | 0.22 | 0.03 |
| Queue Length 95th (ft) | 18 | 0 | 7 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 14.4 | 0.0 | 8.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | A | A | | | | |
| Approach Delay (s/veh) | 14.4 | 0.0 | 1.7 | | 0.0 | | |
| Approach LOS | B | A | | | | | |

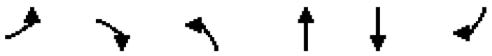
| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 3.0 | | | |
| Intersection Capacity Utilization | 37.1% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 1380 | 1200 | 21 | 0 | 63 |
| Future Volume (Veh/h) | 0 | 1380 | 1200 | 21 | 0 | 63 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 0 | 1468 | 1277 | 22 | 0 | 67 |
| Pedestrians | | | | | 14 | |
| Lane Width (ft) | | | | | 12.0 | |
| Walking Speed (ft/s) | | | | | 4.0 | |
| Percent Blockage | | | | | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | 526 | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1313 | | | | 1791 | 451 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 1313 | | | | 1791 | 451 |
| tC, single (s) | 4.2 | | | | 6.9 | 7.0 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 100 | 88 |
| cM capacity (veh/h) | 511 | | | | 70 | 547 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | SB 1 |
|---|---|---|---|---|---|---|---|
| Volume Total | 489 | 489 | 489 | 511 | 511 | 277 | 67 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 22 | 67 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 547 |
| Volume to Capacity | 0.29 | 0.29 | 0.29 | 0.30 | 0.30 | 0.16 | 0.12 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| Control Delay (s/veh) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12.5 |
| Lane LOS | | | | | | | B |
| Approach Delay (s/veh) | 0.0 | | | 0.0 | | | 12.5 |
| Approach LOS | | | | | | | B |

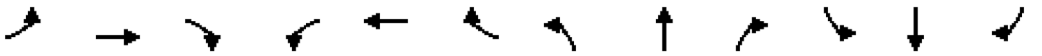
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.3 | | |
| Intersection Capacity Utilization | 34.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 76 | 0 | 2150 | 1730 | 27 |
| Future Volume (Veh/h) | 0 | 76 | 0 | 2150 | 1730 | 27 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Hourly flow rate (vph) | 0 | 79 | 0 | 2240 | 1802 | 28 |
| Pedestrians | 17 | | | | | |
| Lane Width (ft) | 12.0 | | | | | |
| Walking Speed (ft/s) | 4.0 | | | | | |
| Percent Blockage | 1 | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | 647 | 189 | |
| pX, platoon unblocked | 0.87 | 0.76 | 0.76 | | | |
| vC, conflicting volume | 2379 | 618 | 1847 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 0 | 0 | 1005 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 100 | 90 | 100 | | | |
| cM capacity (veh/h) | 878 | 814 | 517 | | | |

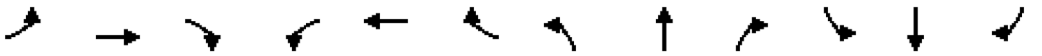
| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | NB 4 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 79 | 320 | 640 | 640 | 640 | 601 | 601 | 601 | 28 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 |
| cSH | 814 | 517 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.10 | 0.00 | 0.38 | 0.38 | 0.38 | 0.35 | 0.35 | 0.35 | 0.02 |
| Queue Length 95th (ft) | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 9.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | | | | | | | |
| Approach Delay (s/veh) | 9.9 | 0.0 | | | | 0.0 | | | |
| Approach LOS | A | | | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 0.2 | | | |
| Intersection Capacity Utilization | 45.5% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



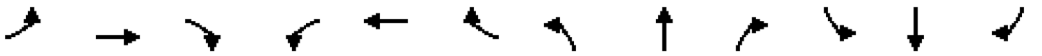
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 620 | 310 | 450 | 150 | 200 | 80 | 560 | 1450 | 130 | 160 | 1170 | 470 |
| Future Volume (vph) | 620 | 310 | 450 | 150 | 200 | 80 | 560 | 1450 | 130 | 160 | 1170 | 470 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.95 | 1.00 | 0.97 | 0.95 | | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 3505 | 1529 | 3400 | 3341 | | 3400 | 5036 | 1544 | 3400 | 5036 | 1545 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 3505 | 1529 | 3400 | 3341 | | 3400 | 5036 | 1544 | 3400 | 5036 | 1545 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 646 | 323 | 469 | 156 | 208 | 83 | 583 | 1510 | 135 | 167 | 1219 | 490 |
| RTOR Reduction (vph) | 0 | 0 | 312 | 0 | 40 | 0 | 0 | 0 | 78 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 646 | 323 | 157 | 156 | 251 | 0 | 583 | 1510 | 57 | 167 | 1219 | 490 |
| Confl. Peds. (#/hr) | | | 13 | | | 1 | | | 3 | | | 10 |
| Confl. Bikes (#/hr) | | | | | | 1 | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Prot | NA | Perm | Prot | NA | Free |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | 8 | | | | | | 6 | | | Free |
| Actuated Green, G (s) | 21.0 | 30.2 | 30.2 | 12.1 | 21.3 | | 21.0 | 48.9 | 48.9 | 10.0 | 37.9 | 120.0 |
| Effective Green, g (s) | 21.0 | 31.6 | 31.6 | 12.1 | 22.7 | | 21.0 | 50.3 | 50.3 | 10.0 | 39.3 | 120.0 |
| Actuated g/C Ratio | 0.18 | 0.26 | 0.26 | 0.10 | 0.19 | | 0.18 | 0.42 | 0.42 | 0.08 | 0.33 | 1.00 |
| Clearance Time (s) | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 595 | 922 | 402 | 342 | 632 | | 595 | 2110 | 647 | 283 | 1649 | 1545 |
| v/s Ratio Prot | c0.19 | 0.09 | | 0.05 | c0.08 | | c0.17 | 0.30 | | 0.05 | c0.24 | |
| v/s Ratio Perm | | | c0.10 | | | | | | 0.04 | | | 0.32 |
| v/c Ratio | 1.09 | 0.35 | 0.39 | 0.46 | 0.40 | | 0.98 | 0.72 | 0.09 | 0.59 | 0.74 | 0.32 |
| Uniform Delay, d1 | 49.5 | 35.9 | 36.3 | 50.8 | 42.7 | | 49.3 | 28.9 | 21.0 | 53.0 | 35.8 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.98 | 1.55 | 0.70 | 0.58 | 1.00 |
| Incremental Delay, d2 | 62.3 | 0.1 | 0.2 | 0.4 | 0.2 | | 26.1 | 1.5 | 0.2 | 1.8 | 2.5 | 0.4 |
| Delay (s) | 111.8 | 36.0 | 36.5 | 51.2 | 42.8 | | 75.6 | 29.8 | 32.7 | 39.2 | 23.3 | 0.4 |
| Level of Service | F | D | D | D | D | | E | C | C | D | C | A |
| Approach Delay (s/veh) | | 70.2 | | | 45.7 | | | 42.0 | | | 18.8 | |
| Approach LOS | | E | | | D | | | D | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 41.8 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.79 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 77.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 260 | 10 | 200 | 10 | 10 | 10 | 250 | 1890 | 10 | 40 | 1550 | 180 |
| Future Volume (vph) | 260 | 10 | 200 | 10 | 10 | 10 | 250 | 1890 | 10 | 40 | 1550 | 180 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 5.4 |
| Lane Util. Factor | 0.95 | 0.95 | 1.00 | | 1.00 | | 1.00 | 0.91 | 1.00 | 1.00 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.96 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 0.96 | 1.00 | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1665 | 1675 | 1546 | | 1732 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1509 |
| Flt Permitted | 0.74 | 0.72 | 1.00 | | 0.48 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1289 | 1259 | 1546 | | 838 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1509 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 277 | 11 | 213 | 11 | 11 | 11 | 266 | 2011 | 11 | 43 | 1649 | 191 |
| RTOR Reduction (vph) | 0 | 0 | 177 | 0 | 10 | 0 | 0 | 0 | 4 | 0 | 0 | 52 |
| Lane Group Flow (vph) | 144 | 144 | 36 | 0 | 23 | 0 | 266 | 2011 | 7 | 43 | 1649 | 139 |
| Confl. Peds. (#/hr) | | | 2 | 2 | | | | | 1 | | | 14 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 7 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | 3 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 3 | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 19.6 | 19.6 | 19.6 | | 5.4 | | 17.8 | 70.3 | 70.3 | 6.4 | 58.9 | 58.9 |
| Effective Green, g (s) | 20.3 | 20.3 | 20.3 | | 5.6 | | 17.8 | 71.7 | 71.7 | 6.4 | 60.3 | 58.9 |
| Actuated g/C Ratio | 0.17 | 0.17 | 0.17 | | 0.05 | | 0.15 | 0.60 | 0.60 | 0.05 | 0.50 | 0.49 |
| Clearance Time (s) | 4.7 | 4.7 | 4.7 | | 4.2 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 218 | 212 | 261 | | 39 | | 259 | 3009 | 914 | 93 | 2530 | 740 |
| v/s Ratio Prot | | | | | | | c0.15 | c0.40 | | 0.02 | c0.33 | |
| v/s Ratio Perm | 0.11 | c0.11 | 0.02 | | c0.03 | | | | 0.00 | | | 0.09 |
| v/c Ratio | 0.66 | 0.68 | 0.14 | | 0.58 | | 1.03 | 0.67 | 0.01 | 0.46 | 0.65 | 0.19 |
| Uniform Delay, d1 | 46.6 | 46.8 | 42.4 | | 56.0 | | 51.1 | 16.2 | 9.8 | 55.1 | 22.1 | 17.1 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.17 | 1.62 | 1.00 | 1.15 | 0.37 | 0.18 |
| Incremental Delay, d2 | 5.7 | 6.6 | 0.1 | | 12.2 | | 49.9 | 0.7 | 0.0 | 1.0 | 1.0 | 0.4 |
| Delay (s) | 52.3 | 53.4 | 42.5 | | 68.2 | | 109.7 | 26.8 | 9.8 | 64.5 | 9.1 | 3.4 |
| Level of Service | D | D | D | | E | | F | C | A | E | A | A |
| Approach Delay (s/veh) | | 48.5 | | | 68.2 | | | 36.4 | | | 9.8 | |
| Approach LOS | | D | | | E | | | D | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 27.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.72 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 68.8% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



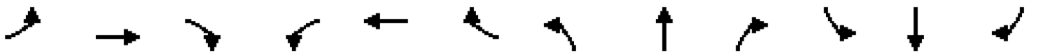
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 0 | 400 | 0 | 260 | 0 | 2070 | 770 | 0 | 1750 | 780 |
| Future Volume (vph) | 0 | 0 | 0 | 400 | 0 | 260 | 0 | 2070 | 770 | 0 | 1750 | 780 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 4.0 | | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | | | | 0.97 | | 0.88 | | 0.95 | 1.00 | | 0.91 | 0.88 |
| Frpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 0.98 | | 1.00 | 0.98 |
| Flpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | | | 1.00 | | 0.85 | | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | 3400 | | 2760 | | 3505 | 1535 | | 5036 | 2703 |
| Flt Permitted | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | 3400 | | 2760 | | 3505 | 1535 | | 5036 | 2703 |
| Peak-hour factor, PHF | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 |
| Adj. Flow (vph) | 0 | 0 | 0 | 404 | 0 | 263 | 0 | 2091 | 778 | 0 | 1768 | 788 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 39 | 0 | 0 | 312 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 404 | 0 | 224 | 0 | 2091 | 466 | 0 | 1768 | 788 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | 1 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | | | | Prot | | Perm | | NA | Perm | | NA | Free |
| Protected Phases | | | | 4 | | | | 6 | | | 2 | |
| Permitted Phases | | | | 4 | | 4 | | | 6 | | | Free |
| Actuated Green, G (s) | | | | 14.7 | | 14.7 | | 34.0 | 34.0 | | 34.0 | 60.0 |
| Effective Green, g (s) | | | | 16.1 | | 16.1 | | 35.9 | 35.9 | | 35.9 | 60.0 |
| Actuated g/C Ratio | | | | 0.27 | | 0.27 | | 0.60 | 0.60 | | 0.60 | 1.00 |
| Clearance Time (s) | | | | 5.4 | | 5.4 | | 5.9 | 5.9 | | 5.9 | |
| Vehicle Extension (s) | | | | 5.0 | | 5.0 | | 5.0 | 5.0 | | 5.0 | |
| Lane Grp Cap (vph) | | | | 912 | | 740 | | 2097 | 918 | | 3013 | 2703 |
| v/s Ratio Prot | | | | c0.12 | | | | c0.60 | | | 0.35 | |
| v/s Ratio Perm | | | | | | 0.08 | | | 0.30 | | | 0.29 |
| v/c Ratio | | | | 0.44 | | 0.30 | | 1.00 | 0.51 | | 0.59 | 0.29 |
| Uniform Delay, d1 | | | | 18.2 | | 17.5 | | 12.0 | 6.9 | | 7.5 | 0.0 |
| Progression Factor | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | | | 0.7 | | 0.5 | | 19.0 | 2.0 | | 0.8 | 0.3 |
| Delay (s) | | | | 18.9 | | 18.0 | | 31.0 | 8.9 | | 8.3 | 0.3 |
| Level of Service | | | | B | | B | | C | A | | A | A |
| Approach Delay (s/veh) | | 0.0 | | | 18.6 | | | 25.0 | | | 5.8 | |
| Approach LOS | | A | | | B | | | C | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 16.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.83 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 75.3% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

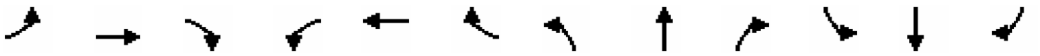
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 750 | 140 | 220 | 140 | 0 | 250 | 0 | 2050 | 130 | 250 | 1450 | 550 |
| Future Volume (vph) | 750 | 140 | 220 | 140 | 0 | 250 | 0 | 2050 | 130 | 250 | 1450 | 550 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | | 3.1 | | 4.0 | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 0.97 | | 0.88 | | 0.86 | | 0.97 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 0.96 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | | 0.85 | | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6284 | | 3400 | 3505 | 1500 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6284 | | 3400 | 3505 | 1500 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 773 | 144 | 227 | 144 | 0 | 258 | 0 | 2113 | 134 | 258 | 1495 | 567 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 228 |
| Lane Group Flow (vph) | 773 | 144 | 227 | 144 | 0 | 258 | 0 | 2240 | 0 | 258 | 1495 | 339 |
| Confl. Peds. (#/hr) | | | 5 | | | 2 | 5 | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | 1 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | | pt+ov | | NA | | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | | 4 5 | | 6 | | 5 | 2 | |
| Permitted Phases | | | Free | | | | | | | | | 2 |
| Actuated Green, G (s) | 30.7 | 15.8 | 120.0 | 25.8 | | 28.7 | | 45.8 | | 13.3 | 63.1 | 63.1 |
| Effective Green, g (s) | 32.1 | 17.2 | 120.0 | 26.3 | | 30.1 | | 47.2 | | 13.3 | 64.5 | 64.5 |
| Actuated g/C Ratio | 0.27 | 0.14 | 1.00 | 0.22 | | 0.25 | | 0.39 | | 0.11 | 0.54 | 0.54 |
| Clearance Time (s) | 5.4 | 5.4 | | 4.5 | | | | 5.4 | | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | | 1.8 | | | | 5.0 | | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 909 | 264 | 1547 | 745 | | 692 | | 2471 | | 376 | 1883 | 806 |
| v/s Ratio Prot | c0.23 | 0.08 | | 0.04 | | c0.09 | | c0.36 | | 0.08 | c0.43 | |
| v/s Ratio Perm | | | 0.15 | | | | | | | | | 0.23 |
| v/c Ratio | 0.85 | 0.55 | 0.15 | 0.19 | | 0.37 | | 0.91 | | 0.69 | 0.79 | 0.42 |
| Uniform Delay, d1 | 41.7 | 47.8 | 0.0 | 38.2 | | 37.1 | | 34.3 | | 51.3 | 22.4 | 16.6 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.79 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 7.4 | 1.2 | 0.2 | 0.0 | | 0.1 | | 5.0 | | 4.1 | 3.5 | 1.6 |
| Delay (s) | 49.1 | 49.0 | 0.2 | 38.2 | | 37.3 | | 32.2 | | 55.5 | 25.9 | 18.2 |
| Level of Service | D | D | A | D | | D | | C | | E | C | B |
| Approach Delay (s/veh) | | 39.4 | | | 37.6 | | | 32.2 | | | 27.3 | |
| Approach LOS | | D | | | D | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 32.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.83 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 72.2% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



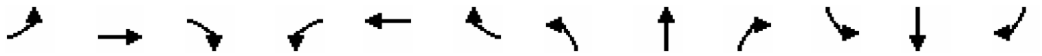
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 700 | 600 | 50 | 230 | 350 | 1100 | 30 | 840 | 160 | 800 | 670 | 310 |
| Future Volume (vph) | 700 | 600 | 50 | 230 | 350 | 1100 | 30 | 840 | 160 | 800 | 670 | 310 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 5036 | 1544 | 3400 | 5036 | 1549 | 3400 | 5036 | 1547 | 3400 | 5036 | 1547 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 5036 | 1544 | 3400 | 5036 | 1549 | 3400 | 5036 | 1547 | 3400 | 5036 | 1547 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 753 | 645 | 54 | 247 | 376 | 1183 | 32 | 903 | 172 | 860 | 720 | 333 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 753 | 645 | 54 | 247 | 376 | 1183 | 32 | 903 | 172 | 860 | 720 | 333 |
| Confl. Peds. (#/hr) | | | 10 | | | 1 | | | 5 | | | 4 |
| Confl. Bikes (#/hr) | | | 2 | | | | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 4 | | 3 | 8 | |
| Permitted Phases | | | Free | | | Free | | | Free | | | Free |
| Actuated Green, G (s) | 30.3 | 32.9 | 123.4 | 13.4 | 16.0 | 123.4 | 3.6 | 27.8 | 123.4 | 30.3 | 54.5 | 123.4 |
| Effective Green, g (s) | 30.3 | 34.6 | 123.4 | 13.4 | 17.7 | 123.4 | 3.6 | 29.1 | 123.4 | 30.3 | 55.8 | 123.4 |
| Actuated g/C Ratio | 0.25 | 0.28 | 1.00 | 0.11 | 0.14 | 1.00 | 0.03 | 0.24 | 1.00 | 0.25 | 0.45 | 1.00 |
| Clearance Time (s) | 4.0 | 5.7 | | 4.0 | 5.7 | | 4.0 | 5.3 | | 4.0 | 5.3 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 834 | 1412 | 1544 | 369 | 722 | 1549 | 99 | 1187 | 1547 | 834 | 2277 | 1547 |
| v/s Ratio Prot | c0.22 | 0.13 | | 0.07 | 0.07 | | 0.01 | 0.18 | | c0.25 | 0.14 | |
| v/s Ratio Perm | | | 0.03 | | | c0.76 | | | 0.11 | | | 0.22 |
| v/c Ratio | 0.90 | 0.46 | 0.03 | 0.67 | 0.52 | 0.76 | 0.32 | 0.76 | 0.11 | 1.03 | 0.32 | 0.22 |
| Uniform Delay, d1 | 45.1 | 36.6 | 0.0 | 52.9 | 48.9 | 0.0 | 58.7 | 43.9 | 0.0 | 46.6 | 21.6 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 12.7 | 0.1 | 0.0 | 3.5 | 0.3 | 3.6 | 0.7 | 2.6 | 0.1 | 39.4 | 0.0 | 0.3 |
| Delay (s) | 57.9 | 36.7 | 0.0 | 56.4 | 49.2 | 3.6 | 59.4 | 46.5 | 0.1 | 86.0 | 21.6 | 0.3 |
| Level of Service | E | D | A | E | D | A | E | D | A | F | C | A |
| Approach Delay (s/veh) | | 46.3 | | | 20.3 | | | 39.7 | | | 46.9 | |
| Approach LOS | | D | | | C | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 37.8 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.94 | | |
| Actuated Cycle Length (s) | 123.4 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 81.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 120 | 750 | 650 | 170 | 390 | 420 | 520 | 1520 | 130 | 350 | 1430 | 50 |
| Future Volume (vph) | 120 | 750 | 650 | 170 | 390 | 420 | 520 | 1520 | 130 | 350 | 1430 | 50 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1752 | 5036 | 1547 | 3400 | 3505 | 1537 | 3400 | 5036 | 1541 | 3400 | 5007 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1752 | 5036 | 1547 | 3400 | 3505 | 1537 | 3400 | 5036 | 1541 | 3400 | 5007 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 122 | 765 | 663 | 173 | 398 | 429 | 531 | 1551 | 133 | 357 | 1459 | 51 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 196 | 0 | 0 | 77 | 0 | 3 | 0 |
| Lane Group Flow (vph) | 122 | 765 | 663 | 173 | 398 | 233 | 531 | 1551 | 56 | 357 | 1507 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 7 | | | 5 | | | 5 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | | | | 9 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Perm | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | Free | | | 8 | | | 2 | | | |
| Actuated Green, G (s) | 9.7 | 28.0 | 120.0 | 10.0 | 28.3 | 28.3 | 24.0 | 49.2 | 49.2 | 14.0 | 39.2 | |
| Effective Green, g (s) | 9.7 | 29.4 | 120.0 | 10.0 | 29.7 | 29.7 | 24.0 | 50.6 | 50.6 | 14.0 | 40.6 | |
| Actuated g/C Ratio | 0.08 | 0.25 | 1.00 | 0.08 | 0.25 | 0.25 | 0.20 | 0.42 | 0.42 | 0.12 | 0.34 | |
| Clearance Time (s) | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 5.0 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 141 | 1233 | 1547 | 283 | 867 | 380 | 680 | 2123 | 649 | 396 | 1694 | |
| v/s Ratio Prot | c0.07 | c0.15 | | 0.05 | 0.11 | | c0.16 | 0.31 | | 0.11 | c0.30 | |
| v/s Ratio Perm | | | 0.43 | | | c0.15 | | | 0.04 | | | |
| v/c Ratio | 0.87 | 0.62 | 0.43 | 0.61 | 0.46 | 0.61 | 0.78 | 0.73 | 0.09 | 0.90 | 0.89 | |
| Uniform Delay, d1 | 54.5 | 40.3 | 0.0 | 53.1 | 38.3 | 40.1 | 45.5 | 29.0 | 20.8 | 52.3 | 37.6 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.24 | 1.32 | |
| Incremental Delay, d2 | 37.8 | 1.4 | 0.9 | 2.7 | 0.8 | 4.2 | 5.4 | 2.3 | 0.3 | 18.0 | 5.7 | |
| Delay (s) | 92.3 | 41.7 | 0.9 | 55.9 | 39.1 | 44.3 | 50.9 | 31.3 | 21.1 | 82.8 | 55.4 | |
| Level of Service | F | D | A | E | D | D | D | C | C | F | E | |
| Approach Delay (s/veh) | | 28.2 | | | 44.2 | | | 35.4 | | | 60.7 | |
| Approach LOS | | C | | | D | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 42.2 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.79 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 79.4% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 0 | 0 | 8 | 41 | 1 | 106 | 12 | 750 | 26 | 140 | 600 | 2 |
| Future Volume (Veh/h) | 0 | 0 | 8 | 41 | 1 | 106 | 12 | 750 | 26 | 140 | 600 | 2 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 |
| Hourly flow rate (vph) | 0 | 0 | 9 | 48 | 1 | 123 | 14 | 872 | 30 | 163 | 698 | 2 |
| Pedestrians | | 9 | | | 10 | | | | | | 11 | |
| Lane Width (ft) | | 12.0 | | | 12.0 | | | | | | 13.0 | |
| Walking Speed (ft/s) | | 4.0 | | | 4.0 | | | | | | 4.0 | |
| Percent Blockage | | 1 | | | 1 | | | | | | 1 | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 1633 | 1974 | 359 | 1609 | 1960 | 472 | 709 | | | 912 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 1633 | 1974 | 359 | 1609 | 1960 | 472 | 709 | | | 912 | | |
| tC, single (s) | 7.6 | 6.6 | 7.0 | 7.6 | 6.6 | 7.0 | 4.2 | | | 4.2 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 100 | 100 | 99 | 12 | 98 | 77 | 98 | | | 78 | | |
| cM capacity (veh/h) | 40 | 46 | 630 | 55 | 47 | 526 | 873 | | | 730 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|
| Volume Total | 9 | 172 | 14 | 581 | 321 | 163 | 465 | 235 |
| Volume Left | 0 | 48 | 14 | 0 | 0 | 163 | 0 | 0 |
| Volume Right | 9 | 123 | 0 | 0 | 30 | 0 | 0 | 2 |
| cSH | 630 | 152 | 873 | 1700 | 1700 | 730 | 1700 | 1700 |
| Volume to Capacity | 0.01 | 1.13 | 0.02 | 0.34 | 0.19 | 0.22 | 0.27 | 0.14 |
| Queue Length 95th (ft) | 1 | 235 | 1 | 0 | 0 | 21 | 0 | 0 |
| Control Delay (s/veh) | 10.8 | 172.9 | 9.2 | 0.0 | 0.0 | 11.3 | 0.0 | 0.0 |
| Lane LOS | B | F | A | | | B | | |
| Approach Delay (s/veh) | 10.8 | 172.9 | 0.1 | | | 2.1 | | |
| Approach LOS | B | F | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 16.2 | | | |
| Intersection Capacity Utilization | 55.7% | ICU Level of Service | | B |
| Analysis Period (min) | 15 | | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 124 | 29 | 7 | 123 | 24 | 13 |
| Future Volume (Veh/h) | 124 | 29 | 7 | 123 | 24 | 13 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 135 | 32 | 8 | 134 | 26 | 14 |
| Pedestrians | 1 | | | 2 | 10 | |
| Lane Width (ft) | 12.0 | | | 12.0 | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | 4.0 | 4.0 | |
| Percent Blockage | 0 | | | 0 | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 177 | | 312 | 163 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 177 | | 312 | 163 |
| tC, single (s) | | | 4.2 | | 6.5 | 6.3 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.3 | | 3.6 | 3.4 |
| p0 queue free % | | | 99 | | 96 | 98 |
| cM capacity (veh/h) | | | 1364 | | 662 | 863 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 167 | 8 | 134 | 40 |
| Volume Left | 0 | 8 | 0 | 26 |
| Volume Right | 32 | 0 | 0 | 14 |
| cSH | 1700 | 1364 | 1700 | 721 |
| Volume to Capacity | 0.10 | 0.01 | 0.08 | 0.06 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 4 |
| Control Delay (s/veh) | 0.0 | 7.7 | 0.0 | 10.3 |
| Lane LOS | | A | | B |
| Approach Delay (s/veh) | 0.0 | 0.4 | | 10.3 |
| Approach LOS | | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.4 | | |
| Intersection Capacity Utilization | 20.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 127 | 36 | 20 | 127 | 20 | 27 |
| Future Volume (Veh/h) | 127 | 36 | 20 | 127 | 20 | 27 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 |
| Hourly flow rate (vph) | 148 | 42 | 23 | 148 | 23 | 31 |
| Pedestrians | 2 | | | 6 | 4 | |
| Lane Width (ft) | 12.0 | | | 12.0 | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | 4.0 | 4.0 | |
| Percent Blockage | 0 | | | 1 | 0 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 194 | | 369 | 179 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 194 | | 369 | 179 |
| tC, single (s) | | | 4.1 | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.2 | | 3.5 | 3.3 |
| p0 queue free % | | | 98 | | 96 | 96 |
| cM capacity (veh/h) | | | 1357 | | 612 | 849 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 190 | 23 | 148 | 54 |
| Volume Left | 0 | 23 | 0 | 23 |
| Volume Right | 42 | 0 | 0 | 31 |
| cSH | 1700 | 1357 | 1700 | 729 |
| Volume to Capacity | 0.11 | 0.02 | 0.09 | 0.07 |
| Queue Length 95th (ft) | 0 | 1 | 0 | 6 |
| Control Delay (s/veh) | 0.0 | 7.7 | 0.0 | 10.3 |
| Lane LOS | | A | | B |
| Approach Delay (s/veh) | 0.0 | 1.0 | | 10.3 |
| Approach LOS | | | | B |

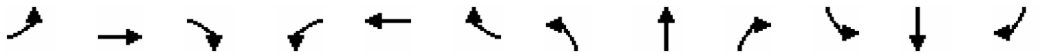
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.8 | | |
| Intersection Capacity Utilization | 28.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 11 | 977 | 27 | 20 | 831 |
| Future Volume (Veh/h) | 0 | 11 | 977 | 27 | 20 | 831 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 |
| Hourly flow rate (vph) | 0 | 13 | 1191 | 33 | 24 | 1013 |
| Pedestrians | 14 | | | | | 1 |
| Lane Width (ft) | 12.0 | | | | | 12.0 |
| Walking Speed (ft/s) | 4.0 | | | | | 4.0 |
| Percent Blockage | 1 | | | | | 0 |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1607 | 627 | | | 1238 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 1607 | 627 | | | 1238 | |
| tC, single (s) | 6.9 | 7.0 | | | 4.2 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 100 | 97 | | | 96 | |
| cM capacity (veh/h) | 90 | 419 | | | 546 | |

| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|
| Volume Total | 13 | 794 | 430 | 24 | 338 | 338 | 338 |
| Volume Left | 0 | 0 | 0 | 24 | 0 | 0 | 0 |
| Volume Right | 13 | 0 | 33 | 0 | 0 | 0 | 0 |
| cSH | 419 | 1700 | 1700 | 546 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.03 | 0.47 | 0.25 | 0.04 | 0.20 | 0.20 | 0.20 |
| Queue Length 95th (ft) | 2 | 0 | 0 | 3 | 0 | 0 | 0 |
| Control Delay (s/veh) | 13.9 | 0.0 | 0.0 | 11.9 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | | | B | | | |
| Approach Delay (s/veh) | 13.9 | 0.0 | | 0.3 | | | |
| Approach LOS | B | | | | | | |

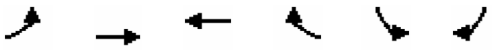
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.2 | | |
| Intersection Capacity Utilization | 38.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 34 | 0 | 105 | 0 | 0 | 0 | 82 | 290 | 0 | 0 | 360 | 43 |
| Future Volume (Veh/h) | 34 | 0 | 105 | 0 | 0 | 0 | 82 | 290 | 0 | 0 | 360 | 43 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 |
| Hourly flow rate (vph) | 42 | 0 | 130 | 0 | 0 | 0 | 101 | 358 | 0 | 0 | 444 | 53 |
| Pedestrians | | 21 | | | 1 | | | 1 | | | | |
| Lane Width (ft) | | 13.0 | | | 12.0 | | | 13.0 | | | | |
| Walking Speed (ft/s) | | 4.0 | | | 4.0 | | | 4.0 | | | | |
| Percent Blockage | | 2 | | | 0 | | | 0 | | | | |
| Right turn flare (veh) | | | 8 | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | 144 | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 1025 | 1026 | 466 | 1006 | 1079 | 359 | 518 | | | 359 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 1025 | 1026 | 466 | 1006 | 1079 | 359 | 518 | | | 359 | | |
| tC, single (s) | 7.2 | 6.6 | 6.2 | 7.2 | 6.6 | 6.2 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 78 | 100 | 78 | 100 | 100 | 100 | 90 | | | 100 | | |
| cM capacity (veh/h) | 188 | 205 | 579 | 153 | 190 | 678 | 1013 | | | 1182 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|
| Volume Total | 172 | 0 | 101 | 358 | 0 | 444 | 53 |
| Volume Left | 42 | 0 | 101 | 0 | 0 | 0 | 0 |
| Volume Right | 130 | 0 | 0 | 0 | 0 | 0 | 53 |
| cSH | 766 | 1700 | 1013 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.22 | 0.00 | 0.10 | 0.21 | 0.00 | 0.26 | 0.03 |
| Queue Length 95th (ft) | 21 | 0 | 8 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 17.1 | 0.0 | 8.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | C | A | A | | | | |
| Approach Delay (s/veh) | 17.1 | 0.0 | 2.0 | | 0.0 | | |
| Approach LOS | C | A | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 3.4 | | | |
| Intersection Capacity Utilization | 37.2% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 972 | 1501 | 66 | 0 | 36 |
| Future Volume (Veh/h) | 0 | 972 | 1501 | 66 | 0 | 36 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 0 | 1057 | 1632 | 72 | 0 | 39 |
| Pedestrians | | | | | 24 | |
| Lane Width (ft) | | | | | 12.0 | |
| Walking Speed (ft/s) | | | | | 4.0 | |
| Percent Blockage | | | | | 2 | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | 526 | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1728 | | | | 2044 | 604 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 1728 | | | | 2044 | 604 |
| tC, single (s) | 4.2 | | | | 6.9 | 7.0 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 100 | 91 |
| cM capacity (veh/h) | 350 | | | | 47 | 430 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | SB 1 |
|---|---|---|---|---|---|---|---|
| Volume Total | 352 | 352 | 352 | 653 | 653 | 398 | 39 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 72 | 39 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 430 |
| Volume to Capacity | 0.21 | 0.21 | 0.21 | 0.38 | 0.38 | 0.23 | 0.09 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| Control Delay (s/veh) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14.2 |
| Lane LOS | | | | | | | B |
| Approach Delay (s/veh) | 0.0 | | | 0.0 | | | 14.2 |
| Approach LOS | | | | | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.2 | | |
| Intersection Capacity Utilization | 40.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 26 | 0 | 1438 | 2050 | 139 |
| Future Volume (Veh/h) | 0 | 26 | 0 | 1438 | 2050 | 139 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Hourly flow rate (vph) | 0 | 27 | 0 | 1467 | 2092 | 142 |
| Pedestrians | 21 | | | | | |
| Lane Width (ft) | 12.0 | | | | | |
| Walking Speed (ft/s) | 4.0 | | | | | |
| Percent Blockage | 2 | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | 647 | 189 | |
| pX, platoon unblocked | 0.77 | 0.71 | 0.71 | | | |
| vC, conflicting volume | 2480 | 718 | 2255 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 615 | 0 | 1338 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 100 | 96 | 100 | | | |
| cM capacity (veh/h) | 321 | 759 | 360 | | | |

| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | NB 4 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 27 | 210 | 419 | 419 | 419 | 697 | 697 | 697 | 142 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 142 |
| cSH | 759 | 360 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.04 | 0.00 | 0.25 | 0.25 | 0.25 | 0.41 | 0.41 | 0.41 | 0.08 |
| Queue Length 95th (ft) | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 9.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | | | | | | | |
| Approach Delay (s/veh) | 9.9 | 0.0 | | | | 0.0 | | | |
| Approach LOS | A | | | | | | | | |

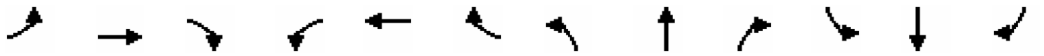
| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 0.1 | | | |
| Intersection Capacity Utilization | 49.6% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 352 | 290 | 340 | 210 | 360 | 80 | 500 | 1006 | 120 | 100 | 1274 | 701 |
| Future Volume (vph) | 352 | 290 | 340 | 210 | 360 | 80 | 500 | 1006 | 120 | 100 | 1274 | 701 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.95 | 1.00 | 0.97 | 0.95 | | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.91 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.94 | 1.00 | 1.00 | 0.98 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 3505 | 1429 | 3400 | 3387 | | 3400 | 5036 | 1480 | 3400 | 5036 | 1544 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 3505 | 1429 | 3400 | 3387 | | 3400 | 5036 | 1480 | 3400 | 5036 | 1544 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 374 | 309 | 362 | 223 | 383 | 85 | 532 | 1070 | 128 | 106 | 1355 | 746 |
| RTOR Reduction (vph) | 0 | 0 | 267 | 0 | 17 | 0 | 0 | 0 | 74 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 374 | 309 | 95 | 223 | 451 | 0 | 532 | 1070 | 54 | 106 | 1355 | 746 |
| Confl. Peds. (#/hr) | | | 74 | | | 15 | | | 40 | | | 12 |
| Confl. Bikes (#/hr) | | | 3 | | | 5 | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Prot | NA | Perm | Prot | NA | Free |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | 8 | | | | | | 6 | | | Free |
| Actuated Green, G (s) | 17.1 | 30.1 | 30.1 | 13.7 | 26.7 | | 21.0 | 49.6 | 49.6 | 7.8 | 36.4 | 120.0 |
| Effective Green, g (s) | 17.1 | 31.5 | 31.5 | 13.7 | 28.1 | | 21.0 | 51.0 | 51.0 | 7.8 | 37.8 | 120.0 |
| Actuated g/C Ratio | 0.14 | 0.26 | 0.26 | 0.11 | 0.23 | | 0.18 | 0.43 | 0.43 | 0.07 | 0.32 | 1.00 |
| Clearance Time (s) | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 484 | 920 | 375 | 388 | 793 | | 595 | 2140 | 629 | 221 | 1586 | 1544 |
| v/s Ratio Prot | c0.11 | 0.09 | | 0.07 | c0.13 | | c0.16 | 0.21 | | 0.03 | c0.27 | |
| v/s Ratio Perm | | | 0.07 | | | | | | 0.04 | | | c0.48 |
| v/c Ratio | 0.77 | 0.34 | 0.25 | 0.57 | 0.57 | | 0.89 | 0.50 | 0.09 | 0.48 | 0.85 | 0.48 |
| Uniform Delay, d1 | 49.6 | 35.8 | 35.0 | 50.4 | 40.6 | | 48.4 | 25.2 | 20.6 | 54.1 | 38.5 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.01 | 0.93 | 2.39 | 0.80 | 0.65 | 1.00 |
| Incremental Delay, d2 | 6.9 | 0.1 | 0.1 | 1.3 | 0.6 | | 13.1 | 0.7 | 0.2 | 0.5 | 4.9 | 0.9 |
| Delay (s) | 56.4 | 35.9 | 35.1 | 51.7 | 41.2 | | 61.9 | 24.0 | 49.5 | 43.8 | 30.0 | 0.9 |
| Level of Service | E | D | D | D | D | | E | C | D | D | C | A |
| Approach Delay (s/veh) | | 43.0 | | | 44.6 | | | 37.5 | | | 20.8 | |
| Approach LOS | | D | | | D | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 32.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.77 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 85.6% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

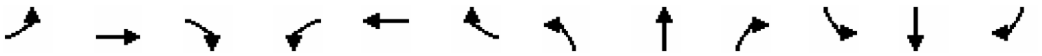
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 165 | 10 | 290 | 20 | 0 | 10 | 268 | 1150 | 20 | 20 | 1898 | 130 |
| Future Volume (vph) | 165 | 10 | 290 | 20 | 0 | 10 | 268 | 1150 | 20 | 20 | 1898 | 130 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 5.4 |
| Lane Util. Factor | 0.95 | 0.95 | 1.00 | | 1.00 | | 1.00 | 0.91 | 1.00 | 1.00 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 0.99 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 0.96 | 1.00 | | 0.97 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1665 | 1678 | 1513 | | 1684 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1524 |
| Flt Permitted | 0.74 | 0.73 | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1291 | 1275 | 1513 | | 1741 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1524 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 170 | 10 | 299 | 21 | 0 | 10 | 276 | 1186 | 21 | 21 | 1957 | 134 |
| RTOR Reduction (vph) | 0 | 0 | 258 | 0 | 30 | 0 | 0 | 0 | 7 | 0 | 0 | 48 |
| Lane Group Flow (vph) | 90 | 90 | 41 | 0 | 1 | 0 | 276 | 1186 | 14 | 21 | 1957 | 86 |
| Confl. Peds. (#/hr) | | | 22 | 22 | | | | | 1 | | | 9 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 4 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | 3 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 3 | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 15.7 | 15.7 | 15.7 | | 3.0 | | 19.5 | 80.1 | 80.1 | 2.9 | 63.5 | 63.5 |
| Effective Green, g (s) | 16.4 | 16.4 | 16.4 | | 3.2 | | 19.5 | 81.5 | 81.5 | 2.9 | 64.9 | 63.5 |
| Actuated g/C Ratio | 0.14 | 0.14 | 0.14 | | 0.03 | | 0.16 | 0.68 | 0.68 | 0.02 | 0.54 | 0.53 |
| Clearance Time (s) | 4.7 | 4.7 | 4.7 | | 4.2 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 176 | 174 | 206 | | 46 | | 284 | 3420 | 1039 | 42 | 2723 | 806 |
| v/s Ratio Prot | | | | | | | c0.16 | 0.24 | | 0.01 | c0.39 | |
| v/s Ratio Perm | 0.07 | c0.07 | 0.03 | | c0.00 | | | | 0.01 | | | 0.06 |
| v/c Ratio | 0.51 | 0.52 | 0.20 | | 0.02 | | 0.97 | 0.35 | 0.01 | 0.50 | 0.72 | 0.11 |
| Uniform Delay, d1 | 48.1 | 48.1 | 46.0 | | 56.9 | | 50.0 | 8.1 | 6.2 | 57.8 | 20.7 | 14.1 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.06 | 1.83 | 1.00 | 1.18 | 0.44 | 0.20 |
| Incremental Delay, d2 | 1.0 | 1.1 | 0.2 | | 0.1 | | 41.6 | 0.2 | 0.0 | 2.2 | 1.1 | 0.2 |
| Delay (s) | 49.1 | 49.2 | 46.1 | | 56.9 | | 94.6 | 15.0 | 6.3 | 70.6 | 10.2 | 3.0 |
| Level of Service | D | D | D | | E | | F | B | A | E | B | A |
| Approach Delay (s/veh) | | 47.3 | | | 56.9 | | | 29.7 | | | 10.3 | |
| Approach LOS | | D | | | E | | | C | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 22.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.71 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 79.3% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



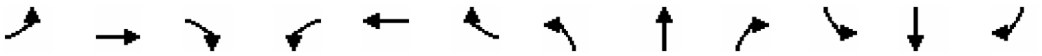
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 0 | 553 | 0 | 310 | 0 | 1555 | 420 | 0 | 1202 | 950 |
| Future Volume (vph) | 0 | 0 | 0 | 553 | 0 | 310 | 0 | 1555 | 420 | 0 | 1202 | 950 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 4.0 | | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | | | | 0.97 | | 0.88 | | 0.95 | 1.00 | | 0.91 | 0.88 |
| Frpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 0.98 | | 1.00 | 0.98 |
| Flpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | | | 1.00 | | 0.85 | | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | 3400 | | 2760 | | 3505 | 1533 | | 5036 | 2698 |
| Flt Permitted | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | 3400 | | 2760 | | 3505 | 1533 | | 5036 | 2698 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 0 | 0 | 0 | 576 | 0 | 323 | 0 | 1620 | 438 | 0 | 1252 | 990 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 38 | 0 | 0 | 186 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 576 | 0 | 285 | 0 | 1620 | 252 | 0 | 1252 | 990 |
| Confl. Peds. (#/hr) | | | | | | | 3 | | | | | 3 |
| Confl. Bikes (#/hr) | | | | | | | | | 4 | | | 2 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | | | | Prot | | Perm | | NA | Perm | | NA | Free |
| Protected Phases | | | | 4 | | | | 6 | | | 2 | |
| Permitted Phases | | | | 4 | | 4 | | | 6 | | | Free |
| Actuated Green, G (s) | | | | 16.1 | | 16.1 | | 32.6 | 32.6 | | 32.6 | 60.0 |
| Effective Green, g (s) | | | | 17.5 | | 17.5 | | 34.5 | 34.5 | | 34.5 | 60.0 |
| Actuated g/C Ratio | | | | 0.29 | | 0.29 | | 0.57 | 0.57 | | 0.57 | 1.00 |
| Clearance Time (s) | | | | 5.4 | | 5.4 | | 5.9 | 5.9 | | 5.9 | |
| Vehicle Extension (s) | | | | 5.0 | | 5.0 | | 5.0 | 5.0 | | 5.0 | |
| Lane Grp Cap (vph) | | | | 991 | | 805 | | 2015 | 881 | | 2895 | 2698 |
| v/s Ratio Prot | | | | c0.17 | | | | c0.46 | | | 0.25 | |
| v/s Ratio Perm | | | | | | 0.10 | | | 0.16 | | | 0.37 |
| v/c Ratio | | | | 0.58 | | 0.35 | | 0.80 | 0.29 | | 0.43 | 0.37 |
| Uniform Delay, d1 | | | | 18.1 | | 16.8 | | 10.1 | 6.5 | | 7.2 | 0.0 |
| Progression Factor | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | | | 1.4 | | 0.6 | | 3.5 | 0.8 | | 0.5 | 0.4 |
| Delay (s) | | | | 19.5 | | 17.4 | | 13.6 | 7.3 | | 7.7 | 0.4 |
| Level of Service | | | | B | | B | | B | A | | A | A |
| Approach Delay (s/veh) | | 0.0 | | | 18.7 | | | 12.3 | | | 4.5 | |
| Approach LOS | | A | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 10.0 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.73 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 65.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



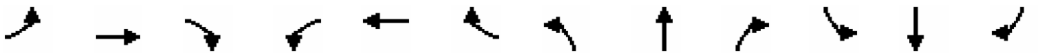
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 950 | 140 | 683 | 180 | 0 | 220 | 0 | 1755 | 80 | 170 | 1535 | 250 |
| Future Volume (vph) | 950 | 140 | 683 | 180 | 0 | 220 | 0 | 1755 | 80 | 170 | 1535 | 250 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | | 3.1 | | 4.0 | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 0.97 | | 0.88 | | 0.86 | | 0.97 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | | 0.85 | | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6300 | | 3400 | 3505 | 1513 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6300 | | 3400 | 3505 | 1513 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 1022 | 151 | 734 | 194 | 0 | 237 | 0 | 1887 | 86 | 183 | 1651 | 269 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 102 |
| Lane Group Flow (vph) | 1022 | 151 | 734 | 194 | 0 | 237 | 0 | 1968 | 0 | 183 | 1651 | 167 |
| Confl. Peds. (#/hr) | | | 5 | | | | 3 | | | | | 3 |
| Confl. Bikes (#/hr) | | | | | | | | | 4 | | | 2 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | | pt+ov | | NA | | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | | 4 5 | | 6 | | 5 | 2 | |
| Permitted Phases | | | Free | | | | | | | | | 2 |
| Actuated Green, G (s) | 34.6 | 16.1 | 120.0 | 27.9 | | 24.5 | | 46.1 | | 10.6 | 60.7 | 60.7 |
| Effective Green, g (s) | 36.0 | 17.5 | 120.0 | 28.4 | | 25.9 | | 47.5 | | 10.6 | 62.1 | 62.1 |
| Actuated g/C Ratio | 0.30 | 0.15 | 1.00 | 0.24 | | 0.22 | | 0.40 | | 0.09 | 0.52 | 0.52 |
| Clearance Time (s) | 5.4 | 5.4 | | 4.5 | | | | 5.4 | | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | | 1.8 | | | | 5.0 | | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 1020 | 269 | 1547 | 804 | | 595 | | 2493 | | 300 | 1813 | 782 |
| v/s Ratio Prot | c0.30 | 0.08 | | 0.06 | | 0.09 | | 0.31 | | 0.05 | c0.47 | |
| v/s Ratio Perm | | | c0.47 | | | | | | | | | 0.11 |
| v/c Ratio | 1.00 | 0.56 | 0.47 | 0.24 | | 0.40 | | 0.79 | | 0.61 | 0.91 | 0.21 |
| Uniform Delay, d1 | 42.0 | 47.7 | 0.0 | 37.1 | | 40.4 | | 31.9 | | 52.7 | 26.4 | 15.7 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.95 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 28.7 | 1.6 | 1.0 | 0.1 | | 0.2 | | 2.6 | | 2.6 | 8.4 | 0.6 |
| Delay (s) | 70.7 | 49.3 | 1.0 | 37.1 | | 40.5 | | 32.9 | | 55.3 | 34.8 | 16.3 |
| Level of Service | E | D | A | D | | D | | C | | E | C | B |
| Approach Delay (s/veh) | | 42.2 | | | 39.0 | | | 32.9 | | | 34.2 | |
| Approach LOS | | D | | | D | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 36.5 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.95 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 76.2% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



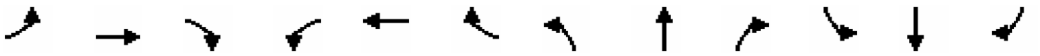
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 100 | 127 | 32 | 155 | 411 | 680 | 61 | 322 | 233 | 720 | 943 | 600 |
| Future Volume (vph) | 100 | 127 | 32 | 155 | 411 | 680 | 61 | 322 | 233 | 720 | 943 | 600 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 5036 | 1545 | 3400 | 5036 | 1546 | 3400 | 5036 | 1547 | 3400 | 5036 | 1549 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 5036 | 1545 | 3400 | 5036 | 1546 | 3400 | 5036 | 1547 | 3400 | 5036 | 1549 |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 110 | 140 | 35 | 170 | 452 | 747 | 67 | 354 | 256 | 791 | 1036 | 659 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 110 | 140 | 35 | 170 | 452 | 747 | 67 | 354 | 256 | 791 | 1036 | 659 |
| Confl. Peds. (#/hr) | | | 7 | | | 7 | | | 5 | | | 1 |
| Confl. Bikes (#/hr) | | | 3 | | | | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 4 | | 3 | 8 | |
| Permitted Phases | | | Free | | | Free | | | Free | | | Free |
| Actuated Green, G (s) | 7.6 | 13.2 | 86.8 | 9.2 | 14.8 | 86.8 | 5.3 | 14.2 | 86.8 | 31.2 | 40.1 | 86.8 |
| Effective Green, g (s) | 7.6 | 14.9 | 86.8 | 9.2 | 16.5 | 86.8 | 5.3 | 15.5 | 86.8 | 31.2 | 41.4 | 86.8 |
| Actuated g/C Ratio | 0.09 | 0.17 | 1.00 | 0.11 | 0.19 | 1.00 | 0.06 | 0.18 | 1.00 | 0.36 | 0.48 | 1.00 |
| Clearance Time (s) | 4.0 | 5.7 | | 4.0 | 5.7 | | 4.0 | 5.3 | | 4.0 | 5.3 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 297 | 864 | 1545 | 360 | 957 | 1546 | 207 | 899 | 1547 | 1222 | 2401 | 1549 |
| v/s Ratio Prot | 0.03 | 0.03 | | 0.05 | 0.09 | | 0.02 | 0.07 | | c0.23 | 0.21 | |
| v/s Ratio Perm | | | 0.02 | | | c0.48 | | | 0.17 | | | 0.43 |
| v/c Ratio | 0.37 | 0.16 | 0.02 | 0.47 | 0.47 | 0.48 | 0.32 | 0.39 | 0.17 | 0.65 | 0.43 | 0.43 |
| Uniform Delay, d1 | 37.3 | 30.6 | 0.0 | 36.5 | 31.3 | 0.0 | 39.0 | 31.5 | 0.0 | 23.2 | 14.9 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.3 | 0.0 | 0.0 | 0.4 | 0.1 | 1.1 | 0.3 | 0.1 | 0.2 | 0.9 | 0.0 | 0.9 |
| Delay (s) | 37.6 | 30.7 | 0.0 | 36.9 | 31.4 | 1.1 | 39.4 | 31.6 | 0.2 | 24.1 | 15.0 | 0.9 |
| Level of Service | D | C | A | D | C | A | D | C | A | C | B | A |
| Approach Delay (s/veh) | | 29.6 | | | 15.5 | | | 20.5 | | | 14.1 | |
| Approach LOS | | C | | | B | | | C | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 16.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.64 | | |
| Actuated Cycle Length (s) | 86.8 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 58.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 40 | 400 | 400 | 250 | 980 | 313 | 640 | 1243 | 200 | 232 | 1502 | 60 |
| Future Volume (vph) | 40 | 400 | 400 | 250 | 980 | 313 | 640 | 1243 | 200 | 232 | 1502 | 60 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1752 | 5036 | 1547 | 3400 | 3505 | 1539 | 3400 | 5036 | 1541 | 3400 | 5000 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1752 | 5036 | 1547 | 3400 | 3505 | 1539 | 3400 | 5036 | 1541 | 3400 | 5000 | |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 41 | 412 | 412 | 258 | 1010 | 323 | 660 | 1281 | 206 | 239 | 1548 | 62 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 153 | 0 | 0 | 126 | 0 | 3 | 0 |
| Lane Group Flow (vph) | 41 | 412 | 412 | 258 | 1010 | 170 | 660 | 1281 | 80 | 239 | 1607 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 6 | | | 5 | | | 6 |
| Confl. Bikes (#/hr) | | | 2 | | | 1 | | | | | | 26 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Perm | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | Free | | | 8 | | | 2 | | | |
| Actuated Green, G (s) | 4.0 | 20.1 | 120.0 | 22.0 | 38.1 | 38.1 | 22.7 | 45.1 | 45.1 | 14.0 | 36.4 | |
| Effective Green, g (s) | 4.0 | 21.5 | 120.0 | 22.0 | 39.5 | 39.5 | 22.7 | 46.5 | 46.5 | 14.0 | 37.8 | |
| Actuated g/C Ratio | 0.03 | 0.18 | 1.00 | 0.18 | 0.33 | 0.33 | 0.19 | 0.39 | 0.39 | 0.12 | 0.32 | |
| Clearance Time (s) | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 5.0 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 58 | 902 | 1547 | 623 | 1153 | 506 | 643 | 1951 | 597 | 396 | 1575 | |
| v/s Ratio Prot | c0.02 | 0.08 | | 0.08 | c0.29 | | c0.19 | 0.25 | | 0.07 | c0.32 | |
| v/s Ratio Perm | | | 0.27 | | | 0.11 | | | 0.05 | | | |
| v/c Ratio | 0.71 | 0.46 | 0.27 | 0.41 | 0.88 | 0.34 | 1.03 | 0.66 | 0.13 | 0.60 | 1.02 | |
| Uniform Delay, d1 | 57.4 | 44.0 | 0.0 | 43.3 | 37.9 | 30.4 | 48.7 | 30.2 | 23.7 | 50.4 | 41.1 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.35 | 1.37 | |
| Incremental Delay, d2 | 27.3 | 0.8 | 0.4 | 0.2 | 8.3 | 0.8 | 42.4 | 1.7 | 0.5 | 1.1 | 23.4 | |
| Delay (s) | 84.7 | 44.8 | 0.4 | 43.5 | 46.2 | 31.2 | 91.0 | 31.9 | 24.2 | 69.0 | 79.6 | |
| Level of Service | F | D | A | D | D | C | F | C | C | E | E | |
| Approach Delay (s/veh) | | 25.6 | | | 42.7 | | | 49.4 | | | 78.2 | |
| Approach LOS | | C | | | D | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 52.8 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.95 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 93.6% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 4 | 0 | 5 | 26 | 0 | 150 | 7 | 850 | 13 | 116 | 750 | 1 |
| Future Volume (Veh/h) | 4 | 0 | 5 | 26 | 0 | 150 | 7 | 850 | 13 | 116 | 750 | 1 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 4 | 0 | 5 | 28 | 0 | 160 | 7 | 904 | 14 | 123 | 798 | 1 |
| Pedestrians | | 16 | | | 6 | | | | | | 13 | |
| Lane Width (ft) | | 12.0 | | | 12.0 | | | | | | 13.0 | |
| Walking Speed (ft/s) | | 4.0 | | | 4.0 | | | | | | 4.0 | |
| Percent Blockage | | 1 | | | 1 | | | | | | 1 | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 1700 | 1999 | 416 | 1581 | 1992 | 478 | 815 | | | 924 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 1700 | 1999 | 416 | 1581 | 1992 | 478 | 815 | | | 924 | | |
| tC, single (s) | 7.6 | 6.6 | 7.0 | 7.6 | 6.6 | 7.0 | 4.2 | | | 4.2 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 88 | 100 | 99 | 54 | 100 | 69 | 99 | | | 83 | | |
| cM capacity (veh/h) | 34 | 47 | 575 | 61 | 48 | 522 | 791 | | | 725 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|
| Volume Total | 9 | 188 | 7 | 603 | 315 | 123 | 532 | 267 |
| Volume Left | 4 | 28 | 7 | 0 | 0 | 123 | 0 | 0 |
| Volume Right | 5 | 160 | 0 | 0 | 14 | 0 | 0 | 1 |
| cSH | 71 | 246 | 791 | 1700 | 1700 | 725 | 1700 | 1700 |
| Volume to Capacity | 0.13 | 0.77 | 0.01 | 0.35 | 0.19 | 0.17 | 0.31 | 0.16 |
| Queue Length 95th (ft) | 10 | 138 | 1 | 0 | 0 | 15 | 0 | 0 |
| Control Delay (s/veh) | 62.6 | 55.4 | 9.6 | 0.0 | 0.0 | 11.0 | 0.0 | 0.0 |
| Lane LOS | F | F | A | | | B | | |
| Approach Delay (s/veh) | 62.6 | 55.4 | 0.1 | | | 1.5 | | |
| Approach LOS | F | F | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 6.1 | | | |
| Intersection Capacity Utilization | 53.0% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 126 | 15 | 5 | 138 | 25 | 41 |
| Future Volume (Veh/h) | 126 | 15 | 5 | 138 | 25 | 41 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 |
| Hourly flow rate (vph) | 154 | 18 | 6 | 168 | 30 | 50 |
| Pedestrians | 3 | | | 1 | 8 | |
| Lane Width (ft) | 12.0 | | | 12.0 | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | 4.0 | 4.0 | |
| Percent Blockage | 0 | | | 0 | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 180 | | 354 | 172 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 180 | | 354 | 172 |
| tC, single (s) | | | 4.2 | | 6.5 | 6.3 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.3 | | 3.6 | 3.4 |
| p0 queue free % | | | 100 | | 95 | 94 |
| cM capacity (veh/h) | | | 1334 | | 618 | 842 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 172 | 6 | 168 | 80 |
| Volume Left | 0 | 6 | 0 | 30 |
| Volume Right | 18 | 0 | 0 | 50 |
| cSH | 1700 | 1334 | 1700 | 741 |
| Volume to Capacity | 0.10 | 0.00 | 0.10 | 0.11 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 9 |
| Control Delay (s/veh) | 0.0 | 7.7 | 0.0 | 10.4 |
| Lane LOS | | A | | B |
| Approach Delay (s/veh) | 0.0 | 0.3 | | 10.4 |
| Approach LOS | | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.1 | | |
| Intersection Capacity Utilization | 19.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 119 | 12 | 5 | 156 | 22 | 28 |
| Future Volume (Veh/h) | 119 | 12 | 5 | 156 | 22 | 28 |
| Sign Control | Free | | | Free | Stop | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Hourly flow rate (vph) | 140 | 14 | 6 | 184 | 26 | 33 |
| Pedestrians | 1 | | | | 10 | |
| Lane Width (ft) | 12.0 | | | | 12.0 | |
| Walking Speed (ft/s) | 4.0 | | | | 4.0 | |
| Percent Blockage | 0 | | | | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | None | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | | | 164 | | 354 | 157 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | | | 164 | | 354 | 157 |
| tC, single (s) | | | 4.2 | | 6.5 | 6.3 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | | | 2.3 | | 3.6 | 3.4 |
| p0 queue free % | | | 100 | | 96 | 96 |
| cM capacity (veh/h) | | | 1373 | | 625 | 868 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 |
|---|---|---|---|---|
| Volume Total | 154 | 6 | 184 | 59 |
| Volume Left | 0 | 6 | 0 | 26 |
| Volume Right | 14 | 0 | 0 | 33 |
| cSH | 1700 | 1373 | 1700 | 741 |
| Volume to Capacity | 0.09 | 0.00 | 0.11 | 0.08 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 6 |
| Control Delay (s/veh) | 0.0 | 7.6 | 0.0 | 10.3 |
| Lane LOS | | A | | B |
| Approach Delay (s/veh) | 0.0 | 0.2 | | 10.3 |
| Approach LOS | | | | B |

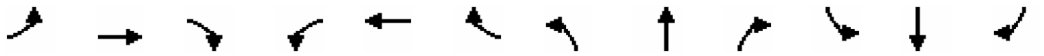
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.6 | | |
| Intersection Capacity Utilization | 18.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 2 | 31 | 1043 | 8 | 7 | 1026 |
| Future Volume (Veh/h) | 2 | 31 | 1043 | 8 | 7 | 1026 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Hourly flow rate (vph) | 2 | 32 | 1064 | 8 | 7 | 1047 |
| Pedestrians | 15 | | | | | |
| Lane Width (ft) | 12.0 | | | | | |
| Walking Speed (ft/s) | 4.0 | | | | | |
| Percent Blockage | 1 | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1446 | 551 | | | 1087 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 1446 | 551 | | | 1087 | |
| tC, single (s) | 6.9 | 7.0 | | | 4.2 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 98 | 93 | | | 99 | |
| cM capacity (veh/h) | 118 | 470 | | | 624 | |

| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|
| Volume Total | 34 | 709 | 363 | 7 | 349 | 349 | 349 |
| Volume Left | 2 | 0 | 0 | 7 | 0 | 0 | 0 |
| Volume Right | 32 | 0 | 8 | 0 | 0 | 0 | 0 |
| cSH | 400 | 1700 | 1700 | 624 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.09 | 0.42 | 0.21 | 0.01 | 0.21 | 0.21 | 0.21 |
| Queue Length 95th (ft) | 7 | 0 | 0 | 1 | 0 | 0 | 0 |
| Control Delay (s/veh) | 14.8 | 0.0 | 0.0 | 10.8 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | | | B | | | |
| Approach Delay (s/veh) | 14.8 | 0.0 | | 0.1 | | | |
| Approach LOS | B | | | | | | |

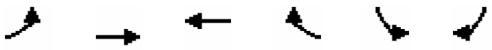
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.3 | | |
| Intersection Capacity Utilization | Err% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 42 | 0 | 128 | 0 | 0 | 0 | 91 | 350 | 0 | 0 | 350 | 48 |
| Future Volume (Veh/h) | 42 | 0 | 128 | 0 | 0 | 0 | 91 | 350 | 0 | 0 | 350 | 48 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 45 | 0 | 136 | 0 | 0 | 0 | 97 | 372 | 0 | 0 | 372 | 51 |
| Pedestrians | | 3 | | | | | | 1 | | | | |
| Lane Width (ft) | | 13.0 | | | | | | 13.0 | | | | |
| Walking Speed (ft/s) | | 4.0 | | | | | | 4.0 | | | | |
| Percent Blockage | | 0 | | | | | | 0 | | | | |
| Right turn flare (veh) | | | 8 | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | 144 | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 941 | 941 | 376 | 939 | 992 | 372 | 426 | | | 372 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 941 | 941 | 376 | 939 | 992 | 372 | 426 | | | 372 | | |
| tC, single (s) | 7.2 | 6.6 | 6.2 | 7.2 | 6.6 | 6.2 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 80 | 100 | 79 | 100 | 100 | 100 | 91 | | | 100 | | |
| cM capacity (veh/h) | 223 | 237 | 661 | 178 | 221 | 667 | 1114 | | | 1170 | | |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|
| Volume Total | 181 | 0 | 97 | 372 | 0 | 372 | 51 |
| Volume Left | 45 | 0 | 97 | 0 | 0 | 0 | 0 |
| Volume Right | 136 | 0 | 0 | 0 | 0 | 0 | 51 |
| cSH | 880 | 1700 | 1114 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.21 | 0.00 | 0.09 | 0.22 | 0.00 | 0.22 | 0.03 |
| Queue Length 95th (ft) | 19 | 0 | 7 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 15.2 | 0.0 | 8.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | C | A | A | | | | |
| Approach Delay (s/veh) | 15.2 | 0.0 | 1.8 | | 0.0 | | |
| Approach LOS | C | A | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 3.3 | | | |
| Intersection Capacity Utilization | 37.1% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | ↑↑↑ | | | ↱ |
| Traffic Volume (veh/h) | 0 | 1381 | 1202 | 21 | 0 | 63 |
| Future Volume (Veh/h) | 0 | 1381 | 1202 | 21 | 0 | 63 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 0 | 1469 | 1279 | 22 | 0 | 67 |
| Pedestrians | | | | | 14 | |
| Lane Width (ft) | | | | | 12.0 | |
| Walking Speed (ft/s) | | | | | 4.0 | |
| Percent Blockage | | | | | 1 | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | 526 | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1315 | | | | 1794 | 451 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 1315 | | | | 1794 | 451 |
| tC, single (s) | 4.2 | | | | 6.9 | 7.0 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 100 | 88 |
| cM capacity (veh/h) | 510 | | | | 70 | 546 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | SB 1 |
|---|---|---|---|---|---|---|---|
| Volume Total | 490 | 490 | 490 | 512 | 512 | 278 | 67 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 22 | 67 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 546 |
| Volume to Capacity | 0.29 | 0.29 | 0.29 | 0.30 | 0.30 | 0.16 | 0.12 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| Control Delay (s/veh) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12.5 |
| Lane LOS | | | | | | | B |
| Approach Delay (s/veh) | 0.0 | | | 0.0 | | | 12.5 |
| Approach LOS | | | | | | | B |

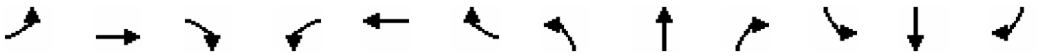
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.3 | | |
| Intersection Capacity Utilization | 34.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 0 | 85 | 0 | 2155 | 1731 | 35 |
| Future Volume (Veh/h) | 0 | 85 | 0 | 2155 | 1731 | 35 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Hourly flow rate (vph) | 0 | 89 | 0 | 2245 | 1803 | 36 |
| Pedestrians | 17 | | | | | |
| Lane Width (ft) | 12.0 | | | | | |
| Walking Speed (ft/s) | 4.0 | | | | | |
| Percent Blockage | 1 | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | 647 | 189 | |
| pX, platoon unblocked | 0.87 | 0.76 | 0.76 | | | |
| vC, conflicting volume | 2381 | 618 | 1856 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 0 | 0 | 1006 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 100 | 89 | 100 | | | |
| cM capacity (veh/h) | 876 | 811 | 515 | | | |

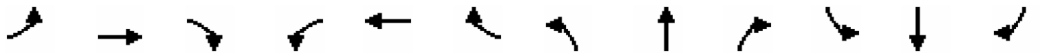
| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | NB 4 | SB 1 | SB 2 | SB 3 | SB 4 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 89 | 321 | 641 | 641 | 641 | 601 | 601 | 601 | 36 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 89 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 |
| cSH | 811 | 515 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.11 | 0.00 | 0.38 | 0.38 | 0.38 | 0.35 | 0.35 | 0.35 | 0.02 |
| Queue Length 95th (ft) | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Control Delay (s/veh) | 10.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | | | | | | | |
| Approach Delay (s/veh) | 10.0 | 0.0 | | | | 0.0 | | | |
| Approach LOS | A | | | | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 0.2 | | | |
| Intersection Capacity Utilization | 45.8% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |



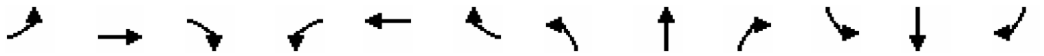
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 621 | 310 | 450 | 150 | 200 | 80 | 560 | 1454 | 130 | 160 | 1177 | 472 |
| Future Volume (vph) | 621 | 310 | 450 | 150 | 200 | 80 | 560 | 1454 | 130 | 160 | 1177 | 472 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.95 | 1.00 | 0.97 | 0.95 | | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 3505 | 1529 | 3400 | 3341 | | 3400 | 5036 | 1544 | 3400 | 5036 | 1545 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 3505 | 1529 | 3400 | 3341 | | 3400 | 5036 | 1544 | 3400 | 5036 | 1545 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 647 | 323 | 469 | 156 | 208 | 83 | 583 | 1515 | 135 | 167 | 1226 | 492 |
| RTOR Reduction (vph) | 0 | 0 | 312 | 0 | 40 | 0 | 0 | 0 | 78 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 647 | 323 | 157 | 156 | 251 | 0 | 583 | 1515 | 57 | 167 | 1226 | 492 |
| Confl. Peds. (#/hr) | | | 13 | | | 1 | | | 3 | | | 10 |
| Confl. Bikes (#/hr) | | | | | | 1 | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Prot | NA | Perm | Prot | NA | Free |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | 8 | | | | | | 6 | | | Free |
| Actuated Green, G (s) | 21.0 | 30.2 | 30.2 | 12.1 | 21.3 | | 21.0 | 48.9 | 48.9 | 10.0 | 37.9 | 120.0 |
| Effective Green, g (s) | 21.0 | 31.6 | 31.6 | 12.1 | 22.7 | | 21.0 | 50.3 | 50.3 | 10.0 | 39.3 | 120.0 |
| Actuated g/C Ratio | 0.18 | 0.26 | 0.26 | 0.10 | 0.19 | | 0.18 | 0.42 | 0.42 | 0.08 | 0.33 | 1.00 |
| Clearance Time (s) | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 595 | 922 | 402 | 342 | 632 | | 595 | 2110 | 647 | 283 | 1649 | 1545 |
| v/s Ratio Prot | c0.19 | 0.09 | | 0.05 | c0.08 | | c0.17 | 0.30 | | 0.05 | c0.24 | |
| v/s Ratio Perm | | | c0.10 | | | | | | 0.04 | | | 0.32 |
| v/c Ratio | 1.09 | 0.35 | 0.39 | 0.46 | 0.40 | | 0.98 | 0.72 | 0.09 | 0.59 | 0.74 | 0.32 |
| Uniform Delay, d1 | 49.5 | 35.9 | 36.3 | 50.8 | 42.7 | | 49.3 | 29.0 | 21.0 | 53.0 | 35.9 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.98 | 1.54 | 0.71 | 0.58 | 1.00 |
| Incremental Delay, d2 | 62.9 | 0.1 | 0.2 | 0.4 | 0.2 | | 26.0 | 1.6 | 0.2 | 1.8 | 2.5 | 0.4 |
| Delay (s) | 112.4 | 36.0 | 36.5 | 51.2 | 42.8 | | 75.5 | 29.9 | 32.6 | 39.2 | 23.4 | 0.4 |
| Level of Service | F | D | D | D | D | | E | C | C | D | C | A |
| Approach Delay (s/veh) | | 70.5 | | | 45.7 | | | 42.0 | | | 18.8 | |
| Approach LOS | | E | | | D | | | D | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 41.8 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.79 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 77.9% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 268 | 10 | 200 | 10 | 10 | 10 | 255 | 1890 | 10 | 40 | 1555 | 180 |
| Future Volume (vph) | 268 | 10 | 200 | 10 | 10 | 10 | 255 | 1890 | 10 | 40 | 1555 | 180 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 5.4 |
| Lane Util. Factor | 0.95 | 0.95 | 1.00 | | 1.00 | | 1.00 | 0.91 | 1.00 | 1.00 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.96 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 0.96 | 1.00 | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1665 | 1675 | 1546 | | 1732 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1509 |
| Flt Permitted | 0.74 | 0.72 | 1.00 | | 0.48 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1289 | 1258 | 1546 | | 838 | | 1752 | 5036 | 1530 | 1752 | 5036 | 1509 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 285 | 11 | 213 | 11 | 11 | 11 | 271 | 2011 | 11 | 43 | 1654 | 191 |
| RTOR Reduction (vph) | 0 | 0 | 176 | 0 | 10 | 0 | 0 | 0 | 4 | 0 | 0 | 53 |
| Lane Group Flow (vph) | 148 | 148 | 37 | 0 | 23 | 0 | 271 | 2011 | 7 | 43 | 1654 | 138 |
| Confl. Peds. (#/hr) | | | 2 | 2 | | | | | 1 | | | 14 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 7 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | 3 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 3 | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 19.9 | 19.9 | 19.9 | | 5.4 | | 17.8 | 70.0 | 70.0 | 6.4 | 58.6 | 58.6 |
| Effective Green, g (s) | 20.6 | 20.6 | 20.6 | | 5.6 | | 17.8 | 71.4 | 71.4 | 6.4 | 60.0 | 58.6 |
| Actuated g/C Ratio | 0.17 | 0.17 | 0.17 | | 0.05 | | 0.15 | 0.60 | 0.60 | 0.05 | 0.50 | 0.49 |
| Clearance Time (s) | 4.7 | 4.7 | 4.7 | | 4.2 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | 1.8 | | 1.8 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 221 | 215 | 265 | | 39 | | 259 | 2996 | 910 | 93 | 2518 | 736 |
| v/s Ratio Prot | | | | | | | c0.15 | c0.40 | | 0.02 | c0.33 | |
| v/s Ratio Perm | 0.11 | c0.12 | 0.02 | | c0.03 | | | | 0.00 | | | 0.09 |
| v/c Ratio | 0.67 | 0.69 | 0.14 | | 0.58 | | 1.05 | 0.67 | 0.01 | 0.46 | 0.66 | 0.19 |
| Uniform Delay, d1 | 46.5 | 46.7 | 42.2 | | 56.0 | | 51.1 | 16.4 | 9.9 | 55.1 | 22.3 | 17.3 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.17 | 1.61 | 1.00 | 1.15 | 0.37 | 0.18 |
| Incremental Delay, d2 | 5.8 | 7.1 | 0.1 | | 12.2 | | 55.4 | 0.7 | 0.0 | 1.0 | 1.0 | 0.4 |
| Delay (s) | 52.4 | 53.8 | 42.3 | | 68.2 | | 115.1 | 27.1 | 9.9 | 64.5 | 9.3 | 3.5 |
| Level of Service | D | D | D | | E | | F | C | A | E | A | A |
| Approach Delay (s/veh) | | 48.5 | | | 68.2 | | | 37.4 | | | 10.0 | |
| Approach LOS | | D | | | E | | | D | | | A | |

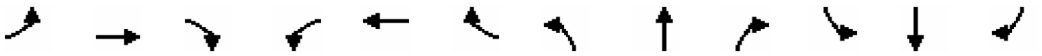
| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 27.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.72 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 69.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 0 | 402 | 0 | 260 | 0 | 2078 | 770 | 0 | 1751 | 780 |
| Future Volume (vph) | 0 | 0 | 0 | 402 | 0 | 260 | 0 | 2078 | 770 | 0 | 1751 | 780 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 4.0 | | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | | | | 0.97 | | 0.88 | | 0.95 | 1.00 | | 0.91 | 0.88 |
| Frpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 0.98 | | 1.00 | 0.98 |
| Flpb, ped/bikes | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | | | 1.00 | | 0.85 | | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | 3400 | | 2760 | | 3505 | 1535 | | 5036 | 2703 |
| Flt Permitted | | | | 0.95 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | 3400 | | 2760 | | 3505 | 1535 | | 5036 | 2703 |
| Peak-hour factor, PHF | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 |
| Adj. Flow (vph) | 0 | 0 | 0 | 406 | 0 | 263 | 0 | 2099 | 778 | 0 | 1769 | 788 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 39 | 0 | 0 | 312 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 406 | 0 | 224 | 0 | 2099 | 466 | 0 | 1769 | 788 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | 1 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | | | | Prot | | Perm | | NA | Perm | | NA | Free |
| Protected Phases | | | | 4 | | | | 6 | | | 2 | |
| Permitted Phases | | | | 4 | | 4 | | | 6 | | | Free |
| Actuated Green, G (s) | | | | 14.7 | | 14.7 | | 34.0 | 34.0 | | 34.0 | 60.0 |
| Effective Green, g (s) | | | | 16.1 | | 16.1 | | 35.9 | 35.9 | | 35.9 | 60.0 |
| Actuated g/C Ratio | | | | 0.27 | | 0.27 | | 0.60 | 0.60 | | 0.60 | 1.00 |
| Clearance Time (s) | | | | 5.4 | | 5.4 | | 5.9 | 5.9 | | 5.9 | |
| Vehicle Extension (s) | | | | 5.0 | | 5.0 | | 5.0 | 5.0 | | 5.0 | |
| Lane Grp Cap (vph) | | | | 912 | | 740 | | 2097 | 918 | | 3013 | 2703 |
| v/s Ratio Prot | | | | c0.12 | | | | c0.60 | | | 0.35 | |
| v/s Ratio Perm | | | | | | 0.08 | | | 0.30 | | | 0.29 |
| v/c Ratio | | | | 0.45 | | 0.30 | | 1.00 | 0.51 | | 0.59 | 0.29 |
| Uniform Delay, d1 | | | | 18.2 | | 17.5 | | 12.1 | 6.9 | | 7.5 | 0.0 |
| Progression Factor | | | | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | | | 0.7 | | 0.5 | | 19.9 | 2.0 | | 0.8 | 0.3 |
| Delay (s) | | | | 19.0 | | 18.0 | | 31.9 | 8.9 | | 8.3 | 0.3 |
| Level of Service | | | | B | | B | | C | A | | A | A |
| Approach Delay (s/veh) | | 0.0 | | | 18.6 | | | 25.7 | | | 5.8 | |
| Approach LOS | | A | | | B | | | C | | | A | |

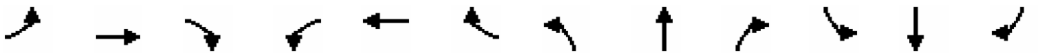
| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 16.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.83 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 75.6% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



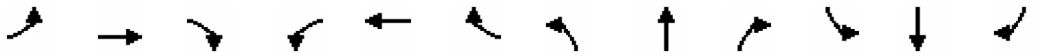
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 750 | 140 | 222 | 140 | 0 | 250 | 0 | 2058 | 130 | 250 | 1453 | 550 |
| Future Volume (vph) | 750 | 140 | 222 | 140 | 0 | 250 | 0 | 2058 | 130 | 250 | 1453 | 550 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | | 3.1 | | 4.0 | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 0.97 | | 0.88 | | 0.86 | | 0.97 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 0.96 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | | 0.85 | | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6284 | | 3400 | 3505 | 1500 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 1845 | 1547 | 3400 | | 2760 | | 6284 | | 3400 | 3505 | 1500 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 773 | 144 | 229 | 144 | 0 | 258 | 0 | 2122 | 134 | 258 | 1498 | 567 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 227 |
| Lane Group Flow (vph) | 773 | 144 | 229 | 144 | 0 | 258 | 0 | 2249 | 0 | 258 | 1498 | 340 |
| Confl. Peds. (#/hr) | | | 5 | | | 2 | 5 | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | 1 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | | pt+ov | | NA | | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | | 4 5 | | 6 | | 5 | 2 | |
| Permitted Phases | | | Free | | | | | | | | | 2 |
| Actuated Green, G (s) | 30.7 | 15.8 | 120.0 | 25.8 | | 28.7 | | 45.8 | | 13.3 | 63.1 | 63.1 |
| Effective Green, g (s) | 32.1 | 17.2 | 120.0 | 26.3 | | 30.1 | | 47.2 | | 13.3 | 64.5 | 64.5 |
| Actuated g/C Ratio | 0.27 | 0.14 | 1.00 | 0.22 | | 0.25 | | 0.39 | | 0.11 | 0.54 | 0.54 |
| Clearance Time (s) | 5.4 | 5.4 | | 4.5 | | | | 5.4 | | 4.0 | 5.4 | 5.4 |
| Vehicle Extension (s) | 1.8 | 1.8 | | 1.8 | | | | 5.0 | | 1.8 | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 909 | 264 | 1547 | 745 | | 692 | | 2471 | | 376 | 1883 | 806 |
| v/s Ratio Prot | c0.23 | 0.08 | | 0.04 | | c0.09 | | c0.36 | | 0.08 | c0.43 | |
| v/s Ratio Perm | | | 0.15 | | | | | | | | | 0.23 |
| v/c Ratio | 0.85 | 0.55 | 0.15 | 0.19 | | 0.37 | | 0.91 | | 0.69 | 0.80 | 0.42 |
| Uniform Delay, d1 | 41.7 | 47.8 | 0.0 | 38.2 | | 37.1 | | 34.4 | | 51.3 | 22.4 | 16.6 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.80 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 7.4 | 1.2 | 0.2 | 0.0 | | 0.1 | | 5.1 | | 4.1 | 3.6 | 1.6 |
| Delay (s) | 49.1 | 49.0 | 0.2 | 38.2 | | 37.3 | | 32.5 | | 55.5 | 26.0 | 18.2 |
| Level of Service | D | D | A | D | | D | | C | | E | C | B |
| Approach Delay (s/veh) | | 39.3 | | | 37.6 | | | 32.5 | | | 27.4 | |
| Approach LOS | | D | | | D | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 32.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.83 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 72.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 700 | 601 | 51 | 233 | 357 | 1100 | 32 | 843 | 165 | 800 | 672 | 310 |
| Future Volume (vph) | 700 | 601 | 51 | 233 | 357 | 1100 | 32 | 843 | 165 | 800 | 672 | 310 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3400 | 5036 | 1544 | 3400 | 5036 | 1549 | 3400 | 5036 | 1547 | 3400 | 5036 | 1547 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3400 | 5036 | 1544 | 3400 | 5036 | 1549 | 3400 | 5036 | 1547 | 3400 | 5036 | 1547 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 753 | 646 | 55 | 251 | 384 | 1183 | 34 | 906 | 177 | 860 | 723 | 333 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 753 | 646 | 55 | 251 | 384 | 1183 | 34 | 906 | 177 | 860 | 723 | 333 |
| Confl. Peds. (#/hr) | | | 10 | | | 1 | | | 5 | | | 4 |
| Confl. Bikes (#/hr) | | | 2 | | | | | | | | | |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free | Prot | NA | Free |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 4 | | 3 | 8 | |
| Permitted Phases | | | Free | | | Free | | | Free | | | Free |
| Actuated Green, G (s) | 30.3 | 32.9 | 123.7 | 13.6 | 16.2 | 123.7 | 3.7 | 27.9 | 123.7 | 30.3 | 54.5 | 123.7 |
| Effective Green, g (s) | 30.3 | 34.6 | 123.7 | 13.6 | 17.9 | 123.7 | 3.7 | 29.2 | 123.7 | 30.3 | 55.8 | 123.7 |
| Actuated g/C Ratio | 0.24 | 0.28 | 1.00 | 0.11 | 0.14 | 1.00 | 0.03 | 0.24 | 1.00 | 0.24 | 0.45 | 1.00 |
| Clearance Time (s) | 4.0 | 5.7 | | 4.0 | 5.7 | | 4.0 | 5.3 | | 4.0 | 5.3 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 832 | 1408 | 1544 | 373 | 728 | 1549 | 101 | 1188 | 1547 | 832 | 2271 | 1547 |
| v/s Ratio Prot | c0.22 | 0.13 | | 0.07 | 0.08 | | 0.01 | 0.18 | | c0.25 | 0.14 | |
| v/s Ratio Perm | | | 0.04 | | | c0.76 | | | 0.11 | | | 0.22 |
| v/c Ratio | 0.91 | 0.46 | 0.04 | 0.67 | 0.53 | 0.76 | 0.34 | 0.76 | 0.11 | 1.03 | 0.32 | 0.22 |
| Uniform Delay, d1 | 45.3 | 36.8 | 0.0 | 52.9 | 49.0 | 0.0 | 58.8 | 44.0 | 0.0 | 46.7 | 21.8 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 13.0 | 0.1 | 0.0 | 3.7 | 0.3 | 3.6 | 0.7 | 2.7 | 0.2 | 40.2 | 0.0 | 0.3 |
| Delay (s) | 58.3 | 36.9 | 0.0 | 56.6 | 49.3 | 3.6 | 59.5 | 46.7 | 0.2 | 86.9 | 21.8 | 0.3 |
| Level of Service | E | D | A | E | D | A | E | D | A | F | C | A |
| Approach Delay (s/veh) | | 46.6 | | | 20.6 | | | 39.7 | | | 47.3 | |
| Approach LOS | | D | | | C | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 38.1 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.94 | | |
| Actuated Cycle Length (s) | 123.7 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 81.8% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 121 | 750 | 650 | 170 | 390 | 422 | 520 | 1522 | 130 | 353 | 1434 | 52 |
| Future Volume (vph) | 121 | 750 | 650 | 170 | 390 | 422 | 520 | 1522 | 130 | 353 | 1434 | 52 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1752 | 5036 | 1547 | 3400 | 3505 | 1537 | 3400 | 5036 | 1541 | 3400 | 5006 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1752 | 5036 | 1547 | 3400 | 3505 | 1537 | 3400 | 5036 | 1541 | 3400 | 5006 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 123 | 765 | 663 | 173 | 398 | 431 | 531 | 1553 | 133 | 360 | 1463 | 53 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 196 | 0 | 0 | 77 | 0 | 3 | 0 |
| Lane Group Flow (vph) | 123 | 765 | 663 | 173 | 398 | 235 | 531 | 1553 | 56 | 360 | 1513 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 7 | | | 5 | | | 5 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | | | | 9 |
| Heavy Vehicles (%) | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Turn Type | Prot | NA | Free | Prot | NA | Perm | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | Free | | | 8 | | | 2 | | | |
| Actuated Green, G (s) | 9.7 | 28.0 | 120.0 | 10.0 | 28.3 | 28.3 | 24.0 | 49.2 | 49.2 | 14.0 | 39.2 | |
| Effective Green, g (s) | 9.7 | 29.4 | 120.0 | 10.0 | 29.7 | 29.7 | 24.0 | 50.6 | 50.6 | 14.0 | 40.6 | |
| Actuated g/C Ratio | 0.08 | 0.25 | 1.00 | 0.08 | 0.25 | 0.25 | 0.20 | 0.42 | 0.42 | 0.12 | 0.34 | |
| Clearance Time (s) | 4.0 | 5.4 | | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | 5.4 | 4.0 | 5.4 | |
| Vehicle Extension (s) | 1.8 | 5.0 | | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | 5.0 | 1.8 | 5.0 | |
| Lane Grp Cap (vph) | 141 | 1233 | 1547 | 283 | 867 | 380 | 680 | 2123 | 649 | 396 | 1693 | |
| v/s Ratio Prot | c0.07 | c0.15 | | 0.05 | 0.11 | | c0.16 | 0.31 | | 0.11 | c0.30 | |
| v/s Ratio Perm | | | 0.43 | | | c0.15 | | | 0.04 | | | |
| v/c Ratio | 0.87 | 0.62 | 0.43 | 0.61 | 0.46 | 0.62 | 0.78 | 0.73 | 0.09 | 0.91 | 0.89 | |
| Uniform Delay, d1 | 54.5 | 40.3 | 0.0 | 53.1 | 38.3 | 40.1 | 45.5 | 29.0 | 20.8 | 52.4 | 37.6 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.24 | 1.32 | |
| Incremental Delay, d2 | 39.6 | 1.4 | 0.9 | 2.7 | 0.8 | 4.3 | 5.4 | 2.3 | 0.3 | 18.8 | 5.9 | |
| Delay (s) | 94.1 | 41.7 | 0.9 | 55.9 | 39.1 | 44.4 | 50.9 | 31.3 | 21.1 | 83.7 | 55.7 | |
| Level of Service | F | D | A | E | D | D | D | C | C | F | E | |
| Approach Delay (s/veh) | | 28.4 | | | 44.3 | | | 35.4 | | | 61.1 | |
| Approach LOS | | C | | | D | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay (s/veh) | 42.4 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.79 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 79.5% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

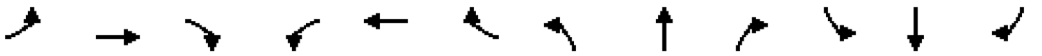
# Appendix C:
# Queue Worksheets

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 300 | | 300 | 110 | | 110 | 400 | | 150 | 200 | | 125 |
| Storage Lanes | 1 | | 1 | 1 | | 0 | 2 | | 1 | 2 | | 1 |
| Taper Length (ft) | 75 | | | 25 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 526 | | | 247 | | | 1536 | | | 647 | |
| Travel Time (s) | | 9.0 | | | 6.7 | | | 23.3 | | | 9.8 | |
| Lane Group Flow (vph) | 209 | 261 | 198 | 218 | 408 | 0 | 376 | 930 | 122 | 88 | 1167 | 447 |
| v/c Ratio | 0.64 | 0.29 | 0.38 | 0.61 | 0.44 | | 0.63 | 0.42 | 0.17 | 0.43 | 0.71 | 0.29 |
| Control Delay (s/veh) | 61.0 | 34.9 | 6.5 | 59.0 | 35.1 | | 52.0 | 24.0 | 10.3 | 49.4 | 29.4 | 0.4 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 61.0 | 34.9 | 6.5 | 59.0 | 35.1 | | 52.0 | 24.0 | 10.3 | 49.4 | 29.4 | 0.4 |
| Queue Length 50th (ft) | 81 | 80 | 0 | 85 | 124 | | 154 | 249 | 34 | 36 | 335 | 0 |
| Queue Length 95th (ft) | 118 | 115 | 55 | 122 | 170 | | 206 | 314 | 97 | 51 | #411 | 0 |
| Internal Link Dist (ft) | | 446 | | | 167 | | | 1456 | | | 567 | |
| Turn Bay Length (ft) | 300 | | 300 | 110 | | | 400 | | 150 | 200 | | 125 |
| Base Capacity (vph) | 595 | 1080 | 577 | 453 | 1026 | | 595 | 2218 | 732 | 258 | 1644 | 1544 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.35 | 0.24 | 0.34 | 0.48 | 0.40 | | 0.63 | 0.42 | 0.17 | 0.34 | 0.71 | 0.29 |

Intersection Summary

Area Type: Other

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 100 | | 0 | 0 | | 0 | 0 | | 120 | 0 | | 130 |
| Storage Lanes | 1 | | 0 | 0 | | 0 | 1 | | 1 | 1 | | 1 |
| Taper Length (ft) | 50 | | | 0 | | | 80 | | | 75 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 30 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 327 | | | 246 | | | 189 | | | 1353 | |
| Travel Time (s) | | 7.4 | | | 6.7 | | | 2.9 | | | 20.5 | |
| Lane Group Flow (vph) | 12 | 13 | 59 | 0 | 15 | 0 | 81 | 1055 | 9 | 14 | 1669 | 80 |
| v/c Ratio | 0.09 | 0.10 | 0.21 | | 0.07 | | 0.38 | 0.26 | 0.01 | 0.17 | 0.48 | 0.08 |
| Control Delay (s/veh) | 44.2 | 44.5 | 1.7 | | 0.6 | | 56.3 | 14.0 | 0.3 | 66.6 | 8.4 | 1.0 |
| Queue Delay | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 44.2 | 44.5 | 1.7 | | 0.6 | | 56.3 | 14.0 | 0.3 | 66.6 | 8.4 | 1.0 |
| Queue Length 50th (ft) | 9 | 10 | 0 | | 0 | | 36 | 80 | 0 | 12 | 88 | 0 |
| Queue Length 95th (ft) | 23 | 24 | 0 | | 0 | | 94 | 286 | m0 | m19 | 512 | m10 |
| Internal Link Dist (ft) | | 247 | | | 166 | | | 109 | | | 1273 | |
| Turn Bay Length (ft) | 100 | | | | | | | | 120 | | | 130 |
| Base Capacity (vph) | 382 | 382 | 544 | | 244 | | 248 | 3988 | 1230 | 146 | 3458 | 1065 |
| Starvation Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.03 | 0.03 | 0.11 | | 0.06 | | 0.33 | 0.26 | 0.01 | 0.10 | 0.48 | 0.08 |

Intersection Summary

Area Type: Other

m Volume for 95th percentile queue is metered by upstream signal.

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 0 | | 0 | 320 | | 600 | 0 | | 0 | 0 | | 0 |
| Storage Lanes | 0 | | 0 | 1 | | 1 | 0 | | 1 | 0 | | 2 |
| Taper Length (ft) | 0 | | | 80 | | | 0 | | | 0 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 35 | | | 40 | | | 45 | | | 45 | |
| Link Distance (ft) | | 210 | | | 379 | | | 632 | | | 460 | |
| Travel Time (s) | | 4.1 | | | 6.5 | | | 9.6 | | | 7.0 | |
| Lane Group Flow (vph) | 0 | 0 | 0 | 543 | 0 | 323 | 0 | 1273 | 393 | 0 | 1055 | 932 |
| v/c Ratio | | | | 0.55 | | 0.37 | | 0.63 | 0.37 | | 0.36 | 0.35 |
| Control Delay (s/veh) | | | | 20.3 | | 13.0 | | 8.4 | 1.4 | | 7.4 | 0.4 |
| Queue Delay | | | | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Total Delay (s/veh) | | | | 20.3 | | 13.0 | | 8.4 | 1.4 | | 7.4 | 0.4 |
| Queue Length 50th (ft) | | | | 83 | | 35 | | 184 | 5 | | 67 | 0 |
| Queue Length 95th (ft) | | | | 125 | | 67 | | 171 | 7 | | 91 | 0 |
| Internal Link Dist (ft) | | 130 | | | 299 | | | 552 | | | 380 | |
| Turn Bay Length (ft) | | | | 320 | | 600 | | | | | | |
| Base Capacity (vph) | | | | 1020 | | 894 | | 2023 | 1051 | | 2907 | 2698 |
| Starvation Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Spillback Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Storage Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Reduced v/c Ratio | | | | 0.53 | | 0.36 | | 0.63 | 0.37 | | 0.36 | 0.35 |

| Intersection Summary | |
|---|---|
| Area Type: | Other |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 620 | | 410 | 150 | | 260 | 0 | | 220 | 420 | | 0 |
| Storage Lanes | 1 | | 1 | 2 | | 1 | 0 | | 1 | 0 | | 1 |
| Taper Length (ft) | 100 | | | 80 | | | 0 | | | 25 | | |
| Right Turn on Red | | | Yes | | | No | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 30 | | | 45 | | | 45 | |
| Link Distance (ft) | | 476 | | | 199 | | | 1572 | | | 266 | |
| Travel Time (s) | | 8.1 | | | 4.5 | | | 23.8 | | | 4.0 | |
| Lane Group Flow (vph) | 739 | 151 | 726 | 183 | 0 | 228 | 0 | 832 | 0 | 158 | 1276 | 210 |
| v/c Ratio | 0.84 | 0.56 | 0.47 | 0.26 | | 0.32 | | 0.34 | | 0.72 | 0.67 | 0.23 |
| Control Delay (s/veh) | 50.9 | 54.2 | 1.0 | 42.2 | | 36.4 | | 22.2 | | 69.8 | 20.4 | 3.1 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 50.9 | 54.2 | 1.0 | 42.2 | | 36.4 | | 22.2 | | 69.8 | 20.4 | 3.1 |
| Queue Length 50th (ft) | 278 | 113 | 0 | 58 | | 79 | | 100 | | 123 | 328 | 3 |
| Queue Length 95th (ft) | 334 | 155 | 0 | 106 | | 114 | | 184 | | 192 | 424 | 44 |
| Internal Link Dist (ft) | | 396 | | | 119 | | | 1492 | | | 186 | |
| Turn Bay Length (ft) | 620 | | 410 | 150 | | 260 | | | | 420 | | |
| Base Capacity (vph) | 1020 | 492 | 1547 | 703 | | 840 | | 2442 | | 306 | 1916 | 922 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.72 | 0.31 | 0.47 | 0.26 | | 0.27 | | 0.34 | | 0.52 | 0.67 | 0.23 |

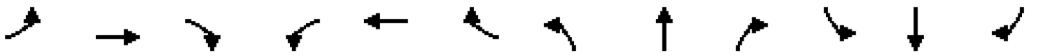
Intersection Summary

Area Type: Other



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 350 | | 200 | 175 | | 0 | 340 | | 0 | 450 | | 200 |
| Storage Lanes | 2 | | 1 | 2 | | 0 | 2 | | 0 | 2 | | 0 |
| Taper Length (ft) | 25 | | | 125 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 45 | | | 40 | | | 40 | |
| Link Distance (ft) | | 465 | | | 388 | | | 272 | | | 528 | |
| Travel Time (s) | | 7.0 | | | 5.9 | | | 4.6 | | | 9.0 | |
| Lane Group Flow (vph) | 70 | 104 | 16 | 101 | 248 | 345 | 26 | 277 | 103 | 435 | 804 | 318 |
| v/c Ratio | 0.19 | 0.10 | 0.01 | 0.25 | 0.23 | 0.22 | 0.08 | 0.27 | 0.07 | 0.58 | 0.35 | 0.21 |
| Control Delay (s/veh) | 35.2 | 23.7 | 0.0 | 34.3 | 22.9 | 0.3 | 37.5 | 23.4 | 0.1 | 28.7 | 14.0 | 0.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 35.2 | 23.7 | 0.0 | 34.3 | 22.9 | 0.3 | 37.5 | 23.4 | 0.1 | 28.7 | 14.0 | 0.3 |
| Queue Length 50th (ft) | 10 | 10 | 0 | 14 | 24 | 0 | 4 | 27 | 0 | 61 | 51 | 0 |
| Queue Length 95th (ft) | 51 | 37 | 0 | 67 | 75 | 0 | 25 | 83 | 0 | 217 | 184 | 0 |
| Internal Link Dist (ft) | | 385 | | | 308 | | | 192 | | | 448 | |
| Turn Bay Length (ft) | 350 | | 200 | 175 | | | 340 | | | 450 | | 200 |
| Base Capacity (vph) | 1898 | 2995 | 1545 | 1898 | 3008 | 1546 | 1265 | 2966 | 1547 | 1898 | 3842 | 1549 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.04 | 0.03 | 0.01 | 0.05 | 0.08 | 0.22 | 0.02 | 0.09 | 0.07 | 0.23 | 0.21 | 0.21 |

| Intersection Summary | |
|---|---|
| Area Type: | Other |



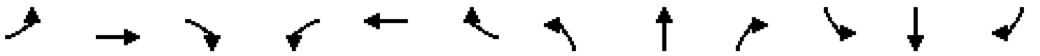
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | 0 |
| Storage Lanes | 1 | | 2 | 1 | | 1 | 2 | | 1 | 2 | | 0 |
| Taper Length (ft) | 60 | | | 60 | | | 150 | | | 120 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 35 | | | 45 | | | 45 | |
| Link Distance (ft) | | 475 | | | 447 | | | 550 | | | 1536 | |
| Travel Time (s) | | 7.2 | | | 8.7 | | | 8.3 | | | 23.3 | |
| Lane Group Flow (vph) | 32 | 194 | 221 | 378 | 480 | 234 | 513 | 1113 | 227 | 177 | 1405 | 0 |
| v/c Ratio | 0.33 | 0.26 | 0.14 | 0.60 | 0.45 | 0.37 | 0.78 | 0.53 | 0.29 | 0.45 | 0.82 | |
| Control Delay (s/veh) | 63.0 | 44.7 | 0.2 | 50.6 | 35.9 | 5.7 | 55.4 | 27.6 | 4.3 | 72.0 | 56.1 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Delay (s/veh) | 63.0 | 44.7 | 0.2 | 50.6 | 35.9 | 5.7 | 55.4 | 27.6 | 4.3 | 72.0 | 56.1 | |
| Queue Length 50th (ft) | 24 | 51 | 0 | 140 | 173 | 0 | 191 | 214 | 0 | 64 | 330 | |
| Queue Length 95th (ft) | 57 | 60 | 0 | #277 | 202 | 56 | #335 | 312 | 54 | m102 | 468 | |
| Internal Link Dist (ft) | | 395 | | | 367 | | | 470 | | | 1456 | |
| Turn Bay Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | |
| Base Capacity (vph) | 146 | 1594 | 1547 | 630 | 1173 | 671 | 659 | 2108 | 777 | 396 | 1710 | |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Reduced v/c Ratio | 0.22 | 0.12 | 0.14 | 0.60 | 0.41 | 0.35 | 0.78 | 0.53 | 0.29 | 0.45 | 0.82 | |

Intersection Summary

Area Type: Other

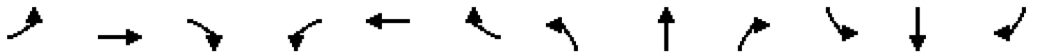
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 300 | | 300 | 110 | | 110 | 400 | | 150 | 200 | | 125 |
| Storage Lanes | 1 | | 1 | 1 | | 0 | 2 | | 1 | 2 | | 1 |
| Taper Length (ft) | 75 | | | 25 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 526 | | | 247 | | | 1536 | | | 647 | |
| Travel Time (s) | | 9.0 | | | 6.7 | | | 23.3 | | | 9.8 | |
| Lane Group Flow (vph) | 395 | 278 | 378 | 153 | 238 | 0 | 392 | 1109 | 135 | 135 | 1017 | 316 |
| v/c Ratio | 0.79 | 0.30 | 0.56 | 0.52 | 0.34 | | 0.66 | 0.50 | 0.18 | 0.53 | 0.59 | 0.20 |
| Control Delay (s/veh) | 61.1 | 35.2 | 6.6 | 58.9 | 32.5 | | 51.6 | 24.9 | 8.9 | 53.5 | 26.5 | 0.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 61.1 | 35.2 | 6.6 | 58.9 | 32.5 | | 51.6 | 24.9 | 8.9 | 53.5 | 26.5 | 0.3 |
| Queue Length 50th (ft) | 153 | 85 | 0 | 59 | 63 | | 156 | 295 | 38 | 56 | 258 | 0 |
| Queue Length 95th (ft) | 203 | 122 | 73 | 92 | 100 | | 208 | 360 | 98 | 66 | 306 | 0 |
| Internal Link Dist (ft) | | 446 | | | 167 | | | 1456 | | | 567 | |
| Turn Bay Length (ft) | 300 | | 300 | 110 | | | 400 | | 150 | 200 | | 125 |
| Base Capacity (vph) | 595 | 1080 | 732 | 453 | 926 | | 595 | 2237 | 765 | 277 | 1731 | 1545 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.66 | 0.26 | 0.52 | 0.34 | 0.26 | | 0.66 | 0.50 | 0.18 | 0.49 | 0.59 | 0.20 |

| Intersection Summary | |
|---|---|
| Area Type: | Other |



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 100 | | 0 | 0 | | 0 | 0 | | 120 | 0 | | 130 |
| Storage Lanes | 1 | | 0 | 0 | | 0 | 1 | | 1 | 1 | | 1 |
| Taper Length (ft) | 50 | | | 0 | | | 80 | | | 75 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 30 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 327 | | | 246 | | | 189 | | | 1353 | |
| Travel Time (s) | | 7.4 | | | 6.7 | | | 2.9 | | | 20.5 | |
| Lane Group Flow (vph) | 55 | 55 | 60 | 0 | 10 | 0 | 45 | 1507 | 3 | 34 | 1434 | 47 |
| v/c Ratio | 0.36 | 0.36 | 0.19 | | 0.11 | | 0.21 | 0.39 | 0.00 | 0.35 | 0.42 | 0.04 |
| Control Delay (s/veh) | 51.3 | 51.6 | 1.4 | | 40.0 | | 57.3 | 16.2 | 0.0 | 68.7 | 6.6 | 0.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 51.3 | 51.6 | 1.4 | | 40.0 | | 57.3 | 16.2 | 0.0 | 68.7 | 6.6 | 0.9 |
| Queue Length 50th (ft) | 44 | 44 | 0 | | 3 | | 23 | 147 | 0 | 27 | 56 | 0 |
| Queue Length 95th (ft) | 69 | 69 | 0 | | 21 | | m59 | 413 | m0 | m44 | 369 | m8 |
| Internal Link Dist (ft) | | 247 | | | 166 | | | 109 | | | 1273 | |
| Turn Bay Length (ft) | 100 | | | | | | | | 120 | | | 130 |
| Base Capacity (vph) | 383 | 377 | 553 | | 104 | | 248 | 3835 | 1187 | 146 | 3428 | 1045 |
| Starvation Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.14 | 0.15 | 0.11 | | 0.10 | | 0.18 | 0.39 | 0.00 | 0.23 | 0.42 | 0.04 |

Intersection Summary

Area Type: Other

m Volume for 95th percentile queue is metered by upstream signal.

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 0 | | 0 | 320 | | 600 | 0 | | 0 | 0 | | 0 |
| Storage Lanes | 0 | | 0 | 1 | | 1 | 0 | | 1 | 0 | | 2 |
| Taper Length (ft) | 0 | | | 80 | | | 0 | | | 0 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 35 | | | 40 | | | 45 | | | 45 | |
| Link Distance (ft) | | 210 | | | 379 | | | 632 | | | 460 | |
| Travel Time (s) | | 4.1 | | | 6.5 | | | 9.6 | | | 7.0 | |
| Lane Group Flow (vph) | 0 | 0 | 0 | 485 | 0 | 260 | 0 | 1261 | 511 | 0 | 1376 | 766 |
| v/c Ratio | | | | 0.51 | | 0.31 | | 0.61 | 0.46 | | 0.47 | 0.28 |
| Control Delay (s/veh) | | | | 19.9 | | 11.1 | | 8.3 | 2.0 | | 8.0 | 0.3 |
| Queue Delay | | | | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Total Delay (s/veh) | | | | 19.9 | | 11.1 | | 8.3 | 2.0 | | 8.0 | 0.3 |
| Queue Length 50th (ft) | | | | 72 | | 24 | | 171 | 7 | | 96 | 0 |
| Queue Length 95th (ft) | | | | 111 | | 51 | | 195 | 15 | | 126 | 0 |
| Internal Link Dist (ft) | | 130 | | | 299 | | | 552 | | | 380 | |
| Turn Bay Length (ft) | | | | 320 | | 600 | | | | | | |
| Base Capacity (vph) | | | | 1020 | | 896 | | 2054 | 1111 | | 2950 | 2703 |
| Starvation Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Spillback Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Storage Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Reduced v/c Ratio | | | | 0.48 | | 0.29 | | 0.61 | 0.46 | | 0.47 | 0.28 |

Intersection Summary

Area Type: Other

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 620 | | 410 | 150 | | 260 | 0 | | 220 | 420 | | 0 |
| Storage Lanes | 1 | | 1 | 2 | | 1 | 0 | | 1 | 0 | | 1 |
| Taper Length (ft) | 100 | | | 80 | | | 0 | | | 25 | | |
| Right Turn on Red | | | Yes | | | No | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 30 | | | 45 | | | 45 | |
| Link Distance (ft) | | 476 | | | 199 | | | 1572 | | | 266 | |
| Travel Time (s) | | 8.1 | | | 4.5 | | | 23.8 | | | 4.0 | |
| Lane Group Flow (vph) | 407 | 138 | 222 | 134 | 0 | 234 | 0 | 1274 | 0 | 251 | 1206 | 472 |
| v/c Ratio | 0.72 | 0.53 | 0.14 | 0.29 | | 0.26 | | 0.49 | | 0.82 | 0.55 | 0.42 |
| Control Delay (s/veh) | 54.3 | 53.6 | 0.2 | 48.9 | | 29.6 | | 22.9 | | 66.6 | 13.0 | 2.4 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 54.3 | 53.6 | 0.2 | 48.9 | | 29.6 | | 22.9 | | 66.6 | 13.0 | 2.4 |
| Queue Length 50th (ft) | 155 | 103 | 0 | 47 | | 75 | | 176 | | 194 | 262 | 3 |
| Queue Length 95th (ft) | 199 | 143 | 0 | 83 | | 101 | | 284 | | #305 | 353 | 81 |
| Internal Link Dist (ft) | | 396 | | | 119 | | | 1492 | | | 186 | |
| Turn Bay Length (ft) | 620 | | 410 | 150 | | 260 | | | | 420 | | |
| Base Capacity (vph) | 1020 | 492 | 1547 | 470 | | 920 | | 2613 | | 329 | 2186 | 1113 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.40 | 0.28 | 0.14 | 0.29 | | 0.25 | | 0.49 | | 0.76 | 0.55 | 0.42 |

Intersection Summary

Area Type: Other

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



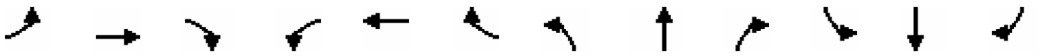
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 350 | | 200 | 175 | | 0 | 340 | | 0 | 450 | | 200 |
| Storage Lanes | 2 | | 1 | 2 | | 0 | 2 | | 0 | 2 | | 0 |
| Taper Length (ft) | 25 | | | 125 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 45 | | | 40 | | | 40 | |
| Link Distance (ft) | | 465 | | | 388 | | | 272 | | | 528 | |
| Travel Time (s) | | 7.0 | | | 5.9 | | | 4.6 | | | 9.0 | |
| Lane Group Flow (vph) | 358 | 383 | 31 | 153 | 214 | 645 | 15 | 660 | 115 | 488 | 445 | 200 |
| v/c Ratio | 0.59 | 0.33 | 0.02 | 0.41 | 0.26 | 0.42 | 0.07 | 0.57 | 0.07 | 0.66 | 0.18 | 0.13 |
| Control Delay (s/veh) | 38.9 | 28.1 | 0.0 | 43.1 | 33.0 | 0.8 | 49.1 | 31.8 | 0.1 | 37.1 | 14.2 | 0.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 38.9 | 28.1 | 0.0 | 43.1 | 33.0 | 0.8 | 49.1 | 31.8 | 0.1 | 37.1 | 14.2 | 0.2 |
| Queue Length 50th (ft) | 75 | 53 | 0 | 32 | 31 | 0 | 3 | 95 | 0 | 101 | 36 | 0 |
| Queue Length 95th (ft) | 211 | 123 | 0 | 106 | 80 | 0 | 19 | 234 | 0 | 274 | 119 | 0 |
| Internal Link Dist (ft) | | 385 | | | 308 | | | 192 | | | 448 | |
| Turn Bay Length (ft) | 350 | | 200 | 175 | | | 340 | | | 450 | | 200 |
| Base Capacity (vph) | 1359 | 2221 | 1544 | 1359 | 2149 | 1549 | 906 | 2129 | 1547 | 1359 | 2903 | 1547 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.26 | 0.17 | 0.02 | 0.11 | 0.10 | 0.42 | 0.02 | 0.31 | 0.07 | 0.36 | 0.15 | 0.13 |

| Intersection Summary | |
|---|---|
| Area Type: | Other |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | 0 |
| Storage Lanes | 1 | | 2 | 1 | | 1 | 2 | | 1 | 2 | | 0 |
| Taper Length (ft) | 60 | | | 60 | | | 150 | | | 120 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 35 | | | 45 | | | 45 | |
| Link Distance (ft) | | 475 | | | 447 | | | 550 | | | 1536 | |
| Travel Time (s) | | 7.2 | | | 8.7 | | | 8.3 | | | 23.3 | |
| Lane Group Flow (vph) | 71 | 657 | 560 | 205 | 215 | 198 | 260 | 1165 | 259 | 267 | 1286 | 0 |
| v/c Ratio | 0.59 | 0.58 | 0.36 | 0.67 | 0.23 | 0.36 | 0.69 | 0.53 | 0.33 | 0.67 | 0.58 | |
| Control Delay (s/veh) | 73.1 | 42.9 | 0.7 | 63.5 | 35.1 | 6.2 | 61.1 | 27.3 | 6.2 | 72.4 | 42.5 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Delay (s/veh) | 73.1 | 42.9 | 0.7 | 63.5 | 35.1 | 6.2 | 61.1 | 27.3 | 6.2 | 72.4 | 42.5 | |
| Queue Length 50th (ft) | 54 | 169 | 0 | 79 | 71 | 0 | 101 | 237 | 14 | 97 | 273 | |
| Queue Length 95th (ft) | 103 | 187 | 0 | 121 | 95 | 54 | 141 | 329 | 78 | 152 | 393 | |
| Internal Link Dist (ft) | | 395 | | | 367 | | | 470 | | | 1456 | |
| Turn Bay Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | |
| Base Capacity (vph) | 146 | 1594 | 1547 | 319 | 1109 | 622 | 481 | 2180 | 795 | 396 | 2200 | |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Reduced v/c Ratio | 0.49 | 0.41 | 0.36 | 0.64 | 0.19 | 0.32 | 0.54 | 0.53 | 0.33 | 0.67 | 0.58 | |

Intersection Summary

Area Type: Other

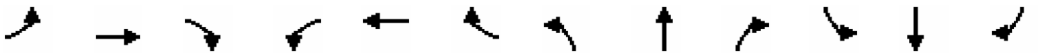


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 300 | | 300 | 110 | | 110 | 400 | | 150 | 200 | | 125 |
| Storage Lanes | 1 | | 1 | 1 | | 0 | 2 | | 1 | 2 | | 1 |
| Taper Length (ft) | 75 | | | 25 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 526 | | | 247 | | | 1536 | | | 647 | |
| Travel Time (s) | | 9.0 | | | 6.7 | | | 23.3 | | | 9.8 | |
| Lane Group Flow (vph) | 209 | 261 | 198 | 218 | 408 | 0 | 376 | 938 | 122 | 88 | 1172 | 447 |
| v/c Ratio | 0.64 | 0.29 | 0.38 | 0.61 | 0.44 | | 0.63 | 0.42 | 0.17 | 0.43 | 0.71 | 0.29 |
| Control Delay (s/veh) | 61.0 | 34.9 | 6.5 | 59.0 | 35.1 | | 51.8 | 24.0 | 10.2 | 47.2 | 29.5 | 0.4 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 61.0 | 34.9 | 6.5 | 59.0 | 35.1 | | 51.8 | 24.0 | 10.2 | 47.2 | 29.5 | 0.4 |
| Queue Length 50th (ft) | 81 | 80 | 0 | 85 | 124 | | 154 | 252 | 34 | 34 | 333 | 0 |
| Queue Length 95th (ft) | 118 | 115 | 55 | 122 | 170 | | 205 | 315 | 97 | 52 | #413 | 0 |
| Internal Link Dist (ft) | | 446 | | | 167 | | | 1456 | | | 567 | |
| Turn Bay Length (ft) | 300 | | 300 | 110 | | | 400 | | 150 | 200 | | 125 |
| Base Capacity (vph) | 595 | 1080 | 577 | 453 | 1026 | | 595 | 2218 | 732 | 258 | 1644 | 1544 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.35 | 0.24 | 0.34 | 0.48 | 0.40 | | 0.63 | 0.42 | 0.17 | 0.34 | 0.71 | 0.29 |

Intersection Summary

Area Type: Other

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 100 | | 0 | 0 | | 0 | 0 | | 120 | 0 | | 130 |
| Storage Lanes | 1 | | 0 | 0 | | 0 | 1 | | 1 | 1 | | 1 |
| Taper Length (ft) | 50 | | | 0 | | | 80 | | | 75 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 30 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 327 | | | 246 | | | 189 | | | 1353 | |
| Travel Time (s) | | 7.4 | | | 6.7 | | | 2.9 | | | 20.5 | |
| Lane Group Flow (vph) | 15 | 15 | 59 | 0 | 15 | 0 | 90 | 1055 | 9 | 14 | 1677 | 80 |
| v/c Ratio | 0.12 | 0.12 | 0.21 | | 0.07 | | 0.36 | 0.26 | 0.01 | 0.17 | 0.52 | 0.08 |
| Control Delay (s/veh) | 44.9 | 44.9 | 1.7 | | 0.6 | | 55.0 | 14.1 | 0.3 | 66.8 | 8.8 | 1.0 |
| Queue Delay | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 44.9 | 44.9 | 1.7 | | 0.6 | | 55.0 | 14.1 | 0.3 | 66.8 | 8.8 | 1.0 |
| Queue Length 50th (ft) | 11 | 11 | 0 | | 0 | | 40 | 81 | 0 | 11 | 88 | 0 |
| Queue Length 95th (ft) | 27 | 27 | 0 | | 0 | | 104 | 286 | m0 | m19 | 510 | m10 |
| Internal Link Dist (ft) | | 247 | | | 166 | | | 109 | | | 1273 | |
| Turn Bay Length (ft) | 100 | | | | | | | | 120 | | | 130 |
| Base Capacity (vph) | 382 | 382 | 544 | | 244 | | 248 | 3984 | 1229 | 146 | 3244 | 1001 |
| Starvation Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.04 | 0.04 | 0.11 | | 0.06 | | 0.36 | 0.26 | 0.01 | 0.10 | 0.52 | 0.08 |

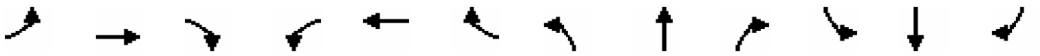
Intersection Summary

Area Type: Other

m Volume for 95th percentile queue is metered by upstream signal.

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 0 | | 0 | 320 | | 600 | 0 | | 0 | 0 | | 0 |
| Storage Lanes | 0 | | 0 | 1 | | 1 | 0 | | 1 | 0 | | 2 |
| Taper Length (ft) | 0 | | | 80 | | | 0 | | | 0 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 35 | | | 40 | | | 45 | | | 45 | |
| Link Distance (ft) | | 210 | | | 379 | | | 632 | | | 460 | |
| Travel Time (s) | | 4.1 | | | 6.5 | | | 9.6 | | | 7.0 | |
| Lane Group Flow (vph) | 0 | 0 | 0 | 546 | 0 | 323 | 0 | 1278 | 393 | 0 | 1057 | 932 |
| v/c Ratio | | | | 0.55 | | 0.37 | | 0.63 | 0.37 | | 0.36 | 0.35 |
| Control Delay (s/veh) | | | | 20.4 | | 13.1 | | 10.4 | 2.0 | | 7.4 | 0.4 |
| Queue Delay | | | | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Total Delay (s/veh) | | | | 20.4 | | 13.1 | | 10.4 | 2.0 | | 7.4 | 0.4 |
| Queue Length 50th (ft) | | | | 84 | | 35 | | 147 | 0 | | 68 | 0 |
| Queue Length 95th (ft) | | | | 126 | | 67 | | 206 | 30 | | 91 | 0 |
| Internal Link Dist (ft) | | 130 | | | 299 | | | 552 | | | 380 | |
| Turn Bay Length (ft) | | | | 320 | | 600 | | | | | | |
| Base Capacity (vph) | | | | 1020 | | 893 | | 2022 | 1051 | | 2905 | 2698 |
| Starvation Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Spillback Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Storage Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Reduced v/c Ratio | | | | 0.54 | | 0.36 | | 0.63 | 0.37 | | 0.36 | 0.35 |

| Intersection Summary | |
|---|---|
| Area Type: | Other |



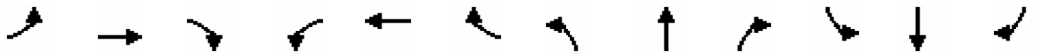
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 620 | | 410 | 150 | | 260 | 0 | | 220 | 420 | | 0 |
| Storage Lanes | 1 | | 1 | 2 | | 1 | 0 | | 1 | 0 | | 1 |
| Taper Length (ft) | 100 | | | 80 | | | 0 | | | 25 | | |
| Right Turn on Red | | | Yes | | | No | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 30 | | | 45 | | | 45 | |
| Link Distance (ft) | | 476 | | | 199 | | | 1572 | | | 266 | |
| Travel Time (s) | | 8.1 | | | 4.5 | | | 23.8 | | | 4.0 | |
| Lane Group Flow (vph) | 739 | 151 | 729 | 183 | 0 | 228 | 0 | 837 | 0 | 158 | 1282 | 210 |
| v/c Ratio | 0.84 | 0.56 | 0.47 | 0.26 | | 0.32 | | 0.34 | | 0.72 | 0.67 | 0.23 |
| Control Delay (s/veh) | 50.9 | 54.2 | 1.0 | 42.2 | | 36.4 | | 22.3 | | 68.5 | 22.3 | 2.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 50.9 | 54.2 | 1.0 | 42.2 | | 36.4 | | 22.3 | | 68.5 | 22.3 | 2.6 |
| Queue Length 50th (ft) | 278 | 113 | 0 | 58 | | 79 | | 100 | | 119 | 374 | 0 |
| Queue Length 95th (ft) | 334 | 155 | 0 | 106 | | 114 | | 185 | | 183 | 467 | 37 |
| Internal Link Dist (ft) | | 396 | | | 119 | | | 1492 | | | 186 | |
| Turn Bay Length (ft) | 620 | | 410 | 150 | | 260 | | | | 420 | | |
| Base Capacity (vph) | 1020 | 492 | 1547 | 703 | | 840 | | 2442 | | 306 | 1916 | 922 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.72 | 0.31 | 0.47 | 0.26 | | 0.27 | | 0.34 | | 0.52 | 0.67 | 0.23 |

| Intersection Summary | |
|---|---|
| Area Type: | Other |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 350 | | 200 | 175 | | 0 | 340 | | 0 | 450 | | 200 |
| Storage Lanes | 2 | | 1 | 2 | | 0 | 2 | | 0 | 2 | | 0 |
| Taper Length (ft) | 25 | | | 125 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 45 | | | 40 | | | 40 | |
| Link Distance (ft) | | 465 | | | 388 | | | 272 | | | 528 | |
| Travel Time (s) | | 7.0 | | | 5.9 | | | 4.6 | | | 9.0 | |
| Lane Group Flow (vph) | 70 | 112 | 19 | 107 | 249 | 345 | 27 | 279 | 107 | 435 | 808 | 318 |
| v/c Ratio | 0.19 | 0.11 | 0.01 | 0.26 | 0.23 | 0.22 | 0.09 | 0.27 | 0.07 | 0.58 | 0.36 | 0.21 |
| Control Delay (s/veh) | 35.2 | 23.8 | 0.0 | 34.2 | 22.8 | 0.3 | 37.4 | 23.5 | 0.1 | 28.8 | 14.0 | 0.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 35.2 | 23.8 | 0.0 | 34.2 | 22.8 | 0.3 | 37.4 | 23.5 | 0.1 | 28.8 | 14.0 | 0.3 |
| Queue Length 50th (ft) | 10 | 10 | 0 | 15 | 24 | 0 | 4 | 27 | 0 | 61 | 52 | 0 |
| Queue Length 95th (ft) | 52 | 39 | 0 | 71 | 75 | 0 | 26 | 84 | 0 | 217 | 186 | 0 |
| Internal Link Dist (ft) | | 385 | | | 308 | | | 192 | | | 448 | |
| Turn Bay Length (ft) | 350 | | 200 | 175 | | | 340 | | | 450 | | 200 |
| Base Capacity (vph) | 1894 | 2990 | 1545 | 1894 | 3005 | 1546 | 1263 | 2960 | 1547 | 1894 | 3838 | 1549 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.04 | 0.04 | 0.01 | 0.06 | 0.08 | 0.22 | 0.02 | 0.09 | 0.07 | 0.23 | 0.21 | 0.21 |

Intersection Summary

Area Type: Other



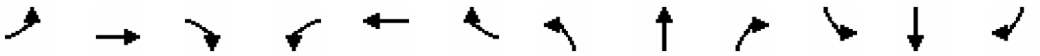
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | 0 |
| Storage Lanes | 1 | | 2 | 1 | | 1 | 2 | | 1 | 2 | | 0 |
| Taper Length (ft) | 60 | | | 60 | | | 150 | | | 120 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 35 | | | 45 | | | 45 | |
| Link Distance (ft) | | 475 | | | 447 | | | 550 | | | 1536 | |
| Travel Time (s) | | 7.2 | | | 8.7 | | | 8.3 | | | 23.3 | |
| Lane Group Flow (vph) | 34 | 194 | 221 | 378 | 480 | 237 | 513 | 1116 | 227 | 179 | 1408 | 0 |
| v/c Ratio | 0.35 | 0.26 | 0.14 | 0.60 | 0.45 | 0.37 | 0.78 | 0.53 | 0.29 | 0.45 | 0.82 | |
| Control Delay (s/veh) | 63.4 | 44.7 | 0.2 | 50.5 | 36.0 | 5.7 | 55.4 | 27.7 | 4.3 | 71.8 | 55.9 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Delay (s/veh) | 63.4 | 44.7 | 0.2 | 50.5 | 36.0 | 5.7 | 55.4 | 27.7 | 4.3 | 71.8 | 55.9 | |
| Queue Length 50th (ft) | 26 | 51 | 0 | 140 | 174 | 0 | 191 | 215 | 0 | 65 | 332 | |
| Queue Length 95th (ft) | 59 | 60 | 0 | #277 | 203 | 57 | #335 | 312 | 54 | m103 | 470 | |
| Internal Link Dist (ft) | | 395 | | | 367 | | | 470 | | | 1456 | |
| Turn Bay Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | |
| Base Capacity (vph) | 146 | 1594 | 1547 | 631 | 1172 | 672 | 659 | 2106 | 776 | 396 | 1709 | |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Reduced v/c Ratio | 0.23 | 0.12 | 0.14 | 0.60 | 0.41 | 0.35 | 0.78 | 0.53 | 0.29 | 0.45 | 0.82 | |

Intersection Summary

Area Type: Other

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 300 | | 300 | 110 | | 110 | 400 | | 150 | 200 | | 125 |
| Storage Lanes | 1 | | 1 | 1 | | 0 | 2 | | 1 | 2 | | 1 |
| Taper Length (ft) | 75 | | | 25 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 526 | | | 247 | | | 1536 | | | 647 | |
| Travel Time (s) | | 9.0 | | | 6.7 | | | 23.3 | | | 9.8 | |
| Lane Group Flow (vph) | 395 | 278 | 378 | 153 | 238 | 0 | 392 | 1115 | 135 | 135 | 1026 | 316 |
| v/c Ratio | 0.79 | 0.30 | 0.56 | 0.52 | 0.34 | | 0.66 | 0.50 | 0.18 | 0.53 | 0.59 | 0.20 |
| Control Delay (s/veh) | 61.1 | 35.2 | 6.6 | 58.9 | 32.5 | | 51.6 | 24.9 | 8.8 | 49.3 | 27.4 | 0.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 61.1 | 35.2 | 6.6 | 58.9 | 32.5 | | 51.6 | 24.9 | 8.8 | 49.3 | 27.4 | 0.3 |
| Queue Length 50th (ft) | 153 | 85 | 0 | 59 | 63 | | 156 | 297 | 38 | 53 | 276 | 0 |
| Queue Length 95th (ft) | 203 | 122 | 73 | 92 | 100 | | 209 | 362 | 98 | 66 | 310 | 0 |
| Internal Link Dist (ft) | | 446 | | | 167 | | | 1456 | | | 567 | |
| Turn Bay Length (ft) | 300 | | 300 | 110 | | | 400 | | 150 | 200 | | 125 |
| Base Capacity (vph) | 595 | 1080 | 732 | 453 | 926 | | 595 | 2237 | 765 | 277 | 1731 | 1545 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.66 | 0.26 | 0.52 | 0.34 | 0.26 | | 0.66 | 0.50 | 0.18 | 0.49 | 0.59 | 0.20 |

| Intersection Summary | |
|---|---|
| Area Type: | Other |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 100 | | 0 | 0 | | 0 | 0 | | 120 | 0 | | 130 |
| Storage Lanes | 1 | | 0 | 0 | | 0 | 1 | | 1 | 1 | | 1 |
| Taper Length (ft) | 50 | | | 0 | | | 80 | | | 75 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 30 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 327 | | | 246 | | | 189 | | | 1353 | |
| Travel Time (s) | | 7.4 | | | 6.7 | | | 2.9 | | | 20.5 | |
| Lane Group Flow (vph) | 59 | 60 | 60 | 0 | 10 | 0 | 50 | 1507 | 3 | 34 | 1439 | 47 |
| v/c Ratio | 0.38 | 0.39 | 0.19 | | 0.11 | | 0.23 | 0.39 | 0.00 | 0.35 | 0.42 | 0.05 |
| Control Delay (s/veh) | 51.8 | 52.5 | 1.4 | | 40.0 | | 57.4 | 16.4 | 0.0 | 69.5 | 6.9 | 0.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 51.8 | 52.5 | 1.4 | | 40.0 | | 57.4 | 16.4 | 0.0 | 69.5 | 6.9 | 0.9 |
| Queue Length 50th (ft) | 47 | 47 | 0 | | 3 | | 26 | 149 | 0 | 26 | 57 | 0 |
| Queue Length 95th (ft) | 72 | 74 | 0 | | 21 | | m63 | 413 | m0 | m43 | 428 | m8 |
| Internal Link Dist (ft) | | 247 | | | 166 | | | 109 | | | 1273 | |
| Turn Bay Length (ft) | 100 | | | | | | | | 120 | | | 130 |
| Base Capacity (vph) | 383 | 376 | 553 | | 104 | | 248 | 3826 | 1184 | 146 | 3419 | 1043 |
| Starvation Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.15 | 0.16 | 0.11 | | 0.10 | | 0.20 | 0.39 | 0.00 | 0.23 | 0.42 | 0.05 |

Intersection Summary

Area Type: Other

m Volume for 95th percentile queue is metered by upstream signal.

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 0 | | 0 | 320 | | 600 | 0 | | 0 | 0 | | 0 |
| Storage Lanes | 0 | | 0 | 1 | | 1 | 0 | | 1 | 0 | | 2 |
| Taper Length (ft) | 0 | | | 80 | | | 0 | | | 0 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 35 | | | 40 | | | 45 | | | 45 | |
| Link Distance (ft) | | 210 | | | 379 | | | 632 | | | 460 | |
| Travel Time (s) | | 4.1 | | | 6.5 | | | 9.6 | | | 7.0 | |
| Lane Group Flow (vph) | 0 | 0 | 0 | 487 | 0 | 260 | 0 | 1269 | 511 | 0 | 1377 | 766 |
| v/c Ratio | | | | 0.51 | | 0.31 | | 0.62 | 0.46 | | 0.47 | 0.28 |
| Control Delay (s/veh) | | | | 19.9 | | 11.3 | | 10.1 | 2.2 | | 8.0 | 0.3 |
| Queue Delay | | | | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Total Delay (s/veh) | | | | 19.9 | | 11.3 | | 10.1 | 2.2 | | 8.0 | 0.3 |
| Queue Length 50th (ft) | | | | 73 | | 25 | | 145 | 0 | | 96 | 0 |
| Queue Length 95th (ft) | | | | 111 | | 52 | | 203 | 33 | | 126 | 0 |
| Internal Link Dist (ft) | | 130 | | | 299 | | | 552 | | | 380 | |
| Turn Bay Length (ft) | | | | 320 | | 600 | | | | | | |
| Base Capacity (vph) | | | | 1020 | | 894 | | 2052 | 1110 | | 2949 | 2703 |
| Starvation Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Spillback Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Storage Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Reduced v/c Ratio | | | | 0.48 | | 0.29 | | 0.62 | 0.46 | | 0.47 | 0.28 |

Intersection Summary

Area Type: Other

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 620 | | 410 | 150 | | 260 | 0 | | 220 | 420 | | 0 |
| Storage Lanes | 1 | | 1 | 2 | | 1 | 0 | | 1 | 0 | | 1 |
| Taper Length (ft) | 100 | | | 80 | | | 0 | | | 25 | | |
| Right Turn on Red | | | Yes | | | No | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 30 | | | 45 | | | 45 | |
| Link Distance (ft) | | 476 | | | 199 | | | 1572 | | | 266 | |
| Travel Time (s) | | 8.1 | | | 4.5 | | | 23.8 | | | 4.0 | |
| Lane Group Flow (vph) | 407 | 138 | 224 | 134 | 0 | 234 | 0 | 1282 | 0 | 251 | 1209 | 472 |
| v/c Ratio | 0.72 | 0.53 | 0.14 | 0.29 | | 0.26 | | 0.49 | | 0.82 | 0.55 | 0.42 |
| Control Delay (s/veh) | 54.3 | 53.6 | 0.2 | 48.9 | | 29.6 | | 23.0 | | 69.0 | 15.2 | 2.4 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 54.3 | 53.6 | 0.2 | 48.9 | | 29.6 | | 23.0 | | 69.0 | 15.2 | 2.4 |
| Queue Length 50th (ft) | 155 | 103 | 0 | 47 | | 75 | | 178 | | 187 | 261 | 0 |
| Queue Length 95th (ft) | 199 | 143 | 0 | 83 | | 101 | | 286 | | #297 | 407 | 49 |
| Internal Link Dist (ft) | | 396 | | | 119 | | | 1492 | | | 186 | |
| Turn Bay Length (ft) | 620 | | 410 | 150 | | 260 | | | | 420 | | |
| Base Capacity (vph) | 1020 | 492 | 1547 | 470 | | 920 | | 2613 | | 329 | 2186 | 1113 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.40 | 0.28 | 0.14 | 0.29 | | 0.25 | | 0.49 | | 0.76 | 0.55 | 0.42 |

Intersection Summary

Area Type: Other

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 350 | | 200 | 175 | | 0 | 340 | | 0 | 450 | | 200 |
| Storage Lanes | 2 | | 1 | 2 | | 0 | 2 | | 0 | 2 | | 0 |
| Taper Length (ft) | 25 | | | 125 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 45 | | | 40 | | | 40 | |
| Link Distance (ft) | | 465 | | | 388 | | | 272 | | | 528 | |
| Travel Time (s) | | 7.0 | | | 5.9 | | | 4.6 | | | 9.0 | |
| Lane Group Flow (vph) | 358 | 384 | 32 | 156 | 222 | 645 | 17 | 663 | 120 | 488 | 447 | 200 |
| v/c Ratio | 0.59 | 0.33 | 0.02 | 0.41 | 0.27 | 0.42 | 0.08 | 0.57 | 0.08 | 0.66 | 0.19 | 0.13 |
| Control Delay (s/veh) | 39.0 | 28.2 | 0.0 | 43.2 | 33.1 | 0.8 | 49.2 | 31.9 | 0.1 | 37.2 | 15.6 | 0.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 39.0 | 28.2 | 0.0 | 43.2 | 33.1 | 0.8 | 49.2 | 31.9 | 0.1 | 37.2 | 15.6 | 0.2 |
| Queue Length 50th (ft) | 75 | 54 | 0 | 33 | 32 | 0 | 3 | 96 | 0 | 101 | 36 | 0 |
| Queue Length 95th (ft) | 211 | 124 | 0 | 107 | 83 | 0 | 21 | 235 | 0 | 274 | 120 | 0 |
| Internal Link Dist (ft) | | 385 | | | 308 | | | 192 | | | 448 | |
| Turn Bay Length (ft) | 350 | | 200 | 175 | | | 340 | | | 450 | | 200 |
| Base Capacity (vph) | 1355 | 2214 | 1544 | 1355 | 2143 | 1549 | 903 | 2123 | 1547 | 1355 | 2891 | 1547 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.26 | 0.17 | 0.02 | 0.12 | 0.10 | 0.42 | 0.02 | 0.31 | 0.08 | 0.36 | 0.15 | 0.13 |

Intersection Summary

Area Type: Other

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | 0 |
| Storage Lanes | 1 | | 2 | 1 | | 1 | 2 | | 1 | 2 | | 0 |
| Taper Length (ft) | 60 | | | 60 | | | 150 | | | 120 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 35 | | | 45 | | | 45 | |
| Link Distance (ft) | | 475 | | | 447 | | | 550 | | | 1536 | |
| Travel Time (s) | | 7.2 | | | 8.7 | | | 8.3 | | | 23.3 | |
| Lane Group Flow (vph) | 72 | 657 | 560 | 205 | 215 | 200 | 260 | 1167 | 259 | 270 | 1292 | 0 |
| v/c Ratio | 0.60 | 0.58 | 0.36 | 0.67 | 0.23 | 0.36 | 0.69 | 0.54 | 0.33 | 0.68 | 0.59 | |
| Control Delay (s/veh) | 73.5 | 42.9 | 0.7 | 63.5 | 35.1 | 6.2 | 61.1 | 27.3 | 6.2 | 72.3 | 42.3 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Delay (s/veh) | 73.5 | 42.9 | 0.7 | 63.5 | 35.1 | 6.2 | 61.1 | 27.3 | 6.2 | 72.3 | 42.3 | |
| Queue Length 50th (ft) | 55 | 169 | 0 | 79 | 71 | 0 | 101 | 237 | 14 | 98 | 275 | |
| Queue Length 95th (ft) | 104 | 187 | 0 | 121 | 95 | 53 | 141 | 330 | 78 | 153 | 396 | |
| Internal Link Dist (ft) | | 395 | | | 367 | | | 470 | | | 1456 | |
| Turn Bay Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | |
| Base Capacity (vph) | 146 | 1594 | 1547 | 319 | 1109 | 623 | 481 | 2180 | 795 | 396 | 2201 | |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Reduced v/c Ratio | 0.49 | 0.41 | 0.36 | 0.64 | 0.19 | 0.32 | 0.54 | 0.54 | 0.33 | 0.68 | 0.59 | |

Intersection Summary

Area Type: Other

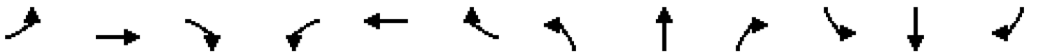
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 300 | | 300 | 110 | | 110 | 400 | | 150 | 200 | | 125 |
| Storage Lanes | 1 | | 1 | 1 | | 0 | 2 | | 1 | 2 | | 1 |
| Taper Length (ft) | 75 | | | 25 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 526 | | | 247 | | | 1536 | | | 647 | |
| Travel Time (s) | | 9.0 | | | 6.7 | | | 23.3 | | | 9.8 | |
| Lane Group Flow (vph) | 330 | 298 | 266 | 223 | 446 | 0 | 585 | 1011 | 128 | 96 | 1266 | 681 |
| v/c Ratio | 0.74 | 0.32 | 0.47 | 0.59 | 0.53 | | 0.98 | 0.47 | 0.18 | 0.45 | 0.79 | 0.44 |
| Control Delay (s/veh) | 60.2 | 35.5 | 6.6 | 57.5 | 39.7 | | 78.0 | 22.9 | 8.3 | 45.1 | 30.1 | 2.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 60.2 | 35.5 | 6.6 | 57.5 | 39.7 | | 78.0 | 22.9 | 8.3 | 45.1 | 30.1 | 2.9 |
| Queue Length 50th (ft) | 128 | 92 | 0 | 87 | 145 | | 242 | 274 | 41 | 36 | 365 | 24 |
| Queue Length 95th (ft) | 172 | 131 | 62 | 125 | 198 | | #360 | 335 | m86 | m50 | #473 | 115 |
| Internal Link Dist (ft) | | 446 | | | 167 | | | 1456 | | | 567 | |
| Turn Bay Length (ft) | 300 | | 300 | 110 | | | 400 | | 150 | 200 | | 125 |
| Base Capacity (vph) | 595 | 1080 | 624 | 453 | 930 | | 595 | 2165 | 718 | 260 | 1602 | 1544 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.55 | 0.28 | 0.43 | 0.49 | 0.48 | | 0.98 | 0.47 | 0.18 | 0.37 | 0.79 | 0.44 |

Intersection Summary

Area Type: Other

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.



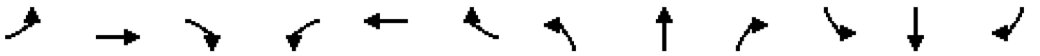
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 100 | | 0 | 0 | | 0 | 0 | | 120 | 0 | | 130 |
| Storage Lanes | 1 | | 0 | 0 | | 0 | 1 | | 1 | 1 | | 1 |
| Taper Length (ft) | 50 | | | 0 | | | 80 | | | 75 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 30 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 327 | | | 246 | | | 189 | | | 1353 | |
| Travel Time (s) | | 7.4 | | | 6.7 | | | 2.9 | | | 20.5 | |
| Lane Group Flow (vph) | 102 | 104 | 278 | 0 | 41 | 0 | 186 | 1165 | 21 | 21 | 1773 | 103 |
| v/c Ratio | 0.55 | 0.57 | 0.61 | | 0.64 | | 0.75 | 0.34 | 0.02 | 0.24 | 0.65 | 0.12 |
| Control Delay (s/veh) | 56.6 | 57.9 | 10.3 | | 85.4 | | 70.7 | 18.8 | 2.1 | 67.6 | 13.7 | 1.5 |
| Queue Delay | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 56.6 | 57.9 | 10.4 | | 85.4 | | 70.7 | 18.8 | 2.1 | 67.6 | 13.7 | 1.5 |
| Queue Length 50th (ft) | 81 | 82 | 0 | | 24 | | 94 | 113 | 0 | 16 | 186 | 0 |
| Queue Length 95th (ft) | 116 | 118 | 64 | | #84 | | #232 | 330 | m4 | m26 | #589 | m18 |
| Internal Link Dist (ft) | | 247 | | | 166 | | | 109 | | | 1273 | |
| Turn Bay Length (ft) | 100 | | | | | | | | 120 | | | 130 |
| Base Capacity (vph) | 373 | 366 | 638 | | 65 | | 248 | 3416 | 1067 | 146 | 2722 | 854 |
| Starvation Cap Reductn | 0 | 0 | 11 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.27 | 0.28 | 0.44 | | 0.63 | | 0.75 | 0.34 | 0.02 | 0.14 | 0.65 | 0.12 |

Intersection Summary

Area Type: Other

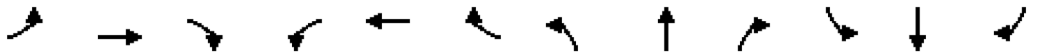
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 0 | | 0 | 320 | | 600 | 0 | | 0 | 0 | | 0 |
| Storage Lanes | 0 | | 0 | 1 | | 1 | 0 | | 1 | 0 | | 2 |
| Taper Length (ft) | 0 | | | 80 | | | 0 | | | 0 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 35 | | | 40 | | | 45 | | | 45 | |
| Link Distance (ft) | | 210 | | | 379 | | | 632 | | | 460 | |
| Travel Time (s) | | 4.1 | | | 6.5 | | | 9.6 | | | 7.0 | |
| Lane Group Flow (vph) | 0 | 0 | 0 | 552 | 0 | 323 | 0 | 1510 | 438 | 0 | 1198 | 979 |
| v/c Ratio | | | | 0.56 | | 0.39 | | 0.75 | 0.41 | | 0.41 | 0.36 |
| Control Delay (s/veh) | | | | 20.4 | | 15.4 | | 12.6 | 2.1 | | 7.7 | 0.4 |
| Queue Delay | | | | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Total Delay (s/veh) | | | | 20.4 | | 15.4 | | 12.6 | 2.1 | | 7.7 | 0.4 |
| Queue Length 50th (ft) | | | | 85 | | 42 | | 194 | 0 | | 79 | 0 |
| Queue Length 95th (ft) | | | | 127 | | 75 | | 272 | 32 | | 105 | 0 |
| Internal Link Dist (ft) | | 130 | | | 299 | | | 552 | | | 380 | |
| Turn Bay Length (ft) | | | | 320 | | 600 | | | | | | |
| Base Capacity (vph) | | | | 1020 | | 865 | | 2021 | 1069 | | 2903 | 2698 |
| Starvation Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Spillback Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Storage Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Reduced v/c Ratio | | | | 0.54 | | 0.37 | | 0.75 | 0.41 | | 0.41 | 0.36 |

| Intersection Summary | |
|---|---|
| Area Type: | Other |

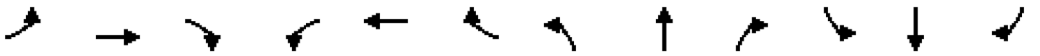


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 620 | | 410 | 150 | | 260 | 0 | | 220 | 420 | | 0 |
| Storage Lanes | 1 | | 1 | 2 | | 1 | 0 | | 1 | 0 | | 1 |
| Taper Length (ft) | 100 | | | 80 | | | 0 | | | 25 | | |
| Right Turn on Red | | | Yes | | | No | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 30 | | | 45 | | | 45 | |
| Link Distance (ft) | | 476 | | | 199 | | | 1572 | | | 266 | |
| Travel Time (s) | | 8.1 | | | 4.5 | | | 23.8 | | | 4.0 | |
| Lane Group Flow (vph) | 806 | 151 | 731 | 183 | 0 | 237 | 0 | 1968 | 0 | 172 | 1333 | 269 |
| v/c Ratio | 0.87 | 0.56 | 0.47 | 0.25 | | 0.33 | | 0.84 | | 0.75 | 0.71 | 0.29 |
| Control Delay (s/veh) | 52.0 | 54.2 | 1.0 | 41.4 | | 36.4 | | 37.7 | | 69.9 | 23.9 | 2.8 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 52.0 | 54.2 | 1.0 | 41.4 | | 36.4 | | 37.7 | | 69.9 | 23.9 | 2.8 |
| Queue Length 50th (ft) | 303 | 113 | 0 | 57 | | 82 | | 359 | | 130 | 408 | 3 |
| Queue Length 95th (ft) | 371 | 155 | 0 | 106 | | 118 | | #554 | | 198 | 496 | 44 |
| Internal Link Dist (ft) | | 396 | | | 119 | | | 1492 | | | 186 | |
| Turn Bay Length (ft) | 620 | | 410 | 150 | | 260 | | | | 420 | | |
| Base Capacity (vph) | 1020 | 492 | 1547 | 738 | | 829 | | 2352 | | 306 | 1881 | 933 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.79 | 0.31 | 0.47 | 0.25 | | 0.29 | | 0.84 | | 0.56 | 0.71 | 0.29 |

Intersection Summary

Area Type: Other

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 350 | | 200 | 175 | | 0 | 340 | | 0 | 450 | | 200 |
| Storage Lanes | 2 | | 1 | 2 | | 0 | 2 | | 0 | 2 | | 0 |
| Taper Length (ft) | 25 | | | 125 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 45 | | | 40 | | | 40 | |
| Link Distance (ft) | | 465 | | | 388 | | | 272 | | | 528 | |
| Travel Time (s) | | 7.0 | | | 5.9 | | | 4.6 | | | 9.0 | |
| Lane Group Flow (vph) | 110 | 110 | 33 | 165 | 418 | 637 | 66 | 495 | 176 | 484 | 901 | 549 |
| v/c Ratio | 0.31 | 0.11 | 0.02 | 0.39 | 0.39 | 0.41 | 0.22 | 0.45 | 0.11 | 0.64 | 0.47 | 0.35 |
| Control Delay (s/veh) | 39.3 | 27.1 | 0.0 | 37.8 | 26.7 | 0.8 | 40.3 | 27.4 | 0.2 | 32.9 | 19.0 | 0.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 39.3 | 27.1 | 0.0 | 37.8 | 26.7 | 0.8 | 40.3 | 27.4 | 0.2 | 32.9 | 19.0 | 0.6 |
| Queue Length 50th (ft) | 20 | 13 | 0 | 30 | 51 | 0 | 12 | 61 | 0 | 86 | 98 | 0 |
| Queue Length 95th (ft) | 75 | 41 | 0 | 103 | 128 | 0 | 51 | 154 | 0 | 248 | 226 | 0 |
| Internal Link Dist (ft) | | 385 | | | 308 | | | 192 | | | 448 | |
| Turn Bay Length (ft) | 350 | | 200 | 175 | | | 340 | | | 450 | | 200 |
| Base Capacity (vph) | 1534 | 2425 | 1545 | 1534 | 2447 | 1546 | 1023 | 2403 | 1547 | 1534 | 3229 | 1549 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.07 | 0.05 | 0.02 | 0.11 | 0.17 | 0.41 | 0.06 | 0.21 | 0.11 | 0.32 | 0.28 | 0.35 |

| Intersection Summary | |
|---|---|
| Area Type: | Other |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | 0 |
| Storage Lanes | 1 | | 2 | 1 | | 1 | 2 | | 1 | 2 | | 0 |
| Taper Length (ft) | 60 | | | 60 | | | 150 | | | 120 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 35 | | | 45 | | | 45 | |
| Link Distance (ft) | | 475 | | | 447 | | | 550 | | | 1536 | |
| Travel Time (s) | | 7.2 | | | 8.7 | | | 8.3 | | | 23.3 | |
| Lane Group Flow (vph) | 41 | 567 | 227 | 454 | 722 | 299 | 649 | 1258 | 474 | 237 | 1516 | 0 |
| v/c Ratio | 0.56 | 0.55 | 0.15 | 0.82 | 0.60 | 0.42 | 1.09 | 0.66 | 0.66 | 0.60 | 0.94 | |
| Control Delay (s/veh) | 84.8 | 43.8 | 0.2 | 61.9 | 35.7 | 6.9 | 110.3 | 32.8 | 21.1 | 73.4 | 64.0 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | |
| Total Delay (s/veh) | 84.8 | 43.8 | 0.2 | 61.9 | 35.7 | 6.9 | 110.3 | 32.8 | 21.3 | 73.4 | 64.0 | |
| Queue Length 50th (ft) | 32 | 147 | 0 | 173 | 248 | 14 | ~292 | 291 | 164 | 91 | 426 | |
| Queue Length 95th (ft) | #85 | 161 | 0 | #388 | 314 | 82 | #409 | 344 | 287 | m128 | #531 | |
| Internal Link Dist (ft) | | 395 | | | 367 | | | 470 | | | 1456 | |
| Turn Bay Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | |
| Base Capacity (vph) | 73 | 1527 | 1547 | 555 | 1203 | 706 | 595 | 1913 | 719 | 396 | 1611 | |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 0 | 0 | |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Reduced v/c Ratio | 0.56 | 0.37 | 0.15 | 0.82 | 0.60 | 0.42 | 1.09 | 0.66 | 0.69 | 0.60 | 0.94 | |

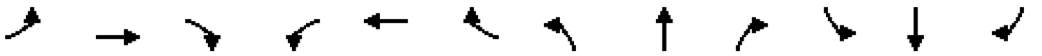
Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 300 | | 300 | 110 | | 110 | 400 | | 150 | 200 | | 125 |
| Storage Lanes | 1 | | 1 | 1 | | 0 | 2 | | 1 | 2 | | 1 |
| Taper Length (ft) | 75 | | | 25 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 526 | | | 247 | | | 1536 | | | 647 | |
| Travel Time (s) | | 9.0 | | | 6.7 | | | 23.3 | | | 9.8 | |
| Lane Group Flow (vph) | 604 | 292 | 521 | 156 | 271 | 0 | 500 | 1313 | 135 | 167 | 1156 | 438 |
| v/c Ratio | 1.02 | 0.32 | 0.73 | 0.45 | 0.41 | | 0.84 | 0.62 | 0.18 | 0.59 | 0.70 | 0.28 |
| Control Delay (s/veh) | 89.8 | 35.4 | 14.0 | 55.9 | 36.4 | | 54.5 | 24.2 | 6.1 | 45.6 | 25.7 | 0.4 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 89.8 | 35.4 | 14.0 | 55.9 | 36.4 | | 54.5 | 24.2 | 6.1 | 45.6 | 25.7 | 0.4 |
| Queue Length 50th (ft) | ~248 | 90 | 56 | 60 | 79 | | 201 | 363 | 33 | 65 | 319 | 0 |
| Queue Length 95th (ft) | #370 | 128 | 187 | 94 | 117 | | #279 | 426 | m61 | 82 | 356 | 0 |
| Internal Link Dist (ft) | | 446 | | | 167 | | | 1456 | | | 567 | |
| Turn Bay Length (ft) | 300 | | 300 | 110 | | | 400 | | 150 | 200 | | 125 |
| Base Capacity (vph) | 595 | 1080 | 764 | 471 | 925 | | 595 | 2114 | 731 | 296 | 1652 | 1545 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.02 | 0.27 | 0.68 | 0.33 | 0.29 | | 0.84 | 0.62 | 0.18 | 0.56 | 0.70 | 0.28 |

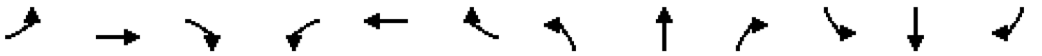
Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 100 | | 0 | 0 | | 0 | 0 | | 120 | 0 | | 130 |
| Storage Lanes | 1 | | 0 | 0 | | 0 | 1 | | 1 | 1 | | 1 |
| Taper Length (ft) | 50 | | | 0 | | | 80 | | | 75 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 30 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 327 | | | 246 | | | 189 | | | 1353 | |
| Travel Time (s) | | 7.4 | | | 6.7 | | | 2.9 | | | 20.5 | |
| Lane Group Flow (vph) | 107 | 106 | 181 | 0 | 33 | 0 | 319 | 1702 | 11 | 43 | 1564 | 181 |
| v/c Ratio | 0.57 | 0.57 | 0.48 | | 0.58 | | 1.29 | 0.53 | 0.01 | 0.40 | 0.58 | 0.21 |
| Control Delay (s/veh) | 57.0 | 57.6 | 9.6 | | 77.9 | | 193.3 | 25.8 | 0.0 | 66.2 | 11.8 | 2.7 |
| Queue Delay | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 57.0 | 57.6 | 9.6 | | 77.9 | | 193.3 | 25.8 | 0.0 | 66.2 | 11.8 | 2.7 |
| Queue Length 50th (ft) | 84 | 84 | 0 | | 17 | | ~304 | 364 | 0 | 28 | 235 | 0 |
| Queue Length 95th (ft) | 121 | 121 | 53 | | #68 | | m#432 | m480 | m0 | m51 | 475 | 61 |
| Internal Link Dist (ft) | | 247 | | | 166 | | | 109 | | | 1273 | |
| Turn Bay Length (ft) | 100 | | | | | | | | 120 | | | 130 |
| Base Capacity (vph) | 376 | 370 | 579 | | 59 | | 248 | 3195 | 1003 | 147 | 2715 | 843 |
| Starvation Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.28 | 0.29 | 0.31 | | 0.56 | | 1.29 | 0.53 | 0.01 | 0.29 | 0.58 | 0.21 |

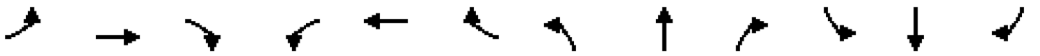
Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 0 | | 0 | 320 | | 600 | 0 | | 0 | 0 | | 0 |
| Storage Lanes | 0 | | 0 | 1 | | 1 | 0 | | 1 | 0 | | 2 |
| Taper Length (ft) | 0 | | | 80 | | | 0 | | | 0 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 35 | | | 40 | | | 45 | | | 45 | |
| Link Distance (ft) | | 210 | | | 379 | | | 632 | | | 460 | |
| Travel Time (s) | | 4.1 | | | 6.5 | | | 9.6 | | | 7.0 | |
| Lane Group Flow (vph) | 0 | 0 | 0 | 495 | 0 | 263 | 0 | 1717 | 556 | 0 | 1556 | 788 |
| v/c Ratio | | | | 0.52 | | 0.32 | | 0.84 | 0.49 | | 0.53 | 0.29 |
| Control Delay (s/veh) | | | | 20.0 | | 14.3 | | 15.8 | 2.4 | | 8.5 | 0.3 |
| Queue Delay | | | | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Total Delay (s/veh) | | | | 20.0 | | 14.3 | | 15.8 | 2.4 | | 8.5 | 0.3 |
| Queue Length 50th (ft) | | | | 74 | | 32 | | 246 | 0 | | 114 | 0 |
| Queue Length 95th (ft) | | | | 113 | | 60 | | #364 | 35 | | 149 | 0 |
| Internal Link Dist (ft) | | 130 | | | 299 | | | 552 | | | 380 | |
| Turn Bay Length (ft) | | | | 320 | | 600 | | | | | | |
| Base Capacity (vph) | | | | 1020 | | 865 | | 2050 | 1128 | | 2945 | 2703 |
| Starvation Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Spillback Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Storage Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Reduced v/c Ratio | | | | 0.49 | | 0.30 | | 0.84 | 0.49 | | 0.53 | 0.29 |

Intersection Summary

Area Type: Other

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

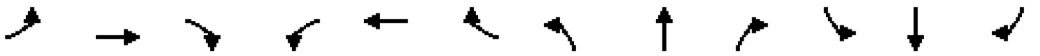
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 620 | | 410 | 150 | | 260 | 0 | | 220 | 420 | | 0 |
| Storage Lanes | 1 | | 1 | 2 | | 1 | 0 | | 1 | 0 | | 1 |
| Taper Length (ft) | 100 | | | 80 | | | 0 | | | 25 | | |
| Right Turn on Red | | | Yes | | | No | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 30 | | | 45 | | | 45 | |
| Link Distance (ft) | | 476 | | | 199 | | | 1572 | | | 266 | |
| Travel Time (s) | | 8.1 | | | 4.5 | | | 23.8 | | | 4.0 | |
| Lane Group Flow (vph) | 557 | 144 | 186 | 134 | 0 | 258 | 0 | 2175 | 0 | 268 | 1289 | 567 |
| v/c Ratio | 0.77 | 0.55 | 0.12 | 0.23 | | 0.29 | | 0.94 | | 0.85 | 0.63 | 0.51 |
| Control Delay (s/veh) | 52.2 | 53.9 | 0.2 | 44.3 | | 30.3 | | 41.3 | | 71.8 | 19.4 | 3.0 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 52.2 | 53.9 | 0.2 | 44.3 | | 30.3 | | 41.3 | | 71.8 | 19.4 | 3.0 |
| Queue Length 50th (ft) | 211 | 107 | 0 | 45 | | 80 | | ~525 | | 197 | 332 | 0 |
| Queue Length 95th (ft) | 258 | 149 | 0 | 81 | | 121 | | #657 | | #356 | 470 | 54 |
| Internal Link Dist (ft) | | 396 | | | 119 | | | 1492 | | | 186 | |
| Turn Bay Length (ft) | 620 | | 410 | 150 | | 260 | | | | 420 | | |
| Base Capacity (vph) | 1020 | 492 | 1547 | 593 | | 909 | | 2325 | | 328 | 2040 | 1110 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.55 | 0.29 | 0.12 | 0.23 | | 0.28 | | 0.94 | | 0.82 | 0.63 | 0.51 |

Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 350 | | 200 | 175 | | 0 | 340 | | 0 | 450 | | 200 |
| Storage Lanes | 2 | | 1 | 2 | | 0 | 2 | | 0 | 2 | | 0 |
| Taper Length (ft) | 25 | | | 125 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 45 | | | 40 | | | 40 | |
| Link Distance (ft) | | 465 | | | 388 | | | 272 | | | 528 | |
| Travel Time (s) | | 7.0 | | | 5.9 | | | 4.6 | | | 9.0 | |
| Lane Group Flow (vph) | 645 | 753 | 54 | 204 | 323 | 699 | 32 | 871 | 129 | 699 | 602 | 258 |
| v/c Ratio | 0.83 | 0.55 | 0.03 | 0.58 | 0.44 | 0.45 | 0.19 | 0.75 | 0.08 | 0.83 | 0.26 | 0.17 |
| Control Delay (s/veh) | 53.3 | 37.6 | 0.0 | 58.3 | 47.0 | 1.0 | 60.9 | 46.1 | 0.1 | 51.1 | 20.8 | 0.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 53.3 | 37.6 | 0.0 | 58.3 | 47.0 | 1.0 | 60.9 | 46.1 | 0.1 | 51.1 | 20.8 | 0.2 |
| Queue Length 50th (ft) | 227 | 175 | 0 | 74 | 82 | 0 | 11 | 216 | 0 | 243 | 98 | 0 |
| Queue Length 95th (ft) | #424 | 250 | 0 | 138 | 123 | 0 | 34 | 332 | 0 | #482 | 176 | 0 |
| Internal Link Dist (ft) | | 385 | | | 308 | | | 192 | | | 448 | |
| Turn Bay Length (ft) | 350 | | 200 | 175 | | | 340 | | | 450 | | 200 |
| Base Capacity (vph) | 930 | 1568 | 1544 | 930 | 1477 | 1549 | 620 | 1465 | 1547 | 930 | 2355 | 1547 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.69 | 0.48 | 0.03 | 0.22 | 0.22 | 0.45 | 0.05 | 0.59 | 0.08 | 0.75 | 0.26 | 0.17 |

Intersection Summary

Area Type: Other

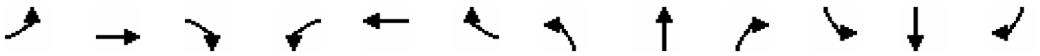
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | 0 |
| Storage Lanes | 1 | | 2 | 1 | | 1 | 2 | | 1 | 2 | | 0 |
| Taper Length (ft) | 60 | | | 60 | | | 150 | | | 120 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 35 | | | 45 | | | 45 | |
| Link Distance (ft) | | 475 | | | 447 | | | 550 | | | 1536 | |
| Travel Time (s) | | 7.2 | | | 8.7 | | | 8.3 | | | 23.3 | |
| Lane Group Flow (vph) | 82 | 816 | 714 | 306 | 459 | 306 | 337 | 1367 | 449 | 357 | 1418 | 0 |
| v/c Ratio | 0.65 | 0.63 | 0.46 | 0.69 | 0.39 | 0.44 | 0.79 | 0.75 | 0.66 | 0.90 | 0.80 | |
| Control Delay (s/veh) | 77.2 | 41.5 | 1.0 | 59.1 | 32.6 | 6.7 | 64.4 | 37.0 | 22.9 | 84.3 | 50.7 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | |
| Total Delay (s/veh) | 77.2 | 41.5 | 1.0 | 59.1 | 32.6 | 6.7 | 64.4 | 37.3 | 22.9 | 84.3 | 50.7 | |
| Queue Length 50th (ft) | 62 | 205 | 0 | 117 | 146 | 11 | 131 | 343 | 166 | 135 | 333 | |
| Queue Length 95th (ft) | #119 | 234 | 0 | #216 | 195 | 79 | 180 | 402 | 289 | #230 | 460 | |
| Internal Link Dist (ft) | | 395 | | | 367 | | | 470 | | | 1456 | |
| Turn Bay Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | |
| Base Capacity (vph) | 146 | 1594 | 1547 | 445 | 1163 | 701 | 481 | 1821 | 683 | 396 | 1767 | |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 101 | 0 | 0 | 0 | |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Reduced v/c Ratio | 0.56 | 0.51 | 0.46 | 0.69 | 0.39 | 0.44 | 0.70 | 0.79 | 0.66 | 0.90 | 0.80 | |

Intersection Summary

Area Type: Other

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



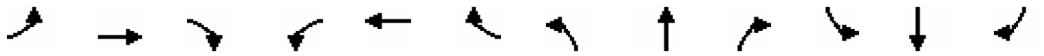
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 300 | | 300 | 110 | | 110 | 400 | | 150 | 200 | | 125 |
| Storage Lanes | 1 | | 1 | 1 | | 0 | 2 | | 1 | 2 | | 1 |
| Taper Length (ft) | 75 | | | 25 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 526 | | | 247 | | | 1536 | | | 647 | |
| Travel Time (s) | | 9.0 | | | 6.7 | | | 23.3 | | | 9.8 | |
| Lane Group Flow (vph) | 332 | 298 | 266 | 223 | 446 | 0 | 585 | 1017 | 128 | 96 | 1270 | 682 |
| v/c Ratio | 0.74 | 0.32 | 0.47 | 0.59 | 0.53 | | 0.98 | 0.47 | 0.18 | 0.45 | 0.79 | 0.44 |
| Control Delay (s/veh) | 60.1 | 35.5 | 6.6 | 57.5 | 39.7 | | 78.0 | 23.0 | 8.2 | 44.9 | 30.1 | 2.8 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 60.1 | 35.5 | 6.6 | 57.5 | 39.7 | | 78.0 | 23.0 | 8.2 | 44.9 | 30.1 | 2.8 |
| Queue Length 50th (ft) | 129 | 92 | 0 | 87 | 145 | | 242 | 276 | 41 | 36 | 367 | 23 |
| Queue Length 95th (ft) | 172 | 131 | 62 | 125 | 199 | | #360 | 337 | m86 | m49 | #476 | 115 |
| Internal Link Dist (ft) | | 446 | | | 167 | | | 1456 | | | 567 | |
| Turn Bay Length (ft) | 300 | | 300 | 110 | | | 400 | | 150 | 200 | | 125 |
| Base Capacity (vph) | 595 | 1080 | 624 | 453 | 929 | | 595 | 2164 | 718 | 260 | 1601 | 1544 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.56 | 0.28 | 0.43 | 0.49 | 0.48 | | 0.98 | 0.47 | 0.18 | 0.37 | 0.79 | 0.44 |

Intersection Summary

Area Type: Other

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 100 | | 0 | 0 | | 0 | 0 | | 120 | 0 | | 130 |
| Storage Lanes | 1 | | 0 | 0 | | 0 | 1 | | 1 | 1 | | 1 |
| Taper Length (ft) | 50 | | | 0 | | | 80 | | | 75 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 30 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 327 | | | 246 | | | 189 | | | 1353 | |
| Travel Time (s) | | 7.4 | | | 6.7 | | | 2.9 | | | 20.5 | |
| Lane Group Flow (vph) | 105 | 106 | 278 | 0 | 41 | 0 | 194 | 1165 | 21 | 21 | 1781 | 103 |
| v/c Ratio | 0.56 | 0.58 | 0.61 | | 0.64 | | 0.78 | 0.34 | 0.02 | 0.24 | 0.66 | 0.12 |
| Control Delay (s/veh) | 56.9 | 58.0 | 10.3 | | 85.4 | | 73.3 | 18.9 | 2.1 | 67.6 | 13.9 | 1.5 |
| Queue Delay | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 56.9 | 58.0 | 10.3 | | 85.4 | | 73.3 | 18.9 | 2.1 | 67.6 | 13.9 | 1.5 |
| Queue Length 50th (ft) | 83 | 84 | 0 | | 24 | | 98 | 114 | 0 | 16 | 193 | 0 |
| Queue Length 95th (ft) | 118 | 121 | 64 | | #84 | | #248 | 330 | m4 | m26 | #594 | m18 |
| Internal Link Dist (ft) | | 247 | | | 166 | | | 109 | | | 1273 | |
| Turn Bay Length (ft) | 100 | | | | | | | | 120 | | | 130 |
| Base Capacity (vph) | 373 | 366 | 638 | | 65 | | 248 | 3408 | 1064 | 146 | 2714 | 851 |
| Starvation Cap Reductn | 0 | 0 | 11 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.28 | 0.29 | 0.44 | | 0.63 | | 0.78 | 0.34 | 0.02 | 0.14 | 0.66 | 0.12 |

Intersection Summary

Area Type: Other

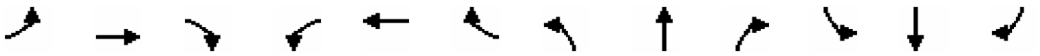
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 0 | | 0 | 320 | | 600 | 0 | | 0 | 0 | | 0 |
| Storage Lanes | 0 | | 0 | 1 | | 1 | 0 | | 1 | 0 | | 2 |
| Taper Length (ft) | 0 | | | 80 | | | 0 | | | 0 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 35 | | | 40 | | | 45 | | | 45 | |
| Link Distance (ft) | | 210 | | | 379 | | | 632 | | | 460 | |
| Travel Time (s) | | 4.1 | | | 6.5 | | | 9.6 | | | 7.0 | |
| Lane Group Flow (vph) | 0 | 0 | 0 | 555 | 0 | 323 | 0 | 1516 | 438 | 0 | 1200 | 979 |
| v/c Ratio | | | | 0.56 | | 0.39 | | 0.75 | 0.41 | | 0.41 | 0.36 |
| Control Delay (s/veh) | | | | 20.5 | | 15.4 | | 12.7 | 2.1 | | 7.7 | 0.4 |
| Queue Delay | | | | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Total Delay (s/veh) | | | | 20.5 | | 15.4 | | 12.7 | 2.1 | | 7.7 | 0.4 |
| Queue Length 50th (ft) | | | | 85 | | 42 | | 195 | 0 | | 80 | 0 |
| Queue Length 95th (ft) | | | | 128 | | 75 | | 274 | 32 | | 106 | 0 |
| Internal Link Dist (ft) | | 130 | | | 299 | | | 552 | | | 380 | |
| Turn Bay Length (ft) | | | | 320 | | 600 | | | | | | |
| Base Capacity (vph) | | | | 1020 | | 865 | | 2021 | 1069 | | 2903 | 2698 |
| Starvation Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Spillback Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Storage Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Reduced v/c Ratio | | | | 0.54 | | 0.37 | | 0.75 | 0.41 | | 0.41 | 0.36 |

Intersection Summary

Area Type: Other

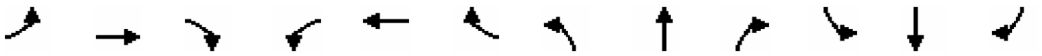


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 620 | | 410 | 150 | | 260 | 0 | | 220 | 420 | | 0 |
| Storage Lanes | 1 | | 1 | 2 | | 1 | 0 | | 1 | 0 | | 1 |
| Taper Length (ft) | 100 | | | 80 | | | 0 | | | 25 | | |
| Right Turn on Red | | | Yes | | | No | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 30 | | | 45 | | | 45 | |
| Link Distance (ft) | | 476 | | | 199 | | | 1572 | | | 266 | |
| Travel Time (s) | | 8.1 | | | 4.5 | | | 23.8 | | | 4.0 | |
| Lane Group Flow (vph) | 806 | 151 | 734 | 183 | 0 | 237 | 0 | 1973 | 0 | 172 | 1339 | 269 |
| v/c Ratio | 0.87 | 0.56 | 0.47 | 0.25 | | 0.33 | | 0.84 | | 0.75 | 0.71 | 0.29 |
| Control Delay (s/veh) | 52.0 | 54.2 | 1.0 | 41.4 | | 36.4 | | 37.9 | | 69.9 | 24.0 | 2.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 52.0 | 54.2 | 1.0 | 41.4 | | 36.4 | | 37.9 | | 69.9 | 24.0 | 2.9 |
| Queue Length 50th (ft) | 303 | 113 | 0 | 57 | | 82 | | 364 | | 130 | 412 | 3 |
| Queue Length 95th (ft) | 371 | 155 | 0 | 106 | | 118 | | #557 | | 198 | 500 | 45 |
| Internal Link Dist (ft) | | 396 | | | 119 | | | 1492 | | | 186 | |
| Turn Bay Length (ft) | 620 | | 410 | 150 | | 260 | | | | 420 | | |
| Base Capacity (vph) | 1020 | 492 | 1547 | 738 | | 829 | | 2352 | | 306 | 1881 | 932 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.79 | 0.31 | 0.47 | 0.25 | | 0.29 | | 0.84 | | 0.56 | 0.71 | 0.29 |

Intersection Summary

Area Type: Other

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 350 | | 200 | 175 | | 0 | 340 | | 0 | 450 | | 200 |
| Storage Lanes | 2 | | 1 | 2 | | 0 | 2 | | 0 | 2 | | 0 |
| Taper Length (ft) | 25 | | | 125 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 45 | | | 40 | | | 40 | |
| Link Distance (ft) | | 465 | | | 388 | | | 272 | | | 528 | |
| Travel Time (s) | | 7.0 | | | 5.9 | | | 4.6 | | | 9.0 | |
| Lane Group Flow (vph) | 110 | 118 | 35 | 170 | 419 | 637 | 67 | 497 | 179 | 484 | 904 | 549 |
| v/c Ratio | 0.31 | 0.12 | 0.02 | 0.40 | 0.39 | 0.41 | 0.22 | 0.45 | 0.12 | 0.64 | 0.47 | 0.35 |
| Control Delay (s/veh) | 39.4 | 27.2 | 0.0 | 37.7 | 26.8 | 0.8 | 40.4 | 27.5 | 0.2 | 32.9 | 19.0 | 0.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 39.4 | 27.2 | 0.0 | 37.7 | 26.8 | 0.8 | 40.4 | 27.5 | 0.2 | 32.9 | 19.0 | 0.6 |
| Queue Length 50th (ft) | 20 | 14 | 0 | 31 | 52 | 0 | 12 | 61 | 0 | 86 | 99 | 0 |
| Queue Length 95th (ft) | 76 | 43 | 0 | 106 | 128 | 0 | 52 | 156 | 0 | 248 | 227 | 0 |
| Internal Link Dist (ft) | | 385 | | | 308 | | | 192 | | | 448 | |
| Turn Bay Length (ft) | 350 | | 200 | 175 | | | 340 | | | 450 | | 200 |
| Base Capacity (vph) | 1533 | 2423 | 1545 | 1533 | 2446 | 1546 | 1022 | 2401 | 1547 | 1533 | 3226 | 1549 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.07 | 0.05 | 0.02 | 0.11 | 0.17 | 0.41 | 0.07 | 0.21 | 0.12 | 0.32 | 0.28 | 0.35 |

| Intersection Summary | |
|---|---|
| Area Type: | Other |



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | 0 |
| Storage Lanes | 1 | | 2 | 1 | | 1 | 2 | | 1 | 2 | | 0 |
| Taper Length (ft) | 60 | | | 60 | | | 150 | | | 120 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 35 | | | 45 | | | 45 | |
| Link Distance (ft) | | 475 | | | 447 | | | 550 | | | 1536 | |
| Travel Time (s) | | 7.2 | | | 8.7 | | | 8.3 | | | 23.3 | |
| Lane Group Flow (vph) | 41 | 567 | 227 | 454 | 722 | 302 | 649 | 1261 | 474 | 239 | 1518 | 0 |
| v/c Ratio | 0.56 | 0.55 | 0.15 | 0.82 | 0.60 | 0.43 | 1.09 | 0.66 | 0.66 | 0.60 | 0.94 | |
| Control Delay (s/veh) | 84.8 | 43.8 | 0.2 | 61.9 | 35.7 | 7.1 | 110.3 | 32.8 | 21.1 | 73.6 | 64.1 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | |
| Total Delay (s/veh) | 84.8 | 43.8 | 0.2 | 61.9 | 35.7 | 7.1 | 110.3 | 32.8 | 21.3 | 73.6 | 64.1 | |
| Queue Length 50th (ft) | 32 | 147 | 0 | 173 | 248 | 16 | ~292 | 292 | 164 | 92 | 426 | |
| Queue Length 95th (ft) | #85 | 161 | 0 | #388 | 314 | 84 | #409 | 345 | 287 | m128 | #531 | |
| Internal Link Dist (ft) | | 395 | | | 367 | | | 470 | | | 1456 | |
| Turn Bay Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | |
| Base Capacity (vph) | 73 | 1527 | 1547 | 555 | 1203 | 706 | 595 | 1913 | 719 | 396 | 1611 | |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 0 | 0 | |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Reduced v/c Ratio | 0.56 | 0.37 | 0.15 | 0.82 | 0.60 | 0.43 | 1.09 | 0.66 | 0.69 | 0.60 | 0.94 | |

Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 300 | | 300 | 110 | | 110 | 400 | | 150 | 200 | | 125 |
| Storage Lanes | 1 | | 1 | 1 | | 0 | 2 | | 1 | 2 | | 1 |
| Taper Length (ft) | 75 | | | 25 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 526 | | | 247 | | | 1536 | | | 647 | |
| Travel Time (s) | | 9.0 | | | 6.7 | | | 23.3 | | | 9.8 | |
| Lane Group Flow (vph) | 605 | 292 | 521 | 156 | 271 | 0 | 500 | 1317 | 135 | 167 | 1164 | 440 |
| v/c Ratio | 1.02 | 0.32 | 0.73 | 0.45 | 0.41 | | 0.84 | 0.62 | 0.18 | 0.59 | 0.70 | 0.28 |
| Control Delay (s/veh) | 90.2 | 35.4 | 14.0 | 55.9 | 36.4 | | 54.5 | 24.3 | 6.1 | 45.5 | 25.6 | 0.4 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 90.2 | 35.4 | 14.0 | 55.9 | 36.4 | | 54.5 | 24.3 | 6.1 | 45.5 | 25.6 | 0.4 |
| Queue Length 50th (ft) | ~250 | 90 | 56 | 60 | 79 | | 201 | 364 | 33 | 65 | 321 | 0 |
| Queue Length 95th (ft) | #371 | 128 | 187 | 94 | 117 | | #281 | 427 | m61 | 82 | 359 | 0 |
| Internal Link Dist (ft) | | 446 | | | 167 | | | 1456 | | | 567 | |
| Turn Bay Length (ft) | 300 | | 300 | 110 | | | 400 | | 150 | 200 | | 125 |
| Base Capacity (vph) | 595 | 1080 | 764 | 471 | 925 | | 595 | 2114 | 731 | 296 | 1652 | 1545 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.02 | 0.27 | 0.68 | 0.33 | 0.29 | | 0.84 | 0.62 | 0.18 | 0.56 | 0.70 | 0.28 |

Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 100 | | 0 | 0 | | 0 | 0 | | 120 | 0 | | 130 |
| Storage Lanes | 1 | | 0 | 0 | | 0 | 1 | | 1 | 1 | | 1 |
| Taper Length (ft) | 50 | | | 0 | | | 80 | | | 75 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 30 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 327 | | | 246 | | | 189 | | | 1353 | |
| Travel Time (s) | | 7.4 | | | 6.7 | | | 2.9 | | | 20.5 | |
| Lane Group Flow (vph) | 110 | 112 | 181 | 0 | 33 | 0 | 324 | 1702 | 11 | 43 | 1569 | 181 |
| v/c Ratio | 0.57 | 0.59 | 0.47 | | 0.58 | | 1.31 | 0.54 | 0.01 | 0.40 | 0.58 | 0.22 |
| Control Delay (s/veh) | 56.9 | 58.3 | 9.4 | | 77.9 | | 200.9 | 26.0 | 0.0 | 65.8 | 12.0 | 2.7 |
| Queue Delay | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 56.9 | 58.3 | 9.4 | | 77.9 | | 200.9 | 26.0 | 0.0 | 65.8 | 12.0 | 2.7 |
| Queue Length 50th (ft) | 86 | 88 | 0 | | 17 | | ~312 | 365 | 0 | 29 | 249 | 2 |
| Queue Length 95th (ft) | 124 | 126 | 53 | | #68 | | m#442 | m480 | m0 | m51 | 477 | 62 |
| Internal Link Dist (ft) | | 247 | | | 166 | | | 109 | | | 1273 | |
| Turn Bay Length (ft) | 100 | | | | | | | | 120 | | | 130 |
| Base Capacity (vph) | 376 | 369 | 579 | | 59 | | 248 | 3179 | 999 | 147 | 2699 | 839 |
| Starvation Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.29 | 0.30 | 0.31 | | 0.56 | | 1.31 | 0.54 | 0.01 | 0.29 | 0.58 | 0.22 |

Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

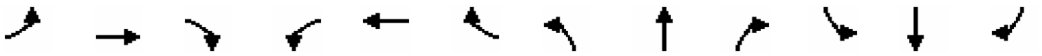
m Volume for 95th percentile queue is metered by upstream signal.

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 0 | | 0 | 320 | | 600 | 0 | | 0 | 0 | | 0 |
| Storage Lanes | 0 | | 0 | 1 | | 1 | 0 | | 1 | 0 | | 2 |
| Taper Length (ft) | 0 | | | 80 | | | 0 | | | 0 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 35 | | | 40 | | | 45 | | | 45 | |
| Link Distance (ft) | | 210 | | | 379 | | | 632 | | | 460 | |
| Travel Time (s) | | 4.1 | | | 6.5 | | | 9.6 | | | 7.0 | |
| Lane Group Flow (vph) | 0 | 0 | 0 | 497 | 0 | 263 | 0 | 1725 | 556 | 0 | 1557 | 788 |
| v/c Ratio | | | | 0.52 | | 0.32 | | 0.84 | 0.49 | | 0.53 | 0.29 |
| Control Delay (s/veh) | | | | 20.0 | | 14.3 | | 16.0 | 2.4 | | 8.5 | 0.3 |
| Queue Delay | | | | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Total Delay (s/veh) | | | | 20.0 | | 14.3 | | 16.0 | 2.4 | | 8.5 | 0.3 |
| Queue Length 50th (ft) | | | | 75 | | 32 | | 247 | 0 | | 114 | 0 |
| Queue Length 95th (ft) | | | | 114 | | 60 | | #371 | 35 | | 149 | 0 |
| Internal Link Dist (ft) | | 130 | | | 299 | | | 552 | | | 380 | |
| Turn Bay Length (ft) | | | | 320 | | 600 | | | | | | |
| Base Capacity (vph) | | | | 1020 | | 865 | | 2049 | 1128 | | 2944 | 2703 |
| Starvation Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Spillback Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Storage Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Reduced v/c Ratio | | | | 0.49 | | 0.30 | | 0.84 | 0.49 | | 0.53 | 0.29 |

Intersection Summary

Area Type: Other

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



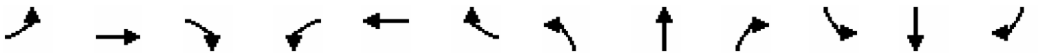
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 620 | | 410 | 150 | | 260 | 0 | | 220 | 420 | | 0 |
| Storage Lanes | 1 | | 1 | 2 | | 1 | 0 | | 1 | 0 | | 1 |
| Taper Length (ft) | 100 | | | 80 | | | 0 | | | 25 | | |
| Right Turn on Red | | | Yes | | | No | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 30 | | | 45 | | | 45 | |
| Link Distance (ft) | | 476 | | | 199 | | | 1572 | | | 266 | |
| Travel Time (s) | | 8.1 | | | 4.5 | | | 23.8 | | | 4.0 | |
| Lane Group Flow (vph) | 557 | 144 | 188 | 134 | 0 | 258 | 0 | 2183 | 0 | 268 | 1292 | 567 |
| v/c Ratio | 0.77 | 0.55 | 0.12 | 0.23 | | 0.29 | | 0.94 | | 0.85 | 0.63 | 0.51 |
| Control Delay (s/veh) | 52.2 | 53.9 | 0.2 | 44.3 | | 30.3 | | 41.7 | | 71.8 | 19.4 | 3.0 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 52.2 | 53.9 | 0.2 | 44.3 | | 30.3 | | 41.7 | | 71.8 | 19.4 | 3.0 |
| Queue Length 50th (ft) | 211 | 107 | 0 | 45 | | 80 | | ~529 | | 197 | 332 | 0 |
| Queue Length 95th (ft) | 258 | 149 | 0 | 81 | | 121 | | #661 | | #356 | 472 | 54 |
| Internal Link Dist (ft) | | 396 | | | 119 | | | 1492 | | | 186 | |
| Turn Bay Length (ft) | 620 | | 410 | 150 | | 260 | | | | 420 | | |
| Base Capacity (vph) | 1020 | 492 | 1547 | 593 | | 909 | | 2325 | | 328 | 2040 | 1110 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.55 | 0.29 | 0.12 | 0.23 | | 0.28 | | 0.94 | | 0.82 | 0.63 | 0.51 |

Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 350 | | 200 | 175 | | 0 | 340 | | 0 | 450 | | 200 |
| Storage Lanes | 2 | | 1 | 2 | | 0 | 2 | | 0 | 2 | | 0 |
| Taper Length (ft) | 25 | | | 125 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 45 | | | 40 | | | 40 | |
| Link Distance (ft) | | 465 | | | 388 | | | 272 | | | 528 | |
| Travel Time (s) | | 7.0 | | | 5.9 | | | 4.6 | | | 9.0 | |
| Lane Group Flow (vph) | 645 | 754 | 55 | 208 | 330 | 699 | 34 | 874 | 134 | 699 | 604 | 258 |
| v/c Ratio | 0.83 | 0.56 | 0.04 | 0.59 | 0.45 | 0.45 | 0.20 | 0.75 | 0.09 | 0.83 | 0.26 | 0.17 |
| Control Delay (s/veh) | 53.5 | 37.8 | 0.0 | 58.4 | 47.1 | 1.0 | 61.0 | 46.3 | 0.1 | 51.3 | 20.9 | 0.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 53.5 | 37.8 | 0.0 | 58.4 | 47.1 | 1.0 | 61.0 | 46.3 | 0.1 | 51.3 | 20.9 | 0.2 |
| Queue Length 50th (ft) | 228 | 176 | 0 | 75 | 83 | 0 | 12 | 217 | 0 | 243 | 98 | 0 |
| Queue Length 95th (ft) | #424 | 251 | 0 | 140 | 126 | 0 | 36 | 334 | 0 | #482 | 177 | 0 |
| Internal Link Dist (ft) | | 385 | | | 308 | | | 192 | | | 448 | |
| Turn Bay Length (ft) | 350 | | 200 | 175 | | | 340 | | | 450 | | 200 |
| Base Capacity (vph) | 927 | 1561 | 1544 | 927 | 1472 | 1549 | 618 | 1461 | 1547 | 927 | 2352 | 1547 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.70 | 0.48 | 0.04 | 0.22 | 0.22 | 0.45 | 0.06 | 0.60 | 0.09 | 0.75 | 0.26 | 0.17 |

Intersection Summary

Area Type: Other

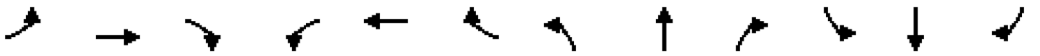
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | 0 |
| Storage Lanes | 1 | | 2 | 1 | | 1 | 2 | | 1 | 2 | | 0 |
| Taper Length (ft) | 60 | | | 60 | | | 150 | | | 120 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 35 | | | 45 | | | 45 | |
| Link Distance (ft) | | 475 | | | 447 | | | 550 | | | 1536 | |
| Travel Time (s) | | 7.2 | | | 8.7 | | | 8.3 | | | 23.3 | |
| Lane Group Flow (vph) | 82 | 816 | 714 | 306 | 459 | 308 | 337 | 1369 | 449 | 360 | 1422 | 0 |
| v/c Ratio | 0.65 | 0.63 | 0.46 | 0.69 | 0.39 | 0.44 | 0.79 | 0.75 | 0.66 | 0.91 | 0.80 | |
| Control Delay (s/veh) | 77.2 | 41.5 | 1.0 | 59.1 | 32.6 | 6.8 | 64.4 | 37.1 | 22.9 | 85.3 | 50.8 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | |
| Total Delay (s/veh) | 77.2 | 41.5 | 1.0 | 59.1 | 32.6 | 6.8 | 64.4 | 37.4 | 22.9 | 85.3 | 50.8 | |
| Queue Length 50th (ft) | 62 | 205 | 0 | 117 | 146 | 12 | 131 | 344 | 166 | 136 | 334 | |
| Queue Length 95th (ft) | #119 | 234 | 0 | #216 | 195 | 80 | 180 | 403 | 289 | #232 | 462 | |
| Internal Link Dist (ft) | | 395 | | | 367 | | | 470 | | | 1456 | |
| Turn Bay Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | |
| Base Capacity (vph) | 146 | 1594 | 1547 | 445 | 1163 | 701 | 481 | 1821 | 683 | 396 | 1767 | |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 101 | 0 | 0 | 0 | |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Reduced v/c Ratio | 0.56 | 0.51 | 0.46 | 0.69 | 0.39 | 0.44 | 0.70 | 0.80 | 0.66 | 0.91 | 0.80 | |

Intersection Summary

Area Type: Other

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 300 | | 300 | 110 | | 110 | 400 | | 150 | 200 | | 125 |
| Storage Lanes | 1 | | 1 | 1 | | 0 | 2 | | 1 | 2 | | 1 |
| Taper Length (ft) | 75 | | | 25 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 526 | | | 247 | | | 1536 | | | 647 | |
| Travel Time (s) | | 9.0 | | | 6.7 | | | 23.3 | | | 9.8 | |
| Lane Group Flow (vph) | 372 | 309 | 362 | 223 | 468 | 0 | 532 | 1064 | 128 | 106 | 1351 | 745 |
| v/c Ratio | 0.77 | 0.34 | 0.56 | 0.58 | 0.58 | | 0.89 | 0.50 | 0.18 | 0.48 | 0.85 | 0.48 |
| Control Delay (s/veh) | 60.6 | 35.6 | 7.0 | 56.9 | 41.1 | | 64.8 | 25.6 | 8.2 | 48.8 | 32.1 | 3.1 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 60.6 | 35.6 | 7.0 | 56.9 | 41.1 | | 64.8 | 25.6 | 8.2 | 48.8 | 32.1 | 3.1 |
| Queue Length 50th (ft) | 144 | 96 | 0 | 87 | 155 | | 220 | 299 | 41 | 39 | 398 | 15 |
| Queue Length 95th (ft) | 191 | 135 | 73 | 125 | 211 | | #313 | 355 | m87 | m55 | #526 | 152 |
| Internal Link Dist (ft) | | 446 | | | 167 | | | 1456 | | | 567 | |
| Turn Bay Length (ft) | 300 | | 300 | 110 | | | 400 | | 150 | 200 | | 125 |
| Base Capacity (vph) | 595 | 1080 | 690 | 456 | 920 | | 595 | 2140 | 711 | 260 | 1587 | 1544 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.63 | 0.29 | 0.52 | 0.49 | 0.51 | | 0.89 | 0.50 | 0.18 | 0.41 | 0.85 | 0.48 |

Intersection Summary

Area Type: Other

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 100 | | 0 | 0 | | 0 | 0 | | 120 | 0 | | 130 |
| Storage Lanes | 1 | | 0 | 0 | | 0 | 1 | | 1 | 1 | | 1 |
| Taper Length (ft) | 50 | | | 0 | | | 80 | | | 75 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 30 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 327 | | | 246 | | | 189 | | | 1353 | |
| Travel Time (s) | | 7.4 | | | 6.7 | | | 2.9 | | | 20.5 | |
| Lane Group Flow (vph) | 87 | 88 | 299 | 0 | 31 | 0 | 268 | 1186 | 21 | 21 | 1948 | 134 |
| v/c Ratio | 0.50 | 0.51 | 0.65 | | 0.14 | | 1.08 | 0.33 | 0.02 | 0.24 | 0.67 | 0.15 |
| Control Delay (s/veh) | 55.3 | 55.9 | 11.2 | | 1.4 | | 127.2 | 17.6 | 1.9 | 68.8 | 10.7 | 1.5 |
| Queue Delay | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 55.3 | 55.9 | 11.2 | | 1.4 | | 127.2 | 17.6 | 1.9 | 68.8 | 10.7 | 1.5 |
| Queue Length 50th (ft) | 68 | 69 | 0 | | 0 | | ~216 | 123 | 0 | 17 | 122 | 0 |
| Queue Length 95th (ft) | 101 | 103 | 67 | | 0 | | #389 | 340 | m2 | m23 | #664 | m16 |
| Internal Link Dist (ft) | | 247 | | | 166 | | | 109 | | | 1273 | |
| Turn Bay Length (ft) | 100 | | | | | | | | 120 | | | 130 |
| Base Capacity (vph) | 376 | 372 | 653 | | 242 | | 248 | 3603 | 1120 | 146 | 2909 | 906 |
| Starvation Cap Reductn | 0 | 0 | 11 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.23 | 0.24 | 0.47 | | 0.13 | | 1.08 | 0.33 | 0.02 | 0.14 | 0.67 | 0.15 |

Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

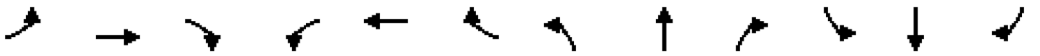
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 0 | | 0 | 320 | | 600 | 0 | | 0 | 0 | | 0 |
| Storage Lanes | 0 | | 0 | 1 | | 1 | 0 | | 1 | 0 | | 2 |
| Taper Length (ft) | 0 | | | 80 | | | 0 | | | 0 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 35 | | | 40 | | | 45 | | | 45 | |
| Link Distance (ft) | | 210 | | | 379 | | | 632 | | | 460 | |
| Travel Time (s) | | 4.1 | | | 6.5 | | | 9.6 | | | 7.0 | |
| Lane Group Flow (vph) | 0 | 0 | 0 | 573 | 0 | 323 | 0 | 1615 | 438 | 0 | 1250 | 990 |
| v/c Ratio | | | | 0.58 | | 0.38 | | 0.80 | 0.41 | | 0.43 | 0.37 |
| Control Delay (s/veh) | | | | 20.8 | | 15.4 | | 14.2 | 2.1 | | 7.9 | 0.4 |
| Queue Delay | | | | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Total Delay (s/veh) | | | | 20.8 | | 15.4 | | 14.2 | 2.1 | | 7.9 | 0.4 |
| Queue Length 50th (ft) | | | | 89 | | 42 | | 219 | 0 | | 84 | 0 |
| Queue Length 95th (ft) | | | | 132 | | 75 | | 308 | 32 | | 112 | 0 |
| Internal Link Dist (ft) | | 130 | | | 299 | | | 552 | | | 380 | |
| Turn Bay Length (ft) | | | | 320 | | 600 | | | | | | |
| Base Capacity (vph) | | | | 1020 | | 865 | | 2019 | 1068 | | 2900 | 2698 |
| Starvation Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Spillback Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Storage Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Reduced v/c Ratio | | | | 0.56 | | 0.37 | | 0.80 | 0.41 | | 0.43 | 0.37 |

Intersection Summary

Area Type: Other



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 620 | | 410 | 150 | | 260 | 0 | | 220 | 420 | | 0 |
| Storage Lanes | 1 | | 1 | 2 | | 1 | 0 | | 1 | 0 | | 1 |
| Taper Length (ft) | 100 | | | 80 | | | 0 | | | 25 | | |
| Right Turn on Red | | | Yes | | | No | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 30 | | | 45 | | | 45 | |
| Link Distance (ft) | | 476 | | | 199 | | | 1572 | | | 266 | |
| Travel Time (s) | | 8.1 | | | 4.5 | | | 23.8 | | | 4.0 | |
| Lane Group Flow (vph) | 1022 | 151 | 731 | 194 | 0 | 237 | 0 | 1968 | 0 | 183 | 1645 | 269 |
| v/c Ratio | 1.00 | 0.56 | 0.47 | 0.24 | | 0.41 | | 0.79 | | 0.61 | 0.91 | 0.30 |
| Control Delay (s/veh) | 70.9 | 54.2 | 1.0 | 40.4 | | 42.5 | | 33.3 | | 61.1 | 35.1 | 4.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 70.9 | 54.2 | 1.0 | 40.4 | | 42.5 | | 33.3 | | 61.1 | 35.1 | 4.9 |
| Queue Length 50th (ft) | ~409 | 113 | 0 | 61 | | 90 | | 340 | | 71 | 589 | 21 |
| Queue Length 95th (ft) | #555 | 155 | 0 | 111 | | 129 | | 462 | | 107 | 711 | 67 |
| Internal Link Dist (ft) | | 396 | | | 119 | | | 1492 | | | 186 | |
| Turn Bay Length (ft) | 620 | | 410 | 150 | | 260 | | | | 420 | | |
| Base Capacity (vph) | 1020 | 492 | 1547 | 804 | | 811 | | 2494 | | 595 | 1812 | 885 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.00 | 0.31 | 0.47 | 0.24 | | 0.29 | | 0.79 | | 0.31 | 0.91 | 0.30 |

Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 350 | | 200 | 175 | | 0 | 340 | | 0 | 450 | | 200 |
| Storage Lanes | 2 | | 1 | 2 | | 0 | 2 | | 0 | 2 | | 0 |
| Taper Length (ft) | 25 | | | 125 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 45 | | | 40 | | | 40 | |
| Link Distance (ft) | | 465 | | | 388 | | | 272 | | | 528 | |
| Travel Time (s) | | 7.0 | | | 5.9 | | | 4.6 | | | 9.0 | |
| Lane Group Flow (vph) | 110 | 132 | 33 | 165 | 451 | 747 | 66 | 352 | 253 | 791 | 1033 | 659 |
| v/c Ratio | 0.37 | 0.15 | 0.02 | 0.47 | 0.47 | 0.48 | 0.26 | 0.42 | 0.16 | 0.65 | 0.43 | 0.43 |
| Control Delay (s/veh) | 45.0 | 31.4 | 0.0 | 44.2 | 32.8 | 1.1 | 45.7 | 33.7 | 0.2 | 29.6 | 17.3 | 0.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 45.0 | 31.4 | 0.0 | 44.2 | 32.8 | 1.1 | 45.7 | 33.7 | 0.2 | 29.6 | 17.3 | 0.9 |
| Queue Length 50th (ft) | 25 | 20 | 0 | 38 | 72 | 0 | 15 | 56 | 0 | 154 | 120 | 0 |
| Queue Length 95th (ft) | 77 | 49 | 0 | 105 | 141 | 0 | 52 | 115 | 0 | #485 | 264 | 0 |
| Internal Link Dist (ft) | | 385 | | | 308 | | | 192 | | | 448 | |
| Turn Bay Length (ft) | 350 | | 200 | 175 | | | 340 | | | 450 | | 200 |
| Base Capacity (vph) | 1235 | 1957 | 1545 | 1235 | 1978 | 1546 | 823 | 1940 | 1547 | 1235 | 2662 | 1549 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.09 | 0.07 | 0.02 | 0.13 | 0.23 | 0.48 | 0.08 | 0.18 | 0.16 | 0.64 | 0.39 | 0.43 |

Intersection Summary

Area Type: Other

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | 0 |
| Storage Lanes | 1 | | 2 | 1 | | 1 | 2 | | 1 | 2 | | 0 |
| Taper Length (ft) | 60 | | | 60 | | | 150 | | | 120 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 35 | | | 45 | | | 45 | |
| Link Distance (ft) | | 475 | | | 447 | | | 550 | | | 1536 | |
| Travel Time (s) | | 7.2 | | | 8.7 | | | 8.3 | | | 23.3 | |
| Lane Group Flow (vph) | 41 | 412 | 412 | 258 | 1010 | 320 | 660 | 1278 | 206 | 237 | 1608 | 0 |
| v/c Ratio | 0.56 | 0.46 | 0.27 | 0.43 | 0.88 | 0.49 | 1.03 | 0.64 | 0.28 | 0.60 | 1.00 | |
| Control Delay (s/veh) | 84.8 | 44.7 | 0.4 | 47.8 | 47.8 | 12.3 | 90.8 | 31.8 | 4.4 | 72.6 | 72.2 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Delay (s/veh) | 84.8 | 44.7 | 0.4 | 47.8 | 47.8 | 12.3 | 90.8 | 31.8 | 4.4 | 72.6 | 72.2 | |
| Queue Length 50th (ft) | 32 | 109 | 0 | 88 | 386 | 52 | ~301 | 298 | 0 | 91 | 457 | |
| Queue Length 95th (ft) | #85 | 118 | 0 | #207 | #486 | 136 | #419 | 350 | 49 | m121 | #586 | |
| Internal Link Dist (ft) | | 395 | | | 367 | | | 470 | | | 1456 | |
| Turn Bay Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | |
| Base Capacity (vph) | 73 | 1527 | 1547 | 600 | 1154 | 658 | 643 | 1984 | 732 | 396 | 1611 | |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Reduced v/c Ratio | 0.56 | 0.27 | 0.27 | 0.43 | 0.88 | 0.49 | 1.03 | 0.64 | 0.28 | 0.60 | 1.00 | |

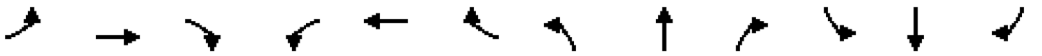
Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 300 | | 300 | 110 | | 110 | 400 | | 150 | 200 | | 125 |
| Storage Lanes | 1 | | 1 | 1 | | 0 | 2 | | 1 | 2 | | 1 |
| Taper Length (ft) | 75 | | | 25 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 526 | | | 247 | | | 1536 | | | 647 | |
| Travel Time (s) | | 9.0 | | | 6.7 | | | 23.3 | | | 9.8 | |
| Lane Group Flow (vph) | 646 | 323 | 469 | 156 | 291 | 0 | 583 | 1510 | 135 | 167 | 1219 | 490 |
| v/c Ratio | 1.09 | 0.35 | 0.66 | 0.46 | 0.43 | | 0.98 | 0.72 | 0.18 | 0.59 | 0.74 | 0.32 |
| Control Delay (s/veh) | 108.7 | 35.8 | 9.8 | 56.1 | 36.4 | | 76.6 | 31.5 | 6.2 | 44.4 | 24.3 | 0.4 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 108.7 | 35.8 | 9.8 | 56.1 | 36.4 | | 76.6 | 31.5 | 6.2 | 44.4 | 24.3 | 0.4 |
| Queue Length 50th (ft) | ~289 | 101 | 26 | 60 | 84 | | 236 | 427 | 36 | 59 | 341 | 0 |
| Queue Length 95th (ft) | #407 | 141 | 126 | 94 | 124 | | m#355 | 486 | m50 | 84 | 379 | 0 |
| Internal Link Dist (ft) | | 446 | | | 167 | | | 1456 | | | 567 | |
| Turn Bay Length (ft) | 300 | | 300 | 110 | | | 400 | | 150 | 200 | | 125 |
| Base Capacity (vph) | 595 | 1080 | 764 | 468 | 926 | | 595 | 2111 | 731 | 296 | 1649 | 1545 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.09 | 0.30 | 0.61 | 0.33 | 0.31 | | 0.98 | 0.72 | 0.18 | 0.56 | 0.74 | 0.32 |

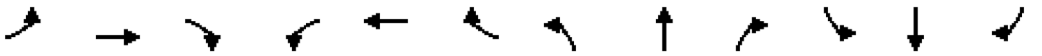
Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 100 | | 0 | 0 | | 0 | 0 | | 120 | 0 | | 130 |
| Storage Lanes | 1 | | 0 | 0 | | 0 | 1 | | 1 | 1 | | 1 |
| Taper Length (ft) | 50 | | | 0 | | | 80 | | | 75 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 30 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 327 | | | 246 | | | 189 | | | 1353 | |
| Travel Time (s) | | 7.4 | | | 6.7 | | | 2.9 | | | 20.5 | |
| Lane Group Flow (vph) | 144 | 144 | 213 | 0 | 33 | 0 | 266 | 2011 | 11 | 43 | 1649 | 191 |
| v/c Ratio | 0.66 | 0.68 | 0.49 | | 0.58 | | 1.07 | 0.65 | 0.01 | 0.40 | 0.63 | 0.24 |
| Control Delay (s/veh) | 59.3 | 60.8 | 8.6 | | 77.9 | | 120.1 | 30.4 | 0.0 | 69.9 | 9.7 | 2.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 59.3 | 60.8 | 8.6 | | 77.9 | | 120.1 | 30.4 | 0.0 | 69.9 | 9.7 | 2.3 |
| Queue Length 50th (ft) | 112 | 112 | 0 | | 17 | | ~222 | 458 | 0 | 30 | 115 | 0 |
| Queue Length 95th (ft) | 160 | 161 | 57 | | #68 | | m#335 | m561 | m0 | m42 | 451 | m43 |
| Internal Link Dist (ft) | | 247 | | | 166 | | | 109 | | | 1273 | |
| Turn Bay Length (ft) | 100 | | | | | | | | 120 | | | 130 |
| Base Capacity (vph) | 376 | 366 | 601 | | 59 | | 248 | 3077 | 970 | 147 | 2597 | 810 |
| Starvation Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.38 | 0.39 | 0.35 | | 0.56 | | 1.07 | 0.65 | 0.01 | 0.29 | 0.63 | 0.24 |

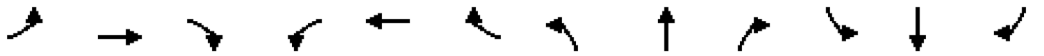
Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.



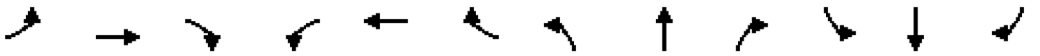
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 0 | | 0 | 320 | | 600 | 0 | | 0 | 0 | | 0 |
| Storage Lanes | 0 | | 0 | 1 | | 1 | 0 | | 1 | 0 | | 2 |
| Taper Length (ft) | 0 | | | 80 | | | 0 | | | 0 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 35 | | | 40 | | | 45 | | | 45 | |
| Link Distance (ft) | | 210 | | | 379 | | | 632 | | | 460 | |
| Travel Time (s) | | 4.1 | | | 6.5 | | | 9.6 | | | 7.0 | |
| Lane Group Flow (vph) | 0 | 0 | 0 | 404 | 0 | 263 | 0 | 2091 | 778 | 0 | 1768 | 788 |
| v/c Ratio | | | | 0.44 | | 0.34 | | 1.00 | 0.63 | | 0.59 | 0.29 |
| Control Delay (s/veh) | | | | 19.5 | | 14.7 | | 34.3 | 3.3 | | 8.8 | 0.3 |
| Queue Delay | | | | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Total Delay (s/veh) | | | | 19.5 | | 14.7 | | 34.3 | 3.3 | | 8.8 | 0.3 |
| Queue Length 50th (ft) | | | | 60 | | 32 | | ~391 | 0 | | 133 | 0 |
| Queue Length 95th (ft) | | | | 92 | | 60 | | #579 | 40 | | 179 | 0 |
| Internal Link Dist (ft) | | 130 | | | 299 | | | 552 | | | 380 | |
| Turn Bay Length (ft) | | | | 320 | | 600 | | | | | | |
| Base Capacity (vph) | | | | 1020 | | 865 | | 2098 | 1231 | | 3014 | 2703 |
| Starvation Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Spillback Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Storage Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Reduced v/c Ratio | | | | 0.40 | | 0.30 | | 1.00 | 0.63 | | 0.59 | 0.29 |

Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

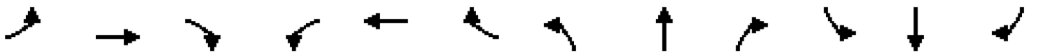


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 620 | | 410 | 150 | | 260 | 0 | | 220 | 420 | | 0 |
| Storage Lanes | 1 | | 1 | 2 | | 1 | 0 | | 1 | 0 | | 1 |
| Taper Length (ft) | 100 | | | 80 | | | 0 | | | 25 | | |
| Right Turn on Red | | | Yes | | | No | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 30 | | | 45 | | | 45 | |
| Link Distance (ft) | | 476 | | | 199 | | | 1572 | | | 266 | |
| Travel Time (s) | | 8.1 | | | 4.5 | | | 23.8 | | | 4.0 | |
| Lane Group Flow (vph) | 773 | 144 | 227 | 144 | 0 | 258 | 0 | 2247 | 0 | 258 | 1495 | 567 |
| v/c Ratio | 0.85 | 0.55 | 0.15 | 0.19 | | 0.38 | | 0.91 | | 0.69 | 0.79 | 0.55 |
| Control Delay (s/veh) | 51.3 | 53.9 | 0.2 | 40.6 | | 39.0 | | 33.4 | | 60.7 | 26.9 | 4.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 51.3 | 53.9 | 0.2 | 40.6 | | 39.0 | | 33.4 | | 60.7 | 26.9 | 4.9 |
| Queue Length 50th (ft) | 290 | 107 | 0 | 44 | | 92 | | 543 | | 100 | 495 | 29 |
| Queue Length 95th (ft) | 353 | 149 | 0 | 86 | | 135 | | #645 | | 140 | 598 | 106 |
| Internal Link Dist (ft) | | 396 | | | 119 | | | 1492 | | | 186 | |
| Turn Bay Length (ft) | 620 | | 410 | 150 | | 260 | | | | 420 | | |
| Base Capacity (vph) | 1020 | 492 | 1547 | 744 | | 856 | | 2482 | | 595 | 1885 | 1034 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.76 | 0.29 | 0.15 | 0.19 | | 0.30 | | 0.91 | | 0.43 | 0.79 | 0.55 |

Intersection Summary

Area Type: Other

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 350 | | 200 | 175 | | 0 | 340 | | 0 | 450 | | 200 |
| Storage Lanes | 2 | | 1 | 2 | | 0 | 2 | | 0 | 2 | | 0 |
| Taper Length (ft) | 25 | | | 125 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 45 | | | 40 | | | 40 | |
| Link Distance (ft) | | 465 | | | 388 | | | 272 | | | 528 | |
| Travel Time (s) | | 7.0 | | | 5.9 | | | 4.6 | | | 9.0 | |
| Lane Group Flow (vph) | 753 | 645 | 54 | 247 | 376 | 1183 | 32 | 903 | 172 | 860 | 720 | 333 |
| v/c Ratio | 0.89 | 0.45 | 0.03 | 0.66 | 0.51 | 0.76 | 0.20 | 0.80 | 0.11 | 1.02 | 0.31 | 0.22 |
| Control Delay (s/veh) | 58.9 | 37.7 | 0.0 | 62.1 | 50.5 | 3.6 | 62.8 | 51.1 | 0.1 | 80.9 | 22.9 | 0.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 58.9 | 37.7 | 0.0 | 62.1 | 50.5 | 3.6 | 62.8 | 51.1 | 0.1 | 80.9 | 22.9 | 0.3 |
| Queue Length 50th (ft) | 286 | 152 | 0 | 94 | 100 | 0 | 12 | 238 | 0 | 340 | 129 | 0 |
| Queue Length 95th (ft) | #538 | 218 | 0 | 161 | 142 | 0 | 34 | 346 | 0 | #651 | 212 | 0 |
| Internal Link Dist (ft) | | 385 | | | 308 | | | 192 | | | 448 | |
| Turn Bay Length (ft) | 350 | | 200 | 175 | | | 340 | | | 450 | | 200 |
| Base Capacity (vph) | 845 | 1431 | 1544 | 845 | 1345 | 1549 | 563 | 1335 | 1547 | 845 | 2306 | 1547 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.89 | 0.45 | 0.03 | 0.29 | 0.28 | 0.76 | 0.06 | 0.68 | 0.11 | 1.02 | 0.31 | 0.22 |

Intersection Summary

Area Type: Other

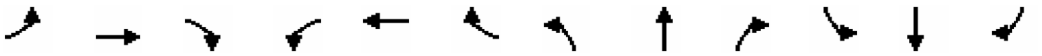
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | 0 |
| Storage Lanes | 1 | | 2 | 1 | | 1 | 2 | | 1 | 2 | | 0 |
| Taper Length (ft) | 60 | | | 60 | | | 150 | | | 120 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 35 | | | 45 | | | 45 | |
| Link Distance (ft) | | 475 | | | 447 | | | 550 | | | 1536 | |
| Travel Time (s) | | 7.2 | | | 8.7 | | | 8.3 | | | 23.3 | |
| Lane Group Flow (vph) | 122 | 765 | 663 | 173 | 398 | 429 | 531 | 1551 | 133 | 357 | 1510 | 0 |
| v/c Ratio | 0.86 | 0.62 | 0.43 | 0.61 | 0.46 | 0.75 | 0.78 | 0.73 | 0.18 | 0.90 | 0.89 | |
| Control Delay (s/veh) | 100.3 | 42.2 | 0.9 | 62.4 | 39.3 | 23.7 | 55.3 | 32.6 | 3.2 | 85.3 | 55.7 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 0.0 | 0.0 | 0.0 | |
| Total Delay (s/veh) | 100.3 | 42.2 | 0.9 | 62.4 | 39.3 | 23.7 | 55.3 | 33.4 | 3.2 | 85.3 | 55.7 | |
| Queue Length 50th (ft) | 95 | 194 | 0 | 67 | 138 | 123 | 199 | 361 | 0 | 134 | 385 | |
| Queue Length 95th (ft) | #205 | 220 | 0 | 104 | 169 | 226 | #352 | 476 | 30 | #229 | #506 | |
| Internal Link Dist (ft) | | 395 | | | 367 | | | 470 | | | 1456 | |
| Turn Bay Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | |
| Base Capacity (vph) | 146 | 1594 | 1547 | 305 | 1109 | 664 | 681 | 2125 | 740 | 396 | 1697 | |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 261 | 0 | 0 | 0 | |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Reduced v/c Ratio | 0.84 | 0.48 | 0.43 | 0.57 | 0.36 | 0.65 | 0.78 | 0.83 | 0.18 | 0.90 | 0.89 | |

Intersection Summary

Area Type: Other

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 300 | | 300 | 110 | | 110 | 400 | | 150 | 200 | | 125 |
| Storage Lanes | 1 | | 1 | 1 | | 0 | 2 | | 1 | 2 | | 1 |
| Taper Length (ft) | 75 | | | 25 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 526 | | | 247 | | | 1536 | | | 647 | |
| Travel Time (s) | | 9.0 | | | 6.7 | | | 23.3 | | | 9.8 | |
| Lane Group Flow (vph) | 374 | 309 | 362 | 223 | 468 | 0 | 532 | 1070 | 128 | 106 | 1355 | 746 |
| v/c Ratio | 0.77 | 0.34 | 0.56 | 0.58 | 0.58 | | 0.89 | 0.50 | 0.18 | 0.48 | 0.85 | 0.48 |
| Control Delay (s/veh) | 60.6 | 35.6 | 7.0 | 56.9 | 41.2 | | 64.8 | 25.7 | 8.2 | 48.9 | 32.2 | 3.1 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 60.6 | 35.6 | 7.0 | 56.9 | 41.2 | | 64.8 | 25.7 | 8.2 | 48.9 | 32.2 | 3.1 |
| Queue Length 50th (ft) | 145 | 96 | 0 | 87 | 156 | | 220 | 300 | 41 | 39 | 400 | 15 |
| Queue Length 95th (ft) | 191 | 135 | 73 | 125 | 211 | | #312 | 357 | m88 | m54 | #528 | 152 |
| Internal Link Dist (ft) | | 446 | | | 167 | | | 1456 | | | 567 | |
| Turn Bay Length (ft) | 300 | | 300 | 110 | | | 400 | | 150 | 200 | | 125 |
| Base Capacity (vph) | 595 | 1080 | 690 | 457 | 920 | | 595 | 2139 | 711 | 260 | 1586 | 1544 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.63 | 0.29 | 0.52 | 0.49 | 0.51 | | 0.89 | 0.50 | 0.18 | 0.41 | 0.85 | 0.48 |

Intersection Summary

Area Type: Other

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 100 | | 0 | 0 | | 0 | 0 | | 120 | 0 | | 130 |
| Storage Lanes | 1 | | 0 | 0 | | 0 | 1 | | 1 | 1 | | 1 |
| Taper Length (ft) | 50 | | | 0 | | | 80 | | | 75 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 30 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 327 | | | 246 | | | 189 | | | 1353 | |
| Travel Time (s) | | 7.4 | | | 6.7 | | | 2.9 | | | 20.5 | |
| Lane Group Flow (vph) | 90 | 90 | 299 | 0 | 31 | 0 | 276 | 1186 | 21 | 21 | 1957 | 134 |
| v/c Ratio | 0.51 | 0.52 | 0.64 | | 0.14 | | 1.11 | 0.33 | 0.02 | 0.24 | 0.67 | 0.15 |
| Control Delay (s/veh) | 55.4 | 56.0 | 11.0 | | 1.4 | | 136.4 | 17.7 | 1.8 | 68.8 | 10.8 | 1.5 |
| Queue Delay | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 55.4 | 56.0 | 11.1 | | 1.4 | | 136.4 | 17.7 | 1.8 | 68.8 | 10.8 | 1.5 |
| Queue Length 50th (ft) | 71 | 71 | 0 | | 0 | | ~229 | 123 | 0 | 17 | 123 | 0 |
| Queue Length 95th (ft) | 104 | 104 | 67 | | 0 | | #404 | 341 | m2 | m23 | #669 | m16 |
| Internal Link Dist (ft) | | 247 | | | 166 | | | 109 | | | 1273 | |
| Turn Bay Length (ft) | 100 | | | | | | | | 120 | | | 130 |
| Base Capacity (vph) | 376 | 371 | 653 | | 242 | | 248 | 3595 | 1117 | 146 | 2900 | 904 |
| Starvation Cap Reductn | 0 | 0 | 11 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.24 | 0.24 | 0.47 | | 0.13 | | 1.11 | 0.33 | 0.02 | 0.14 | 0.67 | 0.15 |

Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 0 | | 0 | 320 | | 600 | 0 | | 0 | 0 | | 0 |
| Storage Lanes | 0 | | 0 | 1 | | 1 | 0 | | 1 | 0 | | 2 |
| Taper Length (ft) | 0 | | | 80 | | | 0 | | | 0 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 35 | | | 40 | | | 45 | | | 45 | |
| Link Distance (ft) | | 210 | | | 379 | | | 632 | | | 460 | |
| Travel Time (s) | | 4.1 | | | 6.5 | | | 9.6 | | | 7.0 | |
| Lane Group Flow (vph) | 0 | 0 | 0 | 576 | 0 | 323 | 0 | 1620 | 438 | 0 | 1252 | 990 |
| v/c Ratio | | | | 0.58 | | 0.38 | | 0.80 | 0.41 | | 0.43 | 0.37 |
| Control Delay (s/veh) | | | | 20.8 | | 15.4 | | 14.3 | 2.1 | | 7.9 | 0.4 |
| Queue Delay | | | | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Total Delay (s/veh) | | | | 20.8 | | 15.4 | | 14.3 | 2.1 | | 7.9 | 0.4 |
| Queue Length 50th (ft) | | | | 89 | | 42 | | 220 | 0 | | 84 | 0 |
| Queue Length 95th (ft) | | | | 133 | | 75 | | 310 | 32 | | 112 | 0 |
| Internal Link Dist (ft) | | 130 | | | 299 | | | 552 | | | 380 | |
| Turn Bay Length (ft) | | | | 320 | | 600 | | | | | | |
| Base Capacity (vph) | | | | 1020 | | 865 | | 2017 | 1068 | | 2898 | 2698 |
| Starvation Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Spillback Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Storage Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Reduced v/c Ratio | | | | 0.56 | | 0.37 | | 0.80 | 0.41 | | 0.43 | 0.37 |

Intersection Summary

Area Type: Other

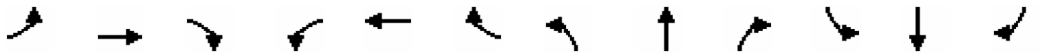
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 620 | | 410 | 150 | | 260 | 0 | | 220 | 420 | | 0 |
| Storage Lanes | 1 | | 1 | 2 | | 1 | 0 | | 1 | 0 | | 1 |
| Taper Length (ft) | 100 | | | 80 | | | 0 | | | 25 | | |
| Right Turn on Red | | | Yes | | | No | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 30 | | | 45 | | | 45 | |
| Link Distance (ft) | | 476 | | | 199 | | | 1572 | | | 266 | |
| Travel Time (s) | | 8.1 | | | 4.5 | | | 23.8 | | | 4.0 | |
| Lane Group Flow (vph) | 1022 | 151 | 734 | 194 | 0 | 237 | 0 | 1973 | 0 | 183 | 1651 | 269 |
| v/c Ratio | 1.00 | 0.56 | 0.47 | 0.24 | | 0.41 | | 0.79 | | 0.61 | 0.91 | 0.30 |
| Control Delay (s/veh) | 70.9 | 54.2 | 1.0 | 40.4 | | 42.5 | | 33.4 | | 61.1 | 35.4 | 4.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 70.9 | 54.2 | 1.0 | 40.4 | | 42.5 | | 33.4 | | 61.1 | 35.4 | 4.9 |
| Queue Length 50th (ft) | ~409 | 113 | 0 | 61 | | 90 | | 341 | | 71 | 593 | 22 |
| Queue Length 95th (ft) | #555 | 155 | 0 | 111 | | 129 | | 466 | | 107 | #720 | 67 |
| Internal Link Dist (ft) | | 396 | | | 119 | | | 1492 | | | 186 | |
| Turn Bay Length (ft) | 620 | | 410 | 150 | | 260 | | | | 420 | | |
| Base Capacity (vph) | 1020 | 492 | 1547 | 804 | | 811 | | 2494 | | 595 | 1812 | 884 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.00 | 0.31 | 0.47 | 0.24 | | 0.29 | | 0.79 | | 0.31 | 0.91 | 0.30 |

Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 350 | | 200 | 175 | | 0 | 340 | | 0 | 450 | | 200 |
| Storage Lanes | 2 | | 1 | 2 | | 0 | 2 | | 0 | 2 | | 0 |
| Taper Length (ft) | 25 | | | 125 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 45 | | | 40 | | | 40 | |
| Link Distance (ft) | | 465 | | | 388 | | | 272 | | | 528 | |
| Travel Time (s) | | 7.0 | | | 5.9 | | | 4.6 | | | 9.0 | |
| Lane Group Flow (vph) | 110 | 140 | 35 | 170 | 452 | 747 | 67 | 354 | 256 | 791 | 1036 | 659 |
| v/c Ratio | 0.37 | 0.16 | 0.02 | 0.47 | 0.47 | 0.48 | 0.26 | 0.42 | 0.17 | 0.65 | 0.43 | 0.43 |
| Control Delay (s/veh) | 45.0 | 31.6 | 0.0 | 44.1 | 32.8 | 1.1 | 45.7 | 33.8 | 0.2 | 29.7 | 17.4 | 0.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 45.0 | 31.6 | 0.0 | 44.1 | 32.8 | 1.1 | 45.7 | 33.8 | 0.2 | 29.7 | 17.4 | 0.9 |
| Queue Length 50th (ft) | 25 | 21 | 0 | 39 | 72 | 0 | 15 | 57 | 0 | 154 | 121 | 0 |
| Queue Length 95th (ft) | 77 | 51 | 0 | 108 | 141 | 0 | 53 | 115 | 0 | #486 | 267 | 0 |
| Internal Link Dist (ft) | | 385 | | | 308 | | | 192 | | | 448 | |
| Turn Bay Length (ft) | 350 | | 200 | 175 | | | 340 | | | 450 | | 200 |
| Base Capacity (vph) | 1234 | 1956 | 1545 | 1234 | 1978 | 1546 | 823 | 1939 | 1547 | 1234 | 2659 | 1549 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.09 | 0.07 | 0.02 | 0.14 | 0.23 | 0.48 | 0.08 | 0.18 | 0.17 | 0.64 | 0.39 | 0.43 |

Intersection Summary

Area Type: Other

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | 0 |
| Storage Lanes | 1 | | 2 | 1 | | 1 | 2 | | 1 | 2 | | 0 |
| Taper Length (ft) | 60 | | | 60 | | | 150 | | | 120 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 35 | | | 45 | | | 45 | |
| Link Distance (ft) | | 475 | | | 447 | | | 550 | | | 1536 | |
| Travel Time (s) | | 7.2 | | | 8.7 | | | 8.3 | | | 23.3 | |
| Lane Group Flow (vph) | 41 | 412 | 412 | 258 | 1010 | 323 | 660 | 1281 | 206 | 239 | 1610 | 0 |
| v/c Ratio | 0.56 | 0.46 | 0.27 | 0.43 | 0.88 | 0.49 | 1.03 | 0.65 | 0.28 | 0.60 | 1.00 | |
| Control Delay (s/veh) | 84.8 | 44.7 | 0.4 | 47.8 | 47.8 | 12.3 | 90.8 | 31.8 | 4.4 | 72.7 | 72.4 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | |
| Total Delay (s/veh) | 84.8 | 44.7 | 0.4 | 47.8 | 47.8 | 12.3 | 90.8 | 32.1 | 4.4 | 72.7 | 72.4 | |
| Queue Length 50th (ft) | 32 | 109 | 0 | 88 | 386 | 52 | ~301 | 298 | 0 | 92 | 458 | |
| Queue Length 95th (ft) | #85 | 118 | 0 | #207 | #486 | 138 | #419 | 352 | 49 | m122 | #588 | |
| Internal Link Dist (ft) | | 395 | | | 367 | | | 470 | | | 1456 | |
| Turn Bay Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | |
| Base Capacity (vph) | 73 | 1527 | 1547 | 600 | 1154 | 659 | 643 | 1984 | 732 | 396 | 1611 | |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 214 | 0 | 0 | 0 | |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Reduced v/c Ratio | 0.56 | 0.27 | 0.27 | 0.43 | 0.88 | 0.49 | 1.03 | 0.72 | 0.28 | 0.60 | 1.00 | |

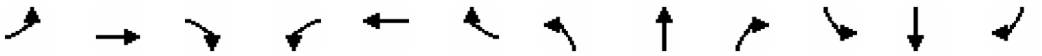
Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 300 | | 300 | 110 | | 110 | 400 | | 150 | 200 | | 125 |
| Storage Lanes | 1 | | 1 | 1 | | 0 | 2 | | 1 | 2 | | 1 |
| Taper Length (ft) | 75 | | | 25 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 526 | | | 247 | | | 1536 | | | 647 | |
| Travel Time (s) | | 9.0 | | | 6.7 | | | 23.3 | | | 9.8 | |
| Lane Group Flow (vph) | 647 | 323 | 469 | 156 | 291 | 0 | 583 | 1515 | 135 | 167 | 1226 | 492 |
| v/c Ratio | 1.09 | 0.35 | 0.66 | 0.46 | 0.43 | | 0.98 | 0.72 | 0.18 | 0.59 | 0.74 | 0.32 |
| Control Delay (s/veh) | 109.3 | 35.8 | 9.8 | 56.1 | 36.4 | | 76.6 | 31.6 | 6.2 | 44.4 | 24.4 | 0.4 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 109.3 | 35.8 | 9.8 | 56.1 | 36.4 | | 76.6 | 31.6 | 6.2 | 44.4 | 24.4 | 0.4 |
| Queue Length 50th (ft) | ~290 | 101 | 26 | 60 | 84 | | 236 | 428 | 36 | 59 | 344 | 0 |
| Queue Length 95th (ft) | #407 | 141 | 126 | 94 | 124 | | m#354 | 488 | m49 | 84 | 383 | 0 |
| Internal Link Dist (ft) | | 446 | | | 167 | | | 1456 | | | 567 | |
| Turn Bay Length (ft) | 300 | | 300 | 110 | | | 400 | | 150 | 200 | | 125 |
| Base Capacity (vph) | 595 | 1080 | 764 | 468 | 926 | | 595 | 2111 | 731 | 296 | 1649 | 1545 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.09 | 0.30 | 0.61 | 0.33 | 0.31 | | 0.98 | 0.72 | 0.18 | 0.56 | 0.74 | 0.32 |

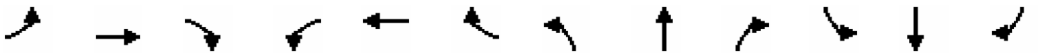
Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 100 | | 0 | 0 | | 0 | 0 | | 120 | 0 | | 130 |
| Storage Lanes | 1 | | 0 | 0 | | 0 | 1 | | 1 | 1 | | 1 |
| Taper Length (ft) | 50 | | | 0 | | | 80 | | | 75 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 30 | | | 25 | | | 45 | | | 45 | |
| Link Distance (ft) | | 327 | | | 246 | | | 189 | | | 1353 | |
| Travel Time (s) | | 7.4 | | | 6.7 | | | 2.9 | | | 20.5 | |
| Lane Group Flow (vph) | 148 | 148 | 213 | 0 | 33 | 0 | 271 | 2011 | 11 | 43 | 1654 | 191 |
| v/c Ratio | 0.67 | 0.69 | 0.48 | | 0.58 | | 1.09 | 0.66 | 0.01 | 0.40 | 0.64 | 0.24 |
| Control Delay (s/veh) | 59.6 | 61.2 | 8.5 | | 77.9 | | 125.6 | 30.7 | 0.0 | 69.9 | 9.8 | 2.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 59.6 | 61.2 | 8.5 | | 77.9 | | 125.6 | 30.7 | 0.0 | 69.9 | 9.8 | 2.3 |
| Queue Length 50th (ft) | 115 | 115 | 0 | | 17 | | ~229 | 459 | 0 | 29 | 126 | 0 |
| Queue Length 95th (ft) | 164 | 165 | 57 | | #68 | | m#343 | m560 | m0 | m43 | 453 | m43 |
| Internal Link Dist (ft) | | 247 | | | 166 | | | 109 | | | 1273 | |
| Turn Bay Length (ft) | 100 | | | | | | | | 120 | | | 130 |
| Base Capacity (vph) | 376 | 366 | 601 | | 59 | | 248 | 3065 | 966 | 147 | 2585 | 807 |
| Starvation Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.39 | 0.40 | 0.35 | | 0.56 | | 1.09 | 0.66 | 0.01 | 0.29 | 0.64 | 0.24 |

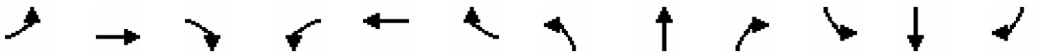
Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.



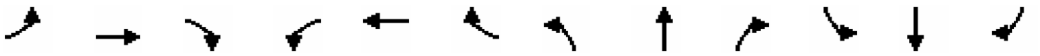
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 0 | | 0 | 320 | | 600 | 0 | | 0 | 0 | | 0 |
| Storage Lanes | 0 | | 0 | 1 | | 1 | 0 | | 1 | 0 | | 2 |
| Taper Length (ft) | 0 | | | 80 | | | 0 | | | 0 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 35 | | | 40 | | | 45 | | | 45 | |
| Link Distance (ft) | | 210 | | | 379 | | | 632 | | | 460 | |
| Travel Time (s) | | 4.1 | | | 6.5 | | | 9.6 | | | 7.0 | |
| Lane Group Flow (vph) | 0 | 0 | 0 | 406 | 0 | 263 | 0 | 2099 | 778 | 0 | 1769 | 788 |
| v/c Ratio | | | | 0.45 | | 0.34 | | 1.00 | 0.63 | | 0.59 | 0.29 |
| Control Delay (s/veh) | | | | 19.5 | | 14.7 | | 35.2 | 3.3 | | 8.8 | 0.3 |
| Queue Delay | | | | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Total Delay (s/veh) | | | | 19.5 | | 14.7 | | 35.2 | 3.3 | | 8.8 | 0.3 |
| Queue Length 50th (ft) | | | | 60 | | 32 | | ~398 | 0 | | 133 | 0 |
| Queue Length 95th (ft) | | | | 93 | | 60 | | #582 | 40 | | 179 | 0 |
| Internal Link Dist (ft) | | 130 | | | 299 | | | 552 | | | 380 | |
| Turn Bay Length (ft) | | | | 320 | | 600 | | | | | | |
| Base Capacity (vph) | | | | 1020 | | 865 | | 2098 | 1231 | | 3014 | 2703 |
| Starvation Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Spillback Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Storage Cap Reductn | | | | 0 | | 0 | | 0 | 0 | | 0 | 0 |
| Reduced v/c Ratio | | | | 0.40 | | 0.30 | | 1.00 | 0.63 | | 0.59 | 0.29 |

Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

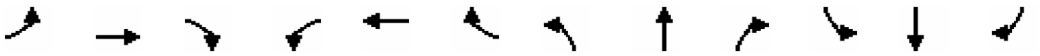


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 620 | | 410 | 150 | | 260 | 0 | | 220 | 420 | | 0 |
| Storage Lanes | 1 | | 1 | 2 | | 1 | 0 | | 1 | 0 | | 1 |
| Taper Length (ft) | 100 | | | 80 | | | 0 | | | 25 | | |
| Right Turn on Red | | | Yes | | | No | | | Yes | | | Yes |
| Link Speed (mph) | | 40 | | | 30 | | | 45 | | | 45 | |
| Link Distance (ft) | | 476 | | | 199 | | | 1572 | | | 266 | |
| Travel Time (s) | | 8.1 | | | 4.5 | | | 23.8 | | | 4.0 | |
| Lane Group Flow (vph) | 773 | 144 | 229 | 144 | 0 | 258 | 0 | 2256 | 0 | 258 | 1498 | 567 |
| v/c Ratio | 0.85 | 0.55 | 0.15 | 0.19 | | 0.38 | | 0.91 | | 0.69 | 0.79 | 0.55 |
| Control Delay (s/veh) | 51.3 | 53.9 | 0.2 | 40.6 | | 39.0 | | 33.7 | | 60.7 | 27.0 | 4.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 51.3 | 53.9 | 0.2 | 40.6 | | 39.0 | | 33.7 | | 60.7 | 27.0 | 4.9 |
| Queue Length 50th (ft) | 290 | 107 | 0 | 44 | | 92 | | 545 | | 100 | 497 | 29 |
| Queue Length 95th (ft) | 353 | 149 | 0 | 86 | | 135 | | #650 | | 140 | 601 | 107 |
| Internal Link Dist (ft) | | 396 | | | 119 | | | 1492 | | | 186 | |
| Turn Bay Length (ft) | 620 | | 410 | 150 | | 260 | | | | 420 | | |
| Base Capacity (vph) | 1020 | 492 | 1547 | 744 | | 856 | | 2482 | | 595 | 1885 | 1034 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.76 | 0.29 | 0.15 | 0.19 | | 0.30 | | 0.91 | | 0.43 | 0.79 | 0.55 |

Intersection Summary

Area Type: Other

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



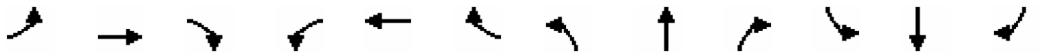
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 350 | | 200 | 175 | | 0 | 340 | | 0 | 450 | | 200 |
| Storage Lanes | 2 | | 1 | 2 | | 0 | 2 | | 0 | 2 | | 0 |
| Taper Length (ft) | 25 | | | 125 | | | 100 | | | 150 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 45 | | | 40 | | | 40 | |
| Link Distance (ft) | | 465 | | | 388 | | | 272 | | | 528 | |
| Travel Time (s) | | 7.0 | | | 5.9 | | | 4.6 | | | 9.0 | |
| Lane Group Flow (vph) | 753 | 646 | 55 | 251 | 384 | 1183 | 34 | 906 | 177 | 860 | 723 | 333 |
| v/c Ratio | 0.89 | 0.45 | 0.04 | 0.67 | 0.52 | 0.76 | 0.21 | 0.80 | 0.11 | 1.02 | 0.31 | 0.22 |
| Control Delay (s/veh) | 59.2 | 37.8 | 0.0 | 62.2 | 50.6 | 3.6 | 62.9 | 51.2 | 0.2 | 81.6 | 23.0 | 0.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay (s/veh) | 59.2 | 37.8 | 0.0 | 62.2 | 50.6 | 3.6 | 62.9 | 51.2 | 0.2 | 81.6 | 23.0 | 0.3 |
| Queue Length 50th (ft) | 287 | 152 | 0 | 96 | 103 | 0 | 13 | 239 | 0 | ~342 | 131 | 0 |
| Queue Length 95th (ft) | #538 | 219 | 0 | 163 | 145 | 0 | 36 | 347 | 0 | #651 | 213 | 0 |
| Internal Link Dist (ft) | | 385 | | | 308 | | | 192 | | | 448 | |
| Turn Bay Length (ft) | 350 | | 200 | 175 | | | 340 | | | 450 | | 200 |
| Base Capacity (vph) | 844 | 1427 | 1544 | 844 | 1341 | 1549 | 562 | 1332 | 1547 | 844 | 2303 | 1547 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.89 | 0.45 | 0.04 | 0.30 | 0.29 | 0.76 | 0.06 | 0.68 | 0.11 | 1.02 | 0.31 | 0.22 |

Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width (ft) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | 0% | | | 0% | | | 0% | | | 0% | |
| Storage Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | 0 |
| Storage Lanes | 1 | | 2 | 1 | | 1 | 2 | | 1 | 2 | | 0 |
| Taper Length (ft) | 60 | | | 60 | | | 150 | | | 120 | | |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Link Speed (mph) | | 45 | | | 35 | | | 45 | | | 45 | |
| Link Distance (ft) | | 475 | | | 447 | | | 550 | | | 1536 | |
| Travel Time (s) | | 7.2 | | | 8.7 | | | 8.3 | | | 23.3 | |
| Lane Group Flow (vph) | 123 | 765 | 663 | 173 | 398 | 431 | 531 | 1553 | 133 | 360 | 1516 | 0 |
| v/c Ratio | 0.87 | 0.62 | 0.43 | 0.61 | 0.46 | 0.75 | 0.78 | 0.73 | 0.18 | 0.91 | 0.89 | |
| Control Delay (s/veh) | 101.0 | 42.2 | 0.9 | 62.2 | 39.2 | 23.9 | 55.4 | 32.7 | 3.2 | 86.2 | 55.9 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 0.0 | 0.0 | 0.0 | |
| Total Delay (s/veh) | 101.0 | 42.2 | 0.9 | 62.2 | 39.2 | 23.9 | 55.4 | 33.4 | 3.2 | 86.2 | 55.9 | |
| Queue Length 50th (ft) | 96 | 194 | 0 | 67 | 138 | 124 | 199 | 362 | 0 | 136 | 390 | |
| Queue Length 95th (ft) | #206 | 220 | 0 | 104 | 169 | 228 | #352 | 477 | 30 | #234 | #510 | |
| Internal Link Dist (ft) | | 395 | | | 367 | | | 470 | | | 1456 | |
| Turn Bay Length (ft) | 210 | | 240 | 210 | | 185 | 300 | | 275 | 320 | | |
| Base Capacity (vph) | 146 | 1594 | 1547 | 307 | 1109 | 664 | 680 | 2123 | 739 | 396 | 1697 | |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 260 | 0 | 0 | 0 | |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Reduced v/c Ratio | 0.84 | 0.48 | 0.43 | 0.56 | 0.36 | 0.65 | 0.78 | 0.83 | 0.18 | 0.91 | 0.89 | |

Intersection Summary

Area Type: Other

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# REVISED GEOTECHNICAL INVESTIGATION & UPDATED GEOLOGIC AND SEISMIC HAZARDS ASSESSMENT REPORT

# PLANNED TRI-VALLEY EAST WING HOSPITAL ADDITION PLEASANTON, CALIFORNIA

BSK PROJECT NO. G00000369

PREPARED FOR:

STANFORD HEALTH CARE
66 WILLOW PLACE, MENLO PARK, CA

October 21, 2024

Stanford MEDICINE | Health Care Tri-Valley

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October 21, 2024 BSK Project No. G00000369

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Senior Project Manager – Planning, Design + Construction
**Stanford Health Care**
66 Willow Place, MC 5536
Menlo Park, CA 94025

**SUBJECT: Revised Geotechnical Investigation & Updated Geologic and Seismic Hazards Assessment Report**
**Planned Tri-Valley East Wing Hospital Addition, Pleasanton, California**

Dear Ms. Bochner:

We are pleased to submit our geotechnical investigation and updated geologic and seismic hazards assessment report for the planned Tri-Valley East Wing Hospital Addition (Site) in Pleasanton, California. The enclosed report describes the geotechnical investigation performed and presents our geotechnical recommendations for foundations, earthwork, and pavements. This report includes an updated geologic and seismic hazards assessment for the Site. Our original report was issued on 11/1/2023 and has been revised due to changes in the layout of the planned addition.

In summary, it is our opinion that the Site does not pose significant geotechnical concerns that would preclude the planned development provided the recommendations presented in our report are incorporated in the design and construction of the project. The main geotechnical concerns for the Site are the presence of moderately expansive and potentially compressible surficial clayey soils, the potential for moderate to intense ground shaking to affect the Site during a future significant seismic event (typical of the entire San Francisco Bay Area), and the presence of shallow groundwater. These concerns are addressed in the enclosed report.

The conclusions and recommendations presented in the enclosed report are based on limited subsurface investigation and laboratory testing programs. Consequently, variations between anticipated and actual subsurface soil conditions may be found in localized areas during construction. If significant variation in the subsurface conditions is encountered during construction, BSK should review the recommendations presented herein and provide supplemental recommendations, if necessary. Additionally, design plans should be reviewed by our office prior to their issuance for conformance with the general intent of our recommendations presented in the enclosed report.

We appreciate the opportunity of providing our services to you on this project and trust this report meets your needs currently. If you have any questions concerning the information presented, please contact us at (925) 315-3151.

Respectfully Submitted,
**BSK Associates, Inc.**

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Project Professional II

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# 1. INTRODUCTION

This report presents the results of our geotechnical investigation and updated geologic and seismic hazards assessment for the planned Tri-Valley East Wing Hospital Addition (Site) in Pleasanton, California. A Vicinity Map showing the location of the Site is presented on Figure 1. This report contains a description of our site investigation methods and findings, including field and limited laboratory data and provides geotechnical recommendations for the project. This report was prepared in accordance with the 2022 California Building Code (CBC), California Code of Regulations, Title 24, Chapters 16A and 18A requirements for a Geotechnical/Engineering Geologic Report and the California Geological Survey (CGS) Note 48. The geologic and seismic hazards assessment is intended to address the location of the planned hospital addition only and not the entire hospital campus. Our original report was issued on 11/1/2023 and has been revised due to changes in the layout of the planned addition. Therefore, this revised report supersedes our 11/1/2023 report.

## 1.1 Site and Project Description

The Tri-Valley hospital is located at 5555 West Las Positas Boulevard in the northeastern portion of Pleasanton, California within a dense residential area of the City. The hospital campus is irregularly shaped and is bounded to the east by Santa Rita Road and Old Santa Rita Road, Andrews Drive to the north and northwest, Owens Drive to the southwest, and West Las Positas Boulevard to the South. The planned Tri-Valley East Wing Hospital Addition is located immediately adjacent to the existing emergency entrance, which is occupied by a covered walkway canopy, ambulance entry/exit area, an MRI trailer, and limited parking (see Figure 2, Site Plan and Geology Map). The Site and the surrounding area are generally level with minor topographic relief. According to Google Earth Pro, the Site has a ground surface elevation of about 340 feet[1]. The unlined channel of the Tassajara Creek is located approximately 900 feet northwest of the Site. The channel, which has a northeast to southwest flow direction, is approximately 10 feet deep along this segment.

The project will consist of the construction of a 3-story addition with a slab-on-grade floor having a footprint area of approximately 22,000 square feet as shown on see Figure 2. The addition will be structurally separated from the main hospital building. At the time this report was issued, the fundamental period of vibration for the building addition is expected to be approximately 0.75 seconds. Additional improvements will include exterior concrete flatwork, paved parking and driveways, new underground utility lines, landscaping, and possibly bioretention areas.

Although a grading plan is not currently available for the project, we assume that site grades will remain close to existing elevations and that cuts and fills during construction will likely be limited to less than 2 feet. Excavations for new underground utility lines, footings, and elevator pit walls are expected to be up to 7 feet deep.

[1] Measured from the WGS84 EGM96 Geoid vertical datum.

If the actual project description differs significantly from that anticipated above, we should be notified so that we may review our recommendations presented herein for applicability.

## 1.2 Approach and Scope of Services

The purpose of this investigation was to explore and evaluate the subsurface conditions at the Site to provide geotechnical input for the design and construction of the planned improvements for this project. The scope of services, as outlined in our January 25, 2023 and September 9, 2024 proposals (BSK Proposal No. G00000369) and structured to adhere to the requirements of the 2022 California Building Standards Code (California Code of Regulations, Title 24) for California public schools, hospitals, skilled nursing facilities, and essential services buildings, consisted of field exploration, laboratory testing, engineering analysis, and preparation of this report. Our updated geologic and seismic hazards assessment followed the guidelines established by the California Geological Survey (CGS) in Note 48 – Checklist for the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings. The CGS is the reviewing agency for the California Department of Health Care Access and Information (HCAi), formerly the Office of Statewide Health Planning & Development (OSHPD).

Note that our investigation did not include assessment of environmental characteristics/contaminants in the soil, water, or air, particularly those involving hazardous substances.

## 1.3 Previous Investigations

BSK has performed numerous investigations and studies at the SHC-TV hospital campus in the past, including the following:

- *Geotechnical Investigation and Updated Geologic and Seismic Hazards Assessment Report, Planned Fuel Oil Tanks and Emergency Generators, Stanford Health Care – ValleyCare, Pleasanton, California,* dated April 12, 2019 (BSK Project No. G19-040-10L);
- *Supplemental Geotechnical Recommendations, Oxygen Tank Pad and ED Canopy, Stanford Health Care – ValleyCare, Pleasanton, California,* dated October 8, 2018 (BSK Project No. G18-249-10L);
- *Geologic/Seismic Hazard Investigation, Oxygen Tank Pad, ValleyCare Medical Center, 5555 W. Las Positas Boulevard, Pleasanton, California,* dated April 4, 2013 (BSK Project No. G12-133-10P);
- *Foundation Recommendations, Oxygen Tank Pad, ValleyCare Medical Center, 5555 West Las Positas Boulevard, Pleasanton, California,* dated November 15, 2012 (BSK Project No. G12-133-10P);
- *Geotechnical Investigation, Emergency Department Addition, ValleyCare Medical Center, 5555 W. Las Positas Boulevard, Pleasanton, California,* dated October 24, 2012 (BSK Project No. G12-109-10P;
- *Addendum No. 2 to Report Dated July 24, 1997, Geotechnical Investigation and Geologic/Seismic Hazards Evaluation, Planned Hospital Building Addition, Valley Care Medical Center, Pleasanton, California*, dated March 25, 1998 (BSK Project No. 04-20-0284);
- *Report – Geotechnical Investigation and Geologic/Seismic Hazards Evaluation, Proposed Hospital*

*Building Addition, Valley Care Medical Center, West Las Positas Boulevard and Santa Rita Road, Pleasanton, California*, dated July 24, 1997 (BSK File No. 04-20-0284); and

- *Geotechnical and Seismic Hazards Investigation, Proposed ValleyCare Medical Center, West Las Positas Blvd. and Santa Rita Road, Pleasanton, California,* dated August 26, 1986 (BSK File No. P86057).

We have taken into consideration the subsurface data and findings presented in these previous investigations and studies, particularly our 2019 investigation. Pertinent subsurface data and laboratory test results from these previous investigations and studies are presented in Appendix D of this report.

## 2. FIELD INVESTIGATION

Our field investigation was performed on July 21, 2023 to evaluate the subsurface conditions at the Site. Our field investigation consisted of drilling one exploratory rotary wash boring (labeled B-1) to a depth of about 55½ feet below the existing ground surface (BGS) and advancing two (2) Cone Penetration Tests (CPTs), labeled CPT-1 and CPT-2, to depths of approximately 42 to 43 feet BGS (where practical refusal was encountered by the CPTs) at the approximate locations shown on Figure 2.

Prior to the subsurface exploration, Underground Service Alert (USA North 811) was notified to provide utility clearance and each exploration location was cleared for detectable underground utilities by a private utility locator. In addition, boring B-1 and CPT-1 were cleared using a hand auger in the upper 5 feet BGS because of congested utilities in the area prior to advancing further. A drilling permit was obtained from Zone 7 Water Agency (Zone 7). Upon completion of the field investigation, the boring and CPTs were backfilled with cement grout and the upper approximately 6 inches of our boring was patched with rapid set concrete. Excess soil cuttings/fluids generated by the boring during drilling operation were drummed and disposed offsite by the drilling subcontractor.

The locations of our exploration points were estimated by our field representative based on rough measurements from existing features at the Site. The elevation shown on the boring log was estimated based on Google Earth Pro. As such the elevations and locations of the exploration points should be considered approximate to the degree implied by the methods used.

### 2.1 Rotary Wash Boring



The boring was drilled on July 21, 2023 by Taber Drilling of West Sacramento, California, using a truck-mounted drill rig equipped with rotary wash capability. The boring was logged by one of our field geologists in general accordance with the ASTM *Standard of Practice for Description and Identification of Soils (Visual-Manual Procedure)* (D2488). Relatively undisturbed samples of the subsurface materials were obtained using a split spoon sampler fitted with stainless steel liners. The general diameter measurements of the sampler are about 3-inches for the outside diameter, and about 2½-inches for the inside diameter (ID). The samplers were driven by the force of a 140-pound automatic hammer, dropping 30-inches. According to a calibration

report dated January 30, 2023, the hammer used has an average hammer efficiency of 76 percent (i.e., hammer energy ratio of approximately 1.27). The successive blow counts were recorded for 6-inch penetration intervals until the sampler advanced 18-inches. The blow counts for each interval are reported on the final boring log. After the 2½ ID split spoon sampler was withdrawn from the borehole, the soil samples were removed from the sampler, sealed to reduce moisture loss, labeled, and returned to our laboratory. Prior to sealing the samples, strength characteristics of the cohesive soil samples recovered were evaluated using a handheld pocket penetrometer. The results of these tests are shown adjacent to the samples on the boring log.

Soil classifications made in the field from auger cuttings and samples were re-evaluated in the laboratory after further examination and testing. Where laboratory tests were performed, most of the test results appear in the final boring log (refer to the "Laboratory Testing" section below for further details). Final soil classification was assessed through the judgement of a responsible Geotechnical Engineer supplemented with the laboratory testing at various intervals in general accordance with the ASTM *Standard Practice for Classification of Soils for Engineering Purposes* (D2487). A summary of the Unified Soil Classification System (USCS), adapted by ASTM D2487 and D2488 is presented in Appendix A, Figure A-1. The Soil Description Key and Log Key are presented on Figure A-2 and A-3. Sample classifications, blow counts recorded during sampling, and other related information are presented on the soil boring log within Appendix A. Discussion of the subsurface conditions encountered at the Site is presented in the "Subsurface Conditions" section of this report.

## 2.2 Cone Penetration Tests




CPT probes were advanced to depths of approximately 42 to 43 feet BGS, where practical refusal was encountered. The CPTs were advanced by Taber Drilling of West Sacramento, California. The CPTs were performed using an integrated electronic cone system in accordance with ASTM D3441. The cone has a tip area of 10 square centimeters, a friction sleeve area of 150 square centimeters, and a ratio of end area friction sleeve to tip end area equal to 0.80. The cone resistance and sleeve friction were measured and recorded during the tests at approximately 5-centimeter (about 2 inches) depth intervals. In addition, shear wave velocity measurements were recorded in approximately 5-foot depth increments.

The cone system was pushed using a 40,000-pound, all-wheel drive, CPT rig, having a down pressure capacity of approximately 20 tons. The information gathered from the CPTs was used for identifying potentially liquefiable and soft soils and for foundation design. The correlated CPT data collected from our CPT (cone resistance, friction ratio, pore pressure, and soil behavior type) versus penetration depth below the existing ground surface, generated using the CPT liquefaction assessment computer software CLiq[2], is presented in Appendix C along with shear wave velocity measurements.

The stratigraphic interpretation of the CPT data was performed based on relationships between cone resistance (also known as tip resistance) and sleeve friction versus penetration depth. The friction ratio, which is sleeve friction divided by cone resistance, is a calculated parameter which is used to infer soil behavior type. Generally, cohesive soils (clays) have high friction ratios, low cone resistance and generate large excess pore water pressures. Cohesionless soils (sands) have lower friction ratios, high cone resistance and generate small excess pore water pressures. The interpretation of soil properties from the cone data has been carried out using correlations developed by Robertson et al, 1990[3], and Lunne, Robertson & Powell, 1997[4]. It should be noted that it is not always possible to clearly identify a soil type based on cone resistance and sleeve friction. In these situations, experience and judgment and an assessment of the pore pressure dissipation data should be used to infer the soil behavior type.

## 2.3 Seismic Survey

On September 21, 2024, a California registered geophysicist from Advanced Geological Services (AGS) of Pleasant Hill, California conducted a seismic survey to evaluate the average shear-wave velocity of the upper 100 feet at the Site. The shear wave velocities determine the Site Class for the Site. Two seismic lines (labeled SL-1 and SL-2 on Figure 2) were performed at the Site. The shear wave velocities were approximately 700 and 677 feet/second for Seismic Lines 1 and 2, respectively, which are indicative of Site Class D – stiff soil. However, because the Site includes potentially liquefiable soils below depths of about 42 to 46½ BGS, the site is classified as Site Class F, per Section 20.3.1 of ASCE 7-16, because the fundamental period of vibration for the planned addition is great than 0.5 seconds as explained later in this report. The results of the seismic survey are presented in AGS's September 30, 2024 report, which is presented in Appendix E.

## 2.4 Laboratory Testing

Laboratory tests were performed on selected soil samples to evaluate their physical characteristics and engineering properties. The laboratory testing program included dry density and moisture content, Atterberg limits, grain size analyses, unconsolidated-undrained triaxial compression (TXUU), consolidation, and direct shear tests. Most of the laboratory test results are presented on the boring log.

[2] CLiq v2.0 by Geologismiki
[3] Robertson P.K., 1990. Soil classification using the cone penetration test. Canadian Geotechnical Journal, 27(1): 151-158
[4] Lunne, T., Robertson, P.K., and Powell, J.J.M 1997. Cone penetration testing in geotechnical practice, E & FN Spon Routledge, 352 p, ISBN 0-7514-0393-8.

The results of the Atterberg limits, TXUU, direct shear, grain size analysis of soils, and consolidation are also presented graphically in Appendix B.

Analytical testing was performed on samples of soil collected from the upper 5 feet BGS to assist in evaluating the corrosion potential of the on-site soils. The corrosivity testing was performed by CERCO Analytical of Concord, California, a State-Certified laboratory, using ASTM methods as described in the CERCO Analytical report. The corrosion results are also presented at the end of Appendix B.

## 3 GEOLOGIC SETTING

The City of Pleasanton is located within the Amador Valley, which is part of the Coast Range geomorphic province of California. The Coast Range geomorphic province is a discontinuous series of northwest-southeast trending mountain ranges, ridges, and intervening valleys characterized by complex folding and faulting. The Amador Valley is a depression between these discontinuous series of northwest-southeast trending ridges which joins the San Ramon Valley to the north with the Livermore Valley to the east. The valley is comprised of thick deposits of unconsolidated Quaternary deposits derived from the surrounding mountain ranges and ridges.

According to Witter et al. (2006) and the CGS (2008a), who have differentiated Quaternary deposits between Holocene (younger than 11,700 years) and Pleistocene (younger than 2.6 million and older than 11,700 years) age, the hospital campus is mapped as Holocene alluvial fan deposits (map symbol Qhf). Holocene alluvial fan deposits include sand, gravel, silt, and clay, and are moderately to poorly sorted, and moderately to poorly bedded. A portion of Witter et al. (2006) geologic map is presented on Figure 3, Area Geologic Map.

Nearby active faults include the zoned portion of the Pleasanton Fault, located approximately 1 mile northwest of the Site, the Calaveras Fault, located approximately 2½ miles southwest of the Site, and the Verona Fault, located approximately 3½ miles south of the Site.

According to the CGS, the Pleasanton Fault extends across Amador Valley from the Dougherty Hills in San Ramon to the Vallecitos Hills south of Pleasanton. According to the Fault Evaluation Reports (FER-104, FER-109) prepared by California Division of Mines and Geology (CDMG, 1981a, 1981b) for the Dublin and Livermore quadrangles, the Pleasanton Fault is not a well-defined, active fault. There is no surface evidence for the Pleasanton Fault south of the Camp Parks area in Dublin (south of Interstate 580). The reports recommended to delete all traces of the Pleasanton Fault and not zone any segments of the fault south of Interstate 580, except the eastern-most trace that extends 2,000 feet south of the highway. They also indicated that there is no evidence for the existence of well-defined, Holocene faults south of Pleasanton.

## 4 SUBSURFACE CONDITIONS

According to our current and past exploration points within the proximity of the Site, the Site is underlain by alluvial soils consisting of firm to hard clays and loose to dense sands and gravels. Our current boring (B-1) encountered possible fill material in the upper approximately 3½ feet BGS consisting of sandy lean clay and silty sand. Beneath the possible fill, soft to hard lean clay was encountered to a depth of about 40 feet BGS. Firm to hard fat clay was encountered from approximately 40 to 42 feet BGS. Medium dense silty sand was encountered from about 42 to 46½ BGS. From about 46½ to 55½ feet BGS (maximum depth of our boring) poorly graded sand was encountered. Despite numerous attempts by our drilling subcontractor in "thickening" the drilling mud in order to stabilize the borehole within this sand layer, the borehole sidewalls kept caving-in. Therefore, we were not able to collect driven tube samples within this layer. Instead, we collected only bulk samples of the soil cuttings generated from this sand layer, which we used to run sieve analyses.

Our CPTs mainly encountered firm to hard clays in the upper 42 to 43 feet BGS before encountering practical refusal. The refusal of our CPTs could have been the result of dense sand layers or the presence of gravel, which was encountered in past borings performed at the hospital campus. Using the shear wave velocities obtained from the seismic survey below a depth of about 40 feet BGS and correlations provided in Wair et al (2012), the sandy/gravelly material at this depth is medium dense.

As shown on Figure 4, a geologic cross-section was constructed to interpret subsurface conditions based on our current and previous exploration points and published geologic maps. Atterberg limits testing performed on a sample collected at a depth of approximately 4 feet BGS at our current boring (B-1) resulted in a liquid limit value of 37 and a plasticity index value of 20. These values are indicative of soils having a moderate expansion potential when subjected to moisture content fluctuation.

The subsurface conditions encountered in our current exploration points are generally consistent with those encountered in our previous exploration points included in Appendix D. The locations of our previous exploration points are shown on Figure 2.

Free groundwater was observed at a depth of 4½ feet BGS at our current boring B-1. During BSK's previous investigations, free groundwater was observed at depths ranging between approximately 5 and 14 feet BGS. According to the California Geological Survey (CGS, 2008[3]), historical high groundwater at the ValleyCare hospital campus lies between 20 and 30 feet BGS (see Figure 5). It should be noted that groundwater levels can fluctuate several feet depending on factors such as seasonal rainfall, groundwater withdrawal, and construction activities on this or adjacent properties.

The above is a general description of the soil and groundwater conditions encountered in our exploration points at the Site. For a more detailed description of the soils encountered, refer to the boring and CPT logs in Appendices A, C, and D and AGS's seismic survey report in Appendix E. Soil and groundwater conditions may deviate from those conditions encountered at the exploration points during our current and previous subsurface investigations.

# 5 GEOLOGIC AND SEISMIC HAZARDS

The types of geologic and seismic hazards assessed in this section and the "Site Seismicity" section of this report include surface ground fault rupture, liquefaction, lateral spreading, seismically induced settlement, slope failure, flood hazards, inundation hazards, soil corrosion, soil expansion, and compressible soils.

## 5.1 Fault Rupture Hazard

The purpose of the Alquist-Priolo Earthquake Fault Zoning Act, as summarized in CGS Special Publication 42 (2018), is to "address the hazard of surface fault rupture through the regulation of development in areas near Holocene-active faults and prevent the construction of structures for human occupancy across traces of active faults." As indicated by Special Publication 42, "the State Geologist (Chief of the California Geological Survey) is required to delineate 'Earthquake Fault Zones (EFZ)' along known Holocene-active faults in California. The EFZs are distributed as 'Earthquake Fault Zone maps.' The zones are regulatory in nature and are one class of 'Earthquake Zones of Required Investigation', which includes other geologic hazards such as liquefaction and earthquake-induced landslides. Cities and counties affected by the zones must regulate certain development 'projects' within the zones. They must withhold development permits for sites within the zones until geologic investigations demonstrate that the sites are not threatened by surface displacement from future faulting."

According to the CGS, the Site is not located within an Alquist-Priolo Earthquake Fault Zone. As shown on the Alquist-Priolo Earthquake Fault Zone, Figure 6, the closest Fault-Rupture Hazard Zone is associated with the zoned portion of the Pleasanton fault located approximately 1 mile northwest of the Site (CGS, 2008b). Therefore, the potential for surface rupture to occur at the Site is considered low.

## 5.2 Seismic Hazard Zones

Per the CGS website, the Seismic Hazards Mapping Act (SHMA) of 1990 (Public Resources Code, Chapter 7.8, Section 2690-2699.6) directs the CGS to identify and map areas prone to earthquake hazards of liquefaction, earthquake-induced landslides, and amplified ground shaking. The purpose of the SHMA is to reduce the threat to public safety and to minimize the loss of life and property by identifying and mitigating these seismic hazards. The SHMA was passed by the legislature following the 1989 Loma Prieta earthquake. The SHMA requires the State Geologist to establish regulatory zones (Zones of Required Investigation) and to issue appropriate maps (Seismic Hazard Zone maps).

The Site is not located in an Earthquake-Induced Landslide Hazard Zone. However, the Site is in a state-delineated Liquefaction Hazard Zone, as shown on the State Seismic Hazard Zones, Figure 7 (CGS, 2008b).

## 5.3 Slope Stability and Potential for Slope Failure

The Site is essentially flat, with little to no topographic relief. Figure 8, Landslide Hazard Map, shows a distribution of landslide occurrence mapped by Wentworth et al. (1997) and shows the Site to be located

in an area of "Surficial Deposits". Therefore, the potential for landslides and slope failures (seismically induced or otherwise) to occur at the Site is considered to be low.

## 5.4 Flood and Inundation Hazards

An evaluation of flooding at the Site includes review of potential hazards from flooding during periods of heavy precipitation and flooding due to a catastrophic dam breach from up-gradient surface impoundments.

### 5.4.1 Flood Hazards

Federal Emergency Management Agency (FEMA) flood hazard data was obtained to present information regarding the potential for flooding at the Site. As shown on the FEMA Flood Zones, Figure 9, according to FEMA Flood Hazard Map Layer (Panel 06001C-NFHL), dated 02/09/2022, the Site lies in Zone X – areas outside the 100-year and 500-year floodplains. According to the City of Pleasanton General Plan 2005-2025 (2009), the Site is located outside of the 500-year floodplain. Therefore, the potential for flooding at the Site due to heavy precipitation is considered to be low.

### 5.4.2 Dam Failure Inundation

According to the Office of Emergency Services (OES), 2013 GIS data, the Site is in the Del Valle Dam inundation area. According to the City of Pleasanton General Plan 2005-2025 (2009) and California Emergency Management Agency, about 6,000 acres of Pleasanton are located within the dam failure inundation hazard area for Lake Del Valle Dam, which includes the Site. The 235-foot Del Valle Dam impounds a reservoir with a total capacity of 77,100 acre-feet. Were the dam to fail, the flood waters would reach the Site within approximately 5 to 40 minutes.

## 5.5 Expansive Soils

Based on soil encountered during our subsurface investigation, the near-surface soils encountered consist of soil comprised primarily of sandy lean clay soils which exhibit a moderate expansion potential. This is consistent with previous subsurface investigations proximate to the Site area.

## 5.6 Corrosion

Based on corrosivity testing at the Site, the results of which are presented at the end of Appendix B, the near surface soils are considered "severely corrosive". Please refer to the section entitled "Corrosion Potential" of this report for further discussion of the corrosivity of the Site soils.

## 5.7 Compressible Soils

Soft clay was not encountered in our previous borings near to the Site. However, a layer of soft lean clay was encountered at depth of approximately 6 feet BGS in our current boring (B-1), which is proximate to the depth of free groundwater observed in the boring (about 4½ feet BGS). We ran a consolidation test on the soft clay sample collected from a depth of approximately 6 feet BGS at our current boring (B-1). Based on the consolidation test result shown on Figure B-5, we estimate a preconsolidation stress of approximately 1,800 psf versus an estimated in-situ overburden stress of approximately 600 psf, which indicates that the soft clay layer is overconsolidated.

To evaluate the impact of this potentially compressible clay layer, we ran consolidation settlement analysis using the program Settle 3D (Version 2.016). For our Settle 3D analysis, we assumed the compressible clay layer is normally consolidated (to be conservative), groundwater lies at 4½ feet BGS, and the soft clay layer extends to a depth of 6 feet BGS.

We analyzed 3 shallow foundation types: 1) continuous spread footings, 2) square spread footings, and 3) a mat foundation. We also analyzed an interior slab-on-grade floor. For the continuous spread footings, we assumed the footings to be 1 to 2 feet wide and embedded 2 feet BGS. For the square spread footings, we assumed the footings to be 6 to 16feet wide and embedded 2 to 4 feet BGS. For the mat foundation and interior slab-on-grade floor, we assume the same overall dimensions of the planned hospital addition shown on Figure 2 (i.e., approximately 22,000 square feet). We used an allowable bearing pressure of 2,500 pounds per square feet (psf) for the footings, allowable bearing pressures of 500 to 1,000 psf for the mat foundation, and an allowable bearing pressure of 100 psf for the interior slab-on-grade floor.

Based on our analysis results, the clayey layer could undergo total consolidation settlement of about 1 inch for the spread footings. For the mat foundation, the potentially compressible clay layer could undergo total consolidation settlement of about 1 to 2 inches for loads of 500 and 1,000 psf, respectively. Our analysis indicated that total consolidation settlement would be less than ¼-inch for the interior slab-on-grade floor. Based on conservative time rate of consolidation curves for Bay Mud presented in the Special Report 97 (CDMG, 1969), we estimate that at least 95 to 100 percent of the consolidation settlement would occur within 1 to 2 years after the new foundations are constructed.

# 6 SITE SEISMICITY

## 6.1 Seismic Source Deaggregation

Figures 10 and 11, Regional Fault Map and Local Fault Map, respectively, present the major faults that may impact the project area in the future. Seismically-induced ground motion at a site can be caused by earthquakes on any of the sources surrounding the site. Deaggregation of the seismic hazard was performed using the USGS Unified Hazard Tool. The deaggregation determination, at the maximum considered earthquake hazard level, results in distance, magnitude, and epsilon (ground-motion uncertainty) for each source that contributes to the hazard.

Results of the deaggregation based on a probabilistic model developed by the USGS (Dynamic: Conterminous U.S. 2014 (v4.2.0)) indicates that the most extreme seismic source that contributes to the peak ground acceleration is from a rupture of the Calaveras Fault. The modal magnitude of 7.29 at a distance of 9.7 km is consistent with the general design earthquake ground motion. For liquefaction and seismic settlement calculations, a magnitude of 7.43 should be used, which was obtained from the site-specific ground motion hazard analysis presented in Appendix E of this report.

## 6.2 Historical Seismicity

The project area and its vicinity are located in an area characterized by high seismic activity. A number of large earthquakes have occurred within the Site region during historic time (since 1800). The Historical Earthquakes, Figure 12, presents earthquake magnitudes of significant earthquakes based on the National Seismic Hazard Model (NSHM) Earthquake Catalogs. This earthquake catalog is for the Western United States and provides a listing for all known M ≥ 2.5 earthquakes. Some of the significant regional earthquake events include the 1980 M5.8 Livermore earthquake located approximately 12 miles northeast of the project area, the 1868 M6.8 earthquake that originated on the Hayward Fault approximately 12 miles west of the Site, and the M7.8 1906 San Francisco earthquake located approximately 34 miles west of the Site. In March 2015, scientists and engineers released a new earthquake forecast for the State of California, which was compiled by the USGS, the Southern California Earthquake Center, and the CGS with support from the California Earthquake Authority (Field et al., 2014). It updates the earthquake forecast made for the greater San Francisco Bay Area by the 2007 Working Group for California Earthquake Probabilities. According to this recent study, there is a 72 percent probability that one or more magnitude M6.7 or greater earthquakes will occur in the San Francisco Bay Area between 2014 and 2044. As has been demonstrated recently by the 1989 (M6.9) Loma Prieta, the 1994 (M6.7) Northridge, and the 1995 (M6.9) Kobe earthquakes, earthquakes of this magnitude range can cause severe ground shaking and significant damage to modern urban environments.

## 6.3 Earthquake Ground Motion, 2022 California Building Standards Code

### 6.3.1 Site Class

Based on Section 1613A.2.2 of the 2022 CBC, the project Site shall be classified as Site Class A, B, C, D, E or F based on the Site soil properties and in accordance with Chapter 20 of ASCE 7-16. Based on the undrained shear strength, pocket penetrometer readings, blow count readings, and the seismic survey performed by AGS obtained from our current boring (B-1) as well as our previous borings near the Site, we would classify the Site as Site Class D, similar to what we did on past projects at this hospital campus. However, because the fundamental period of vibration for the planned hospital addition is greater than 0.5 seconds and we conclude that the Site has a liquefaction potential, we classify the Site as Site Class F, which required preparation of a site response analysis.

### 6.3.2 Site Response Analysis

A site response analysis based on Section 21.1 of ASCE 7-16 was performed for the Site by our subconsultant, Dr. Robert Pyke, Consulting Engineer, of Alamo, California, the results of which are presented in his reported dated October 17, 2024 included in Appendix G of this report. 2022 CBC seismic design parameters based on the site response analysis are also presented in Appendix G and are listed below.

- $S_{MS}$ = 1.43g
- $S_{M1}$ = 1.46g
- $S_{DS}$ =0.95g
- $S_{D1}$ = 0.97g

## 6.4 Seismically Induced Ground Failure

### 6.4.1 Liquefaction

Liquefaction is a condition where saturated, granular soils undergo a substantial loss of strength and deformation due to pore pressure increase, resulting from cyclic stress application induced by earthquakes. In the process, the soil acquires mobility sufficient to permit both horizontal and vertical movements if the soil is not confined. Soils most susceptible to liquefaction are saturated, loose, clean, uniformly graded, silt and fine sand and some low plasticity clays. If liquefaction occurs, foundations resting above or within the liquefiable layer may undergo settlements and/or a loss of bearing capacity.

In order for liquefaction triggering to occur due to ground shaking, it is generally accepted that four conditions will exist:

- The subsurface soils are in a relatively loose state
- The soils are saturated

- The soils have low plasticity
- Ground shaking is of sufficient intensity to act as a triggering mechanism

In addition, after soil liquefies, dissipation of the excess pore pressures can produce volume changes within the liquefied soil layer, which can result in ground surface settlement.

We performed liquefaction analyses for the current boring (boring B-1) and the CPTs (CPT-1 and CPT-2) using the methods proposed by Boulanger and Idriss (2014). For our analyses, we used peak ground accelerations of 0.37g associated with an earthquake magnitude of 7.43 (as recommended in the site response analysis presented in Appendix G of this report). Free groundwater was observed in the current boring at a depth of approximately 4½ feet BGS. Previous borings in the Site area have encountered groundwater at depths of 5 feet BGS or less. For our analysis, we assumed a design groundwater depth of 4½ BGS. Our analysis results are presented in Appendices A and C.

Our analysis for the CPTs, which extended to 42 to 43 feet BGS due to practical refusal, estimates less than ¼-inch of total liquefaction-induced settlement at depths of 40 to 43 feet BGS. Our analysis for boring B-1 indicated no liquefaction within the upper approximately 46½ feet BGS. As noted in the "Subsurface Conditions" section of this report, we could not obtain blow counts in the poorly graded sand layer encountered below 46½ feet BGS in boring B-1 because the hole kept caving-in. During our 2019 and 1986 investigations (refer to boring logs B-2 drilled in 2019 and B-5 drilled in 1986 and presented in Appendix D), we encountered a similar granular layer at depths of approximately 47 and 49 feet BGS and recorded blow counts for the last 12 inches driven indicative of a dense to very dense state and thus unlikely to liquefy during a seismic event.

We also analyzed the Site's liquefaction potential using the Vs30 readings obtained from seismic lines LS-1 and LS-2 presented in Appendix E using the software program LiqSVs v2.3.2.11 and the methods presented in Kayen et al. (2013). This method predicts approximately ¾-inch of total liquefaction-induced settlement between a depth of about 40 and 50 feet BGS at seismic lines LS-1 and LS-2. The liquefaction analysis for the seismic lines is presented in Appendix H of this report.

Based on the above information and our past studies within the hospital campus, we anticipate up to 1-inch and ½-inch of total and differential liquefaction-induced settlement, respectively, could occur at the Site. This is consistent with the findings from the site response analysis, which estimates about ½- to ¾-inch of liquefaction-induced settlement at the Site (refer to page 12 of 22 the site response analysis report in Appendix G). Differential settlement is defined in this report as the vertical difference in settlement between adjacent supports or across a horizontal distance of 30 feet, whichever is less.

Based on Youd and Garris (1995), we conclude that the potential for ground surface disruption associated with liquefaction to occur at the Site is low due to the much thicker non-liquefiable clay layers (40+ feet thick) overlaying the much thinner potentially liquefiable layers.

### 6.4.2 Lateral Spreading

Lateral spreading is a potential hazard commonly associated with liquefaction where extensional ground cracking and settlement occur as a response to lateral migration of subsurface liquefied soils during a design seismic event. These phenomena typically occur adjacent to free faces such as slopes and creek channels. There is an approximately 10-foot-deep channel of the Tassajara Creek located approximately 800 feet northwest of the Site. Our current boring and CPTs encountered predominantly clay soils in the upper 40 feet BGS at the Site. According to our Atterberg limits tests conducted on samples from depths of approximately 4, 20, and 41 feet BGS in boring B-1, the clay soils have a moderate to high expansion potential. Based on that and the depth of the potentially liquefiable soils in our CPTs (about 40 to 43 feet BGS), we conclude that the potential for lateral spreading to occur at the Site is low.

### 6.4.3 Dynamic Compaction (Seismic Settlement)

Another type of seismically induced ground failure, which can occur as a result of seismic shaking, is dynamic compaction, or seismic settlement. Such phenomena typically occur in unsaturated, loose granular material or uncompacted fill soils. These types of soils were not encountered within the maximum depth of the borings and CPTs of approximately 55½ feet BGS. Sand layers were encountered in our current and previous borings above free groundwater, but they were generally medium dense to dense. Therefore, we conclude that the potential for seismic settlement to occur at the Site is low. Nevertheless, our report includes recommendations for overexcavation and replacement of loose or soft soils that are encountered at the bottom of shallow foundation excavations.

# 7 CONCLUSIONS

## 7.1 General

Based on the results of our field investigation, it is our opinion that the proposed improvements are geotechnically feasible and that the Site may be developed as presently planned. This conclusion is based on the assumption that the recommendations presented in this report will be incorporated into the design and construction of this project.

The main geotechnical concerns for the proposed improvements are the presence of moderately expansive and potentially compressible surficial clayey soils, the potential for moderate to intense ground shaking to affect the Site during a future significant seismic event (typical of the entire San Francisco Bay Area), and the presence of shallow groundwater. While the presence of expansive soils poses additional challenges to the proposed improvements, there are conventional methods which can aid in mitigating the effects of expansive soil, which are incorporated into the recommendations presented in this report. Also, the seismic provisions of the 2022 CBC should be incorporated into the project's design.

Additional discussions of the conclusions drawn from our investigation, including general recommendations, are presented below. Specific recommendations regarding geotechnical design and construction aspects for the project are presented in the "Recommendations" section of this report.

## 7.2 Settlements

### 7.2.1 Differential Settlements

Differential settlement is defined herein as the vertical difference in settlement between adjacent foundation supports or across a horizontal distance of 30 feet, whichever is less.

### 7.2.2 Elastic Settlements

Our report includes recommendations for overexcavation and replacement of loose or soft soils that are encountered at the bottom of shallow foundation excavations. Based on that and the subsurface conditions encountered in our current and previous exploration points in the Site area, we expect total elastic settlement (i.e., static loading) at the Site for shallow foundations consisting of spread footings and mat foundations to be up to ½-inch and differential elastic settlement to be up to ¼-inch. Most of the elastic settlement is expected to occur during construction as loads are applied.

We expect elastic settlement for cast-in-drilled-hole (CIDH) piers to be negligible.

### 7.2.3 Consolidation Settlements

In addition to elastic settlement, the shallow foundations could also experience consolidation settlement associated with the potentially compressible clay layer identified in the current boring B-1 and CPT-1. As

discussed in the "Compressible Soils" section of this report, we estimate approximately 1-inch of total consolidation settlement for spread footings and 1 to 2 inches for mat foundations. In order to limit the total consolidation settlement for mat foundations to 1-inch, we are recommending that this foundation type be designed for an average bearing pressure of 500 psf with localized maximum bearing pressures of up to 1,000 psf. With these bearing pressures, we estimate that differential consolidation settlement could be up to ½-inch. We estimate that at least 95 to 100 percent of the consolidation settlement would occur within 1 to 2 years after the new foundations are constructed.

We do not expect cast-in-drilled-hole (CIDH) piers to be susceptible to consolidation settlement because such piers would extend below the potentially compressible clay layer.

### 7.2.4 Liquefaction-Induced Settlements

Based on our current investigation and our past studies within the hospital campus, we anticipate up to 1-inch and ½-inch of total and differential liquefaction-induced settlement, respectively, could occur at the Site. Such settlement could affect spread footings, mat foundations, CIDH piers extending to depths of 40 feet BGS or less, and slabs-on-grade.

### 7.2.5 Combined Settlements

The settlement estimates discussed above should be treated as cumulative from a design standpoint. Therefore, for shallow foundations consisting of spread footings and mat foundations, up to 2½ inches of total settlement and up to 1¼ inches of differential settlement could occur at the Site.

Total and differential settlements for CIDH piers would be limited to the potential liquefaction-induced settlement of 1-inch total and ½-inch differential.

Note that the total elastic and consolidation settlements discussed would occur differentially to the existing hospital building. Therefore, consideration should be given to structurally separating the new and existing structures.

### 7.2.6 Interior Slab Settlements

Based on our experience with similar projects, we expect that dead plus live loading for interior floor slabs to be in the range of approximately 50 to 100 psf. Therefore, we expect elastic settlement for standard interior slab-on-grade floors to be negligible provided they are properly designed and constructed based on the recommendations presented in this report. However, such slabs could still be susceptible to total and differential consolidation settlements of less than ¼-inch, and total and differential liquefaction-induced settlements of 1-inch and ½-inch, respectively, unless they are designed as structural slabs that span unsupported between adjacent foundations.

## 7.3 Mitigation of Foundation and Interior Slab Settlements

Based on the anticipated elastic, consolidation, and liquefaction-induced settlements discussed above information, consideration should be given to implementing one or possibly a combination of the following mitigation measures for this project:

- Found the planned hospital addition on shallow spread footings interconnected by grade beams to form a stiffened foundation system in addition to using an interior structural slab designed to span unsupported between footings and grade beams. This option would not eliminate the total elastic, consolidation, and liquefaction-induced settlements, but should reduce the combined differential elastic, consolidation, and liquefaction-induced settlement to about half (or approximately ¾-inch).
- Found the planned hospital addition building on a thick mat foundation (i.e., 12- to 24-inch thick) designed to reduce differential settlement. This option would not eliminate the total elastic, consolidation, and liquefaction-induced settlements, but should reduce the combined differential elastic, consolidation, and liquefaction-induced settlement to about half (or approximately ¾-inch).
- Found the planned hospital addition on CIDH piers extending to depths of up to 40 feet BGS in addition to using an interior structural slab designed to span unsupported between the piers. This option would eliminate total elastic and consolidation settlements but would not eliminate the estimated total and differential liquefaction-induced settlements of 1-inch and ½-inch, respectively.
- Perform ground improvement to a depth of about 10 feet BGS, such as compacted aggregate piers, under the planned hospital addition. For this option, the planned hospital addition could then be founded on regular spread footings possibly in combination with a standard interior slab-on-grade floor or an interior structural slab designed to span unsupported between adjacent foundations. This option would eliminate total elastic and consolidation settlements for the foundations but would not eliminate the estimated total and differential liquefaction-induced settlements of 1-inch and ½-inch, respectively.

  If ground improvement is only performed underneath perimeter and interior spread footings and not underneath the interior slab-on-grade floor, such floors would still be subject to the combined total and differential consolidation and liquefaction-induced settlements of 1¼ inches and ¾-inch, respectively. Also, this option could lead to differential consolidation settlement on the order of ¼-inch between the interior slab-on-grade floor and interior/perimeter foundations where they meet.

## 7.4 Shallow Groundwater

As discussed in the “Subsurface Conditions” section of this report, free groundwater was observed at depths ranging from about 4½ to 14 feet BGS within current and previous borings performed at or near

the Site. However, the actual depth at which groundwater may be encountered in trenches and excavations may vary. Therefore, excavations deeper than about 4 feet BGS will likely require dewatering (possibly continuous) during construction. Consideration should be given to waterproofing below grade retaining walls, and the bottom of mat foundations and other sensitive improvements that will extend below the design groundwater depth of 4½ feet BGS.

As previously noted, groundwater levels can fluctuate several feet depending on factors such as seasonal rainfall, groundwater withdrawal, and construction activities on this or adjacent properties. This potential fluctuation should be taken into consideration when selecting the type of material and/or corrosion protection for underground utility lines and foundations.

## 7.5 Underpinning

Due to the proximity of the planned hospital addition to the existing building, underpinning of the existing building footings adjacent to the hospital addition may be required during the excavation activities for the planned hospital addition, such as footing excavations. Specific recommendations for underpinning the existing perimeter footings are provided in the “Site Preparation and Grading” section of this report.

# 8 RECOMMENDATIONS

Presented below are our recommendations for earthwork, foundations, ground improvement, retaining walls, interior slabs-on-grade, exterior concrete flatwork and pavers, pavements, landscaping and irrigation considerations, site drainage, and storm water runoff mitigation as well as associated construction considerations for the planned improvements at this Site.

## 8.1 Earthwork

### 8.1.1 Site Preparation and Grading

Our general site preparation and grading recommendations are as follows:

1. The areas to be graded should be cleared of debris, significant surface vegetation and obstructions including abandoned underground pipes, foundations and concrete slabs. Stripped surface organics should be stockpiled and may be reused only in landscaping areas or disposed off-site.
2. The root system of trees to be demolished should be removed such that there are no roots thicker than approximately 1-inch in diameter and the remaining organics are no greater than 3 percent by dry unit weight within the upper 5 feet of finished subgrade or the depth of the root ball, whichever is shallower and laterally a minimum of 5 feet beyond the limits of the improvements (defined as the outside perimeter of walls, spread footing, mat foundations, or pier cap outer limits, whichever results in the greatest building envelope) and 3 feet beyond the edge of flatwork, pavers, and pavement where achievable. A BSK representative should check the excavation bottoms before they are backfilled with engineered backfill[5].
3. Existing pipelines crossing the Site to be abandoned should be removed whenever feasible. Abandoned pipes to remain should be capped at both ends if smaller than 2 inches in diameter or be filled with 1-sack sand-cement slurry if greater than 2 inches in diameter. Existing pipelines to remain, including subdrain lines, should be carefully located and protected during demolition and during construction.
4. Existing foundations and below-grade structures to be abandoned within the project limits should be demolished and removed. The resulting excavations should then be properly backfilled with compacted engineered fill as recommended herein under the observation of a BSK representative.

[5] "Engineered fill/backfill" is defined in this report as suitable on-site soil and imported fill that is used to backfill excavations or raise site grade and is properly moisture conditioned and compacted per the requirements of this report. The requirements for the suitability of on-site soils and import fill are provided in the "Site Preparation and Grading" section of this report.

5. From a geotechnical standpoint only, the on-site soils are generally suitable for re-use as general engineered fill[6], provided they are free of debris, vegetation such that remaining organics are no greater than 3 percent by dry unit weight, and other deleterious matter and properly processed so that particle sizes are not greater than 3 inches in largest dimension. At least 90 percent by weight of the fill/backfill materials should be passing the 1-inch sieve. All fill materials should be subject to evaluation and approval by a BSK representative prior to their use.

   If zones of loose/soft or saturated soils, including in existing fill areas, are encountered during excavation and compaction, deeper excavations may be required to expose firm soils. This should be evaluated in the field by a BSK representative. Where deleterious matter is encountered in excavations, this material should be overexcavated and disposed off-site.

6. Controlled Low Strength Material (CLSM) typically consists of a mixture of cement, fly ash, coarse and fine aggregate, an air entrainment admixture, and water. CLSM should have a 28-day compressive strength of at least 50 pounds per square inch (psi) tested in conformance with ASTM D4832 and sampled in accordance with ASTM D5971. For future excavatability of the CLSM, its 28-day compressive strength should not exceed 1,000 psi. A minimum of one set of cylinders should be cast each day CLSM is placed. One flowability test should be conducted per ASTM D6103 each day CLSM is placed and should be at least 8 inches diameter prior to placement.

   The CLSM mix design should be reviewed by the design team and BSK for approval at least 10 business days prior to its use. CLSM placement should be observed and tested by a qualified representative of BSK.

7. Due to the proximity of the planned hospital addition to the existing building, underpinning of the existing building footings adjacent to the hospital addition may be required during the excavation activities for the planned hospital addition, such as footing excavations. This can be accomplished by excavating a 2- to 3-foot-thick section underneath the existing footings, or to the bottom of the planned new footing excavation, whichever is deeper, and backfilling the resulting excavation with CLSM (the excavation would need to be formed prior to backfill). The underpinning excavation should be performed in short segments no longer than 3 feet or as advised by the structural engineer with BSK's input. Consecutive segments should not be excavated until after the CLSM for the adjacent segments has reached a compressive strength of at least 50 psi. Multiple segments may be excavated simultaneously provided they are spaced at least 6 feet apart or as advised by the structural engineer with BSK's input.

   Alternative underpinning methods desired by the contractor should be subjected to review by BSK and the structural engineer at least 10 working days before implementation during construction. If an alternative underpinning method is submitted by the contractor, a formal submittal presenting the alternative method should be provided and it should be signed and

[6] "General engineered fill" is defined in this report as suitable on-site soil that is used to backfill excavations or raise site grade and is properly moisture conditioned and compacted per the requirements of this report. The requirements for the suitability of on-site soils are provided in the "Site Preparation and Grading" section of this report.

stamped by a Registered Structural Engineer in the State of California experienced in the underpinning method being proposed.

Regardless of which underpinning method is used, the contractor should be responsible for its safe conduct of workers and the integrity of the existing building. Should any signs of distress to the building be observed during the underpinning operation, the contractor should immediately notify the owner, BSK, and the structural engineer and immediately take steps to halt further distress. The contractor would then be responsible for mitigating the distress prior to proceeding with the underpinning operation again. BSK and the structural engineer should review any mitigation measures proposed by the contractor prior to their implementation. A BSK representative should perform periodic observation of the underpinning operations during construction.

8. Existing concrete flatwork and asphalt concrete (AC) may be pulverized and mixed with existing aggregate base for use as general engineered fill or "non-expansive" fill[7] if it meets the preceding gradation requirements. This material can also be used as Caltrans Class 2 aggregate base for future paved areas, exterior flatwork, and pavers provided it meets the gradation, R-Value, durability index, and sand equivalent requirements of Section 26 of the 2018 Caltrans Standard Specifications unless otherwise indicated by BSK during construction.

9. Proper granular bedding and shading should be used beneath and around new utilities. Imported fill material should not be classified as being more corrosive than "moderately corrosive." **Imported fill, including "non-expansive" fill,** should be granular in nature, adhere to the above gradation recommendations, and conform to the minimum criteria presented in Table 3 below (unless otherwise permitted by BSK). Highly pervious materials such as pea gravel or clean sands are not recommended because they permit transmission of water to the adjacent and/or underlying soils.

**TABLE 3**
**IMPORT FILL CRITERIA**

| | |
|---|---|
| Plasticity Index | 12 or less |
| Liquid Limit | Less than 30% |
| % Passing #200 Sieve | 8% – 40% (general fill)<br>Less than 8% (bedding and shading) |

10. Following stripping and removal of deleterious materials, the Site should be scarified to a minimum depth of 12 inches, moisture conditioned to near optimum moisture content, and re-compacted to a minimum of 90 percent relative compaction. Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density determined by ASTM D1557 compaction test procedures. Optimum moisture is the water content (percentage by dry weight) corresponding to the maximum dry density. Scarification and recompaction should extend laterally a minimum of 5 feet beyond the limits of structures (defined as the outside

[7] "Non-expansive fill" is defined as imported soil material that has a low expansion potential and meets the requirements for "non-expansive fill" provided in the "Site Preparation and Grading" section of this report.

perimeter of building walls or foundation outer limits, whichever results in the greatest building envelope) and 3 feet beyond the edge of flatwork, pavers, and pavements, where achievable.

11. Where fills/backfills are greater than 7 feet in depth below finish grade, the zone below a depth of 7 feet should be compacted to a minimum of 95 percent compaction.

9. **In areas to be exposed to vehicular traffic**, the upper 12 inches of the soil subgrade immediately below the aggregate base layer should be compacted to a minimum of 92 percent relative compaction at least 2 percent above the optimum moisture content for clayey soils and to a minimum of 95 percent relative compaction near optimum moisture content for granular soils. Subgrade preparation should extend a minimum of 3 feet laterally beyond the edge of flatwork, pavers, and pavements, where feasible. The aggregate base layer underneath such flatwork, pavers, and pavement should be compacted to a minimum of 95 percent relative compaction near optimum moisture content. In addition to these compaction requirements, areas to be exposed to vehicular traffic should be firm and stable and should be proof rolled with a heavy piece of construction equipment, such as a loaded dump truck or water truck, to check for signs of subgrade instability.

10. Compact the upper 12 inches of subgrade **bioretention areas** to no more than 85 percent compaction near optimum moisture content. No vibratory compaction should be applied to the subgrade for bioretention areas.

11. Unless otherwise indicated above, all fill and backfill should be placed in thin lifts up to 8-inch maximum uncompacted thickness, properly moisture conditioned to at least 2 percent over the optimum moisture content for clayey soils and to near optimum moisture content for granular soils, and compacted to at least 90 percent compaction per ASTM D1557. Aggregate base should be moisture conditioned to near-optimum moisture content.

12. Observations and compaction testing should be carried out by a BSK representative during grading and backfill operations to assist the contractor in obtaining the required degree of compaction and proper moisture content. Where the moisture content or compaction is outside the range required, additional compactive effort and adjustment of moisture content should be made until the specified compaction and moisture conditioning is achieved.

13. BSK should be notified at least 48 hours prior to any grading and backfill operations. The procedure and methods of grading may then be discussed between the contractor and BSK.

### 8.1.2 Weather/Moisture Considerations

If earthwork operations and construction for this project are scheduled to be performed during the rainy season (usually November to May) or in areas containing saturated soils, provisions may be required for drying of soil or providing admixtures, such as quicklime treatment, to the soil prior to compaction. Conversely, additional moisture may be required during dry months. Water trucks should be made available in sufficient numbers to provide adequate water during earthwork operations.

If unstable (i.e., pumping) subgrade conditions are exposed during construction, the pertinent areas should be evaluated by a BSK representative prior to mitigation. Possible mitigation measures could include the following:

- Do nothing if the area in question would not adversely affect site performance;
- 12-inch scarification followed by air/wind drying of the affected soils over a period of several days/weeks;
- Treating the upper 12 inches of the subgrade with between 3 to 5 percent of quicklime or cement by dry unit weight; and/or
- 12 inches of overexcavation, placement of geotextile fabric (such as Mirafi 600X or equivalent), and backfill with dryer on-site soil or Caltrans Class 2 aggregate base.

During the summer months, consideration could be given to lining the sides and/or bottoms of the foundation excavations with burlap and periodically moisturizing it in order to help maintain the moisture content and shape of the sides of the excavations if they will not be backfilled with concrete within a week of excavation, especially during hot, dry, windy weather conditions. Consideration could also be given to placing a "rat" slab at the bottom of shallow foundation excavations that consists of at least 2 inches of CLSM. The "rat" slab would serve a dual role of protection against moisture loss of the subgrade soils below the shallow foundations and helping protect the subgrade soils from being saturated during rainstorms. Prior to placing CLSM, the bottoms of shallow foundation excavations should be observed by a BSK representative to check that they are consistent with the soils encountered in our investigation, properly moisture conditioned, firm and stable, and provide adequate bearing.

The above preliminary mitigation measures are not all-inclusive and may need to be modified or enhanced during construction based on actual field conditions and BSK's input.

### 8.1.3 New Utility Trench Excavation and Backfill

All excavations should conform to current OSHA requirements for work safety. Where trenches or other excavations extend deeper than 5 feet, the excavations may become unstable and should be evaluated by the contractor to monitor stability prior to personnel entering the trenches. Shoring or sloping of any trench wall may be necessary to protect personnel and to provide stability. It is the contractor's responsibility to follow OSHA temporary excavation guidelines and grade the slopes with adequate layback or provide adequate shoring and underpinning of existing structures and improvements, as needed. Slope layback and/or shoring measures should be adjusted as necessary in the field to suit the actual conditions encountered, in order to protect personnel and equipment within excavations. Based on the subsurface conditions encountered in our borings, we expect the sidewalls of trenches that extend to depths of up to about 5 feet to remain relatively vertical for a period of several days unless poorly graded sandy layers are exposed in the trench sidewalls. Nevertheless, the longer the trenches remain open the higher the potential for the sidewalls to start to slough off or cave.

Free groundwater was observed in our current and previous borings as shallow as 4½ feet BGS. However, the actual depth at which groundwater may be encountered in trenches and excavations may vary. Provisions should be made to ensure that conventional sump pumps used in typical trenching and excavation projects are available during construction in case substantial runoff water accumulates within the excavations as a result of wet weather conditions or if groundwater is encountered in the excavations.

Material quality, placement, and compaction requirements for utility bedding and shading materials[8] should meet applicable agency requirements. Utility trench backfill above the shading materials may consist of on-site soils provided they are free of organics, debris, rock over 3 inches in largest dimension, and other deleterious material. Backfill materials should be placed in lifts not exceeding 8 inches in loose thickness, moisture conditioned, and compacted to the requirements provided in the "Site Preparation and Grading" section of this report.

Where new utility trenches extend from the exterior into the interior limits of a building or pavement, CSLM or lean concrete should be used as backfill material for a distance of 2 feet laterally on each side of the perimeter footing centerline, edge of mat foundation, or edge of pavements to reduce the potential for the trench to act as a conduit for exterior surface water. In addition, where new utilities cross through exterior footings, flexible waterproof caulking should be provided between the sleeve and the pipe. Utility trenches located in landscaped areas should also be capped with a minimum of 12 inches of compacted on-site clayey soils.

## 8.2 Foundation Recommendations

### 8.2.1 Spread Footings and Mat Foundations

We recommend the criteria presented in Tables 4 and 5 below be incorporated into the design of spread footings and mat foundations for this project. Due to the moderate expansion potential of the surficial soils, **a continuous perimeter footing should be constructed for the planned hospital addition** (unless it is supported on mat foundations) to reduce the potential for moisture fluctuation underneath the building, which could lead to vertical movement associated with shrinkage/swell cycles. As discussed in the "Mitigation of Foundation and Interior Slab Settlements" section of this report, **consideration should be given to interconnecting perimeter and interior spread footings via grade beams to reduce elastic and consolidation differential settlements**. Where existing underground structures, such as utility concrete vaults, are in conflict with the new perimeter footings or grade beams, either the existing underground structures would need to be relocated away from these structural elements or the configuration of the perimeter footings/grade beams would need to be modified to avoid the existing underground structures. Depending on the proximity and depth of the underground structures from the perimeter footings/grade beams, the walls for underground structures should be checked for surcharge loads imposed by these structural elements onto the existing underground structures or by the existing

[8] Bedding material typically consists of sand used to backfill a few inches (typically 3 to 6 inches) below the invert elevation of a pipe. Shading material typically consists of sand used to backfill around and a few inches (typically 6 to 12 inches) above the top of a pipe.

underground structures onto these structural elements. Please refer to the "Surcharge Loading" section of this report for additional recommendations.

**In addition, if loose/soft soil is encountered immediately below the footing/mat foundation excavations, the foundation excavation should be overexcavated to expose firm and stable soil or to a depth of 24 inches deeper than the design depth of the foundation, whichever is shallower. The overexcavated zone should then be backfilled with CLSM or lean concrete.**

**TABLE 4**
**FOOTING DESIGN CRITERIA**

| | |
|---|---|
| Static Allowable Bearing Capacity[1,5,6] | 2,500 psf (4,000 psf) |
| Seismic/Wind Allowable Bearing Capacity[1,5,6] | 3,750 psf (6,000 psf) |
| Passive Resistance (Equivalent Fluid Pressure)[2,3] | 300 pcf |
| Allowable Lateral Sliding Resistance Adhesion[3] | 250 psf |
| Minimum Embedment Depth[4] | 24 inches |
| Minimum Width | 12 inches (continuous)<br>18 inches (isolated) |

Notes:

1. These are net values and include a factor of safety of at least 3 for static loading and at least 2 for transient loading (i.e., seismic or wind conditions). **Values shown in parenthesis may only be used for footings that are supported on ground improved soils (values must be confirmed by the ground improvement contractor).**
2. Neglect upper 1 foot if surface is not confined by concrete slab or pavement. **For foundations located on or proximate to sloping ground such as bioretention areas, the passive resistance should be neglected in the upper portion of the foundation until there is a horizontal distance of at least 7 feet between the slope face and the nearest edge of the foundation.**
3. The sliding resistance and passive resistance may be used concurrently, and the passive resistance can be increased by one-third for wind and/or seismic loading. Values include a factor of safety of at least 1½. The sliding resistance adhesion should be multiplied by the foundation area to obtain horizontal sliding resistance.
4. Below lowest adjacent grade considered to be bottom of slab on the interior or finished grade on the exterior.
5. The static and seismic/wind allowable bearing capacities may be increased to 3,000 psf and 4,500 psf, respectively, for elevator pit footings that are embedded at least 7 feet BGS.
6. Where footings need to resist uplift loading, they could be oversized to provide more counterweight to resist the uplift loads and/or be connected to hold down drilled piers designed based on the recommendations of the "Shallow Drilled Piers" section of this report. Such hold down drilled piers should **only** be designed to resist uplift loads (i.e., the downward capacity of such piers should be **excluded** from the footing design) and should be located at the center of the footings to avoid causing eccentricity of the footings.

| TABLE 5<br>MAT FOUNDATION CRITERIA[1] | |
|---|---|
| Average Static Allowable Bearing Capacity[2] | 500 psf |
| Average Seismic/Wind Allowable Bearing Capacity[2] | 750 psf |
| Passive Resistance (Equivalent Fluid Pressure)[3, 4] | 300 pcf |
| Allowable Coefficient of Friction[4] | 0.30 |
| Modulus of Vertical Subgrade Reaction[5] | 60 psi/in |
| Minimum Slab Thickness[6] at the Edges | 18 inches |

Notes:

1. Mat foundations should be supported on a minimum of 12 inches of compacted Caltrans Class 2 aggregate base to provide enhanced slab support. If moisture vapor through the slab is objectionable (i.e., moisture sensitive flooring or objects will be placed over slabs), a vapor barrier at least 15 mils thick (meeting the requirements of the "Floor Slab Moisture" section of this report) and capillary moisture break consisting of a minimum 6-inch-thick layer of crushed drain rock (meeting the requirements of the "Interior Floor Slabs" section of this report) should be installed underneath mat foundations. If used, the crushed drain rock layer may substitute an equivalent amount of the recommended aggregate base layer. The crushed rock layer should be ¾-inch maximum size with no more than 10 percent by weight passing the No. 4 sieve.
2. These are net values and include a factor of safety of at least 3 for static loading and at least 2 for transient loading (i.e., seismic or wind conditions). The values provided represent average values. Localized areas of the mat foundation may be loaded up to double the average allowable values provided herein.
3. Neglect upper 1 foot if surface is not confined by concrete slab or pavement. **For foundations located on or proximate to sloping ground, such as bioretention areas, the passive resistance should be neglected in the upper portion of the foundation until there is a horizontal distance of at least 7 feet between the slope face and the nearest edge of the foundation.**
4. The allowable coefficient of friction and passive resistance may be used concurrently, and the passive resistance can be increased by one-third for wind and/or seismic loading. Values include a factor of safety of at least 1½. The coefficient of friction should be multiplied by the normal force to obtain the sliding resistance.
5. Based on a one square foot bearing plate. This unadjusted value needs to be adjusted for the actual size of the mat as follows:
    a. Multiply by [(m+0.5)/(1.5 x m)] where m is the ratio of the mat length divided by its width (unitless).
    b. If a computer program is used to design the mat for this project and it requires the input of a modulus of subgrade reaction for the Site, the designer should check whether the program requires input of the unadjusted or adjusted modulus of vertical subgrade reaction.
6. Below lowest adjacent finished grade. The thickened edge should be a minimum of 12 inches wide. The slab designer should determine the slab concrete thickness and reinforcing.

### 8.2.3 Additional Considerations for Shallow Foundations

Where foundations are located adjacent to below-grade structures (including existing footings) or near major underground utilities, the bottom of the foundation should extend 9 inches below a 2H:1V (horizontal to vertical) plane projected upward from the bottom of the structure foundation or bottom of the underground utility to avoid surcharging the below grade structure and underground utility with foundation loads. Where this is not possible or feasible, we recommend that CLSM be used to backfill the portion of the utility trench that extends below the 2H:1V projection. Also, if a utility crosses perpendicular

to a footing, if it is located within 2 x W of the bottom of the footing, where W = width of footing, the utility should be encased in CLSM or lean concrete. If a perpendicular utility is located below a depth of 2 x W below the footing, the utility does not need to be encased in CLSM or lean concrete, but the trench should be backfilled with impervious material a distance of 2 feet laterally on each side of the perimeter footing centerline, edge of mat foundations, as recommended in the "New Utility Trench Excavation and Backfill" section of this report. In addition, where utilities cross through footings, flexible waterproof caulking should be provided between the sleeve and the pipe. Utility plans should be reviewed by BSK prior to trenching for conformance to these requirements.

Concrete for foundations should be placed neat against firm native soil or engineered fill. **It is critical that foundation excavations not be allowed to dry before placing concrete.** If shrinkage cracks appear in the foundation excavations, the excavations should be thoroughly moistened to close all cracks prior to concrete placement. The foundation excavations should be monitored by a representative of BSK for compliance with appropriate moisture control and to confirm the adequacy of the bearing materials.

### 8.2.4 Shallow Drilled Piers

**Ancillary, non-critical structures, such as light poles, fences, and gates, can be supported on shallow drilled piers.** We recommend the criteria presented in Table 6 below be incorporated into the design of shallow drilled pier foundations for this project. We expect elastic and consolidation settlements for shallow drilled piers to be negligible. However, such piers would still be susceptible to total and differential liquefaction-induced settlements of up to 1-inch and ½-inch, respectively.

Recommendations for deeper cast-in-drilled hole (CIDH) piers appropriate for support of the planned hospital addition are provided below in subsequent sections of this report.

| TABLE 6<br>SHALLOW DRILLED PIER FOUNDATION CRITERIA | |
|---|---|
| Static Allowable Downward Skin Friction[1] | 250 psf |
| Seismic/Wind Allowable Downward Skin Friction[1] | 330 psf |
| Passive Resistance (Equivalent Fluid Pressure)[2] | 300 pcf |
| Minimum Pier Diameter | 12 inches |
| Minimum Pier Depth Below Ground Surface | 5 feet (3 feet)[3] |
| Minimum Pier Center to Center Spacing | 3D[4] (axial loading)<br>6D[4,5] (lateral loading) |

Notes:

1. These are net values and include a factor of safety of at least 2 for static loading and at least 1½ for transient loading (i.e., seismic or wind conditions). Uplift resistance may be taken as 2/3 of downward capacity. Weight of piers may be used to resist upward loading.
2. Neglect upper 1 foot if surface is not confined by concrete slab or pavement. **For piers located on or proximate to sloping ground, such as bioretention areas, the passive resistance should be neglected in the upper portion of the piers until there is a horizontal distance of at least 7 feet between the slope face and the nearest edge of the piers.** Passive resistance should be limited to 2,000 psf and may be applied to twice the diameter of the piers. Passive resistance may be increased by 1/3 for seismic or wind loads. Value includes a factor of safety of at least 1½.
3. The pier embedment depth may be reduced to 3 feet for chain link fences and chain link gates that are up to 6 feet in vertical height.
4. D = pier diameter. Minimum spacing for lateral loading only applies to piers aligned in the direction of loading (i.e., one or more piers shadow another pier).
5. For **piers spaced less than 6D apart** and where the loading direction is such that there is one or more trailing pier(s) shadowing the leading pier, reductions to lateral capacity of the trailing pier(s) should be applied as follows:
    a. For trailing[9] piers spaced 3D (D = pier diameter) apart, reduce trailing pier capacity by 50 percent (multiply contribution of trailing piers to group capacity by 0.5),
    b. For trailing piers spaced between 4D and 5D apart, reduce trailing pier capacity by 40 percent (multiply contribution of trailing piers to group capacity by 0.6),
    c. For trailing piers spaced 6D or greater apart, no reduction is needed, and
    d. For trailing piers spaced between 3D and 4D apart and 5D and 6D apart, interpolate the reduction factors provided above.

### 8.2.5 Axial Capacity of CIDH Piers

Plots illustrating the net ultimate downward (compressive) axial capacity of a unit (1-foot) diameter, straight-sided, cast-in-drilled-hole (CIDH) pier foundation installed from the existing ground surface are shown on Figures 13 and 14. The first plot (Figure 13) should be used to design piers if the interior slab for the planned hospital addition will consist of a reinforced structural slab designed to span unsupported between piers (no downdrag condition). The second plot (Figure 14) should be used to design piers if the interior slab for the planned hospital addition will consist of a standard slab-on-grade floor (downdrag

[9] The leading pier is defined as the pier that has no pier in front of it in the direction of lateral loading, while the trailing pier is defined as the pier that is behind (i.e., shadows) the leading pier in the direction of lateral loading.

condition). The axial capacity for piers with diameters larger than 1-foot may be obtained by multiplying the capacity for the 1-foot diameter pier presented on Figures 13 and 14 by the desired pier diameter (in units of feet). The plots are applicable for piers of up to 60 inches in diameter.

Due to the presence of the potentially compressible clay layer at the Site, the axial capacity plot shown on Figure 14 includes a downdrag zone (associated with consolidation of the potentially compressible clay layer due to the addition of the interior slab load) where axial capacity of CIDH piers should be neglected. It also provides a recommended drag load that should be included in the design of the CIDH piers unfactored. **This drag load should not be used to resist uplift loads for the project because this would result in unconservative design.**

The axial capacity was computed based on the Federal Highway Administration (FHWA) procedures for design of drilled piers (Brown et al., 2010)[10] using the computer program SHAFT (version 2012). Our SHAFT output file is presented in Appendix F of this report. The ultimate uplift capacity may be obtained by multiplying the ultimate frictional compressive capacity by 2/3 and by adding the weight of the pier foundation. The weight of the foundation is not included in the allowable resistance shown on Figures 13 and 14. Piers should be at least 18 inches in diameter and have a minimum spacing (center to center) of three pier diameters or BSK should be contacted to provide a reduced vertical capacity.

The ultimate downward axial capacity does not include end-bearing due to strain incompatibility issues associated with the installation of CIDH piers (i.e., the piers need to settle a certain amount, typically 5 percent of the pier diameter, upon loading before the end bearing capacity can be mobilized).

### 8.2.6 Lateral Capacity of CIDH Piers

We estimated the displacement, shear, and bending moment for 18- and 24-inch diameter CIDH piers under lateral loads using the linear-elastic model in the computer program Lpile (version 2018.10.07). Our Lpile output files are presented in Appendix F of this report. Both fixed-head (no pile top rotation allowed) and free-head (pile top rotation allowed) conditions were analyzed. If a different diameter CIDH pier is proposed, BSK should be consulted to provide an updated Lpile analysis.

Figures 15 through 20 present the Lpile deflection, shear force, and bending moment versus pier length for each pier size analyzed for ¼-, ½-, ¾-, and 1-inch lateral displacements at the pier top. As noted in these figures, the plots are based on unfactored values and the designer should consider applying a factor of safety to the results. **The plots shown on Figures 15 through 20 apply only to piers spaced at least 6 diameters apart (center to center) or where the loading direction is such that there is no trailing pier shadowing the leading pier.** For piers spaced less than 6 diameters apart and where the loading direction

[10] Brown, D.A., Turner, J.P., and Castelli, R.J. (2010), Drilled Shafts: Construction Procedures and LRFD Design Methods, prepared for U.S. Department of Transportation, Federal Highway Administration, Publication No. FHWA-NHI-10-016, 2010.

is such that there is one or more trailing pier(s) shadowing the leading pier, reductions to lateral capacity of the trailing pier(s) should be applied as follows:

- For trailing piers spaced 3D (D = pier diameter) apart, reduce trailing pier capacity by 50 percent (multiply contribution of trailing piers to group capacity by 0.5),
- For trailing piers spaced between 4D and 5D apart, reduce trailing pier capacity by 40 percent (multiply contribution of trailing piers to group capacity by 0.6),
- For trailing piers spaced 6D or greater apart, no reduction is needed, and
- For trailing piers spaced between 3D and 4D apart and 5D and 6D apart, interpolate the reduction factors provided above.

### 8.2.7 Bearing and Lateral Capacity of Pier Caps

**Except for the allowable friction coefficient at the bottom of the pier caps (i.e., it shall be excluded)**, the same bearing and lateral capacity parameters recommended in Table 4 above may be used for the design of pier caps for both static and seismic conditions, except that the contributory area associated with the piers underneath the pier caps should be excluded for bearing capacity purposes. Mobilization of passive resistance will require lateral movement of up to 0.004H to 0.04H, where H is the height of the pier cap embedded in the soil. The applicable pier cap capacities may be used concurrently with the CIDH pier capacities.

### 8.2.8 Additional Considerations for CIDH Piers and Shallow Drilled Piers

We recommend that CIDH pier and shallow drilled pier steel reinforcement and concrete be placed within about 4 to 6 hours upon completion of each drilled hole. As a minimum, the holes should be poured the same day they are drilled. If the holes cannot be backfilled the same day they are drilled, the hole needs to be checked for caving, sloughing or squeezing prior to setting the rebar cage and checked again before pouring concrete. The steel reinforcement should be centered in the drilled hole. Concrete used for pier construction should be discharged vertically into the holes to reduce aggregate segregation. Under no circumstances should concrete be allowed to free-fall against either the steel reinforcement or the sides of the excavation during construction.

As discussed in the “Subsurface Conditions” section of this report, free groundwater could be less than 5 feet BGS at the Site. However, the actual depth at which groundwater may be encountered in excavations may vary. If water more than 6 inches deep is present during concrete placement, either the water needs to be pumped out or the concrete needs to be placed into the hole using tremie methods. If tremie methods are used, the end of the tremie pipe must remain below the surface of the in-place concrete at all times. Unit prices for dewatering and/or tremie placement methods should be obtained during the bidding process.

Concrete for piers should be designed and placed in general conformance with the recommendations provided in ACI 336.3R-14, Design and Construction of Drilled Piers[11]. The recommendations provided within ACI 336.3R-14 should be followed, in particular when concrete placement is necessary below groundwater level, in caving or sloughing soils, or in sand, which may necessitate casing or the slurry displacement method for concrete placement. These methods require concrete placement at higher slumps than "dry" conditions and concrete mix specifications, including the addition of concrete admixtures and consideration of consolidation methods, should be provided by the design team. If temporary casing is used, it should consist of smooth walled steel. **Corrugated metal pipe (CMP) should not be used as temporary casing because it has a tendency to create voids or disturbed zones during removal and temporary smooth-walled casing should not be permanently left in the pier hole unless BSK is consulted.**

The pier excavations should be monitored by a representative of BSK to confirm the adequacy of the bearing materials and check that the contractor properly mitigates the presence of groundwater and caving conditions during installation of the piers.

### 8.2.9 Surcharge Loading

A surcharge load should be applied to the new footings, mat foundations, or pier caps where these structural elements are located below a 2H:1V line projected down from a point located 9 inches above the bottom of the outboard edge of nearby footings for the existing building or existing underground structures. We recommend that uniform vertical and horizontal pressures equal to 100 and 50 percent of the allowable bearing pressure for existing footings/underground structures, respectively, be used as the surcharge pressure for the affected structural elements.

If the new footings or mat foundations are located above a 2H:1V line projected up from the bottom of nearby footings for the existing building or existing underground structures, we recommend that uniform vertical and horizontal pressures equal to 100 and 50 percent of the allowable bearing pressure for new footings and mat foundations, respectively, be used as the surcharge pressure for the affected existing footings/underground structures.

A possible way to avoid surcharging new structural elements, existing footings, or existing underground structures, would be to underpin existing footings and existing underground structures with CLSM or deepen the new structural elements, so that their bottoms are at the same depth relative to each other.

Additional analyses during design may be needed to evaluate the effects of non-uniform surcharge loads such as point loads, line loads, or other such presently undefined surcharge loads. In that case, BSK should be consulted for supplemental geotechnical recommendations.

If the new footings, mat foundations, or pier caps are located within a lateral distance equivalent to twice the thickness of these structural elements or 7 feet, whichever is lower, from the nearby existing footings

[11] ACI Committee 336, 2014

for the existing building or existing underground structures, then the allowable passive pressure between the new structural elements and the existing footings/underground structures should be assumed to impact each other. Where this is the case, BSK should be consulted for supplemental geotechnical recommendations.

### 8.2.10 Soil Anchors

We understand that the design team is planning to use soil anchors to anchor down relocation trailers for this project. The location of such trailers and detailed information about the soil anchors were not available to BSK during preparation of this report except that Abesco cross drive anchors with stabilizer plates are anticipated to be used.

BSK's experience with this type of foundation is that it is proprietary and the design is based on empirical correlations provided by the manufacturer based on pre-selected soil profile types/properties. So, BSK does not typically provide any type of capacity recommendations for this type of foundation. This is similar to helical anchors, where the capacity of the anchors is based on empirical correlations provided by the manufacturer and the torque applied during installation of the helical anchors is used in the field to confirm the capacity of the anchors. Typically, at least one helical anchor is proof loaded to confirm the capacity of the anchors. So, we anticipate that a certain percentage of the soil anchors will need to be proof loaded in tension after installation to confirm that they meet the manufacturer's expected capacity based on the selected soil profile type.

Once additional information for the soil anchors is available, BSK should be consulted, so that we can assist the design team with selection of an appropriate soil profile type, selection of the minimum embedment length of the soil anchors, and selection of the minimum specified number of soil anchors to be proof loaded during construction.

## 8.3 Ground Improvement

Based on the subsurface conditions encountered at the Site, we believe that compacted aggregate piers (or similar methods, such as Geopier® elements) could be used successfully underneath the planned hospital addition to mitigate the consolidation settlement associated with the potentially compressible clay layer. This method also can provide greater bearing capacity for shallow foundations constructed above the ground improvement columns.

At this time, we anticipate that the zone requiring ground improvement would need to extend to a depth of about 10 feet BGS. **On a preliminary basis**, we anticipate spacings of 8 to 10 feet on centers between ground improvement columns and column diameters of 18 to 36 inches. The ground improvement columns need to be installed below the footprint of foundations and interior slab. **If ground improvement columns are not installed underneath the interior slab, then the slab should be designed for one of the following alternatives:**

1. The interior slab should be designed as a structural slab that spans unsupported between adjacent

foundations, or

2. The differential settlement between the interior slab-on-grade floor and interior/perimeter foundations discussed in the "Mitigation of Foundation and Interior Slab Settlements" section of this report should be incorporated into the building's design.

**The final spacing, diameter, and depth of the ground improvement columns should be designed by a qualified and experienced ground improvement contractor based on magnitude and distribution of the structural loads.**

Ground improvement contractors bidding on this project individually or as subcontractors to the general contractor should demonstrate a minimum of 5 years of continuous experience designing and installing ground improvement columns in similar subsurface conditions as that found at the Site. They should also provide examples of instances of when things went wrong during particular projects and how they were remediated during construction. BSK should be provided with an opportunity to review the ground improvement plans before they are finalized to confirm they satisfactorily address BSK's findings and recommendations.

During construction, a BSK representative should observe the installation of the ground improvement columns to check that they are consistent with the ground improvement plans.

## 8.4 Retaining Walls

We anticipated that below-grade retaining walls up to 7 feet in height may be constructed for the elevator pit(s). Such walls may be supported on spread footings per the recommendations presented in the "Spread Footings and Mat Foundations" section above. Based on our experience, the walls for the elevator pit(s) will likely be restrained (i.e., at-rest earth pressure condition will apply). Due to the presence of shallow groundwater at the Site, we recommend designing the walls to resist an undrained equivalent fluid at-rest pressure of 90 pounds per cubic foot (pcf). **The back of the walls and the bottom of the foundation for the walls (including the interior slab for the elevator pit(s) should be waterproofed.** In addition, the elevator pit's foundation should be designed to resist a buoyancy force equivalent to a design groundwater depth of 4½ feet BGS. See the "Uplift Loading Due to Buoyancy" below for additional recommendations.

### 8.4.1 Seismic Wall Pressures

According to Section 1803A.5.12 of the 2022 CBC, dynamic seismic lateral earth pressures need to be included in the design of retaining walls supporting more than 6 feet of backfill height. We understand that the elevator pits could be up to 7 feet deep for this project. Therefore, based on Agusti and Sitar (2013) and a PGA value of 0.37g (as recommended in the site response analysis presented in Appendix G of this report), we recommend using seismic pressures of 11 and 22 pcf for unrestrained and restrained walls, respectively. The seismic earth pressure should be applied as a triangular distribution with the resultant force acting 1/3 times the wall height above the base of the wall.

### 8.4.2 Surcharge Loads

Surcharge loads caused by vehicular and/or construction traffic adjacent to the walls may be assumed to consist of a rectangular distributed uniform pressure of 100 psf acting over a depth of 10 feet below the ground surface of the retained soil. For other surcharge loads, a rectangular distribution with a uniform pressure equal to one-third and one-half of the surcharge pressure should be used for an unrestrained wall (active earth pressure condition) and for a restrained wall (at-rest earth pressure conditions), respectively. The wall designer should evaluate whether this surcharge is appropriate for the expected traffic loading. Additional analyses during design may be needed to evaluate the effects of non-uniform surcharge loads such as point loads, line loads, or other such presently undefined surcharge loads. In that case, we should be consulted for supplemental geotechnical recommendations.

### 8.4.3 Uplift Loading Due to Buoyancy

Below-grade structures for this project should be designed to resist a buoyancy force based on a recommended design groundwater depth of 4½ feet BGS. The weight of the below-grade structures may be used to resist this uplift pressure as well as friction between the below-grade structure walls and the surrounding backfill. An allowable friction coefficient of 0.25 between the walls and surrounding backfill may be used. This value includes a factor of safety of about 1½. Normal pressures of 60D psf and 30D psf above and below the design groundwater depth, respectively, where D is the depth in feet of the below-grade structure below the ground surface, may be used to compute the normal force to be used with the allowable friction coefficient.

If a mat foundation is used to support below-grade structures and mat foundation extends laterally beyond the outboard edge of the below-grade structure's wall limits to form a "lip", the weight of the backfill above the lip plus a soil wedge extending upward at a 65-degree angle from the horizontal from the edge of the lip may be used to resist uplift pressure in lieu of the wall friction discussed in the paragraph above. Effective soil unit weights of 120 and 58 pcf may be used above and below the design groundwater depth, respectively.

If additional resistance to buoyancy is required, this could be provided via use of thicker walls and a greater weight for the below-grade structures, placing CLSM/lean concrete backfill above the lip of the mat foundation extending beyond the walls, or using hold down drilled piers.

## 8.5 Slabs-on-Grade

Slabs-on-grade for this project may consist of concrete floor slabs and exterior flatwork and pavers. The near-surface soils are moderately expansive and will be subject to shrink/swell cycles with fluctuations in moisture content. To reduce these potentially adverse effects, we recommend that interior concrete slabs and exterior flatwork/pavers be underlain by 18 inches and 6 inches of "non-expansive" engineered fill, respectively, placed on subgrade prepared as described in the "Site Preparation and Grading" section of this report. The properties of this "non-expansive" fill should meet the criteria listed in the "Site

Preparation and Grading" section of this report. See below for additional criteria for interior floor slabs. As discussed in the "Interior Floor Slabs" section below, the upper 6 inches of the 18-inch "non-expansive" fill below interior slabs should consist of crushed drain rock.

The "non-expansive" fill should extend minimum horizontal distances of 5 feet beyond all building areas (defined as the outside perimeter of building walls or foundation outer limits, whichever results in the greatest building envelope) and 3 feet elsewhere, such as for exterior flatwork and pavers. The lateral over-build zone of "non-expansive" fill can be eliminated where landscaping is planned; however, it is important that the "non-expansive" fill extends to the edge of the structural improvements. Therefore, special care should be exercised during surveying and staking of the building limits during construction. Alternatively, the over-build zone of the "non-expansive" fill could proceed as recommended and then be removed from within landscaping areas afterwards prior to planting. If "non-expansive" fill is used, it is important that placement of this material be done as soon as possible after compaction of the subgrade to prevent drying of the native subgrade soils and that slabs be constructed as soon as possible after "non-expansive" material is placed, as subgrades will dry out even through "non-expansive" fills. A representative of BSK should be present to observe the condition of the subgrade and observe and test the installation of the "non-expansive" engineered fill.

**Where "non-expansive" fill is removed to install utilities within building limits, exterior flatwork, pavers, or pavement, this layer should be backfilled with new imported "non-expansive" fill or Caltrans Class 2 aggregate base and not the "non-expansive" fill that was removed from the trench. This is because it is difficult to keep "non-expansive" fill separated from other soil excavated from the trench.**

### 8.5.1 Interior Floor Slabs

**As discussed in the "Mitigation of Foundation and Interior Slab Settlements" section of this report, depending on the settlement tolerance of the planned improvements, interior slabs may need to be designed as structural slabs that can span unsupported between adjacent foundations.**

Concrete floor slabs should be supported on at least 6 inches of crushed drain rock to enhance subgrade support for the slab and provide a capillary moisture break. This material may be considered part of the required minimum of 18 inches of the recommended "non-expansive" fill layer. If moisture vapor through interior slabs is objectionable (i.e., moisture sensitive flooring or objects will be placed over slabs), a vapor barrier at least 15 mils thick (meeting the requirements of the "Floor Slab Moisture" section of this report) should be placed above the crushed drain rock layer and the crushed drain rock material should be ¾ inch maximum size with no more than 10 percent by weight passing the No. 4 sieve. It is important that placement of this material and concrete be done as soon as possible after compaction of the "non-expansive" fill to reduce drying of the subgrade.

A Structural Engineer should design the reinforcing and slab thickness. The floor slab should be separated from footings, structural walls, and utilities and provisions made to allow for settlement or swelling

movements at these interfaces, such as the potential differential settlement discussed in the "Mitigation of Foundation and Interior Slab Settlements" section of this report.

### 8.5.2 Floor Slab Moisture

Subsurface moisture and moisture vapor naturally migrate upward through the soil and, where the soil is covered by a building or pavement, this subsurface moisture will collect. To reduce the impact of the subsurface moisture and potential impact of future introduced moisture (such as landscape irrigation or precipitation), **a vapor barrier should be incorporated into the floor slab design in all areas where moisture sensitive floor coverings, coating, underlayments, adhesives, moisture sensitive goods, humidity-controlled environments, or climate-cooled environments are anticipated initially or in the future**. The vapor barrier should consist of a minimum 15 mil extruded polyolefin plastic, such as 15 mil Stego® Wrap vapor barrier or equivalent. The vapor barrier material should not include any recycled or woven materials and should have a permeance (as tested before and after mandatory conditioning per ASTM E1745 Section 7.1, latest edition) of less than 0.01 perms and should comply with ASTM E1745 Class A requirements. The vapor barrier should also meet Sections 8.1 and 9.3 of ASTM E1745 and subsequent documentation should be provided by the vapor barrier manufacturer. The vapor barrier should be installed in accordance with ASTM E1643, latest edition, including proper perimeter seal, such as Stego® Crete Claw® tape.

The vapor barrier should be placed directly over the crushed rock layer recommended in the "Interior Floor Slabs" section of this report. **A sand layer should not be placed between the vapor barrier and the concrete slab or it could serve as a reservoir for trapped moisture that could lead to long-term vapor transmission through the slab.**

It should be noted that although vapor barrier systems are currently the industry standard, these systems may not be completely effective in preventing floor slab moisture problems. These systems typically will not necessarily assure that floor slab moisture transmission rates will meet floor-covering manufacturer standards and that indoor humidity levels be appropriate to inhibit mold growth. The design and construction of such systems are dependent on the proposed use and design of the proposed building and all elements of building design and function should be considered in the interior slab-on-grade floor design. Building design and construction have a greater role in perceived moisture problems since sealed buildings/rooms or inadequate ventilation may produce excessive moisture in a building and affect indoor air quality.

Various factors such as surface grades, adjacent planters, the quality of slab concrete and the permeability of the on-site soils affect slab moisture and can control future performance. In many cases, floor moisture problems are the result of either improper curing of floors slabs or improper application of flooring adhesives. We recommend contacting a flooring consultant experienced in the area of concrete slab-on-grade floors for specific recommendations regarding your proposed flooring applications.

Special precautions must be taken during the placement and curing of all concrete slabs. Excessive slump (high water-cement ratio) of the concrete and/or improper curing procedures used during either hot or cold weather conditions could lead to excessive shrinkage, cracking, or curling of the slabs. High water-cement ratio and/or improper curing also greatly increase the water vapor permeability of concrete. We recommend that all concrete placement and curing operations be performed in accordance with the American Concrete Institute (ACI) manual.

It is emphasized that we are not floor moisture vapor proofing experts. We make no guarantee nor provide any assurance that use of capillary break/vapor retarder system will reduce concrete slab-on-grade floor moisture penetration to any specific rate or level, particularly those required by floor covering manufacturers. The builder and designers should consider all available measures for floor slab moisture protection.

Exterior grading will have an impact on potential moisture beneath the floor slab. Recommendations for exterior drainage are provided in the "Site Drainage" section of this report.

**It should be noted that the purpose of vapor barrier systems is to mitigate floor moisture vapor. These systems should <u>not</u> be used for waterproofing against shallow groundwater or surface water.**

### 8.5.3 Exterior Concrete Flatwork and Pavers

New exterior concrete flatwork and pavers will be constructed on soils subject to swell/shrink cycles. Some of the adverse effects of swelling and shrinking can be reduced with proper moisture treatment. The intent is to reduce the fluctuations in moisture content by moisture conditioning the soils, sealing the moisture in, and controlling it. Near-surface soils to receive exterior concrete flatwork and pavers should be moisture conditioned according to the recommendations in the "Site Preparation and Grading" section of this report. In addition, all exterior flatwork and pavers should be supported on a minimum of 6 inches of "non-expansive" fill. Where concrete flatwork and pavers are to be exposed to vehicle traffic, the upper 6-inch layer of "non-expansive" fill should consist of Caltrans Class 2 aggregate base.

Practices recommended by the Portland Cement Association (PCA) and the American Concrete Institute (ACI) for proper placement and curing of concrete, as well as for joint spacing and construction, should be followed during exterior concrete flatwork slab construction. Due to the presence of expansive soils near the site surface, flatwork should have control joints (i.e., weakened plane joints) spaced no more than 8 feet on centers. New pedestrian concrete flatwork should have a minimum thickness of 4 inches and minimum reinforcing of #4 bars at 18 inches on center (both ways). The rebar should be discontinued at expansion joints. Slip Dowels should be used at expansion joints. Vehicular concrete should be designed as discussed in the "Portland Cement Concrete Pavements" section of this report. Final design of exterior concrete flatwork is the responsibility of the civil or structural engineer for the project.

Exterior flatwork and pavers will be subjected to edge effects due to the drying out of subgrade soils. To protect against edge effects adjacent to unprotected areas, such as vacant or landscaped areas, lateral

cutoffs, such as inverted curbs (i.e., turndown edges) that extend at least 2 inches below the aggregate base or "non-expansive" fill layer into the subgrade soils, are recommended. Alternatively, a moisture barrier at least 80 mils thick extending at least 6 inches below the aggregate base or "non-expansive" fill layer into the subgrade soils could be installed at the edge of the flatwork and pavers.

Prior to construction of the flatwork and pavers, the aggregate base should be moisture conditioned to near optimum moisture content. If the aggregate base is not covered within about 30 days after placement, the soils below this material will need to be checked to confirm that their moisture content is at least 2 percent over optimum. If the moisture is found to be below this level, the aggregate base layer over flatwork and paver areas will need to be soaked until the proper moisture content is reached. Where flatwork is adjacent to curbs, reinforcing bars should be placed between the flatwork and the curbs. Expansion joint material should be used between flatwork/pavers and buildings, including concrete driveways.

## 8.6 Pavements

### 8.6.1 Asphalt Concrete Pavements

We have developed our pavement design sections assuming the pavement subgrade soil will be similar to the near surface soils described in the current and previous boring logs. Asphalt pavement sections for this project have been calculated using Caltrans Flexible Pavement Design Method. Based on near-surface conditions, we used an assumed design R-value of 5 in our analyses and we have developed the pavement sections presented in Table 7 below. These sections take into consideration the moderate expansion potential of the near surface soils. Each TI represents a different level of use. The owner or designer should determine which level of use best reflects the project and select appropriate pavement sections.

**TABLE 7**
**PAVEMENT DESIGN RECOMMENDATIONS**
**(R-VALUE = 5)**

| Traffic Index | AC[1] (inches) | AB[2] (inches) |
|---|---|---|
| 4.0 | 2.5 | 7.0 |
| 4.5 | 2.5 | 9.0 |
| 5.0 | 3.0 | 9.5 |
| 5.5 | 3.0 | 11.5 |
| 6.0 | 3.5 | 12.5 |
| 6.5 | 3.5 | 14.5 |
| 7.0 | 4.0 | 15.5 |

1. AC = Asphalt Concrete
2. AB = Caltrans Class 2 Aggregate Base (Minimum R-Value = 78)

### 8.6.2 Portland Cement Concrete Pavements

If used, Portland Cement Concrete (PCC) pavement should have a minimum thickness of 6 inches supported over 6 inches of Caltrans Class 2 aggregate base. This section is equivalent to a Traffic Index of at least 6.0 to 6.5 based on our experience and is expected to support traffic loading from a fire engine, a delivery truck, or a maintenance truck. The aggregate base and subgrade for PCC pavements should be properly moisture conditioned and compacted. Construction joints should be located no more than 12 feet apart in both directions. Concrete compressive strength should be tested in lieu of third point loading for rupture strength. A minimum 28-day compressive strength of 3,000 pounds per cubic foot (psi) should be specified for the concrete mix design. The PCC pavement should be continuously reinforced using No. 4 bars (or larger) spaced no more than 18 inches on center in both directions. Final design of the PCC pavement is the responsibility of the civil or structural engineer for the project.

### 8.6.3 Additional Pavement Recommendations

Paved areas should be sloped and drainage gradients maintained to carry all surface water to appropriate collection points. Surface water ponding should not be allowed anywhere on the Site during or after construction. We recommend that the pavement section be isolated from non-developed areas and areas of intrusion of irrigation water from landscaped areas. **Concrete curbs should extend a minimum of 2 inches below the aggregate base and into the subgrade to provide a barrier against drying of the subgrade soils or reduction of migration of landscape water into the pavement section.** Weep holes spaced at 4 feet on centers should also be provided. In lieu of the weep holes, a more effective system is to install a subdrain behind the curbs.

## 8.7 Effect of Plants on Foundation and Flatwork

Because of the moderately expansive nature of some of the on-site soils, trees and other large plants can significantly contribute to differential settlement of a foundation, flatwork, paver, and paved areas. The roots of trees and large plants can absorb the moisture from the soil, causing the soil to shrink much faster than other soil areas exposed to the weather. The soil where the moisture is lost more rapidly will sink lower than the surrounding soil, causing differential settlement in overlying or adjacent improvements. Certain trees and plants are known to be more water-consuming than others. Research studies indicate that a tree should be at least as far away from a building, flatwork and pavement as the mature height of the tree to minimize the effect of drying caused by the tree. A plant and tree specialist should be consulted to avoid the issues described herein.

A root barrier should be considered between trees and adjacent improvements and should be designed and installed following the recommendations of a landscape architect.

## 8.8 Landscaping Irrigation

Vegetation should not be planted immediately adjacent to structures. If planting adjacent to structures is desired, we recommend using plants that require very little moisture with drip irrigation systems.

Sprinkler systems should not be installed where they may cause ponding or saturation of subgrade soils within 5 feet of structures, slabs, pavements, concrete flatwork, or pavers. Otherwise, such ponding could cause loss of soil strength and movement of foundations, slabs, pavements, concrete flatwork, and pavers.

Irrigation of landscaped areas should be strictly limited to that necessary to sustain vegetation. Excessive irrigation could result in saturation and weakening of foundation soil.

## 8.9 Site Drainage

Proper site drainage is important for the long-term performance of future improvements. The Site should generally be graded to provide positive drainage towards drain inlets, catch basins, or bioretention areas. The Site should be graded so as to carry surface water away from the planned hospital addition and other structures at a minimum of 2 percent in flatwork areas and 5 percent in landscaped areas to a minimum of 10 feet laterally from a structure's perimeter foundations as required by the 2022 CBC, if feasible, when considering Americans with Disabilities Act (ADA) requirements. If used, roof gutters should be connected directly into the storm drainage system or drain onto impervious surfaces provided that a safety hazard is not created. Water should not be allowed to pond anywhere on-site.

## 8.10 Storm Water Runoff Mitigation

Storm runoff regulations require pretreatment of runoff and infiltration of storm water to the extent feasible. Typically, this results in the use of bioretention areas, vegetated swales, infiltration trenches, or permeable pavement near or within parking lots. These features are not well-suited to fine-grained soils (silts and clays) because these soils typically have relatively low permeability and require significant time for infiltration to occur. In addition, allowing water to pond on expansive soils will cause the soils to swell, which can cause distress to adjacent pavements, slabs, and lightly loaded structures.

**Implementation of storm water infiltration criteria could result in increased distress and reduced service life of flatwork, pavers, and pavement if not carefully designed in fine-grained soils such as those covering the surface of the Site.** Bioretention areas, vegetated swales, and infiltration areas should be located in landscaped areas and well away (typically 5 to 10+ feet laterally) from slopes, foundations, flatwork, pavers, and pavements. If it is not possible to locate these infiltration systems away from such improvements, alternatives that isolate the infiltrated water, such as flow-through planters, could be considered. When using an infiltration system in clay soils, underdrains should be used. Improvements should be located such that there is at least 1 foot of horizontal distance between the edge of improvements and the top edge of the bioretention area excavation for every 1 foot of vertical bioswale depth. If this is not possible, then concrete curbs for pavements, lateral restraints for exterior flatwork and pavers, or footings located adjacent to a bioretention area should be adequately keyed into the native soil to reduce the potential for rotation or lateral movement of these improvements. Due to the potential adverse effects on project performance, BSK should review the geotechnical aspects of the storm water infiltration system and its location before the project plans are finalized.

We expect the near surface clayey soils encountered at the Site to have low permeability. Therefore, **we classify the Site's surficial soils as predominantly hydrologic soil group D** per Chapter 7 of Part 630 Hydrology National Engineering Handbook (United States Department of Agriculture, 2007). Hydrologic soil group D soils have saturated hydraulic conductivities of less than 0.14 inches/hour.

During periods of prolonged precipitation, the underlying soils tend to become saturated to greater and greater depths/extents. Therefore, infiltration rates tend to decrease with prolonged rainfall. Also, denser soils have lower infiltration rates than less dense soils. Therefore, **it is important to not over-compact the bottom of unlined bioretention areas and similar unlined facilities beyond what is recommended in the "Site Preparation and Grading" section of this report**.

## 8.11 Corrosion Potential

A soil sample was collected during our current subsurface investigation within the upper 4 to 5½ feet BGS in boring B-1 and submitted for corrosion testing. The sample was tested by CERCO Analytical, a State-certified laboratory in Concord, California, for redox potential, pH, resistivity, chloride content, and sulfate content in accordance with ASTM test methods. The test results are presented at the end of Appendix B. Also included is the evaluation by CERCO Analytical of the corrosion test results.

Based upon the resistivity measurements, the sample tested was classified as "severely corrosive" by CERCO Analytical. The sulfate ion concentration was 510 mg/kg (ppm). This result is indicative of an exposure category S1 per Table 19.3.1.1 of ACI 318-19. For an S1 exposure class, Table 19.3.2.1 indicates that the minimum f'c of the concrete is 4,000 psi. CERCO Analytical recommends that concrete that comes into contact with this soil use sulfate resistant cement, such as Type II, with a maximum water-to-cement ratio of 0.55. They also recommend that all buried iron, steel, cast iron, ductile iron, galvanized steel, and dielectric coated steel or iron be properly protected against corrosion depending upon the critical nature of the structure. CERCO Analytical also recommends that all buried metallic pressure piping, such as ductile iron firewater pipelines, should be protected against corrosion. Because we are not corrosion specialists, we recommend that a corrosion specialist be consulted for advice on proper corrosion protection for underground piping which will be in contact with the soils and other design details.

The above are general discussions. A more detailed investigation may include more or fewer concerns and should be directed by a corrosion expert. BSK does not practice corrosion engineering. Consideration should also be given to soils in contact with concrete that will be imported to the Site during construction, such as topsoil and landscaping materials, which typically contain fertilizers and other chemicals that can be highly corrosive to metals and concrete. Any imported soil or landscaping materials should not be any more corrosive than the on-site soils and should not be classified as being more corrosive than "moderately corrosive." Also, on-site cutting and filling may result in soils contacting concrete that were not anticipated at the time of this investigation.

## 8.12 Plan Review and Construction Observation

We recommend that BSK be retained by the Client to review the geotechnical aspects of the project plans and specifications before they go out to bid. It has been our experience that this review provides an opportunity to detect misinterpretation or misunderstandings of our recommendations prior to the start of construction.

Variations in soil types and conditions are possible and may be encountered during construction. To permit correlation between the soil data obtained during this investigation and the actual soil conditions encountered during construction, we recommend that BSK be retained to provide observation and testing services during site earthwork. This will allow us the opportunity to compare actual conditions exposed during construction with those encountered in our investigation and to provide supplemental recommendations if warranted by the exposed conditions. Earthwork should be performed in accordance with the recommendations presented in this report, or as recommended by BSK during construction. BSK should be notified at least two weeks prior to the start of construction and prior to when observation and testing services are needed.

# 9 ADDITIONAL SERVICES AND LIMITATIONS

## 9.1 Additional Services

The review of plans and specifications, and field observation and testing during construction by BSK are an integral part of the conclusions and recommendations made in this report. If BSK is not retained for these services, the client will be assuming BSK's responsibility for any potential claims that may arise during or after construction due to the misinterpretation of the recommendations presented herein. The recommended tests, observations, and consultation by BSK during construction include, but are not limited to:

- review of plans and specifications;
- observations of site grading, including stripping and engineered fill construction and underpinning of existing footings adjacent to the planned hospital addition;
- observation of foundation excavations;
- observation of ground improvement (if applicable); and
- in-place density testing of fills, backfills, and finished subgrades.

## 9.2 Limitations

The recommendations contained in this report are based on our field observations and current and previous subsurface exploration, limited laboratory tests, review of available geologic maps and publications, and our present knowledge of the proposed construction. It is possible that soil conditions could vary between or beyond the points explored. If soil conditions are encountered during construction that differ from those described herein, we should be notified immediately in order that a review may be made and any supplemental recommendations provided. If the scope of the proposed construction, including the proposed loads or structural locations, changes from that described in this report, our recommendations should also be reviewed.

We prepared this report in substantial accordance with the generally accepted geotechnical engineering practice as it exists in the Site area at the time of our study. No warranty, either express or implied, is made. The recommendations provided in this report are based on the assumption that an adequate program of tests and observations will be conducted by BSK during the construction phase in order to evaluate compliance with our recommendations. Other standards or documents referenced in any given standard cited in this report, or otherwise relied upon by the author of this report, are only mentioned in the given standard; they are not incorporated into it or "included by reference", as that latter term is used relative to contracts or other matters of law.

This report may be used only by the Client and only for the purposes stated within a reasonable time from its issuance, but in no event later than two (2) years from the date of the report, or if conditions at the Site have changed. If this report is used beyond this period, BSK should be contacted to evaluate whether site conditions have changed since the report was issued.

Also, land or facility use, on and off-site conditions, regulations, or other factors may change over time, and additional work may be required with the passage of time. Based on the intended use of the report, BSK may recommend that additional work be performed and that an updated report be issued.

The scope of services for this subsurface investigation and geotechnical report did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous substances in the air, soil, surface water, or groundwater at this Site.

BSK conducted subsurface exploration and provided recommendations for this project. We understand that BSK will be given the opportunity to perform a formal geotechnical review of the final project plans and specifications. In the event BSK is not retained to review the final project plans and specifications to evaluate if our recommendations have been properly interpreted, we will assume no responsibility for misinterpretation of our recommendations.

We recommend that all earthwork during construction be monitored by a representative from BSK, including site preparation, foundation excavation, ground improvement (if applicable), placement of engineered fill, and trench/wall backfill. The purpose of these services would be to provide BSK the opportunity to observe the actual soil conditions encountered during construction, evaluate the applicability of the recommendations presented in this report to the soil conditions encountered, and recommend appropriate changes in design or construction procedures if conditions differ from those described herein.

## 10 REFERENCES

American Society of Civil Engineers (ASCE) 7-16 (2016), Minimum Design Loads for Buildings and Other Structures, ASCE Standard ASCE/SEI 7-16.

Agusti, G.C. and Sitar, N. (2013), Seismic Earth Pressures on Retaining Structures in Cohesive Soils, Geotechnical Engineering Department of Civil and Environmental Engineering, University of California at Berkley, Report No. UCB GT 13-02.

Boulanger, R. W., and Idriss, I. M. (2014), CPT and SPT Based Liquefaction Triggering Procedures, Center for Geotechnical Modeling, Department of Civil and Environmental Engineering, College of Engineering, University of California at Davis, California Report No. UCD/CGM-14/01, April 2014.

California Building Code (CBC, 2022), also known as the California Code of Regulations (CCR), Title 24, Parts 2, Volume 2, California Building Standards Commission.

California Department of Water Resources (CDWR, 2020), California's Groundwater - Bulletin 118, update 2020, https://www.water.ca.gov/Programs/Groundwater-Management/Bulletin-118.

California Division of Mines and Geology (CDMG, 1997), Guidelines for Evaluating and Mitigating Seismic Hazards in California, Special Publication 117.

California Division of Mines and Geology (CDMG, 1981a), Fault Evaluation Report 104, dated March 31, 1981

California Division of Mines and Geology (CDMG, 1981b), Fault Evaluation Report 109, dated January 30, 1981, Supplement No. 1 issued October 31, 1981.

California Division of Mines and Geology (CDMG, 1969), Geologic and Engineering Aspects of San Francisco Bay Fill, Special Report 97, 1969.

California Geological Survey Staff (2022), California Geological Survey – Note 48, Checklist for the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings, November 2022.

California Geological Survey, (2021), Interactive Web Maps, https://maps.conservation.ca.gov/geologichazards/#dataviewer

California Geological Survey Staff (2018), Earthquake Fault Zones – A Guide for Government Agencies, Property Owners/Developers, and Geoscience Practitioners for Assessing Fault Rupture Hazards in California: California Geological Survey, Special Publication 42, Revised 2018.

California Geological Survey Staff (2008a), Seismic Hazard Zone Report for the Dublin 7.5-Minute Quadrangle, Alameda County, California, Seismic Hazard Zone Report 113.

California Geological Survey Staff (2008b), Earthquake Zones of Required Investigation, Dublin Quadrangle: California Geological Survey, Seismic Hazard Zones, Official Map, August 27, 2008.

California Geological Survey (CGS, 2002), Note 36, California Geomorphic Provinces, Revised 12/2002.

City of Pleasanton (2009), Pleasanton General Plan 2005-2025, Adopted July 21, 2009, last amended August 20, 2019, https://www.cityofpleasantonca.gov/gov/depts/cd/planning/general.asp

Federal Emergency Management Agency (FEMA), FEMA Flood Hazard Map Layer, 06001C-NFHL, 02/09/2022.

Field, E.H., and the 2014 Working Group on California Earthquake Probabilities (2015), UCERF3: A new earthquake forecast for California's complex fault system: U.S. Geological Survey 2015-3009.

Field, E.H., Biasi, G.P., Bird, P., Dawson, T.E., Felzer, K.R., Jackson, D.D., Johnson, K.M., Jordan, T.H., Madden, C., Michael, A.J., Milner, K.R., Page, M.T., Parsons, T., Powers, P.M., Shaw, B.E., Thatcher, W.R., Weldon, R.J., II, and Zeng, Y., 2013, Uniform California earthquake rupture forecast, version 3 (UCERF3)—The time-independent model: U.S. Geological Survey Open-File Report 2013–1165, 97 p., California Geological Survey Special Report 228, and Southern California Earthquake Center Publication 1792, http://pubs.usgs.gov/of/2013/1165/

Kayen, R.K., Moss, R.E.S, Thompson, E.M., Seed, R.B., Cetin, K.O., Der Kiureghian, A., Tanaka, Y, and Tokimatsu, K. (2013), Shear-Wave Velocity–Based Probabilistic and Deterministic Assessment of Seismic Soil Liquefaction Potential, Journal of Geotechnical and Geoenvironmental Engineering, Vol. 139, No. 3, March 1.

Petersen, M.D., Frankel, A.D., Harmsen, S.C., Mueller, C.S., Haller, K.M., Wheeler, R.L., Wesson, R.L., Zeng, Y., Boyd, O.S., Perkins, D.M., Luco, N., Field, E.H., Wills, C.J., and Rukstales, K.S. (2008), Documentation for the 2008 Update of the United States National Seismic Hazard Maps: U.S. Geological Survey Open-File Report 2008–1128, 61 p.

United States Geological Survey (USGS, 2014a) National Seismic Hazard Model (NSHM) Catalogs, https://github.com/usgs/nshmp-haz-catalogs/tree/master/2014

United States Geological Survey (USGS, 2014b), 2008 Interactive Deaggregations, https://earthquake.usgs.gov/hazards/interactive/.

USGS/OSHPD, U.S. Seismic Design Maps, https://seismicmaps.org/

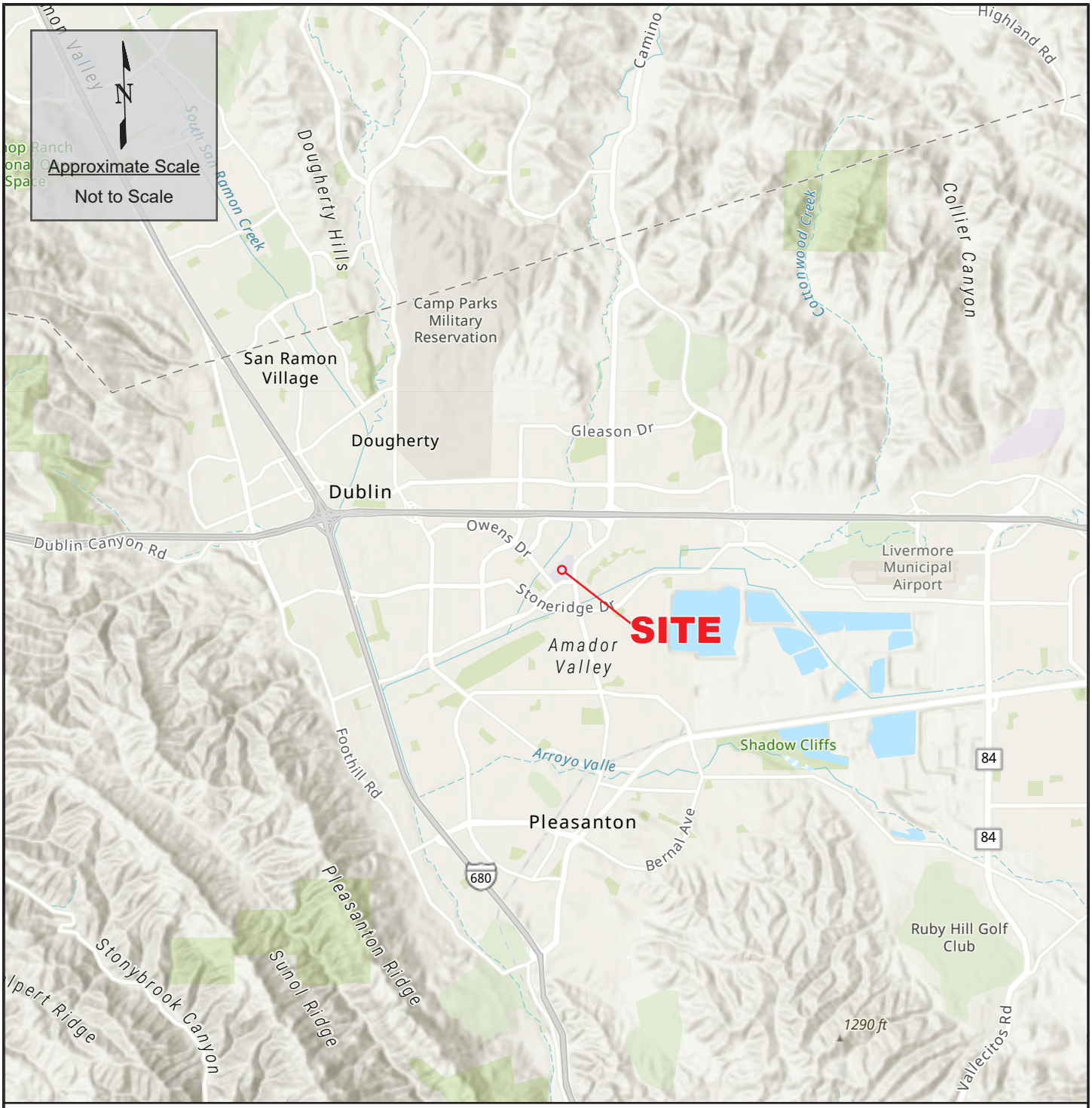
Wair, B.R., DeJong, J.T., and Shantz, T. (2012), Guidelines for Estimation of Shear Wave Velocity Profiles, Report 2012/08: Pacific Earthquake Engineering Research Center, December 2012.

Wentworth, M.C., Graham, S.E., Pike, R.J., Beukelman, G.S., Ramsey, D.W., and Barron, A.D., (1997), Summary Distribution of Slides and Earth Flows in the San Francisco Bay Region, California U.S. Geological Survey, Open-File Report OF 97-745-C, scale 1:125000.

Witter, R.C., Knudsen, K.L., Sowers, J.M., Wentworth, C.M., Koehler, R.D., Randolph, C.E., Brooks, S.K., and Gans, K.D., (2006), Maps of Quaternary Deposits and Liquefaction Susceptibility in the Central San Francisco Bay Region, California: U.S. Geological Survey, Open-File Report OF-2006-1037, scale 1:200,000.

Youd, T.L. and Garris, C.T. (1995), Liquefaction-Induced Ground-Surface Disruption, Journal of Geotechnical Engineering, ASCE, Vol. 121, No. 11, November, pp. 805-809.

# FIGURES




References: 1. https://www.arcgis.com/apps/mapviewer/index.html, 2023

Note: Locations are approximate

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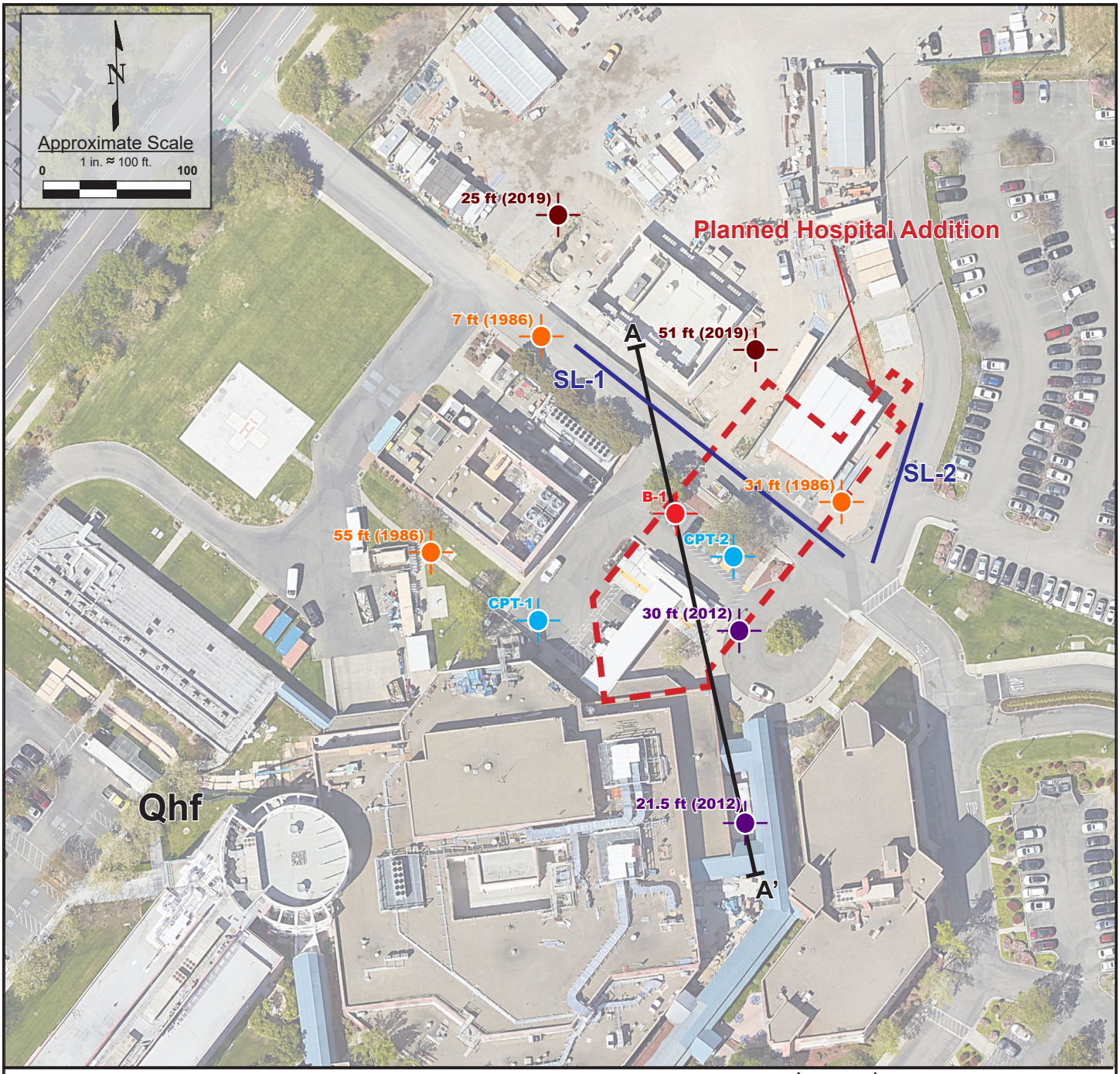
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|---|---|
| PROJECT NO. | G00000369 |
| DRAWN: | 08/18/23 |
| DRAWN BY: | D. Tower |
| CHECKED BY: | C. Melo |
| FILE NAME: | Figures.indd |

**VICINITY MAP**

**Planned Tri-Valley East Wing Hospital Addition**
**5555 W. Las Positas Boulevard**
**Pleasanton, California**

FIGURE

**1**




References: 1. http://earth.google.com, 2023
2. Taylor Design, Appendix A- Architectural Test Fit

Notes: Locations are approximate

**Qhf -** Holocene Alluvial Deposits

**SL-1** Approximate location of seismic survey lines (By AGS, 2024)

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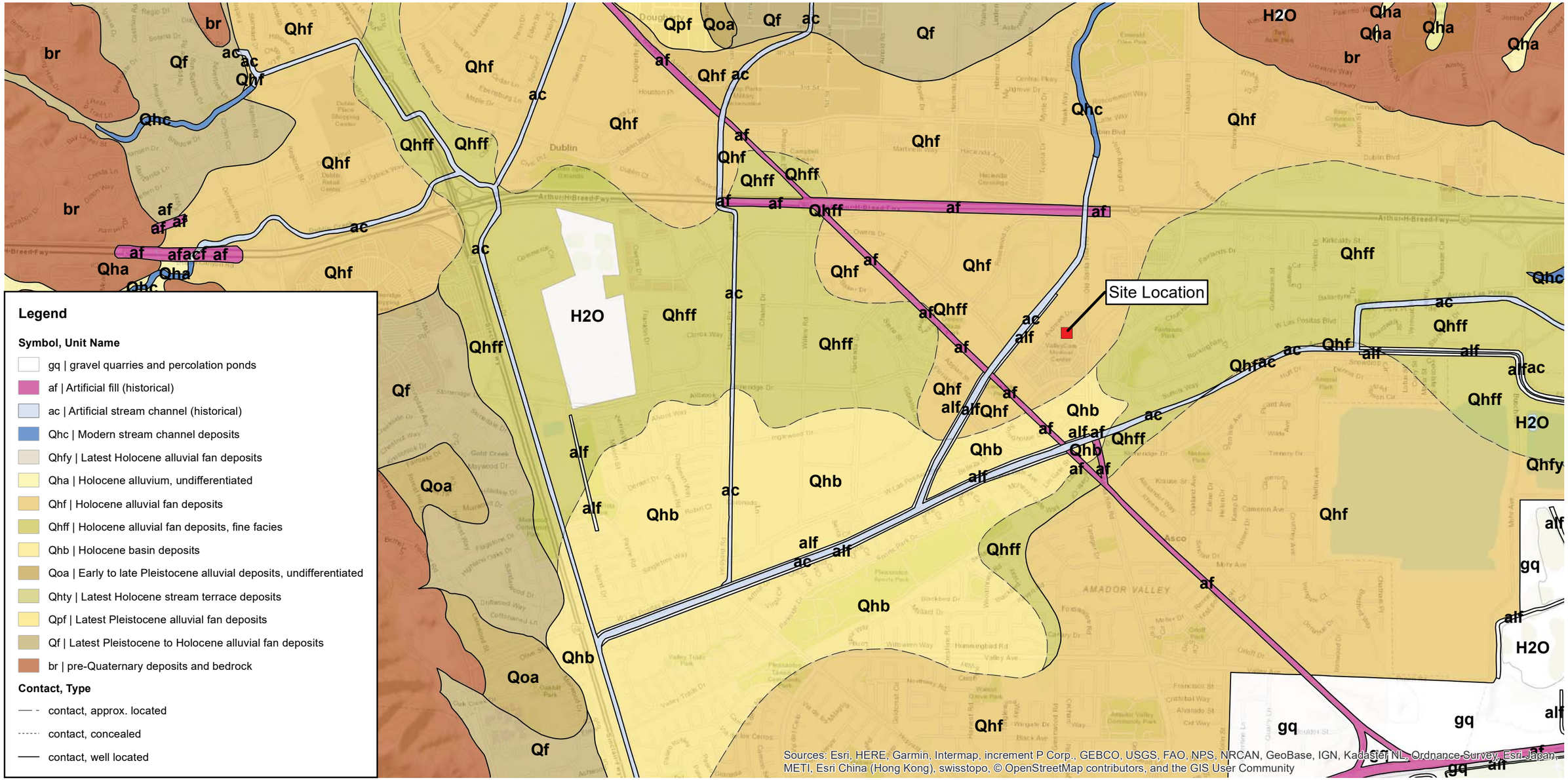
## Legend

- B-1 — Approximate Boring Location (By BSK, 2023)
- CPT-1 — Approximate CPT Locations (By BSK, 2023)
- 51 ft (2019) — Approximate Boring Location (By BSK, 2019)
- 21.5 ft (2012) — Approximate Boring Location (By BSK 2012)
- 55 ft (1986) — Approximate Boring Location (By BSK 1986)
- A — A' Geologic Cross Section (See Figure 4)

BSK ASSOCIATES

| | |
|---|---|
| PROJECT NO. G00000369 | **SITE PLAN** |
| DRAWN: 10/17/24 | |
| DRAWN BY: D. Tower | |
| CHECKED BY: C. Melo | **Planned Tri-Valley East Wing Hospital Addition**<br>**5555 W. Las Positas Boulevard**<br>**Pleasanton, California** |
| FILE NAME: Figures.indd | |

FIGURE **2**




**Legend**

**Symbol, Unit Name**

- gq | gravel quarries and percolation ponds
- af | Artificial fill (historical)
- ac | Artificial stream channel (historical)
- Qhc | Modern stream channel deposits
- Qhfy | Latest Holocene alluvial fan deposits
- Qha | Holocene alluvium, undifferentiated
- Qhf | Holocene alluvial fan deposits
- Qhff | Holocene alluvial fan deposits, fine facies
- Qhb | Holocene basin deposits
- Qoa | Early to late Pleistocene alluvial deposits, undifferentiated
- Qhty | Latest Holocene stream terrace deposits
- Qpf | Latest Pleistocene alluvial fan deposits
- Qf | Latest Pleistocene to Holocene alluvial fan deposits
- br | pre-Quaternary deposits and bedrock

**Contact, Type**

- contact, approx. located
- contact, concealed
- contact, well located

References: Witter, Knudsen, Sowers, Maps of Quaternary Deposits and Liquefaction Susceptibility in the Central San Francisco Bay Region, California, U.S. Geological Survey Open-File Report 2006-1037

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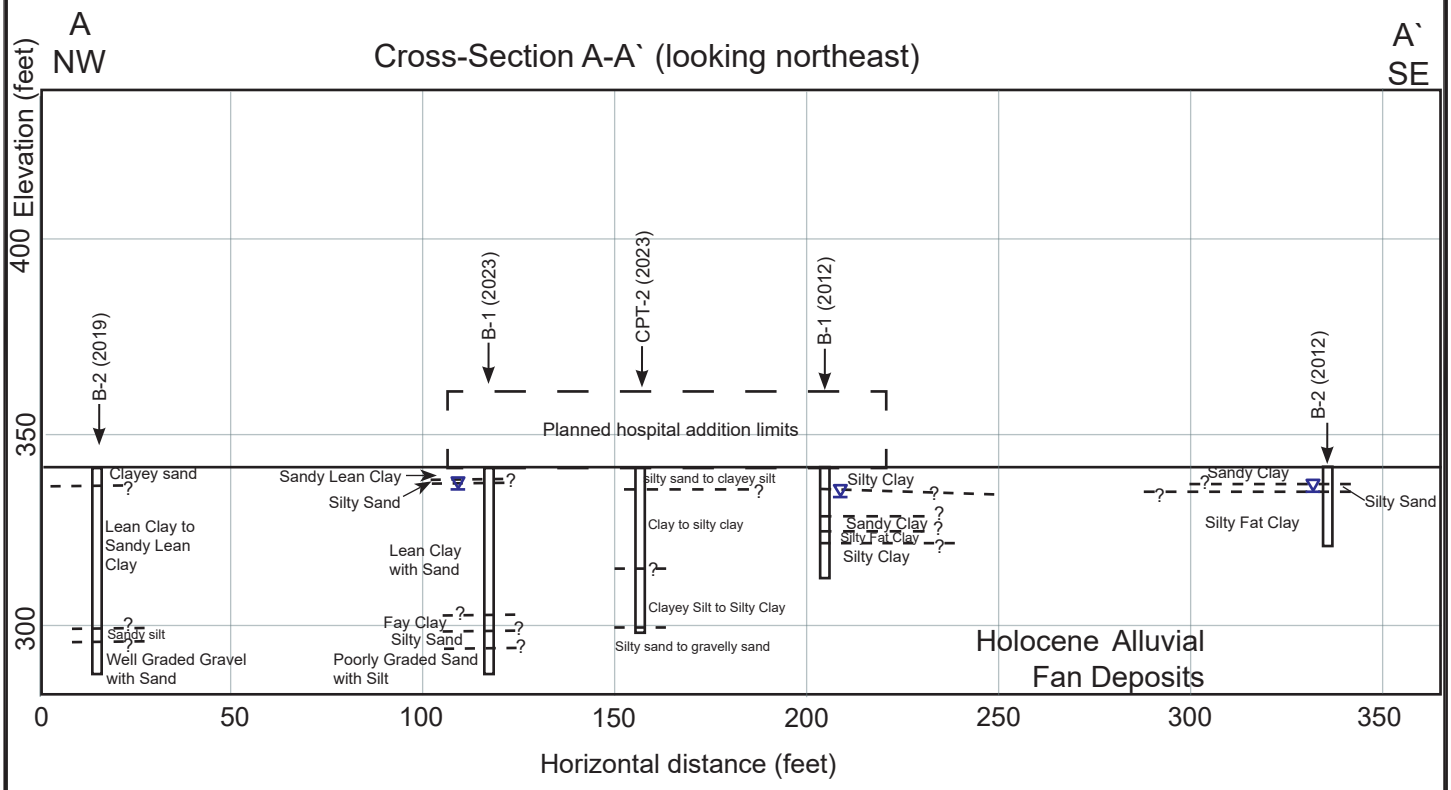
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| | |
|---|---|
| PROJECT NO. | G00000369 |
| Drawn: | 8/2023 |
| DRAWN BY: | MR |
| CHECKED BY: | OK |
| FILE NAME: | Geologic_Map |

**AREA GEOLOGY MAP**

**Planned Tri-Valley East Wing Hospital Addition**
**5555 W. Las Positas Boulevard**
**Pleasanton, California**

**Figure 3**




## LEGEND

Soil boring location

Unit contact

Groundwater Level

Note: Locations are approximate

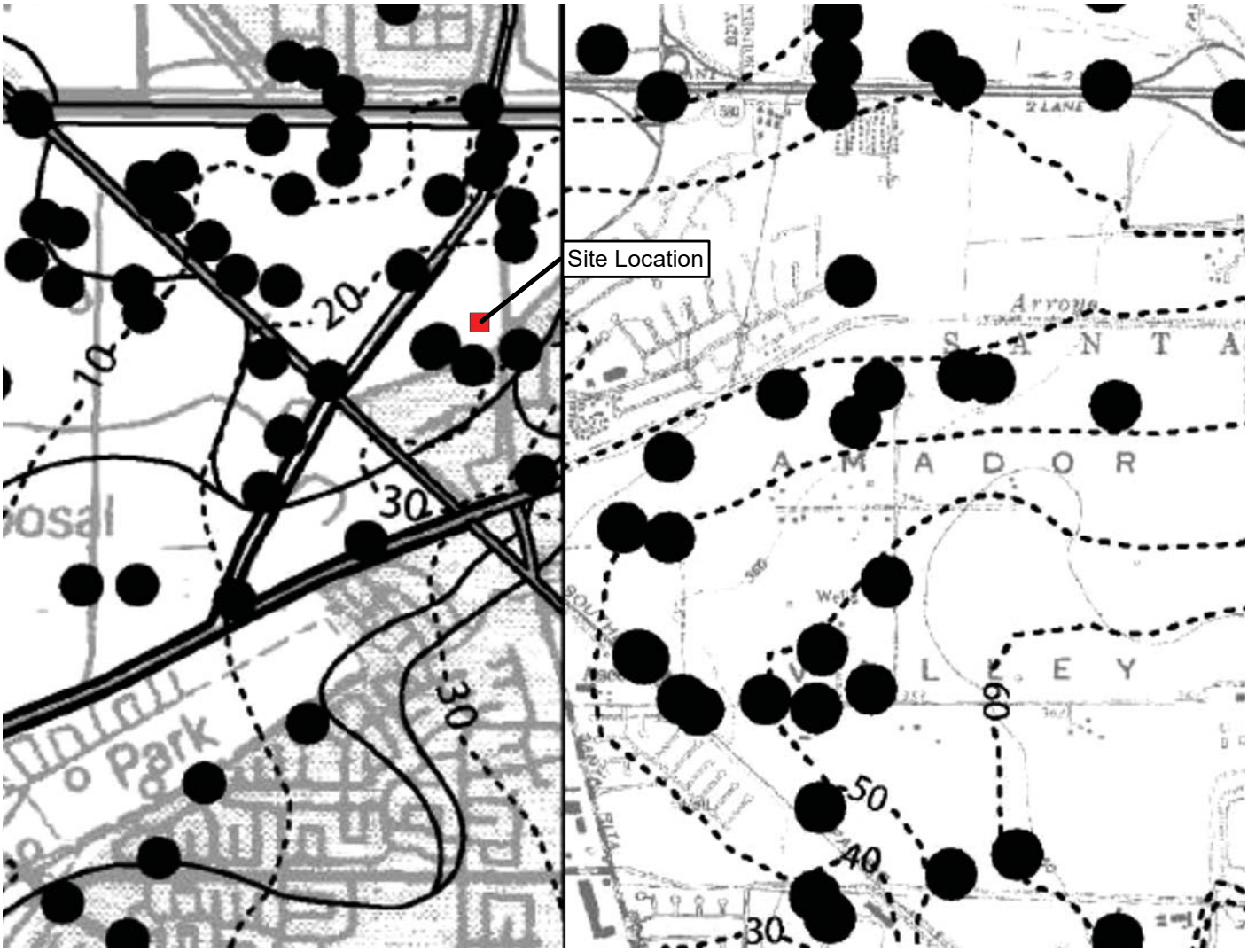
Scale 1 inch : 50 feet

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BSK ASSOCIATES

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| PROJECT NO. G00000369 | **GEOLOGIC CROSS SECTION** |
| DRAWN: 10/17/24 | |
| DRAWN BY: K. Yang | |
| CHECKED BY: C. Melo | **Planned Tri-Valley East Wing Hospital Addition** |
| FILE NAME: Figures.indd | **5555 W. Las Positas Boulevard Pleasanton, California** |

FIGURE **4**




50 Ground-water depth contours (in feet)

B = Pre-Quaternary bedrock. See "Bedrock and Surficial Geology" in Section 1 of report for descriptions of units.

● Geotechnical borings used in liquefaction evaluation

Reference: CGS, 2008, Seismic Hazard Zone Report for the Dublin and Livermore 7.5-Minute Quadrangles, Alameda County, California, Seismic Hazard Zone Reports 112 and 114

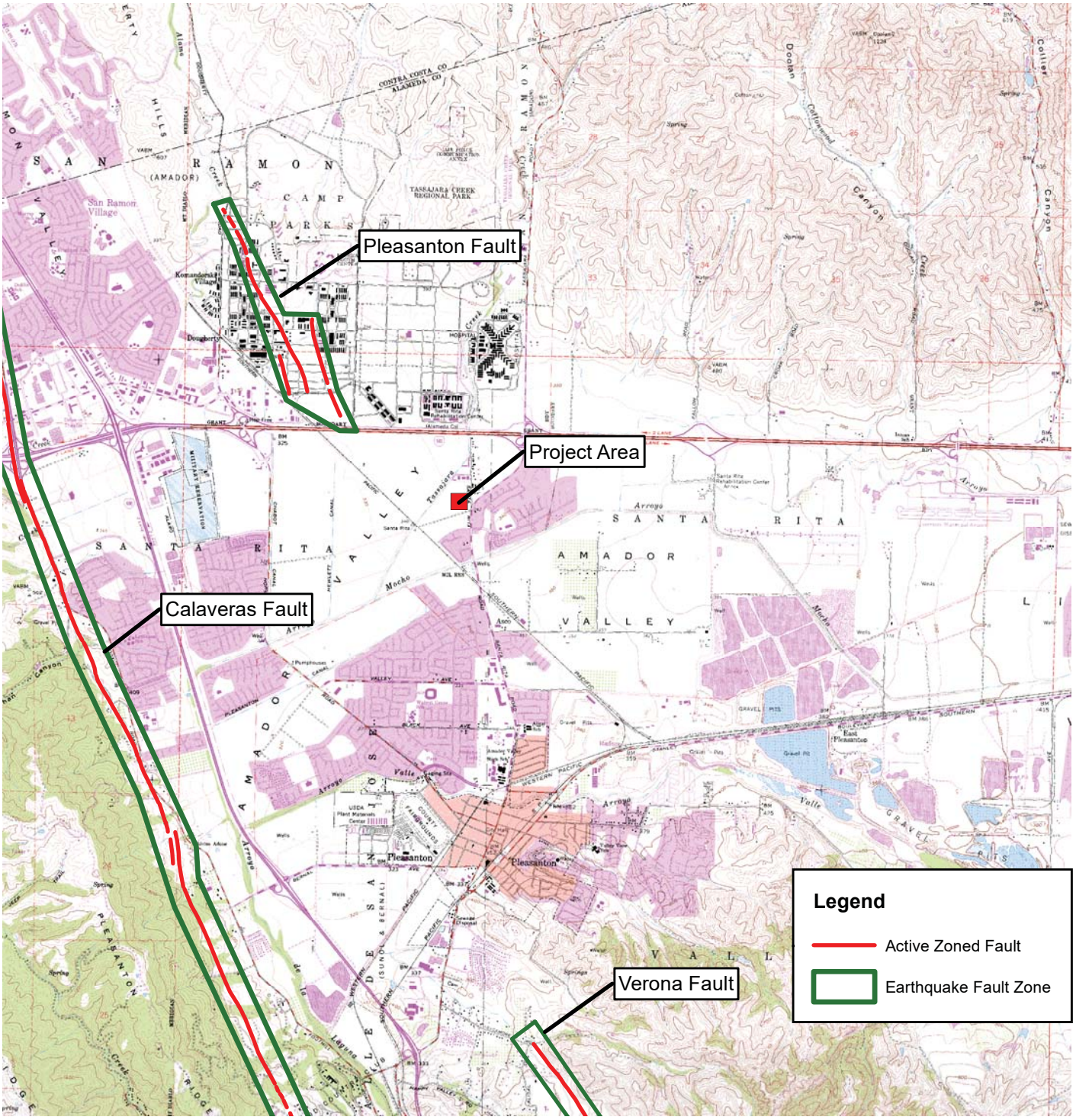
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| PROJECT NO. G00000369 | **HISTORICALLY HIGH GROUNDWATER DEPTH** |
| Drawn: 8/2023 | |
| DRAWN BY: MR | |
| CHECKED BY: | **Planned Tri-Valley East Wing Hospital Addition** |
| OK | **5555 W. Las Positas Boulevard** |
| FILE NAME: Historic GW | **Pleasanton, California** |

**Figure 5**




Reference: Special Studies Zones, Dublin and Livermore Quads, CGS
http://maps.conservation.ca.gov/cgs/informationwarehouse/index.html?map=regulatorymaps

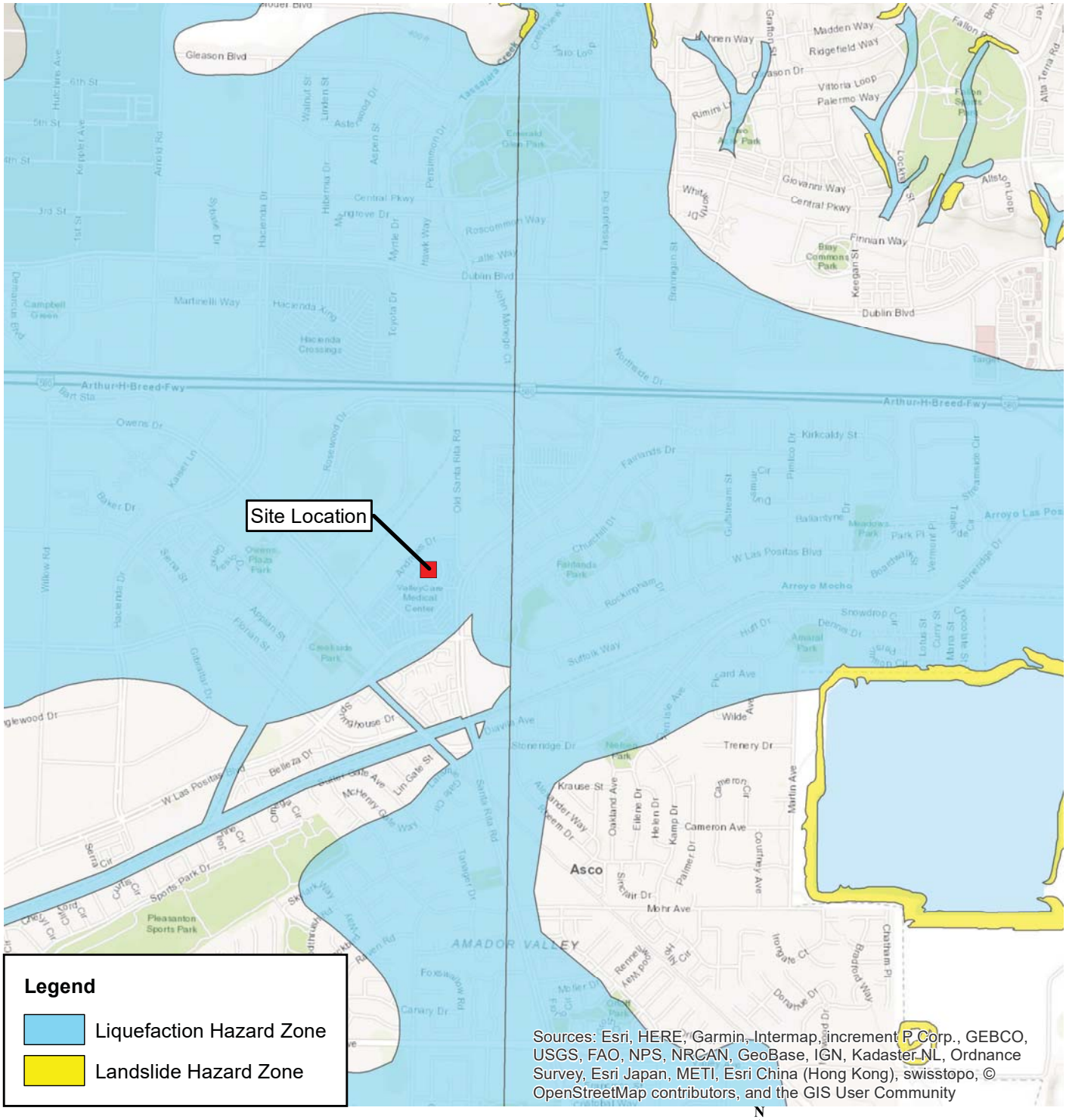
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| PROJECT NO.G00000369 | |
| Drawn: 8/2023 | |
| DRAWN BY: MR | |
| CHECKED BY: OK | |
| FILE NAME: AP_Fault_map | |

**ALQUIST-PRIOLO EARTHQUAKE FAULT ZONE**

**Planned Tri-Valley East Wing Hospital Addition**
**5555 W. Las Positas Boulevard**
**Pleasanton, California**

**Figure**

**6**




Reference: Special Studies Zones, Dublin and Livermore Quads, CGS
http://maps.conservation.ca.gov/cgs/informationwarehouse/index.html?map=regulatorymaps

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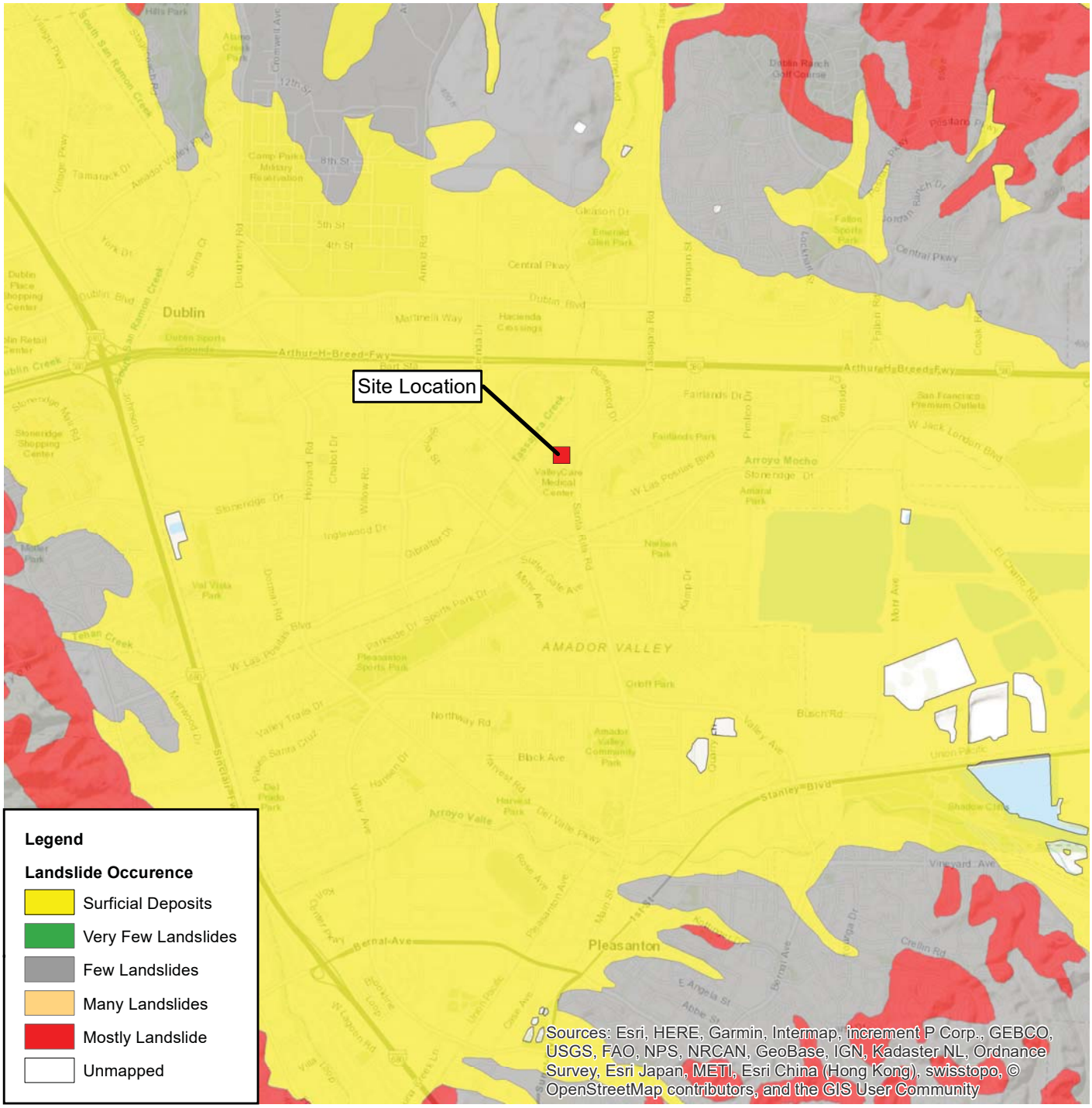
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| PROJECT NO. G00000369 | |
| Drawn: 8/2023 | |
| DRAWN BY: MR | |
| CHECKED BY: OK | |
| FILE NAME: Seismic Hazard Zone | |

**SEISMIC HAZARD ZONES**

**Planned Tri-Valley East Wing Hospital Addition**
**5555 W. Las Positas Boulevard**
**Pleasanton, California**

**Figure**

**7**




Reference: Adapted from USGS Open-File Report 97-745C,
By: C.M. Wentworth et al, 1997

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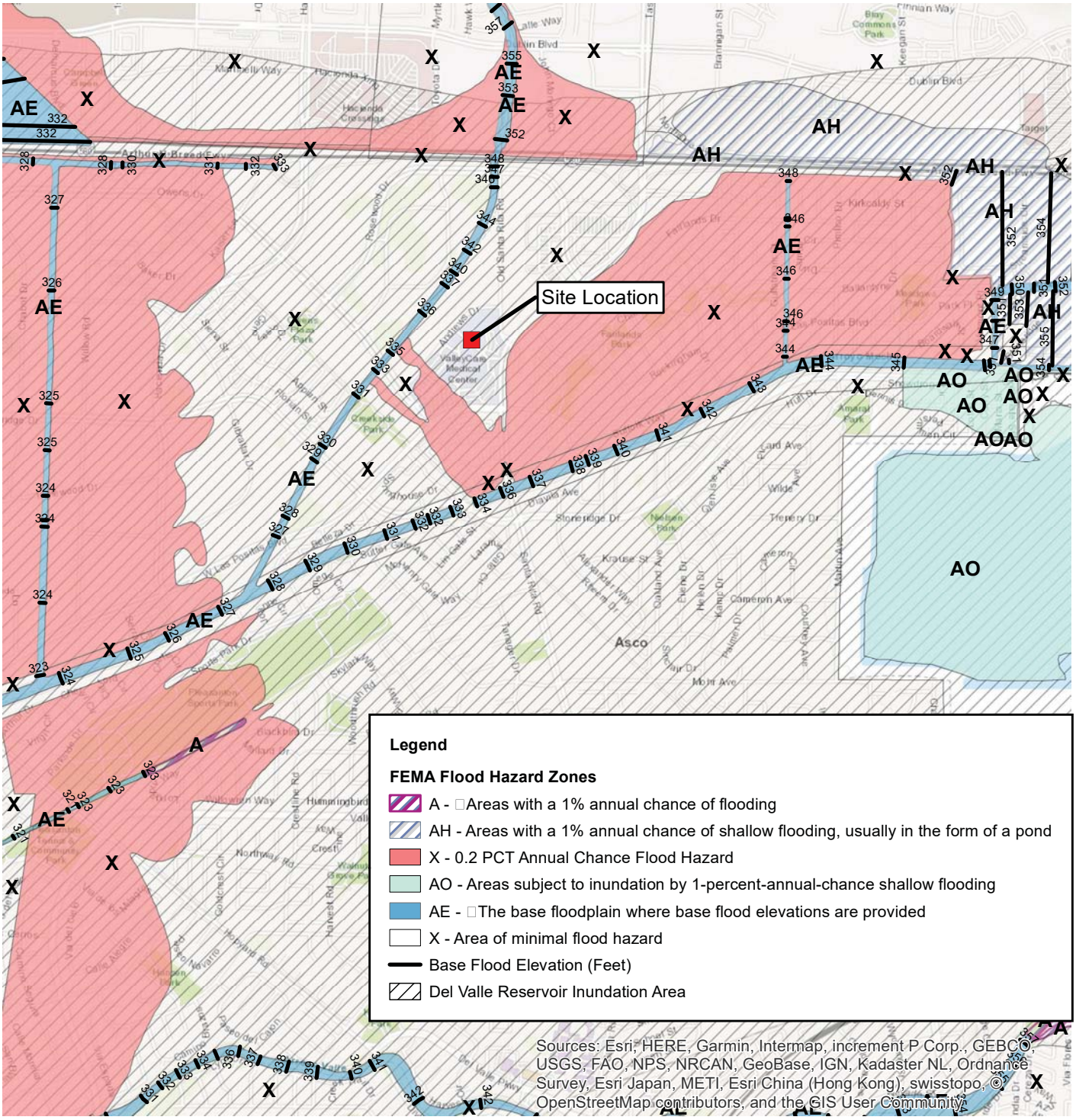
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| PROJECT NO. G00000369 | |
| Drawn: 8/2023 | |
| DRAWN BY: MR | |
| CHECKED BY: OK | |
| FILE NAME: landslides | |

**LANDSLIDE HAZARD MAP**

**Planned Tri-Valley East Wing Hospital Addition**
**5555 W. Las Positas Boulevard**
**Pleasanton, California**

**Figure**

**8**




Reference: FEMA Flood Hazard Layer, 06001C-NFHL, 2/9/2022
State of California OES Dam Inundation DVD

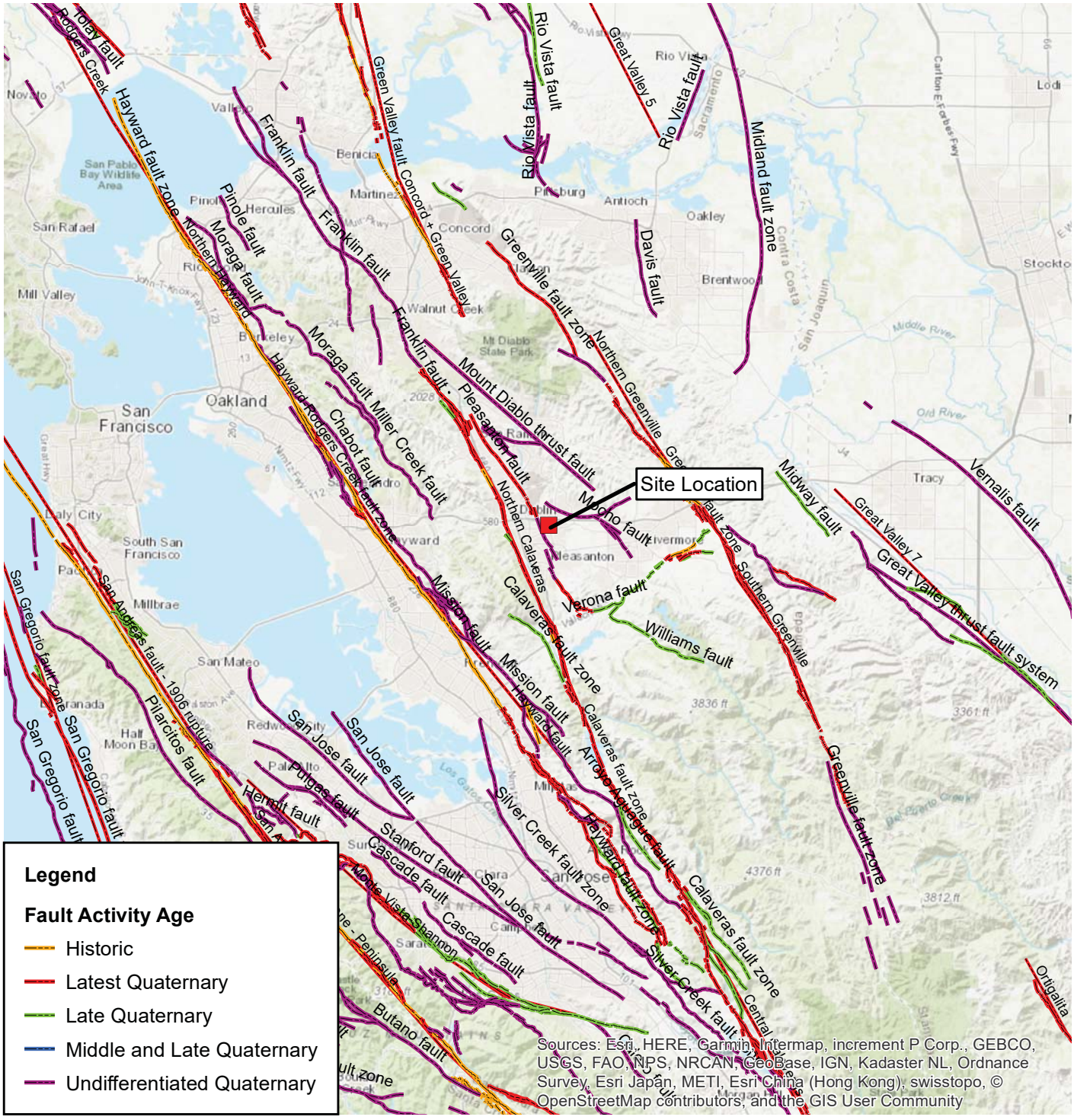
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| PROJECT NO. G00000369 | |
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| DRAWN BY: MR | |
| CHECKED BY: OK | |
| FILE NAME: FEMA map | |

**FEMA FLOOD ZONES**

**Planned Tri-Valley East Wing Hospital Addition**
**5555 W. Las Positas Boulevard**
**Pleasanton, California**

**Figure 9**




Reference: USGS Quaternary Fault Database ftp://hazards.cr.usgs.gov/maps/qfault/

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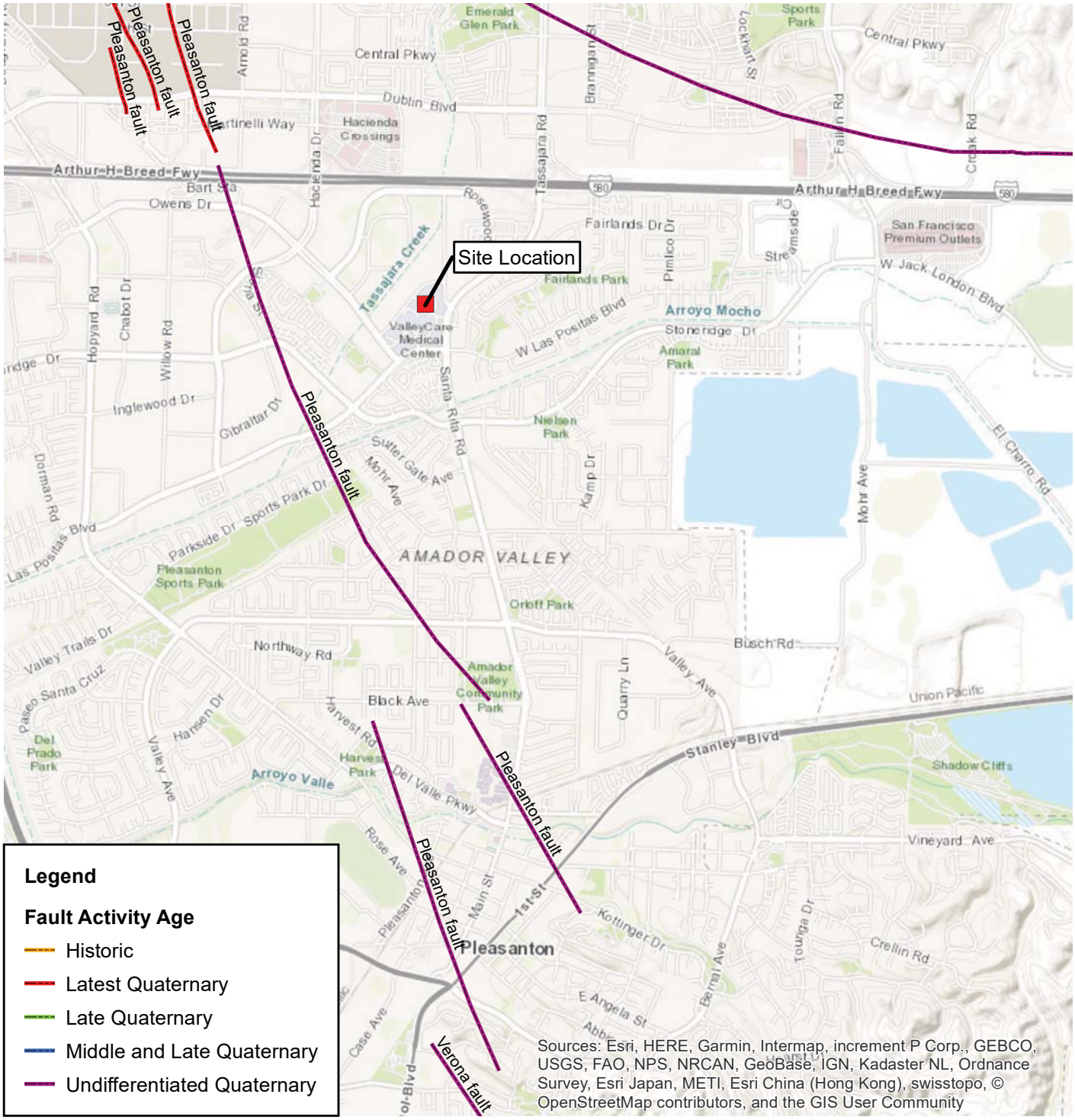
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| PROJECT NO. G00000369 | REGIONAL FAULT MAP |
| Drawn: 8/2023 | |
| DRAWN BY: MR | |
| CHECKED BY: OK | Planned Tri-Valley East Wing Hospital Addition<br>5555 W. Las Positas Boulevard<br>Pleasanton, California |
| FILE NAME: Regional Fault map | |

Figure

10




Reference: USGS Quaternary Fault Database ftp://hazards.cr.usgs.gov/maps/qfault/

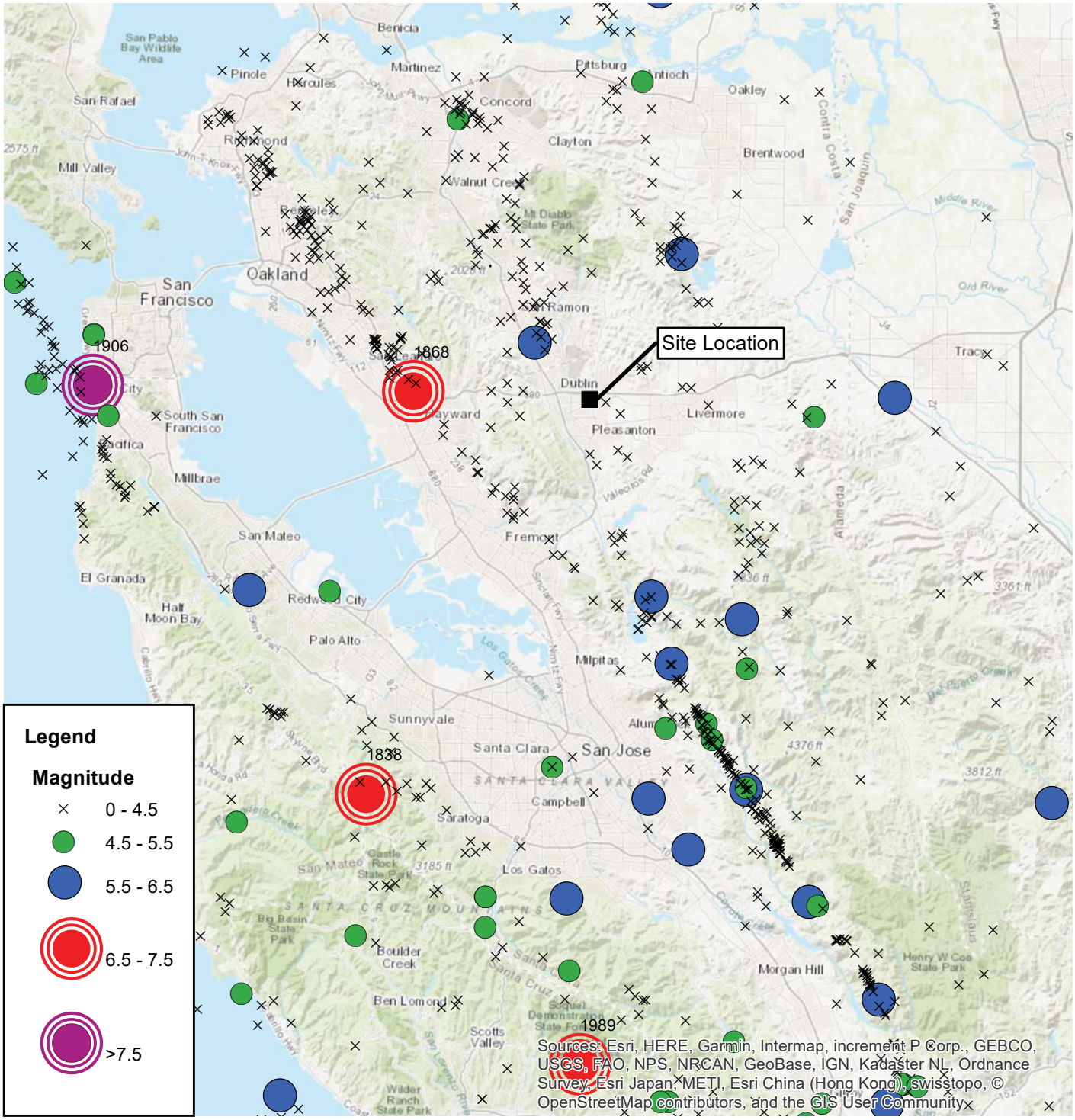
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| PROJECT NO. G00000369 | **LOCAL FAULT MAP** |
| Drawn: 8/2023 | |
| DRAWN BY: MR | |
| CHECKED BY: OK | **Planned Tri-Valley East Wing Hospital Addition 5555 W. Las Positas Boulevard Pleasanton, California** |
| FILE NAME: Local Fault map | |

**Figure 11**




Source: National Seismic Hazard Model (NSHM) Earthquake Catalogs, 2014 NSHM Catalogs, USGS, https://github.com/usgs/nshmp-haz-catalogs

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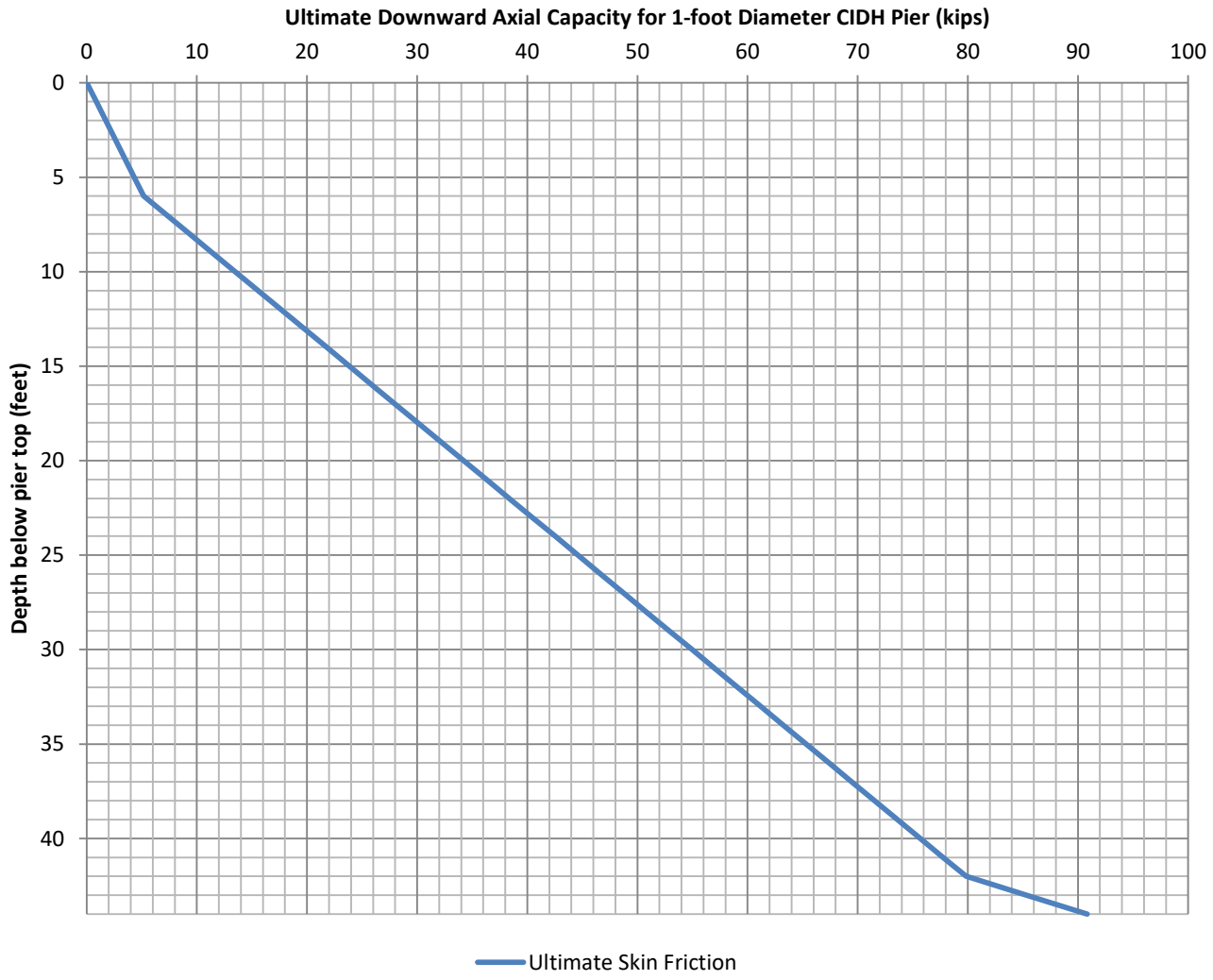
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|---|---|
| PROJECT NO. G00000369 | |
| Drawn: 8/2023 | |
| DRAWN BY: MR | |
| CHECKED BY: OK | |
| FILE NAME: Historic Earthquakes map | |

**HISTORICAL EARTHQUAKES**

**Planned Tri-Valley East Wing Hospital Addition**
**5555 W. Las Positas Boulevard**
**Pleasanton, California**

**Figure**

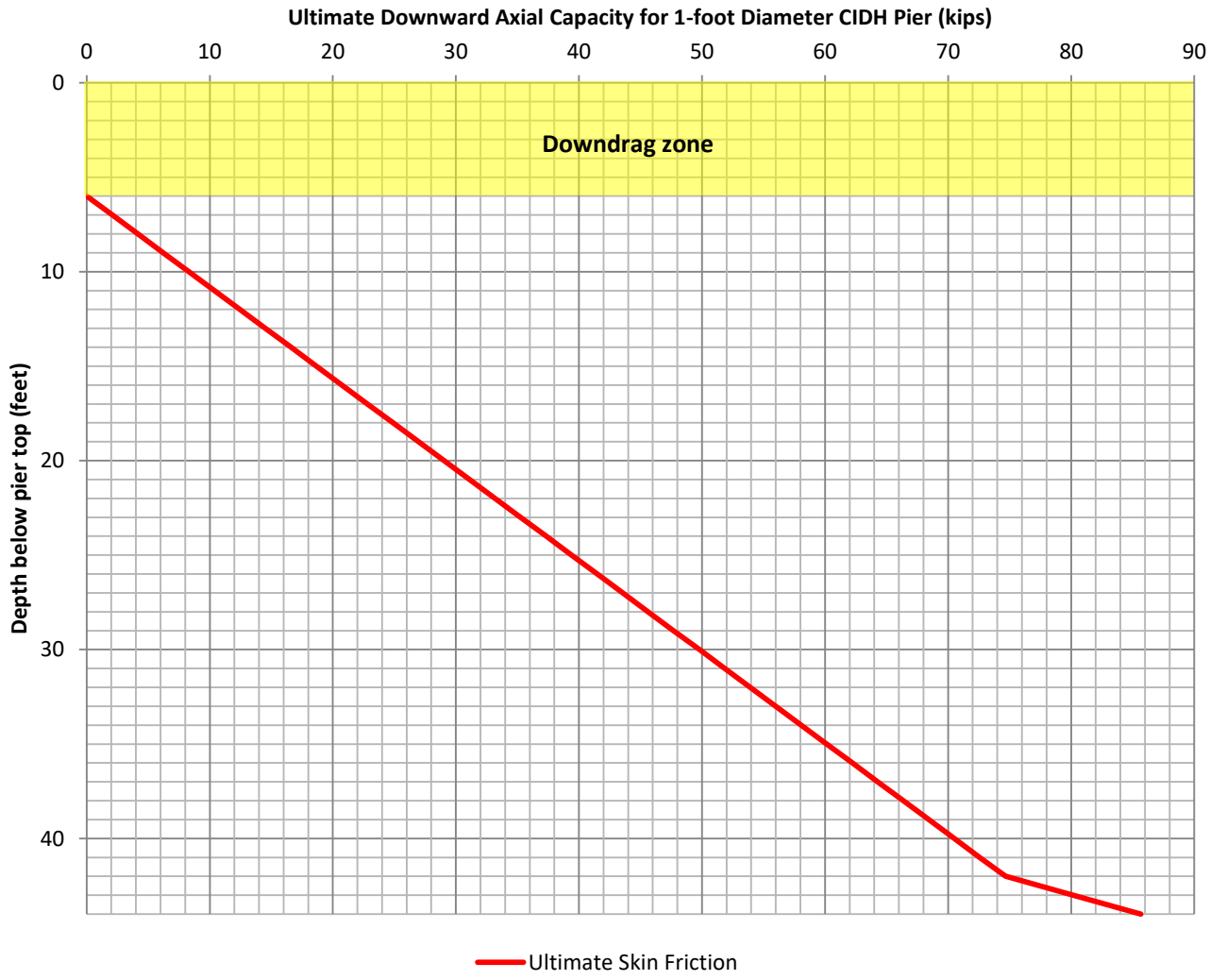
**12**




**Notes:**

1. We recommend applying factors of safety of 2 and 1.5 to the ultimate values provided in the plot above for static and transient loading (wind/seismic), respectively.
2. The downward axial capacity of a CIDH pier having a diameter larger than 1-foot may be obtained by multiplying the capacity for the 1-foot diameter pier presented in the plot above by the desired pier diameter in units of feet. As an example, for an 18-inch CIDH pier, multiply the above values by 1.5.
3. Piers must be spaced at least 3 diameters apart (center to center) for axial capacities presented here to be valid.
4. The uplift axial capacity may be obtained by multiplying the downward skin friction values presented in the plot above by 2/3. The pier weight can also be added to the uplift capacity.
5. **This plot should only be used if the interior slab consists of a reinforced structural slab designed to span unsupported between CIDH piers.**

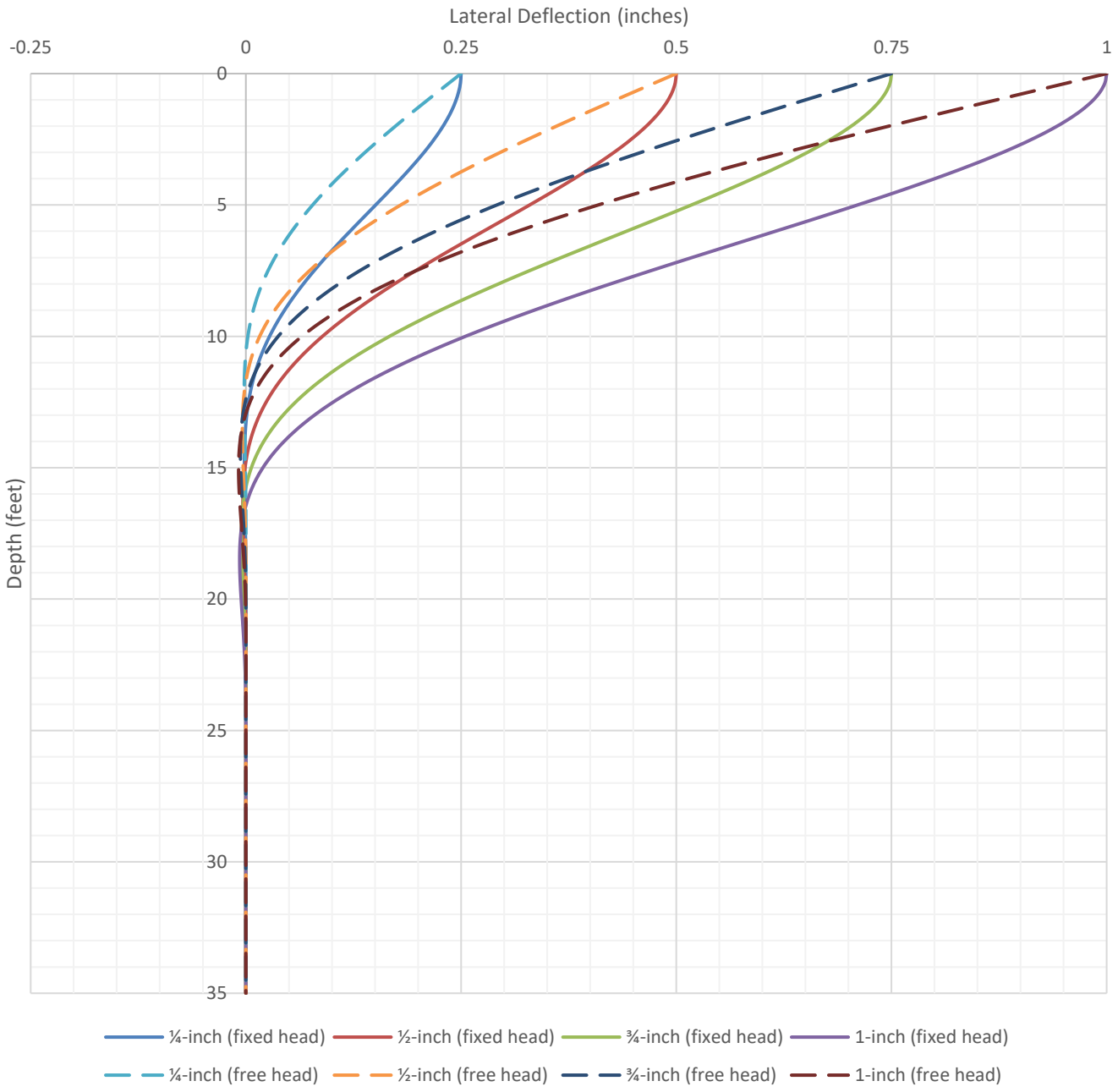
| | | | |
|---|---|---|---|
| BSK ASSOCIATES | PROJECT NO. G00000369<br>DRAWN: 9/22/2023<br>DRAWN BY: C. Melo<br>CHECKED BY: C. Foulk<br>FILE NAME: FIGURE 13-14 | **Ultimate Axial Capacity**<br>**CIDH Piers (No Downdrag)**<br>**Planned Tri-Valley East Wing Hospital Addition Pleasanton, California** | FIGURE<br>**13** |




**Notes:**

1. We recommend applying factors of safety of 2 and 1.5 to the ultimate values provided in the plot above for static and transient loading (wind/seismic), respectively.
2. The downward axial capacity of a CIDH pier having a diameter larger than 1-foot may be obtained by multiplying the capacity for the 1-foot diameter pier presented in the plot above by the desired pier diameter in units of feet. As an example, for an 18-inch CIDH pier, multiply the above values by 1.5.
3. Piers must be spaced at least 3 diameters apart (center to center) for axial capacities presented here to be valid.
4. The uplift axial capacity may be obtained by multiplying the downward skin friction values presented in the plot above by 2/3. The pier weight can also be added to the uplift capacity.
5. An unfactored (i.e., ultimate) drag load of 5D kips (where D is the pier diameter in feet) should be added to the design loads. **This load should be applied <u>unfactored</u> for the design of the piers and should <u>not</u> be used to resist uplift loads.**
6. **This plot should <u>only</u> be used if the interior slab is supported by the subgrade soils below the slab (i.e., there is no significant load transfer from the slab to the adjacent CIDH piers).**

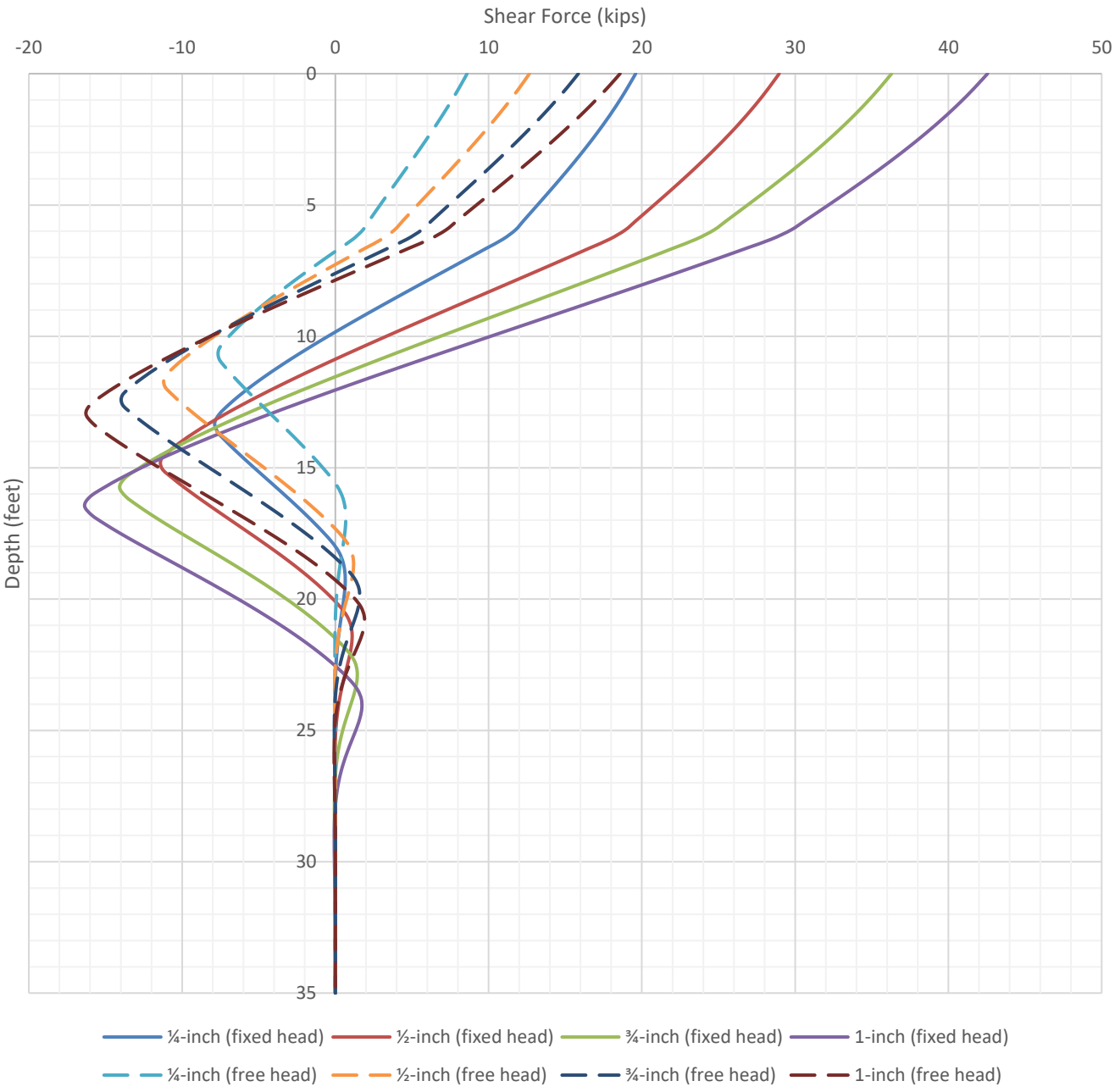
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| BSK ASSOCIATES | PROJECT NO. G00000369 | Ultimate Axial Capacity | FIGURE |
| | DRAWN: 9/22/2023 | | |
| | DRAWN BY: C. Melo | CIDH Piers (With Downdrag) | 14 |
| | CHECKED BY: C. Foulk | | |
| | FILE NAME: FIGURE 13-14 | Planned Tri-Valley East Wing Hospital Addition Pleasanton, California | |




**Notes:**

1. Plots are based on unfactored values. Designer should consider applying resistance factors per AASHTO to the results.
2. Minimum pier depth to achieve fixity is 35 feet.

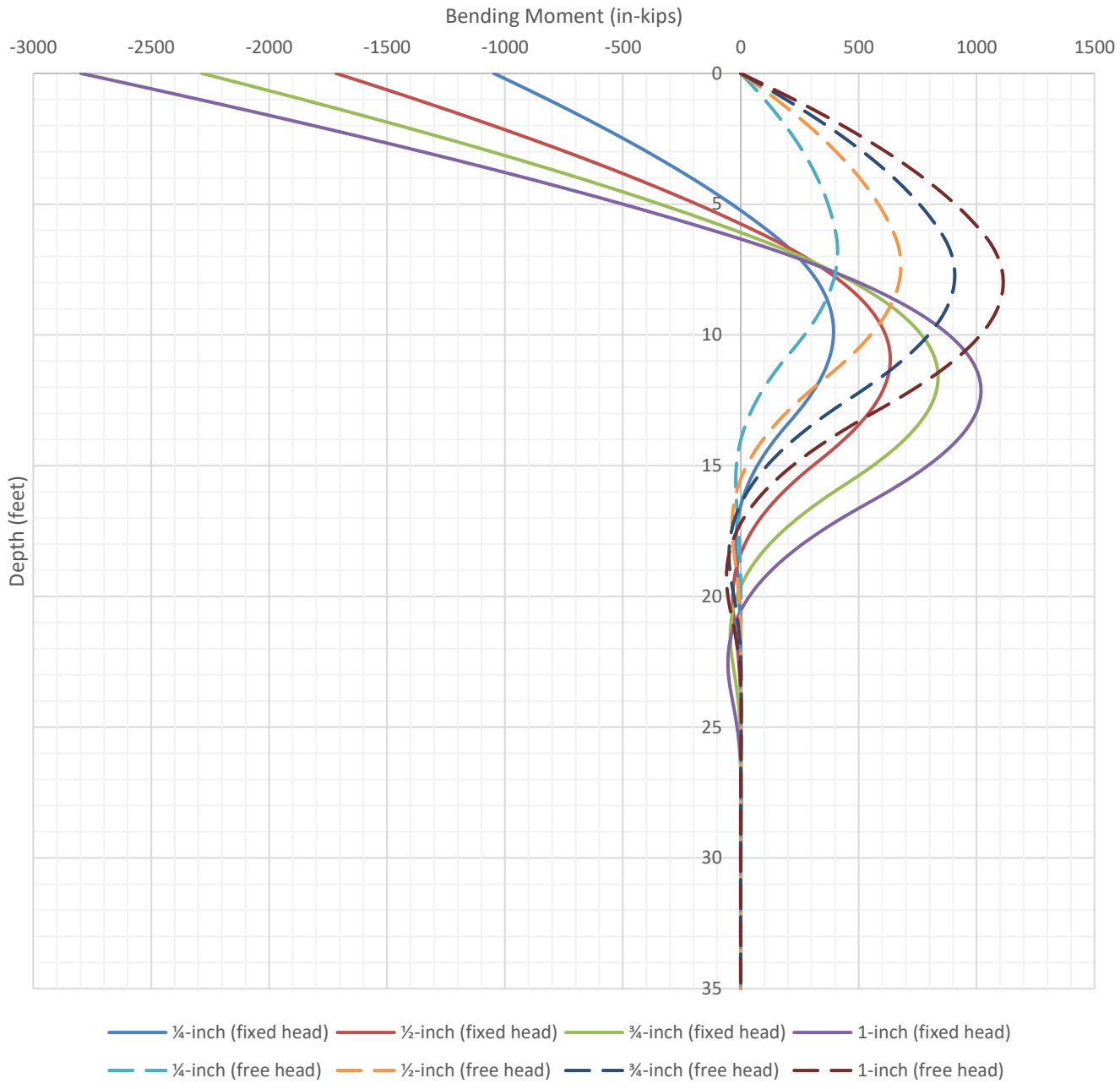
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| BSK ASSOCIATES | **PROJECT NO.** G00000369 | **Lpile Deflection Curves** | **FIGURE** |
| | **DRAWN:** 09/22/23 | **18-inch CIDH Piers** | **15** |
| | **DRAWN BY:** C. Melo | | |
| | **CHECKED BY:** C. Foulk | **Planned Tri-Valley East Wing Hospital Addition** | |
| | **FILE NAME:** Figures 15-17 | **Pleasanton, California** | |




**Notes:**

1. Plots are based on unfactored values. Designer should consider applying resistance factors per AASHTO to the results.
2. Minimum pier depth to achieve fixity is 35 feet.

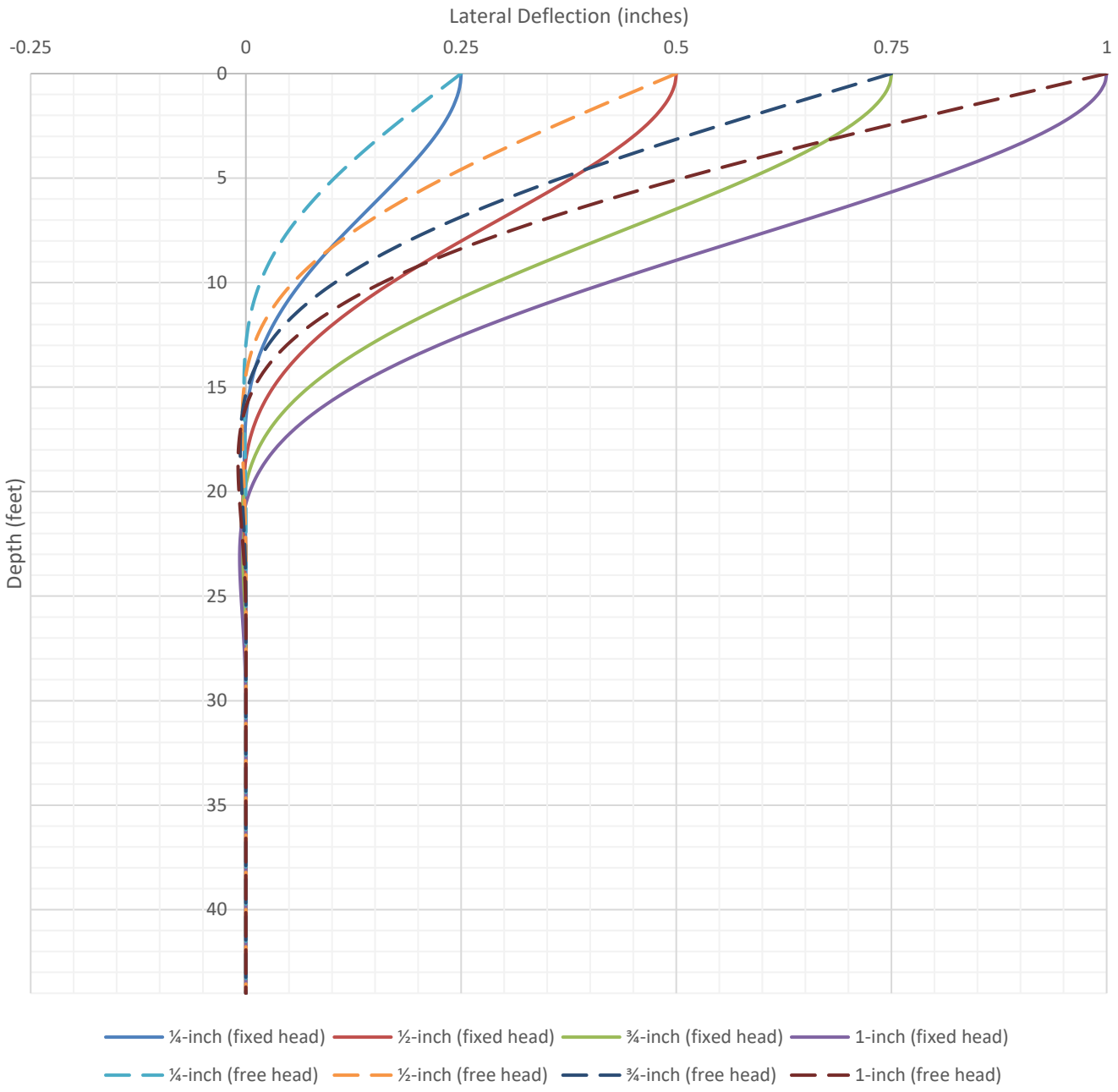
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| BSK ASSOCIATES | PROJECT NO. G00000369 | Lpile Shear Force Curves | FIGURE |
| | DRAWN: 09/22/23 | 18-inch CIDH Piers | 16 |
| | DRAWN BY: C. Melo | | |
| | CHECKED BY: C. Foulk | Planned Tri-Valley East Wing Hospital Addition | |
| | FILE NAME: Figures 15-17 | Pleasanton, California | |




**Notes:**

1. Plots are based on unfactored values. Designer should consider applying resistance factors per AASHTO to the results.
2. Minimum pier depth to achieve fixity is 35 feet.

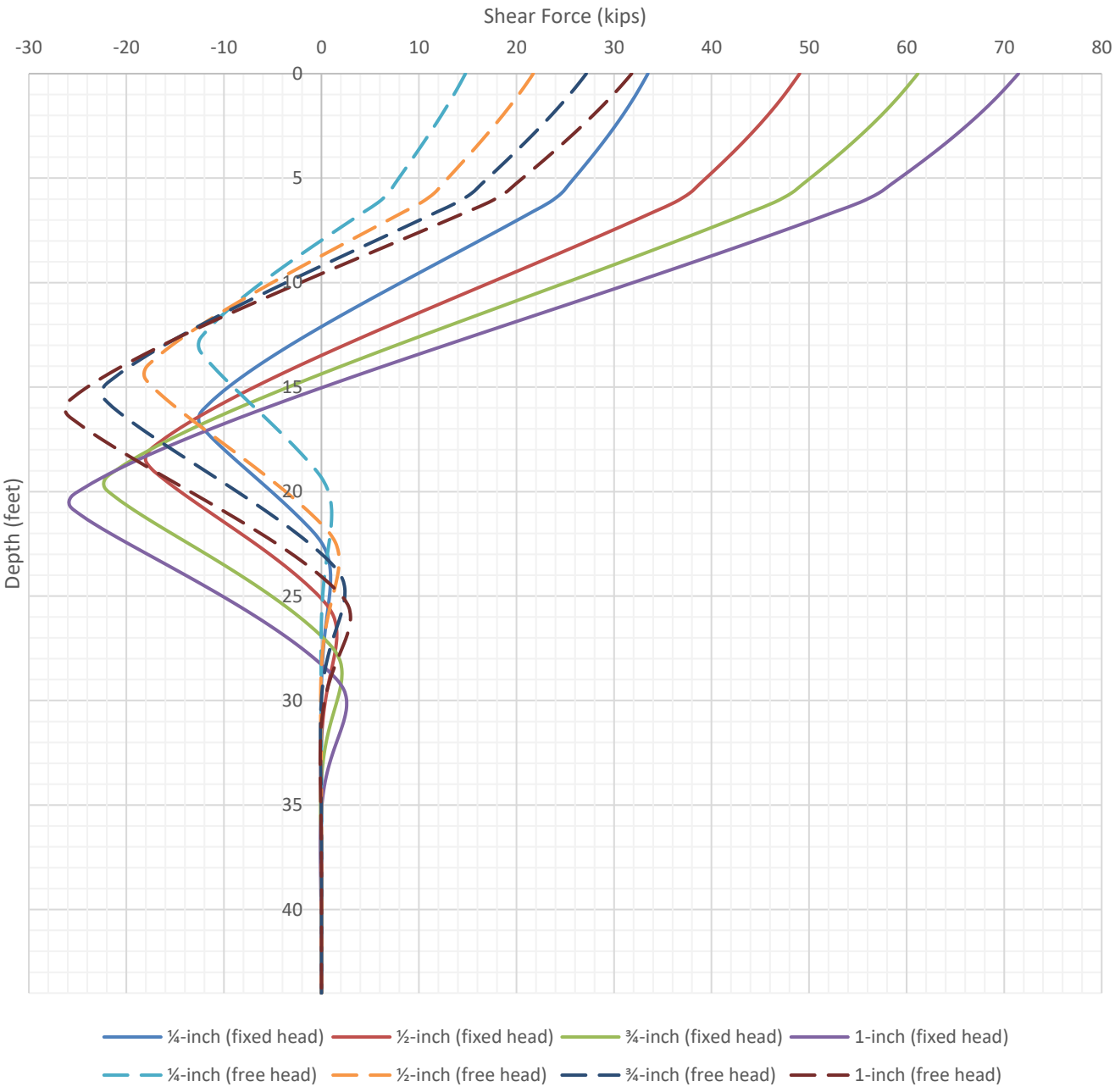
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| BSK ASSOCIATES | PROJECT NO. G00000369<br>DRAWN: 09/22/23<br>DRAWN BY: C. Melo<br>CHECKED BY: C. Foulk<br>FILE NAME: Figures 15-17 | **Lpile Bending Moment Curves**<br>**18-inch CIDH Piers**<br>**Planned Tri-Valley East Wing Hospital Addition**<br>**Pleasanton, California** | FIGURE<br>**17** |




**Notes:**

1. Plots are based on unfactored values. Designer should consider applying resistance factors per AASHTO to the results.
2. Minimum pier depth to achieve fixity is 44 feet.

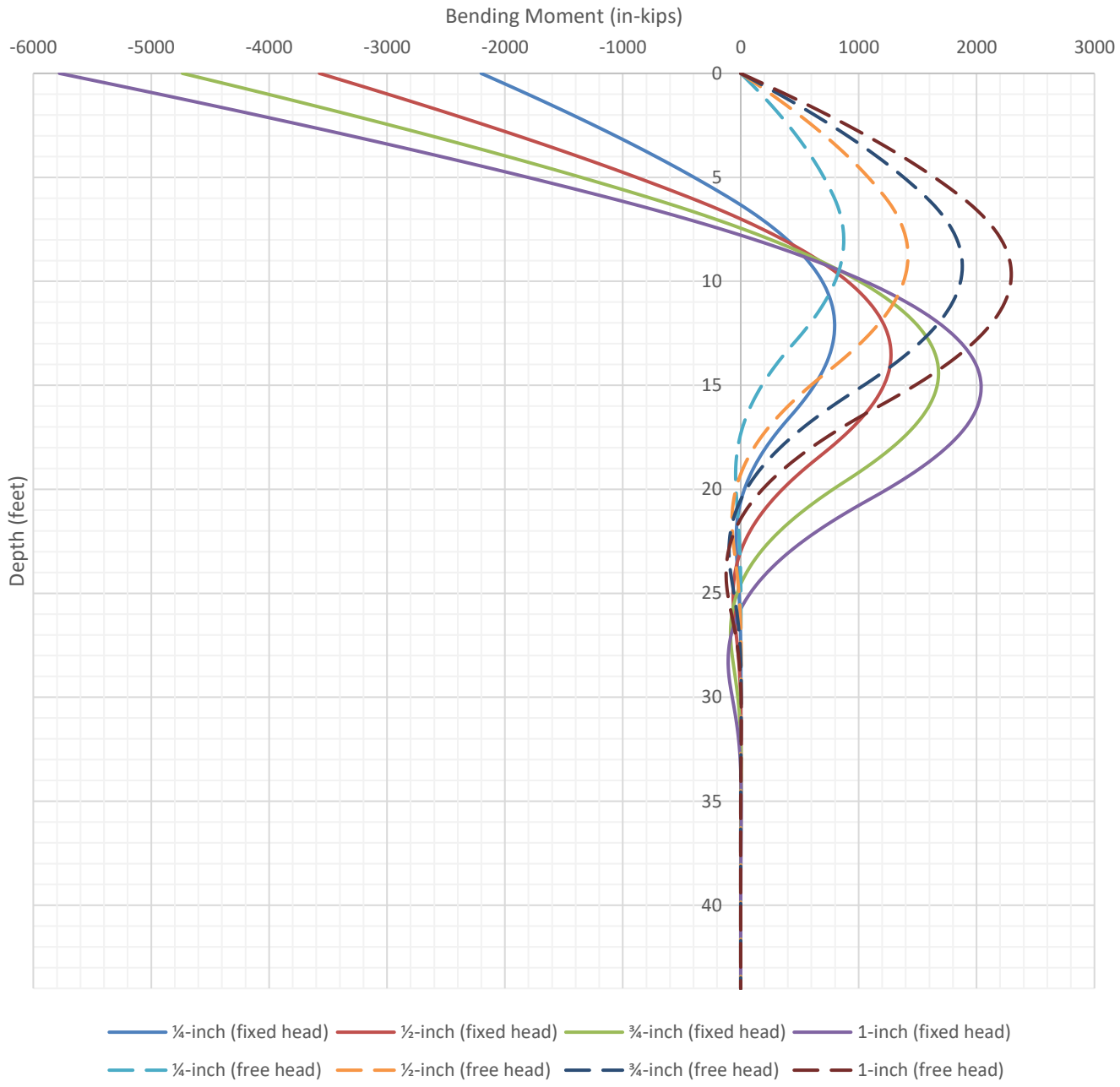
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|---|---|---|---|
| BSK ASSOCIATES | **PROJECT NO.** G00000369 | **Lpile Deflection Curves** | **FIGURE** |
| | **DRAWN:** 09/22/23 | **24-inch CIDH Piers** | **18** |
| | **DRAWN BY:** C. Melo | | |
| | **CHECKED BY:** C. Foulk | **Planned Tri-Valley East Wing Hospital Addition** | |
| | **FILE NAME:** Figures 18-20 | **Pleasanton, California** | |




**Notes:**

1. Plots are based on unfactored values. Designer should consider applying resistance factors per AASHTO to the results.
2. Minimum pier depth to achieve fixity is 44 feet.

| | | | |
|---|---|---|---|
| BSK ASSOCIATES | **PROJECT NO.** G00000369 | **Lpile Shear Force Curves** | **FIGURE** |
| | **DRAWN:** 09/22/23 | **24-inch CIDH Piers** | **19** |
| | **DRAWN BY:** C. Melo | | |
| | **CHECKED BY:** C. Foulk | **Planned Tri-Valley East Wing Hospital Addition** | |
| | **FILE NAME:** Figures 18-20 | **Pleasanton, California** | |




**Notes:**

1. Plots are based on unfactored values. Designer should consider applying resistance factors per AASHTO to the results.
2. Minimum pier depth to achieve fixity is 44 feet.

| | | | |
|---|---|---|---|
| BSK ASSOCIATES | **PROJECT NO.** G00000369 | **Lpile Bending Moment Curves** | **FIGURE** |
| | **DRAWN:** 09/22/23 | **24-inch CIDH Piers** | **20** |
| | **DRAWN BY:** C. Melo | | |
| | **CHECKED BY:** C. Foulk | **Planned Tri-Valley East Wing Hospital Addition** | |
| | **FILE NAME:** Figures 18-20 | **Pleasanton, California** | |

# APPENDIX A

# Boring Log and Liquefaction Analysis

# UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2487/2488)

| MAJOR DIVISIONS | | | | GRAPHIC LOG | | TYPICAL DESCRIPTIONS |
|---|---|---|---|---|---|---|
| COARSE GRAINED SOILS (More than half of material is larger than the #200 sieve) | GRAVELS (More than half of coarse fraction is larger than the #4 sieve) | CLEAN GRAVELS WITH <5% FINES | Cu ≥4 and 1≤ Cc≤3 | | GW | WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES |
| | | | Cu <4 and/or 1>Cc >3 | | GP | POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES |
| | | GRAVELS WITH 5 to 12% FINES | Cu ≥4 and 1≤ Cc≤3 | | GW-GM | WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES |
| | | | | | GW-GC | WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES |
| | | | Cu <4 and/or 1>Cc >3 | | GP-GM | POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES |
| | | | | | GP-GC | POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES |
| | | GRAVELS WITH >12% FINES | | | GM | SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES |
| | | | | | GC | CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES |
| | | | | | GC-GM | CLAYEY GRAVELS, GRAVEL-SAND-CLAY-SILT MIXTURES |
| | SANDS (More than half of coarse fraction is smaller than the #4 sieve) | CLEAN SANDS WITH <5% FINES | Cu ≥6 and 1≤ Cc≤3 | | SW | WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES |
| | | | Cu <6 and/or 1>Cc >3 | | SP | POORLY-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES |
| | | SANDS WITH 5 to 12% FINES | Cu ≥6 and 1≤ Cc≤3 | | SW-SM | WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES |
| | | | | | SW-SC | WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES |
| | | | Cu <6 and/or 1>Cc >3 | | SP-SM | POORLY-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES |
| | | | | | SP-SC | POORLY-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES |
| | | SANDS WITH >12% FINES | | | SM | SILTY SANDS, SAND-GRAVEL-SILT MIXTURES |
| | | | | | SC | CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES |
| | | | | | SC-SM | CLAYEY SANDS, SAND-SILT-CLAY MIXTURES |
| FINE GRAINED SOILS (More than half of material is smaller than the #200 sieve) | SILTS AND CLAYS (Liquid limit less than 50) | | | | ML | INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, SILTS WITH SLIGHT PLASTICITY, |
| | | | | | CL | INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS |
| | | | | | CL-ML | INORGANIC CLAYS-SILTS OF LOW PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS |
| | | | | | OL | ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY |
| | SILTS AND CLAYS (Liquid limit greater than 50) | | | | MH | INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT |
| | | | | | CH | INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS |
| | | | | | OH | ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY |

**UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2487/2488)**

**FIGURE**

**A-1**

# SOIL DESCRIPTION KEY

## MOISTURE CONTENT

| DESCRIPTION | ABBR | FIELD TEST |
|---|---|---|
| Dry | D | Absence of moisture, dusty, dry to the touch |
| Moist | M | Damp but no visible water |
| Wet | W | Visible free water, usually soil is below water table |

## CEMENTATION

| DESCRIPTION | FIELD TEST |
|---|---|
| Weakly | Crumbles or breaks with handling or slight finger pressure |
| Moderately | Crumbles or breaks with considerable finger pressure |
| Strongly | Will not crumble or break with finger pressure |

## PLASTICITY

| DESCRIPTION | ABBR | FIELD TEST |
|---|---|---|
| Non-plastic | NP | A 1/8-in. (3 mm) thread cannot be rolled at any water content. |
| Low (L) | LP | The thread can barely be rolled and the lump or thread cannot be formed when drier than the plastic limit. |
| Medium (M) | MP | The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump or thread crumbles when drier than the plastic limit |
| High (H) | HP | It takes considerable time rolling and kneeding to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump or thread can be formed without crumbling when drier than the plastic limit |

## GRAIN SIZE

| DESCRIPTION | | SIEVE SIZE | GRAIN SIZE | APPROXIMATE SIZE |
|---|---|---|---|---|
| Boulders | | >12" | >12" | Larger than basketball-sized |
| Cobbles | | 3 - 12' | 3 - 12" | Fist-sized to basketball-sized |
| Gravel | coarse | 3/4 -3" | 3/4 -3" | Thumb-sized to fist-sized |
| | fine | #4 - 3/4" | 0.19 - 0.75" | Pea-sized to thumb-sized |
| Sand | coarse | #10 - #4 | 0.079 - 0.19" | Rock salt-sized to pea-sized |
| | medium | #40 - #10 | 0.017 - 0.079" | Sugar-sized to rock salt-sized |
| | fine | #200 - #10 | 0.0029 - 0.017" | Flour-sized to sugar-sized |
| Fines | | Passing #200 | <0.0029 | Flour-sized and smaller |

## STRUCTURE

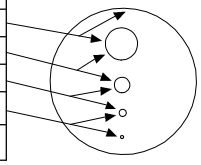
| DESCRIPTION | CRITERIA |
|---|---|
| Stratified | Alternating layers of varying material or color with layers at least 1/4 in. thick, note thickness |
| Laminated | Alternating layers of varying material or color with the layer less than 1/4 in. thick, note thickness |
| Fissured | Breaks along definite planes of fracture with little resistance to fracturing |
| Slickensided | Fracture planes appear polished or glossy, sometimes striated |
| Blocky | Cohesive soil that can be broken down into small angular lumps which resist further breakdown |
| Lensed | Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness |
| Homogeneous | Same color and appearance throughout |

## CONSISTENCY - FINE-GRAINED SOIL

| CONSISTENCY | ABBR | FIELD TEST |
|---|---|---|
| Very Soft | VS | Thumb will penetrate soil more than 1 in. (25 mm) |
| Soft | S | Thumb will penetrate soil about 1 in. (25 mm) |
| Firm | F | Thumb will indent soil about 1/4 in. (6 mm) |
| Hard | H | Thumb wil not indent soil but readily indented with thumbnail |
| Very Hard | VH | Thumbnail will not indent soil |

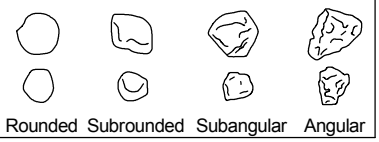
## REACTION WITH HCL

| DESCRIPTION | FIELD TEST |
|---|---|
| None | No visible reaction |
| Weak | Some reaction, with bubbles forming slowly |
| Strong | Violent reaction, with bubbles forming immediately |



## ANGULARITY

| DESCRIPTION | ABBR | CRITERIA |
|---|---|---|
| Angular | A | Particles have sharp edges and relatively plane sides with unpolished surfaces |
| Subangular | SA | Particles are similar to angular description but have rounded edges |
| Subrounded | SR | Particles have nearly plane sides but have well-rounded corners and edges |
| Rounded | R | Particles have smoothly curved sides and no edges |




## APPARENT / RELATIVE DENSITY - COARSE-GRAINED SOIL

| APPARENT DENSITY | ABBR | SPT (# blows/ft) | MODIFIED CA SAMPLER (# blows/ft) | CALIFORNIA SAMPLER (# blows/ft) | RELATIVE DENSITY (%) | FIELD TEST |
|---|---|---|---|---|---|---|
| Very Loose | VL | <4 | <4 | <5 | 0 - 15 | Easily penetrated with 1/2-inch reinforcing rod by hand |
| Loose | L | 4 - 10 | 5 - 12 | 5 - 15 | 15 - 35 | Difficult to penetrate with 1/2-inch reinforcing rod pushed by hand |
| Medium Dense | MD | 10 - 30 | 12- 35 | 15 - 40 | 35 - 65 | Easily penetrated a foot with 1/2-inch reinforcing rod driven with 5-lb. hammer |
| Dense | D | 30 - 50 | 35 - 60 | 40 - 70 | 65 - 85 | Difficult to penetrate a foot with 1/2-inch reinforcing rod driven with 5-lb. hammer |
| Very Dense | VD | >50 | >60 | >70 | 85 - 100 | Penetrated only a few inches with 1/2-inch reinforcing rod driven with 5-lb. hammer |

## *LOG SYMBOLS*

| | | | |
|---|---|---|---|
|  | BULK / BAG SAMPLE | -4 | PERCENT FINER THAN THE NO. 4 SIEVE (ASTM Test Method C 136) |
|  | SPLIT BARREL SAMPLER (2-1/2 inch outside diameter) | -200 | PERCENT FINER THAN THE NO. 200 SIEVE (ASTM Test Method C 117) |
|  | SPLIT BARREL SAMPLER (3 inch outside diameter) | LL | LIQUID LIMIT (ASTM Test Method D 4318) |
|  | STANDARD PENETRATION SPLIT SPOON SAMPLER (2 inch outside diameter) | PI | PLASTICITY INDEX (ASTM Test Method D 4318) |
|  | CONTINUOUS CORE | TXUU | UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (EM 1110-1-1906)/ASTM Test Method D 2850 |
|  | SHELBY TUBE | EI | EXPANSION INDEX (UBC STANDARD 18-2) |
|  | ROCK CORE | COL | COLLAPSE POTENTIAL |
|  | GROUNDWATER LEVEL (encountered at time of drilling) | UC | UNCONFINED COMPRESSION (ASTM Test Method D 2166) |
|  | GROUNDWATER LEVEL (measured after drilling) | | |
|  | SEEPAGE | MC | MOISTURE CONTENT (ASTM Test Method D 2216) |

## *GENERAL NOTES*

*Boring log data represents a data snapshot.*

*This data represents subsurface characteristics only to the extent encountered at the location of the boring.*

*The data inherently cannot accurately predict the entire subsurface conditions to be encountered at the project site relative to construction or other subsurface activities.*

*Lines between soil layers and/or rock units are approximate and may be gradual transitions.*

*The information provided should be used only for the purposes intended as described in the accompanying documents.*

*In general, Unified Soil Classification System designations presented on the logs were evaluated by visual methods.*

*Where laboratory tests were performed, the designations reflect the laboratory test results.*

*The Responsible Geotechnical Engineer, Professional Engineer, or Professional Geologist uses professional judgement and visual-manual procedures in general conformance with ASTM D2488 to classify soil when the full classification suite of tests per ASTM D2487 is not conducted.*

BSK Associates
399 Lindbergh Avenue
Livermore, CA 94551
Telephone: (925) 315-3151

# LOG OF BORING NO. B-1

Project Name: **Tri-Valley East Wing Hospital Addition**
Project Number: **G00000369**
Project Location: **5555 West Las Positas Blvd, Pleasanton, CA**
Logged by: **O. Khan**
Checked by: **M. Romero**

Surface El.: **341 feet**
Location: **37.694250, -121.879921**

| Depth, feet | Graphic Log | MATERIAL DESCRIPTION | Samples | Sample Number | Penetration Blows / 6 inches | Pocket Penetrometer, TSF | % Passing No. 200 Sieve | In-Situ Dry Weight (pcf) | In-Situ Moisture Content (%) | Liquid Limit | Plastic Limit | Plasticity Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **ASPHALT:** approximately 2 inches of asphalt | | | | | | | | | | |
| | | **Sandy Gravel:** possibly aggregate base (FILL) | | | | | | | | | | |
| | | **Sandy Lean CLAY (CL):** dark olive brown, moist, medium plasticity, fine sand (possibly fill) | | 1 | | | | | | | | |
| | | **Silty SAND (SM):** dark olive brown, moist, fine to medium sand, trace clay (possibly fill) | | 2 | | | | | | | | |
| | | **Lean CLAY with Sand (CL):** dark olive brown, moist to wet, medium to high plasticity, fine to medium sand | | 3 | | | 80 | | | 37 | 17 | 20 |
| 5 | | soft | | 4A | 3 | 0.5- | | 92 | 29 | | | |
| | | Consolidation Test (see figure B-5) | | 4B | 5 | 1.5 | | | | | | |
| | | firm | | 4C | 7 | 2.5 | | 99 | 26 | | | |
| | | TXUU (see figure B-3) c= 1,310 psf | | | | | | | | | | |
| 10 | | | | 5A | 4 | 1.5- | | | | | | |
| | | | | 5B | 4 | | | | | | | |
| | | TXUU (see figure B-2) c= 1,200 psf | | 5C | 6 | 2.5 | | 96 | 28 | | | |
| 15 | | decreased sand content | | 6A | 4 | 2.0- | | | | | | |
| | | | | 6B | 4 | | | | | | | |
| | | | | 6C | 7 | 2.5 | | 100 | 25 | | | |
| 20 | | | | | | | | | | | | |

**Completion Depth:** 55.5
**Date Started:** 7/21/23
**Date Completed:** 7/21/23
**California Sampler:** 2.5-in inner diameter
**SPT Sampler:** 1.4-in inner diameter

**Drilling Equipment:** Taber Drilling CME 75
**Drilling Method:** Rotary Wash
**Drive Weight:** 140 lbs
**Hole Diameter:** 4-in
**Drop:** 30-in
**Remarks:** Automatic Hammer

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# LOG OF BORING NO. B-1

Project Name: **Tri-Valley East Wing Hospital Addition**
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| Depth, feet | Graphic Log | MATERIAL DESCRIPTION | Samples | Sample Number | Penetration Blows / 6 inches | Pocket Penetrometer, TSF | % Passing No. 200 Sieve | In-Situ Dry Weight (pcf) | In-Situ Moisture Content (%) | Liquid Limit | Plastic Limit | Plasticity Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Lean CLAY with Sand (CL):** dark olive brown, moist to wet, medium to high plasticity, fine to medium sand *(continued)* manganese oxide staining | | 7A<br>7B<br>7C | 5<br>6<br>10 | 1.8-<br>2.0 | 88 | | | 44 | 19 | 25 |
| 25 | | olive, firm to hard, trace fine gravel, calcium carbonate nodules | | 8A<br>8B<br>8C | 5<br>9<br>10 | 2.5<br>3.0 | | | | | | |
| 30 | | mottled with calcium carbonate, manganese oxide staining<br>TXUU (see figure B-2) c= 1,160 psf | | 9A<br>9B<br>9C | 5<br>5<br>8 | 2.0<br>1.5-2.5 | | 98 | 26 | | | |
| 35 | | | | 10A<br>10B<br>10C | 6<br>8<br>13 | 1.5-<br>3.0 | | | | | | |
| 40 | | | | | | | | | | | | |

**Completion Depth:** 55.5
**Date Started:** 7/21/23
**Date Completed:** 7/21/23
**California Sampler:** 2.5-in inner diameter
**SPT Sampler:** 1.4-in inner diameter

**Drilling Equipment:** Taber Drilling CME 75
**Drilling Method:** Rotary Wash
**Drive Weight:** 140 lbs
**Hole Diameter:** 4-in
**Drop:** 30-in
**Remarks:** Automatic Hammer

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# LOG OF BORING NO. B-1

Project Name: **Tri-Valley East Wing Hospital Addition**
Project Number: **G00000369**
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Logged by: **O. Khan**
Checked by: **M. Romero**

Surface El.: **341 feet**
Location: **37.694250, -121.879921**

| Depth, feet | Graphic Log | MATERIAL DESCRIPTION | Samples | Sample Number | Penetration Blows / 6 inches | Pocket Penetrometer, TSF | % Passing No. 200 Sieve | In-Situ Dry Weight (pcf) | In-Situ Moisture Content (%) | Liquid Limit | Plastic Limit | Plasticity Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Fat CLAY (CH):** pale olive, moist to wet, firm to hard, high plasticity, fine to medium sand | | 11A<br>11B<br>11C | 5<br>7<br>11 | 1.5-<br>2.0 | 92 | 100 | 24 | 51 | 23 | 28 |
| 45 | | **Silty SAND (SM):** yellowish brown, moist, medium dense to dense, iron oxide staining<br>Direct Shear (see figure B-4) c= 744 psf, Ø= 45° | | 12A<br>12B<br>12C | 16<br>19<br>27 | | 17 | 110 | 12 | | | |
| | | **Poorly Graded SAND with Silt (SP-SM):** gray, wet, coarse sand, trace fine gravel | | 13 | | | 12 | | | | | |
| 50 | | **Poorly Graded SAND (SP):** gray, wet, coarse sand, trace fine gravel | | 14 | | | 4 | | | | | |
| 55 | | Boring terminated at approximately 55.5 feet. Free groundwater was observed at approximately 4.5 feet. Upper approximately 5 feet drilled using a 4-inch diameter hand auger. Rest of boring drilled using rotary wash drilling. Boring was backfilled with cement grout and upper approximately 6 inches patched with rapid set concrete. | | | | | | | | | | |
| 60 | | | | | | | | | | | | |

| | | | |
|---|---|---|---|
| **Completion Depth:** | 55.5 | **Drilling Equipment:** | Taber Drilling CME 75 |
| **Date Started:** | 7/21/23 | **Drilling Method:** | Rotary Wash |
| **Date Completed:** | 7/21/23 | **Drive Weight:** | 140 lbs |
| **California Sampler:** | 2.5-in inner diameter | **Hole Diameter:** | 4-in |
| **SPT Sampler:** | 1.4-in inner diameter | **Drop:** | 30-in |
| | | **Remarks:** | Automatic Hammer |

GEOLOGISMIKI Geotechnical Software

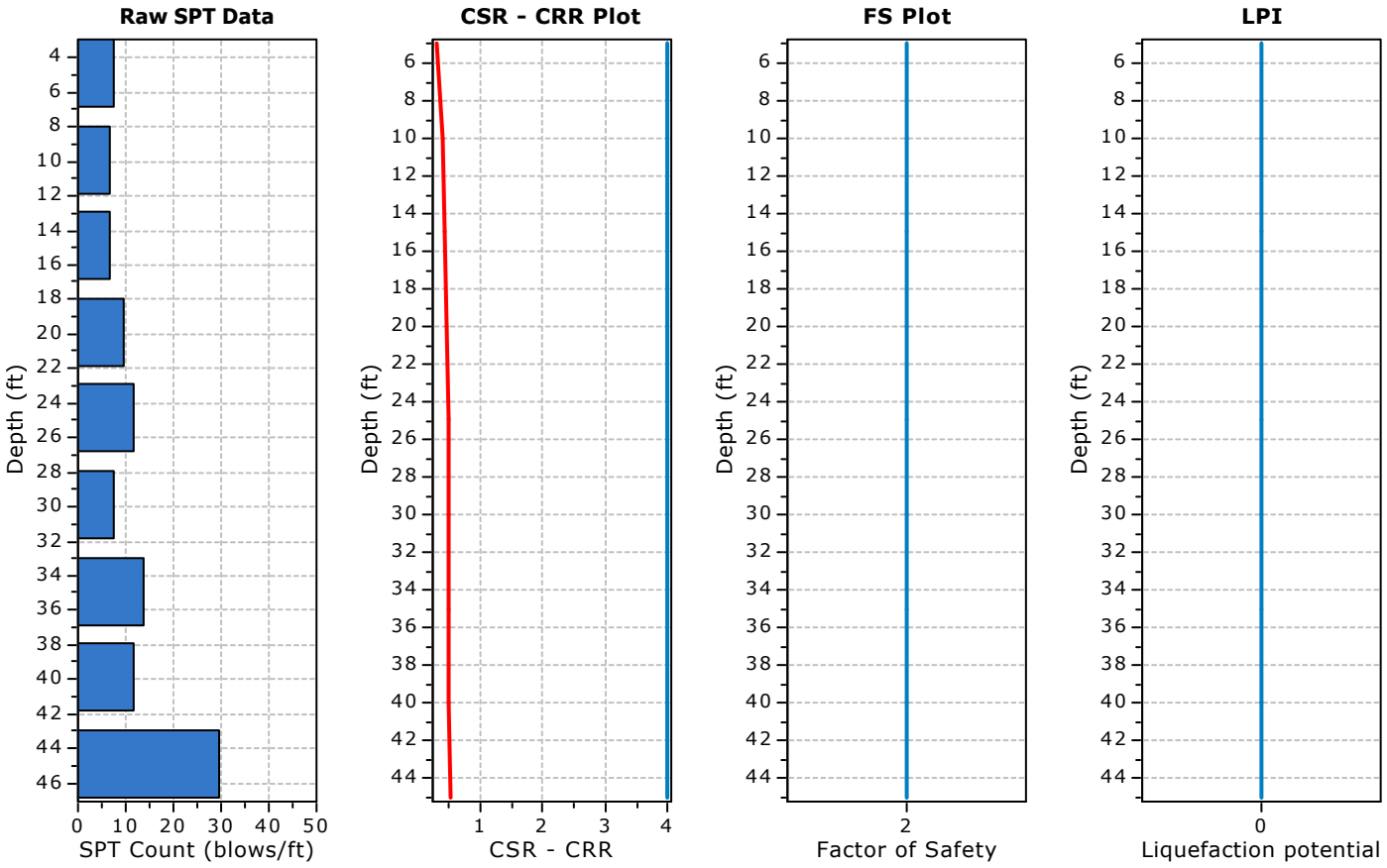
# SPT BASED LIQUEFACTION ANALYSIS REPORT

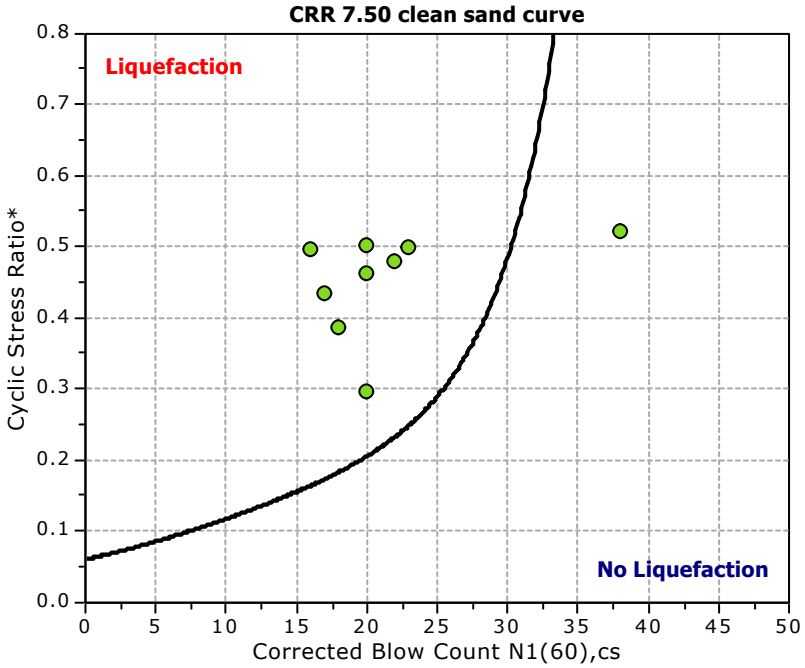
**Project title : Tri-Valley Hospital Exspansion** **SPT Name: B-1**

**Location :**

**:: Input parameters and analysis properties ::**

| | | | |
|---|---|---|---|
| Analysis method: | Boulanger & Idriss, 2014 | G.W.T. (in-situ): | 4.50 ft |
| Fines correction method: | Boulanger & Idriss, 2014 | G.W.T. (earthq.): | 4.50 ft |
| Sampling method: | Standard Sampler | Earthquake magnitude $M_w$: | 7.43 |
| Borehole diameter: | 65mm to 115mm | Peak ground acceleration: | 0.37 g |
| Rod length: | 5.00 ft | Eq. external load: | 0.00 tsf |
| Hammer energy ratio: | 1.27 | | |



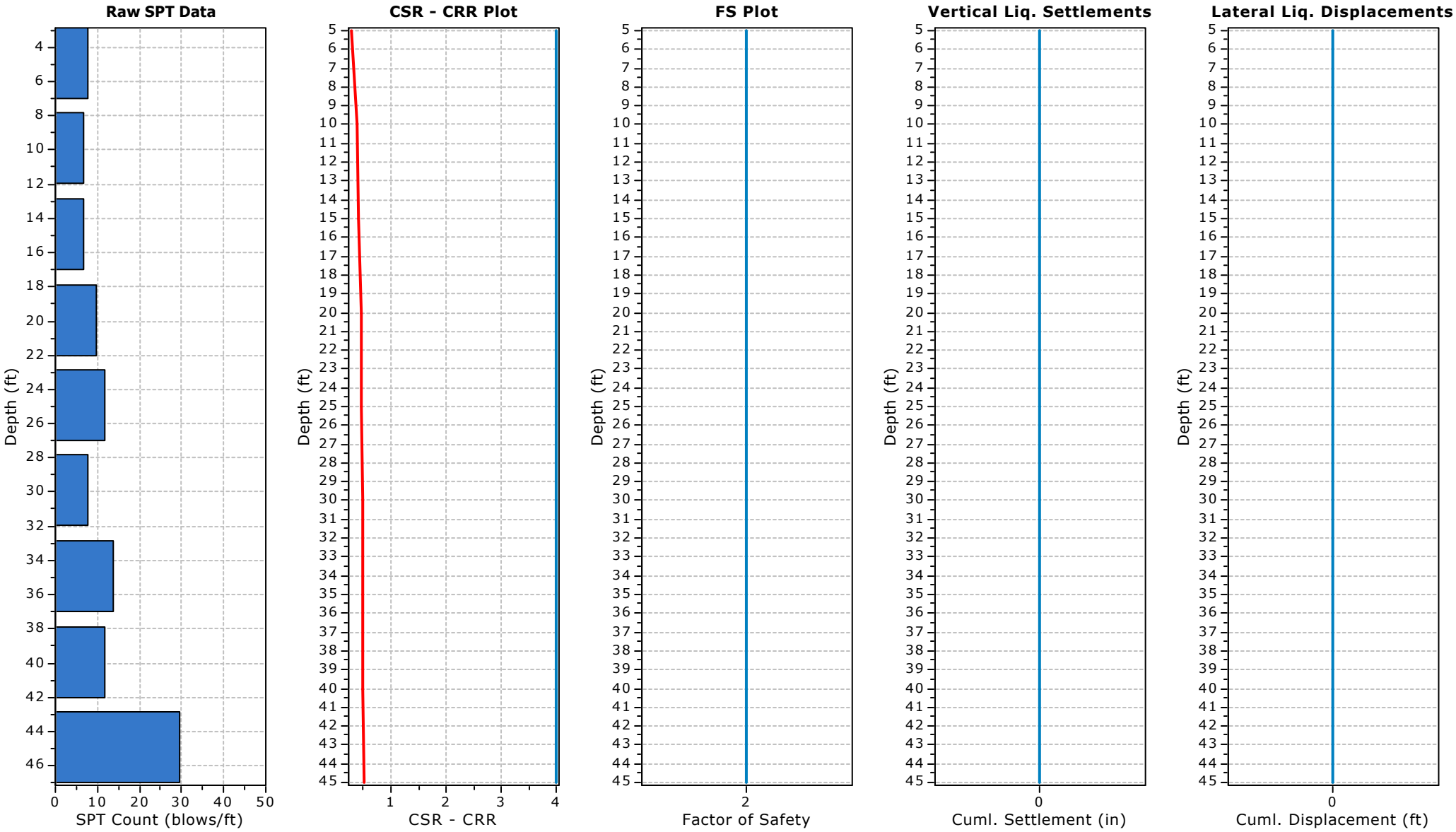

**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LPI color scheme**

- Very high risk
- High risk
- Low risk

## :: Overall Liquefaction Assessment Analysis Plots ::



**:: Field input data ::**

| Test Depth (ft) | SPT Field Value (blows) | Fines Content (%) | Unit Weight (pcf) | Infl. Thickness (ft) | Can Liquefy |
|---|---|---|---|---|---|
| 5.00 | 8 | 80.00 | 120.00 | 3.50 | No |
| 10.00 | 7 | 51.00 | 123.00 | 5.00 | No |
| 15.00 | 7 | 51.00 | 125.00 | 5.00 | No |
| 20.00 | 10 | 88.00 | 120.00 | 5.00 | No |
| 25.00 | 12 | 51.00 | 120.00 | 5.00 | No |
| 30.00 | 8 | 51.00 | 123.00 | 5.00 | No |
| 35.00 | 14 | 51.00 | 120.00 | 5.00 | No |
| 40.00 | 12 | 92.00 | 124.00 | 4.00 | No |
| 45.00 | 30 | 17.00 | 123.00 | 4.50 | Yes |

**Abbreviations**

Depth: Depth at which test was performed (ft)
SPT Field Value: Number of blows per foot
Fines Content: Fines content at test depth (%)
Unit Weight: Unit weight at test depth (pcf)
Infl. Thickness: Thickness of the soil layer to be considered in settlements analysis (ft)
Can Liquefy: User defined switch for excluding/including test depth from the analysis procedure

**:: Cyclic Resistance Ratio (CRR) calculation data ::**

| Depth (ft) | SPT Field Value | Unit Weight (pcf) | $\sigma_v$ (tsf) | $u_o$ (tsf) | $\sigma'_{vo}$ (tsf) | m | $C_N$ | $C_E$ | $C_B$ | $C_R$ | $C_S$ | $(N_1)_{60}$ | FC (%) | $\Delta(N_1)_{60}$ | $(N_1)_{60cs}$ | $CRR_{7.5}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5.00 | 8 | 120.00 | 0.30 | 0.02 | 0.28 | 0.50 | 1.70 | 1.27 | 1.00 | 0.80 | 1.00 | 14 | 80.00 | 5.54 | 20 | 4.000 |
| 10.00 | 7 | 123.00 | 0.61 | 0.17 | 0.44 | 0.52 | 1.58 | 1.27 | 1.00 | 0.85 | 1.00 | 12 | 51.00 | 5.61 | 18 | 4.000 |
| 15.00 | 7 | 125.00 | 0.92 | 0.33 | 0.59 | 0.52 | 1.36 | 1.27 | 1.00 | 0.95 | 1.00 | 11 | 51.00 | 5.61 | 17 | 4.000 |
| 20.00 | 10 | 120.00 | 1.22 | 0.48 | 0.74 | 0.49 | 1.20 | 1.27 | 1.00 | 0.95 | 1.00 | 14 | 88.00 | 5.52 | 20 | 4.000 |
| 25.00 | 12 | 120.00 | 1.52 | 0.64 | 0.88 | 0.48 | 1.09 | 1.27 | 1.00 | 0.95 | 1.00 | 16 | 51.00 | 5.61 | 22 | 4.000 |
| 30.00 | 8 | 123.00 | 1.83 | 0.80 | 1.03 | 0.54 | 1.01 | 1.27 | 1.00 | 1.00 | 1.00 | 10 | 51.00 | 5.61 | 16 | 4.000 |
| 35.00 | 14 | 120.00 | 2.13 | 0.95 | 1.18 | 0.47 | 0.95 | 1.27 | 1.00 | 1.00 | 1.00 | 17 | 51.00 | 5.61 | 23 | 4.000 |
| 40.00 | 12 | 124.00 | 2.44 | 1.11 | 1.33 | 0.50 | 0.89 | 1.27 | 1.00 | 1.00 | 1.00 | 14 | 92.00 | 5.51 | 20 | 4.000 |
| 45.00 | 30 | 123.00 | 2.75 | 1.26 | 1.48 | 0.34 | 0.89 | 1.27 | 1.00 | 1.00 | 1.00 | 34 | 17.00 | 3.85 | 38 | 4.000 |

**Abbreviations**

$\sigma_v$: Total stress during SPT test (tsf)
$u_o$: Water pore pressure during SPT test (tsf)
$\sigma'_{vo}$: Effective overburden pressure during SPT test (tsf)
m: Stress exponent normalization factor
$C_N$: Overburden corretion factor
$C_E$: Energy correction factor
$C_B$: Borehole diameter correction factor
$C_R$: Rod length correction factor
$C_S$: Liner correction factor
$N_{1(60)}$: Corrected $N_{SPT}$ to a 60% energy ratio
$\Delta(N_1)_{60}$ Equivalent clean sand adjustment
$N_{1(60)cs}$: Corected $N_{1(60)}$ value for fines content
$CRR_{7.5}$: Cyclic resistance ratio for M=7.5

**:: Cyclic Stress Ratio calculation (CSR fully adjusted and normalized) ::**

| Depth (ft) | Unit Weight (pcf) | $\sigma_{v,eq}$ (tsf) | $u_{b,eq}$ (tsf) | $\sigma'_{vo,eq}$ (tsf) | $r_d$ | $\alpha$ | CSR | $MSF_{max}$ | $(N_1)_{60cs}$ | MSF | $CSR_{eq,M=7.5}$ | $K_{sigma}$ | $CSR^*$ | FS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5.00 | 120.00 | 0.30 | 0.02 | 0.28 | 0.99 | 1.00 | 0.252 | 1.49 | 20 | 1.01 | 0.249 | 1.10 | 0.383 | 2.000 | ● |
| 10.00 | 123.00 | 0.61 | 0.17 | 0.44 | 0.98 | 1.00 | 0.329 | 1.42 | 18 | 1.01 | 0.325 | 1.10 | 0.500 | 2.000 | ● |
| 15.00 | 125.00 | 0.92 | 0.33 | 0.59 | 0.96 | 1.00 | 0.360 | 1.38 | 17 | 1.01 | 0.357 | 1.07 | 0.564 | 2.000 | ● |

**:: Cyclic Stress Ratio calculation (CSR fully adjusted and normalized) ::**

| Depth (ft) | Unit Weight (pcf) | $\sigma_{v,eq}$ (tsf) | $u_{o,eq}$ (tsf) | $\sigma'_{vo,eq}$ (tsf) | $r_d$ | $\alpha$ | CSR | $MSF_{max}$ | $(N_1)_{60cs}$ | MSF | $CSR_{eq,M=7.5}$ | $K_{sigma}$ | $CSR^*$ | FS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20.00 | 120.00 | 1.22 | 0.48 | 0.74 | 0.95 | 1.00 | 0.377 | 1.49 | 20 | 1.01 | 0.372 | 1.05 | 0.600 | 2.000 | ● |
| 25.00 | 120.00 | 1.52 | 0.64 | 0.88 | 0.93 | 1.00 | 0.384 | 1.58 | 22 | 1.01 | 0.379 | 1.03 | 0.624 | 2.000 | ● |
| 30.00 | 123.00 | 1.83 | 0.80 | 1.03 | 0.90 | 1.00 | 0.385 | 1.35 | 16 | 1.01 | 0.382 | 1.00 | 0.643 | 2.000 | ● |
| 35.00 | 120.00 | 2.13 | 0.95 | 1.18 | 0.88 | 1.00 | 0.384 | 1.62 | 23 | 1.01 | 0.378 | 0.98 | 0.649 | 2.000 | ● |
| 40.00 | 124.00 | 2.44 | 1.11 | 1.33 | 0.86 | 1.00 | 0.378 | 1.49 | 20 | 1.01 | 0.374 | 0.97 | 0.652 | 2.000 | ● |
| 45.00 | 123.00 | 2.75 | 1.26 | 1.48 | 0.83 | 1.00 | 0.372 | 2.20 | 38 | 1.03 | 0.362 | 0.90 | 0.679 | 2.000 | ● |

**Abbreviations**

$\sigma_{v,eq}$: Total overburden pressure at test point, during earthquake (tsf)
$u_{o,eq}$: Water pressure at test point, during earthquake (tsf)
$\sigma'_{vo,eq}$: Effective overburden pressure, during earthquake (tsf)
$r_d$: Nonlinear shear mass factor
$\alpha$: Improvement factor due to stone columns
CSR : Cyclic Stress Ratio
MSF : Magnitude Scaling Factor
$CSR_{eq,M=7.5}$: CSR adjusted for M=7.5
$K_{sigma}$: Effective overburden stress factor
$CSR^*$: CSR fully adjusted (user FS applied)$^{***}$
FS: Calculated factor of safety against soil liquefaction

$^{***}$ User FS: 1.30

**:: Liquefaction potential according to Iwasaki ::**

| Depth (ft) | FS | F | wz | Thickness (ft) | $I_L$ |
|---|---|---|---|---|---|
| 5.00 | 2.000 | 0.00 | 9.24 | 5.00 | 0.00 |
| 10.00 | 2.000 | 0.00 | 8.48 | 5.00 | 0.00 |
| 15.00 | 2.000 | 0.00 | 7.71 | 5.00 | 0.00 |
| 20.00 | 2.000 | 0.00 | 6.95 | 5.00 | 0.00 |
| 25.00 | 2.000 | 0.00 | 6.19 | 5.00 | 0.00 |
| 30.00 | 2.000 | 0.00 | 5.43 | 5.00 | 0.00 |
| 35.00 | 2.000 | 0.00 | 4.67 | 5.00 | 0.00 |
| 40.00 | 2.000 | 0.00 | 3.90 | 5.00 | 0.00 |
| 45.00 | 2.000 | 0.00 | 3.14 | 5.00 | 0.00 |

**Overall potential $I_L$ : 0.00**

$I_L$ = 0.00 - No liquefaction
$I_L$ between 0.00 and 5 - Liquefaction not probable
$I_L$ between 5 and 15 - Liquefaction probable
$I_L$ > 15 - Liquefaction certain

**:: Vertical & Lateral displ.acements estimation for saturated sands ::**

| Depth (ft) | $(N_1)_{60cs}$ | $\gamma_{lim}$ (%) | $F_\alpha$ | $FS_{liq}$ | $\gamma_{max}$ (%) | $e_v$ weight factor | $e_v$ (%) | dz (ft) | $S_{v-1D}$ (in) | LDI (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 5.00 | 20 | 0.00 | 0.00 | 2.000 | 0.00 | 0.00 | 0.00 | 3.50 | 0.000 | 0.00 |
| 10.00 | 18 | 0.00 | 0.00 | 2.000 | 0.00 | 0.00 | 0.00 | 5.00 | 0.000 | 0.00 |
| 15.00 | 17 | 0.00 | 0.00 | 2.000 | 0.00 | 0.00 | 0.00 | 5.00 | 0.000 | 0.00 |
| 20.00 | 20 | 0.00 | 0.00 | 2.000 | 0.00 | 0.00 | 0.00 | 5.00 | 0.000 | 0.00 |
| 25.00 | 22 | 0.00 | 0.00 | 2.000 | 0.00 | 0.00 | 0.00 | 5.00 | 0.000 | 0.00 |
| 30.00 | 16 | 0.00 | 0.00 | 2.000 | 0.00 | 0.00 | 0.00 | 5.00 | 0.000 | 0.00 |
| 35.00 | 23 | 0.00 | 0.00 | 2.000 | 0.00 | 0.00 | 0.00 | 5.00 | 0.000 | 0.00 |
| 40.00 | 20 | 0.00 | 0.00 | 2.000 | 0.00 | 0.00 | 0.00 | 4.00 | 0.000 | 0.00 |

**:: Vertical & Lateral displ.acements estimation for saturated sands ::**

| Depth (ft) | $(N_1)_{60cs}$ | $\gamma_{lim}$ (%) | $F_a$ | $FS_{liq}$ | $\gamma_{max}$ (%) | $e_v$ weight factor | $e_v$ (%) | dz (ft) | $S_{v-1D}$ (in) | LDI (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 45.00 | 38 | 1.30 | -0.65 | 2.000 | 0.00 | 1.00 | 0.00 | 4.50 | 0.000 | 0.00 |
| | | | | | **Cumulative settlements:** | | | **0.000** | **0.00** | |

**Abbreviations**

$\gamma_{lim}$: Limiting shear strain (%)
$F_a$/N: Maximun shear strain factor
$\gamma_{max}$: Maximum shear strain (%)
$e_v$:: Post liquefaction volumetric strain (%)
$S_{v-1D}$: Estimated vertical settlement (in)
LDI: Estimated lateral displacement (ft)

## References


- Ronald D. Andrus, Hossein Hayati, Nisha P. Mohanan, 2009. Correcting Liquefaction Resistance for Aged Sands Using Measured to Estimated Velocity Ratio, Journal of Geotechnical and Geoenvironmental Engineering, Vol. 135, No. 6, June 1

- Boulanger, R.W. and Idriss, I. M., 2014. CPT AND SPT BASED LIQUEFACTION TRIGGERING PROCEDURES. DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING COLLEGE OF ENGINEERING UNIVERSITY OF CALIFORNIA AT DAVIS

- Dipl.-Ing. Heinz J. Priebe, Vibro Replacement to Prevent Earthquake Induced Liquefaction, Proceedings of the Geotechnique-Colloquium at Darmstadt, Germany, on March 19th, 1998 (also published in Ground Engineering, September 1998), Technical paper 12-57E

- Robertson, P.K. and Cabal, K.L., 2007, Guide to Cone Penetration Testing for Geotechnical Engineering. Available at no cost at http://www.geologismiki.gr/

- Youd, T.L., Idriss, I.M., Andrus, R.D., Arango, I., Castro, G., Christian, J.T., Dobry, R., Finn, W.D.L., Harder, L.F., Hynes, M.E., Ishihara, K., Koester, J., Liao, S., Marcuson III, W.F., Martin, G.R., Mitchell, J.K., Moriwaki, Y., Power, M.S., Robertson, P.K., Seed, R., and Stokoe, K.H., Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshop on Evaluation of Liquefaction Resistance of Soils, ASCE, Journal of Geotechnical & Geoenvironmental Engineering, Vol. 127, October, pp 817-833

- Zhang, G., Robertson. P.K., Brachman, R., 2002, Estimating Liquefaction Induced Ground Settlements from the CPT, Canadian Geotechnical Journal, 39: pp 1168-1180

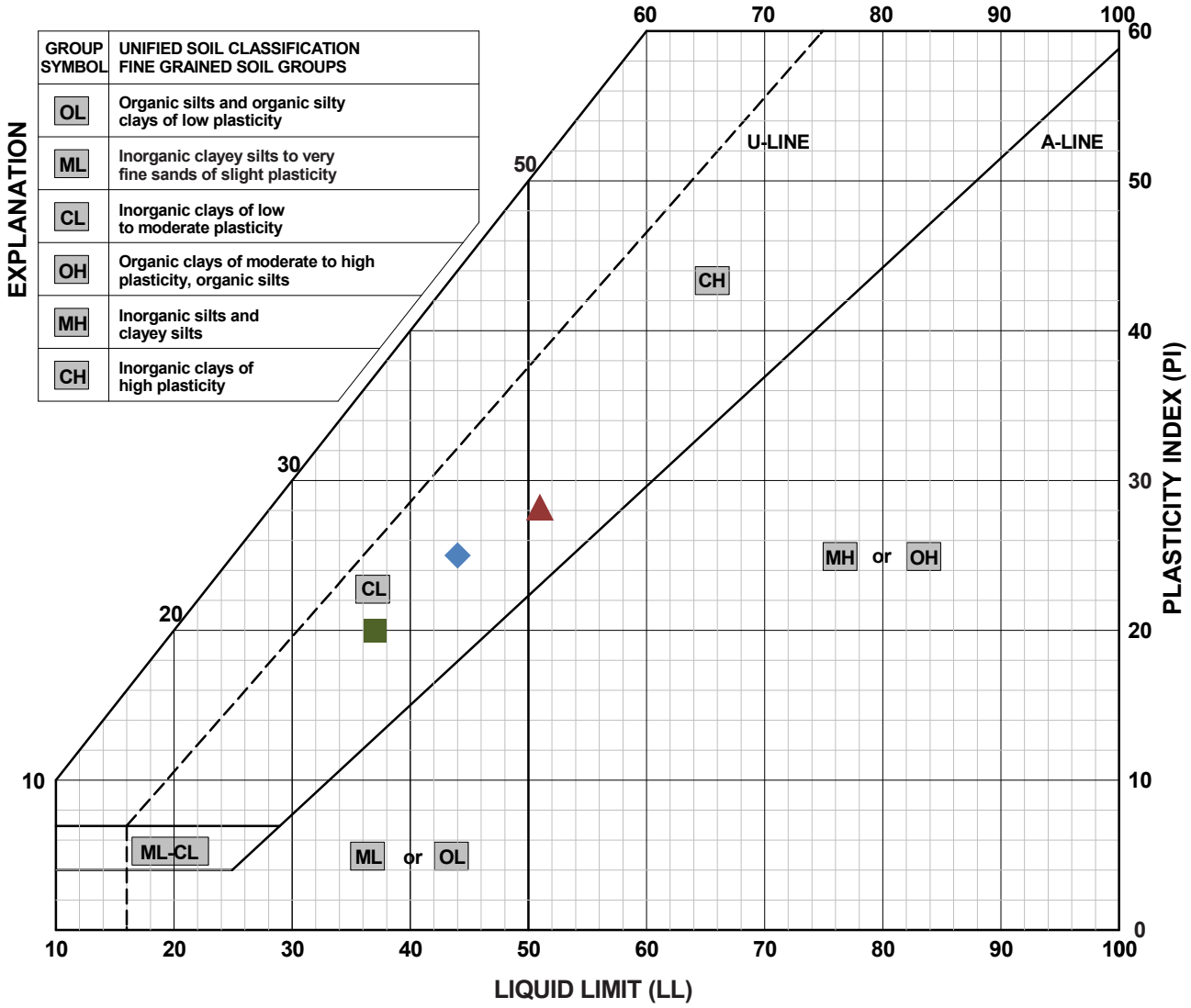
- Zhang, G., Robertson. P.K., Brachman, R., 2004, Estimating Liquefaction Induced Lateral Displacements using the SPT and CPT, ASCE, Journal of Geotechnical & Geoenvironmental Engineering, Vol. 130, No. 8, 861-871

- Pradel, D., 1998, Procedure to Evaluate Earthquake-Induced Settlements in Dry Sandy Soils, ASCE, Journal of Geotechnical & Geoenvironmental Engineering, Vol. 124, No. 4, 364-368

- R. Kayen, R. E. S. Moss, E. M. Thompson, R. B. Seed, K. O. Cetin, A. Der Kiureghian, Y. Tanaka, K. Tokimatsu, 2013. Shear-Wave Velocity–Based Probabilistic and Deterministic Assessment of Seismic Soil Liquefaction Potential, Journal of

# APPENDIX B

# Laboratory Test Results




| LEGEND: | SOURCE | DEPTH (ft) | LL | PL | PI | DESCRIPTION |
|---|---|---|---|---|---|---|
| ■ | B-1 | 4.0-5.5 | 37 | 17 | 20 | Lean Clay with Sand (CL) |
| ◆ | B-1 | 20.5 | 44 | 19 | 25 | Lean Clay (CL) |
| ▲ | B-1 | 41.0 | 51 | 23 | 28 | Fat Clay (CH) |

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CHECKED BY: C. Melo
FILE NAME: Figures.indd

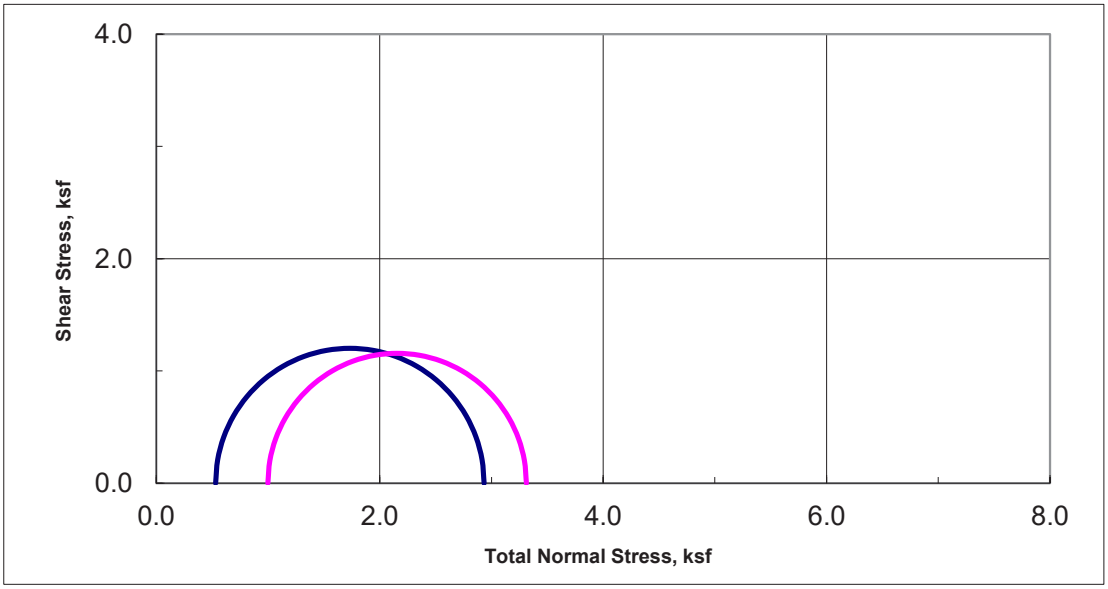
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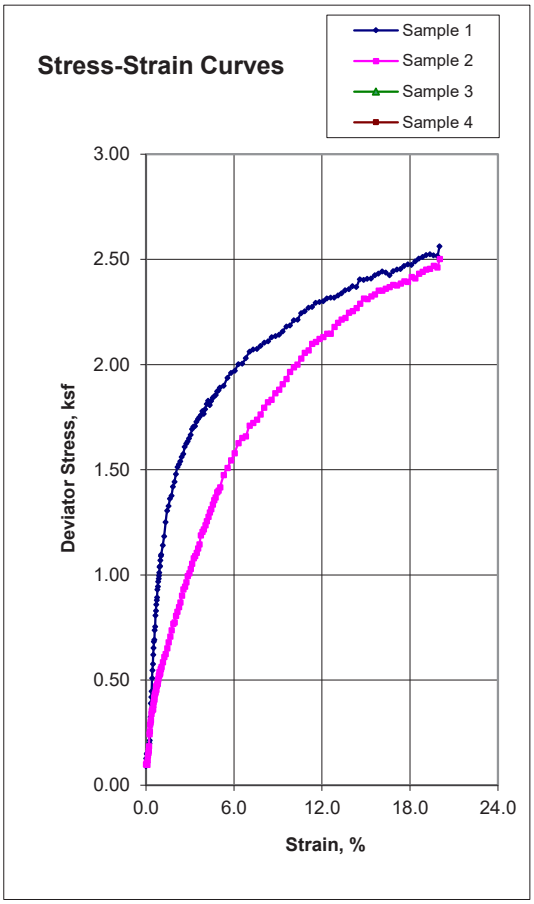
Planned Tri-Valley East Wing Hospital Addition
5555 W. Las Positas Boulevard
Pleasanton, California

FIGURE
**B-1**

COOPER TESTING LABORATORY

# Unconsolidated-Undrained Triaxial Test
ASTM D2850




| Sample Data | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Moisture % | 27.8 | 26.1 | | |
| Dry Den,pcf | 96.1 | 98.3 | | |
| Void Ratio | 0.754 | 0.715 | | |
| Saturation % | 99.5 | 98.7 | | |
| Height in | 5.00 | 5.00 | | |
| Diameter in | 2.41 | 2.41 | | |
| Cell psi | 3.7 | 6.9 | | |
| Strain % | 15.00 | 15.00 | | |
| Deviator, ksf | 2.403 | 2.314 | | |
| Rate %/min | 1.00 | 1.00 | | |
| in/min | 0.050 | 0.050 | | |
| Job No.: | 664-502 | | | |
| Client: | BSK Associates | | | |
| Project: | G00000369 | | | |
| Boring: | B-1 | B-1 | | |
| Sample: | 5C | 9C | | |
| Depth ft: | 11 | 31 | | |

| Visual Soil Description | |
|---|---|
| Sample # | |
| 1 | Lean Clay with Sand (CL) |
| 2 | Lean Clay with Sand (CL) |
| 3 | |
| 4 | |

Remarks:

Note: Strengths are picked at the peak deviator stress or 15% strain which ever occurs first per ASTM D2850.

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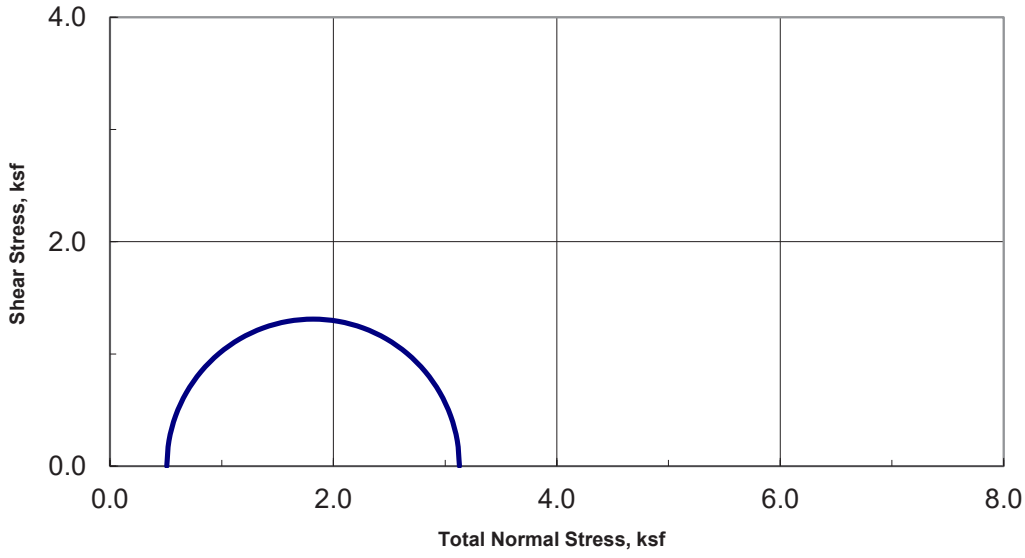
**UNCONSOLIDATED-UNDRAINED TRIAXIAL TEST**

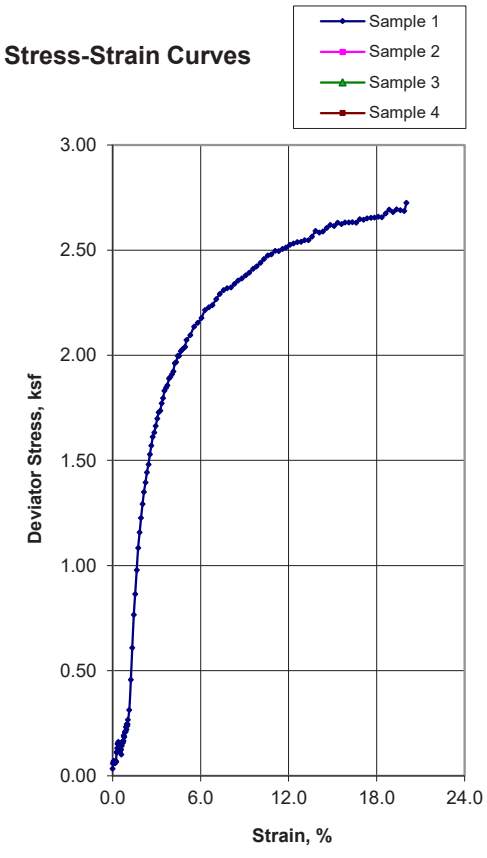
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5555 W. Las Positas Boulevard
Pleasanton, California

FIGURE
**B-2**

COOPER TESTING LABORATORY

# Unconsolidated-Undrained Triaxial Test
ASTM D2850




| Sample Data | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Moisture % | 25.9 | | | |
| Dry Den,pcf | 98.6 | | | |
| Void Ratio | 0.709 | | | |
| Saturation % | 98.7 | | | |
| Height in | 5.02 | | | |
| Diameter in | 2.41 | | | |
| Cell psi | 3.5 | | | |
| Strain % | 15.00 | | | |
| Deviator, ksf | 2.620 | | | |
| Rate %/min | 1.00 | | | |
| in/min | 0.050 | | | |
| Job No.: | 664-508 | | | |
| Client: | BSK Associates | | | |
| Project: | G00000369 | | | |
| Boring: | B-1 | | | |
| Sample: | 4C | | | |
| Depth ft: | 6.5 | | | |

| Visual Soil Description | |
|---|---|
| Sample # | |
| 1 | Lean Clay with Sand (CL) |
| 2 | |
| 3 | |
| 4 | |
| Remarks: | |

Note: Strengths are picked at the peak deviator stress or 15% strain which ever occurs first per ASTM D2850.

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**UNCONSOLIDATED-UNDRAINED TRIAXIAL TEST**

Planned Tri-Valley East Wing Hospital Addition
5555 W. Las Positas Boulevard
Pleasanton, California

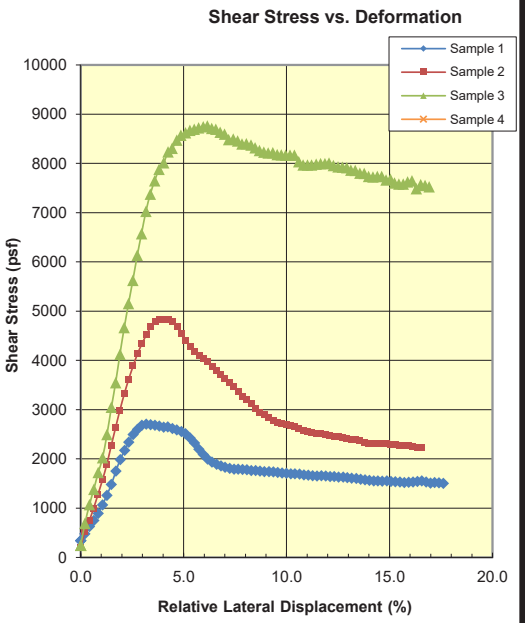
FIGURE
**B-3**

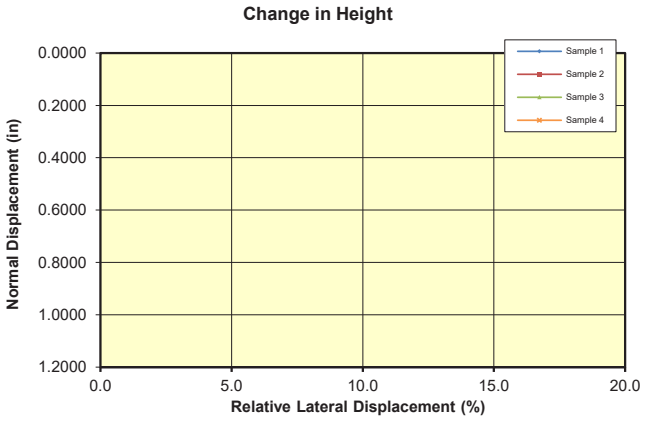
# Consolidated Undrained Direct Shear (ASTM D3080M)

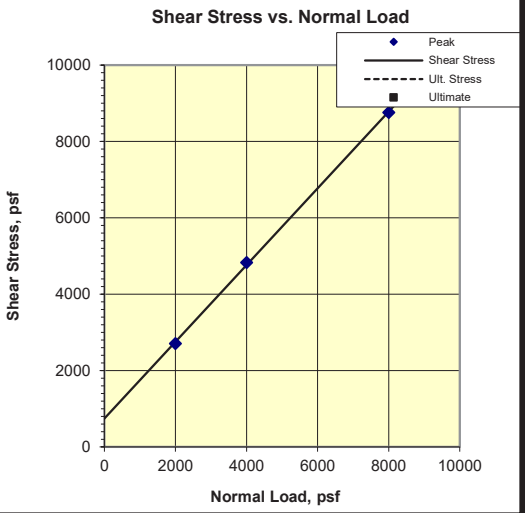
| | | | | | |
|---|---|---|---|---|---|
| CTL Job #: | 664-502 | Project #: | G00000369 | By: | MD |
| Client: | BSK Associates | Date: | 8/10/2023 | Checked: | PJ |
| Project Name: | Tri-Valley Hospital ED | Remolding Info: | | | |

| Specimen Data | | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Boring: | B-1 | B-1 | B-1 | |
| Sample: | 12C | 12C | 12C | |
| Depth (ft): | 46 | 46 | 46 | |
| Visual Description: | Silty Sand (SM) | Silty Sand (SM) | Silty Sand (SM) | |
| Normal Load (psf) | 2000 | 4000 | 8000 | |
| Dry Mass of Specimen (g) | 129.6 | 132.8 | 136.1 | |
| Initial Height (in) | 1.00 | 1.00 | 1.00 | |
| Initial Diameter (in) | 2.42 | 2.42 | 2.42 | |
| Initial Void Ratio | 0.571 | 0.533 | 0.496 | |
| Initial Moisture (%) | 12.8 | 12.0 | 10.1 | |
| Initial Wet Density (pcf) | 121.1 | 123.1 | 124.1 | |
| Initial Dry Density (pcf) | 107.3 | 110.0 | 112.7 | |
| Initial Saturation (%) | 60.6 | 60.8 | 55.3 | |
| ΔHeight Consol (in) | 0.0181 | 0.0275 | 0.0347 | |
| At Test Void Ratio | 0.542 | 0.491 | 0.444 | |
| At Test Moisture (%) | 16.2 | 15.8 | 14.4 | |
| At Test Wet Density (pcf) | 127.0 | 131.0 | 133.5 | |
| At Test Dry Density (pcf) | 109.3 | 113.1 | 116.7 | |
| At Test Saturation (%) | 80.8 | 87.1 | 87.5 | |
| Strain Rate (%/min) | 1.1 | 1.1 | 1.0 | |
| Strengths Picked at | Peak | Peak | Peak | |
| Shear Stress (psf) | 2708 | 4831 | 8760 | |
| ΔHeight (in) at Peak | | | | |
| Ultimate Stress (psf) | | | | |

| | | | |
|---|---|---|---|
| Phi (deg) | 45.1 | Ult. Phi (deg) | |
| Cohesion (psf) | 744 | Ult. Cohesion (psf) | |




Remarks: *DS-CU* A fully undrained condition may not be attained in this test. ΔH is not measured during undrained direct shear tests. Due to the high apparent phi angle, no phi or cohesion is reported. To add phi and cohesion to the report go to the "phi" tab and in cells G30, G31, H30, and H31 enter end points for a line through the 3 data points. The points plotted can be changed on the "Eng Values" tab using cells L6, A2, C2, and E2.

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| DRAWN: | 08/18/23 |
| DRAWN BY: | D. Tower |
| CHECKED BY: | C. Melo |
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**CONSOLIDATED UNDRAINED DIRECT SHEAR**

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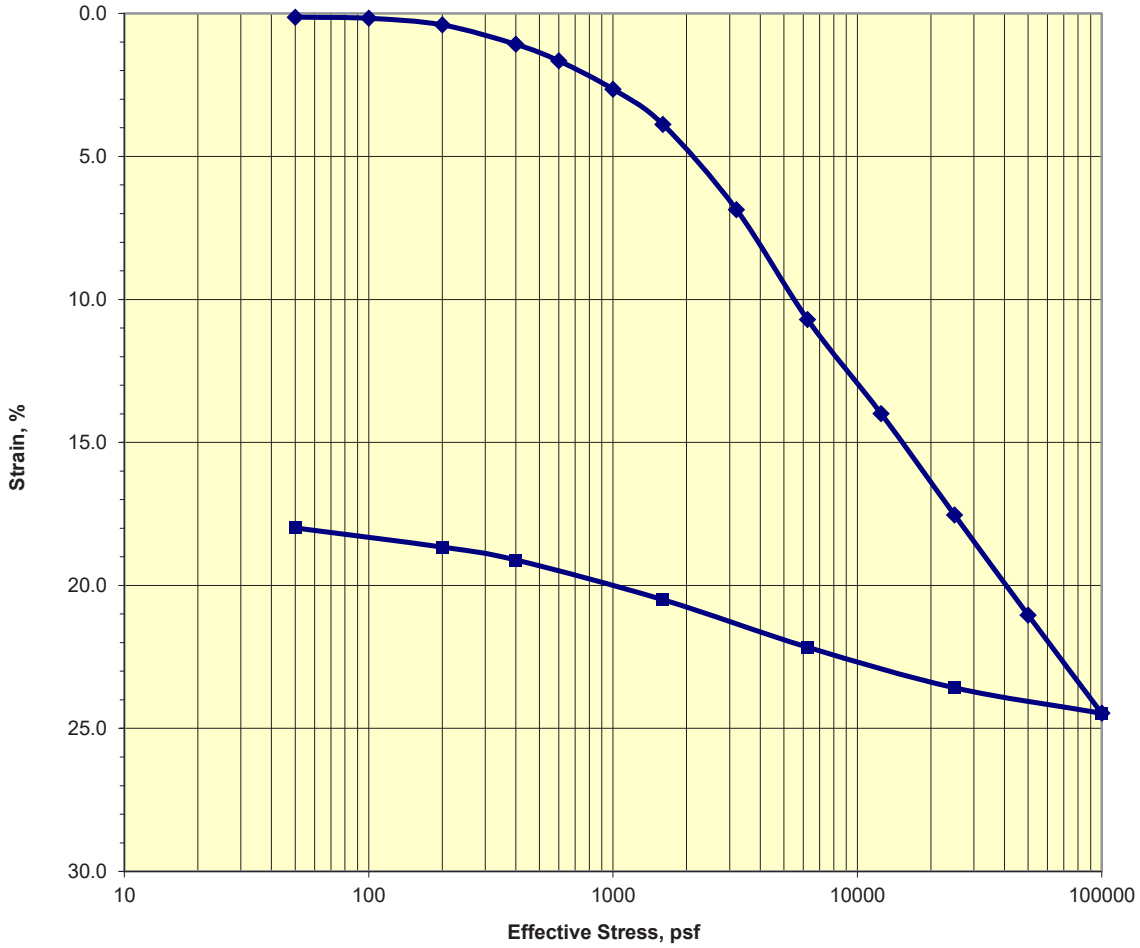
FIGURE
**B-4**

COOPER TESTING LABORATORY

# Consolidation Test
## ASTM D2435

| | | | | | |
|---|---|---|---|---|---|
| **Job No.:** | 664-508 | **Boring:** | B-1 | **Run By:** | HM |
| **Client:** | BSK Associates | **Sample:** | 4B | **Reduced:** | RU |
| **Project:** | G00000369 | **Depth, ft.:** | 6 | **Checked:** | PJ |
| **Soil Type:** | Lean Clay with Sand (CL) | | | **Date:** | 10/19/2023 |

## Strain-Log-P Curve




| Assumed Gs 2.75 | Initial | Final |
|---|---|---|
| **Moisture %:** | 28.8 | 18.9 |
| **Dry Density, pcf:** | 92.2 | 112.9 |
| **Void Ratio:** | 0.862 | 0.521 |
| **% Saturation:** | 91.9 | 100.0 |

**Remarks**:

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| **DRAWN:** 08/18/23 | |
| **DRAWN BY:** D. Tower | |
| **CHECKED BY:** C. Melo | |
| **FILE NAME:** Figures.indd | |

**CONSOLIDATION TEST**

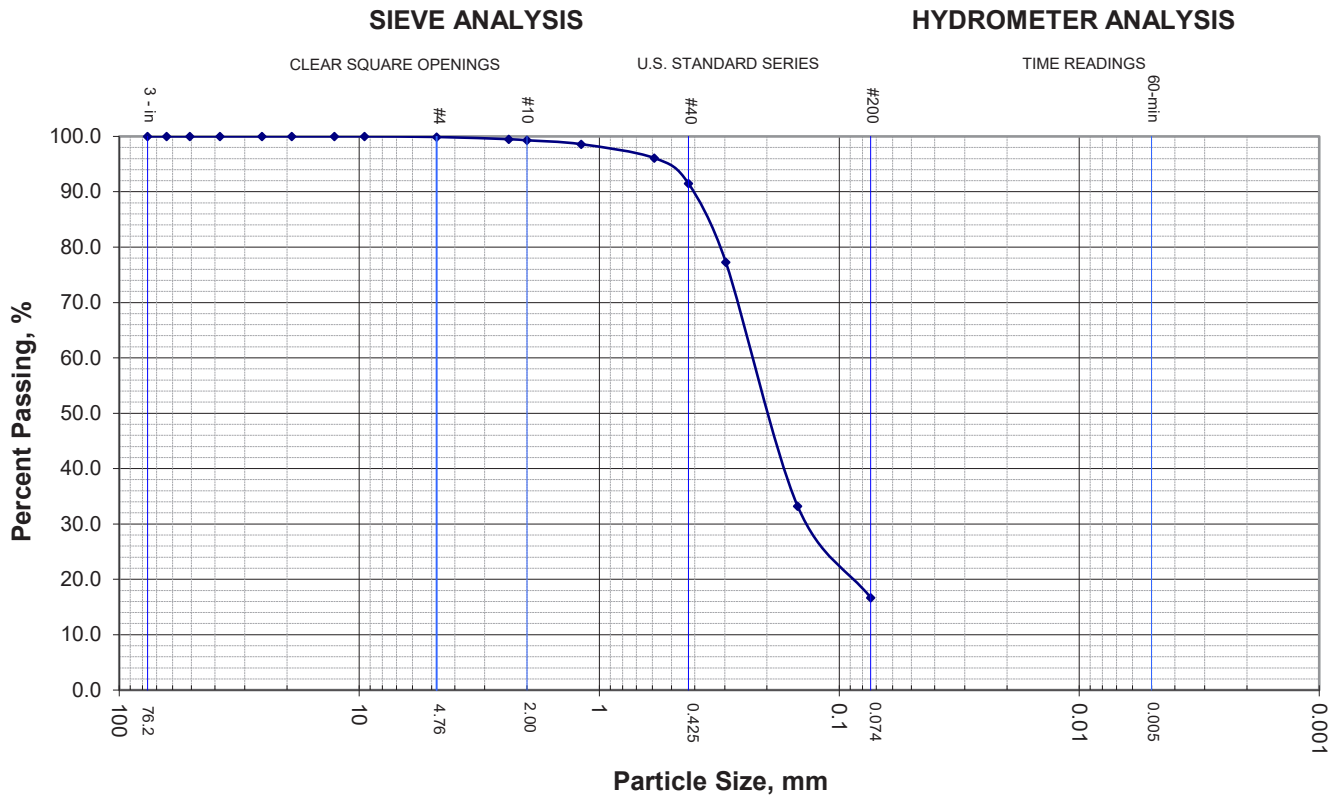
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**5555 W. Las Positas Boulevard**
**Pleasanton, California**

FIGURE

**B-5**

# GRAIN SIZE ANALYSIS OF SOILS
## (ASTM D 422)

| | | | |
|---|---|---|---|
| Client: | Stanford Health Care | Project No.: | G00000369 |
| Project: | Tri-Valley Hospital Expansion | Boring Number: | B-1 |
| Tested By: | N.S | Sample ID: | 12B |
| Reviewed By: | R.C | Sample Depth: | 45.5 feet |
| | | Date Tested: | 8/17/2023 |




PARTICLE SIZE DISTRIBUTION

| Cobbles | Gravel | Sand | | | Silt (non-plastic) and Clay (plastic) |
|---|---|---|---|---|---|
| | | Coarse | Medium | Fine | |
| 0 | 0 | 0 | 8 | 75 | 17 |

Specific Gravity, $G_s$ - 0

Description of Soil: Silty Sand (SM)

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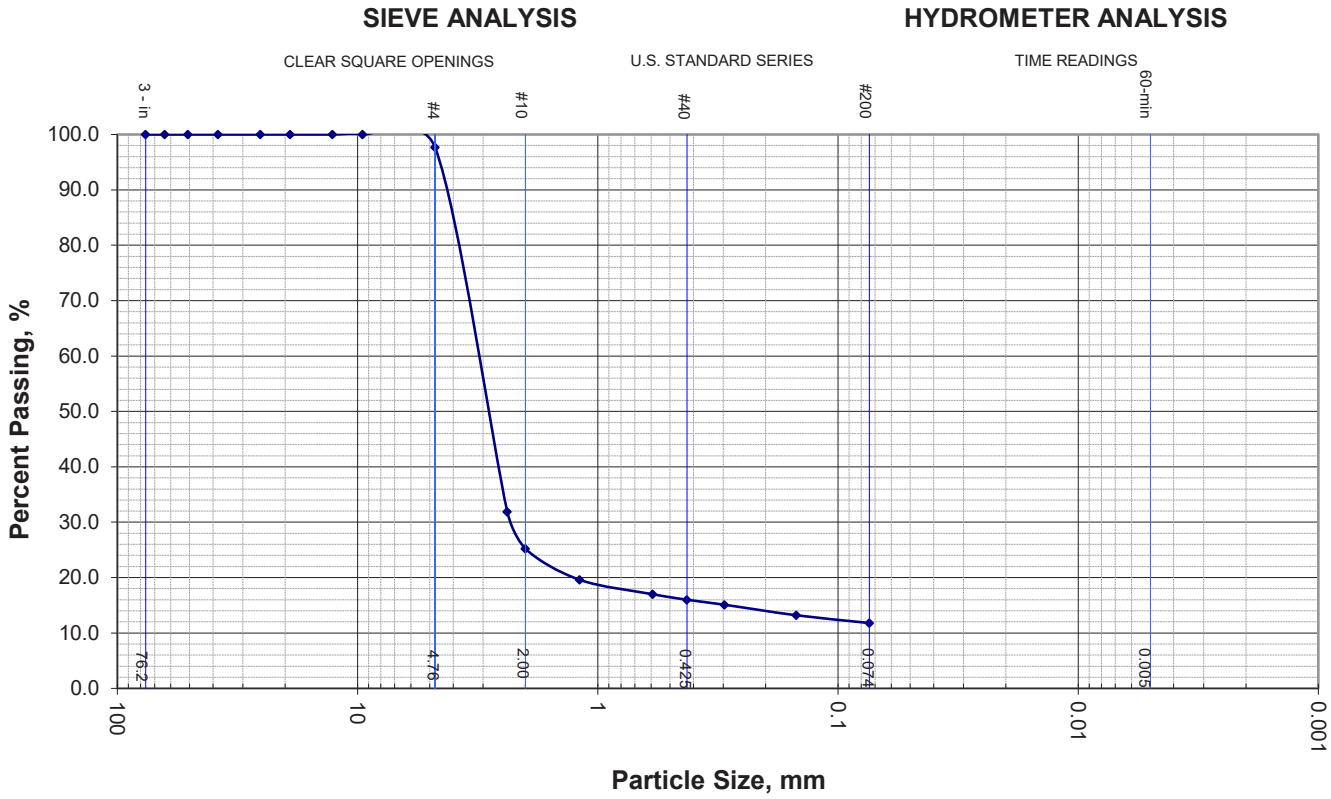
BSK ASSOCIATES

| | |
|---|---|
| PROJECT NO. G00000369 | GRAIN SIZE ANALYSIS OF SOILS |
| DRAWN: 08/24/23 | |
| DRAWN BY: D. Tower | |
| CHECKED BY: C. Melo | Planned Tri-Valley East Wing Hospital Addition<br>5555 W. Las Positas Boulevard<br>Pleasanton, California |
| FILE NAME: Figures.indd | |

FIGURE **B-6**

# GRAIN SIZE ANALYSIS OF SOILS
## (ASTM D 422)

| | | | |
|---|---|---|---|
| Client: | Stanford Health Care | Project No.: | G00000369 |
| Project: | Tri-Valley Hospital ED | Boring Number: | B-1 |
| Tested By: | N.S | Sample ID: | 13 |
| Reviewed By: | R.C | Sample Depth: | 46.5-50 |
| | | Date Tested: | 9/13/2023 |




PARTICLE SIZE DISTRIBUTION

| Cobbles | Gravel | Sand | | | Silt (non-plastic) and Clay (plastic) |
|---|---|---|---|---|---|
| | | Coarse | Medium | Fine | |
| 0 | 2 | 73 | 9 | 4 | 12 |

Specific Gravity, $G_s$ - 2.65

Description of Soil: Poorly Graded Sand with Silt (SP-SM)

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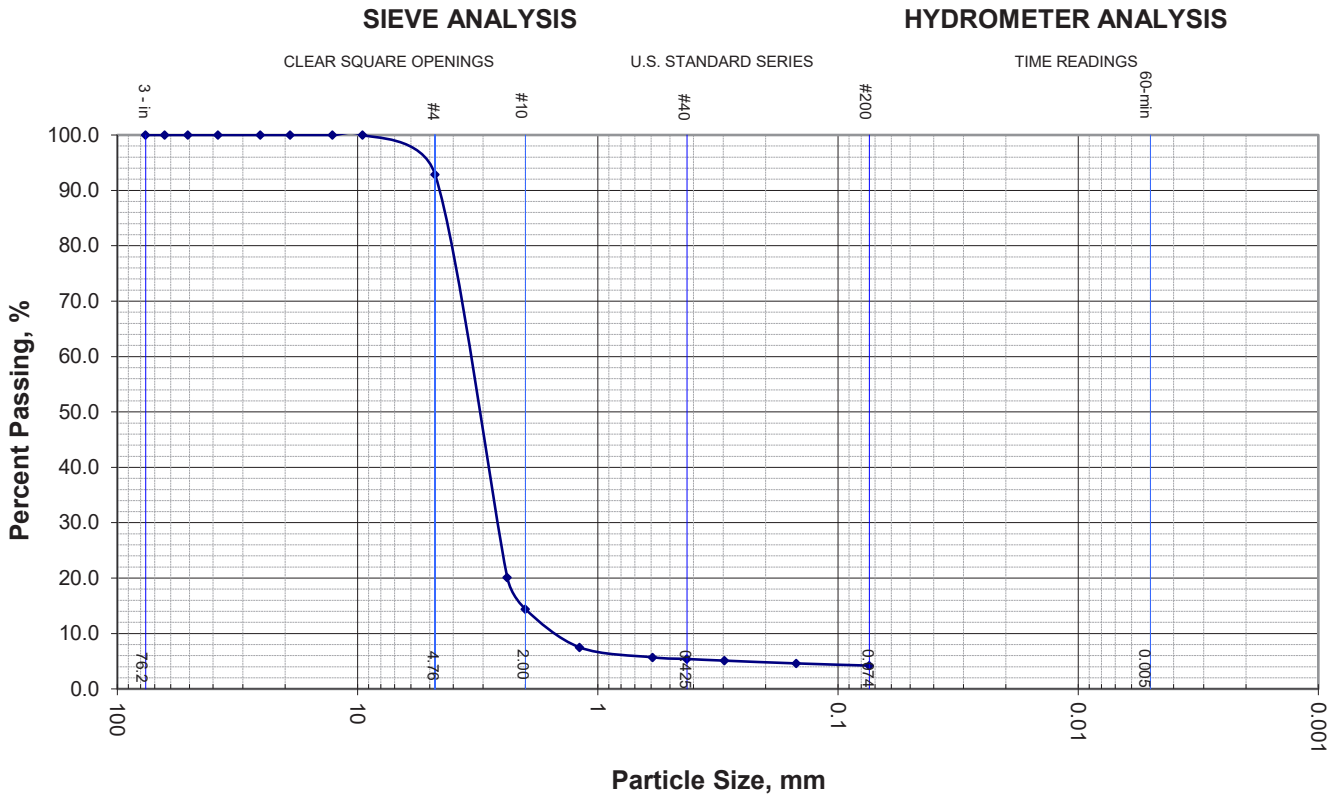
BSK ASSOCIATES

| | |
|---|---|
| PROJECT NO. G00000369 | GRAIN SIZE ANALYSIS OF SOILS |
| DRAWN: 09/22/23 | |
| DRAWN BY: D. Tower | |
| CHECKED BY: C. Melo | Planned Tri-Valley East Wing Hospital Addition<br>5555 W. Las Positas Boulevard<br>Pleasanton, California |
| FILE NAME: Figures.indd | |

FIGURE **B-7**

# GRAIN SIZE ANALYSIS OF SOILS
## (ASTM D 422)

| | | | |
|---|---|---|---|
| Client: | Stanford Health Care | Project No.: | G00000369 |
| Project: | Tri-Valley Hospital ED | Boring Number: | B-1 |
| Tested By: | N.S | Sample ID: | 14 |
| Reviewed By: | R.C | Sample Depth: | 50-55.5 |
| | | Date Tested: | 9/13/2023 |




PARTICLE SIZE DISTRIBUTION

| Cobbles | Gravel | Sand | | | Silt (non-plastic) and Clay (plastic) |
|---|---|---|---|---|---|
| | | Coarse | Medium | Fine | |
| 0 | 7 | 79 | 9 | 1 | 4 |

Specific Gravity, $G_s$ - 2.65

Description of Soil: Poorly Graded Sand (SP)

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BSK ASSOCIATES

| | | |
|---|---|---|
| PROJECT NO. G00000369 | GRAIN SIZE ANALYSIS OF SOILS | FIGURE |
| DRAWN: 09/22/23 | | |
| DRAWN BY: D. Tower | | B-8 |
| CHECKED BY: C. Melo | Planned Tri-Valley East Wing Hospital Addition<br>5555 W. Las Positas Boulevard<br>Pleasanton, California | |
| FILE NAME: Figures.indd | | |

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax. 925 462 2775
www.cercoanalytical.com

8 August, 2023

Job No. 2308005
Cust. No. 12667

Mr. Michael Romero
BSK Associates Engineers & Laboratories
399 Lindbergh Avenue
Livermore, CA 94551

Subject: Project No.: G00000369
Project Name: Tri-Valley Hospital ED Expansion
Corrosivity Analysis – ASTM Test Methods

Dear Mr. Romero:

Pursuant to your request, CERCO Analytical has analyzed the soil sample submitted on August 03, 2023. Based on the analytical results, this brief corrosivity evaluation is enclosed for your consideration.

Based upon the resistivity measurement, this sample is classified as "severely corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentration is 59 mg/kg and is determined to be insufficient to attack steel embedded in a concrete mortar coating.

The sulfate ion concentration is 510 mg/kg and is determined to be sufficient to potentially be detrimental to reinforced concrete structures and cement mortar-coated steel at these locations. Therefore, concrete that comes into contact with this soil should use sulfate resistant cement such as Type II, with a maximum water-to-cement ratio of 0.55.

The pH of the soil is 8.10, which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

The redox potential is 270-mV and is indicative of potentially "slightly corrosive" soils resulting from anaerobic soil conditions.

This corrosivity evaluation is based on general corrosion engineering standards and is non-specific in nature. For specific long-term corrosion control design recommendations or consultation, please call *JDH Corrosion Consultants, Inc. at (925) 927-6630.*

We appreciate the opportunity of working with you on this project. If you have any questions, or if you require further information, please do not hesitate to contact us.

Very truly yours,
**CERCO ANALYTICAL, INC.**

for

J. Darby Howard, Jr., P.E.
President

JDH/jdl
Enclosure

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax. 925 462 2775
www.cercoanalytical.com

Client: BSK Associates Engineers & Laboratories
Client's Project No.: G00000369
Client's Project Name: Tri-Valley Hospital ED Expansion
Date Sampled: 21-Jul-23
Date Received: 3-Aug-23
Matrix: Soil
Authorization: Signed Chain of Custody

Date of Report: 8-Aug-2023

| Job/Sample No. | Sample I.D. | Redox (mV) | pH | Conductivity (umhos/cm)* | Resistivity (100% Saturation) (ohms-cm) | Sulfide (mg/kg)* | Chloride (mg/kg)* | Sulfate (mg/kg)* |
|---|---|---|---|---|---|---|---|---|
| 2308005-001 | B-1/3 @ 4-5.5' | 270 | 8.10 | - | 470 | - | 59 | 510 |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
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| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

| Method: | ASTM D1498 | ASTM D4972 | ASTM D1125M | ASTM G57 | ASTM D4658M | ASTM D4327 | ASTM D4327 |
|---|---|---|---|---|---|---|---|
| Reporting Limit: | - | - | 10 | - | 50 | 15 | 15 |
| Date Analyzed: | 3-Aug-2023 | 4-Aug-2023 | - | 3-Aug-2023 | - | 4-Aug-2023 | 4-Aug-2023 |

Julia Clauson
Chemist

* Results Reported on "As Received" Basis
N.D. - None Detected

**Quality Control Summary** - **All laboratory quality control parameters were found to be within established limits**

# APPENDIX C

# CPT Logs, Shear Wave Velocities, and Liquefaction Analysis

# TABLE OF CONTENTS


**CPT 1 results**

| | |
|---|---|
| Summary data report | 1 |
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| Cyclic resistance ratio results | 20 |
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| Vertical settlements summary report | 29 |
| Vertical settlements data report | 30 |
| Strength loss data report | 34 |

**CPT 2 results**

| | |
|---|---|
| Summary data report | 42 |
| Input field data | 49 |
| Cyclic stress resistance results | 55 |
| Cyclic resistance ratio results | 61 |
| Liquefaction potential index data | 67 |
| Vertical settlements summary report | 70 |
| Vertical settlements data report | 71 |
| Strength loss data report | 75 |

**GeoLogismiki**
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

Ignore CPT results in the upper 5 feet below the ground surface for CPT-1 because the CPT hole was cleared using a hand auger within this zone prior to advancing the CPT probe.

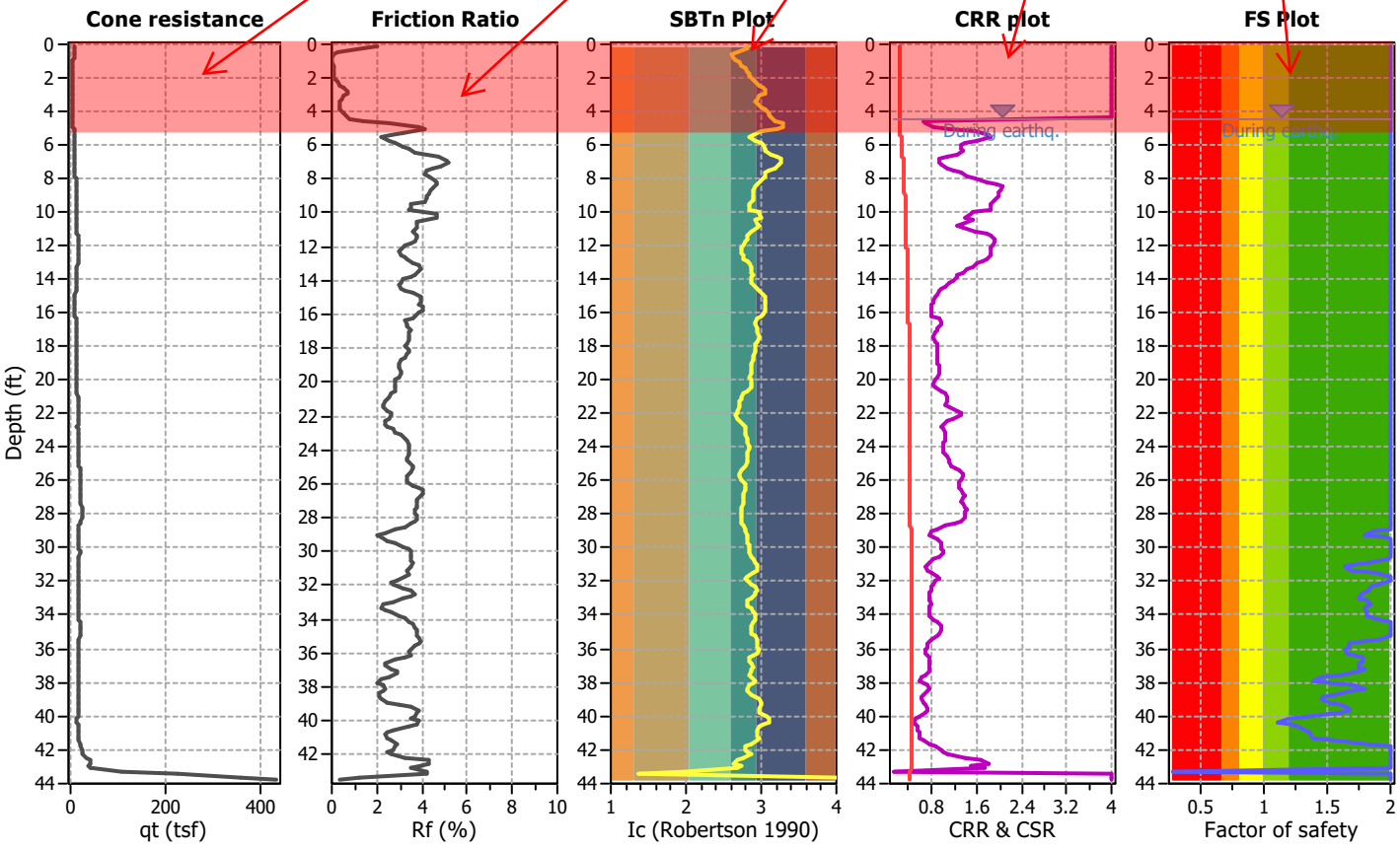
# LIQUEFACTION ANALYSIS REPORT

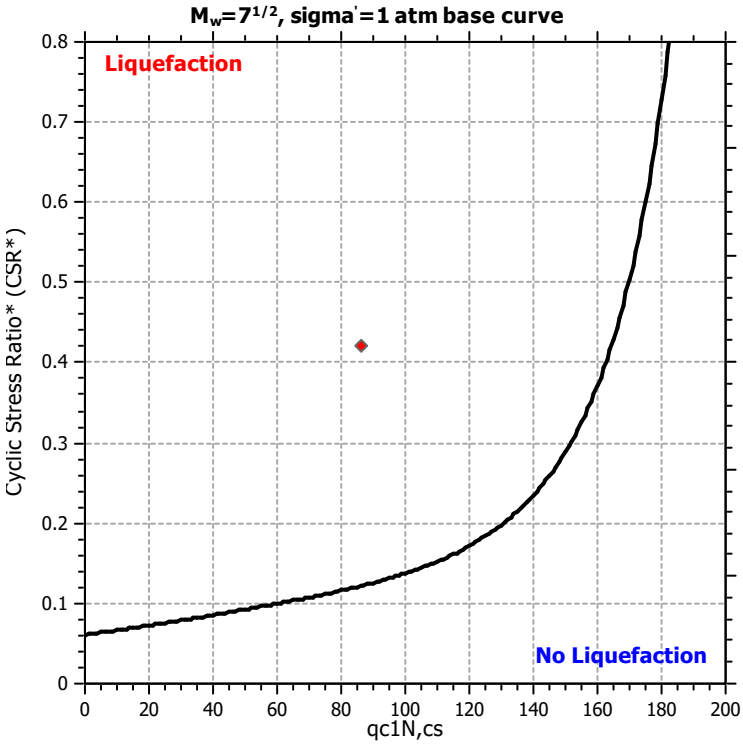
**Project title : Tri-Valley** **Location :**

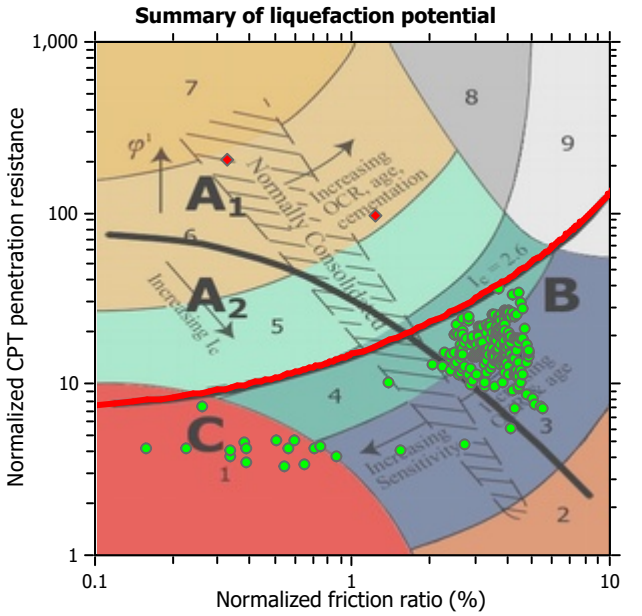
**CPT file : CPT 1**

**Input parameters and analysis data**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | G.W.T. (in-situ): | 4.50 ft | Use fill: | No | Clay like behavior applied: | Sand & Clay |
| Fines correction method: | B&I (2014) | G.W.T. (earthq.): | 4.50 ft | Fill height: | N/A | Limit depth applied: | No |
| Points to test: | Based on Ic value | Average results interval: | 3 | Fill weight: | N/A | Limit depth: | N/A |
| Earthquake magnitude $M_w$: | 7.43 | Ic cut-off value: | 2.60 | Trans. detect. applied: | No | MSF method: | Method based |
| Peak ground acceleration: | 0.37 | Unit weight calculation: | Based on SBT | $K_\sigma$ applied: | Yes | | |



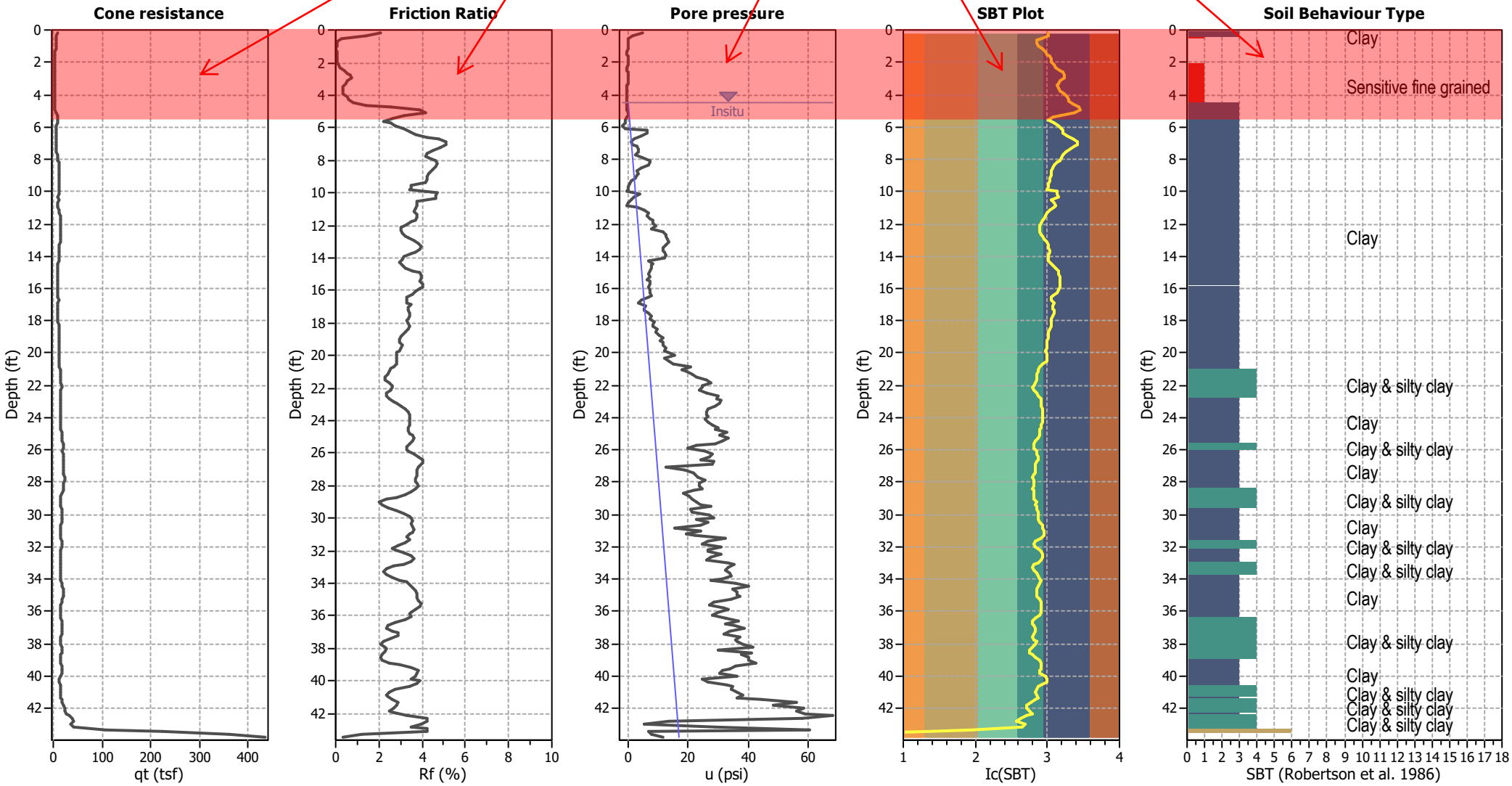




Zone $A_1$: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone $A_2$: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Ignore CPT results in the upper 5 feet below the ground surface for CPT-1 because the CPT hole was cleared using a hand auger within this zone prior to advancing the CPT probe.



## CPT basic interpretation plots




### Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.50 ft | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 7.43 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration: | 0.37 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 4.50 ft | Fill height: | N/A | Limit depth: | N/A |

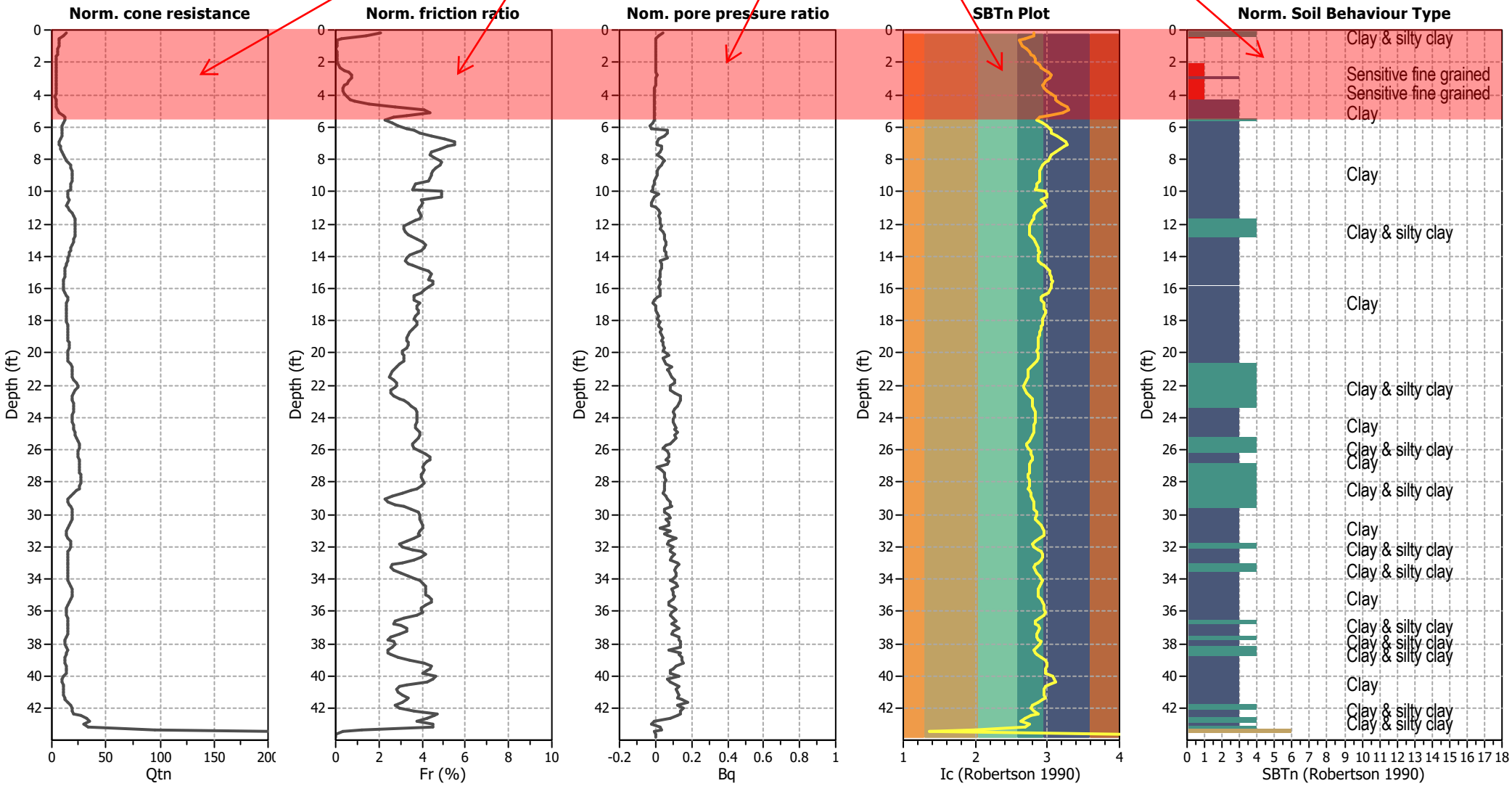
**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Ignore CPT results in the upper 5 feet below the ground surface for CPT-1 because the CPT hole was cleared using a hand auger within this zone prior to advancing the CPT probe.



## CPT basic interpretation plots (normalized)




### Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.50 ft | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 7.43 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration: | 0.37 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 4.50 ft | Fill height: | N/A | Limit depth: | N/A |

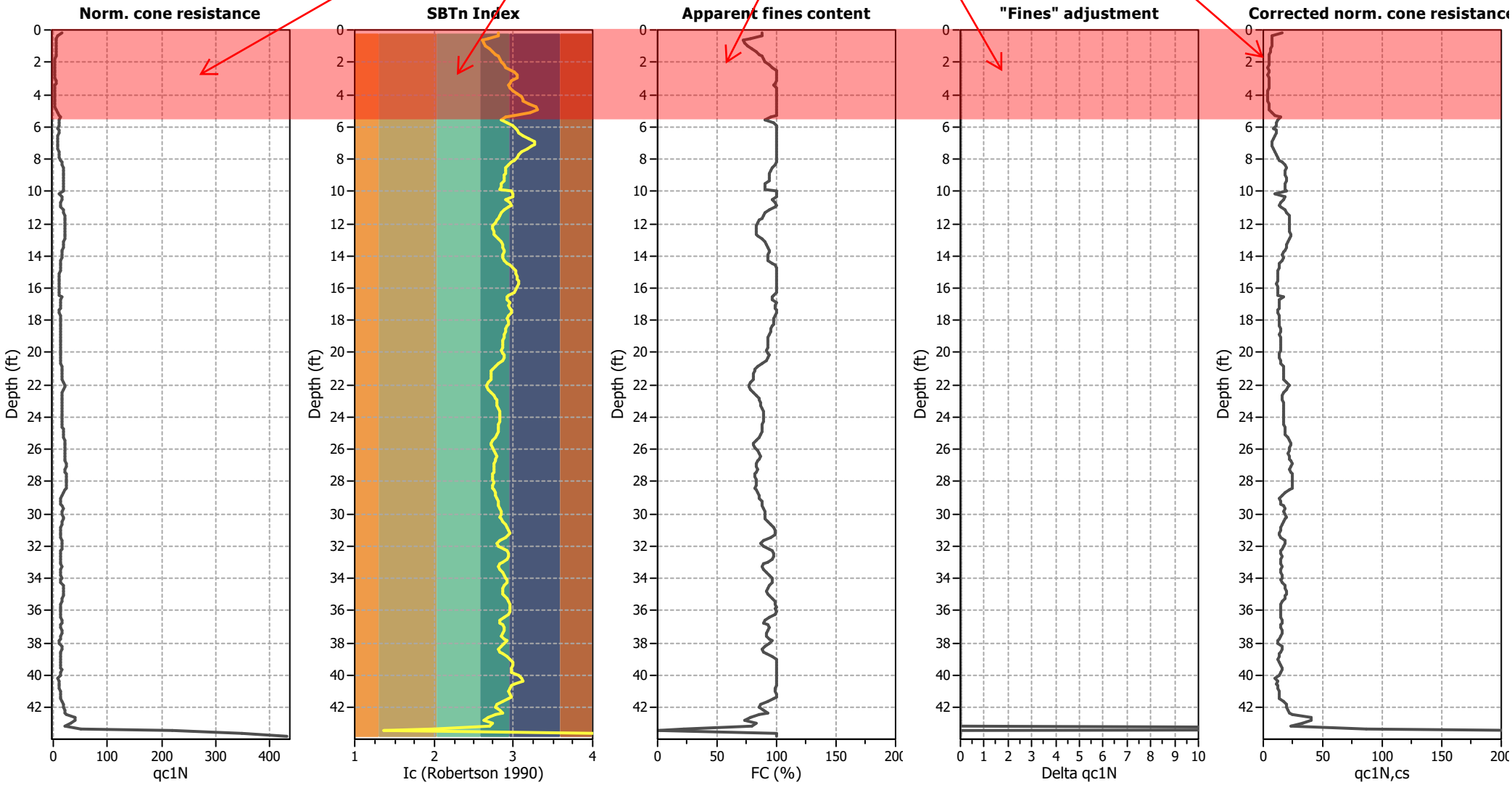
**SBTn legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Ignore CPT results in the upper 5 feet below the ground surface for CPT-1 because the CPT hole was cleared using a hand auger within this zone prior to advancing the CPT probe.



## Liquefaction analysis overall plots (intermediate results)



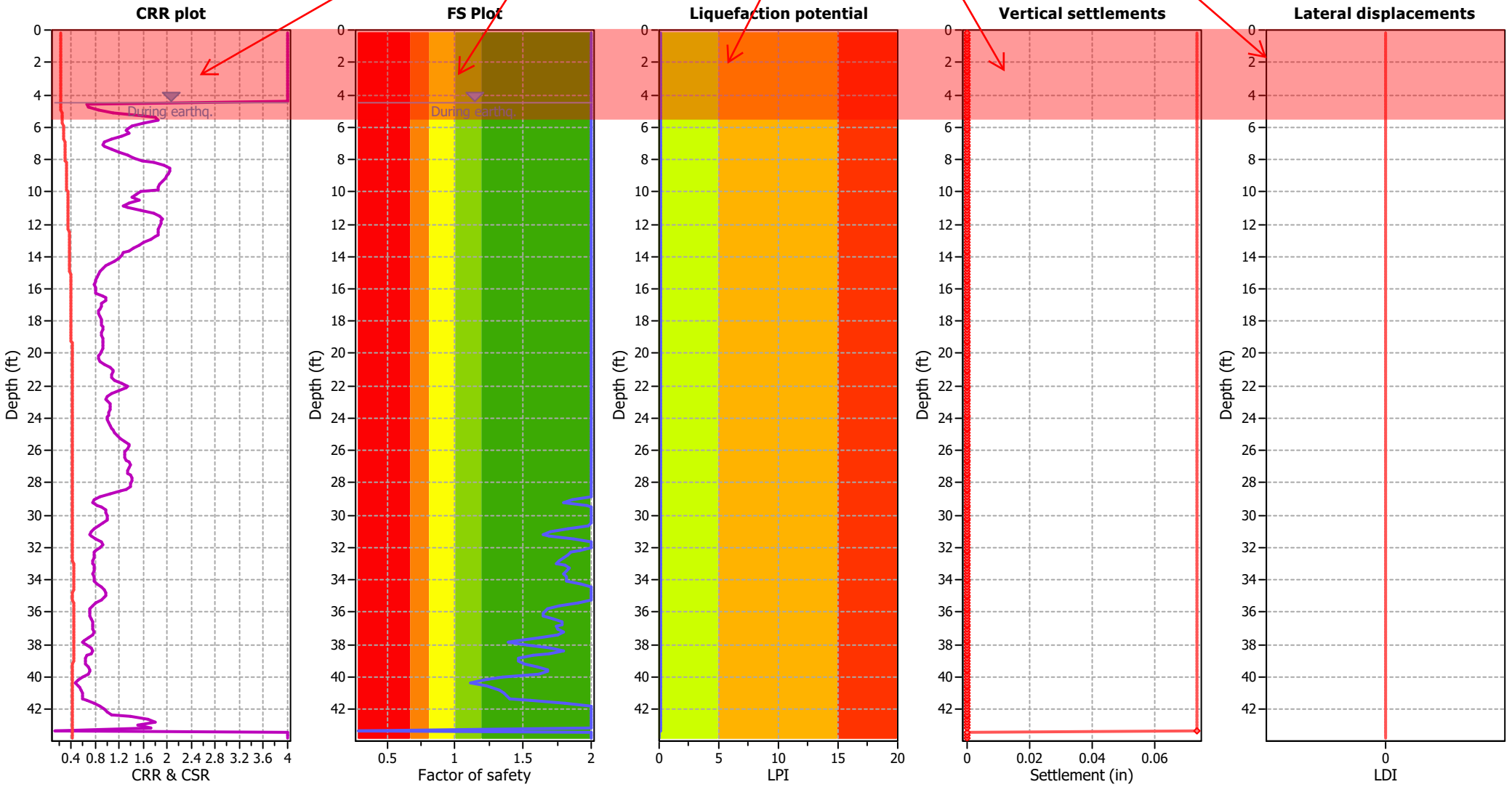

### Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.50 ft | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 7.43 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration: | 0.37 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 4.50 ft | Fill height: | N/A | Limit depth: | N/A |

Ignore CPT results in the upper 5 feet below the ground surface for CPT-1 because the CPT hole was cleared using a hand auger within this zone prior to advancing the CPT probe.



## Liquefaction analysis overall plots




### Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.50 ft | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 7.43 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration: | 0.37 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 4.50 ft | Fill height: | N/A | Limit depth: | N/A |

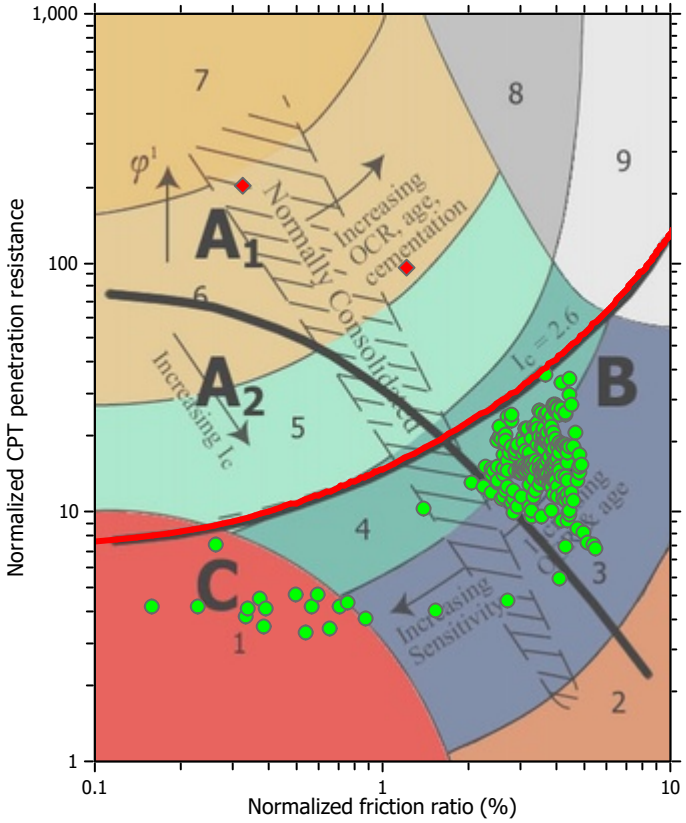
**F.S. color scheme**

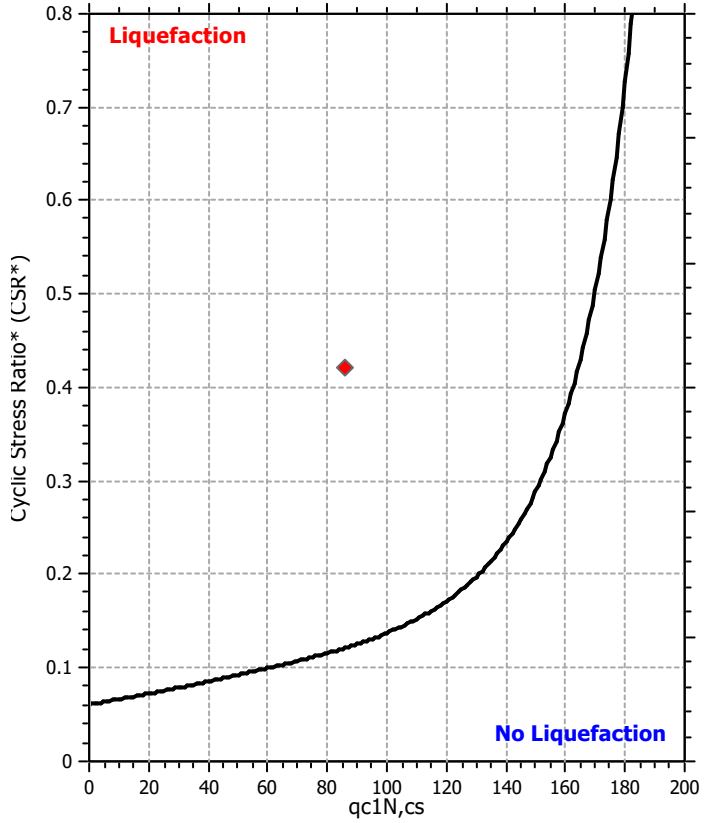
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

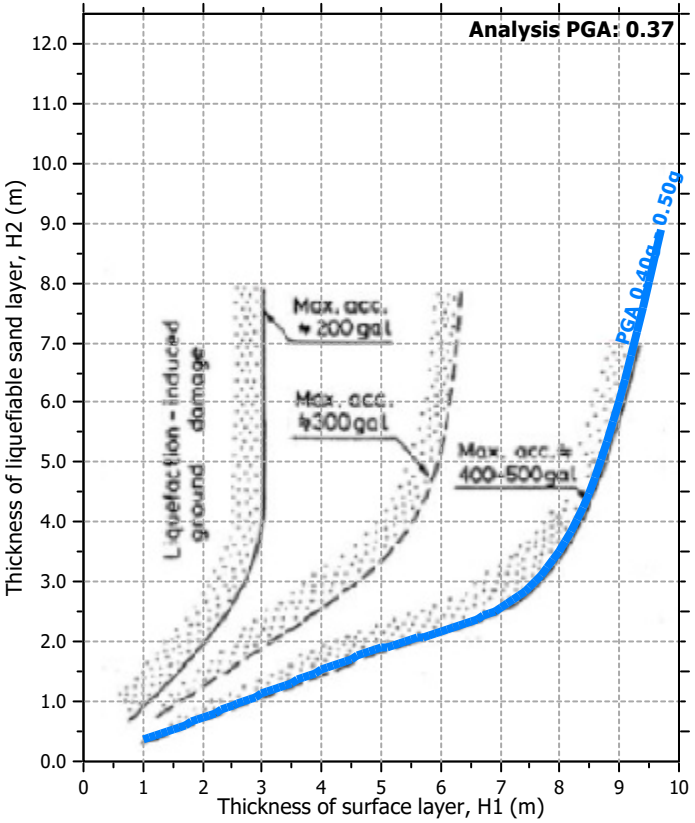
**LPI color scheme**

- Very high risk
- High risk
- Low risk

# Liquefaction analysis summary plots



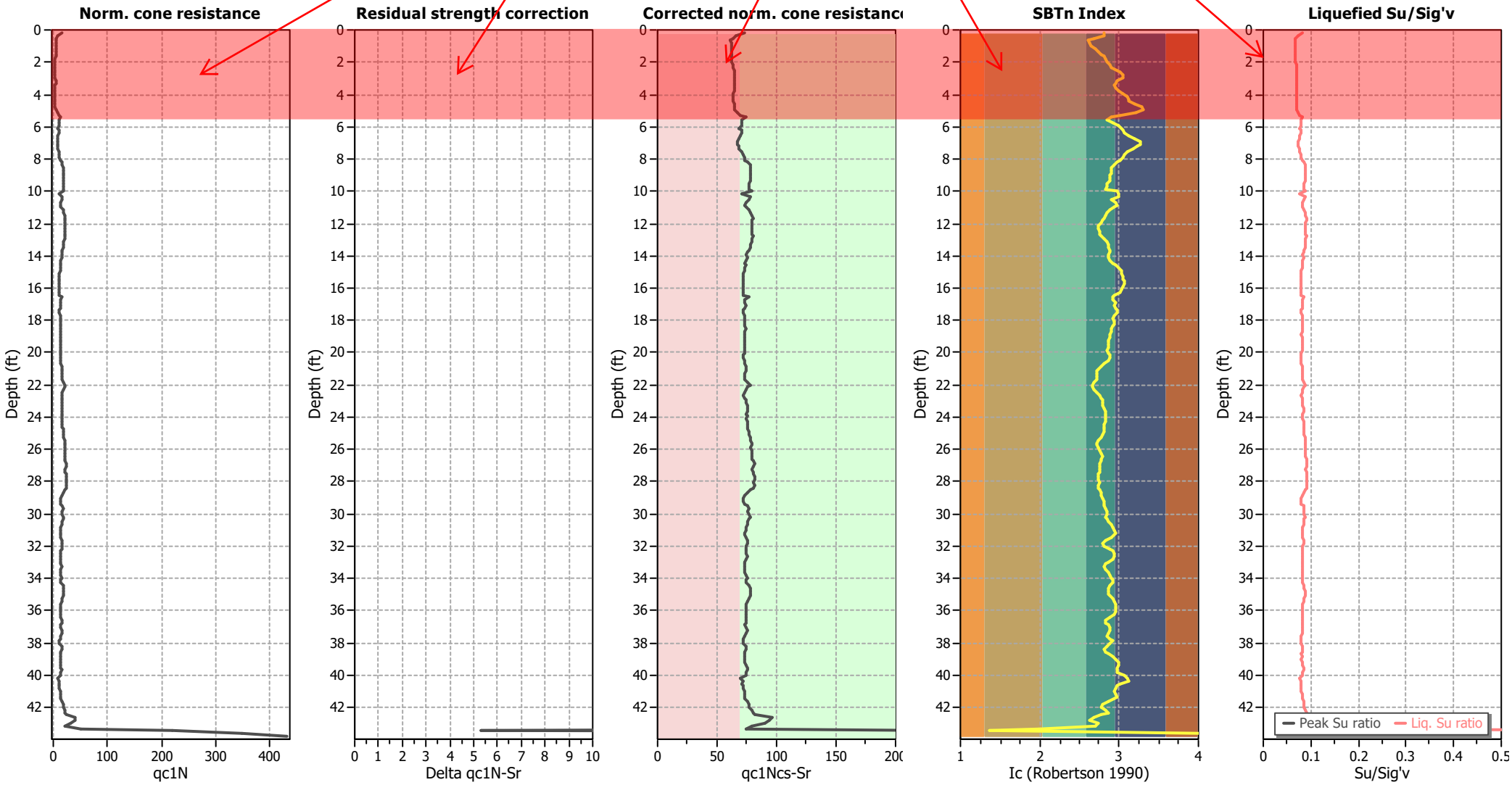

**Input parameters and analysis data**

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.50 ft | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 7.43 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration: | 0.37 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 4.50 ft | Fill height: | N/A | Limit depth: | N/A |

Ignore CPT results in the upper 5 feet below the ground surface for CPT-1 because the CPT hole was cleared using a hand auger within this zone prior to advancing the CPT probe.



## Check for strength loss plots (Idriss & Boulanger (2008))




### Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.50 ft | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 7.43 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration: | 0.37 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 4.50 ft | Fill height: | N/A | Limit depth: | N/A |

**:: Field input data ::**

| Point ID | Depth (ft) | $q_c$ (tsf) | $f_s$ (tsf) | u (tsf) | Fines content (%) | Unit weight (pcf) |
|---|---|---|---|---|---|---|
| 1 | 0.16 | 9.63 | 0.23 | 5.09 | 46.65 | 102.22 |
| 2 | 0.33 | 4.81 | 0.03 | 1.83 | 46.90 | 97.10 |
| 3 | 0.49 | 4.56 | 0.00 | 0.08 | 39.59 | 87.36 |
| 4 | 0.66 | 4.34 | 0.00 | -0.01 | 36.09 | 87.36 |
| 5 | 0.82 | 4.57 | 0.00 | 0.07 | 36.74 | 87.36 |
| 6 | 0.98 | 4.31 | 0.00 | 0.01 | 37.88 | 87.36 |
| 7 | 1.15 | 3.67 | 0.00 | -0.02 | 40.99 | 87.36 |
| 8 | 1.31 | 3.42 | 0.00 | -0.07 | 42.90 | 87.36 |
| 9 | 1.48 | 3.02 | 0.00 | -0.05 | 44.73 | 87.36 |
| 10 | 1.64 | 2.97 | 0.00 | 0.02 | 46.76 | 87.36 |
| 11 | 1.80 | 2.75 | 0.00 | 0.01 | 47.76 | 87.36 |
| 12 | 1.97 | 2.71 | 0.00 | -0.01 | 48.39 | 87.36 |
| 13 | 2.13 | 2.76 | 0.00 | -0.03 | 50.96 | 87.36 |
| 14 | 2.30 | 2.56 | 0.01 | -0.07 | 52.58 | 87.36 |
| 15 | 2.46 | 2.75 | 0.01 | -0.05 | 56.54 | 87.36 |
| 16 | 2.63 | 2.68 | 0.01 | -0.02 | 59.61 | 87.36 |
| 17 | 2.79 | 2.64 | 0.02 | 0.24 | 61.88 | 87.36 |
| 18 | 2.95 | 2.77 | 0.02 | 0.04 | 61.24 | 87.36 |
| 19 | 3.12 | 3.04 | 0.02 | 0.10 | 56.85 | 87.36 |
| 20 | 3.28 | 3.25 | 0.01 | 0.12 | 55.30 | 87.36 |
| 21 | 3.44 | 2.81 | 0.01 | -0.06 | 53.97 | 87.36 |
| 22 | 3.61 | 2.74 | 0.01 | -0.12 | 55.59 | 87.36 |
| 23 | 3.77 | 2.56 | 0.01 | -0.09 | 57.72 | 87.36 |
| 24 | 3.94 | 2.25 | 0.01 | -0.12 | 61.50 | 87.36 |
| 25 | 4.10 | 2.12 | 0.01 | -0.14 | 65.87 | 87.36 |
| 26 | 4.26 | 2.31 | 0.02 | -0.11 | 66.81 | 87.36 |
| 27 | 4.43 | 2.47 | 0.02 | -0.13 | 67.50 | 87.36 |
| 28 | 4.59 | 2.71 | 0.03 | -0.13 | 72.51 | 88.91 |
| 29 | 4.76 | 2.94 | 0.07 | -0.10 | 79.50 | 93.86 |
| 30 | 4.92 | 3.11 | 0.12 | -0.12 | 80.71 | 98.92 |
| 31 | 5.08 | 4.69 | 0.22 | 0.06 | 73.53 | 102.04 |
| 32 | 5.25 | 6.28 | 0.24 | -0.04 | 58.77 | 103.56 |
| 33 | 5.41 | 9.17 | 0.18 | -0.31 | 52.09 | 103.63 |
| 34 | 5.58 | 7.94 | 0.19 | -0.53 | 48.75 | 102.73 |
| 35 | 5.74 | 7.15 | 0.16 | -0.62 | 53.54 | 102.60 |
| 36 | 5.91 | 6.55 | 0.19 | -1.73 | 58.07 | 102.11 |
| 37 | 6.07 | 5.50 | 0.18 | -0.93 | 61.02 | 102.78 |
| 38 | 6.23 | 6.53 | 0.22 | 6.40 | 62.43 | 103.47 |
| 39 | 6.40 | 6.54 | 0.25 | 6.53 | 62.79 | 104.45 |
| 40 | 6.56 | 6.21 | 0.26 | 4.75 | 67.26 | 104.67 |
| 41 | 6.73 | 5.20 | 0.26 | 2.12 | 73.09 | 104.44 |
| 42 | 6.89 | 4.64 | 0.25 | 1.39 | 77.87 | 103.95 |
| 43 | 7.05 | 4.66 | 0.24 | 1.78 | 78.64 | 103.77 |
| 44 | 7.22 | 4.90 | 0.24 | 3.12 | 75.69 | 103.86 |
| 45 | 7.38 | 5.42 | 0.25 | 3.46 | 70.98 | 104.45 |
| 46 | 7.55 | 6.42 | 0.27 | 3.34 | 66.19 | 105.15 |
| 47 | 7.71 | 7.12 | 0.29 | 2.54 | 62.74 | 106.21 |
| 48 | 7.87 | 7.81 | 0.34 | 5.21 | 61.25 | 107.35 |

Ignore CPT results in the upper 5 feet below the ground surface for CPT-1 because the CPT hole was cleared using a hand auger within this zone prior to advancing the CPT probe.

**:: Field input data :: (continued)**

| Point ID | Depth (ft) | $q_c$ (tsf) | $f_s$ (tsf) | u (tsf) | Fines content (%) | Unit weight (pcf) |
|---|---|---|---|---|---|---|
| 49 | 8.04 | 8.31 | 0.39 | 7.67 | 59.80 | 108.83 |
| 50 | 8.20 | 9.64 | 0.47 | 7.32 | 57.27 | 110.15 |
| 51 | 8.37 | 11.12 | 0.52 | 7.18 | 54.58 | 111.19 |
| 52 | 8.53 | 11.82 | 0.54 | 4.68 | 52.60 | 111.51 |
| 53 | 8.69 | 11.75 | 0.51 | 3.17 | 51.87 | 111.42 |
| 54 | 8.86 | 11.59 | 0.49 | 3.69 | 51.61 | 111.25 |
| 55 | 9.02 | 11.75 | 0.51 | 3.12 | 51.34 | 111.23 |
| 56 | 9.19 | 11.95 | 0.50 | 2.41 | 51.10 | 111.24 |
| 57 | 9.35 | 11.86 | 0.49 | 0.93 | 51.15 | 111.01 |
| 58 | 9.51 | 11.35 | 0.47 | 0.79 | 48.76 | 109.67 |
| 59 | 9.68 | 11.47 | 0.26 | 0.35 | 48.71 | 109.57 |
| 60 | 9.84 | 11.75 | 0.47 | 0.15 | 48.14 | 109.62 |
| 61 | 10.01 | 11.93 | 0.47 | -0.19 | 57.09 | 110.36 |
| 62 | 10.17 | 6.35 | 0.47 | 4.29 | 57.49 | 110.10 |
| 63 | 10.34 | 11.09 | 0.43 | 2.02 | 58.59 | 109.60 |
| 64 | 10.50 | 10.57 | 0.40 | 1.05 | 52.63 | 109.07 |
| 65 | 10.66 | 9.30 | 0.33 | 0.22 | 55.20 | 108.09 |
| 66 | 10.83 | 8.08 | 0.32 | -0.08 | 56.58 | 107.37 |
| 67 | 10.99 | 8.83 | 0.32 | 2.89 | 54.55 | 108.05 |
| 68 | 11.15 | 11.32 | 0.40 | 5.37 | 50.82 | 109.38 |
| 69 | 11.32 | 12.51 | 0.47 | 6.71 | 48.31 | 110.88 |
| 70 | 11.48 | 13.49 | 0.53 | 6.38 | 47.16 | 111.60 |
| 71 | 11.65 | 13.80 | 0.51 | 7.40 | 46.22 | 111.82 |
| 72 | 11.81 | 13.87 | 0.50 | 8.46 | 45.20 | 111.49 |
| 73 | 11.97 | 13.79 | 0.46 | 8.59 | 44.02 | 110.97 |
| 74 | 12.14 | 13.86 | 0.41 | 9.46 | 42.96 | 110.44 |
| 75 | 12.30 | 13.84 | 0.40 | 8.09 | 42.74 | 110.35 |
| 76 | 12.47 | 13.80 | 0.44 | 11.72 | 43.02 | 110.58 |
| 77 | 12.63 | 14.05 | 0.45 | 12.83 | 43.48 | 110.99 |
| 78 | 12.79 | 14.20 | 0.47 | 12.80 | 44.33 | 111.19 |
| 79 | 12.96 | 13.37 | 0.49 | 12.99 | 46.24 | 111.41 |
| 80 | 13.12 | 12.64 | 0.51 | 13.48 | 48.39 | 111.40 |
| 81 | 13.29 | 12.24 | 0.50 | 12.71 | 49.62 | 111.21 |
| 82 | 13.45 | 11.98 | 0.47 | 11.55 | 50.36 | 110.64 |
| 83 | 13.62 | 11.01 | 0.42 | 11.85 | 50.83 | 109.79 |
| 84 | 13.78 | 10.41 | 0.37 | 12.02 | 51.45 | 108.81 |
| 85 | 13.94 | 9.93 | 0.33 | 12.55 | 49.97 | 108.08 |
| 86 | 14.11 | 10.93 | 0.31 | 12.44 | 50.05 | 107.52 |
| 87 | 14.27 | 9.59 | 0.30 | 7.06 | 50.55 | 106.90 |
| 88 | 14.44 | 8.77 | 0.27 | 8.56 | 53.11 | 106.44 |
| 89 | 14.60 | 8.81 | 0.28 | 7.80 | 55.12 | 106.31 |
| 90 | 14.76 | 8.32 | 0.30 | 7.67 | 57.51 | 106.79 |
| 91 | 14.93 | 8.14 | 0.33 | 7.38 | 60.24 | 107.10 |
| 92 | 15.09 | 7.89 | 0.33 | 6.83 | 61.19 | 107.06 |
| 93 | 15.26 | 7.85 | 0.30 | 7.48 | 61.77 | 106.78 |
| 94 | 15.42 | 7.60 | 0.30 | 6.62 | 61.75 | 106.50 |
| 95 | 15.58 | 7.60 | 0.30 | 7.46 | 62.89 | 106.61 |
| 96 | 15.75 | 7.50 | 0.32 | 7.67 | 62.74 | 106.66 |

**:: Field input data :: (continued)**

| Point ID | Depth (ft) | $q_c$ (tsf) | $f_s$ (tsf) | u (tsf) | Fines content (%) | Unit weight (pcf) |
|---|---|---|---|---|---|---|
| 97 | 15.91 | 7.74 | 0.31 | 6.88 | 61.82 | 106.50 |
| 98 | 16.08 | 7.84 | 0.28 | 7.48 | 60.63 | 106.25 |
| 99 | 16.24 | 7.78 | 0.28 | 7.59 | 59.37 | 106.28 |
| 100 | 16.40 | 8.35 | 0.30 | 8.03 | 54.35 | 106.96 |
| 101 | 16.57 | 11.30 | 0.32 | 6.85 | 53.33 | 107.45 |
| 102 | 16.73 | 9.11 | 0.33 | 4.36 | 53.07 | 107.61 |
| 103 | 16.90 | 8.82 | 0.32 | 3.45 | 55.85 | 107.40 |
| 104 | 17.06 | 9.43 | 0.32 | 5.87 | 55.01 | 107.20 |
| 105 | 17.22 | 9.33 | 0.30 | 5.68 | 55.32 | 107.11 |
| 106 | 17.39 | 8.51 | 0.31 | 5.71 | 56.47 | 106.91 |
| 107 | 17.55 | 8.56 | 0.30 | 7.14 | 56.27 | 106.98 |
| 108 | 17.72 | 9.52 | 0.31 | 7.76 | 54.76 | 107.20 |
| 109 | 17.88 | 9.62 | 0.33 | 7.34 | 53.63 | 107.37 |
| 110 | 18.05 | 9.45 | 0.31 | 8.93 | 54.12 | 107.64 |
| 111 | 18.21 | 9.61 | 0.34 | 8.52 | 54.10 | 107.70 |
| 112 | 18.37 | 9.72 | 0.33 | 8.53 | 53.30 | 107.91 |
| 113 | 18.54 | 10.25 | 0.33 | 9.95 | 52.33 | 107.72 |
| 114 | 18.70 | 9.95 | 0.31 | 9.51 | 51.70 | 107.46 |
| 115 | 18.86 | 9.74 | 0.30 | 10.21 | 51.21 | 107.26 |
| 116 | 19.03 | 10.29 | 0.31 | 11.75 | 50.62 | 107.31 |
| 117 | 19.19 | 10.41 | 0.32 | 10.96 | 49.95 | 107.56 |
| 118 | 19.36 | 10.56 | 0.32 | 11.53 | 50.35 | 107.84 |
| 119 | 19.52 | 10.47 | 0.34 | 11.90 | 49.98 | 107.85 |
| 120 | 19.68 | 10.67 | 0.31 | 12.84 | 49.75 | 107.71 |
| 121 | 19.85 | 10.52 | 0.30 | 12.45 | 49.17 | 107.20 |
| 122 | 20.01 | 10.09 | 0.28 | 14.72 | 49.86 | 106.83 |
| 123 | 20.18 | 9.64 | 0.28 | 15.75 | 50.73 | 106.69 |
| 124 | 20.34 | 9.77 | 0.29 | 12.03 | 50.65 | 106.79 |
| 125 | 20.50 | 10.32 | 0.29 | 13.50 | 49.65 | 107.21 |
| 126 | 20.67 | 10.95 | 0.32 | 15.26 | 46.42 | 107.59 |
| 127 | 20.83 | 12.63 | 0.31 | 20.77 | 44.22 | 108.12 |
| 128 | 21.00 | 13.02 | 0.34 | 18.24 | 42.53 | 108.37 |
| 129 | 21.16 | 12.92 | 0.33 | 19.44 | 41.97 | 108.11 |
| 130 | 21.32 | 12.69 | 0.28 | 21.45 | 41.71 | 107.72 |
| 131 | 21.49 | 12.50 | 0.29 | 22.66 | 41.64 | 107.73 |
| 132 | 21.65 | 12.93 | 0.33 | 26.25 | 41.41 | 108.86 |
| 133 | 21.82 | 15.03 | 0.41 | 27.82 | 40.02 | 110.31 |
| 134 | 21.98 | 17.14 | 0.47 | 24.59 | 38.98 | 110.99 |
| 135 | 22.15 | 16.08 | 0.42 | 24.99 | 38.69 | 110.61 |
| 136 | 22.31 | 14.72 | 0.35 | 23.60 | 39.55 | 109.37 |
| 137 | 22.47 | 13.29 | 0.31 | 26.30 | 41.27 | 108.32 |
| 138 | 22.64 | 11.97 | 0.31 | 30.31 | 43.35 | 108.08 |
| 139 | 22.80 | 12.14 | 0.33 | 29.56 | 44.98 | 108.58 |
| 140 | 22.97 | 12.68 | 0.38 | 31.10 | 45.17 | 109.38 |
| 141 | 23.13 | 13.38 | 0.41 | 30.64 | 45.42 | 110.23 |
| 142 | 23.29 | 13.69 | 0.46 | 29.35 | 45.91 | 110.85 |
| 143 | 23.46 | 13.64 | 0.48 | 26.64 | 46.64 | 111.19 |
| 144 | 23.62 | 13.55 | 0.47 | 26.14 | 47.37 | 111.24 |

**:: Field input data :: (continued)**

| Point ID | Depth (ft) | $q_c$ (tsf) | $f_s$ (tsf) | u (tsf) | Fines content (%) | Unit weight (pcf) |
|---|---|---|---|---|---|---|
| 145 | 23.79 | 13.23 | 0.47 | 26.28 | 47.53 | 111.11 |
| 146 | 23.95 | 13.36 | 0.46 | 26.80 | 47.88 | 111.05 |
| 147 | 24.11 | 13.21 | 0.47 | 25.95 | 47.70 | 111.12 |
| 148 | 24.28 | 13.68 | 0.48 | 26.55 | 47.47 | 111.29 |
| 149 | 24.44 | 14.05 | 0.48 | 27.96 | 46.78 | 111.47 |
| 150 | 24.61 | 14.36 | 0.49 | 30.00 | 46.30 | 111.77 |
| 151 | 24.77 | 14.94 | 0.53 | 29.37 | 46.17 | 112.27 |
| 152 | 24.93 | 15.38 | 0.57 | 32.99 | 46.29 | 112.74 |
| 153 | 25.10 | 15.47 | 0.58 | 30.68 | 45.82 | 113.19 |
| 154 | 25.26 | 16.66 | 0.61 | 33.43 | 44.54 | 113.55 |
| 155 | 25.43 | 18.03 | 0.63 | 31.77 | 42.98 | 114.05 |
| 156 | 25.59 | 19.09 | 0.66 | 29.26 | 41.52 | 114.20 |
| 157 | 25.75 | 19.54 | 0.62 | 22.70 | 41.54 | 114.19 |
| 158 | 25.92 | 18.32 | 0.63 | 20.11 | 42.08 | 114.15 |
| 159 | 26.08 | 18.38 | 0.66 | 25.67 | 43.96 | 114.50 |
| 160 | 26.25 | 17.95 | 0.73 | 27.94 | 44.80 | 115.02 |
| 161 | 26.41 | 18.75 | 0.77 | 27.21 | 45.43 | 115.46 |
| 162 | 26.57 | 18.97 | 0.79 | 24.39 | 45.05 | 115.76 |
| 163 | 26.74 | 19.56 | 0.81 | 28.48 | 44.05 | 115.87 |
| 164 | 26.90 | 20.69 | 0.78 | 27.93 | 43.35 | 115.85 |
| 165 | 27.07 | 20.32 | 0.77 | 12.96 | 43.23 | 115.64 |
| 166 | 27.23 | 19.38 | 0.74 | 19.23 | 43.81 | 115.60 |
| 167 | 27.39 | 19.94 | 0.77 | 22.06 | 43.51 | 115.70 |
| 168 | 27.56 | 21.10 | 0.78 | 22.59 | 42.60 | 115.93 |
| 169 | 27.72 | 21.69 | 0.79 | 23.27 | 42.30 | 116.16 |
| 170 | 27.89 | 21.31 | 0.83 | 25.74 | 42.75 | 116.32 |
| 171 | 28.05 | 21.06 | 0.84 | 23.66 | 43.10 | 116.36 |
| 172 | 28.21 | 21.46 | 0.81 | 23.77 | 42.72 | 116.09 |
| 173 | 28.38 | 21.19 | 0.74 | 24.73 | 42.67 | 115.39 |
| 174 | 28.54 | 19.03 | 0.64 | 21.88 | 43.15 | 113.98 |
| 175 | 28.71 | 16.64 | 0.47 | 18.57 | 44.05 | 111.76 |
| 176 | 28.87 | 14.25 | 0.31 | 20.56 | 44.86 | 109.06 |
| 177 | 29.04 | 12.22 | 0.25 | 21.27 | 45.10 | 106.99 |
| 178 | 29.20 | 12.54 | 0.24 | 23.07 | 46.70 | 107.17 |
| 179 | 29.36 | 13.11 | 0.34 | 24.45 | 46.41 | 108.87 |
| 180 | 29.53 | 15.62 | 0.44 | 27.50 | 46.80 | 110.85 |
| 181 | 29.69 | 16.36 | 0.53 | 21.00 | 47.22 | 112.13 |
| 182 | 29.86 | 15.71 | 0.56 | 21.34 | 48.57 | 112.90 |
| 183 | 30.02 | 16.08 | 0.60 | 27.23 | 48.51 | 113.31 |
| 184 | 30.18 | 17.46 | 0.61 | 28.48 | 48.18 | 113.52 |
| 185 | 30.35 | 16.74 | 0.60 | 23.08 | 48.39 | 113.41 |
| 186 | 30.51 | 15.71 | 0.58 | 26.61 | 49.91 | 112.95 |
| 187 | 30.68 | 14.84 | 0.53 | 24.28 | 52.30 | 112.30 |
| 188 | 30.84 | 13.10 | 0.50 | 15.80 | 53.76 | 111.47 |
| 189 | 31.00 | 12.85 | 0.44 | 24.25 | 54.97 | 110.72 |
| 190 | 31.17 | 12.62 | 0.41 | 19.44 | 55.21 | 110.22 |
| 191 | 31.33 | 12.04 | 0.42 | 22.16 | 55.00 | 110.72 |
| 192 | 31.50 | 13.90 | 0.52 | 32.30 | 51.69 | 111.24 |

**:: Field input data :: (continued)**

| Point ID | Depth (ft) | $q_c$ (tsf) | $f_s$ (tsf) | u (tsf) | Fines content (%) | Unit weight (pcf) |
|---|---|---|---|---|---|---|
| 193 | 31.66 | 16.43 | 0.47 | 26.71 | 47.66 | 111.53 |
| 194 | 31.82 | 16.81 | 0.43 | 24.98 | 45.52 | 111.11 |
| 195 | 31.99 | 15.51 | 0.42 | 30.85 | 47.12 | 111.10 |
| 196 | 32.15 | 14.71 | 0.48 | 26.67 | 50.84 | 111.46 |
| 197 | 32.32 | 13.83 | 0.52 | 26.76 | 53.35 | 111.95 |
| 198 | 32.48 | 14.30 | 0.54 | 31.07 | 54.33 | 112.20 |
| 199 | 32.64 | 14.47 | 0.54 | 27.84 | 53.99 | 111.86 |
| 200 | 32.81 | 13.55 | 0.45 | 26.38 | 52.79 | 110.96 |
| 201 | 32.97 | 13.60 | 0.37 | 33.40 | 50.35 | 109.76 |
| 202 | 33.14 | 14.32 | 0.33 | 35.64 | 47.40 | 109.00 |
| 203 | 33.30 | 14.91 | 0.33 | 33.30 | 46.48 | 108.90 |
| 204 | 33.47 | 14.46 | 0.35 | 32.55 | 47.43 | 109.22 |
| 205 | 33.63 | 14.13 | 0.38 | 33.78 | 49.53 | 110.05 |
| 206 | 33.79 | 14.60 | 0.46 | 34.29 | 51.03 | 111.04 |
| 207 | 33.96 | 15.18 | 0.51 | 31.45 | 52.66 | 111.79 |
| 208 | 34.12 | 14.35 | 0.52 | 27.62 | 53.47 | 112.19 |
| 209 | 34.28 | 14.80 | 0.54 | 36.02 | 52.73 | 112.98 |
| 210 | 34.45 | 17.65 | 0.66 | 40.04 | 51.57 | 114.03 |
| 211 | 34.61 | 18.11 | 0.73 | 34.69 | 50.19 | 114.87 |
| 212 | 34.78 | 18.75 | 0.72 | 36.60 | 49.73 | 115.04 |
| 213 | 34.94 | 18.89 | 0.70 | 36.25 | 49.79 | 115.13 |
| 214 | 35.10 | 18.39 | 0.76 | 37.36 | 50.72 | 115.07 |
| 215 | 35.27 | 17.61 | 0.72 | 34.28 | 52.76 | 114.80 |
| 216 | 35.43 | 16.07 | 0.66 | 28.45 | 54.54 | 113.88 |
| 217 | 35.60 | 14.50 | 0.55 | 26.98 | 55.25 | 112.80 |
| 218 | 35.76 | 14.62 | 0.49 | 32.20 | 55.52 | 112.06 |
| 219 | 35.92 | 14.30 | 0.51 | 33.56 | 55.41 | 111.93 |
| 220 | 36.09 | 14.39 | 0.53 | 30.12 | 56.11 | 111.98 |
| 221 | 36.25 | 14.28 | 0.50 | 28.10 | 54.77 | 111.54 |
| 222 | 36.42 | 14.68 | 0.42 | 32.62 | 51.19 | 110.76 |
| 223 | 36.58 | 16.09 | 0.36 | 36.79 | 48.10 | 110.03 |
| 224 | 36.74 | 15.91 | 0.37 | 32.35 | 47.76 | 109.97 |
| 225 | 36.91 | 14.99 | 0.41 | 35.25 | 50.03 | 110.65 |
| 226 | 37.07 | 15.27 | 0.48 | 38.86 | 51.26 | 111.35 |
| 227 | 37.24 | 16.27 | 0.49 | 34.10 | 50.65 | 111.59 |
| 228 | 37.40 | 16.31 | 0.44 | 32.20 | 49.55 | 110.63 |
| 229 | 37.57 | 14.41 | 0.31 | 37.40 | 49.13 | 108.85 |
| 230 | 37.73 | 13.09 | 0.24 | 36.01 | 50.68 | 107.49 |
| 231 | 37.89 | 12.39 | 0.30 | 36.30 | 53.21 | 107.83 |
| 232 | 38.06 | 12.98 | 0.37 | 38.37 | 51.45 | 109.02 |
| 233 | 38.22 | 16.73 | 0.37 | 41.80 | 48.58 | 109.75 |
| 234 | 38.39 | 16.83 | 0.37 | 30.12 | 46.20 | 109.70 |
| 235 | 38.55 | 15.54 | 0.34 | 41.35 | 47.44 | 109.16 |
| 236 | 38.71 | 14.36 | 0.31 | 38.02 | 49.64 | 108.78 |
| 237 | 38.88 | 13.80 | 0.34 | 40.09 | 53.18 | 109.20 |
| 238 | 39.04 | 13.22 | 0.42 | 40.07 | 56.18 | 110.46 |
| 239 | 39.21 | 14.24 | 0.51 | 42.85 | 58.36 | 112.05 |
| 240 | 39.37 | 15.28 | 0.63 | 36.07 | 58.42 | 113.30 |

**:: Field input data :: (continued)**

| Point ID | Depth (ft) | $q_c$ (tsf) | $f_s$ (tsf) | u (tsf) | Fines content (%) | Unit weight (pcf) |
|---|---|---|---|---|---|---|
| 241 | 39.53 | 15.98 | 0.67 | 33.74 | 57.06 | 113.53 |
| 242 | 39.70 | 16.26 | 0.55 | 31.61 | 56.50 | 113.37 |
| 243 | 39.86 | 15.64 | 0.59 | 30.38 | 56.66 | 112.71 |
| 244 | 40.03 | 14.43 | 0.53 | 36.26 | 63.29 | 112.07 |
| 245 | 40.19 | 9.80 | 0.48 | 24.83 | 65.50 | 110.96 |
| 246 | 40.35 | 12.34 | 0.40 | 26.89 | 66.59 | 109.68 |
| 247 | 40.52 | 11.89 | 0.33 | 33.08 | 59.60 | 108.89 |
| 248 | 40.68 | 12.93 | 0.33 | 34.93 | 57.09 | 108.33 |
| 249 | 40.85 | 13.20 | 0.31 | 34.54 | 55.26 | 108.51 |
| 250 | 41.01 | 13.63 | 0.34 | 36.48 | 54.82 | 108.88 |
| 251 | 41.17 | 14.00 | 0.37 | 38.06 | 55.55 | 109.53 |
| 252 | 41.34 | 13.85 | 0.40 | 36.29 | 56.89 | 110.39 |
| 253 | 41.50 | 14.10 | 0.47 | 44.35 | 54.17 | 111.18 |
| 254 | 41.67 | 17.84 | 0.47 | 56.04 | 49.75 | 112.21 |
| 255 | 41.83 | 20.77 | 0.54 | 48.46 | 45.29 | 112.79 |
| 256 | 41.99 | 21.28 | 0.53 | 58.38 | 44.68 | 114.06 |
| 257 | 42.16 | 22.72 | 0.72 | 56.06 | 47.17 | 115.93 |
| 258 | 42.32 | 23.07 | 1.03 | 59.05 | 49.85 | 118.59 |
| 259 | 42.49 | 26.67 | 1.45 | 68.18 | 44.55 | 120.96 |
| 260 | 42.65 | 43.34 | 1.60 | 57.83 | 39.83 | 122.26 |
| 261 | 42.81 | 43.22 | 1.53 | 13.72 | 36.75 | 122.08 |
| 262 | 42.98 | 36.15 | 1.23 | 5.69 | 42.75 | 121.81 |
| 263 | 43.14 | 25.11 | 1.68 | 29.06 | 40.31 | 123.11 |
| 264 | 43.31 | 57.34 | 2.16 | 60.64 | 12.48 | 123.48 |
| 265 | 43.47 | 237.96 | 0.00 | 7.18 | 1.19 | 121.07 |
| 266 | 43.63 | 376.12 | 0.00 | 8.04 | 100.00 | 87.36 |
| 267 | 43.80 | 464.61 | 0.00 | 11.56 | 100.00 | 87.36 |

**Abbreviations**

| | |
|---|---|
| Depth: | Depth from free surface, at which CPT was performed (ft) |
| $q_c$: | Measured cone resistance (tsf) |
| $f_s$: | Sleeve friction resistance (tsf) |
| u: | Pore pressure (tsf) |
| Fines content: | Percentage of fines in soil (%) |
| Unit weight: | Bulk soil unit weight (pcf) |

Ignore CPT results in the upper 5 feet below the ground surface for CPT-1 because the CPT hole was cleared using a hand auger within this zone prior to advancing the CPT probe.



**:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data ::**

| Point ID | Depth (ft) | $\sigma_v$ (tsf) | $u_0$ (tsf) | $\sigma_v'$ (tsf) | $r_d$ | CSR | MSF | $CSR_{eq}$ | $K_\sigma$ | User FS | $CSR^*$ | Belongs to transition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.16 | 0.01 | 0.00 | 0.01 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 2 | 0.33 | 0.02 | 0.00 | 0.02 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 3 | 0.49 | 0.02 | 0.00 | 0.02 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 4 | 0.66 | 0.03 | 0.00 | 0.03 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 5 | 0.82 | 0.04 | 0.00 | 0.04 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 6 | 0.98 | 0.04 | 0.00 | 0.04 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 7 | 1.15 | 0.05 | 0.00 | 0.05 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 8 | 1.31 | 0.06 | 0.00 | 0.06 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 9 | 1.48 | 0.07 | 0.00 | 0.07 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 10 | 1.64 | 0.07 | 0.00 | 0.07 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 11 | 1.80 | 0.08 | 0.00 | 0.08 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 12 | 1.97 | 0.09 | 0.00 | 0.09 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 13 | 2.13 | 0.10 | 0.00 | 0.10 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 14 | 2.30 | 0.10 | 0.00 | 0.10 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 15 | 2.46 | 0.11 | 0.00 | 0.11 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 16 | 2.63 | 0.12 | 0.00 | 0.12 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 17 | 2.79 | 0.12 | 0.00 | 0.12 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 18 | 2.95 | 0.13 | 0.00 | 0.13 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 19 | 3.12 | 0.14 | 0.00 | 0.14 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 20 | 3.28 | 0.15 | 0.00 | 0.15 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 21 | 3.44 | 0.15 | 0.00 | 0.15 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 22 | 3.61 | 0.16 | 0.00 | 0.16 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 23 | 3.77 | 0.17 | 0.00 | 0.17 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 24 | 3.94 | 0.17 | 0.00 | 0.17 | 1.00 | 0.240 | 1.02 | 0.235 | 1.10 | 1.00 | 0.217 | No |
| 25 | 4.10 | 0.18 | 0.00 | 0.18 | 1.00 | 0.240 | 1.02 | 0.235 | 1.10 | 1.00 | 0.217 | No |
| 26 | 4.26 | 0.19 | 0.00 | 0.19 | 1.00 | 0.240 | 1.02 | 0.235 | 1.10 | 1.00 | 0.217 | No |
| 27 | 4.43 | 0.20 | 0.00 | 0.20 | 1.00 | 0.240 | 1.02 | 0.235 | 1.10 | 1.00 | 0.217 | No |
| 28 | 4.59 | 0.20 | 0.00 | 0.20 | 1.00 | 0.243 | 1.02 | 0.238 | 1.10 | 1.00 | 0.220 | No |
| 29 | 4.76 | 0.21 | 0.01 | 0.20 | 1.00 | 0.249 | 1.02 | 0.244 | 1.10 | 1.00 | 0.226 | No |
| 30 | 4.92 | 0.22 | 0.01 | 0.21 | 0.99 | 0.255 | 1.02 | 0.250 | 1.10 | 1.00 | 0.231 | No |
| 31 | 5.08 | 0.23 | 0.02 | 0.21 | 0.99 | 0.260 | 1.02 | 0.255 | 1.10 | 1.00 | 0.236 | No |
| 32 | 5.25 | 0.24 | 0.02 | 0.21 | 0.99 | 0.265 | 1.02 | 0.260 | 1.10 | 1.00 | 0.240 | No |
| 33 | 5.41 | 0.24 | 0.03 | 0.22 | 0.99 | 0.271 | 1.02 | 0.266 | 1.10 | 1.00 | 0.245 | No |
| 34 | 5.58 | 0.25 | 0.03 | 0.22 | 0.99 | 0.276 | 1.02 | 0.270 | 1.10 | 1.00 | 0.250 | No |
| 35 | 5.74 | 0.26 | 0.04 | 0.22 | 0.99 | 0.280 | 1.02 | 0.275 | 1.10 | 1.00 | 0.254 | No |
| 36 | 5.91 | 0.27 | 0.04 | 0.23 | 0.99 | 0.285 | 1.02 | 0.280 | 1.10 | 1.00 | 0.258 | No |
| 37 | 6.07 | 0.28 | 0.05 | 0.23 | 0.99 | 0.290 | 1.02 | 0.284 | 1.10 | 1.00 | 0.262 | No |
| 38 | 6.23 | 0.29 | 0.05 | 0.23 | 0.99 | 0.294 | 1.02 | 0.289 | 1.10 | 1.00 | 0.266 | No |
| 39 | 6.40 | 0.29 | 0.06 | 0.24 | 0.99 | 0.298 | 1.02 | 0.293 | 1.10 | 1.00 | 0.270 | No |
| 40 | 6.56 | 0.30 | 0.06 | 0.24 | 0.99 | 0.302 | 1.02 | 0.297 | 1.10 | 1.00 | 0.274 | No |
| 41 | 6.73 | 0.31 | 0.07 | 0.24 | 0.99 | 0.306 | 1.02 | 0.301 | 1.10 | 1.00 | 0.278 | No |
| 42 | 6.89 | 0.32 | 0.07 | 0.25 | 0.99 | 0.310 | 1.02 | 0.304 | 1.10 | 1.00 | 0.281 | No |
| 43 | 7.05 | 0.33 | 0.08 | 0.25 | 0.99 | 0.314 | 1.02 | 0.308 | 1.10 | 1.00 | 0.284 | No |
| 44 | 7.22 | 0.34 | 0.08 | 0.25 | 0.99 | 0.318 | 1.02 | 0.312 | 1.10 | 1.00 | 0.288 | No |
| 45 | 7.38 | 0.35 | 0.09 | 0.26 | 0.99 | 0.321 | 1.02 | 0.315 | 1.10 | 1.00 | 0.291 | No |
| 46 | 7.55 | 0.35 | 0.10 | 0.26 | 0.99 | 0.325 | 1.02 | 0.319 | 1.10 | 1.00 | 0.294 | No |
| 47 | 7.71 | 0.36 | 0.10 | 0.26 | 0.99 | 0.328 | 1.02 | 0.322 | 1.10 | 1.00 | 0.297 | No |
| 48 | 7.87 | 0.37 | 0.11 | 0.27 | 0.99 | 0.331 | 1.02 | 0.325 | 1.10 | 1.00 | 0.300 | No |

**:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)**

| Point ID | Depth (ft) | $\sigma_v$ (tsf) | $u_0$ (tsf) | $\sigma_v'$ (tsf) | $r_d$ | CSR | MSF | $CSR_{eq}$ | $K_\sigma$ | User FS | $CSR^*$ | Belongs to transition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 49 | 8.04 | 0.38 | 0.11 | 0.27 | 0.99 | 0.334 | 1.02 | 0.328 | 1.10 | 1.00 | 0.303 | No |
| 50 | 8.20 | 0.39 | 0.12 | 0.27 | 0.99 | 0.337 | 1.02 | 0.331 | 1.10 | 1.00 | 0.305 | No |
| 51 | 8.37 | 0.40 | 0.12 | 0.28 | 0.99 | 0.340 | 1.02 | 0.333 | 1.10 | 1.00 | 0.307 | No |
| 52 | 8.53 | 0.41 | 0.13 | 0.28 | 0.98 | 0.342 | 1.02 | 0.336 | 1.10 | 1.00 | 0.310 | No |
| 53 | 8.69 | 0.42 | 0.13 | 0.29 | 0.98 | 0.345 | 1.02 | 0.338 | 1.10 | 1.00 | 0.312 | No |
| 54 | 8.86 | 0.43 | 0.14 | 0.29 | 0.98 | 0.347 | 1.02 | 0.341 | 1.10 | 1.00 | 0.314 | No |
| 55 | 9.02 | 0.44 | 0.14 | 0.29 | 0.98 | 0.350 | 1.02 | 0.343 | 1.10 | 1.00 | 0.317 | No |
| 56 | 9.19 | 0.44 | 0.15 | 0.30 | 0.98 | 0.352 | 1.02 | 0.346 | 1.10 | 1.00 | 0.319 | No |
| 57 | 9.35 | 0.45 | 0.15 | 0.30 | 0.98 | 0.354 | 1.02 | 0.348 | 1.10 | 1.00 | 0.321 | No |
| 58 | 9.51 | 0.46 | 0.16 | 0.31 | 0.98 | 0.357 | 1.02 | 0.350 | 1.10 | 1.00 | 0.323 | No |
| 59 | 9.68 | 0.47 | 0.16 | 0.31 | 0.98 | 0.359 | 1.02 | 0.352 | 1.10 | 1.00 | 0.325 | No |
| 60 | 9.84 | 0.48 | 0.17 | 0.31 | 0.98 | 0.361 | 1.02 | 0.354 | 1.10 | 1.00 | 0.327 | No |
| 61 | 10.01 | 0.49 | 0.17 | 0.32 | 0.98 | 0.363 | 1.02 | 0.356 | 1.10 | 1.00 | 0.329 | No |
| 62 | 10.17 | 0.50 | 0.18 | 0.32 | 0.98 | 0.365 | 1.02 | 0.358 | 1.10 | 1.00 | 0.332 | No |
| 63 | 10.34 | 0.51 | 0.18 | 0.33 | 0.98 | 0.367 | 1.02 | 0.360 | 1.10 | 1.00 | 0.332 | No |
| 64 | 10.50 | 0.52 | 0.19 | 0.33 | 0.98 | 0.369 | 1.02 | 0.362 | 1.10 | 1.00 | 0.334 | No |
| 65 | 10.66 | 0.53 | 0.19 | 0.33 | 0.98 | 0.371 | 1.02 | 0.364 | 1.10 | 1.00 | 0.336 | No |
| 66 | 10.83 | 0.53 | 0.20 | 0.34 | 0.98 | 0.373 | 1.02 | 0.366 | 1.10 | 1.00 | 0.339 | No |
| 67 | 10.99 | 0.54 | 0.20 | 0.34 | 0.98 | 0.375 | 1.02 | 0.368 | 1.10 | 1.00 | 0.340 | No |
| 68 | 11.15 | 0.55 | 0.21 | 0.34 | 0.98 | 0.376 | 1.02 | 0.369 | 1.10 | 1.00 | 0.341 | No |
| 69 | 11.32 | 0.56 | 0.21 | 0.35 | 0.98 | 0.378 | 1.02 | 0.371 | 1.10 | 1.00 | 0.342 | No |
| 70 | 11.48 | 0.57 | 0.22 | 0.35 | 0.98 | 0.380 | 1.02 | 0.373 | 1.10 | 1.00 | 0.344 | No |
| 71 | 11.65 | 0.58 | 0.22 | 0.36 | 0.98 | 0.381 | 1.02 | 0.374 | 1.10 | 1.00 | 0.345 | No |
| 72 | 11.81 | 0.59 | 0.23 | 0.36 | 0.97 | 0.383 | 1.02 | 0.375 | 1.10 | 1.00 | 0.347 | No |
| 73 | 11.97 | 0.60 | 0.23 | 0.36 | 0.97 | 0.384 | 1.02 | 0.377 | 1.10 | 1.00 | 0.348 | No |
| 74 | 12.14 | 0.61 | 0.24 | 0.37 | 0.97 | 0.385 | 1.02 | 0.378 | 1.10 | 1.00 | 0.350 | No |
| 75 | 12.30 | 0.62 | 0.24 | 0.37 | 0.97 | 0.387 | 1.02 | 0.380 | 1.10 | 1.00 | 0.352 | No |
| 76 | 12.47 | 0.63 | 0.25 | 0.38 | 0.97 | 0.388 | 1.02 | 0.381 | 1.09 | 1.00 | 0.353 | No |
| 77 | 12.63 | 0.63 | 0.25 | 0.38 | 0.97 | 0.390 | 1.02 | 0.382 | 1.09 | 1.00 | 0.354 | No |
| 78 | 12.79 | 0.64 | 0.26 | 0.38 | 0.97 | 0.391 | 1.02 | 0.384 | 1.09 | 1.00 | 0.356 | No |
| 79 | 12.96 | 0.65 | 0.26 | 0.39 | 0.97 | 0.392 | 1.02 | 0.385 | 1.09 | 1.00 | 0.358 | No |
| 80 | 13.12 | 0.66 | 0.27 | 0.39 | 0.97 | 0.393 | 1.02 | 0.386 | 1.09 | 1.00 | 0.359 | No |
| 81 | 13.29 | 0.67 | 0.27 | 0.40 | 0.97 | 0.394 | 1.02 | 0.387 | 1.09 | 1.00 | 0.361 | No |
| 82 | 13.45 | 0.68 | 0.28 | 0.40 | 0.97 | 0.396 | 1.02 | 0.388 | 1.09 | 1.00 | 0.362 | No |
| 83 | 13.62 | 0.69 | 0.28 | 0.40 | 0.97 | 0.397 | 1.02 | 0.389 | 1.09 | 1.00 | 0.364 | No |
| 84 | 13.78 | 0.70 | 0.29 | 0.41 | 0.97 | 0.398 | 1.02 | 0.391 | 1.08 | 1.00 | 0.366 | No |
| 85 | 13.94 | 0.71 | 0.29 | 0.41 | 0.97 | 0.399 | 1.02 | 0.392 | 1.08 | 1.00 | 0.367 | No |
| 86 | 14.11 | 0.72 | 0.30 | 0.42 | 0.97 | 0.400 | 1.02 | 0.393 | 1.08 | 1.00 | 0.368 | No |
| 87 | 14.27 | 0.72 | 0.30 | 0.42 | 0.97 | 0.401 | 1.02 | 0.394 | 1.08 | 1.00 | 0.370 | No |
| 88 | 14.44 | 0.73 | 0.31 | 0.42 | 0.97 | 0.402 | 1.02 | 0.395 | 1.08 | 1.00 | 0.372 | No |
| 89 | 14.60 | 0.74 | 0.32 | 0.43 | 0.97 | 0.404 | 1.02 | 0.396 | 1.08 | 1.00 | 0.373 | No |
| 90 | 14.76 | 0.75 | 0.32 | 0.43 | 0.96 | 0.405 | 1.02 | 0.397 | 1.08 | 1.00 | 0.375 | No |
| 91 | 14.93 | 0.76 | 0.33 | 0.43 | 0.96 | 0.406 | 1.02 | 0.398 | 1.08 | 1.00 | 0.376 | No |
| 92 | 15.09 | 0.77 | 0.33 | 0.44 | 0.96 | 0.407 | 1.02 | 0.399 | 1.07 | 1.00 | 0.377 | No |
| 93 | 15.26 | 0.78 | 0.34 | 0.44 | 0.96 | 0.408 | 1.02 | 0.400 | 1.07 | 1.00 | 0.379 | No |
| 94 | 15.42 | 0.79 | 0.34 | 0.44 | 0.96 | 0.409 | 1.02 | 0.401 | 1.07 | 1.00 | 0.380 | No |
| 95 | 15.58 | 0.79 | 0.35 | 0.45 | 0.96 | 0.410 | 1.02 | 0.402 | 1.07 | 1.00 | 0.381 | No |
| 96 | 15.75 | 0.80 | 0.35 | 0.45 | 0.96 | 0.411 | 1.02 | 0.403 | 1.07 | 1.00 | 0.382 | No |

**:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)**

| Point ID | Depth (ft) | $\sigma_v$ (tsf) | $u_0$ (tsf) | $\sigma_v'$ (tsf) | $r_d$ | CSR | MSF | $CSR_{eq}$ | $K_\sigma$ | User FS | $CSR^*$ | Belongs to transition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 97 | 15.91 | 0.81 | 0.36 | 0.46 | 0.96 | 0.412 | 1.02 | 0.404 | 1.07 | 1.00 | 0.383 | No |
| 98 | 16.08 | 0.82 | 0.36 | 0.46 | 0.96 | 0.412 | 1.02 | 0.405 | 1.07 | 1.00 | 0.384 | No |
| 99 | 16.24 | 0.83 | 0.37 | 0.46 | 0.96 | 0.413 | 1.02 | 0.406 | 1.07 | 1.00 | 0.385 | No |
| 100 | 16.40 | 0.84 | 0.37 | 0.47 | 0.96 | 0.414 | 1.02 | 0.406 | 1.07 | 1.00 | 0.386 | No |
| 101 | 16.57 | 0.85 | 0.38 | 0.47 | 0.96 | 0.415 | 1.02 | 0.407 | 1.07 | 1.00 | 0.386 | No |
| 102 | 16.73 | 0.86 | 0.38 | 0.47 | 0.96 | 0.416 | 1.02 | 0.408 | 1.07 | 1.00 | 0.388 | No |
| 103 | 16.90 | 0.86 | 0.39 | 0.48 | 0.96 | 0.417 | 1.02 | 0.409 | 1.07 | 1.00 | 0.389 | No |
| 104 | 17.06 | 0.87 | 0.39 | 0.48 | 0.96 | 0.417 | 1.02 | 0.410 | 1.07 | 1.00 | 0.390 | No |
| 105 | 17.22 | 0.88 | 0.40 | 0.49 | 0.96 | 0.418 | 1.02 | 0.410 | 1.07 | 1.00 | 0.391 | No |
| 106 | 17.39 | 0.89 | 0.40 | 0.49 | 0.96 | 0.419 | 1.02 | 0.411 | 1.07 | 1.00 | 0.392 | No |
| 107 | 17.55 | 0.90 | 0.41 | 0.49 | 0.95 | 0.419 | 1.02 | 0.412 | 1.06 | 1.00 | 0.393 | No |
| 108 | 17.72 | 0.91 | 0.41 | 0.50 | 0.95 | 0.420 | 1.02 | 0.412 | 1.06 | 1.00 | 0.393 | No |
| 109 | 17.88 | 0.92 | 0.42 | 0.50 | 0.95 | 0.421 | 1.02 | 0.413 | 1.06 | 1.00 | 0.394 | No |
| 110 | 18.05 | 0.93 | 0.42 | 0.50 | 0.95 | 0.421 | 1.02 | 0.414 | 1.06 | 1.00 | 0.395 | No |
| 111 | 18.21 | 0.93 | 0.43 | 0.51 | 0.95 | 0.422 | 1.02 | 0.414 | 1.06 | 1.00 | 0.396 | No |
| 112 | 18.37 | 0.94 | 0.43 | 0.51 | 0.95 | 0.423 | 1.02 | 0.415 | 1.06 | 1.00 | 0.397 | No |
| 113 | 18.54 | 0.95 | 0.44 | 0.51 | 0.95 | 0.423 | 1.02 | 0.416 | 1.06 | 1.00 | 0.397 | No |
| 114 | 18.70 | 0.96 | 0.44 | 0.52 | 0.95 | 0.424 | 1.02 | 0.416 | 1.06 | 1.00 | 0.398 | No |
| 115 | 18.86 | 0.97 | 0.45 | 0.52 | 0.95 | 0.425 | 1.02 | 0.417 | 1.06 | 1.00 | 0.399 | No |
| 116 | 19.03 | 0.98 | 0.45 | 0.53 | 0.95 | 0.425 | 1.02 | 0.417 | 1.06 | 1.00 | 0.400 | No |
| 117 | 19.19 | 0.99 | 0.46 | 0.53 | 0.95 | 0.426 | 1.02 | 0.418 | 1.06 | 1.00 | 0.400 | No |
| 118 | 19.36 | 1.00 | 0.46 | 0.53 | 0.95 | 0.426 | 1.02 | 0.418 | 1.06 | 1.00 | 0.401 | No |
| 119 | 19.52 | 1.01 | 0.47 | 0.54 | 0.95 | 0.427 | 1.02 | 0.419 | 1.06 | 1.00 | 0.402 | No |
| 120 | 19.68 | 1.01 | 0.47 | 0.54 | 0.95 | 0.427 | 1.02 | 0.419 | 1.06 | 1.00 | 0.402 | No |
| 121 | 19.85 | 1.02 | 0.48 | 0.54 | 0.95 | 0.428 | 1.02 | 0.420 | 1.06 | 1.00 | 0.403 | No |
| 122 | 20.01 | 1.03 | 0.48 | 0.55 | 0.95 | 0.428 | 1.02 | 0.420 | 1.06 | 1.00 | 0.404 | No |
| 123 | 20.18 | 1.04 | 0.49 | 0.55 | 0.94 | 0.429 | 1.02 | 0.421 | 1.05 | 1.00 | 0.405 | No |
| 124 | 20.34 | 1.05 | 0.49 | 0.56 | 0.94 | 0.429 | 1.02 | 0.421 | 1.05 | 1.00 | 0.406 | No |
| 125 | 20.50 | 1.06 | 0.50 | 0.56 | 0.94 | 0.430 | 1.02 | 0.422 | 1.05 | 1.00 | 0.406 | No |
| 126 | 20.67 | 1.07 | 0.50 | 0.56 | 0.94 | 0.430 | 1.02 | 0.422 | 1.05 | 1.00 | 0.407 | No |
| 127 | 20.83 | 1.08 | 0.51 | 0.57 | 0.94 | 0.430 | 1.02 | 0.423 | 1.05 | 1.00 | 0.407 | No |
| 128 | 21.00 | 1.08 | 0.51 | 0.57 | 0.94 | 0.431 | 1.02 | 0.423 | 1.05 | 1.00 | 0.407 | No |
| 129 | 21.16 | 1.09 | 0.52 | 0.57 | 0.94 | 0.431 | 1.02 | 0.423 | 1.05 | 1.00 | 0.408 | No |
| 130 | 21.32 | 1.10 | 0.52 | 0.58 | 0.94 | 0.432 | 1.02 | 0.424 | 1.05 | 1.00 | 0.409 | No |
| 131 | 21.49 | 1.11 | 0.53 | 0.58 | 0.94 | 0.432 | 1.02 | 0.424 | 1.05 | 1.00 | 0.409 | No |
| 132 | 21.65 | 1.12 | 0.54 | 0.59 | 0.94 | 0.432 | 1.02 | 0.424 | 1.05 | 1.00 | 0.410 | No |
| 133 | 21.82 | 1.13 | 0.54 | 0.59 | 0.94 | 0.433 | 1.02 | 0.425 | 1.05 | 1.00 | 0.410 | No |
| 134 | 21.98 | 1.14 | 0.55 | 0.59 | 0.94 | 0.433 | 1.02 | 0.425 | 1.05 | 1.00 | 0.409 | No |
| 135 | 22.15 | 1.15 | 0.55 | 0.60 | 0.94 | 0.433 | 1.02 | 0.425 | 1.05 | 1.00 | 0.410 | No |
| 136 | 22.31 | 1.16 | 0.56 | 0.60 | 0.94 | 0.433 | 1.02 | 0.425 | 1.05 | 1.00 | 0.411 | No |
| 137 | 22.47 | 1.17 | 0.56 | 0.60 | 0.94 | 0.434 | 1.02 | 0.426 | 1.05 | 1.00 | 0.412 | No |
| 138 | 22.64 | 1.17 | 0.57 | 0.61 | 0.93 | 0.434 | 1.02 | 0.426 | 1.05 | 1.00 | 0.413 | No |
| 139 | 22.80 | 1.18 | 0.57 | 0.61 | 0.93 | 0.434 | 1.02 | 0.426 | 1.05 | 1.00 | 0.413 | No |
| 140 | 22.97 | 1.19 | 0.58 | 0.62 | 0.93 | 0.435 | 1.02 | 0.427 | 1.05 | 1.00 | 0.414 | No |
| 141 | 23.13 | 1.20 | 0.58 | 0.62 | 0.93 | 0.435 | 1.02 | 0.427 | 1.05 | 1.00 | 0.414 | No |
| 142 | 23.29 | 1.21 | 0.59 | 0.62 | 0.93 | 0.435 | 1.02 | 0.427 | 1.05 | 1.00 | 0.414 | No |
| 143 | 23.46 | 1.22 | 0.59 | 0.63 | 0.93 | 0.435 | 1.02 | 0.427 | 1.05 | 1.00 | 0.415 | No |
| 144 | 23.62 | 1.23 | 0.60 | 0.63 | 0.93 | 0.435 | 1.02 | 0.427 | 1.05 | 1.00 | 0.415 | No |

**:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)**

| Point ID | Depth (ft) | $\sigma_v$ (tsf) | $u_0$ (tsf) | $\sigma_v'$ (tsf) | $r_d$ | CSR | MSF | $CSR_{eq}$ | $K_\sigma$ | User FS | $CSR^*$ | Belongs to transition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 145 | 23.79 | 1.24 | 0.60 | 0.64 | 0.93 | 0.435 | 1.02 | 0.427 | 1.04 | 1.00 | 0.415 | No |
| 146 | 23.95 | 1.25 | 0.61 | 0.64 | 0.93 | 0.436 | 1.02 | 0.428 | 1.04 | 1.00 | 0.416 | No |
| 147 | 24.11 | 1.26 | 0.61 | 0.64 | 0.93 | 0.436 | 1.02 | 0.428 | 1.04 | 1.00 | 0.416 | No |
| 148 | 24.28 | 1.26 | 0.62 | 0.65 | 0.93 | 0.436 | 1.02 | 0.428 | 1.04 | 1.00 | 0.416 | No |
| 149 | 24.44 | 1.27 | 0.62 | 0.65 | 0.93 | 0.436 | 1.02 | 0.428 | 1.04 | 1.00 | 0.417 | No |
| 150 | 24.61 | 1.28 | 0.63 | 0.66 | 0.93 | 0.436 | 1.02 | 0.428 | 1.04 | 1.00 | 0.417 | No |
| 151 | 24.77 | 1.29 | 0.63 | 0.66 | 0.93 | 0.436 | 1.02 | 0.428 | 1.04 | 1.00 | 0.417 | No |
| 152 | 24.93 | 1.30 | 0.64 | 0.66 | 0.93 | 0.436 | 1.02 | 0.428 | 1.04 | 1.00 | 0.417 | No |
| 153 | 25.10 | 1.31 | 0.64 | 0.67 | 0.92 | 0.436 | 1.02 | 0.428 | 1.04 | 1.00 | 0.418 | No |
| 154 | 25.26 | 1.32 | 0.65 | 0.67 | 0.92 | 0.436 | 1.02 | 0.428 | 1.04 | 1.00 | 0.418 | No |
| 155 | 25.43 | 1.33 | 0.65 | 0.68 | 0.92 | 0.436 | 1.02 | 0.428 | 1.04 | 1.00 | 0.418 | No |
| 156 | 25.59 | 1.34 | 0.66 | 0.68 | 0.92 | 0.436 | 1.02 | 0.428 | 1.04 | 1.00 | 0.418 | No |
| 157 | 25.75 | 1.35 | 0.66 | 0.69 | 0.92 | 0.436 | 1.02 | 0.428 | 1.04 | 1.00 | 0.418 | No |
| 158 | 25.92 | 1.36 | 0.67 | 0.69 | 0.92 | 0.436 | 1.02 | 0.428 | 1.04 | 1.00 | 0.418 | No |
| 159 | 26.08 | 1.37 | 0.67 | 0.69 | 0.92 | 0.436 | 1.02 | 0.428 | 1.04 | 1.00 | 0.418 | No |
| 160 | 26.25 | 1.38 | 0.68 | 0.70 | 0.92 | 0.436 | 1.02 | 0.428 | 1.04 | 1.00 | 0.419 | No |
| 161 | 26.41 | 1.39 | 0.68 | 0.70 | 0.92 | 0.436 | 1.02 | 0.428 | 1.04 | 1.00 | 0.419 | No |
| 162 | 26.57 | 1.40 | 0.69 | 0.71 | 0.92 | 0.436 | 1.02 | 0.428 | 1.04 | 1.00 | 0.419 | No |
| 163 | 26.74 | 1.40 | 0.69 | 0.71 | 0.92 | 0.436 | 1.02 | 0.428 | 1.04 | 1.00 | 0.419 | No |
| 164 | 26.90 | 1.41 | 0.70 | 0.72 | 0.92 | 0.436 | 1.02 | 0.428 | 1.04 | 1.00 | 0.419 | No |
| 165 | 27.07 | 1.42 | 0.70 | 0.72 | 0.92 | 0.436 | 1.02 | 0.428 | 1.04 | 1.00 | 0.419 | No |
| 166 | 27.23 | 1.43 | 0.71 | 0.72 | 0.92 | 0.436 | 1.02 | 0.428 | 1.03 | 1.00 | 0.419 | No |
| 167 | 27.39 | 1.44 | 0.71 | 0.73 | 0.92 | 0.436 | 1.02 | 0.428 | 1.03 | 1.00 | 0.419 | No |
| 168 | 27.56 | 1.45 | 0.72 | 0.73 | 0.91 | 0.436 | 1.02 | 0.428 | 1.03 | 1.00 | 0.419 | No |
| 169 | 27.72 | 1.46 | 0.72 | 0.74 | 0.91 | 0.436 | 1.02 | 0.428 | 1.03 | 1.00 | 0.419 | No |
| 170 | 27.89 | 1.47 | 0.73 | 0.74 | 0.91 | 0.436 | 1.02 | 0.428 | 1.03 | 1.00 | 0.420 | No |
| 171 | 28.05 | 1.48 | 0.73 | 0.75 | 0.91 | 0.435 | 1.02 | 0.427 | 1.03 | 1.00 | 0.420 | No |
| 172 | 28.21 | 1.49 | 0.74 | 0.75 | 0.91 | 0.435 | 1.02 | 0.427 | 1.03 | 1.00 | 0.420 | No |
| 173 | 28.38 | 1.50 | 0.75 | 0.76 | 0.91 | 0.435 | 1.02 | 0.427 | 1.03 | 1.00 | 0.420 | No |
| 174 | 28.54 | 1.51 | 0.75 | 0.76 | 0.91 | 0.435 | 1.02 | 0.427 | 1.03 | 1.00 | 0.421 | No |
| 175 | 28.71 | 1.52 | 0.76 | 0.76 | 0.91 | 0.435 | 1.02 | 0.427 | 1.03 | 1.00 | 0.421 | No |
| 176 | 28.87 | 1.53 | 0.76 | 0.77 | 0.91 | 0.435 | 1.02 | 0.427 | 1.03 | 1.00 | 0.422 | No |
| 177 | 29.04 | 1.54 | 0.77 | 0.77 | 0.91 | 0.435 | 1.02 | 0.427 | 1.03 | 1.00 | 0.422 | No |
| 178 | 29.20 | 1.55 | 0.77 | 0.77 | 0.91 | 0.435 | 1.02 | 0.427 | 1.03 | 1.00 | 0.423 | No |
| 179 | 29.36 | 1.55 | 0.78 | 0.78 | 0.91 | 0.435 | 1.02 | 0.427 | 1.03 | 1.00 | 0.423 | No |
| 180 | 29.53 | 1.56 | 0.78 | 0.78 | 0.91 | 0.435 | 1.02 | 0.427 | 1.03 | 1.00 | 0.422 | No |
| 181 | 29.69 | 1.57 | 0.79 | 0.79 | 0.91 | 0.435 | 1.02 | 0.427 | 1.03 | 1.00 | 0.422 | No |
| 182 | 29.86 | 1.58 | 0.79 | 0.79 | 0.90 | 0.435 | 1.02 | 0.427 | 1.03 | 1.00 | 0.423 | No |
| 183 | 30.02 | 1.59 | 0.80 | 0.79 | 0.90 | 0.435 | 1.02 | 0.427 | 1.03 | 1.00 | 0.423 | No |
| 184 | 30.18 | 1.60 | 0.80 | 0.80 | 0.90 | 0.435 | 1.02 | 0.427 | 1.03 | 1.00 | 0.423 | No |
| 185 | 30.35 | 1.61 | 0.81 | 0.80 | 0.90 | 0.435 | 1.02 | 0.427 | 1.02 | 1.00 | 0.423 | No |
| 186 | 30.51 | 1.62 | 0.81 | 0.81 | 0.90 | 0.435 | 1.02 | 0.427 | 1.02 | 1.00 | 0.423 | No |
| 187 | 30.68 | 1.63 | 0.82 | 0.81 | 0.90 | 0.435 | 1.02 | 0.427 | 1.02 | 1.00 | 0.423 | No |
| 188 | 30.84 | 1.64 | 0.82 | 0.82 | 0.90 | 0.435 | 1.02 | 0.427 | 1.02 | 1.00 | 0.424 | No |
| 189 | 31.00 | 1.65 | 0.83 | 0.82 | 0.90 | 0.435 | 1.02 | 0.427 | 1.02 | 1.00 | 0.424 | No |
| 190 | 31.17 | 1.66 | 0.83 | 0.82 | 0.90 | 0.435 | 1.02 | 0.427 | 1.02 | 1.00 | 0.424 | No |
| 191 | 31.33 | 1.66 | 0.84 | 0.83 | 0.90 | 0.435 | 1.02 | 0.426 | 1.02 | 1.00 | 0.424 | No |
| 192 | 31.50 | 1.67 | 0.84 | 0.83 | 0.90 | 0.434 | 1.02 | 0.426 | 1.02 | 1.00 | 0.424 | No |

**:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)**

| Point ID | Depth (ft) | $\sigma_v$ (tsf) | $u_0$ (tsf) | $\sigma_v'$ (tsf) | $r_d$ | CSR | MSF | $CSR_{eq}$ | $K_\sigma$ | User FS | $CSR^*$ | Belongs to transition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 193 | 31.66 | 1.68 | 0.85 | 0.84 | 0.90 | 0.434 | 1.02 | 0.426 | 1.02 | 1.00 | 0.424 | No |
| 194 | 31.82 | 1.69 | 0.85 | 0.84 | 0.90 | 0.434 | 1.02 | 0.426 | 1.02 | 1.00 | 0.424 | No |
| 195 | 31.99 | 1.70 | 0.86 | 0.84 | 0.90 | 0.434 | 1.02 | 0.426 | 1.02 | 1.00 | 0.424 | No |
| 196 | 32.15 | 1.71 | 0.86 | 0.85 | 0.89 | 0.434 | 1.02 | 0.426 | 1.02 | 1.00 | 0.424 | No |
| 197 | 32.32 | 1.72 | 0.87 | 0.85 | 0.89 | 0.434 | 1.02 | 0.426 | 1.02 | 1.00 | 0.424 | No |
| 198 | 32.48 | 1.73 | 0.87 | 0.86 | 0.89 | 0.434 | 1.02 | 0.426 | 1.02 | 1.00 | 0.424 | No |
| 199 | 32.64 | 1.74 | 0.88 | 0.86 | 0.89 | 0.434 | 1.02 | 0.426 | 1.02 | 1.00 | 0.425 | No |
| 200 | 32.81 | 1.75 | 0.88 | 0.86 | 0.89 | 0.434 | 1.02 | 0.426 | 1.02 | 1.00 | 0.425 | No |
| 201 | 32.97 | 1.76 | 0.89 | 0.87 | 0.89 | 0.434 | 1.02 | 0.426 | 1.02 | 1.00 | 0.425 | No |
| 202 | 33.14 | 1.76 | 0.89 | 0.87 | 0.89 | 0.434 | 1.02 | 0.426 | 1.02 | 1.00 | 0.425 | No |
| 203 | 33.30 | 1.77 | 0.90 | 0.87 | 0.89 | 0.433 | 1.02 | 0.425 | 1.02 | 1.00 | 0.425 | No |
| 204 | 33.47 | 1.78 | 0.90 | 0.88 | 0.89 | 0.433 | 1.02 | 0.425 | 1.02 | 1.00 | 0.425 | No |
| 205 | 33.63 | 1.79 | 0.91 | 0.88 | 0.89 | 0.433 | 1.02 | 0.425 | 1.02 | 1.00 | 0.425 | No |
| 206 | 33.79 | 1.80 | 0.91 | 0.89 | 0.89 | 0.433 | 1.02 | 0.425 | 1.02 | 1.00 | 0.425 | No |
| 207 | 33.96 | 1.81 | 0.92 | 0.89 | 0.89 | 0.433 | 1.02 | 0.425 | 1.01 | 1.00 | 0.425 | No |
| 208 | 34.12 | 1.82 | 0.92 | 0.89 | 0.89 | 0.433 | 1.02 | 0.425 | 1.01 | 1.00 | 0.425 | No |
| 209 | 34.28 | 1.83 | 0.93 | 0.90 | 0.88 | 0.433 | 1.02 | 0.425 | 1.01 | 1.00 | 0.425 | No |
| 210 | 34.45 | 1.84 | 0.93 | 0.90 | 0.88 | 0.433 | 1.02 | 0.425 | 1.01 | 1.00 | 0.425 | No |
| 211 | 34.61 | 1.85 | 0.94 | 0.91 | 0.88 | 0.432 | 1.02 | 0.424 | 1.01 | 1.00 | 0.425 | No |
| 212 | 34.78 | 1.86 | 0.94 | 0.91 | 0.88 | 0.432 | 1.02 | 0.424 | 1.01 | 1.00 | 0.425 | No |
| 213 | 34.94 | 1.87 | 0.95 | 0.92 | 0.88 | 0.432 | 1.02 | 0.424 | 1.01 | 1.00 | 0.425 | No |
| 214 | 35.10 | 1.88 | 0.95 | 0.92 | 0.88 | 0.432 | 1.02 | 0.424 | 1.01 | 1.00 | 0.425 | No |
| 215 | 35.27 | 1.88 | 0.96 | 0.92 | 0.88 | 0.431 | 1.02 | 0.423 | 1.01 | 1.00 | 0.425 | No |
| 216 | 35.43 | 1.89 | 0.97 | 0.93 | 0.88 | 0.431 | 1.02 | 0.423 | 1.01 | 1.00 | 0.425 | No |
| 217 | 35.60 | 1.90 | 0.97 | 0.93 | 0.88 | 0.431 | 1.02 | 0.423 | 1.01 | 1.00 | 0.425 | No |
| 218 | 35.76 | 1.91 | 0.98 | 0.94 | 0.88 | 0.431 | 1.02 | 0.423 | 1.01 | 1.00 | 0.425 | No |
| 219 | 35.92 | 1.92 | 0.98 | 0.94 | 0.88 | 0.431 | 1.02 | 0.423 | 1.01 | 1.00 | 0.425 | No |
| 220 | 36.09 | 1.93 | 0.99 | 0.95 | 0.88 | 0.431 | 1.02 | 0.423 | 1.01 | 1.00 | 0.425 | No |
| 221 | 36.25 | 1.94 | 0.99 | 0.95 | 0.88 | 0.430 | 1.02 | 0.422 | 1.01 | 1.00 | 0.425 | No |
| 222 | 36.42 | 1.95 | 1.00 | 0.95 | 0.87 | 0.430 | 1.02 | 0.422 | 1.01 | 1.00 | 0.425 | No |
| 223 | 36.58 | 1.96 | 1.00 | 0.96 | 0.87 | 0.430 | 1.02 | 0.422 | 1.01 | 1.00 | 0.425 | No |
| 224 | 36.74 | 1.97 | 1.01 | 0.96 | 0.87 | 0.430 | 1.02 | 0.422 | 1.01 | 1.00 | 0.425 | No |
| 225 | 36.91 | 1.98 | 1.01 | 0.97 | 0.87 | 0.430 | 1.02 | 0.422 | 1.01 | 1.00 | 0.425 | No |
| 226 | 37.07 | 1.99 | 1.02 | 0.97 | 0.87 | 0.430 | 1.02 | 0.422 | 1.01 | 1.00 | 0.425 | No |
| 227 | 37.24 | 1.99 | 1.02 | 0.97 | 0.87 | 0.429 | 1.02 | 0.421 | 1.01 | 1.00 | 0.425 | No |
| 228 | 37.40 | 2.00 | 1.03 | 0.98 | 0.87 | 0.429 | 1.02 | 0.421 | 1.01 | 1.00 | 0.425 | No |
| 229 | 37.57 | 2.01 | 1.03 | 0.98 | 0.87 | 0.429 | 1.02 | 0.421 | 1.01 | 1.00 | 0.425 | No |
| 230 | 37.73 | 2.02 | 1.04 | 0.98 | 0.87 | 0.429 | 1.02 | 0.421 | 1.01 | 1.00 | 0.425 | No |
| 231 | 37.89 | 2.03 | 1.04 | 0.99 | 0.87 | 0.429 | 1.02 | 0.421 | 1.01 | 1.00 | 0.425 | No |
| 232 | 38.06 | 2.04 | 1.05 | 0.99 | 0.87 | 0.429 | 1.02 | 0.421 | 1.01 | 1.00 | 0.425 | No |
| 233 | 38.22 | 2.05 | 1.05 | 1.00 | 0.87 | 0.429 | 1.02 | 0.421 | 1.01 | 1.00 | 0.425 | No |
| 234 | 38.39 | 2.06 | 1.06 | 1.00 | 0.87 | 0.428 | 1.02 | 0.420 | 1.00 | 1.00 | 0.425 | No |
| 235 | 38.55 | 2.07 | 1.06 | 1.00 | 0.87 | 0.428 | 1.02 | 0.420 | 1.00 | 1.00 | 0.425 | No |
| 236 | 38.71 | 2.07 | 1.07 | 1.01 | 0.86 | 0.428 | 1.02 | 0.420 | 1.00 | 1.00 | 0.425 | No |
| 237 | 38.88 | 2.08 | 1.07 | 1.01 | 0.86 | 0.428 | 1.02 | 0.420 | 1.00 | 1.00 | 0.425 | No |
| 238 | 39.04 | 2.09 | 1.08 | 1.02 | 0.86 | 0.428 | 1.02 | 0.420 | 1.00 | 1.00 | 0.425 | No |
| 239 | 39.21 | 2.10 | 1.08 | 1.02 | 0.86 | 0.428 | 1.02 | 0.420 | 1.00 | 1.00 | 0.425 | No |
| 240 | 39.37 | 2.11 | 1.09 | 1.02 | 0.86 | 0.427 | 1.02 | 0.419 | 1.00 | 1.00 | 0.425 | No |

**:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)**

| Point ID | Depth (ft) | $\sigma_v$ (tsf) | $u_0$ (tsf) | $\sigma_v'$ (tsf) | $r_d$ | CSR | MSF | $CSR_{eq}$ | $K_\sigma$ | User FS | $CSR^*$ | Belongs to transition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 241 | 39.53 | 2.12 | 1.09 | 1.03 | 0.86 | 0.427 | 1.02 | 0.419 | 1.00 | 1.00 | 0.424 | No |
| 242 | 39.70 | 2.13 | 1.10 | 1.03 | 0.86 | 0.427 | 1.02 | 0.419 | 1.00 | 1.00 | 0.424 | No |
| 243 | 39.86 | 2.14 | 1.10 | 1.04 | 0.86 | 0.427 | 1.02 | 0.419 | 1.00 | 1.00 | 0.424 | No |
| 244 | 40.03 | 2.15 | 1.11 | 1.04 | 0.86 | 0.426 | 1.02 | 0.418 | 1.00 | 1.00 | 0.424 | No |
| 245 | 40.19 | 2.16 | 1.11 | 1.04 | 0.86 | 0.426 | 1.02 | 0.418 | 1.00 | 1.00 | 0.424 | No |
| 246 | 40.35 | 2.17 | 1.12 | 1.05 | 0.86 | 0.426 | 1.02 | 0.418 | 1.00 | 1.00 | 0.424 | No |
| 247 | 40.52 | 2.18 | 1.12 | 1.05 | 0.86 | 0.426 | 1.02 | 0.418 | 1.00 | 1.00 | 0.424 | No |
| 248 | 40.68 | 2.18 | 1.13 | 1.06 | 0.86 | 0.426 | 1.02 | 0.418 | 1.00 | 1.00 | 0.424 | No |
| 249 | 40.85 | 2.19 | 1.13 | 1.06 | 0.85 | 0.425 | 1.02 | 0.418 | 1.00 | 1.00 | 0.424 | No |
| 250 | 41.01 | 2.20 | 1.14 | 1.06 | 0.85 | 0.425 | 1.02 | 0.417 | 1.00 | 1.00 | 0.424 | No |
| 251 | 41.17 | 2.21 | 1.14 | 1.07 | 0.85 | 0.425 | 1.02 | 0.417 | 1.00 | 1.00 | 0.424 | No |
| 252 | 41.34 | 2.22 | 1.15 | 1.07 | 0.85 | 0.425 | 1.02 | 0.417 | 1.00 | 1.00 | 0.424 | No |
| 253 | 41.50 | 2.23 | 1.15 | 1.07 | 0.85 | 0.425 | 1.02 | 0.417 | 1.00 | 1.00 | 0.424 | No |
| 254 | 41.67 | 2.24 | 1.16 | 1.08 | 0.85 | 0.424 | 1.02 | 0.417 | 1.00 | 1.00 | 0.424 | No |
| 255 | 41.83 | 2.25 | 1.16 | 1.08 | 0.85 | 0.424 | 1.02 | 0.416 | 1.00 | 1.00 | 0.423 | No |
| 256 | 41.99 | 2.26 | 1.17 | 1.09 | 0.85 | 0.424 | 1.02 | 0.416 | 1.00 | 1.00 | 0.423 | No |
| 257 | 42.16 | 2.27 | 1.17 | 1.09 | 0.85 | 0.424 | 1.02 | 0.416 | 1.00 | 1.00 | 0.423 | No |
| 258 | 42.32 | 2.28 | 1.18 | 1.10 | 0.85 | 0.423 | 1.02 | 0.415 | 1.00 | 1.00 | 0.423 | No |
| 259 | 42.49 | 2.29 | 1.19 | 1.10 | 0.85 | 0.423 | 1.02 | 0.415 | 1.00 | 1.00 | 0.422 | No |
| 260 | 42.65 | 2.30 | 1.19 | 1.11 | 0.85 | 0.422 | 1.02 | 0.415 | 1.00 | 1.00 | 0.422 | No |
| 261 | 42.81 | 2.31 | 1.20 | 1.11 | 0.85 | 0.422 | 1.02 | 0.414 | 0.99 | 1.00 | 0.421 | No |
| 262 | 42.98 | 2.32 | 1.20 | 1.12 | 0.84 | 0.422 | 1.02 | 0.414 | 0.99 | 1.00 | 0.422 | No |
| 263 | 43.14 | 2.33 | 1.21 | 1.12 | 0.84 | 0.421 | 1.02 | 0.413 | 0.99 | 1.00 | 0.422 | No |
| 264 | 43.31 | 2.34 | 1.21 | 1.13 | 0.84 | 0.421 | 1.02 | 0.413 | 0.99 | 1.00 | 0.421 | No |
| 265 | 43.47 | 2.35 | 1.22 | 1.13 | 0.84 | 0.420 | 1.02 | 0.413 | 0.98 | 1.00 | 0.417 | No |
| 266 | 43.63 | 2.35 | 1.22 | 1.13 | 0.84 | 0.420 | 1.02 | 0.413 | 0.98 | 1.00 | 0.417 | No |
| 267 | 43.80 | 2.36 | 1.23 | 1.13 | 0.84 | 0.421 | 1.02 | 0.413 | 0.98 | 1.00 | 0.418 | No |

**Abbreviations**

Depth: Depth from free surface, at which CPT was performed (ft)
$\sigma_v$: Total overburden pressure at test point (tsf)
$u_0$: Water pressure at test point (tsf)
$\sigma_v'$: Effective overburden pressure based on GWT during earthquake (tsf)
$r_d$: Nonlinear shear mass factor
CSR: Cyclic Stress Ratio
MSF: Magnitude Scaling Factor
$CSR_{eq}$: CSR adjusted for M=7.5
$K_\sigma$: Effective overburden stress factor
$CSR^*$: CSR fully adjusted

Ignore CPT results in the upper 5 feet below the ground surface for CPT-1 because the CPT hole was cleared using a hand auger within this zone prior to advancing the CPT probe.



**:: Cyclic Resistance Ratio (CRR) calculation data ::**

| Point ID | Depth (ft) | $q_t$ (tsf) | FC (%) | Ic | m | $C_N$ | $q_{c1N}$ | $\Delta q_{c1N}$ | $q_{c1N,cs}$ | $CRR_{7.5}$ | Belongs to trans. layer | Clay-like behaviour | FS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.16 | 8.08 | 87.91 | 2.81 | 0.56 | 1.70 | 15.47 | 0.00 | 15.47 | 4.000 | No | Yes | 2.00 |
| 2 | 0.33 | 6.37 | 88.25 | 2.82 | 0.59 | 1.70 | 7.73 | 0.00 | 7.73 | 4.000 | No | Yes | 2.00 |
| 3 | 0.49 | 4.58 | 77.70 | 2.68 | 0.60 | 1.70 | 7.33 | 0.00 | 7.33 | 4.000 | No | Yes | 2.00 |
| 4 | 0.66 | 4.49 | 72.19 | 2.61 | 0.60 | 1.70 | 6.97 | 0.00 | 6.97 | 4.000 | No | Yes | 2.00 |
| 5 | 0.82 | 4.41 | 73.23 | 2.63 | 0.60 | 1.70 | 7.34 | 0.00 | 7.34 | 4.000 | No | Yes | 2.00 |
| 6 | 0.98 | 4.18 | 75.05 | 2.65 | 0.60 | 1.70 | 6.92 | 0.00 | 6.92 | 4.000 | No | Yes | 2.00 |
| 7 | 1.15 | 3.80 | 79.80 | 2.71 | 0.61 | 1.70 | 5.90 | 0.00 | 5.90 | 4.000 | No | Yes | 2.00 |
| 8 | 1.31 | 3.37 | 82.61 | 2.75 | 0.61 | 1.70 | 5.49 | 0.00 | 5.49 | 4.000 | No | Yes | 2.00 |
| 9 | 1.48 | 3.14 | 85.23 | 2.78 | 0.61 | 1.70 | 4.85 | 0.00 | 4.85 | 4.000 | No | Yes | 2.00 |
| 10 | 1.64 | 2.91 | 88.06 | 2.81 | 0.61 | 1.70 | 4.77 | 0.00 | 4.77 | 4.000 | No | Yes | 2.00 |
| 11 | 1.80 | 2.81 | 89.42 | 2.83 | 0.61 | 1.70 | 4.42 | 0.00 | 4.42 | 4.000 | No | Yes | 2.00 |
| 12 | 1.97 | 2.74 | 90.27 | 2.84 | 0.61 | 1.70 | 4.35 | 0.00 | 4.35 | 4.000 | No | Yes | 2.00 |
| 13 | 2.13 | 2.68 | 93.66 | 2.88 | 0.61 | 1.70 | 4.43 | 0.00 | 4.43 | 4.000 | No | Yes | 2.00 |
| 14 | 2.30 | 2.69 | 95.74 | 2.91 | 0.61 | 1.70 | 4.11 | 0.00 | 4.11 | 4.000 | No | Yes | 2.00 |
| 15 | 2.46 | 2.66 | 100.00 | 2.97 | 0.61 | 1.70 | 4.42 | 0.00 | 4.42 | 4.000 | No | Yes | 2.00 |
| 16 | 2.63 | 2.69 | 100.00 | 3.02 | 0.61 | 1.70 | 4.31 | 0.00 | 4.31 | 4.000 | No | Yes | 2.00 |
| 17 | 2.79 | 2.70 | 100.00 | 3.05 | 0.61 | 1.70 | 4.24 | 0.00 | 4.24 | 4.000 | No | Yes | 2.00 |
| 18 | 2.95 | 2.82 | 100.00 | 3.04 | 0.60 | 1.70 | 4.45 | 0.00 | 4.45 | 4.000 | No | Yes | 2.00 |
| 19 | 3.12 | 3.02 | 100.00 | 2.98 | 0.60 | 1.70 | 4.88 | 0.00 | 4.88 | 4.000 | No | Yes | 2.00 |
| 20 | 3.28 | 3.03 | 99.15 | 2.95 | 0.60 | 1.70 | 5.22 | 0.00 | 5.22 | 4.000 | No | Yes | 2.00 |
| 21 | 3.44 | 2.93 | 97.49 | 2.93 | 0.61 | 1.70 | 4.51 | 0.00 | 4.51 | 4.000 | No | Yes | 2.00 |
| 22 | 3.61 | 2.70 | 99.50 | 2.96 | 0.61 | 1.70 | 4.40 | 0.00 | 4.40 | 4.000 | No | Yes | 2.00 |
| 23 | 3.77 | 2.52 | 100.00 | 2.99 | 0.61 | 1.70 | 4.11 | 0.00 | 4.11 | 4.000 | No | Yes | 2.00 |
| 24 | 3.94 | 2.31 | 100.00 | 3.04 | 0.61 | 1.70 | 3.61 | 0.00 | 3.61 | 4.000 | No | Yes | 2.00 |
| 25 | 4.10 | 2.22 | 100.00 | 3.11 | 0.61 | 1.70 | 3.41 | 0.00 | 3.41 | 4.000 | No | Yes | 2.00 |
| 26 | 4.26 | 2.30 | 100.00 | 3.12 | 0.61 | 1.70 | 3.71 | 0.00 | 3.71 | 4.000 | No | Yes | 2.00 |
| 27 | 4.43 | 2.49 | 100.00 | 3.13 | 0.61 | 1.70 | 3.97 | 0.00 | 3.97 | 4.000 | No | Yes | 2.00 |
| 28 | 4.59 | 2.70 | 100.00 | 3.19 | 0.61 | 1.70 | 4.35 | 0.00 | 4.35 | 0.644 | No | Yes | 2.00 |
| 29 | 4.76 | 2.92 | 100.00 | 3.28 | 0.60 | 1.70 | 4.72 | 0.00 | 4.72 | 0.688 | No | Yes | 2.00 |
| 30 | 4.92 | 3.58 | 100.00 | 3.30 | 0.60 | 1.70 | 5.00 | 0.00 | 5.00 | 0.841 | No | Yes | 2.00 |
| 31 | 5.08 | 4.69 | 100.00 | 3.21 | 0.59 | 1.70 | 7.54 | 0.00 | 7.54 | 1.101 | No | Yes | 2.00 |
| 32 | 5.25 | 6.71 | 100.00 | 3.00 | 0.58 | 1.70 | 10.09 | 0.00 | 10.09 | 1.571 | No | Yes | 2.00 |
| 33 | 5.41 | 7.79 | 95.12 | 2.90 | 0.57 | 1.70 | 14.73 | 0.00 | 14.73 | 1.802 | No | Yes | 2.00 |
| 34 | 5.58 | 8.08 | 90.75 | 2.85 | 0.57 | 1.70 | 12.76 | 0.00 | 12.76 | 1.840 | No | Yes | 2.00 |
| 35 | 5.74 | 7.20 | 96.96 | 2.92 | 0.58 | 1.70 | 11.49 | 0.00 | 11.49 | 1.607 | No | Yes | 2.00 |
| 36 | 5.91 | 6.38 | 100.00 | 2.99 | 0.58 | 1.70 | 10.52 | 0.00 | 10.52 | 1.396 | No | Yes | 2.00 |
| 37 | 6.07 | 6.21 | 100.00 | 3.04 | 0.59 | 1.70 | 8.84 | 0.00 | 8.84 | 1.335 | No | Yes | 2.00 |
| 38 | 6.23 | 6.25 | 100.00 | 3.06 | 0.58 | 1.70 | 10.49 | 0.00 | 10.49 | 1.321 | No | Yes | 2.00 |
| 39 | 6.40 | 6.51 | 100.00 | 3.06 | 0.58 | 1.70 | 10.51 | 0.00 | 10.51 | 1.358 | No | Yes | 2.00 |
| 40 | 6.56 | 6.05 | 100.00 | 3.12 | 0.58 | 1.70 | 9.98 | 0.00 | 9.98 | 1.237 | No | Yes | 2.00 |
| 41 | 6.73 | 5.39 | 100.00 | 3.20 | 0.59 | 1.70 | 8.35 | 0.00 | 8.35 | 1.077 | No | Yes | 2.00 |
| 42 | 6.89 | 4.86 | 100.00 | 3.26 | 0.59 | 1.70 | 7.45 | 0.00 | 7.45 | 0.950 | No | Yes | 2.00 |
| 43 | 7.05 | 4.76 | 100.00 | 3.27 | 0.59 | 1.70 | 7.49 | 0.00 | 7.49 | 0.915 | No | Yes | 2.00 |
| 44 | 7.22 | 5.03 | 100.00 | 3.23 | 0.59 | 1.70 | 7.87 | 0.00 | 7.87 | 0.956 | No | Yes | 2.00 |
| 45 | 7.38 | 5.63 | 100.00 | 3.17 | 0.59 | 1.70 | 8.71 | 0.00 | 8.71 | 1.061 | No | Yes | 2.00 |
| 46 | 7.55 | 6.36 | 100.00 | 3.11 | 0.58 | 1.70 | 10.31 | 0.00 | 10.31 | 1.191 | No | Yes | 2.00 |
| 47 | 7.71 | 7.17 | 100.00 | 3.06 | 0.58 | 1.70 | 11.44 | 0.00 | 11.44 | 1.330 | No | Yes | 2.00 |
| 48 | 7.87 | 7.82 | 100.00 | 3.04 | 0.57 | 1.70 | 12.55 | 0.00 | 12.55 | 1.436 | No | Yes | 2.00 |

**:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)**

| Point ID | Depth (ft) | $q_t$ (tsf) | FC (%) | Ic | m | $C_N$ | $q_{c1N}$ | $\Delta q_{c1N}$ | $q_{c1N,cs}$ | $CRR_{7.5}$ | Belongs to trans. layer | Clay-like behaviour | FS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 49 | 8.04 | 8.68 | 100.00 | 3.02 | 0.57 | 1.70 | 13.35 | 0.00 | 13.35 | 1.578 | No | Yes | 2.00 |
| 50 | 8.20 | 9.80 | 100.00 | 2.98 | 0.56 | 1.70 | 15.49 | 0.00 | 15.49 | 1.762 | No | Yes | 2.00 |
| 51 | 8.37 | 10.95 | 98.26 | 2.94 | 0.55 | 1.70 | 17.87 | 0.00 | 17.87 | 1.949 | No | Yes | 2.00 |
| 52 | 8.53 | 11.64 | 95.77 | 2.91 | 0.55 | 1.70 | 18.99 | 0.00 | 18.99 | 2.044 | No | Yes | 2.00 |
| 53 | 8.69 | 11.78 | 94.84 | 2.90 | 0.55 | 1.70 | 18.88 | 0.00 | 18.88 | 2.038 | No | Yes | 2.00 |
| 54 | 8.86 | 11.74 | 94.50 | 2.89 | 0.55 | 1.70 | 18.62 | 0.00 | 18.62 | 2.003 | No | Yes | 2.00 |
| 55 | 9.02 | 11.81 | 94.15 | 2.89 | 0.55 | 1.70 | 18.88 | 0.00 | 18.88 | 1.985 | No | Yes | 2.00 |
| 56 | 9.19 | 11.88 | 93.85 | 2.89 | 0.55 | 1.70 | 19.20 | 0.00 | 19.20 | 1.970 | No | Yes | 2.00 |
| 57 | 9.35 | 11.74 | 93.91 | 2.89 | 0.55 | 1.70 | 19.05 | 0.00 | 19.05 | 1.918 | No | Yes | 2.00 |
| 58 | 9.51 | 11.57 | 90.77 | 2.85 | 0.55 | 1.70 | 18.24 | 0.00 | 18.24 | 1.864 | No | Yes | 2.00 |
| 59 | 9.68 | 11.53 | 90.70 | 2.85 | 0.55 | 1.70 | 18.43 | 0.00 | 18.43 | 1.833 | No | Yes | 2.00 |
| 60 | 9.84 | 11.72 | 89.93 | 2.84 | 0.55 | 1.70 | 18.88 | 0.00 | 18.88 | 1.839 | No | Yes | 2.00 |
| 61 | 10.01 | 10.03 | 100.00 | 2.98 | 0.55 | 1.70 | 19.17 | 0.00 | 19.17 | 1.542 | No | Yes | 2.00 |
| 62 | 10.17 | 9.82 | 100.00 | 2.99 | 0.58 | 1.70 | 10.20 | 0.00 | 10.20 | 1.488 | No | Yes | 2.00 |
| 63 | 10.34 | 9.37 | 100.00 | 3.00 | 0.55 | 1.70 | 17.82 | 0.00 | 17.82 | 1.399 | No | Yes | 2.00 |
| 64 | 10.50 | 10.34 | 95.80 | 2.91 | 0.56 | 1.70 | 16.98 | 0.00 | 16.98 | 1.531 | No | Yes | 2.00 |
| 65 | 10.66 | 9.32 | 99.02 | 2.95 | 0.56 | 1.70 | 14.94 | 0.00 | 14.94 | 1.357 | No | Yes | 2.00 |
| 66 | 10.83 | 8.75 | 100.00 | 2.97 | 0.57 | 1.70 | 12.98 | 0.00 | 12.98 | 1.253 | No | Yes | 2.00 |
| 67 | 10.99 | 9.45 | 98.22 | 2.94 | 0.57 | 1.70 | 14.19 | 0.00 | 14.19 | 1.343 | No | Yes | 2.00 |
| 68 | 11.15 | 10.96 | 93.48 | 2.88 | 0.55 | 1.70 | 18.19 | 0.00 | 18.19 | 1.552 | No | Yes | 2.00 |
| 69 | 11.32 | 12.53 | 90.16 | 2.84 | 0.55 | 1.70 | 20.10 | 0.00 | 20.10 | 1.765 | No | Yes | 2.00 |
| 70 | 11.48 | 13.37 | 88.61 | 2.82 | 0.54 | 1.70 | 21.67 | 0.00 | 21.67 | 1.865 | No | Yes | 2.00 |
| 71 | 11.65 | 13.83 | 87.31 | 2.80 | 0.54 | 1.70 | 22.17 | 0.00 | 22.17 | 1.909 | No | Yes | 2.00 |
| 72 | 11.81 | 13.94 | 85.89 | 2.79 | 0.54 | 1.70 | 22.28 | 0.00 | 22.28 | 1.902 | No | Yes | 2.00 |
| 73 | 11.97 | 13.97 | 84.22 | 2.77 | 0.54 | 1.70 | 22.16 | 0.00 | 22.16 | 1.885 | No | Yes | 2.00 |
| 74 | 12.14 | 13.96 | 82.71 | 2.75 | 0.54 | 1.70 | 22.27 | 0.00 | 22.27 | 1.861 | No | Yes | 2.00 |
| 75 | 12.30 | 13.97 | 82.39 | 2.74 | 0.54 | 1.70 | 22.24 | 0.00 | 22.24 | 1.843 | No | Yes | 2.00 |
| 76 | 12.47 | 14.05 | 82.78 | 2.75 | 0.54 | 1.70 | 22.17 | 0.00 | 22.17 | 1.833 | No | Yes | 2.00 |
| 77 | 12.63 | 14.20 | 83.45 | 2.76 | 0.54 | 1.70 | 22.57 | 0.00 | 22.57 | 1.832 | No | Yes | 2.00 |
| 78 | 12.79 | 14.06 | 84.67 | 2.77 | 0.54 | 1.70 | 22.81 | 0.00 | 22.81 | 1.794 | No | Yes | 2.00 |
| 79 | 12.96 | 13.59 | 87.34 | 2.80 | 0.54 | 1.70 | 21.48 | 0.00 | 21.48 | 1.712 | No | Yes | 2.00 |
| 80 | 13.12 | 12.94 | 90.26 | 2.84 | 0.55 | 1.70 | 20.31 | 0.00 | 20.31 | 1.608 | No | Yes | 2.00 |
| 81 | 13.29 | 12.47 | 91.91 | 2.86 | 0.55 | 1.70 | 19.67 | 0.00 | 19.67 | 1.529 | No | Yes | 2.00 |
| 82 | 13.45 | 11.92 | 92.88 | 2.87 | 0.55 | 1.70 | 19.25 | 0.00 | 19.25 | 1.442 | No | Yes | 2.00 |
| 83 | 13.62 | 11.30 | 93.49 | 2.88 | 0.56 | 1.70 | 17.69 | 0.00 | 17.69 | 1.349 | No | Yes | 2.00 |
| 84 | 13.78 | 10.62 | 94.30 | 2.89 | 0.56 | 1.70 | 16.73 | 0.00 | 16.73 | 1.250 | No | Yes | 2.00 |
| 85 | 13.94 | 10.60 | 92.37 | 2.87 | 0.56 | 1.70 | 15.94 | 0.00 | 15.94 | 1.235 | No | Yes | 2.00 |
| 86 | 14.11 | 10.30 | 92.47 | 2.87 | 0.56 | 1.68 | 17.37 | 0.00 | 17.37 | 1.186 | No | Yes | 2.00 |
| 87 | 14.27 | 9.90 | 93.12 | 2.88 | 0.56 | 1.69 | 15.27 | 0.00 | 15.27 | 1.125 | No | Yes | 2.00 |
| 88 | 14.44 | 9.17 | 96.42 | 2.92 | 0.57 | 1.68 | 13.95 | 0.00 | 13.95 | 1.025 | No | Yes | 2.00 |
| 89 | 14.60 | 8.75 | 98.93 | 2.95 | 0.57 | 1.67 | 13.94 | 0.00 | 13.94 | 0.965 | No | Yes | 2.00 |
| 90 | 14.76 | 8.53 | 100.00 | 2.99 | 0.57 | 1.67 | 13.13 | 0.00 | 13.13 | 0.930 | No | Yes | 2.00 |
| 91 | 14.93 | 8.22 | 100.00 | 3.03 | 0.57 | 1.66 | 12.80 | 0.00 | 12.80 | 0.884 | No | Yes | 2.00 |
| 92 | 15.09 | 8.06 | 100.00 | 3.04 | 0.57 | 1.66 | 12.37 | 0.00 | 12.37 | 0.857 | No | Yes | 2.00 |
| 93 | 15.26 | 7.88 | 100.00 | 3.05 | 0.57 | 1.65 | 12.25 | 0.00 | 12.25 | 0.828 | No | Yes | 2.00 |
| 94 | 15.42 | 7.79 | 100.00 | 3.05 | 0.58 | 1.65 | 11.82 | 0.00 | 11.82 | 0.809 | No | Yes | 2.00 |
| 95 | 15.58 | 7.67 | 100.00 | 3.06 | 0.58 | 1.64 | 11.77 | 0.00 | 11.77 | 0.789 | No | Yes | 2.00 |
| 96 | 15.75 | 7.72 | 100.00 | 3.06 | 0.58 | 1.63 | 11.57 | 0.00 | 11.57 | 0.787 | No | Yes | 2.00 |

**:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)**

| Point ID | Depth (ft) | $q_t$ (tsf) | FC (%) | Ic | m | $C_N$ | $q_{c1N}$ | $\Delta q_{c1N}$ | $q_{c1N,cs}$ | $CRR_{7.5}$ | Belongs to trans. layer | Clay-like behaviour | FS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 97 | 15.91 | 7.80 | 100.00 | 3.05 | 0.57 | 1.62 | 11.87 | 0.00 | 11.87 | 0.788 | No | Yes | 2.00 |
| 98 | 16.08 | 7.89 | 100.00 | 3.03 | 0.57 | 1.62 | 11.97 | 0.00 | 11.97 | 0.792 | No | Yes | 2.00 |
| 99 | 16.24 | 8.10 | 100.00 | 3.01 | 0.58 | 1.61 | 11.83 | 0.00 | 11.83 | 0.808 | No | Yes | 2.00 |
| 100 | 16.40 | 9.25 | 97.97 | 2.94 | 0.57 | 1.60 | 12.61 | 0.00 | 12.61 | 0.927 | No | Yes | 2.00 |
| 101 | 16.57 | 9.68 | 96.69 | 2.92 | 0.56 | 1.57 | 16.79 | 0.00 | 16.79 | 0.966 | No | Yes | 2.00 |
| 102 | 16.73 | 9.81 | 96.37 | 2.92 | 0.57 | 1.58 | 13.60 | 0.00 | 13.60 | 0.972 | No | Yes | 2.00 |
| 103 | 16.90 | 9.19 | 99.82 | 2.96 | 0.57 | 1.57 | 13.12 | 0.00 | 13.12 | 0.896 | No | Yes | 2.00 |
| 104 | 17.06 | 9.27 | 98.79 | 2.95 | 0.57 | 1.56 | 13.93 | 0.00 | 13.93 | 0.897 | No | Yes | 2.00 |
| 105 | 17.22 | 9.17 | 99.17 | 2.95 | 0.57 | 1.56 | 13.73 | 0.00 | 13.73 | 0.879 | No | Yes | 2.00 |
| 106 | 17.39 | 8.89 | 100.00 | 2.97 | 0.57 | 1.56 | 12.52 | 0.00 | 12.52 | 0.842 | No | Yes | 2.00 |
| 107 | 17.55 | 8.96 | 100.00 | 2.97 | 0.57 | 1.55 | 12.54 | 0.00 | 12.54 | 0.842 | No | Yes | 2.00 |
| 108 | 17.72 | 9.34 | 98.48 | 2.94 | 0.57 | 1.54 | 13.84 | 0.00 | 13.84 | 0.874 | No | Yes | 2.00 |
| 109 | 17.88 | 9.65 | 97.07 | 2.93 | 0.57 | 1.53 | 13.92 | 0.00 | 13.92 | 0.898 | No | Yes | 2.00 |
| 110 | 18.05 | 9.68 | 97.68 | 2.93 | 0.57 | 1.53 | 13.63 | 0.00 | 13.63 | 0.894 | No | Yes | 2.00 |
| 111 | 18.21 | 9.72 | 97.67 | 2.93 | 0.57 | 1.52 | 13.79 | 0.00 | 13.79 | 0.891 | No | Yes | 2.00 |
| 112 | 18.37 | 9.99 | 96.66 | 2.92 | 0.57 | 1.51 | 13.89 | 0.00 | 13.89 | 0.911 | No | Yes | 2.00 |
| 113 | 18.54 | 10.11 | 95.42 | 2.91 | 0.57 | 1.50 | 14.57 | 0.00 | 14.57 | 0.915 | No | Yes | 2.00 |
| 114 | 18.70 | 10.12 | 94.62 | 2.90 | 0.57 | 1.50 | 14.10 | 0.00 | 14.10 | 0.909 | No | Yes | 2.00 |
| 115 | 18.86 | 10.14 | 93.99 | 2.89 | 0.57 | 1.50 | 13.76 | 0.00 | 13.76 | 0.904 | No | Yes | 2.00 |
| 116 | 19.03 | 10.30 | 93.22 | 2.88 | 0.57 | 1.49 | 14.46 | 0.00 | 14.46 | 0.912 | No | Yes | 2.00 |
| 117 | 19.19 | 10.58 | 92.35 | 2.87 | 0.57 | 1.48 | 14.57 | 0.00 | 14.57 | 0.932 | No | Yes | 2.00 |
| 118 | 19.36 | 10.65 | 92.86 | 2.87 | 0.57 | 1.47 | 14.71 | 0.00 | 14.71 | 0.931 | No | Yes | 2.00 |
| 119 | 19.52 | 10.74 | 92.38 | 2.87 | 0.57 | 1.47 | 14.54 | 0.00 | 14.54 | 0.933 | No | Yes | 2.00 |
| 120 | 19.68 | 10.73 | 92.08 | 2.86 | 0.57 | 1.46 | 14.75 | 0.00 | 14.75 | 0.925 | No | Yes | 2.00 |
| 121 | 19.85 | 10.62 | 91.31 | 2.85 | 0.57 | 1.46 | 14.50 | 0.00 | 14.50 | 0.907 | No | Yes | 2.00 |
| 122 | 20.01 | 10.29 | 92.22 | 2.87 | 0.57 | 1.45 | 13.87 | 0.00 | 13.87 | 0.869 | No | Yes | 2.00 |
| 123 | 20.18 | 10.04 | 93.37 | 2.88 | 0.57 | 1.45 | 13.22 | 0.00 | 13.22 | 0.839 | No | Yes | 2.00 |
| 124 | 20.34 | 10.11 | 93.27 | 2.88 | 0.57 | 1.45 | 13.35 | 0.00 | 13.35 | 0.839 | No | Yes | 2.00 |
| 125 | 20.50 | 10.54 | 91.95 | 2.86 | 0.57 | 1.44 | 14.03 | 0.00 | 14.03 | 0.873 | No | Yes | 2.00 |
| 126 | 20.67 | 11.54 | 87.59 | 2.81 | 0.57 | 1.43 | 14.81 | 0.00 | 14.81 | 0.957 | No | Yes | 2.00 |
| 127 | 20.83 | 12.46 | 84.51 | 2.77 | 0.56 | 1.42 | 16.95 | 0.00 | 16.95 | 1.034 | No | Yes | 2.00 |
| 128 | 21.00 | 13.14 | 82.07 | 2.74 | 0.56 | 1.41 | 17.40 | 0.00 | 17.40 | 1.087 | No | Yes | 2.00 |
| 129 | 21.16 | 13.16 | 81.26 | 2.73 | 0.56 | 1.41 | 17.21 | 0.00 | 17.21 | 1.082 | No | Yes | 2.00 |
| 130 | 21.32 | 13.01 | 80.87 | 2.72 | 0.56 | 1.41 | 16.86 | 0.00 | 16.86 | 1.060 | No | Yes | 2.00 |
| 131 | 21.49 | 13.04 | 80.77 | 2.72 | 0.56 | 1.40 | 16.56 | 0.00 | 16.56 | 1.056 | No | Yes | 2.00 |
| 132 | 21.65 | 13.85 | 80.43 | 2.72 | 0.56 | 1.39 | 17.05 | 0.00 | 17.05 | 1.119 | No | Yes | 2.00 |
| 133 | 21.82 | 15.41 | 78.35 | 2.69 | 0.55 | 1.38 | 19.64 | 0.00 | 19.64 | 1.247 | No | Yes | 2.00 |
| 134 | 21.98 | 16.45 | 76.75 | 2.67 | 0.55 | 1.37 | 22.21 | 0.00 | 22.21 | 1.328 | No | Yes | 2.00 |
| 135 | 22.15 | 16.33 | 76.30 | 2.67 | 0.55 | 1.37 | 20.82 | 0.00 | 20.82 | 1.308 | No | Yes | 2.00 |
| 136 | 22.31 | 15.06 | 77.63 | 2.68 | 0.56 | 1.37 | 19.05 | 0.00 | 19.05 | 1.190 | No | Yes | 2.00 |
| 137 | 22.47 | 13.71 | 80.22 | 2.72 | 0.56 | 1.37 | 17.20 | 0.00 | 17.20 | 1.067 | No | Yes | 2.00 |
| 138 | 22.64 | 12.88 | 83.26 | 2.75 | 0.57 | 1.37 | 15.48 | 0.00 | 15.48 | 0.990 | No | Yes | 2.00 |
| 139 | 22.80 | 12.70 | 85.59 | 2.78 | 0.56 | 1.36 | 15.63 | 0.00 | 15.63 | 0.968 | No | Yes | 2.00 |
| 140 | 22.97 | 13.17 | 85.85 | 2.79 | 0.56 | 1.36 | 16.25 | 0.00 | 16.25 | 1.000 | No | Yes | 2.00 |
| 141 | 23.13 | 13.69 | 86.20 | 2.79 | 0.56 | 1.35 | 17.06 | 0.00 | 17.06 | 1.036 | No | Yes | 2.00 |
| 142 | 23.29 | 13.99 | 86.89 | 2.80 | 0.56 | 1.34 | 17.38 | 0.00 | 17.38 | 1.053 | No | Yes | 2.00 |
| 143 | 23.46 | 14.02 | 87.89 | 2.81 | 0.56 | 1.34 | 17.25 | 0.00 | 17.25 | 1.049 | No | Yes | 2.00 |
| 144 | 23.62 | 13.85 | 88.89 | 2.82 | 0.56 | 1.33 | 17.08 | 0.00 | 17.08 | 1.028 | No | Yes | 2.00 |

**:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)**

| Point ID | Depth (ft) | $q_t$ (tsf) | FC (%) | Ic | m | $C_N$ | $q_{c1N}$ | $\Delta q_{c1N}$ | $q_{c1N,cs}$ | $CRR_{7.5}$ | Belongs to trans. layer | Clay-like behaviour | FS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 145 | 23.79 | 13.76 | 89.11 | 2.83 | 0.56 | 1.33 | 16.63 | 0.00 | 16.63 | 1.013 | No | Yes | 2.00 |
| 146 | 23.95 | 13.65 | 89.59 | 2.83 | 0.56 | 1.33 | 16.73 | 0.00 | 16.73 | 0.997 | No | Yes | 2.00 |
| 147 | 24.11 | 13.80 | 89.34 | 2.83 | 0.56 | 1.32 | 16.50 | 0.00 | 16.50 | 1.002 | No | Yes | 2.00 |
| 148 | 24.28 | 14.03 | 89.03 | 2.83 | 0.56 | 1.32 | 17.01 | 0.00 | 17.01 | 1.014 | No | Yes | 2.00 |
| 149 | 24.44 | 14.44 | 88.08 | 2.81 | 0.56 | 1.31 | 17.40 | 0.00 | 17.40 | 1.038 | No | Yes | 2.00 |
| 150 | 24.61 | 14.87 | 87.43 | 2.81 | 0.56 | 1.31 | 17.71 | 0.00 | 17.71 | 1.065 | No | Yes | 2.00 |
| 151 | 24.77 | 15.34 | 87.24 | 2.80 | 0.55 | 1.30 | 18.35 | 0.00 | 18.35 | 1.094 | No | Yes | 2.00 |
| 152 | 24.93 | 15.71 | 87.40 | 2.81 | 0.55 | 1.29 | 18.81 | 0.00 | 18.81 | 1.116 | No | Yes | 2.00 |
| 153 | 25.10 | 16.30 | 86.75 | 2.80 | 0.55 | 1.29 | 18.85 | 0.00 | 18.85 | 1.154 | No | Yes | 2.00 |
| 154 | 25.26 | 17.18 | 84.96 | 2.77 | 0.55 | 1.28 | 20.20 | 0.00 | 20.20 | 1.213 | No | Yes | 2.00 |
| 155 | 25.43 | 18.38 | 82.73 | 2.75 | 0.54 | 1.28 | 21.74 | 0.00 | 21.74 | 1.296 | No | Yes | 2.00 |
| 156 | 25.59 | 19.29 | 80.60 | 2.72 | 0.54 | 1.27 | 22.90 | 0.00 | 22.90 | 1.356 | No | Yes | 2.00 |
| 157 | 25.75 | 19.33 | 80.62 | 2.72 | 0.54 | 1.26 | 23.35 | 0.00 | 23.35 | 1.350 | No | Yes | 2.00 |
| 158 | 25.92 | 19.08 | 81.42 | 2.73 | 0.54 | 1.26 | 21.86 | 0.00 | 21.86 | 1.322 | No | Yes | 2.00 |
| 159 | 26.08 | 18.57 | 84.14 | 2.76 | 0.54 | 1.26 | 21.85 | 0.00 | 21.85 | 1.275 | No | Yes | 2.00 |
| 160 | 26.25 | 18.75 | 85.33 | 2.78 | 0.55 | 1.25 | 21.28 | 0.00 | 21.28 | 1.280 | No | Yes | 2.00 |
| 161 | 26.41 | 18.94 | 86.21 | 2.79 | 0.54 | 1.25 | 22.13 | 0.00 | 22.13 | 1.285 | No | Yes | 2.00 |
| 162 | 26.57 | 19.48 | 85.68 | 2.78 | 0.54 | 1.24 | 22.31 | 0.00 | 22.31 | 1.316 | No | Yes | 2.00 |
| 163 | 26.74 | 20.13 | 84.27 | 2.77 | 0.54 | 1.24 | 22.91 | 0.00 | 22.91 | 1.354 | No | Yes | 2.00 |
| 164 | 26.90 | 20.52 | 83.26 | 2.75 | 0.54 | 1.23 | 24.12 | 0.00 | 24.12 | 1.373 | No | Yes | 2.00 |
| 165 | 27.07 | 20.42 | 83.09 | 2.75 | 0.54 | 1.23 | 23.63 | 0.00 | 23.63 | 1.357 | No | Yes | 2.00 |
| 166 | 27.23 | 20.14 | 83.92 | 2.76 | 0.54 | 1.23 | 22.49 | 0.00 | 22.49 | 1.328 | No | Yes | 2.00 |
| 167 | 27.39 | 20.45 | 83.49 | 2.76 | 0.54 | 1.22 | 23.05 | 0.00 | 23.05 | 1.341 | No | Yes | 2.00 |
| 168 | 27.56 | 21.24 | 82.18 | 2.74 | 0.54 | 1.22 | 24.28 | 0.00 | 24.28 | 1.388 | No | Yes | 2.00 |
| 169 | 27.72 | 21.71 | 81.73 | 2.73 | 0.53 | 1.21 | 24.86 | 0.00 | 24.86 | 1.412 | No | Yes | 2.00 |
| 170 | 27.89 | 21.70 | 82.40 | 2.74 | 0.54 | 1.21 | 24.36 | 0.00 | 24.36 | 1.403 | No | Yes | 2.00 |
| 171 | 28.05 | 21.63 | 82.90 | 2.75 | 0.54 | 1.21 | 24.01 | 0.00 | 24.01 | 1.388 | No | Yes | 2.00 |
| 172 | 28.21 | 21.58 | 82.36 | 2.74 | 0.54 | 1.20 | 24.38 | 0.00 | 24.38 | 1.377 | No | Yes | 2.00 |
| 173 | 28.38 | 20.90 | 82.27 | 2.74 | 0.54 | 1.20 | 24.01 | 0.00 | 24.01 | 1.321 | No | Yes | 2.00 |
| 174 | 28.54 | 19.27 | 82.98 | 2.75 | 0.55 | 1.20 | 21.55 | 0.00 | 21.55 | 1.203 | No | Yes | 2.00 |
| 175 | 28.71 | 16.93 | 84.26 | 2.77 | 0.55 | 1.20 | 18.85 | 0.00 | 18.85 | 1.039 | No | Yes | 2.00 |
| 176 | 28.87 | 14.66 | 85.41 | 2.78 | 0.56 | 1.20 | 16.14 | 0.00 | 16.14 | 0.880 | No | Yes | 2.00 |
| 177 | 29.04 | 13.31 | 85.76 | 2.78 | 0.57 | 1.20 | 13.84 | 0.00 | 13.84 | 0.786 | No | Yes | 1.86 |
| 178 | 29.20 | 12.95 | 87.98 | 2.81 | 0.57 | 1.19 | 14.16 | 0.00 | 14.16 | 0.758 | No | Yes | 1.79 |
| 179 | 29.36 | 14.12 | 87.58 | 2.81 | 0.57 | 1.19 | 14.75 | 0.00 | 14.75 | 0.830 | No | Yes | 1.96 |
| 180 | 29.53 | 15.38 | 88.12 | 2.81 | 0.56 | 1.18 | 17.47 | 0.00 | 17.47 | 0.908 | No | Yes | 2.00 |
| 181 | 29.69 | 16.23 | 88.69 | 2.82 | 0.55 | 1.18 | 18.23 | 0.00 | 18.23 | 0.959 | No | Yes | 2.00 |
| 182 | 29.86 | 16.38 | 90.51 | 2.84 | 0.56 | 1.18 | 17.47 | 0.00 | 17.47 | 0.963 | No | Yes | 2.00 |
| 183 | 30.02 | 16.79 | 90.43 | 2.84 | 0.56 | 1.17 | 17.82 | 0.00 | 17.82 | 0.983 | No | Yes | 2.00 |
| 184 | 30.18 | 17.14 | 89.99 | 2.84 | 0.55 | 1.17 | 19.26 | 0.00 | 19.26 | 1.000 | No | Yes | 2.00 |
| 185 | 30.35 | 17.01 | 90.27 | 2.84 | 0.55 | 1.17 | 18.43 | 0.00 | 18.43 | 0.986 | No | Yes | 2.00 |
| 186 | 30.51 | 16.12 | 92.29 | 2.87 | 0.56 | 1.16 | 17.26 | 0.00 | 17.26 | 0.924 | No | Yes | 2.00 |
| 187 | 30.68 | 14.87 | 95.39 | 2.90 | 0.56 | 1.16 | 16.27 | 0.00 | 16.27 | 0.839 | No | Yes | 1.98 |
| 188 | 30.84 | 13.91 | 97.24 | 2.93 | 0.57 | 1.16 | 14.35 | 0.00 | 14.35 | 0.774 | No | Yes | 1.83 |
| 189 | 31.00 | 13.14 | 98.74 | 2.95 | 0.57 | 1.16 | 14.04 | 0.00 | 14.04 | 0.722 | No | Yes | 1.70 |
| 190 | 31.17 | 12.82 | 99.03 | 2.95 | 0.57 | 1.15 | 13.76 | 0.00 | 13.76 | 0.698 | No | Yes | 1.65 |
| 191 | 31.33 | 13.21 | 98.78 | 2.95 | 0.57 | 1.15 | 13.10 | 0.00 | 13.10 | 0.718 | No | Yes | 1.69 |
| 192 | 31.50 | 14.51 | 94.60 | 2.90 | 0.56 | 1.15 | 15.06 | 0.00 | 15.06 | 0.794 | No | Yes | 1.87 |

**:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)**

| Point ID | Depth (ft) | $q_t$ (tsf) | FC (%) | Ic | m | $C_N$ | $q_{c1N}$ | $\Delta q_{c1N}$ | $q_{c1N,cs}$ | $CRR_{7.5}$ | Belongs to trans. layer | Clay-like behaviour | FS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 193 | 31.66 | 16.12 | 89.28 | 2.83 | 0.56 | 1.14 | 17.71 | 0.00 | 17.71 | 0.889 | No | Yes | 2.00 |
| 194 | 31.82 | 16.65 | 86.34 | 2.79 | 0.56 | 1.14 | 18.07 | 0.00 | 18.07 | 0.917 | No | Yes | 2.00 |
| 195 | 31.99 | 16.07 | 88.55 | 2.82 | 0.56 | 1.14 | 16.65 | 0.00 | 16.65 | 0.877 | No | Yes | 2.00 |
| 196 | 32.15 | 15.09 | 93.50 | 2.88 | 0.56 | 1.13 | 15.75 | 0.00 | 15.75 | 0.812 | No | Yes | 1.91 |
| 197 | 32.32 | 14.69 | 96.73 | 2.92 | 0.57 | 1.13 | 14.78 | 0.00 | 14.78 | 0.783 | No | Yes | 1.85 |
| 198 | 32.48 | 14.61 | 97.95 | 2.94 | 0.56 | 1.13 | 15.23 | 0.00 | 15.23 | 0.775 | No | Yes | 1.82 |
| 199 | 32.64 | 14.52 | 97.52 | 2.93 | 0.56 | 1.12 | 15.37 | 0.00 | 15.37 | 0.765 | No | Yes | 1.80 |
| 200 | 32.81 | 14.29 | 96.01 | 2.91 | 0.57 | 1.12 | 14.37 | 0.00 | 14.37 | 0.747 | No | Yes | 1.76 |
| 201 | 32.97 | 14.28 | 92.87 | 2.87 | 0.57 | 1.12 | 14.39 | 0.00 | 14.39 | 0.743 | No | Yes | 1.75 |
| 202 | 33.14 | 14.77 | 88.93 | 2.82 | 0.57 | 1.12 | 15.11 | 0.00 | 15.11 | 0.768 | No | Yes | 1.81 |
| 203 | 33.30 | 15.05 | 87.67 | 2.81 | 0.56 | 1.11 | 15.69 | 0.00 | 15.69 | 0.780 | No | Yes | 1.84 |
| 204 | 33.47 | 14.98 | 88.97 | 2.82 | 0.57 | 1.11 | 15.18 | 0.00 | 15.18 | 0.772 | No | Yes | 1.82 |
| 205 | 33.63 | 14.88 | 91.79 | 2.86 | 0.57 | 1.11 | 14.80 | 0.00 | 14.80 | 0.763 | No | Yes | 1.79 |
| 206 | 33.79 | 15.11 | 93.76 | 2.88 | 0.56 | 1.10 | 15.25 | 0.00 | 15.25 | 0.772 | No | Yes | 1.82 |
| 207 | 33.96 | 15.16 | 95.84 | 2.91 | 0.56 | 1.10 | 15.80 | 0.00 | 15.80 | 0.771 | No | Yes | 1.81 |
| 208 | 34.12 | 15.23 | 96.87 | 2.92 | 0.56 | 1.10 | 14.91 | 0.00 | 14.91 | 0.771 | No | Yes | 1.81 |
| 209 | 34.28 | 16.10 | 95.94 | 2.91 | 0.56 | 1.10 | 15.33 | 0.00 | 15.33 | 0.816 | No | Yes | 1.92 |
| 210 | 34.45 | 17.38 | 94.45 | 2.89 | 0.55 | 1.09 | 18.21 | 0.00 | 18.21 | 0.885 | No | Yes | 2.00 |
| 211 | 34.61 | 18.70 | 92.66 | 2.87 | 0.55 | 1.09 | 18.63 | 0.00 | 18.63 | 0.955 | No | Yes | 2.00 |
| 212 | 34.78 | 19.10 | 92.06 | 2.86 | 0.55 | 1.09 | 19.23 | 0.00 | 19.23 | 0.973 | No | Yes | 2.00 |
| 213 | 34.94 | 19.21 | 92.14 | 2.86 | 0.55 | 1.08 | 19.33 | 0.00 | 19.33 | 0.973 | No | Yes | 2.00 |
| 214 | 35.10 | 18.81 | 93.36 | 2.88 | 0.55 | 1.08 | 18.77 | 0.00 | 18.77 | 0.947 | No | Yes | 2.00 |
| 215 | 35.27 | 17.84 | 95.97 | 2.91 | 0.55 | 1.08 | 17.93 | 0.00 | 17.93 | 0.887 | No | Yes | 2.00 |
| 216 | 35.43 | 16.49 | 98.21 | 2.94 | 0.56 | 1.08 | 16.33 | 0.00 | 16.33 | 0.808 | No | Yes | 1.90 |
| 217 | 35.60 | 15.48 | 99.09 | 2.95 | 0.56 | 1.07 | 14.71 | 0.00 | 14.71 | 0.749 | No | Yes | 1.76 |
| 218 | 35.76 | 14.92 | 99.42 | 2.96 | 0.56 | 1.07 | 14.80 | 0.00 | 14.80 | 0.714 | No | Yes | 1.68 |
| 219 | 35.92 | 14.90 | 99.29 | 2.95 | 0.57 | 1.07 | 14.44 | 0.00 | 14.44 | 0.709 | No | Yes | 1.67 |
| 220 | 36.09 | 14.76 | 100.00 | 2.96 | 0.57 | 1.07 | 14.50 | 0.00 | 14.50 | 0.698 | No | Yes | 1.64 |
| 221 | 36.25 | 14.89 | 98.50 | 2.94 | 0.57 | 1.06 | 14.35 | 0.00 | 14.35 | 0.701 | No | Yes | 1.65 |
| 222 | 36.42 | 15.48 | 93.96 | 2.89 | 0.57 | 1.06 | 14.72 | 0.00 | 14.72 | 0.730 | No | Yes | 1.72 |
| 223 | 36.58 | 16.05 | 89.88 | 2.84 | 0.56 | 1.06 | 16.09 | 0.00 | 16.09 | 0.757 | No | Yes | 1.78 |
| 224 | 36.74 | 16.16 | 89.42 | 2.83 | 0.56 | 1.06 | 15.87 | 0.00 | 15.87 | 0.760 | No | Yes | 1.79 |
| 225 | 36.91 | 15.90 | 92.45 | 2.87 | 0.57 | 1.05 | 14.92 | 0.00 | 14.92 | 0.742 | No | Yes | 1.75 |
| 226 | 37.07 | 16.03 | 94.06 | 2.89 | 0.56 | 1.05 | 15.17 | 0.00 | 15.17 | 0.745 | No | Yes | 1.75 |
| 227 | 37.24 | 16.45 | 93.25 | 2.88 | 0.56 | 1.05 | 16.12 | 0.00 | 16.12 | 0.764 | No | Yes | 1.80 |
| 228 | 37.40 | 16.16 | 91.81 | 2.86 | 0.56 | 1.05 | 16.12 | 0.00 | 16.12 | 0.745 | No | Yes | 1.75 |
| 229 | 37.57 | 15.11 | 91.26 | 2.85 | 0.57 | 1.04 | 14.22 | 0.00 | 14.22 | 0.687 | No | Yes | 1.62 |
| 230 | 37.73 | 13.82 | 93.30 | 2.88 | 0.57 | 1.04 | 12.89 | 0.00 | 12.89 | 0.616 | No | Yes | 1.45 |
| 231 | 37.89 | 13.35 | 96.54 | 2.92 | 0.57 | 1.04 | 12.18 | 0.00 | 12.18 | 0.589 | No | Yes | 1.39 |
| 232 | 38.06 | 14.59 | 94.29 | 2.89 | 0.57 | 1.04 | 12.73 | 0.00 | 12.73 | 0.651 | No | Yes | 1.53 |
| 233 | 38.22 | 16.04 | 90.53 | 2.84 | 0.56 | 1.03 | 16.36 | 0.00 | 16.36 | 0.723 | No | Yes | 1.70 |
| 234 | 38.39 | 16.91 | 87.29 | 2.80 | 0.56 | 1.03 | 16.42 | 0.00 | 16.42 | 0.764 | No | Yes | 1.80 |
| 235 | 38.55 | 16.10 | 88.98 | 2.82 | 0.57 | 1.03 | 15.13 | 0.00 | 15.13 | 0.719 | No | Yes | 1.69 |
| 236 | 38.71 | 15.14 | 91.93 | 2.86 | 0.57 | 1.03 | 13.96 | 0.00 | 13.96 | 0.667 | No | Yes | 1.57 |
| 237 | 38.88 | 14.36 | 96.51 | 2.92 | 0.57 | 1.03 | 13.38 | 0.00 | 13.38 | 0.624 | No | Yes | 1.47 |
| 238 | 39.04 | 14.34 | 100.00 | 2.97 | 0.57 | 1.02 | 12.79 | 0.00 | 12.79 | 0.621 | No | Yes | 1.46 |
| 239 | 39.21 | 14.82 | 100.00 | 3.00 | 0.57 | 1.02 | 13.75 | 0.00 | 13.75 | 0.642 | No | Yes | 1.51 |
| 240 | 39.37 | 15.71 | 100.00 | 3.00 | 0.56 | 1.02 | 14.71 | 0.00 | 14.71 | 0.683 | No | Yes | 1.61 |

**:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)**

| Point ID | Depth (ft) | $q_t$ (tsf) | FC (%) | Ic | m | $C_N$ | $q_{c1N}$ | $\Delta q_{c1N}$ | $q_{c1N,cs}$ | $CRR_{7.5}$ | Belongs to trans. layer | Clay-like behaviour | FS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 241 | 39.53 | 16.33 | 100.00 | 2.98 | 0.56 | 1.02 | 15.35 | 0.00 | 15.35 | 0.711 | No | Yes | 1.68 |
| 242 | 39.70 | 16.42 | 100.00 | 2.97 | 0.56 | 1.01 | 15.59 | 0.00 | 15.59 | 0.712 | No | Yes | 1.68 |
| 243 | 39.86 | 15.91 | 100.00 | 2.97 | 0.56 | 1.01 | 14.96 | 0.00 | 14.96 | 0.684 | No | Yes | 1.61 |
| 244 | 40.03 | 13.73 | 100.00 | 3.07 | 0.57 | 1.01 | 13.77 | 0.00 | 13.77 | 0.573 | No | Yes | 1.35 |
| 245 | 40.19 | 12.61 | 100.00 | 3.10 | 0.58 | 1.01 | 9.33 | 0.00 | 9.33 | 0.515 | No | Yes | 1.21 |
| 246 | 40.35 | 11.75 | 100.00 | 3.12 | 0.58 | 1.01 | 11.73 | 0.00 | 11.73 | 0.470 | No | Yes | 1.11 |
| 247 | 40.52 | 12.84 | 100.00 | 3.02 | 0.58 | 1.00 | 11.28 | 0.00 | 11.28 | 0.522 | No | Yes | 1.23 |
| 248 | 40.68 | 13.17 | 100.00 | 2.98 | 0.57 | 1.00 | 12.24 | 0.00 | 12.24 | 0.535 | No | Yes | 1.26 |
| 249 | 40.85 | 13.76 | 99.10 | 2.95 | 0.57 | 1.00 | 12.47 | 0.00 | 12.47 | 0.562 | No | Yes | 1.32 |
| 250 | 41.01 | 14.13 | 98.55 | 2.94 | 0.57 | 1.00 | 12.85 | 0.00 | 12.85 | 0.577 | No | Yes | 1.36 |
| 251 | 41.17 | 14.36 | 99.46 | 2.96 | 0.57 | 1.00 | 13.17 | 0.00 | 13.17 | 0.585 | No | Yes | 1.38 |
| 252 | 41.34 | 14.55 | 100.00 | 2.98 | 0.57 | 0.99 | 13.00 | 0.00 | 13.00 | 0.592 | No | Yes | 1.40 |
| 253 | 41.50 | 15.92 | 97.75 | 2.93 | 0.57 | 0.99 | 13.21 | 0.00 | 13.21 | 0.655 | No | Yes | 1.55 |
| 254 | 41.67 | 18.28 | 92.07 | 2.86 | 0.56 | 0.99 | 16.68 | 0.00 | 16.68 | 0.765 | No | Yes | 1.81 |
| 255 | 41.83 | 20.75 | 86.03 | 2.79 | 0.55 | 0.99 | 19.38 | 0.00 | 19.38 | 0.878 | No | Yes | 2.00 |
| 256 | 41.99 | 22.37 | 85.16 | 2.78 | 0.55 | 0.99 | 19.81 | 0.00 | 19.81 | 0.951 | No | Yes | 2.00 |
| 257 | 42.16 | 23.19 | 88.61 | 2.82 | 0.54 | 0.98 | 21.11 | 0.00 | 21.11 | 0.986 | No | Yes | 2.00 |
| 258 | 42.32 | 25.03 | 92.21 | 2.87 | 0.54 | 0.98 | 21.39 | 0.00 | 21.39 | 1.067 | No | Yes | 2.00 |
| 259 | 42.49 | 31.91 | 84.98 | 2.77 | 0.53 | 0.98 | 24.67 | 0.00 | 24.67 | 1.384 | No | Yes | 2.00 |
| 260 | 42.65 | 38.41 | 78.06 | 2.69 | 0.49 | 0.98 | 40.08 | 0.00 | 40.08 | 1.679 | No | Yes | 2.00 |
| 261 | 42.81 | 41.27 | 73.25 | 2.63 | 0.49 | 0.98 | 39.88 | 0.00 | 39.88 | 1.804 | No | Yes | 2.00 |
| 262 | 42.98 | 35.06 | 82.39 | 2.74 | 0.51 | 0.97 | 33.25 | 0.00 | 33.25 | 1.509 | No | Yes | 2.00 |
| 263 | 43.14 | 39.99 | 78.78 | 2.70 | 0.54 | 0.97 | 23.00 | 0.00 | 23.00 | 1.728 | No | Yes | 2.00 |
| 264 | 43.31 | 107.27 | 21.60 | 1.98 | 0.53 | 0.97 | 52.44 | 33.67 | 86.11 | 0.122 | No | No | 0.29 |
| 265 | 43.47 | 224.17 | 0.00 | 1.37 | 0.30 | 0.98 | 220.41 | 0.00 | 220.41 | 4.000 | No | No | 2.00 |
| 266 | 43.63 | 359.69 | 100.00 | 4.06 | 0.26 | 0.98 | 349.13 | 0.00 | 349.13 | 4.000 | No | Yes | 2.00 |
| 267 | 43.80 | 435.26 | 100.00 | 4.06 | 0.26 | 0.98 | 431.06 | 0.00 | 431.06 | 4.000 | No | Yes | 2.00 |

**Abbreviations**

Depth: Depth from free surface, at which CPT was performed (ft)
$q_t$: Total cone resistance
FC: Fines content (%)
$I_c$: Soil behavior type index
m: Stress exponent
$C_N$: Overburden correction factor
$q_{c1N}$: Normalized and adjusted cone resistance
$\Delta q_{c1N}$: Cone resistance correction factor due to fines
$q_{c1N,cs}$: Normalized and adjusted cone resistance
$CRR_{7.5}$: Cyclic resistance ratio for $M_w$=7.5
FS: Factor of safety against soil liquefaction

Ignore CPT results in the upper 5 feet below the ground surface for CPT-1 because the CPT hole was cleared using a hand auger within this zone prior to advancing the CPT probe.



**:: Liquefaction Potential Index calculation data ::**

| Depth (ft) | FS | m(FS) | $H_1$*m(FS) | $d_z$ | $LPI_{ISH}$ | Depth (ft) | FS | m(FS) | $H_1$*m(FS) | $d_z$ | $LPI_{ISH}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 0.33 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 0.49 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 0.66 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 0.82 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 0.98 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 1.15 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 1.31 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 1.48 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 1.64 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 1.80 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 1.97 | 2.00 | 0.00 | 0.00 | 0.17 | 0.00 |
| 2.13 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 2.30 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 2.46 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 2.63 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 2.79 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 2.95 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 3.12 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 3.28 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 3.44 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 3.61 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 3.77 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 3.94 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 4.10 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 4.26 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 4.43 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 4.59 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 4.76 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 4.92 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 5.08 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 5.25 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 5.41 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 5.58 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 5.74 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 5.91 | 2.00 | 0.00 | 0.00 | 0.17 | 0.00 |
| 6.07 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 6.23 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 6.40 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 6.56 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 6.73 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 6.89 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 7.05 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 7.22 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 7.38 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 7.55 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 7.71 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 7.87 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 8.04 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 8.20 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 8.37 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 8.53 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 8.69 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 8.86 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 9.02 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 9.19 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 9.35 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 9.51 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 9.68 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 9.84 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 10.01 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 10.17 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 10.34 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 10.50 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 10.66 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 10.83 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 10.99 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 11.15 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 11.32 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 11.48 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 11.65 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 11.81 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 11.97 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 12.14 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 12.30 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 12.47 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 12.63 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 12.79 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 12.96 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 13.12 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 13.29 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 13.45 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 13.62 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 13.78 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 13.94 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 14.11 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 14.27 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 14.44 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 14.60 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 14.76 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 14.93 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 15.09 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 15.26 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 15.42 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 15.58 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 15.75 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |

**:: Liquefaction Potential Index calculation data ::**

| Depth (ft) | FS | m(FS) | $H_1$*m(FS) | $d_z$ | $LPI_{ISH}$ | Depth (ft) | FS | m(FS) | $H_1$*m(FS) | $d_z$ | $LPI_{ISH}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15.91 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 16.08 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 16.24 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 16.40 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 16.57 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 16.73 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 16.90 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 17.06 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 17.22 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 17.39 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 17.55 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 17.72 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 17.88 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 18.05 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 18.21 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 18.37 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 18.54 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 18.70 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 18.86 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 19.03 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 19.19 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 19.36 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 19.52 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 19.68 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 19.85 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 20.01 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 20.18 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 20.34 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 20.50 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 20.67 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 20.83 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 21.00 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 21.16 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 21.32 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 21.49 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 21.65 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 21.82 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 21.98 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 22.15 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 22.31 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 22.47 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 22.64 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 22.80 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 22.97 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 23.13 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 23.29 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 23.46 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 23.62 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 23.79 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 23.95 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 24.11 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 24.28 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 24.44 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 24.61 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 24.77 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 24.93 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 25.10 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 25.26 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 25.43 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 25.59 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 25.75 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 25.92 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 26.08 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 26.25 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 26.41 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 26.57 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 26.74 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 26.90 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 27.07 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 27.23 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 27.39 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 27.56 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 27.72 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 27.89 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 28.05 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 28.21 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 28.38 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 28.54 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 28.71 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 28.87 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 29.04 | 1.86 | 0.00 | 0.00 | 0.16 | 0.00 | 29.20 | 1.79 | 0.00 | 0.00 | 0.16 | 0.00 |
| 29.36 | 1.96 | 0.00 | 0.00 | 0.16 | 0.00 | 29.53 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 29.69 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 29.86 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 30.02 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 30.18 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 30.35 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 30.51 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 30.68 | 1.98 | 0.00 | 0.00 | 0.16 | 0.00 | 30.84 | 1.83 | 0.00 | 0.00 | 0.16 | 0.00 |
| 31.00 | 1.70 | 0.00 | 0.00 | 0.16 | 0.00 | 31.17 | 1.65 | 0.00 | 0.00 | 0.16 | 0.00 |
| 31.33 | 1.69 | 0.00 | 0.00 | 0.16 | 0.00 | 31.50 | 1.87 | 0.00 | 0.00 | 0.16 | 0.00 |

**:: Liquefaction Potential Index calculation data ::**

| Depth (ft) | FS | m(FS) | $H_1$*m(FS) | $d_z$ | $LPI_{ISH}$ | Depth (ft) | FS | m(FS) | $H_1$*m(FS) | $d_z$ | $LPI_{ISH}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 31.66 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 31.82 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 31.99 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 32.15 | 1.91 | 0.00 | 0.00 | 0.16 | 0.00 |
| 32.32 | 1.85 | 0.00 | 0.00 | 0.16 | 0.00 | 32.48 | 1.82 | 0.00 | 0.00 | 0.16 | 0.00 |
| 32.64 | 1.80 | 0.00 | 0.00 | 0.16 | 0.00 | 32.81 | 1.76 | 0.00 | 0.00 | 0.16 | 0.00 |
| 32.97 | 1.75 | 0.00 | 0.00 | 0.16 | 0.00 | 33.14 | 1.81 | 0.00 | 0.00 | 0.16 | 0.00 |
| 33.30 | 1.84 | 0.00 | 0.00 | 0.16 | 0.00 | 33.47 | 1.82 | 0.00 | 0.00 | 0.16 | 0.00 |
| 33.63 | 1.79 | 0.00 | 0.00 | 0.16 | 0.00 | 33.79 | 1.82 | 0.00 | 0.00 | 0.16 | 0.00 |
| 33.96 | 1.81 | 0.00 | 0.00 | 0.16 | 0.00 | 34.12 | 1.81 | 0.00 | 0.00 | 0.16 | 0.00 |
| 34.28 | 1.92 | 0.00 | 0.00 | 0.16 | 0.00 | 34.45 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 34.61 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 34.78 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 34.94 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 35.10 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 35.27 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 35.43 | 1.90 | 0.00 | 0.00 | 0.16 | 0.00 |
| 35.60 | 1.76 | 0.00 | 0.00 | 0.16 | 0.00 | 35.76 | 1.68 | 0.00 | 0.00 | 0.16 | 0.00 |
| 35.92 | 1.67 | 0.00 | 0.00 | 0.16 | 0.00 | 36.09 | 1.64 | 0.00 | 0.00 | 0.16 | 0.00 |
| 36.25 | 1.65 | 0.00 | 0.00 | 0.16 | 0.00 | 36.42 | 1.72 | 0.00 | 0.00 | 0.16 | 0.00 |
| 36.58 | 1.78 | 0.00 | 0.00 | 0.16 | 0.00 | 36.74 | 1.79 | 0.00 | 0.00 | 0.16 | 0.00 |
| 36.91 | 1.75 | 0.00 | 0.00 | 0.16 | 0.00 | 37.07 | 1.75 | 0.00 | 0.00 | 0.16 | 0.00 |
| 37.24 | 1.80 | 0.00 | 0.00 | 0.16 | 0.00 | 37.40 | 1.75 | 0.00 | 0.00 | 0.16 | 0.00 |
| 37.57 | 1.62 | 0.00 | 0.00 | 0.16 | 0.00 | 37.73 | 1.45 | 0.00 | 0.00 | 0.16 | 0.00 |
| 37.89 | 1.39 | 0.00 | 0.00 | 0.16 | 0.00 | 38.06 | 1.53 | 0.00 | 0.00 | 0.16 | 0.00 |
| 38.22 | 1.70 | 0.00 | 0.00 | 0.16 | 0.00 | 38.39 | 1.80 | 0.00 | 0.00 | 0.16 | 0.00 |
| 38.55 | 1.69 | 0.00 | 0.00 | 0.16 | 0.00 | 38.71 | 1.57 | 0.00 | 0.00 | 0.16 | 0.00 |
| 38.88 | 1.47 | 0.00 | 0.00 | 0.16 | 0.00 | 39.04 | 1.46 | 0.00 | 0.00 | 0.16 | 0.00 |
| 39.21 | 1.51 | 0.00 | 0.00 | 0.16 | 0.00 | 39.37 | 1.61 | 0.00 | 0.00 | 0.16 | 0.00 |
| 39.53 | 1.68 | 0.00 | 0.00 | 0.16 | 0.00 | 39.70 | 1.68 | 0.00 | 0.00 | 0.16 | 0.00 |
| 39.86 | 1.61 | 0.00 | 0.00 | 0.16 | 0.00 | 40.03 | 1.35 | 0.00 | 0.00 | 0.16 | 0.00 |
| 40.19 | 1.21 | 0.00 | 0.00 | 0.16 | 0.00 | 40.35 | 1.11 | 0.00 | 0.00 | 0.16 | 0.00 |
| 40.52 | 1.23 | 0.00 | 0.00 | 0.16 | 0.00 | 40.68 | 1.26 | 0.00 | 0.00 | 0.16 | 0.00 |
| 40.85 | 1.32 | 0.00 | 0.00 | 0.16 | 0.00 | 41.01 | 1.36 | 0.00 | 0.00 | 0.17 | 0.00 |
| 41.17 | 1.38 | 0.00 | 0.00 | 0.16 | 0.00 | 41.34 | 1.40 | 0.00 | 0.00 | 0.16 | 0.00 |
| 41.50 | 1.55 | 0.00 | 0.00 | 0.16 | 0.00 | 41.67 | 1.81 | 0.00 | 0.00 | 0.16 | 0.00 |
| 41.83 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 41.99 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 42.16 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 42.32 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 42.49 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 42.65 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 42.81 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 42.98 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 43.14 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 43.31 | 0.29 | 0.00 | 0.00 | 0.16 | 0.12 |
| 43.47 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 43.63 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 43.80 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | | | | | | |

**Overall liquefaction potential: 0.12**

$LPI_{ISH}$ > 5.0 - Liquefaction manifestation is expected

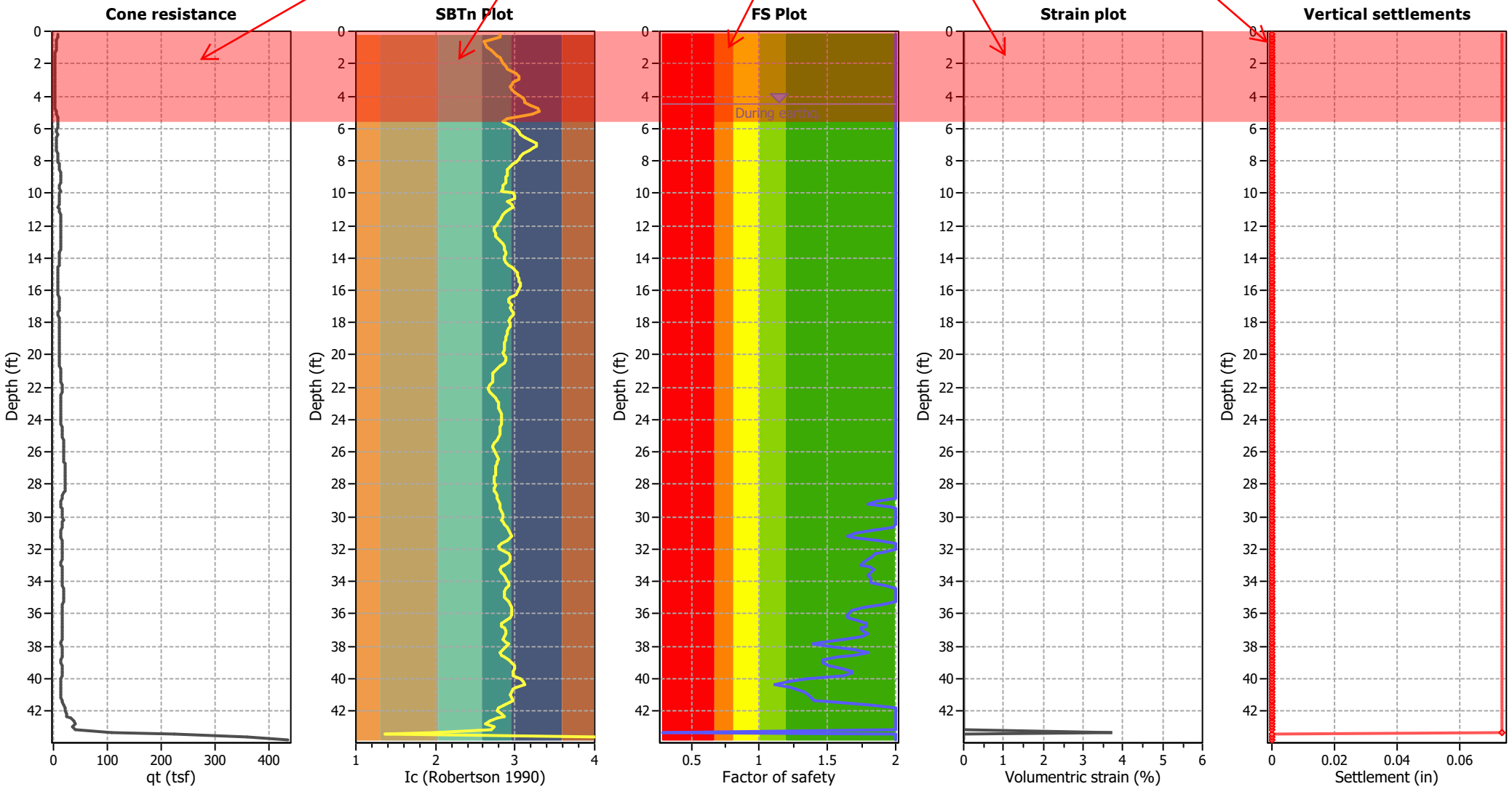
**Abbreviations**

FS: Calculated factor of safety for test point
$d_z$: Layer thickness (ft)
LPI: Liquefaction potential index value for test point

Ignore CPT results in the upper 5 feet below the ground surface for CPT-1 because the CPT hole was cleared using a hand auger within this zone prior to advancing the CPT probe.



## Estimation of post-earthquake settlements




**Abbreviations**

| | |
|---|---|
| $q_t$: | Total cone resistance (cone resistance $q_c$ corrected for pore water effects) |
| $I_c$: | Soil Behaviour Type Index |
| FS: | Calculated Factor of Safety against liquefaction |
| Volumentric strain: | Post-liquefaction volumentric strain |

Ignore CPT results in the upper 5 feet below the ground surface for CPT-1 because the CPT hole was cleared using a hand auger within this zone prior to advancing the CPT probe.



**:: Post-earthquake settlement of dry sands ::**

| Depth (ft) | Ic | $Q_{tn}$ | $K_c$ | $Q_{tn,cs}$ | $N_{1,60}$ (blows) | $G_{max}$ (tsf) | CSR | Shear, γ (%) | $e_{vol(15)}$ (%) | $N_c$ | $e_v$ (%) | Settle. (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 2.81 | 12.97 | 6.00 | 77.77 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 0.33 | 2.82 | 10.20 | 6.05 | 61.73 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 0.49 | 2.68 | 7.32 | 4.54 | 33.22 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 0.66 | 2.61 | 7.17 | 3.88 | 27.82 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 0.82 | 2.63 | 7.02 | 4.00 | 28.08 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 0.98 | 2.65 | 6.65 | 4.21 | 28.01 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 1.15 | 2.71 | 6.02 | 4.81 | 28.97 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 1.31 | 2.75 | 5.32 | 5.20 | 27.65 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 1.48 | 2.78 | 4.93 | 5.58 | 27.53 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 1.64 | 2.81 | 4.56 | 6.02 | 27.46 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 1.80 | 2.83 | 4.38 | 6.24 | 27.36 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 1.97 | 2.84 | 4.26 | 6.38 | 27.18 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 2.13 | 2.88 | 4.15 | 6.96 | 28.87 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 2.30 | 2.91 | 4.16 | 7.34 | 30.52 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 2.46 | 2.97 | 4.10 | 8.30 | 34.04 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 2.63 | 3.02 | 4.14 | 9.07 | 37.51 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 2.79 | 3.05 | 4.14 | 9.66 | 39.94 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 2.95 | 3.04 | 4.32 | 9.49 | 40.97 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 3.12 | 2.98 | 4.63 | 8.37 | 38.79 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 3.28 | 2.95 | 4.64 | 8.00 | 37.11 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 3.44 | 2.93 | 4.47 | 7.67 | 34.27 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 3.61 | 2.96 | 4.08 | 8.06 | 32.94 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 3.77 | 2.99 | 3.77 | 8.59 | 32.42 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 3.94 | 3.04 | 3.43 | 9.56 | 32.77 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 4.10 | 3.11 | 3.28 | 10.72 | 35.20 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 4.26 | 3.12 | 3.39 | 10.98 | 37.22 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 4.43 | 3.13 | 3.69 | 11.17 | 41.26 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |

**Total estimated settlement: 0.00**

**Abbreviations**

$Q_{tn}$: Normalized cone resistance
$K_c$: Fines correction factor
$Q_{tn,cs}$: Equivalent clean sand normalized cone resistance
$G_{max}$: Small strain shear modulus
CSR: Soil cyclic stress ratio
γ: Cyclic shear strain
$e_{vol(15)}$: Volumetric strain after 15 cycles
$N_c$: Equivalent number of cycles
$e_v$: Volumetric strain
Settle.: Calculated settlement

**:: Post-earthquake settlement due to soil liquefaction ::**

| Depth (ft) | $q_{c1N,cs}$ | FS | $e_v$ (%) | DF | Settlement (in) | Depth (ft) | $q_{c1N,cs}$ | FS | $e_v$ (%) | DF | Settlement (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4.59 | 4.35 | 2.00 | 0.00 | 1.00 | 0.00 | 4.76 | 4.72 | 2.00 | 0.00 | 1.00 | 0.00 |
| 4.92 | 5.00 | 2.00 | 0.00 | 1.00 | 0.00 | 5.08 | 7.54 | 2.00 | 0.00 | 1.00 | 0.00 |
| 5.25 | 10.09 | 2.00 | 0.00 | 1.00 | 0.00 | 5.41 | 14.73 | 2.00 | 0.00 | 1.00 | 0.00 |
| 5.58 | 12.76 | 2.00 | 0.00 | 1.00 | 0.00 | 5.74 | 11.49 | 2.00 | 0.00 | 1.00 | 0.00 |
| 5.91 | 10.52 | 2.00 | 0.00 | 1.00 | 0.00 | 6.07 | 8.84 | 2.00 | 0.00 | 1.00 | 0.00 |
| 6.23 | 10.49 | 2.00 | 0.00 | 1.00 | 0.00 | 6.40 | 10.51 | 2.00 | 0.00 | 1.00 | 0.00 |
| 6.56 | 9.98 | 2.00 | 0.00 | 1.00 | 0.00 | 6.73 | 8.35 | 2.00 | 0.00 | 1.00 | 0.00 |
| 6.89 | 7.45 | 2.00 | 0.00 | 1.00 | 0.00 | 7.05 | 7.49 | 2.00 | 0.00 | 1.00 | 0.00 |

**:: Post-earthquake settlement due to soil liquefaction :: (continued)**

| Depth (ft) | $q_{c1N,cs}$ | FS | $e_v$ (%) | DF | Settlement (in) | Depth (ft) | $q_{c1N,cs}$ | FS | $e_v$ (%) | DF | Settlement (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 7.22 | 7.87 | 2.00 | 0.00 | 1.00 | 0.00 | 7.38 | 8.71 | 2.00 | 0.00 | 1.00 | 0.00 |
| 7.55 | 10.31 | 2.00 | 0.00 | 1.00 | 0.00 | 7.71 | 11.44 | 2.00 | 0.00 | 1.00 | 0.00 |
| 7.87 | 12.55 | 2.00 | 0.00 | 1.00 | 0.00 | 8.04 | 13.35 | 2.00 | 0.00 | 1.00 | 0.00 |
| 8.20 | 15.49 | 2.00 | 0.00 | 1.00 | 0.00 | 8.37 | 17.87 | 2.00 | 0.00 | 1.00 | 0.00 |
| 8.53 | 18.99 | 2.00 | 0.00 | 1.00 | 0.00 | 8.69 | 18.88 | 2.00 | 0.00 | 1.00 | 0.00 |
| 8.86 | 18.62 | 2.00 | 0.00 | 1.00 | 0.00 | 9.02 | 18.88 | 2.00 | 0.00 | 1.00 | 0.00 |
| 9.19 | 19.20 | 2.00 | 0.00 | 1.00 | 0.00 | 9.35 | 19.05 | 2.00 | 0.00 | 1.00 | 0.00 |
| 9.51 | 18.24 | 2.00 | 0.00 | 1.00 | 0.00 | 9.68 | 18.43 | 2.00 | 0.00 | 1.00 | 0.00 |
| 9.84 | 18.88 | 2.00 | 0.00 | 1.00 | 0.00 | 10.01 | 19.17 | 2.00 | 0.00 | 1.00 | 0.00 |
| 10.17 | 10.20 | 2.00 | 0.00 | 1.00 | 0.00 | 10.34 | 17.82 | 2.00 | 0.00 | 1.00 | 0.00 |
| 10.50 | 16.98 | 2.00 | 0.00 | 1.00 | 0.00 | 10.66 | 14.94 | 2.00 | 0.00 | 1.00 | 0.00 |
| 10.83 | 12.98 | 2.00 | 0.00 | 1.00 | 0.00 | 10.99 | 14.19 | 2.00 | 0.00 | 1.00 | 0.00 |
| 11.15 | 18.19 | 2.00 | 0.00 | 1.00 | 0.00 | 11.32 | 20.10 | 2.00 | 0.00 | 1.00 | 0.00 |
| 11.48 | 21.67 | 2.00 | 0.00 | 1.00 | 0.00 | 11.65 | 22.17 | 2.00 | 0.00 | 1.00 | 0.00 |
| 11.81 | 22.28 | 2.00 | 0.00 | 1.00 | 0.00 | 11.97 | 22.16 | 2.00 | 0.00 | 1.00 | 0.00 |
| 12.14 | 22.27 | 2.00 | 0.00 | 1.00 | 0.00 | 12.30 | 22.24 | 2.00 | 0.00 | 1.00 | 0.00 |
| 12.47 | 22.17 | 2.00 | 0.00 | 1.00 | 0.00 | 12.63 | 22.57 | 2.00 | 0.00 | 1.00 | 0.00 |
| 12.79 | 22.81 | 2.00 | 0.00 | 1.00 | 0.00 | 12.96 | 21.48 | 2.00 | 0.00 | 1.00 | 0.00 |
| 13.12 | 20.31 | 2.00 | 0.00 | 1.00 | 0.00 | 13.29 | 19.67 | 2.00 | 0.00 | 1.00 | 0.00 |
| 13.45 | 19.25 | 2.00 | 0.00 | 1.00 | 0.00 | 13.62 | 17.69 | 2.00 | 0.00 | 1.00 | 0.00 |
| 13.78 | 16.73 | 2.00 | 0.00 | 1.00 | 0.00 | 13.94 | 15.94 | 2.00 | 0.00 | 1.00 | 0.00 |
| 14.11 | 17.37 | 2.00 | 0.00 | 1.00 | 0.00 | 14.27 | 15.27 | 2.00 | 0.00 | 1.00 | 0.00 |
| 14.44 | 13.95 | 2.00 | 0.00 | 1.00 | 0.00 | 14.60 | 13.94 | 2.00 | 0.00 | 1.00 | 0.00 |
| 14.76 | 13.13 | 2.00 | 0.00 | 1.00 | 0.00 | 14.93 | 12.80 | 2.00 | 0.00 | 1.00 | 0.00 |
| 15.09 | 12.37 | 2.00 | 0.00 | 1.00 | 0.00 | 15.26 | 12.25 | 2.00 | 0.00 | 1.00 | 0.00 |
| 15.42 | 11.82 | 2.00 | 0.00 | 1.00 | 0.00 | 15.58 | 11.77 | 2.00 | 0.00 | 1.00 | 0.00 |
| 15.75 | 11.57 | 2.00 | 0.00 | 1.00 | 0.00 | 15.91 | 11.87 | 2.00 | 0.00 | 1.00 | 0.00 |
| 16.08 | 11.97 | 2.00 | 0.00 | 1.00 | 0.00 | 16.24 | 11.83 | 2.00 | 0.00 | 1.00 | 0.00 |
| 16.40 | 12.61 | 2.00 | 0.00 | 1.00 | 0.00 | 16.57 | 16.79 | 2.00 | 0.00 | 1.00 | 0.00 |
| 16.73 | 13.60 | 2.00 | 0.00 | 1.00 | 0.00 | 16.90 | 13.12 | 2.00 | 0.00 | 1.00 | 0.00 |
| 17.06 | 13.93 | 2.00 | 0.00 | 1.00 | 0.00 | 17.22 | 13.73 | 2.00 | 0.00 | 1.00 | 0.00 |
| 17.39 | 12.52 | 2.00 | 0.00 | 1.00 | 0.00 | 17.55 | 12.54 | 2.00 | 0.00 | 1.00 | 0.00 |
| 17.72 | 13.84 | 2.00 | 0.00 | 1.00 | 0.00 | 17.88 | 13.92 | 2.00 | 0.00 | 1.00 | 0.00 |
| 18.05 | 13.63 | 2.00 | 0.00 | 1.00 | 0.00 | 18.21 | 13.79 | 2.00 | 0.00 | 1.00 | 0.00 |
| 18.37 | 13.89 | 2.00 | 0.00 | 1.00 | 0.00 | 18.54 | 14.57 | 2.00 | 0.00 | 1.00 | 0.00 |
| 18.70 | 14.10 | 2.00 | 0.00 | 1.00 | 0.00 | 18.86 | 13.76 | 2.00 | 0.00 | 1.00 | 0.00 |
| 19.03 | 14.46 | 2.00 | 0.00 | 1.00 | 0.00 | 19.19 | 14.57 | 2.00 | 0.00 | 1.00 | 0.00 |
| 19.36 | 14.71 | 2.00 | 0.00 | 1.00 | 0.00 | 19.52 | 14.54 | 2.00 | 0.00 | 1.00 | 0.00 |
| 19.68 | 14.75 | 2.00 | 0.00 | 1.00 | 0.00 | 19.85 | 14.50 | 2.00 | 0.00 | 1.00 | 0.00 |
| 20.01 | 13.87 | 2.00 | 0.00 | 1.00 | 0.00 | 20.18 | 13.22 | 2.00 | 0.00 | 1.00 | 0.00 |
| 20.34 | 13.35 | 2.00 | 0.00 | 1.00 | 0.00 | 20.50 | 14.03 | 2.00 | 0.00 | 1.00 | 0.00 |
| 20.67 | 14.81 | 2.00 | 0.00 | 1.00 | 0.00 | 20.83 | 16.95 | 2.00 | 0.00 | 1.00 | 0.00 |
| 21.00 | 17.40 | 2.00 | 0.00 | 1.00 | 0.00 | 21.16 | 17.21 | 2.00 | 0.00 | 1.00 | 0.00 |
| 21.32 | 16.86 | 2.00 | 0.00 | 1.00 | 0.00 | 21.49 | 16.56 | 2.00 | 0.00 | 1.00 | 0.00 |
| 21.65 | 17.05 | 2.00 | 0.00 | 1.00 | 0.00 | 21.82 | 19.64 | 2.00 | 0.00 | 1.00 | 0.00 |
| 21.98 | 22.21 | 2.00 | 0.00 | 1.00 | 0.00 | 22.15 | 20.82 | 2.00 | 0.00 | 1.00 | 0.00 |
| 22.31 | 19.05 | 2.00 | 0.00 | 1.00 | 0.00 | 22.47 | 17.20 | 2.00 | 0.00 | 1.00 | 0.00 |
| 22.64 | 15.48 | 2.00 | 0.00 | 1.00 | 0.00 | 22.80 | 15.63 | 2.00 | 0.00 | 1.00 | 0.00 |

**:: Post-earthquake settlement due to soil liquefaction :: (continued)**

| Depth (ft) | $q_{c1N,cs}$ | FS | $e_v$ (%) | DF | Settlement (in) | Depth (ft) | $q_{c1N,cs}$ | FS | $e_v$ (%) | DF | Settlement (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 22.97 | 16.25 | 2.00 | 0.00 | 1.00 | 0.00 | 23.13 | 17.06 | 2.00 | 0.00 | 1.00 | 0.00 |
| 23.29 | 17.38 | 2.00 | 0.00 | 1.00 | 0.00 | 23.46 | 17.25 | 2.00 | 0.00 | 1.00 | 0.00 |
| 23.62 | 17.08 | 2.00 | 0.00 | 1.00 | 0.00 | 23.79 | 16.63 | 2.00 | 0.00 | 1.00 | 0.00 |
| 23.95 | 16.73 | 2.00 | 0.00 | 1.00 | 0.00 | 24.11 | 16.50 | 2.00 | 0.00 | 1.00 | 0.00 |
| 24.28 | 17.01 | 2.00 | 0.00 | 1.00 | 0.00 | 24.44 | 17.40 | 2.00 | 0.00 | 1.00 | 0.00 |
| 24.61 | 17.71 | 2.00 | 0.00 | 1.00 | 0.00 | 24.77 | 18.35 | 2.00 | 0.00 | 1.00 | 0.00 |
| 24.93 | 18.81 | 2.00 | 0.00 | 1.00 | 0.00 | 25.10 | 18.85 | 2.00 | 0.00 | 1.00 | 0.00 |
| 25.26 | 20.20 | 2.00 | 0.00 | 1.00 | 0.00 | 25.43 | 21.74 | 2.00 | 0.00 | 1.00 | 0.00 |
| 25.59 | 22.90 | 2.00 | 0.00 | 1.00 | 0.00 | 25.75 | 23.35 | 2.00 | 0.00 | 1.00 | 0.00 |
| 25.92 | 21.86 | 2.00 | 0.00 | 1.00 | 0.00 | 26.08 | 21.85 | 2.00 | 0.00 | 1.00 | 0.00 |
| 26.25 | 21.28 | 2.00 | 0.00 | 1.00 | 0.00 | 26.41 | 22.13 | 2.00 | 0.00 | 1.00 | 0.00 |
| 26.57 | 22.31 | 2.00 | 0.00 | 1.00 | 0.00 | 26.74 | 22.91 | 2.00 | 0.00 | 1.00 | 0.00 |
| 26.90 | 24.12 | 2.00 | 0.00 | 1.00 | 0.00 | 27.07 | 23.63 | 2.00 | 0.00 | 1.00 | 0.00 |
| 27.23 | 22.49 | 2.00 | 0.00 | 1.00 | 0.00 | 27.39 | 23.05 | 2.00 | 0.00 | 1.00 | 0.00 |
| 27.56 | 24.28 | 2.00 | 0.00 | 1.00 | 0.00 | 27.72 | 24.86 | 2.00 | 0.00 | 1.00 | 0.00 |
| 27.89 | 24.36 | 2.00 | 0.00 | 1.00 | 0.00 | 28.05 | 24.01 | 2.00 | 0.00 | 1.00 | 0.00 |
| 28.21 | 24.38 | 2.00 | 0.00 | 1.00 | 0.00 | 28.38 | 24.01 | 2.00 | 0.00 | 1.00 | 0.00 |
| 28.54 | 21.55 | 2.00 | 0.00 | 1.00 | 0.00 | 28.71 | 18.85 | 2.00 | 0.00 | 1.00 | 0.00 |
| 28.87 | 16.14 | 2.00 | 0.00 | 1.00 | 0.00 | 29.04 | 13.84 | 1.86 | 0.00 | 1.00 | 0.00 |
| 29.20 | 14.16 | 1.79 | 0.00 | 1.00 | 0.00 | 29.36 | 14.75 | 1.96 | 0.00 | 1.00 | 0.00 |
| 29.53 | 17.47 | 2.00 | 0.00 | 1.00 | 0.00 | 29.69 | 18.23 | 2.00 | 0.00 | 1.00 | 0.00 |
| 29.86 | 17.47 | 2.00 | 0.00 | 1.00 | 0.00 | 30.02 | 17.82 | 2.00 | 0.00 | 1.00 | 0.00 |
| 30.18 | 19.26 | 2.00 | 0.00 | 1.00 | 0.00 | 30.35 | 18.43 | 2.00 | 0.00 | 1.00 | 0.00 |
| 30.51 | 17.26 | 2.00 | 0.00 | 1.00 | 0.00 | 30.68 | 16.27 | 1.98 | 0.00 | 1.00 | 0.00 |
| 30.84 | 14.35 | 1.83 | 0.00 | 1.00 | 0.00 | 31.00 | 14.04 | 1.70 | 0.00 | 1.00 | 0.00 |
| 31.17 | 13.76 | 1.65 | 0.00 | 1.00 | 0.00 | 31.33 | 13.10 | 1.69 | 0.00 | 1.00 | 0.00 |
| 31.50 | 15.06 | 1.87 | 0.00 | 1.00 | 0.00 | 31.66 | 17.71 | 2.00 | 0.00 | 1.00 | 0.00 |
| 31.82 | 18.07 | 2.00 | 0.00 | 1.00 | 0.00 | 31.99 | 16.65 | 2.00 | 0.00 | 1.00 | 0.00 |
| 32.15 | 15.75 | 1.91 | 0.00 | 1.00 | 0.00 | 32.32 | 14.78 | 1.85 | 0.00 | 1.00 | 0.00 |
| 32.48 | 15.23 | 1.82 | 0.00 | 1.00 | 0.00 | 32.64 | 15.37 | 1.80 | 0.00 | 1.00 | 0.00 |
| 32.81 | 14.37 | 1.76 | 0.00 | 1.00 | 0.00 | 32.97 | 14.39 | 1.75 | 0.00 | 1.00 | 0.00 |
| 33.14 | 15.11 | 1.81 | 0.00 | 1.00 | 0.00 | 33.30 | 15.69 | 1.84 | 0.00 | 1.00 | 0.00 |
| 33.47 | 15.18 | 1.82 | 0.00 | 1.00 | 0.00 | 33.63 | 14.80 | 1.79 | 0.00 | 1.00 | 0.00 |
| 33.79 | 15.25 | 1.82 | 0.00 | 1.00 | 0.00 | 33.96 | 15.80 | 1.81 | 0.00 | 1.00 | 0.00 |
| 34.12 | 14.91 | 1.81 | 0.00 | 1.00 | 0.00 | 34.28 | 15.33 | 1.92 | 0.00 | 1.00 | 0.00 |
| 34.45 | 18.21 | 2.00 | 0.00 | 1.00 | 0.00 | 34.61 | 18.63 | 2.00 | 0.00 | 1.00 | 0.00 |
| 34.78 | 19.23 | 2.00 | 0.00 | 1.00 | 0.00 | 34.94 | 19.33 | 2.00 | 0.00 | 1.00 | 0.00 |
| 35.10 | 18.77 | 2.00 | 0.00 | 1.00 | 0.00 | 35.27 | 17.93 | 2.00 | 0.00 | 1.00 | 0.00 |
| 35.43 | 16.33 | 1.90 | 0.00 | 1.00 | 0.00 | 35.60 | 14.71 | 1.76 | 0.00 | 1.00 | 0.00 |
| 35.76 | 14.80 | 1.68 | 0.00 | 1.00 | 0.00 | 35.92 | 14.44 | 1.67 | 0.00 | 1.00 | 0.00 |
| 36.09 | 14.50 | 1.64 | 0.00 | 1.00 | 0.00 | 36.25 | 14.35 | 1.65 | 0.00 | 1.00 | 0.00 |
| 36.42 | 14.72 | 1.72 | 0.00 | 1.00 | 0.00 | 36.58 | 16.09 | 1.78 | 0.00 | 1.00 | 0.00 |
| 36.74 | 15.87 | 1.79 | 0.00 | 1.00 | 0.00 | 36.91 | 14.92 | 1.75 | 0.00 | 1.00 | 0.00 |
| 37.07 | 15.17 | 1.75 | 0.00 | 1.00 | 0.00 | 37.24 | 16.12 | 1.80 | 0.00 | 1.00 | 0.00 |
| 37.40 | 16.12 | 1.75 | 0.00 | 1.00 | 0.00 | 37.57 | 14.22 | 1.62 | 0.00 | 1.00 | 0.00 |
| 37.73 | 12.89 | 1.45 | 0.00 | 1.00 | 0.00 | 37.89 | 12.18 | 1.39 | 0.00 | 1.00 | 0.00 |
| 38.06 | 12.73 | 1.53 | 0.00 | 1.00 | 0.00 | 38.22 | 16.36 | 1.70 | 0.00 | 1.00 | 0.00 |
| 38.39 | 16.42 | 1.80 | 0.00 | 1.00 | 0.00 | 38.55 | 15.13 | 1.69 | 0.00 | 1.00 | 0.00 |

**:: Post-earthquake settlement due to soil liquefaction :: (continued)**

| Depth (ft) | $q_{c1N,cs}$ | FS | $e_v$ (%) | DF | Settlement (in) | Depth (ft) | $q_{c1N,cs}$ | FS | $e_v$ (%) | DF | Settlement (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 38.71 | 13.96 | 1.57 | 0.00 | 1.00 | 0.00 | 38.88 | 13.38 | 1.47 | 0.00 | 1.00 | 0.00 |
| 39.04 | 12.79 | 1.46 | 0.00 | 1.00 | 0.00 | 39.21 | 13.75 | 1.51 | 0.00 | 1.00 | 0.00 |
| 39.37 | 14.71 | 1.61 | 0.00 | 1.00 | 0.00 | 39.53 | 15.35 | 1.68 | 0.00 | 1.00 | 0.00 |
| 39.70 | 15.59 | 1.68 | 0.00 | 1.00 | 0.00 | 39.86 | 14.96 | 1.61 | 0.00 | 1.00 | 0.00 |
| 40.03 | 13.77 | 1.35 | 0.00 | 1.00 | 0.00 | 40.19 | 9.33 | 1.21 | 0.00 | 1.00 | 0.00 |
| 40.35 | 11.73 | 1.11 | 0.00 | 1.00 | 0.00 | 40.52 | 11.28 | 1.23 | 0.00 | 1.00 | 0.00 |
| 40.68 | 12.24 | 1.26 | 0.00 | 1.00 | 0.00 | 40.85 | 12.47 | 1.32 | 0.00 | 1.00 | 0.00 |
| 41.01 | 12.85 | 1.36 | 0.00 | 1.00 | 0.00 | 41.17 | 13.17 | 1.38 | 0.00 | 1.00 | 0.00 |
| 41.34 | 13.00 | 1.40 | 0.00 | 1.00 | 0.00 | 41.50 | 13.21 | 1.55 | 0.00 | 1.00 | 0.00 |
| 41.67 | 16.68 | 1.81 | 0.00 | 1.00 | 0.00 | 41.83 | 19.38 | 2.00 | 0.00 | 1.00 | 0.00 |
| 41.99 | 19.81 | 2.00 | 0.00 | 1.00 | 0.00 | 42.16 | 21.11 | 2.00 | 0.00 | 1.00 | 0.00 |
| 42.32 | 21.39 | 2.00 | 0.00 | 1.00 | 0.00 | 42.49 | 24.67 | 2.00 | 0.00 | 1.00 | 0.00 |
| 42.65 | 40.08 | 2.00 | 0.00 | 1.00 | 0.00 | 42.81 | 39.88 | 2.00 | 0.00 | 1.00 | 0.00 |
| 42.98 | 33.25 | 2.00 | 0.00 | 1.00 | 0.00 | 43.14 | 23.00 | 2.00 | 0.00 | 1.00 | 0.00 |
| 43.31 | 86.11 | 0.29 | 3.73 | 1.00 | 0.07 | 43.47 | 220.41 | 2.00 | 0.00 | 1.00 | 0.00 |
| 43.63 | 349.13 | 2.00 | 0.00 | 1.00 | 0.00 | 43.80 | 431.06 | 2.00 | 0.00 | 1.00 | 0.00 |

**Total estimated settlement: 0.07**

**Abbreviations**

| | |
|---|---|
| $Q_{tn,cs}$: | Equivalent clean sand normalized cone resistance |
| FS: | Factor of safety against liquefaction |
| $e_v$ (%): | Post-liquefaction volumentric strain |
| DF: | $e_v$ depth weighting factor |
| Settlement: | Calculated settlement |

**:: Strength loss calculation Idriss & Boulanger (2008) ::**

| Depth (ft) | $q_t$ (tsf) | $Q_{tn}$ | $K_c$ | $Q_{tn,cs}$ | $I_c$ | $S_{u(liq)}/\sigma'_v$ | $S_{u(peak)}/\sigma'_v$ |
|---|---|---|---|---|---|---|---|
| 0.16 | 8.08 | 12.97 | 6.00 | 77.77 | 2.81 | 0.08 | 0.62 |
| 0.33 | 6.37 | 10.20 | 6.05 | 61.73 | 2.82 | 0.07 | 0.62 |
| 0.49 | 4.58 | 7.32 | 4.54 | 33.22 | 2.68 | 0.07 | 0.62 |
| 0.66 | 4.49 | 7.17 | 3.88 | 27.82 | 2.61 | 0.07 | 0.62 |
| 0.82 | 4.41 | 7.02 | 4.00 | 28.08 | 2.63 | 0.07 | 0.62 |
| 0.98 | 4.18 | 6.65 | 4.21 | 28.01 | 2.65 | 0.07 | 0.62 |
| 1.15 | 3.80 | 6.02 | 4.81 | 28.97 | 2.71 | 0.07 | 0.62 |
| 1.31 | 3.37 | 5.32 | 5.20 | 27.65 | 2.75 | 0.07 | 0.62 |
| 1.48 | 3.14 | 4.93 | 5.58 | 27.53 | 2.78 | 0.07 | 0.62 |
| 1.64 | 2.91 | 4.56 | 6.02 | 27.46 | 2.81 | 0.07 | 0.62 |
| 1.80 | 2.81 | 4.38 | 6.24 | 27.36 | 2.83 | 0.07 | 0.62 |
| 1.97 | 2.74 | 4.26 | 6.38 | 27.18 | 2.84 | 0.07 | 0.62 |
| 2.13 | 2.68 | 4.15 | 6.96 | 28.87 | 2.88 | 0.07 | 0.62 |
| 2.30 | 2.69 | 4.16 | 7.34 | 30.52 | 2.91 | 0.07 | 0.62 |
| 2.46 | 2.66 | 4.10 | 8.30 | 34.04 | 2.97 | 0.07 | 0.62 |
| 2.63 | 2.69 | 4.14 | 9.07 | 37.51 | 3.02 | 0.07 | 1.58 |
| 2.79 | 2.70 | 4.14 | 9.66 | 39.94 | 3.05 | 0.07 | 1.48 |
| 2.95 | 2.82 | 4.32 | 9.49 | 40.97 | 3.04 | 0.07 | 1.47 |
| 3.12 | 3.02 | 4.63 | 8.37 | 38.79 | 2.98 | 0.07 | 0.62 |
| 3.28 | 3.03 | 4.64 | 8.00 | 37.11 | 2.95 | 0.07 | 0.62 |
| 3.44 | 2.93 | 4.47 | 7.67 | 34.27 | 2.93 | 0.07 | 0.62 |
| 3.61 | 2.70 | 4.08 | 8.06 | 32.94 | 2.96 | 0.07 | 0.62 |
| 3.77 | 2.52 | 3.77 | 8.59 | 32.42 | 2.99 | 0.07 | 0.62 |
| 3.94 | 2.31 | 3.43 | 9.56 | 32.77 | 3.04 | 0.07 | 0.88 |
| 4.10 | 2.22 | 3.28 | 10.72 | 35.20 | 3.11 | 0.07 | 0.81 |
| 4.26 | 2.30 | 3.39 | 10.98 | 37.22 | 3.12 | 0.07 | 0.80 |
| 4.43 | 2.49 | 3.69 | 11.17 | 41.26 | 3.13 | 0.07 | 0.84 |
| 4.59 | 2.70 | 4.02 | 12.59 | 50.62 | 3.19 | 0.07 | 0.89 |
| 4.76 | 2.92 | 4.35 | 14.69 | 63.93 | 3.28 | 0.07 | 0.96 |
| 4.92 | 3.58 | 5.40 | 15.07 | 81.40 | 3.30 | 0.07 | 1.17 |
| 5.08 | 4.69 | 7.18 | 12.89 | 92.48 | 3.21 | 0.07 | 1.53 |
| 5.25 | 6.71 | 10.41 | 8.86 | 92.14 | 3.00 | 0.08 | 2.18 |
| 5.41 | 7.79 | 12.13 | 7.23 | 87.64 | 2.90 | 0.08 | 0.62 |
| 5.58 | 8.08 | 12.58 | 6.46 | 81.24 | 2.85 | 0.08 | 0.62 |
| 5.74 | 7.20 | 11.15 | 7.57 | 84.39 | 2.92 | 0.08 | 0.62 |
| 5.91 | 6.38 | 9.82 | 8.68 | 85.28 | 2.99 | 0.08 | 0.62 |
| 6.07 | 6.21 | 9.53 | 9.43 | 89.92 | 3.04 | 0.08 | 1.85 |
| 6.23 | 6.25 | 9.58 | 9.80 | 93.86 | 3.06 | 0.08 | 1.84 |
| 6.40 | 6.51 | 9.99 | 9.90 | 98.84 | 3.06 | 0.08 | 1.89 |
| 6.56 | 6.05 | 9.23 | 11.10 | 102.46 | 3.12 | 0.08 | 1.72 |
| 6.73 | 5.39 | 8.16 | 12.76 | 104.09 | 3.20 | 0.08 | 1.50 |
| 6.89 | 4.86 | 7.29 | 14.19 | 103.48 | 3.26 | 0.07 | 1.32 |
| 7.05 | 4.76 | 7.12 | 14.43 | 102.79 | 3.27 | 0.07 | 1.27 |
| 7.22 | 5.03 | 7.54 | 13.53 | 102.09 | 3.23 | 0.07 | 1.33 |
| 7.38 | 5.63 | 8.49 | 12.15 | 103.09 | 3.17 | 0.08 | 1.47 |
| 7.55 | 6.36 | 9.66 | 10.81 | 104.37 | 3.11 | 0.08 | 1.65 |
| 7.71 | 7.17 | 10.94 | 9.88 | 108.06 | 3.06 | 0.08 | 1.85 |
| 7.87 | 7.82 | 11.97 | 9.49 | 113.58 | 3.04 | 0.08 | 1.99 |

Ignore CPT results in the upper 5 feet below the ground surface for CPT-1 because the CPT hole was cleared using a hand auger within this zone prior to advancing the CPT probe.

**:: Strength loss calculation (Idriss & Boulanger (2008) :: (continued)**

| Depth (ft) | $q_t$ (tsf) | $Q_{tn}$ | $K_c$ | $Q_{tn,cs}$ | $I_c$ | $S_{u(liq)}/\sigma'_v$ | $S_{u(peak)}/\sigma'_v$ |
|---|---|---|---|---|---|---|---|
| 8.04 | 8.68 | 13.34 | 9.12 | 121.61 | 3.02 | 0.08 | 2.19 |
| 8.20 | 9.80 | 15.11 | 8.48 | 128.15 | 2.98 | 0.08 | 0.62 |
| 8.37 | 10.95 | 16.95 | 7.82 | 132.58 | 2.94 | 0.09 | 0.62 |
| 8.53 | 11.64 | 18.04 | 7.35 | 132.54 | 2.91 | 0.09 | 0.62 |
| 8.69 | 11.78 | 18.25 | 7.18 | 130.94 | 2.90 | 0.09 | 0.62 |
| 8.86 | 11.74 | 18.18 | 7.11 | 129.38 | 2.89 | 0.09 | 0.62 |
| 9.02 | 11.81 | 18.27 | 7.05 | 128.85 | 2.89 | 0.09 | 0.62 |
| 9.19 | 11.88 | 18.38 | 7.00 | 128.60 | 2.89 | 0.09 | 0.62 |
| 9.35 | 11.74 | 18.13 | 7.01 | 127.08 | 2.89 | 0.09 | 0.62 |
| 9.51 | 11.57 | 17.85 | 6.46 | 115.34 | 2.85 | 0.09 | 0.62 |
| 9.68 | 11.53 | 17.77 | 6.45 | 114.62 | 2.85 | 0.09 | 0.62 |
| 9.84 | 11.72 | 18.05 | 6.32 | 114.17 | 2.84 | 0.09 | 0.62 |
| 10.01 | 10.03 | 15.33 | 8.43 | 129.28 | 2.98 | 0.09 | 0.62 |
| 10.17 | 9.82 | 14.97 | 8.53 | 127.80 | 2.99 | 0.08 | 0.62 |
| 10.34 | 9.37 | 14.24 | 8.81 | 125.48 | 3.00 | 0.09 | 1.94 |
| 10.50 | 10.34 | 15.78 | 7.35 | 116.00 | 2.91 | 0.09 | 0.62 |
| 10.66 | 9.32 | 14.13 | 7.97 | 112.63 | 2.95 | 0.08 | 0.62 |
| 10.83 | 8.75 | 13.20 | 8.31 | 109.69 | 2.97 | 0.08 | 0.62 |
| 10.99 | 9.45 | 14.31 | 7.81 | 111.78 | 2.94 | 0.08 | 0.62 |
| 11.15 | 10.96 | 16.72 | 6.93 | 115.89 | 2.88 | 0.09 | 0.62 |
| 11.32 | 12.53 | 19.23 | 6.36 | 122.32 | 2.84 | 0.09 | 0.62 |
| 11.48 | 13.37 | 20.56 | 6.11 | 125.55 | 2.82 | 0.09 | 0.62 |
| 11.65 | 13.83 | 21.28 | 5.90 | 125.59 | 2.80 | 0.09 | 0.62 |
| 11.81 | 13.94 | 21.45 | 5.68 | 121.85 | 2.79 | 0.09 | 0.62 |
| 11.97 | 13.97 | 21.48 | 5.43 | 116.69 | 2.77 | 0.09 | 0.62 |
| 12.14 | 13.96 | 21.45 | 5.21 | 111.79 | 2.75 | 0.09 | 0.62 |
| 12.30 | 13.97 | 21.46 | 5.17 | 110.89 | 2.74 | 0.09 | 0.62 |
| 12.47 | 14.05 | 21.57 | 5.22 | 112.69 | 2.75 | 0.09 | 0.62 |
| 12.63 | 14.20 | 21.79 | 5.32 | 115.91 | 2.76 | 0.09 | 0.62 |
| 12.79 | 14.06 | 21.55 | 5.50 | 118.50 | 2.77 | 0.09 | 0.62 |
| 12.96 | 13.59 | 20.79 | 5.91 | 122.77 | 2.80 | 0.09 | 0.62 |
| 13.12 | 12.94 | 19.72 | 6.38 | 125.81 | 2.84 | 0.09 | 0.62 |
| 13.29 | 12.47 | 18.95 | 6.66 | 126.18 | 2.86 | 0.09 | 0.62 |
| 13.45 | 11.92 | 18.05 | 6.83 | 123.22 | 2.87 | 0.09 | 0.62 |
| 13.62 | 11.30 | 17.05 | 6.93 | 118.23 | 2.88 | 0.09 | 0.62 |
| 13.78 | 10.62 | 15.95 | 7.08 | 112.89 | 2.89 | 0.08 | 0.62 |
| 13.94 | 10.60 | 15.90 | 6.74 | 107.08 | 2.87 | 0.08 | 0.62 |
| 14.11 | 10.30 | 15.40 | 6.75 | 104.05 | 2.87 | 0.09 | 0.62 |
| 14.27 | 9.90 | 14.74 | 6.87 | 101.23 | 2.88 | 0.08 | 0.62 |
| 14.44 | 9.17 | 13.55 | 7.47 | 101.21 | 2.92 | 0.08 | 0.62 |
| 14.60 | 8.75 | 12.86 | 7.95 | 102.28 | 2.95 | 0.08 | 0.62 |
| 14.76 | 8.53 | 12.50 | 8.54 | 106.78 | 2.99 | 0.08 | 0.62 |
| 14.93 | 8.22 | 11.99 | 9.23 | 110.68 | 3.03 | 0.08 | 1.23 |
| 15.09 | 8.06 | 11.72 | 9.48 | 111.07 | 3.04 | 0.08 | 1.19 |
| 15.26 | 7.88 | 11.41 | 9.63 | 109.88 | 3.05 | 0.08 | 1.15 |
| 15.42 | 7.79 | 11.25 | 9.62 | 108.23 | 3.05 | 0.08 | 1.12 |
| 15.58 | 7.67 | 11.05 | 9.92 | 109.63 | 3.06 | 0.08 | 1.10 |
| 15.75 | 7.72 | 11.11 | 9.88 | 109.81 | 3.06 | 0.08 | 1.09 |

**:: Strength loss calculation (Idriss & Boulanger (2008) :: (continued)**

| Depth (ft) | $q_t$ (tsf) | $Q_{tn}$ | $K_c$ | $Q_{tn,cs}$ | $I_c$ | $S_{u(liq)}/\sigma'_v$ | $S_{u(peak)}/\sigma'_v$ |
|---|---|---|---|---|---|---|---|
| 15.91 | 7.80 | 11.23 | 9.64 | 108.22 | 3.05 | 0.08 | 1.10 |
| 16.08 | 7.89 | 11.36 | 9.33 | 106.00 | 3.03 | 0.08 | 1.10 |
| 16.24 | 8.10 | 11.68 | 9.01 | 105.25 | 3.01 | 0.08 | 1.12 |
| 16.40 | 9.25 | 13.52 | 7.76 | 104.94 | 2.94 | 0.08 | 0.62 |
| 16.57 | 9.68 | 14.19 | 7.52 | 106.70 | 2.92 | 0.09 | 0.62 |
| 16.73 | 9.81 | 14.39 | 7.46 | 107.36 | 2.92 | 0.08 | 0.62 |
| 16.90 | 9.19 | 13.37 | 8.13 | 108.67 | 2.96 | 0.08 | 0.62 |
| 17.06 | 9.27 | 13.48 | 7.92 | 106.83 | 2.95 | 0.08 | 0.62 |
| 17.22 | 9.17 | 13.32 | 8.00 | 106.55 | 2.95 | 0.08 | 0.62 |
| 17.39 | 8.89 | 12.85 | 8.28 | 106.40 | 2.97 | 0.08 | 0.62 |
| 17.55 | 8.96 | 12.95 | 8.23 | 106.63 | 2.97 | 0.08 | 0.62 |
| 17.72 | 9.34 | 13.55 | 7.86 | 106.53 | 2.94 | 0.08 | 0.62 |
| 17.88 | 9.65 | 14.02 | 7.59 | 106.45 | 2.93 | 0.08 | 0.62 |
| 18.05 | 9.68 | 14.06 | 7.71 | 108.41 | 2.93 | 0.08 | 0.62 |
| 18.21 | 9.72 | 14.11 | 7.71 | 108.73 | 2.93 | 0.08 | 0.62 |
| 18.37 | 9.99 | 14.53 | 7.51 | 109.20 | 2.92 | 0.08 | 0.62 |
| 18.54 | 10.11 | 14.71 | 7.28 | 107.12 | 2.91 | 0.08 | 0.62 |
| 18.70 | 10.12 | 14.72 | 7.14 | 105.04 | 2.90 | 0.08 | 0.62 |
| 18.86 | 10.14 | 14.74 | 7.02 | 103.51 | 2.89 | 0.08 | 0.62 |
| 19.03 | 10.30 | 14.98 | 6.89 | 103.17 | 2.88 | 0.08 | 0.62 |
| 19.19 | 10.58 | 15.42 | 6.73 | 103.81 | 2.87 | 0.08 | 0.62 |
| 19.36 | 10.65 | 15.50 | 6.82 | 105.76 | 2.87 | 0.08 | 0.62 |
| 19.52 | 10.74 | 15.64 | 6.74 | 105.40 | 2.87 | 0.08 | 0.62 |
| 19.68 | 10.73 | 15.61 | 6.69 | 104.39 | 2.86 | 0.08 | 0.62 |
| 19.85 | 10.62 | 15.42 | 6.55 | 101.05 | 2.85 | 0.08 | 0.62 |
| 20.01 | 10.29 | 14.87 | 6.71 | 99.81 | 2.87 | 0.08 | 0.62 |
| 20.18 | 10.04 | 14.45 | 6.91 | 99.91 | 2.88 | 0.08 | 0.62 |
| 20.34 | 10.11 | 14.55 | 6.89 | 100.33 | 2.88 | 0.08 | 0.62 |
| 20.50 | 10.54 | 15.24 | 6.66 | 101.54 | 2.86 | 0.08 | 0.62 |
| 20.67 | 11.54 | 16.82 | 5.95 | 100.02 | 2.81 | 0.08 | 0.62 |
| 20.83 | 12.46 | 18.29 | 5.47 | 100.13 | 2.77 | 0.08 | 0.62 |
| 21.00 | 13.14 | 19.36 | 5.12 | 99.21 | 2.74 | 0.08 | 0.62 |
| 21.16 | 13.16 | 19.39 | 5.01 | 97.14 | 2.73 | 0.08 | 0.62 |
| 21.32 | 13.01 | 19.13 | 4.96 | 94.81 | 2.72 | 0.08 | 0.62 |
| 21.49 | 13.04 | 19.17 | 4.94 | 94.77 | 2.72 | 0.08 | 0.62 |
| 21.65 | 13.85 | 20.46 | 4.90 | 100.19 | 2.72 | 0.08 | 0.62 |
| 21.82 | 15.41 | 22.92 | 4.62 | 105.90 | 2.69 | 0.08 | 0.62 |
| 21.98 | 16.45 | 24.32 | 4.42 | 107.49 | 2.67 | 0.09 | 0.62 |
| 22.15 | 16.33 | 23.94 | 4.36 | 104.49 | 2.67 | 0.09 | 0.62 |
| 22.31 | 15.06 | 21.87 | 4.53 | 99.09 | 2.68 | 0.08 | 0.62 |
| 22.47 | 13.71 | 19.77 | 4.87 | 96.24 | 2.72 | 0.08 | 0.62 |
| 22.64 | 12.88 | 18.49 | 5.29 | 97.86 | 2.75 | 0.08 | 0.62 |
| 22.80 | 12.70 | 18.20 | 5.64 | 102.57 | 2.78 | 0.08 | 0.62 |
| 22.97 | 13.17 | 18.84 | 5.68 | 106.91 | 2.79 | 0.08 | 0.62 |
| 23.13 | 13.69 | 19.53 | 5.73 | 111.90 | 2.79 | 0.08 | 0.62 |
| 23.29 | 13.99 | 19.90 | 5.84 | 116.15 | 2.80 | 0.08 | 0.62 |
| 23.46 | 14.02 | 19.88 | 5.99 | 119.12 | 2.81 | 0.08 | 0.62 |
| 23.62 | 13.85 | 19.53 | 6.15 | 120.19 | 2.82 | 0.08 | 0.62 |

**:: Strength loss calculation (Idriss & Boulanger (2008) :: (continued)**

| Depth (ft) | $q_t$ (tsf) | $Q_{tn}$ | $K_c$ | $Q_{tn,cs}$ | $I_c$ | $S_{u(liq)}/\sigma'_v$ | $S_{u(peak)}/\sigma'_v$ |
|---|---|---|---|---|---|---|---|
| 23.79 | 13.76 | 19.27 | 6.19 | 119.24 | 2.83 | 0.08 | 0.62 |
| 23.95 | 13.65 | 18.99 | 6.27 | 119.00 | 2.83 | 0.08 | 0.62 |
| 24.11 | 13.80 | 19.08 | 6.23 | 118.83 | 2.83 | 0.08 | 0.62 |
| 24.28 | 14.03 | 19.30 | 6.18 | 119.21 | 2.83 | 0.08 | 0.62 |
| 24.44 | 14.44 | 19.74 | 6.02 | 118.88 | 2.81 | 0.08 | 0.62 |
| 24.61 | 14.87 | 20.23 | 5.92 | 119.73 | 2.81 | 0.08 | 0.62 |
| 24.77 | 15.34 | 20.78 | 5.89 | 122.40 | 2.80 | 0.09 | 0.62 |
| 24.93 | 15.71 | 21.20 | 5.92 | 125.42 | 2.81 | 0.09 | 0.62 |
| 25.10 | 16.30 | 21.90 | 5.81 | 127.33 | 2.80 | 0.09 | 0.62 |
| 25.26 | 17.18 | 22.94 | 5.54 | 127.14 | 2.77 | 0.09 | 0.62 |
| 25.43 | 18.38 | 24.41 | 5.22 | 127.31 | 2.75 | 0.09 | 0.62 |
| 25.59 | 19.29 | 25.43 | 4.92 | 125.11 | 2.72 | 0.09 | 0.62 |
| 25.75 | 19.33 | 25.34 | 4.92 | 124.73 | 2.72 | 0.09 | 0.62 |
| 25.92 | 19.08 | 24.87 | 5.03 | 125.14 | 2.73 | 0.09 | 0.62 |
| 26.08 | 18.57 | 24.14 | 5.42 | 130.84 | 2.76 | 0.09 | 0.62 |
| 26.25 | 18.75 | 24.29 | 5.60 | 135.95 | 2.78 | 0.09 | 0.62 |
| 26.41 | 18.94 | 24.45 | 5.73 | 140.09 | 2.79 | 0.09 | 0.62 |
| 26.57 | 19.48 | 25.01 | 5.65 | 141.33 | 2.78 | 0.09 | 0.62 |
| 26.74 | 20.13 | 25.68 | 5.44 | 139.68 | 2.77 | 0.09 | 0.62 |
| 26.90 | 20.52 | 26.01 | 5.29 | 137.68 | 2.75 | 0.09 | 0.62 |
| 27.07 | 20.42 | 25.71 | 5.27 | 135.42 | 2.75 | 0.09 | 0.62 |
| 27.23 | 20.14 | 25.22 | 5.39 | 135.85 | 2.76 | 0.09 | 0.62 |
| 27.39 | 20.45 | 25.45 | 5.33 | 135.55 | 2.76 | 0.09 | 0.62 |
| 27.56 | 21.24 | 26.29 | 5.14 | 135.09 | 2.74 | 0.09 | 0.62 |
| 27.72 | 21.71 | 26.74 | 5.08 | 135.74 | 2.73 | 0.09 | 0.62 |
| 27.89 | 21.70 | 26.60 | 5.17 | 137.51 | 2.74 | 0.09 | 0.62 |
| 28.05 | 21.63 | 26.37 | 5.24 | 138.18 | 2.75 | 0.09 | 0.62 |
| 28.21 | 21.58 | 26.13 | 5.16 | 134.94 | 2.74 | 0.09 | 0.62 |
| 28.38 | 20.90 | 25.09 | 5.15 | 129.27 | 2.74 | 0.09 | 0.62 |
| 28.54 | 19.27 | 22.88 | 5.25 | 120.16 | 2.75 | 0.09 | 0.62 |
| 28.71 | 16.93 | 19.80 | 5.44 | 107.69 | 2.77 | 0.08 | 0.62 |
| 28.87 | 14.66 | 16.82 | 5.61 | 94.35 | 2.78 | 0.08 | 0.62 |
| 29.04 | 13.31 | 15.03 | 5.66 | 85.09 | 2.78 | 0.08 | 0.62 |
| 29.20 | 12.95 | 14.54 | 6.01 | 87.34 | 2.81 | 0.08 | 0.62 |
| 29.36 | 14.12 | 15.93 | 5.94 | 94.66 | 2.81 | 0.08 | 0.62 |
| 29.53 | 15.38 | 17.45 | 6.03 | 105.19 | 2.81 | 0.08 | 0.62 |
| 29.69 | 16.23 | 18.43 | 6.12 | 112.83 | 2.82 | 0.09 | 0.62 |
| 29.86 | 16.38 | 18.57 | 6.42 | 119.20 | 2.84 | 0.08 | 0.62 |
| 30.02 | 16.79 | 18.96 | 6.41 | 121.49 | 2.84 | 0.09 | 0.62 |
| 30.18 | 17.14 | 19.28 | 6.33 | 122.10 | 2.84 | 0.09 | 0.62 |
| 30.35 | 17.01 | 19.02 | 6.38 | 121.37 | 2.84 | 0.09 | 0.62 |
| 30.51 | 16.12 | 17.87 | 6.72 | 120.14 | 2.87 | 0.08 | 0.62 |
| 30.68 | 14.87 | 16.30 | 7.28 | 118.61 | 2.90 | 0.08 | 0.62 |
| 30.84 | 13.91 | 15.05 | 7.62 | 114.72 | 2.93 | 0.08 | 0.62 |
| 31.00 | 13.14 | 14.03 | 7.91 | 111.05 | 2.95 | 0.08 | 0.62 |
| 31.17 | 12.82 | 13.56 | 7.97 | 108.12 | 2.95 | 0.08 | 0.62 |
| 31.33 | 13.21 | 13.96 | 7.92 | 110.55 | 2.95 | 0.08 | 0.62 |
| 31.50 | 14.51 | 15.42 | 7.13 | 109.98 | 2.90 | 0.08 | 0.62 |

**:: Strength loss calculation (Idriss & Boulanger (2008) :: (continued)**

| Depth (ft) | $q_t$ (tsf) | $Q_{tn}$ | $K_c$ | $Q_{tn,cs}$ | $I_c$ | $S_{u(liq)}/\sigma'_v$ | $S_{u(peak)}/\sigma'_v$ |
|---|---|---|---|---|---|---|---|
| 31.66 | 16.12 | 17.15 | 6.22 | 106.62 | 2.83 | 0.08 | 0.62 |
| 31.82 | 16.65 | 17.63 | 5.75 | 101.39 | 2.79 | 0.08 | 0.62 |
| 31.99 | 16.07 | 16.91 | 6.10 | 103.11 | 2.82 | 0.08 | 0.62 |
| 32.15 | 15.09 | 15.75 | 6.94 | 109.23 | 2.88 | 0.08 | 0.62 |
| 32.32 | 14.69 | 15.23 | 7.53 | 114.64 | 2.92 | 0.08 | 0.62 |
| 32.48 | 14.61 | 15.06 | 7.76 | 116.89 | 2.94 | 0.08 | 0.62 |
| 32.64 | 14.52 | 14.87 | 7.68 | 114.16 | 2.93 | 0.08 | 0.62 |
| 32.81 | 14.29 | 14.53 | 7.39 | 107.43 | 2.91 | 0.08 | 0.62 |
| 32.97 | 14.28 | 14.40 | 6.82 | 98.29 | 2.87 | 0.08 | 0.62 |
| 33.14 | 14.77 | 14.83 | 6.16 | 91.36 | 2.82 | 0.08 | 0.62 |
| 33.30 | 15.05 | 15.06 | 5.96 | 89.74 | 2.81 | 0.08 | 0.62 |
| 33.47 | 14.98 | 14.93 | 6.17 | 92.04 | 2.82 | 0.08 | 0.62 |
| 33.63 | 14.88 | 14.78 | 6.64 | 98.07 | 2.86 | 0.08 | 0.62 |
| 33.79 | 15.11 | 14.99 | 6.98 | 104.65 | 2.88 | 0.08 | 0.62 |
| 33.96 | 15.16 | 14.99 | 7.36 | 110.32 | 2.91 | 0.08 | 0.62 |
| 34.12 | 15.23 | 14.99 | 7.55 | 113.23 | 2.92 | 0.08 | 0.62 |
| 34.28 | 16.10 | 15.87 | 7.38 | 117.12 | 2.91 | 0.08 | 0.62 |
| 34.45 | 17.38 | 17.20 | 7.11 | 122.23 | 2.89 | 0.09 | 0.62 |
| 34.61 | 18.70 | 18.54 | 6.79 | 125.83 | 2.87 | 0.09 | 0.62 |
| 34.78 | 19.10 | 18.87 | 6.68 | 126.08 | 2.86 | 0.09 | 0.62 |
| 34.94 | 19.21 | 18.89 | 6.70 | 126.47 | 2.86 | 0.09 | 0.62 |
| 35.10 | 18.81 | 18.38 | 6.91 | 126.99 | 2.88 | 0.09 | 0.62 |
| 35.27 | 17.84 | 17.25 | 7.38 | 127.40 | 2.91 | 0.09 | 0.62 |
| 35.43 | 16.49 | 15.71 | 7.81 | 122.73 | 2.94 | 0.08 | 0.62 |
| 35.60 | 15.48 | 14.56 | 7.98 | 116.19 | 2.95 | 0.08 | 0.62 |
| 35.76 | 14.92 | 13.88 | 8.05 | 111.71 | 2.96 | 0.08 | 0.62 |
| 35.92 | 14.90 | 13.79 | 8.02 | 110.59 | 2.95 | 0.08 | 0.62 |
| 36.09 | 14.76 | 13.58 | 8.19 | 111.24 | 2.96 | 0.08 | 0.62 |
| 36.25 | 14.89 | 13.64 | 7.87 | 107.28 | 2.94 | 0.08 | 0.62 |
| 36.42 | 15.48 | 14.19 | 7.02 | 99.59 | 2.89 | 0.08 | 0.62 |
| 36.58 | 16.05 | 14.69 | 6.31 | 92.73 | 2.84 | 0.08 | 0.62 |
| 36.74 | 16.16 | 14.74 | 6.24 | 91.94 | 2.83 | 0.08 | 0.62 |
| 36.91 | 15.90 | 14.41 | 6.75 | 97.30 | 2.87 | 0.08 | 0.62 |
| 37.07 | 16.03 | 14.49 | 7.03 | 101.92 | 2.89 | 0.08 | 0.62 |
| 37.24 | 16.45 | 14.85 | 6.89 | 102.35 | 2.88 | 0.08 | 0.62 |
| 37.40 | 16.16 | 14.47 | 6.64 | 96.12 | 2.86 | 0.08 | 0.62 |
| 37.57 | 15.11 | 13.34 | 6.55 | 87.30 | 2.85 | 0.08 | 0.62 |
| 37.73 | 13.82 | 11.98 | 6.90 | 82.67 | 2.88 | 0.08 | 0.62 |
| 37.89 | 13.35 | 11.46 | 7.49 | 85.82 | 2.92 | 0.08 | 0.62 |
| 38.06 | 14.59 | 12.65 | 7.08 | 89.54 | 2.89 | 0.08 | 0.62 |
| 38.22 | 16.04 | 14.03 | 6.42 | 90.14 | 2.84 | 0.08 | 0.62 |
| 38.39 | 16.91 | 14.83 | 5.90 | 87.44 | 2.80 | 0.08 | 0.62 |
| 38.55 | 16.10 | 13.97 | 6.17 | 86.13 | 2.82 | 0.08 | 0.62 |
| 38.71 | 15.14 | 12.96 | 6.66 | 86.33 | 2.86 | 0.08 | 0.62 |
| 38.88 | 14.36 | 12.14 | 7.48 | 90.86 | 2.92 | 0.08 | 0.62 |
| 39.04 | 14.34 | 12.07 | 8.21 | 99.08 | 2.97 | 0.08 | 0.62 |
| 39.21 | 14.82 | 12.47 | 8.75 | 109.19 | 3.00 | 0.08 | 0.62 |
| 39.37 | 15.71 | 13.28 | 8.77 | 116.47 | 3.00 | 0.08 | 0.62 |

**:: Strength loss calculation (Idriss & Boulanger (2008) :: (continued)**

| Depth (ft) | $q_t$ (tsf) | $Q_{tn}$ | $K_c$ | $Q_{tn,cs}$ | $I_c$ | $S_{u(liq)}/\sigma'_v$ | $S_{u(peak)}/\sigma'_v$ |
|---|---|---|---|---|---|---|---|
| 39.53 | 16.33 | 13.82 | 8.43 | 116.49 | 2.98 | 0.08 | 0.62 |
| 39.70 | 16.42 | 13.85 | 8.29 | 114.77 | 2.97 | 0.08 | 0.62 |
| 39.86 | 15.91 | 13.30 | 8.33 | 110.72 | 2.97 | 0.08 | 0.62 |
| 40.03 | 13.73 | 11.13 | 10.03 | 111.64 | 3.07 | 0.08 | 0.80 |
| 40.19 | 12.61 | 10.01 | 10.62 | 106.36 | 3.10 | 0.08 | 0.72 |
| 40.35 | 11.75 | 9.15 | 10.92 | 99.86 | 3.12 | 0.08 | 0.65 |
| 40.52 | 12.84 | 10.14 | 9.07 | 91.95 | 3.02 | 0.08 | 0.72 |
| 40.68 | 13.17 | 10.40 | 8.44 | 87.76 | 2.98 | 0.08 | 0.62 |
| 40.85 | 13.76 | 10.92 | 7.99 | 87.20 | 2.95 | 0.08 | 0.62 |
| 41.01 | 14.13 | 11.22 | 7.88 | 88.41 | 2.94 | 0.08 | 0.62 |
| 41.17 | 14.36 | 11.38 | 8.06 | 91.70 | 2.96 | 0.08 | 0.62 |
| 41.34 | 14.55 | 11.52 | 8.39 | 96.58 | 2.98 | 0.08 | 0.62 |
| 41.50 | 15.92 | 12.74 | 7.72 | 98.34 | 2.93 | 0.08 | 0.62 |
| 41.67 | 18.28 | 14.87 | 6.69 | 99.44 | 2.86 | 0.08 | 0.62 |
| 41.83 | 20.75 | 17.09 | 5.70 | 97.46 | 2.79 | 0.09 | 0.62 |
| 41.99 | 22.37 | 18.52 | 5.57 | 103.16 | 2.78 | 0.09 | 0.62 |
| 42.16 | 23.19 | 19.18 | 6.11 | 117.15 | 2.82 | 0.09 | 0.62 |
| 42.32 | 25.03 | 20.76 | 6.71 | 139.30 | 2.87 | 0.09 | 0.62 |
| 42.49 | 31.91 | 26.95 | 5.54 | 149.43 | 2.77 | 0.09 | 0.62 |
| 42.65 | 38.41 | 32.76 | 4.58 | 150.18 | 2.69 | 0.11 | 0.62 |
| 42.81 | 41.27 | 35.24 | 4.00 | 141.02 | 2.63 | 0.11 | 0.62 |
| 42.98 | 35.06 | 29.43 | 5.17 | 152.06 | 2.74 | 0.10 | 0.62 |
| 43.14 | 39.99 | 33.74 | 4.68 | 157.82 | 2.70 | 0.09 | 0.62 |
| 43.31 | 107.27 | 95.20 | 1.29 | 123.12 | 1.98 | 0.08 | 0.72 |
| 43.47 | 224.17 | 203.80 | 1.00 | 203.80 | 1.37 | 0.93 | 0.91 |
| 43.63 | 359.69 | 315.47 | 54.25 | 17114.21 | 4.06 | 1.00 | 22.53 |
| 43.80 | 435.26 | 381.50 | 54.25 | 20695.84 | 4.06 | 1.04 | 27.25 |

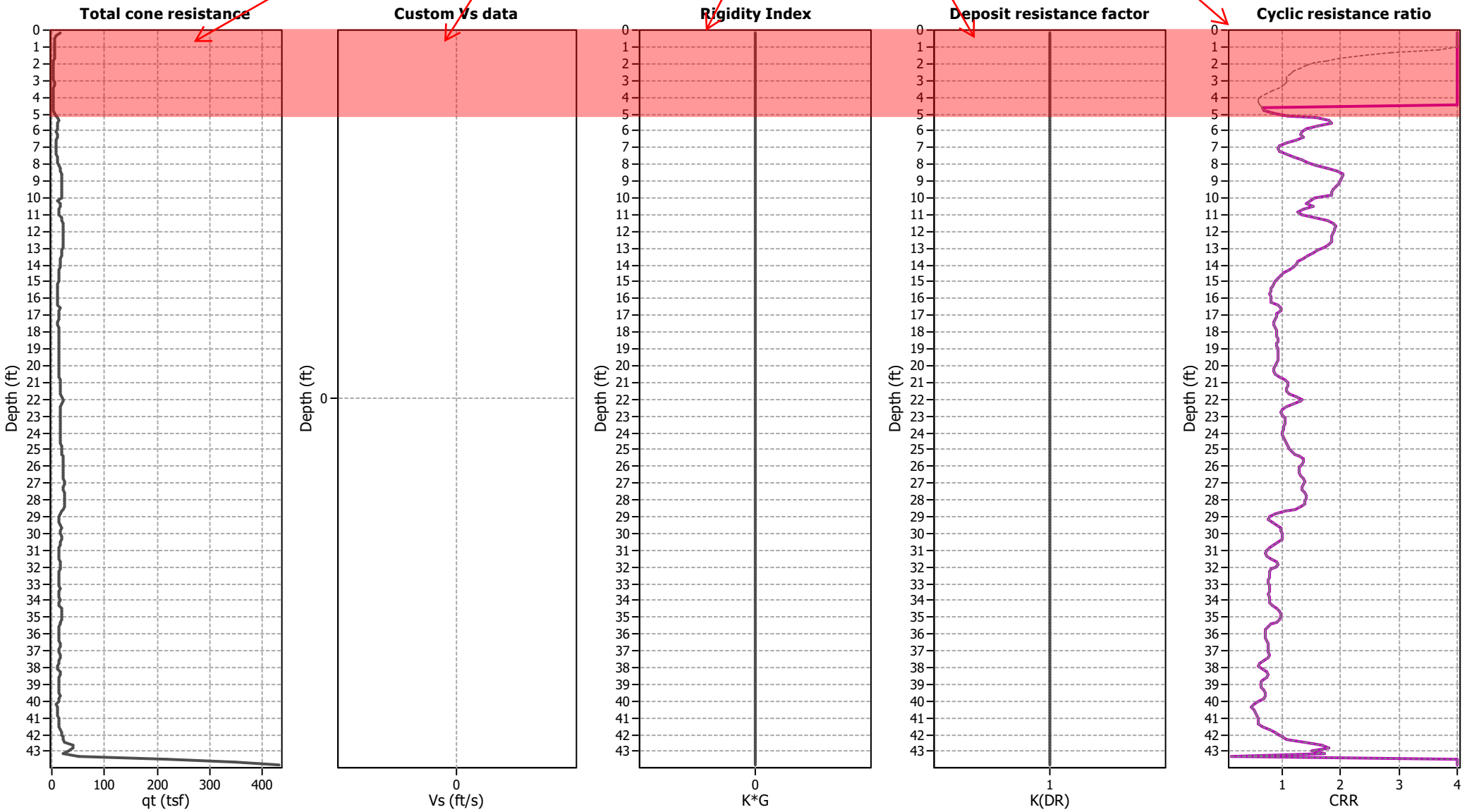
**Abbreviations**

$q_t$: Total cone resistance
$K_c$: Cone resistance correction factor due to fines
$Q_{tn,cs}$: Adjusted and corrected cone resistance due to fines
$I_c$: Soil behavior type index
$S_{u(liq)}/\sigma'_v$: Calculated liquefied undrained strength ratio
$S_{u(peak)}/\sigma'_v$: Calculated peak undrained strength ratio

Ignore CPT results in the upper 5 feet below the ground surface for CPT-1 because the CPT hole was cleared using a hand auger within this zone prior to advancing the CPT probe.



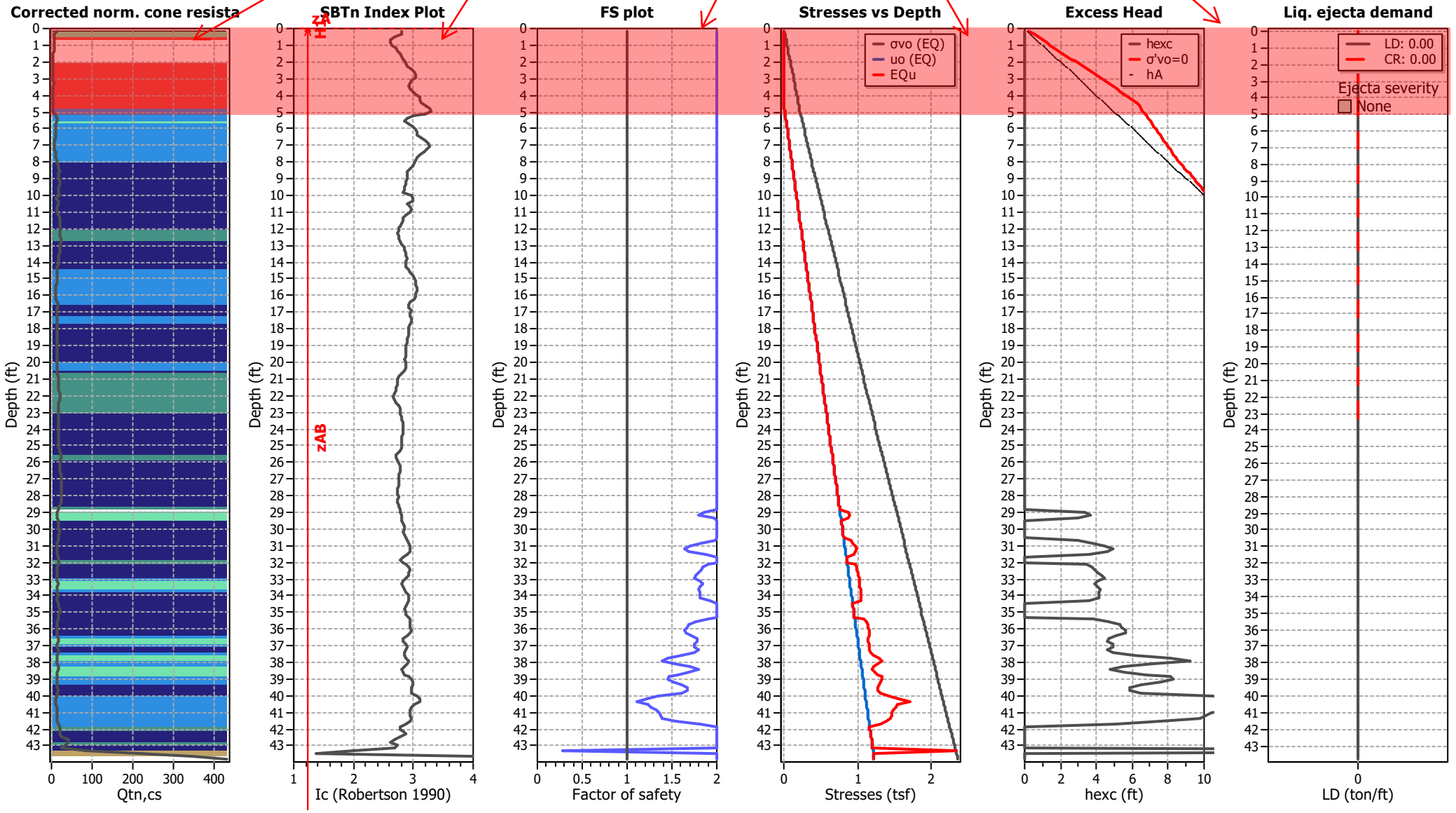
## Aging Calculation Estimation



Ignore CPT results in the upper 5 feet below the ground surface for CPT-1 because the CPT hole was cleared using a hand auger within this zone prior to advancing the CPT probe.



## Ejecta Severity Estimation



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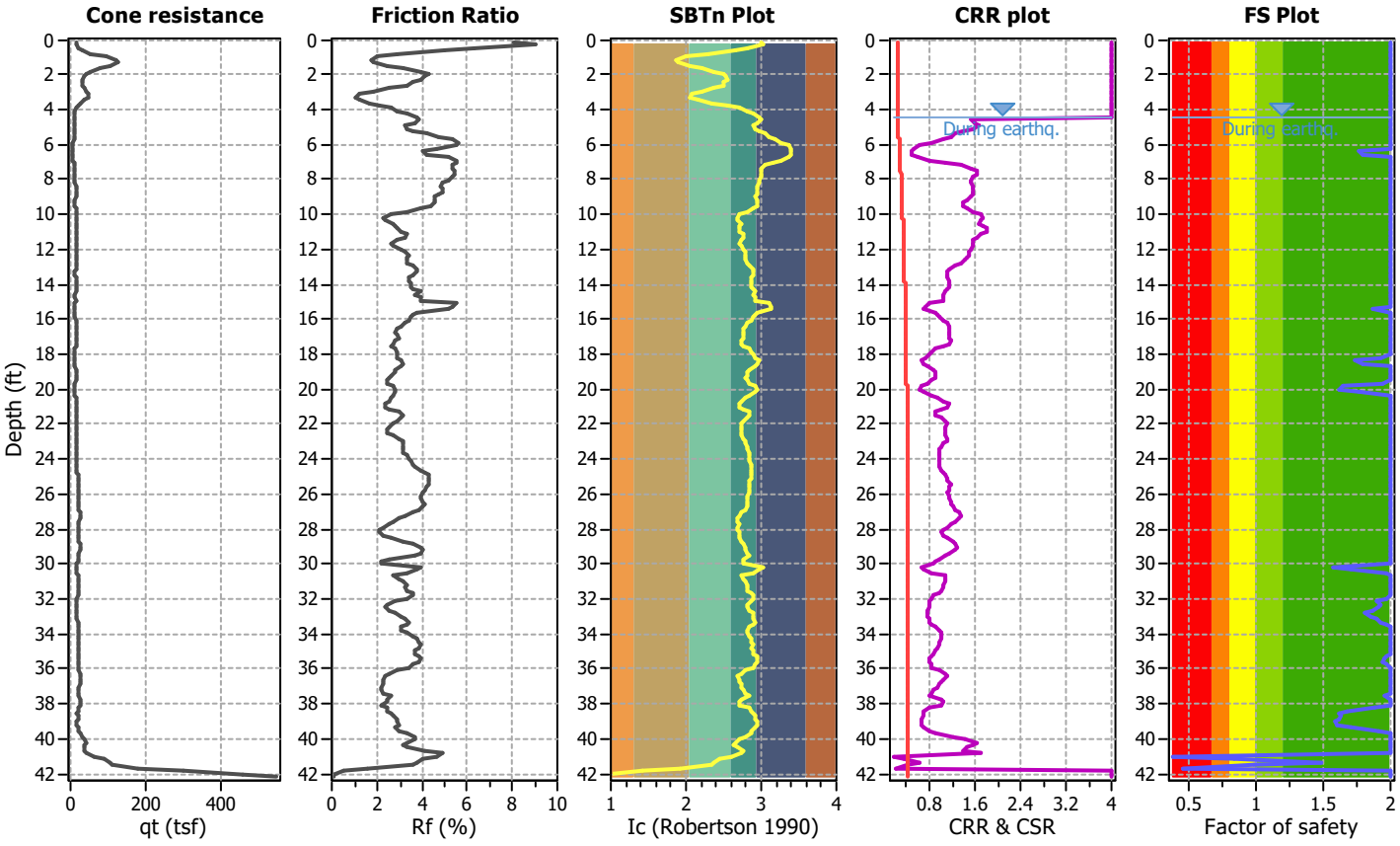
# LIQUEFACTION ANALYSIS REPORT

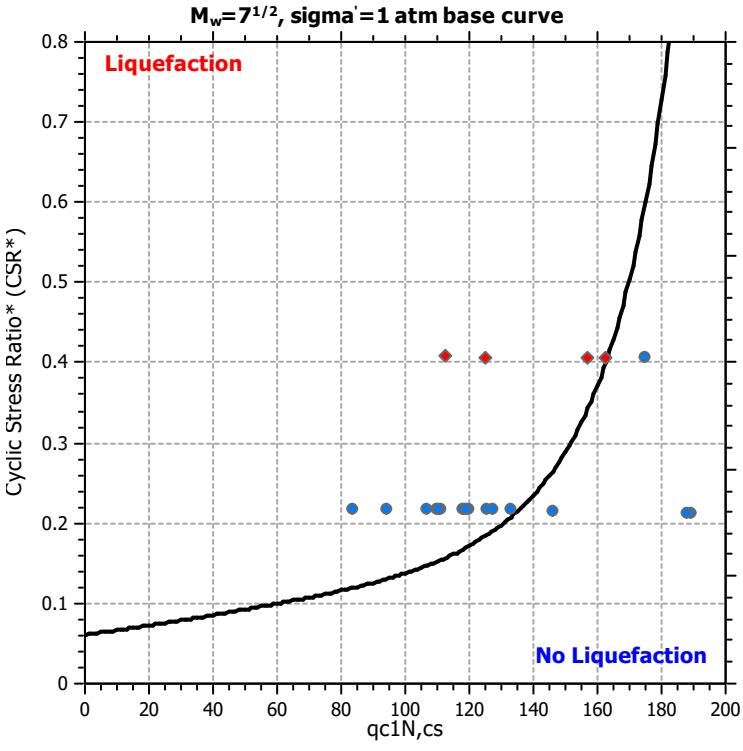
**Project title : Tri-Valley** **Location :**

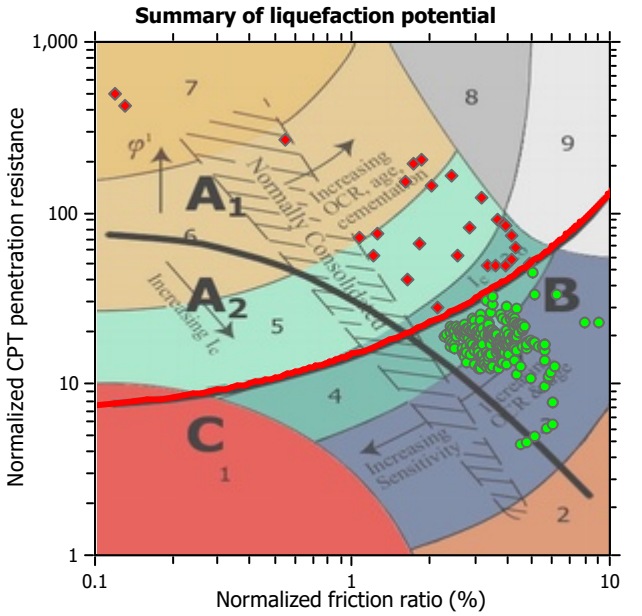
**CPT file : CPT 2**

**Input parameters and analysis data**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | G.W.T. (in-situ): | 4.50 ft | Use fill: | No | Clay like behavior applied: | Sand & Clay |
| Fines correction method: | B&I (2014) | G.W.T. (earthq.): | 4.50 ft | Fill height: | N/A | Limit depth applied: | No |
| Points to test: | Based on Ic value | Average results interval: | 3 | Fill weight: | N/A | Limit depth: | N/A |
| Earthquake magnitude $M_w$: | 7.43 | Ic cut-off value: | 2.60 | Trans. detect. applied: | No | MSF method: | Method based |
| Peak ground acceleration: | 0.37 | Unit weight calculation: | Based on SBT | $K_\sigma$ applied: | Yes | | |

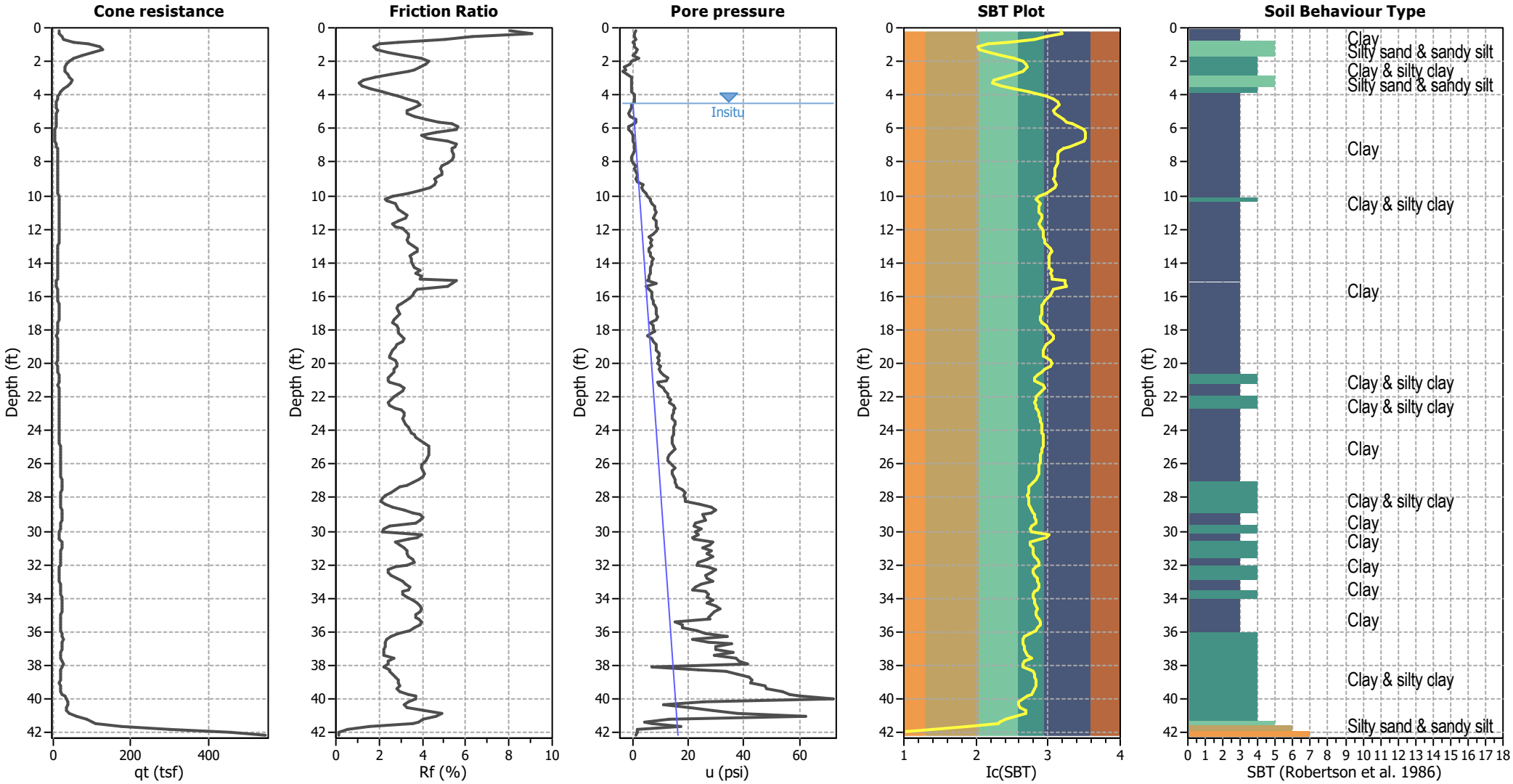



Zone $A_1$: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone $A_2$: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

# CPT basic interpretation plots



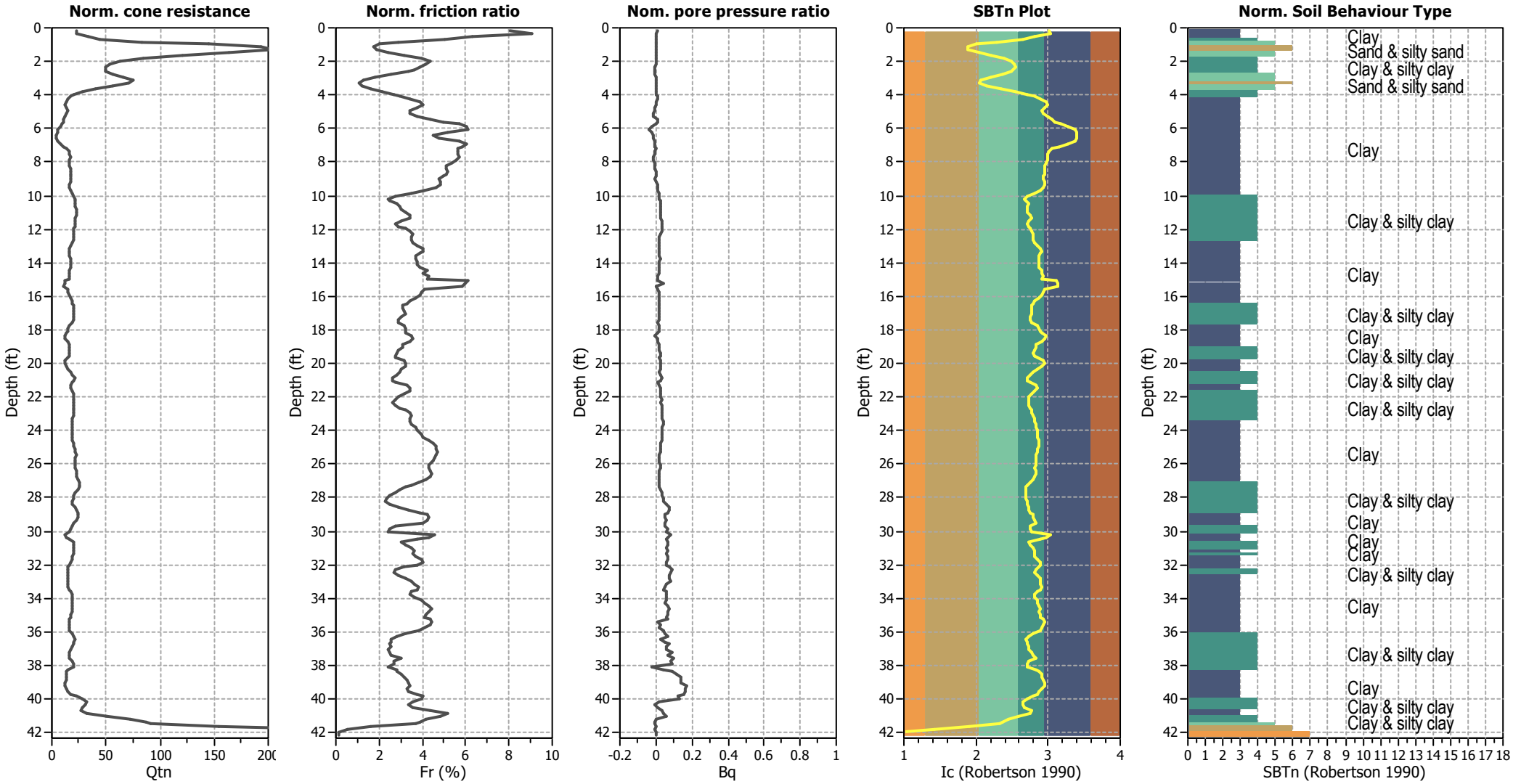

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.50 ft | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 7.43 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration: | 0.37 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 4.50 ft | Fill height: | N/A | Limit depth: | N/A |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

## CPT basic interpretation plots (normalized)



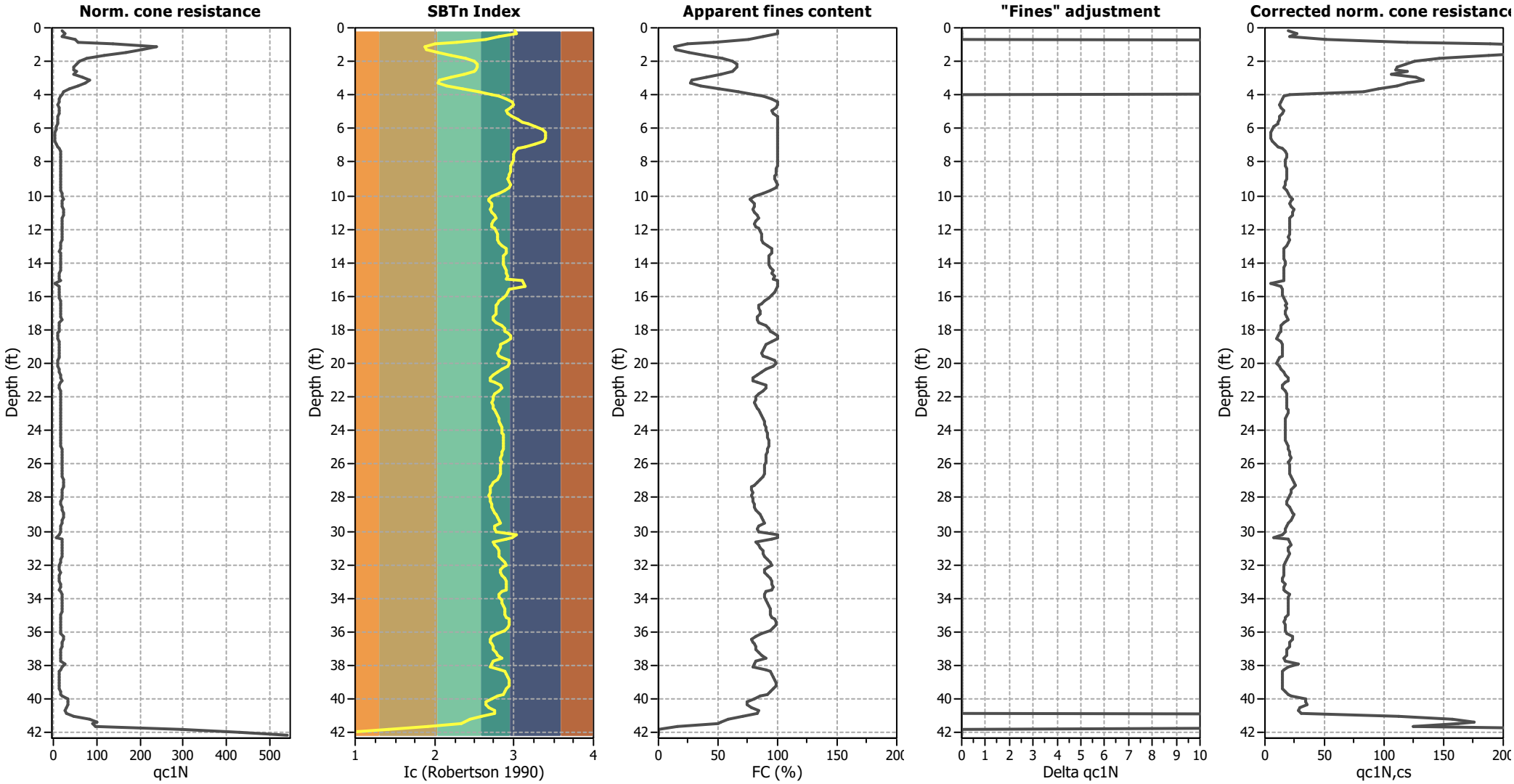

### Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.50 ft | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 7.43 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration: | 0.37 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 4.50 ft | Fill height: | N/A | Limit depth: | N/A |

**SBTn legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

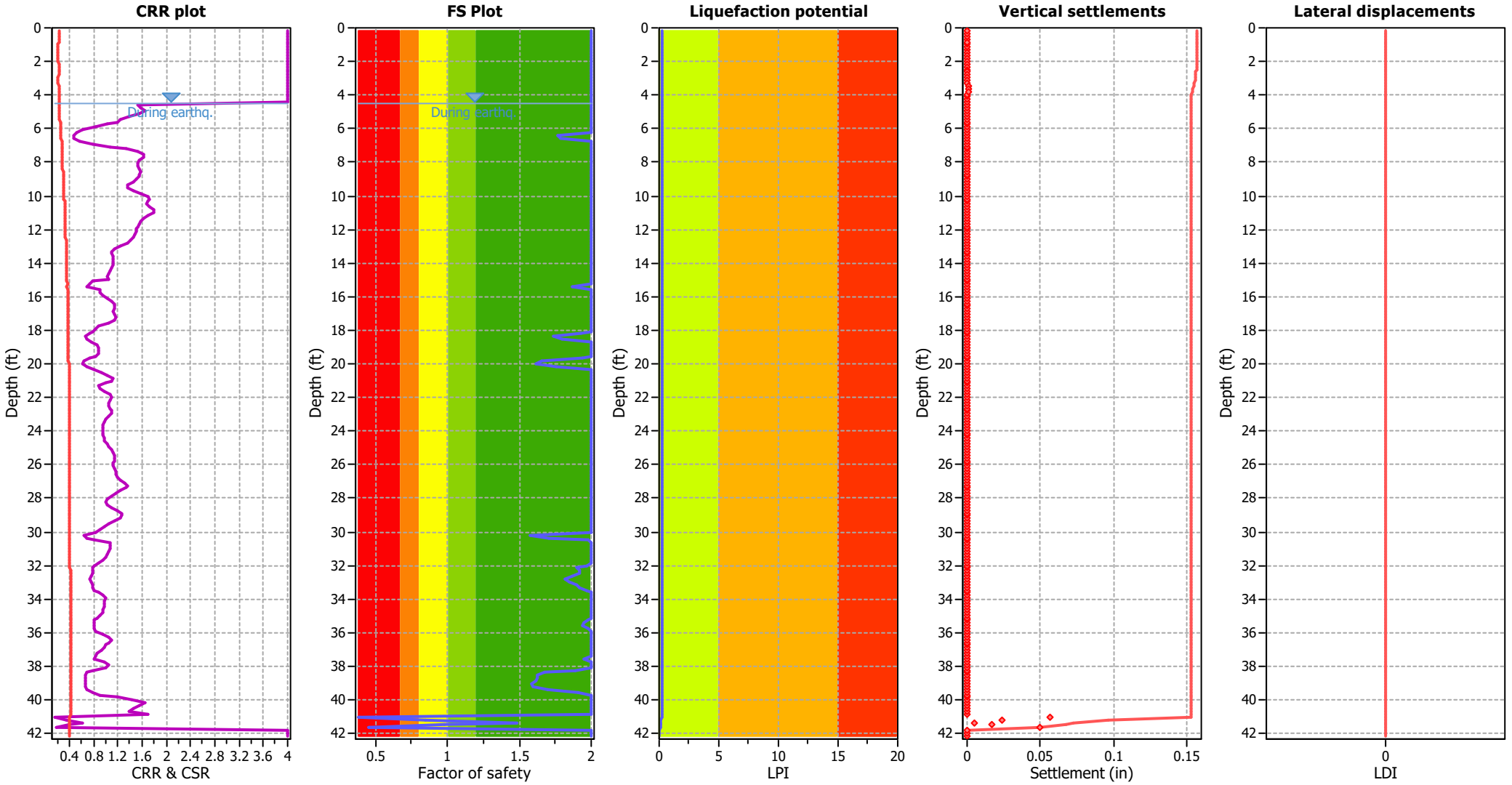
# Liquefaction analysis overall plots (intermediate results)




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.50 ft | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 7.43 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration: | 0.37 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 4.50 ft | Fill height: | N/A | Limit depth: | N/A |

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.50 ft | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 7.43 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration: | 0.37 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 4.50 ft | Fill height: | N/A | Limit depth: | N/A |

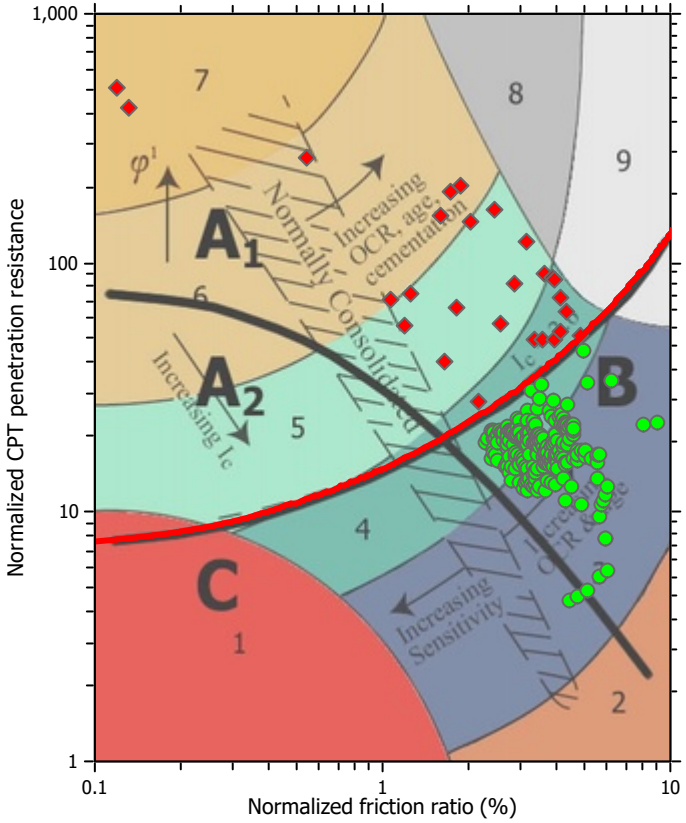
**F.S. color scheme**

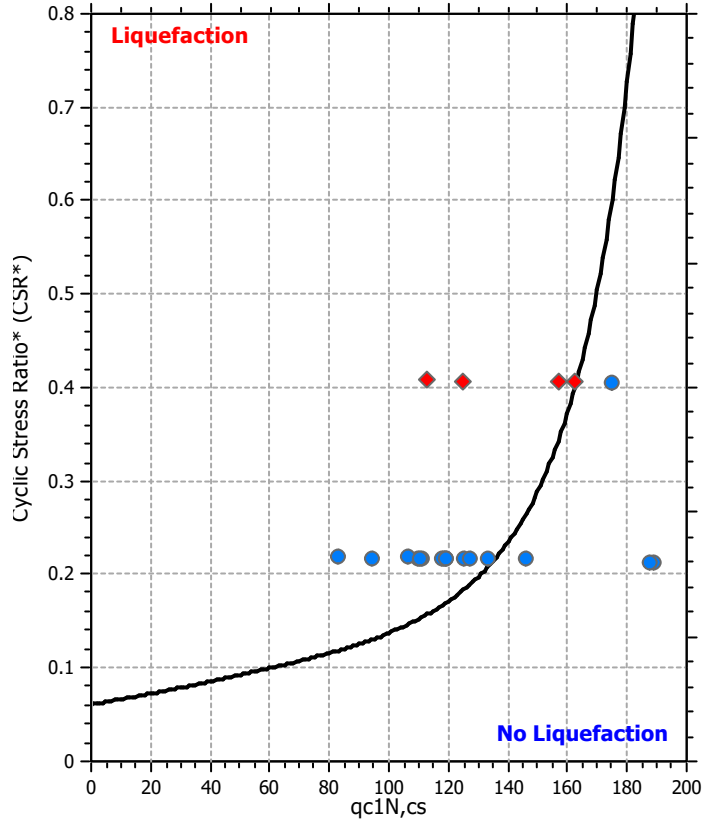
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

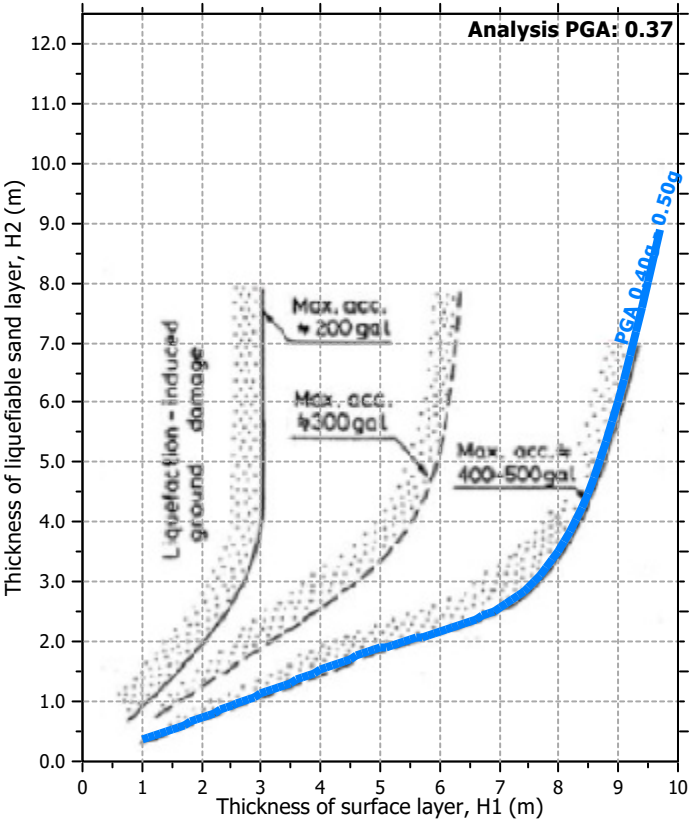
**LPI color scheme**

- Very high risk
- High risk
- Low risk

# Liquefaction analysis summary plots



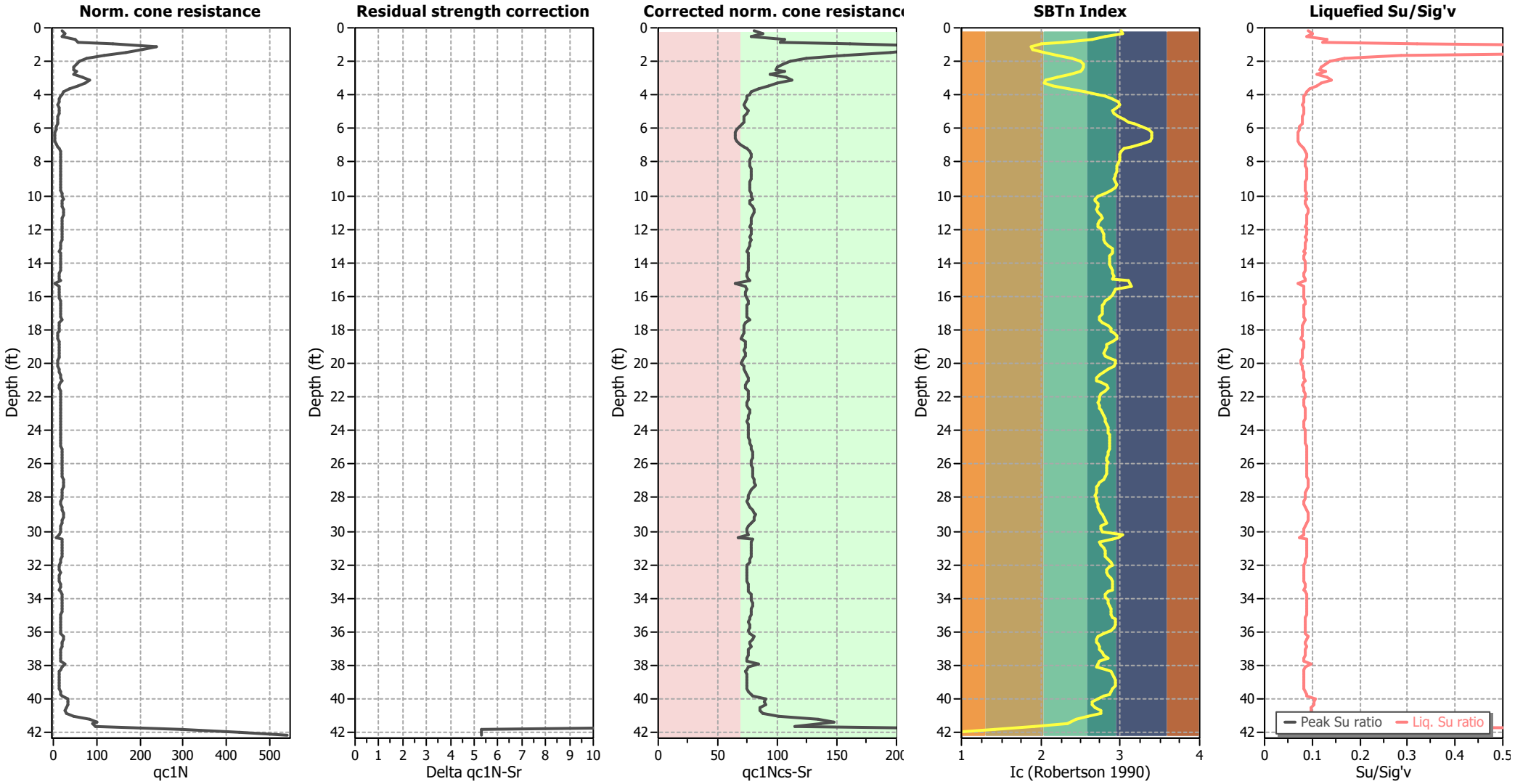




**Input parameters and analysis data**

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.50 ft | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 7.43 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration: | 0.37 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 4.50 ft | Fill height: | N/A | Limit depth: | N/A |

# Check for strength loss plots (Idriss & Boulanger (2008))




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.50 ft | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 7.43 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration: | 0.37 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 4.50 ft | Fill height: | N/A | Limit depth: | N/A |

**:: Field input data ::**

| Point ID | Depth (ft) | $q_c$ (tsf) | $f_s$ (tsf) | u (tsf) | Fines content (%) | Unit weight (pcf) |
|---|---|---|---|---|---|---|
| 1 | 0.16 | 12.38 | 0.94 | 1.29 | 58.75 | 117.56 |
| 2 | 0.33 | 16.97 | 1.50 | 0.57 | 60.99 | 118.51 |
| 3 | 0.49 | 12.86 | 1.39 | 0.78 | 46.40 | 119.58 |
| 4 | 0.66 | 32.13 | 1.01 | 1.16 | 37.96 | 120.65 |
| 5 | 0.82 | 36.92 | 1.71 | 0.42 | 22.00 | 122.77 |
| 6 | 0.98 | 85.74 | 1.73 | 0.87 | 13.22 | 125.70 |
| 7 | 1.15 | 149.11 | 2.07 | 0.69 | 9.83 | 127.33 |
| 8 | 1.31 | 127.23 | 2.45 | 1.81 | 10.11 | 128.38 |
| 9 | 1.48 | 104.87 | 2.57 | 1.49 | 14.06 | 128.20 |
| 10 | 1.64 | 73.42 | 2.43 | 0.37 | 19.25 | 127.16 |
| 11 | 1.80 | 48.44 | 2.13 | 2.19 | 25.66 | 125.34 |
| 12 | 1.97 | 37.11 | 1.70 | -0.19 | 30.53 | 123.17 |
| 13 | 2.13 | 33.12 | 1.30 | -0.97 | 32.27 | 121.20 |
| 14 | 2.30 | 29.73 | 1.15 | -2.90 | 32.53 | 119.96 |
| 15 | 2.46 | 29.35 | 1.15 | -2.54 | 31.23 | 119.47 |
| 16 | 2.63 | 34.22 | 1.06 | -3.40 | 30.29 | 118.91 |
| 17 | 2.79 | 29.38 | 0.90 | -1.78 | 25.12 | 118.27 |
| 18 | 2.95 | 42.82 | 0.76 | -0.33 | 19.48 | 117.19 |
| 19 | 3.12 | 51.84 | 0.57 | -0.41 | 14.85 | 115.69 |
| 20 | 3.28 | 45.93 | 0.42 | -0.19 | 14.13 | 114.09 |
| 21 | 3.44 | 36.14 | 0.44 | -0.14 | 17.53 | 112.63 |
| 22 | 3.61 | 23.70 | 0.40 | -0.18 | 24.51 | 111.64 |
| 23 | 3.77 | 16.09 | 0.39 | -0.17 | 33.13 | 110.03 |
| 24 | 3.94 | 12.73 | 0.33 | 0.58 | 41.20 | 108.67 |
| 25 | 4.10 | 10.22 | 0.31 | 0.94 | 46.49 | 107.52 |
| 26 | 4.26 | 9.29 | 0.30 | 0.92 | 51.69 | 107.16 |
| 27 | 4.43 | 8.54 | 0.32 | 0.59 | 56.30 | 107.09 |
| 28 | 4.59 | 7.47 | 0.33 | -0.19 | 57.68 | 107.00 |
| 29 | 4.76 | 8.49 | 0.29 | -0.24 | 55.46 | 107.03 |
| 30 | 4.92 | 9.81 | 0.31 | -0.90 | 52.37 | 106.80 |
| 31 | 5.08 | 8.99 | 0.29 | -1.26 | 53.51 | 106.45 |
| 32 | 5.25 | 7.38 | 0.26 | -0.88 | 57.42 | 106.05 |
| 33 | 5.41 | 7.24 | 0.30 | 1.09 | 62.30 | 106.35 |
| 34 | 5.58 | 7.07 | 0.35 | 1.51 | 65.67 | 106.96 |
| 35 | 5.74 | 6.64 | 0.35 | 0.92 | 71.51 | 106.70 |
| 36 | 5.91 | 4.92 | 0.30 | -1.08 | 78.31 | 105.20 |
| 37 | 6.07 | 3.89 | 0.21 | -1.14 | 86.86 | 102.55 |
| 38 | 6.23 | 3.11 | 0.14 | -0.24 | 88.88 | 99.60 |
| 39 | 6.40 | 3.11 | 0.11 | 0.12 | 89.25 | 97.69 |
| 40 | 6.56 | 3.03 | 0.12 | 0.30 | 89.30 | 98.44 |
| 41 | 6.73 | 3.42 | 0.18 | 0.49 | 87.09 | 101.59 |
| 42 | 6.89 | 4.94 | 0.29 | 0.84 | 78.21 | 105.21 |
| 43 | 7.05 | 7.21 | 0.40 | 0.56 | 68.81 | 108.14 |
| 44 | 7.22 | 9.05 | 0.48 | 0.94 | 62.41 | 110.18 |
| 45 | 7.38 | 10.31 | 0.55 | 0.83 | 59.06 | 111.53 |
| 46 | 7.55 | 11.16 | 0.61 | 0.08 | 57.79 | 112.24 |
| 47 | 7.71 | 11.09 | 0.61 | -0.36 | 57.63 | 112.36 |
| 48 | 7.87 | 10.66 | 0.57 | -0.53 | 57.75 | 112.01 |

**:: Field input data :: (continued)**

| Point ID | Depth (ft) | $q_c$ (tsf) | $f_s$ (tsf) | u (tsf) | Fines content (%) | Unit weight (pcf) |
|---|---|---|---|---|---|---|
| 49 | 8.04 | 10.50 | 0.54 | 0.43 | 57.35 | 111.61 |
| 50 | 8.20 | 10.67 | 0.52 | 1.09 | 56.01 | 111.46 |
| 51 | 8.37 | 11.31 | 0.53 | 0.78 | 55.30 | 111.63 |
| 52 | 8.53 | 11.28 | 0.56 | 1.37 | 55.13 | 111.89 |
| 53 | 8.69 | 11.28 | 0.57 | 1.57 | 54.95 | 111.90 |
| 54 | 8.86 | 11.47 | 0.53 | 1.77 | 54.20 | 111.75 |
| 55 | 9.02 | 11.58 | 0.53 | 1.11 | 53.87 | 111.39 |
| 56 | 9.19 | 10.89 | 0.50 | 1.67 | 54.77 | 111.11 |
| 57 | 9.35 | 10.33 | 0.49 | 3.66 | 55.63 | 110.66 |
| 58 | 9.51 | 10.24 | 0.45 | 3.48 | 54.68 | 110.48 |
| 59 | 9.68 | 11.21 | 0.46 | 4.06 | 51.26 | 110.29 |
| 60 | 9.84 | 12.45 | 0.42 | 4.79 | 46.85 | 109.94 |
| 61 | 10.01 | 13.17 | 0.36 | 5.28 | 41.35 | 108.93 |
| 62 | 10.17 | 14.43 | 0.27 | 6.30 | 39.25 | 108.27 |
| 63 | 10.34 | 13.36 | 0.33 | 6.67 | 39.67 | 108.37 |
| 64 | 10.50 | 12.90 | 0.37 | 7.24 | 41.78 | 109.35 |
| 65 | 10.66 | 14.20 | 0.41 | 7.89 | 41.47 | 110.05 |
| 66 | 10.83 | 15.16 | 0.42 | 8.26 | 40.77 | 110.68 |
| 67 | 10.99 | 15.10 | 0.46 | 8.71 | 41.59 | 111.24 |
| 68 | 11.15 | 14.55 | 0.51 | 8.27 | 43.48 | 111.35 |
| 69 | 11.32 | 13.37 | 0.46 | 7.70 | 44.07 | 110.85 |
| 70 | 11.48 | 13.42 | 0.38 | 8.61 | 42.60 | 109.76 |
| 71 | 11.65 | 13.76 | 0.33 | 8.55 | 41.44 | 109.21 |
| 72 | 11.81 | 13.44 | 0.38 | 8.71 | 41.96 | 109.43 |
| 73 | 11.97 | 13.35 | 0.41 | 9.34 | 43.77 | 110.19 |
| 74 | 12.14 | 13.51 | 0.45 | 8.73 | 44.76 | 110.65 |
| 75 | 12.30 | 13.46 | 0.46 | 7.51 | 45.59 | 110.81 |
| 76 | 12.47 | 12.96 | 0.45 | 6.18 | 45.47 | 110.68 |
| 77 | 12.63 | 13.40 | 0.43 | 6.80 | 45.77 | 110.43 |
| 78 | 12.79 | 12.72 | 0.42 | 6.46 | 46.58 | 110.24 |
| 79 | 12.96 | 11.86 | 0.43 | 6.91 | 49.07 | 110.05 |
| 80 | 13.12 | 10.97 | 0.42 | 6.18 | 51.79 | 109.84 |
| 81 | 13.29 | 10.31 | 0.41 | 6.00 | 52.36 | 109.45 |
| 82 | 13.45 | 10.85 | 0.38 | 6.64 | 51.69 | 109.21 |
| 83 | 13.62 | 11.06 | 0.38 | 6.60 | 50.27 | 109.08 |
| 84 | 13.78 | 11.11 | 0.38 | 7.34 | 50.10 | 109.31 |
| 85 | 13.94 | 11.39 | 0.41 | 6.80 | 50.00 | 109.45 |
| 86 | 14.11 | 11.39 | 0.40 | 6.79 | 50.12 | 109.59 |
| 87 | 14.27 | 11.30 | 0.41 | 6.65 | 50.87 | 109.73 |
| 88 | 14.44 | 11.09 | 0.43 | 6.52 | 52.72 | 110.05 |
| 89 | 14.60 | 10.63 | 0.47 | 6.47 | 52.30 | 109.47 |
| 90 | 14.76 | 10.67 | 0.31 | 6.00 | 53.56 | 110.00 |
| 91 | 14.93 | 11.11 | 0.52 | 5.75 | 52.66 | 110.08 |
| 92 | 15.09 | 11.44 | 0.47 | 5.30 | 66.21 | 110.08 |
| 93 | 15.26 | 2.94 | 0.43 | 8.81 | 67.25 | 109.24 |
| 94 | 15.42 | 9.65 | 0.39 | 4.80 | 68.43 | 108.51 |
| 95 | 15.58 | 10.13 | 0.37 | 6.00 | 54.73 | 108.73 |
| 96 | 15.75 | 10.04 | 0.36 | 6.98 | 53.61 | 108.68 |

**:: Field input data :: (continued)**

| Point ID | Depth (ft) | $q_c$ (tsf) | $f_s$ (tsf) | u (tsf) | Fines content (%) | Unit weight (pcf) |
|---|---|---|---|---|---|---|
| 97 | 15.91 | 10.27 | 0.38 | 6.91 | 52.36 | 108.91 |
| 98 | 16.08 | 11.30 | 0.39 | 7.26 | 50.00 | 109.38 |
| 99 | 16.24 | 12.51 | 0.41 | 7.46 | 47.08 | 109.67 |
| 100 | 16.40 | 13.12 | 0.39 | 7.77 | 45.34 | 109.69 |
| 101 | 16.57 | 12.89 | 0.38 | 7.88 | 44.24 | 109.41 |
| 102 | 16.73 | 13.00 | 0.36 | 8.36 | 44.16 | 109.30 |
| 103 | 16.90 | 12.98 | 0.38 | 8.83 | 44.51 | 109.45 |
| 104 | 17.06 | 12.86 | 0.40 | 8.61 | 44.60 | 109.70 |
| 105 | 17.22 | 13.43 | 0.40 | 9.01 | 42.89 | 109.73 |
| 106 | 17.39 | 14.73 | 0.36 | 8.47 | 42.91 | 109.18 |
| 107 | 17.55 | 11.78 | 0.33 | 6.71 | 44.25 | 108.24 |
| 108 | 17.72 | 10.47 | 0.29 | 7.58 | 48.73 | 107.46 |
| 109 | 17.88 | 9.90 | 0.31 | 7.72 | 50.56 | 106.99 |
| 110 | 18.05 | 9.82 | 0.28 | 7.97 | 51.27 | 106.61 |
| 111 | 18.21 | 9.52 | 0.26 | 7.12 | 52.91 | 106.01 |
| 112 | 18.37 | 8.17 | 0.26 | 5.62 | 56.21 | 105.65 |
| 113 | 18.54 | 7.65 | 0.27 | 6.89 | 55.62 | 106.19 |
| 114 | 18.70 | 10.48 | 0.31 | 7.76 | 52.49 | 107.10 |
| 115 | 18.86 | 11.11 | 0.33 | 8.37 | 48.18 | 107.67 |
| 116 | 19.03 | 11.40 | 0.30 | 8.68 | 47.45 | 107.74 |
| 117 | 19.19 | 11.14 | 0.31 | 8.83 | 46.52 | 107.48 |
| 118 | 19.36 | 11.45 | 0.30 | 9.71 | 46.10 | 107.18 |
| 119 | 19.52 | 11.37 | 0.27 | 9.53 | 46.57 | 106.59 |
| 120 | 19.68 | 9.93 | 0.25 | 9.10 | 49.02 | 105.65 |
| 121 | 19.85 | 8.36 | 0.22 | 9.44 | 54.09 | 105.15 |
| 122 | 20.01 | 7.65 | 0.25 | 9.14 | 54.86 | 105.14 |
| 123 | 20.18 | 9.56 | 0.25 | 10.05 | 53.11 | 106.09 |
| 124 | 20.34 | 10.62 | 0.30 | 9.84 | 48.70 | 107.24 |
| 125 | 20.50 | 12.39 | 0.34 | 10.05 | 45.83 | 108.33 |
| 126 | 20.67 | 13.86 | 0.36 | 11.14 | 42.93 | 109.18 |
| 127 | 20.83 | 15.20 | 0.38 | 12.82 | 40.59 | 109.51 |
| 128 | 21.00 | 15.85 | 0.36 | 12.31 | 40.81 | 109.39 |
| 129 | 21.16 | 13.50 | 0.34 | 9.14 | 43.32 | 108.91 |
| 130 | 21.32 | 11.55 | 0.34 | 9.80 | 47.98 | 109.08 |
| 131 | 21.49 | 11.83 | 0.42 | 11.20 | 48.69 | 109.65 |
| 132 | 21.65 | 13.98 | 0.42 | 11.63 | 46.57 | 110.52 |
| 133 | 21.82 | 15.30 | 0.45 | 12.55 | 43.94 | 110.75 |
| 134 | 21.98 | 15.22 | 0.43 | 12.81 | 42.55 | 110.49 |
| 135 | 22.15 | 15.14 | 0.37 | 13.65 | 42.10 | 109.94 |
| 136 | 22.31 | 14.71 | 0.36 | 13.32 | 41.75 | 109.53 |
| 137 | 22.47 | 14.86 | 0.37 | 15.00 | 42.20 | 109.79 |
| 138 | 22.64 | 15.28 | 0.41 | 15.22 | 43.00 | 110.70 |
| 139 | 22.80 | 15.90 | 0.50 | 14.96 | 44.00 | 111.58 |
| 140 | 22.97 | 15.84 | 0.52 | 14.78 | 44.91 | 111.99 |
| 141 | 23.13 | 15.34 | 0.49 | 14.38 | 45.70 | 111.79 |
| 142 | 23.29 | 14.66 | 0.47 | 14.38 | 46.32 | 111.26 |
| 143 | 23.46 | 14.10 | 0.43 | 15.46 | 47.13 | 111.06 |
| 144 | 23.62 | 14.16 | 0.46 | 15.42 | 47.75 | 111.09 |

**:: Field input data :: (continued)**

| Point ID | Depth (ft) | $q_c$ (tsf) | $f_s$ (tsf) | u (tsf) | Fines content (%) | Unit weight (pcf) |
|---|---|---|---|---|---|---|
| 145 | 23.79 | 14.23 | 0.48 | 15.01 | 48.33 | 111.46 |
| 146 | 23.95 | 14.42 | 0.50 | 15.01 | 48.82 | 111.74 |
| 147 | 24.11 | 14.40 | 0.52 | 14.94 | 49.10 | 112.02 |
| 148 | 24.28 | 14.69 | 0.54 | 14.59 | 49.43 | 112.33 |
| 149 | 24.44 | 14.92 | 0.56 | 14.46 | 49.42 | 112.64 |
| 150 | 24.61 | 15.24 | 0.58 | 14.49 | 50.11 | 113.22 |
| 151 | 24.77 | 15.44 | 0.66 | 14.38 | 50.27 | 113.93 |
| 152 | 24.93 | 16.56 | 0.72 | 14.93 | 50.25 | 114.54 |
| 153 | 25.10 | 16.90 | 0.72 | 15.16 | 49.48 | 115.02 |
| 154 | 25.26 | 17.72 | 0.77 | 14.41 | 49.15 | 115.29 |
| 155 | 25.43 | 17.83 | 0.79 | 13.44 | 48.39 | 115.60 |
| 156 | 25.59 | 18.91 | 0.80 | 12.93 | 48.22 | 115.51 |
| 157 | 25.75 | 17.85 | 0.74 | 12.79 | 48.11 | 115.36 |
| 158 | 25.92 | 17.69 | 0.74 | 13.20 | 48.32 | 115.06 |
| 159 | 26.08 | 17.94 | 0.72 | 14.42 | 47.62 | 115.11 |
| 160 | 26.25 | 18.98 | 0.74 | 15.16 | 47.22 | 115.26 |
| 161 | 26.41 | 18.78 | 0.77 | 14.32 | 47.40 | 115.55 |
| 162 | 26.57 | 18.70 | 0.80 | 14.35 | 47.56 | 115.68 |
| 163 | 26.74 | 19.34 | 0.78 | 14.75 | 46.67 | 115.83 |
| 164 | 26.90 | 20.56 | 0.80 | 15.31 | 45.07 | 116.02 |
| 165 | 27.07 | 21.75 | 0.82 | 15.55 | 42.87 | 116.02 |
| 166 | 27.23 | 22.95 | 0.74 | 16.05 | 41.05 | 115.68 |
| 167 | 27.39 | 22.63 | 0.67 | 15.71 | 40.14 | 114.84 |
| 168 | 27.56 | 20.58 | 0.59 | 17.70 | 40.13 | 113.78 |
| 169 | 27.72 | 19.61 | 0.50 | 19.07 | 40.33 | 112.51 |
| 170 | 27.89 | 18.59 | 0.42 | 18.29 | 39.89 | 111.27 |
| 171 | 28.05 | 17.90 | 0.37 | 18.94 | 40.31 | 110.29 |
| 172 | 28.21 | 16.60 | 0.36 | 18.81 | 40.64 | 109.97 |
| 173 | 28.38 | 17.39 | 0.38 | 24.12 | 41.28 | 110.82 |
| 174 | 28.54 | 19.12 | 0.50 | 28.60 | 41.65 | 112.64 |
| 175 | 28.71 | 20.96 | 0.66 | 30.07 | 42.67 | 114.69 |
| 176 | 28.87 | 22.10 | 0.82 | 28.40 | 43.81 | 116.18 |
| 177 | 29.04 | 22.42 | 0.91 | 25.39 | 45.03 | 116.92 |
| 178 | 29.20 | 21.79 | 0.91 | 25.56 | 45.95 | 116.87 |
| 179 | 29.36 | 20.67 | 0.82 | 26.07 | 46.86 | 116.16 |
| 180 | 29.53 | 18.94 | 0.71 | 22.80 | 47.68 | 115.04 |
| 181 | 29.69 | 17.40 | 0.61 | 22.21 | 43.62 | 111.44 |
| 182 | 29.86 | 16.38 | 0.03 | 24.72 | 43.25 | 109.98 |
| 183 | 30.02 | 15.98 | 0.49 | 22.78 | 44.37 | 109.23 |
| 184 | 30.18 | 14.47 | 0.52 | 23.44 | 60.46 | 111.39 |
| 185 | 30.35 | 6.43 | 0.49 | 21.49 | 57.33 | 111.75 |
| 186 | 30.51 | 19.07 | 0.52 | 21.95 | 51.97 | 112.22 |
| 187 | 30.68 | 20.16 | 0.55 | 28.71 | 42.67 | 113.36 |
| 188 | 30.84 | 20.78 | 0.60 | 27.84 | 43.69 | 113.95 |
| 189 | 31.00 | 19.41 | 0.66 | 25.41 | 45.14 | 114.36 |
| 190 | 31.17 | 19.42 | 0.66 | 28.32 | 46.27 | 114.48 |
| 191 | 31.33 | 19.71 | 0.64 | 26.88 | 46.16 | 114.42 |
| 192 | 31.50 | 19.48 | 0.64 | 28.69 | 47.10 | 114.42 |

**:: Field input data :: (continued)**

| Point ID | Depth (ft) | $q_c$ (tsf) | $f_s$ (tsf) | u (tsf) | Fines content (%) | Unit weight (pcf) |
|---|---|---|---|---|---|---|
| 193 | 31.66 | 18.31 | 0.68 | 26.74 | 49.26 | 114.42 |
| 194 | 31.82 | 17.09 | 0.67 | 23.66 | 51.56 | 113.80 |
| 195 | 31.99 | 15.39 | 0.53 | 23.24 | 51.72 | 112.57 |
| 196 | 32.15 | 15.30 | 0.42 | 26.71 | 49.78 | 110.98 |
| 197 | 32.32 | 15.54 | 0.37 | 29.74 | 47.45 | 110.16 |
| 198 | 32.48 | 16.08 | 0.38 | 28.40 | 47.22 | 110.03 |
| 199 | 32.64 | 15.39 | 0.40 | 26.44 | 48.92 | 110.44 |
| 200 | 32.81 | 14.78 | 0.44 | 26.75 | 50.99 | 110.91 |
| 201 | 32.97 | 15.09 | 0.47 | 28.77 | 51.88 | 111.73 |
| 202 | 33.14 | 16.43 | 0.54 | 24.58 | 52.11 | 112.40 |
| 203 | 33.30 | 16.23 | 0.57 | 22.67 | 52.71 | 112.90 |
| 204 | 33.47 | 15.88 | 0.58 | 21.60 | 51.78 | 112.95 |
| 205 | 33.63 | 17.60 | 0.54 | 26.29 | 48.80 | 113.26 |
| 206 | 33.79 | 20.43 | 0.59 | 27.40 | 47.02 | 113.94 |
| 207 | 33.96 | 20.08 | 0.70 | 26.95 | 47.07 | 114.83 |
| 208 | 34.12 | 20.27 | 0.75 | 28.66 | 48.54 | 115.42 |
| 209 | 34.28 | 20.34 | 0.76 | 26.76 | 49.29 | 115.76 |
| 210 | 34.45 | 20.20 | 0.80 | 29.94 | 50.13 | 115.97 |
| 211 | 34.61 | 19.88 | 0.82 | 31.42 | 50.93 | 116.10 |
| 212 | 34.78 | 19.80 | 0.81 | 29.55 | 50.82 | 115.78 |
| 213 | 34.94 | 19.54 | 0.71 | 28.41 | 51.04 | 115.20 |
| 214 | 35.10 | 18.10 | 0.66 | 27.27 | 51.87 | 114.72 |
| 215 | 35.27 | 17.60 | 0.70 | 27.98 | 54.19 | 114.56 |
| 216 | 35.43 | 16.83 | 0.70 | 15.47 | 54.83 | 114.65 |
| 217 | 35.60 | 17.89 | 0.69 | 18.18 | 54.65 | 114.53 |
| 218 | 35.76 | 17.76 | 0.67 | 18.15 | 53.13 | 114.24 |
| 219 | 35.92 | 17.73 | 0.60 | 23.32 | 51.30 | 114.10 |
| 220 | 36.09 | 19.60 | 0.63 | 26.25 | 46.05 | 114.13 |
| 221 | 36.25 | 24.58 | 0.60 | 34.06 | 41.98 | 114.18 |
| 222 | 36.42 | 24.42 | 0.55 | 21.50 | 40.12 | 113.87 |
| 223 | 36.58 | 21.96 | 0.54 | 27.29 | 40.72 | 113.32 |
| 224 | 36.74 | 21.79 | 0.50 | 35.80 | 41.25 | 112.96 |
| 225 | 36.91 | 22.37 | 0.49 | 30.02 | 42.25 | 112.72 |
| 226 | 37.07 | 19.68 | 0.51 | 29.81 | 42.52 | 112.08 |
| 227 | 37.24 | 19.61 | 0.39 | 36.07 | 44.13 | 111.60 |
| 228 | 37.40 | 18.83 | 0.43 | 29.50 | 45.29 | 111.22 |
| 229 | 37.57 | 17.12 | 0.46 | 37.21 | 48.37 | 112.29 |
| 230 | 37.73 | 18.59 | 0.60 | 38.36 | 42.58 | 113.40 |
| 231 | 37.89 | 30.11 | 0.57 | 41.52 | 41.45 | 113.96 |
| 232 | 38.06 | 21.44 | 0.56 | 6.91 | 40.81 | 113.12 |
| 233 | 38.22 | 17.26 | 0.43 | 23.86 | 48.14 | 111.70 |
| 234 | 38.39 | 15.68 | 0.40 | 33.48 | 50.68 | 110.60 |
| 235 | 38.55 | 15.67 | 0.40 | 37.76 | 52.31 | 110.81 |
| 236 | 38.71 | 15.91 | 0.47 | 42.15 | 53.10 | 111.22 |
| 237 | 38.88 | 15.75 | 0.47 | 42.75 | 53.99 | 111.53 |
| 238 | 39.04 | 15.52 | 0.46 | 42.50 | 54.73 | 111.55 |
| 239 | 39.21 | 15.27 | 0.48 | 47.89 | 54.73 | 111.71 |
| 240 | 39.37 | 16.11 | 0.50 | 48.39 | 52.68 | 112.02 |

**:: Field input data :: (continued)**

| Point ID | Depth (ft) | $q_c$ (tsf) | $f_s$ (tsf) | u (tsf) | Fines content (%) | Unit weight (pcf) |
|---|---|---|---|---|---|---|
| 241 | 39.53 | 18.23 | 0.50 | 53.98 | 50.70 | 113.38 |
| 242 | 39.70 | 20.90 | 0.72 | 56.31 | 49.49 | 115.50 |
| 243 | 39.86 | 23.77 | 0.98 | 60.40 | 45.13 | 118.79 |
| 244 | 40.03 | 37.57 | 1.46 | 72.13 | 41.60 | 120.47 |
| 245 | 40.19 | 37.36 | 1.32 | 25.94 | 37.61 | 121.04 |
| 246 | 40.35 | 38.79 | 1.10 | 11.27 | 37.53 | 120.04 |
| 247 | 40.52 | 32.80 | 1.01 | 20.57 | 39.45 | 119.91 |
| 248 | 40.68 | 31.54 | 1.32 | 29.13 | 43.84 | 121.04 |
| 249 | 40.85 | 33.80 | 1.74 | 37.80 | 43.11 | 124.17 |
| 250 | 41.01 | 52.87 | 2.81 | 61.98 | 35.19 | 127.88 |
| 251 | 41.17 | 93.51 | 3.93 | 13.06 | 28.10 | 130.26 |
| 252 | 41.34 | 110.90 | 3.70 | 4.38 | 25.26 | 131.49 |
| 253 | 41.50 | 101.36 | 4.04 | 6.82 | 23.92 | 131.53 |
| 254 | 41.67 | 109.32 | 3.81 | 17.35 | 10.77 | 130.42 |
| 255 | 41.83 | 320.89 | 0.54 | 1.75 | 1.73 | 127.73 |
| 256 | 41.99 | 467.32 | 0.53 | 1.80 | 0.00 | 121.43 |
| 257 | 42.16 | 589.15 | 0.72 | 1.34 | 0.00 | 122.57 |

**Abbreviations**

| | |
|---|---|
| Depth: | Depth from free surface, at which CPT was performed (ft) |
| $q_c$: | Measured cone resistance (tsf) |
| $f_s$: | Sleeve friction resistance (tsf) |
| u: | Pore pressure (tsf) |
| Fines content: | Percentage of fines in soil (%) |
| Unit weight: | Bulk soil unit weight (pcf) |

**:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data ::**

| Point ID | Depth (ft) | $\sigma_v$ (tsf) | $u_0$ (tsf) | $\sigma_v'$ (tsf) | $r_d$ | CSR | MSF | $CSR_{eq}$ | $K_\sigma$ | User FS | $CSR^*$ | Belongs to transition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.16 | 0.01 | 0.00 | 0.01 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 2 | 0.33 | 0.02 | 0.00 | 0.02 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 3 | 0.49 | 0.03 | 0.00 | 0.03 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.218 | No |
| 4 | 0.66 | 0.04 | 0.00 | 0.04 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.217 | No |
| 5 | 0.82 | 0.05 | 0.00 | 0.05 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.217 | No |
| 6 | 0.98 | 0.06 | 0.00 | 0.06 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.213 | No |
| 7 | 1.15 | 0.07 | 0.00 | 0.07 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.213 | No |
| 8 | 1.31 | 0.08 | 0.00 | 0.08 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.213 | No |
| 9 | 1.48 | 0.09 | 0.00 | 0.09 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.213 | No |
| 10 | 1.64 | 0.10 | 0.00 | 0.10 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.213 | No |
| 11 | 1.80 | 0.11 | 0.00 | 0.11 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.215 | No |
| 12 | 1.97 | 0.12 | 0.00 | 0.12 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.216 | No |
| 13 | 2.13 | 0.13 | 0.00 | 0.13 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.217 | No |
| 14 | 2.30 | 0.14 | 0.00 | 0.14 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.217 | No |
| 15 | 2.46 | 0.15 | 0.00 | 0.15 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.217 | No |
| 16 | 2.63 | 0.16 | 0.00 | 0.16 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.217 | No |
| 17 | 2.79 | 0.17 | 0.00 | 0.17 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.217 | No |
| 18 | 2.95 | 0.18 | 0.00 | 0.18 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.216 | No |
| 19 | 3.12 | 0.19 | 0.00 | 0.19 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.216 | No |
| 20 | 3.28 | 0.20 | 0.00 | 0.20 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.216 | No |
| 21 | 3.44 | 0.21 | 0.00 | 0.21 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.217 | No |
| 22 | 3.61 | 0.22 | 0.00 | 0.22 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.217 | No |
| 23 | 3.77 | 0.23 | 0.00 | 0.23 | 1.00 | 0.240 | 1.02 | 0.236 | 1.10 | 1.00 | 0.217 | No |
| 24 | 3.94 | 0.24 | 0.00 | 0.24 | 1.00 | 0.240 | 1.02 | 0.235 | 1.10 | 1.00 | 0.217 | No |
| 25 | 4.10 | 0.24 | 0.00 | 0.24 | 1.00 | 0.240 | 1.02 | 0.235 | 1.10 | 1.00 | 0.217 | No |
| 26 | 4.26 | 0.25 | 0.00 | 0.25 | 1.00 | 0.240 | 1.02 | 0.235 | 1.10 | 1.00 | 0.217 | No |
| 27 | 4.43 | 0.26 | 0.00 | 0.26 | 1.00 | 0.240 | 1.02 | 0.235 | 1.10 | 1.00 | 0.217 | No |
| 28 | 4.59 | 0.27 | 0.00 | 0.27 | 1.00 | 0.242 | 1.02 | 0.238 | 1.10 | 1.00 | 0.219 | No |
| 29 | 4.76 | 0.28 | 0.01 | 0.27 | 1.00 | 0.246 | 1.02 | 0.242 | 1.10 | 1.00 | 0.223 | No |
| 30 | 4.92 | 0.29 | 0.01 | 0.28 | 0.99 | 0.251 | 1.02 | 0.246 | 1.10 | 1.00 | 0.227 | No |
| 31 | 5.08 | 0.30 | 0.02 | 0.28 | 0.99 | 0.255 | 1.02 | 0.250 | 1.10 | 1.00 | 0.231 | No |
| 32 | 5.25 | 0.31 | 0.02 | 0.28 | 0.99 | 0.259 | 1.02 | 0.254 | 1.10 | 1.00 | 0.234 | No |
| 33 | 5.41 | 0.31 | 0.03 | 0.29 | 0.99 | 0.263 | 1.02 | 0.258 | 1.10 | 1.00 | 0.238 | No |
| 34 | 5.58 | 0.32 | 0.03 | 0.29 | 0.99 | 0.267 | 1.02 | 0.262 | 1.10 | 1.00 | 0.241 | No |
| 35 | 5.74 | 0.33 | 0.04 | 0.29 | 0.99 | 0.270 | 1.02 | 0.265 | 1.10 | 1.00 | 0.245 | No |
| 36 | 5.91 | 0.34 | 0.04 | 0.30 | 0.99 | 0.274 | 1.02 | 0.269 | 1.10 | 1.00 | 0.248 | No |
| 37 | 6.07 | 0.35 | 0.05 | 0.30 | 0.99 | 0.277 | 1.02 | 0.272 | 1.10 | 1.00 | 0.252 | No |
| 38 | 6.23 | 0.36 | 0.05 | 0.30 | 0.99 | 0.281 | 1.02 | 0.276 | 1.10 | 1.00 | 0.255 | No |
| 39 | 6.40 | 0.37 | 0.06 | 0.31 | 0.99 | 0.284 | 1.02 | 0.279 | 1.10 | 1.00 | 0.259 | No |
| 40 | 6.56 | 0.37 | 0.06 | 0.31 | 0.99 | 0.288 | 1.02 | 0.282 | 1.10 | 1.00 | 0.262 | No |
| 41 | 6.73 | 0.38 | 0.07 | 0.31 | 0.99 | 0.291 | 1.02 | 0.286 | 1.10 | 1.00 | 0.265 | No |
| 42 | 6.89 | 0.39 | 0.07 | 0.32 | 0.99 | 0.294 | 1.02 | 0.289 | 1.10 | 1.00 | 0.267 | No |
| 43 | 7.05 | 0.40 | 0.08 | 0.32 | 0.99 | 0.297 | 1.02 | 0.292 | 1.10 | 1.00 | 0.269 | No |
| 44 | 7.22 | 0.41 | 0.08 | 0.32 | 0.99 | 0.300 | 1.02 | 0.295 | 1.10 | 1.00 | 0.272 | No |
| 45 | 7.38 | 0.42 | 0.09 | 0.33 | 0.99 | 0.303 | 1.02 | 0.297 | 1.10 | 1.00 | 0.274 | No |
| 46 | 7.55 | 0.43 | 0.10 | 0.33 | 0.99 | 0.306 | 1.02 | 0.300 | 1.10 | 1.00 | 0.277 | No |
| 47 | 7.71 | 0.44 | 0.10 | 0.34 | 0.99 | 0.308 | 1.02 | 0.303 | 1.10 | 1.00 | 0.279 | No |
| 48 | 7.87 | 0.44 | 0.11 | 0.34 | 0.99 | 0.311 | 1.02 | 0.305 | 1.10 | 1.00 | 0.282 | No |

**:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)**

| Point ID | Depth (ft) | $\sigma_v$ (tsf) | $u_0$ (tsf) | $\sigma_v'$ (tsf) | $r_d$ | CSR | MSF | $CSR_{eq}$ | $K_\sigma$ | User FS | $CSR^*$ | Belongs to transition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 49 | 8.04 | 0.45 | 0.11 | 0.34 | 0.99 | 0.313 | 1.02 | 0.308 | 1.10 | 1.00 | 0.284 | No |
| 50 | 8.20 | 0.46 | 0.12 | 0.35 | 0.99 | 0.316 | 1.02 | 0.310 | 1.10 | 1.00 | 0.286 | No |
| 51 | 8.37 | 0.47 | 0.12 | 0.35 | 0.99 | 0.318 | 1.02 | 0.312 | 1.10 | 1.00 | 0.289 | No |
| 52 | 8.53 | 0.48 | 0.13 | 0.36 | 0.98 | 0.321 | 1.02 | 0.315 | 1.10 | 1.00 | 0.291 | No |
| 53 | 8.69 | 0.49 | 0.13 | 0.36 | 0.98 | 0.323 | 1.02 | 0.317 | 1.10 | 1.00 | 0.293 | No |
| 54 | 8.86 | 0.50 | 0.14 | 0.36 | 0.98 | 0.325 | 1.02 | 0.319 | 1.10 | 1.00 | 0.296 | No |
| 55 | 9.02 | 0.51 | 0.14 | 0.37 | 0.98 | 0.327 | 1.02 | 0.321 | 1.09 | 1.00 | 0.298 | No |
| 56 | 9.19 | 0.52 | 0.15 | 0.37 | 0.98 | 0.329 | 1.02 | 0.323 | 1.09 | 1.00 | 0.300 | No |
| 57 | 9.35 | 0.53 | 0.15 | 0.38 | 0.98 | 0.331 | 1.02 | 0.325 | 1.09 | 1.00 | 0.303 | No |
| 58 | 9.51 | 0.54 | 0.16 | 0.38 | 0.98 | 0.333 | 1.02 | 0.327 | 1.09 | 1.00 | 0.305 | No |
| 59 | 9.68 | 0.55 | 0.16 | 0.38 | 0.98 | 0.335 | 1.02 | 0.329 | 1.09 | 1.00 | 0.306 | No |
| 60 | 9.84 | 0.55 | 0.17 | 0.39 | 0.98 | 0.337 | 1.02 | 0.331 | 1.09 | 1.00 | 0.308 | No |
| 61 | 10.01 | 0.56 | 0.17 | 0.39 | 0.98 | 0.339 | 1.02 | 0.333 | 1.09 | 1.00 | 0.310 | No |
| 62 | 10.17 | 0.57 | 0.18 | 0.40 | 0.98 | 0.341 | 1.02 | 0.335 | 1.09 | 1.00 | 0.311 | No |
| 63 | 10.34 | 0.58 | 0.18 | 0.40 | 0.98 | 0.343 | 1.02 | 0.337 | 1.09 | 1.00 | 0.314 | No |
| 64 | 10.50 | 0.59 | 0.19 | 0.40 | 0.98 | 0.345 | 1.02 | 0.338 | 1.09 | 1.00 | 0.316 | No |
| 65 | 10.66 | 0.60 | 0.19 | 0.41 | 0.98 | 0.346 | 1.02 | 0.340 | 1.09 | 1.00 | 0.317 | No |
| 66 | 10.83 | 0.61 | 0.20 | 0.41 | 0.98 | 0.348 | 1.02 | 0.342 | 1.09 | 1.00 | 0.319 | No |
| 67 | 10.99 | 0.62 | 0.20 | 0.41 | 0.98 | 0.350 | 1.02 | 0.343 | 1.09 | 1.00 | 0.320 | No |
| 68 | 11.15 | 0.63 | 0.21 | 0.42 | 0.98 | 0.351 | 1.02 | 0.345 | 1.09 | 1.00 | 0.322 | No |
| 69 | 11.32 | 0.64 | 0.21 | 0.42 | 0.98 | 0.353 | 1.02 | 0.346 | 1.08 | 1.00 | 0.324 | No |
| 70 | 11.48 | 0.64 | 0.22 | 0.43 | 0.98 | 0.354 | 1.02 | 0.348 | 1.08 | 1.00 | 0.326 | No |
| 71 | 11.65 | 0.65 | 0.22 | 0.43 | 0.98 | 0.356 | 1.02 | 0.349 | 1.08 | 1.00 | 0.328 | No |
| 72 | 11.81 | 0.66 | 0.23 | 0.43 | 0.97 | 0.358 | 1.02 | 0.351 | 1.08 | 1.00 | 0.330 | No |
| 73 | 11.97 | 0.67 | 0.23 | 0.44 | 0.97 | 0.359 | 1.02 | 0.352 | 1.08 | 1.00 | 0.331 | No |
| 74 | 12.14 | 0.68 | 0.24 | 0.44 | 0.97 | 0.360 | 1.02 | 0.354 | 1.08 | 1.00 | 0.333 | No |
| 75 | 12.30 | 0.69 | 0.24 | 0.45 | 0.97 | 0.362 | 1.02 | 0.355 | 1.08 | 1.00 | 0.334 | No |
| 76 | 12.47 | 0.70 | 0.25 | 0.45 | 0.97 | 0.363 | 1.02 | 0.356 | 1.08 | 1.00 | 0.336 | No |
| 77 | 12.63 | 0.71 | 0.25 | 0.45 | 0.97 | 0.364 | 1.02 | 0.358 | 1.08 | 1.00 | 0.337 | No |
| 78 | 12.79 | 0.72 | 0.26 | 0.46 | 0.97 | 0.366 | 1.02 | 0.359 | 1.07 | 1.00 | 0.339 | No |
| 79 | 12.96 | 0.73 | 0.26 | 0.46 | 0.97 | 0.367 | 1.02 | 0.360 | 1.07 | 1.00 | 0.341 | No |
| 80 | 13.12 | 0.73 | 0.27 | 0.47 | 0.97 | 0.368 | 1.02 | 0.361 | 1.07 | 1.00 | 0.342 | No |
| 81 | 13.29 | 0.74 | 0.27 | 0.47 | 0.97 | 0.369 | 1.02 | 0.363 | 1.07 | 1.00 | 0.344 | No |
| 82 | 13.45 | 0.75 | 0.28 | 0.47 | 0.97 | 0.371 | 1.02 | 0.364 | 1.07 | 1.00 | 0.345 | No |
| 83 | 13.62 | 0.76 | 0.28 | 0.48 | 0.97 | 0.372 | 1.02 | 0.365 | 1.07 | 1.00 | 0.346 | No |
| 84 | 13.78 | 0.77 | 0.29 | 0.48 | 0.97 | 0.373 | 1.02 | 0.366 | 1.07 | 1.00 | 0.348 | No |
| 85 | 13.94 | 0.78 | 0.29 | 0.48 | 0.97 | 0.374 | 1.02 | 0.367 | 1.07 | 1.00 | 0.349 | No |
| 86 | 14.11 | 0.79 | 0.30 | 0.49 | 0.97 | 0.375 | 1.02 | 0.368 | 1.07 | 1.00 | 0.350 | No |
| 87 | 14.27 | 0.80 | 0.30 | 0.49 | 0.97 | 0.376 | 1.02 | 0.369 | 1.07 | 1.00 | 0.351 | No |
| 88 | 14.44 | 0.81 | 0.31 | 0.50 | 0.97 | 0.377 | 1.02 | 0.370 | 1.07 | 1.00 | 0.353 | No |
| 89 | 14.60 | 0.82 | 0.32 | 0.50 | 0.97 | 0.378 | 1.02 | 0.371 | 1.06 | 1.00 | 0.354 | No |
| 90 | 14.76 | 0.82 | 0.32 | 0.50 | 0.96 | 0.379 | 1.02 | 0.372 | 1.06 | 1.00 | 0.355 | No |
| 91 | 14.93 | 0.83 | 0.33 | 0.51 | 0.96 | 0.380 | 1.02 | 0.373 | 1.06 | 1.00 | 0.356 | No |
| 92 | 15.09 | 0.84 | 0.33 | 0.51 | 0.96 | 0.381 | 1.02 | 0.374 | 1.06 | 1.00 | 0.357 | No |
| 93 | 15.26 | 0.85 | 0.34 | 0.52 | 0.96 | 0.382 | 1.02 | 0.375 | 1.06 | 1.00 | 0.361 | No |
| 94 | 15.42 | 0.86 | 0.34 | 0.52 | 0.96 | 0.383 | 1.02 | 0.376 | 1.06 | 1.00 | 0.360 | No |
| 95 | 15.58 | 0.87 | 0.35 | 0.52 | 0.96 | 0.384 | 1.02 | 0.377 | 1.06 | 1.00 | 0.361 | No |
| 96 | 15.75 | 0.88 | 0.35 | 0.53 | 0.96 | 0.385 | 1.02 | 0.378 | 1.06 | 1.00 | 0.362 | No |

**:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)**

| Point ID | Depth (ft) | $\sigma_v$ (tsf) | $u_0$ (tsf) | $\sigma_v'$ (tsf) | $r_d$ | CSR | MSF | $CSR_{eq}$ | $K_\sigma$ | User FS | $CSR^*$ | Belongs to transition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 97 | 15.91 | 0.89 | 0.36 | 0.53 | 0.96 | 0.386 | 1.02 | 0.379 | 1.06 | 1.00 | 0.363 | No |
| 98 | 16.08 | 0.90 | 0.36 | 0.54 | 0.96 | 0.387 | 1.02 | 0.380 | 1.06 | 1.00 | 0.364 | No |
| 99 | 16.24 | 0.91 | 0.37 | 0.54 | 0.96 | 0.388 | 1.02 | 0.380 | 1.06 | 1.00 | 0.365 | No |
| 100 | 16.40 | 0.91 | 0.37 | 0.54 | 0.96 | 0.388 | 1.02 | 0.381 | 1.06 | 1.00 | 0.365 | No |
| 101 | 16.57 | 0.92 | 0.38 | 0.55 | 0.96 | 0.389 | 1.02 | 0.382 | 1.06 | 1.00 | 0.366 | No |
| 102 | 16.73 | 0.93 | 0.38 | 0.55 | 0.96 | 0.390 | 1.02 | 0.383 | 1.06 | 1.00 | 0.367 | No |
| 103 | 16.90 | 0.94 | 0.39 | 0.55 | 0.96 | 0.391 | 1.02 | 0.384 | 1.06 | 1.00 | 0.368 | No |
| 104 | 17.06 | 0.95 | 0.39 | 0.56 | 0.96 | 0.391 | 1.02 | 0.384 | 1.06 | 1.00 | 0.369 | No |
| 105 | 17.22 | 0.96 | 0.40 | 0.56 | 0.96 | 0.392 | 1.02 | 0.385 | 1.06 | 1.00 | 0.370 | No |
| 106 | 17.39 | 0.97 | 0.40 | 0.57 | 0.96 | 0.393 | 1.02 | 0.386 | 1.06 | 1.00 | 0.371 | No |
| 107 | 17.55 | 0.98 | 0.41 | 0.57 | 0.95 | 0.394 | 1.02 | 0.386 | 1.05 | 1.00 | 0.372 | No |
| 108 | 17.72 | 0.99 | 0.41 | 0.57 | 0.95 | 0.394 | 1.02 | 0.387 | 1.05 | 1.00 | 0.374 | No |
| 109 | 17.88 | 0.99 | 0.42 | 0.58 | 0.95 | 0.395 | 1.02 | 0.388 | 1.05 | 1.00 | 0.375 | No |
| 110 | 18.05 | 1.00 | 0.42 | 0.58 | 0.95 | 0.396 | 1.02 | 0.389 | 1.05 | 1.00 | 0.376 | No |
| 111 | 18.21 | 1.01 | 0.43 | 0.58 | 0.95 | 0.397 | 1.02 | 0.389 | 1.05 | 1.00 | 0.376 | No |
| 112 | 18.37 | 1.02 | 0.43 | 0.59 | 0.95 | 0.397 | 1.02 | 0.390 | 1.05 | 1.00 | 0.378 | No |
| 113 | 18.54 | 1.03 | 0.44 | 0.59 | 0.95 | 0.398 | 1.02 | 0.391 | 1.05 | 1.00 | 0.379 | No |
| 114 | 18.70 | 1.04 | 0.44 | 0.60 | 0.95 | 0.399 | 1.02 | 0.391 | 1.05 | 1.00 | 0.379 | No |
| 115 | 18.86 | 1.05 | 0.45 | 0.60 | 0.95 | 0.399 | 1.02 | 0.392 | 1.05 | 1.00 | 0.379 | No |
| 116 | 19.03 | 1.06 | 0.45 | 0.60 | 0.95 | 0.400 | 1.02 | 0.393 | 1.05 | 1.00 | 0.380 | No |
| 117 | 19.19 | 1.06 | 0.46 | 0.61 | 0.95 | 0.401 | 1.02 | 0.393 | 1.05 | 1.00 | 0.381 | No |
| 118 | 19.36 | 1.07 | 0.46 | 0.61 | 0.95 | 0.401 | 1.02 | 0.394 | 1.05 | 1.00 | 0.382 | No |
| 119 | 19.52 | 1.08 | 0.47 | 0.61 | 0.95 | 0.402 | 1.02 | 0.394 | 1.05 | 1.00 | 0.383 | No |
| 120 | 19.68 | 1.09 | 0.47 | 0.62 | 0.95 | 0.402 | 1.02 | 0.395 | 1.05 | 1.00 | 0.384 | No |
| 121 | 19.85 | 1.10 | 0.48 | 0.62 | 0.95 | 0.403 | 1.02 | 0.396 | 1.04 | 1.00 | 0.385 | No |
| 122 | 20.01 | 1.11 | 0.48 | 0.62 | 0.95 | 0.404 | 1.02 | 0.396 | 1.04 | 1.00 | 0.386 | No |
| 123 | 20.18 | 1.12 | 0.49 | 0.63 | 0.94 | 0.404 | 1.02 | 0.397 | 1.04 | 1.00 | 0.386 | No |
| 124 | 20.34 | 1.13 | 0.49 | 0.63 | 0.94 | 0.405 | 1.02 | 0.397 | 1.04 | 1.00 | 0.386 | No |
| 125 | 20.50 | 1.13 | 0.50 | 0.64 | 0.94 | 0.405 | 1.02 | 0.398 | 1.04 | 1.00 | 0.387 | No |
| 126 | 20.67 | 1.14 | 0.50 | 0.64 | 0.94 | 0.406 | 1.02 | 0.398 | 1.04 | 1.00 | 0.387 | No |
| 127 | 20.83 | 1.15 | 0.51 | 0.64 | 0.94 | 0.406 | 1.02 | 0.399 | 1.04 | 1.00 | 0.388 | No |
| 128 | 21.00 | 1.16 | 0.51 | 0.65 | 0.94 | 0.407 | 1.02 | 0.399 | 1.04 | 1.00 | 0.388 | No |
| 129 | 21.16 | 1.17 | 0.52 | 0.65 | 0.94 | 0.407 | 1.02 | 0.400 | 1.04 | 1.00 | 0.389 | No |
| 130 | 21.32 | 1.18 | 0.52 | 0.65 | 0.94 | 0.408 | 1.02 | 0.400 | 1.04 | 1.00 | 0.390 | No |
| 131 | 21.49 | 1.19 | 0.53 | 0.66 | 0.94 | 0.408 | 1.02 | 0.400 | 1.04 | 1.00 | 0.391 | No |
| 132 | 21.65 | 1.20 | 0.54 | 0.66 | 0.94 | 0.408 | 1.02 | 0.401 | 1.04 | 1.00 | 0.391 | No |
| 133 | 21.82 | 1.21 | 0.54 | 0.67 | 0.94 | 0.409 | 1.02 | 0.401 | 1.04 | 1.00 | 0.391 | No |
| 134 | 21.98 | 1.22 | 0.55 | 0.67 | 0.94 | 0.409 | 1.02 | 0.401 | 1.04 | 1.00 | 0.392 | No |
| 135 | 22.15 | 1.22 | 0.55 | 0.67 | 0.94 | 0.409 | 1.02 | 0.402 | 1.04 | 1.00 | 0.392 | No |
| 136 | 22.31 | 1.23 | 0.56 | 0.68 | 0.94 | 0.410 | 1.02 | 0.402 | 1.04 | 1.00 | 0.393 | No |
| 137 | 22.47 | 1.24 | 0.56 | 0.68 | 0.94 | 0.410 | 1.02 | 0.403 | 1.04 | 1.00 | 0.393 | No |
| 138 | 22.64 | 1.25 | 0.57 | 0.69 | 0.93 | 0.410 | 1.02 | 0.403 | 1.04 | 1.00 | 0.394 | No |
| 139 | 22.80 | 1.26 | 0.57 | 0.69 | 0.93 | 0.411 | 1.02 | 0.403 | 1.04 | 1.00 | 0.394 | No |
| 140 | 22.97 | 1.27 | 0.58 | 0.69 | 0.93 | 0.411 | 1.02 | 0.403 | 1.04 | 1.00 | 0.395 | No |
| 141 | 23.13 | 1.28 | 0.58 | 0.70 | 0.93 | 0.411 | 1.02 | 0.404 | 1.04 | 1.00 | 0.395 | No |
| 142 | 23.29 | 1.29 | 0.59 | 0.70 | 0.93 | 0.412 | 1.02 | 0.404 | 1.04 | 1.00 | 0.396 | No |
| 143 | 23.46 | 1.30 | 0.59 | 0.71 | 0.93 | 0.412 | 1.02 | 0.404 | 1.04 | 1.00 | 0.396 | No |
| 144 | 23.62 | 1.31 | 0.60 | 0.71 | 0.93 | 0.412 | 1.02 | 0.404 | 1.03 | 1.00 | 0.397 | No |

**:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)**

| Point ID | Depth (ft) | $\sigma_v$ (tsf) | $u_0$ (tsf) | $\sigma_v'$ (tsf) | $r_d$ | CSR | MSF | $CSR_{eq}$ | $K_\sigma$ | User FS | $CSR^*$ | Belongs to transition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 145 | 23.79 | 1.32 | 0.60 | 0.71 | 0.93 | 0.412 | 1.02 | 0.405 | 1.03 | 1.00 | 0.397 | No |
| 146 | 23.95 | 1.32 | 0.61 | 0.72 | 0.93 | 0.413 | 1.02 | 0.405 | 1.03 | 1.00 | 0.397 | No |
| 147 | 24.11 | 1.33 | 0.61 | 0.72 | 0.93 | 0.413 | 1.02 | 0.405 | 1.03 | 1.00 | 0.398 | No |
| 148 | 24.28 | 1.34 | 0.62 | 0.73 | 0.93 | 0.413 | 1.02 | 0.405 | 1.03 | 1.00 | 0.398 | No |
| 149 | 24.44 | 1.35 | 0.62 | 0.73 | 0.93 | 0.413 | 1.02 | 0.406 | 1.03 | 1.00 | 0.399 | No |
| 150 | 24.61 | 1.36 | 0.63 | 0.73 | 0.93 | 0.413 | 1.02 | 0.406 | 1.03 | 1.00 | 0.399 | No |
| 151 | 24.77 | 1.37 | 0.63 | 0.74 | 0.93 | 0.413 | 1.02 | 0.406 | 1.03 | 1.00 | 0.399 | No |
| 152 | 24.93 | 1.38 | 0.64 | 0.74 | 0.93 | 0.414 | 1.02 | 0.406 | 1.03 | 1.00 | 0.399 | No |
| 153 | 25.10 | 1.39 | 0.64 | 0.75 | 0.92 | 0.414 | 1.02 | 0.406 | 1.03 | 1.00 | 0.400 | No |
| 154 | 25.26 | 1.40 | 0.65 | 0.75 | 0.92 | 0.414 | 1.02 | 0.406 | 1.03 | 1.00 | 0.400 | No |
| 155 | 25.43 | 1.41 | 0.65 | 0.76 | 0.92 | 0.414 | 1.02 | 0.406 | 1.03 | 1.00 | 0.400 | No |
| 156 | 25.59 | 1.42 | 0.66 | 0.76 | 0.92 | 0.414 | 1.02 | 0.406 | 1.03 | 1.00 | 0.400 | No |
| 157 | 25.75 | 1.43 | 0.66 | 0.76 | 0.92 | 0.414 | 1.02 | 0.406 | 1.03 | 1.00 | 0.401 | No |
| 158 | 25.92 | 1.44 | 0.67 | 0.77 | 0.92 | 0.414 | 1.02 | 0.407 | 1.03 | 1.00 | 0.401 | No |
| 159 | 26.08 | 1.45 | 0.67 | 0.77 | 0.92 | 0.414 | 1.02 | 0.407 | 1.03 | 1.00 | 0.401 | No |
| 160 | 26.25 | 1.46 | 0.68 | 0.78 | 0.92 | 0.414 | 1.02 | 0.407 | 1.03 | 1.00 | 0.401 | No |
| 161 | 26.41 | 1.47 | 0.68 | 0.78 | 0.92 | 0.414 | 1.02 | 0.407 | 1.03 | 1.00 | 0.402 | No |
| 162 | 26.57 | 1.48 | 0.69 | 0.79 | 0.92 | 0.414 | 1.02 | 0.407 | 1.03 | 1.00 | 0.402 | No |
| 163 | 26.74 | 1.48 | 0.69 | 0.79 | 0.92 | 0.414 | 1.02 | 0.407 | 1.03 | 1.00 | 0.402 | No |
| 164 | 26.90 | 1.49 | 0.70 | 0.80 | 0.92 | 0.415 | 1.02 | 0.407 | 1.03 | 1.00 | 0.402 | No |
| 165 | 27.07 | 1.50 | 0.70 | 0.80 | 0.92 | 0.415 | 1.02 | 0.407 | 1.03 | 1.00 | 0.402 | No |
| 166 | 27.23 | 1.51 | 0.71 | 0.80 | 0.92 | 0.415 | 1.02 | 0.407 | 1.03 | 1.00 | 0.402 | No |
| 167 | 27.39 | 1.52 | 0.71 | 0.81 | 0.92 | 0.415 | 1.02 | 0.407 | 1.03 | 1.00 | 0.403 | No |
| 168 | 27.56 | 1.53 | 0.72 | 0.81 | 0.91 | 0.415 | 1.02 | 0.407 | 1.02 | 1.00 | 0.403 | No |
| 169 | 27.72 | 1.54 | 0.72 | 0.82 | 0.91 | 0.415 | 1.02 | 0.407 | 1.02 | 1.00 | 0.404 | No |
| 170 | 27.89 | 1.55 | 0.73 | 0.82 | 0.91 | 0.415 | 1.02 | 0.407 | 1.02 | 1.00 | 0.404 | No |
| 171 | 28.05 | 1.56 | 0.73 | 0.82 | 0.91 | 0.415 | 1.02 | 0.407 | 1.02 | 1.00 | 0.404 | No |
| 172 | 28.21 | 1.57 | 0.74 | 0.83 | 0.91 | 0.415 | 1.02 | 0.407 | 1.02 | 1.00 | 0.405 | No |
| 173 | 28.38 | 1.58 | 0.75 | 0.83 | 0.91 | 0.415 | 1.02 | 0.408 | 1.02 | 1.00 | 0.405 | No |
| 174 | 28.54 | 1.59 | 0.75 | 0.84 | 0.91 | 0.415 | 1.02 | 0.408 | 1.02 | 1.00 | 0.405 | No |
| 175 | 28.71 | 1.60 | 0.76 | 0.84 | 0.91 | 0.415 | 1.02 | 0.408 | 1.02 | 1.00 | 0.405 | No |
| 176 | 28.87 | 1.61 | 0.76 | 0.85 | 0.91 | 0.415 | 1.02 | 0.408 | 1.02 | 1.00 | 0.405 | No |
| 177 | 29.04 | 1.62 | 0.77 | 0.85 | 0.91 | 0.415 | 1.02 | 0.407 | 1.02 | 1.00 | 0.405 | No |
| 178 | 29.20 | 1.62 | 0.77 | 0.85 | 0.91 | 0.415 | 1.02 | 0.407 | 1.02 | 1.00 | 0.405 | No |
| 179 | 29.36 | 1.63 | 0.78 | 0.86 | 0.91 | 0.415 | 1.02 | 0.407 | 1.02 | 1.00 | 0.406 | No |
| 180 | 29.53 | 1.64 | 0.78 | 0.86 | 0.91 | 0.415 | 1.02 | 0.407 | 1.02 | 1.00 | 0.406 | No |
| 181 | 29.69 | 1.65 | 0.79 | 0.87 | 0.91 | 0.415 | 1.02 | 0.407 | 1.02 | 1.00 | 0.406 | No |
| 182 | 29.86 | 1.66 | 0.79 | 0.87 | 0.90 | 0.415 | 1.02 | 0.407 | 1.02 | 1.00 | 0.407 | No |
| 183 | 30.02 | 1.67 | 0.80 | 0.87 | 0.90 | 0.415 | 1.02 | 0.408 | 1.02 | 1.00 | 0.407 | No |
| 184 | 30.18 | 1.68 | 0.80 | 0.88 | 0.90 | 0.415 | 1.02 | 0.408 | 1.02 | 1.00 | 0.407 | No |
| 185 | 30.35 | 1.69 | 0.81 | 0.88 | 0.90 | 0.415 | 1.02 | 0.408 | 1.01 | 1.00 | 0.408 | No |
| 186 | 30.51 | 1.70 | 0.81 | 0.89 | 0.90 | 0.415 | 1.02 | 0.408 | 1.02 | 1.00 | 0.407 | No |
| 187 | 30.68 | 1.71 | 0.82 | 0.89 | 0.90 | 0.415 | 1.02 | 0.408 | 1.02 | 1.00 | 0.407 | No |
| 188 | 30.84 | 1.72 | 0.82 | 0.90 | 0.90 | 0.415 | 1.02 | 0.408 | 1.02 | 1.00 | 0.407 | No |
| 189 | 31.00 | 1.73 | 0.83 | 0.90 | 0.90 | 0.415 | 1.02 | 0.408 | 1.01 | 1.00 | 0.408 | No |
| 190 | 31.17 | 1.74 | 0.83 | 0.90 | 0.90 | 0.415 | 1.02 | 0.407 | 1.01 | 1.00 | 0.408 | No |
| 191 | 31.33 | 1.75 | 0.84 | 0.91 | 0.90 | 0.415 | 1.02 | 0.407 | 1.01 | 1.00 | 0.408 | No |
| 192 | 31.50 | 1.75 | 0.84 | 0.91 | 0.90 | 0.415 | 1.02 | 0.407 | 1.01 | 1.00 | 0.408 | No |

**:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)**

| Point ID | Depth (ft) | $\sigma_v$ (tsf) | $u_0$ (tsf) | $\sigma_v'$ (tsf) | $r_d$ | CSR | MSF | $CSR_{eq}$ | $K_\sigma$ | User FS | $CSR^*$ | Belongs to transition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 193 | 31.66 | 1.76 | 0.85 | 0.92 | 0.90 | 0.415 | 1.02 | 0.407 | 1.01 | 1.00 | 0.408 | No |
| 194 | 31.82 | 1.77 | 0.85 | 0.92 | 0.90 | 0.415 | 1.02 | 0.407 | 1.01 | 1.00 | 0.408 | No |
| 195 | 31.99 | 1.78 | 0.86 | 0.92 | 0.90 | 0.415 | 1.02 | 0.407 | 1.01 | 1.00 | 0.409 | No |
| 196 | 32.15 | 1.79 | 0.86 | 0.93 | 0.89 | 0.415 | 1.02 | 0.407 | 1.01 | 1.00 | 0.409 | No |
| 197 | 32.32 | 1.80 | 0.87 | 0.93 | 0.89 | 0.415 | 1.02 | 0.407 | 1.01 | 1.00 | 0.409 | No |
| 198 | 32.48 | 1.81 | 0.87 | 0.94 | 0.89 | 0.415 | 1.02 | 0.407 | 1.01 | 1.00 | 0.409 | No |
| 199 | 32.64 | 1.82 | 0.88 | 0.94 | 0.89 | 0.415 | 1.02 | 0.407 | 1.01 | 1.00 | 0.409 | No |
| 200 | 32.81 | 1.83 | 0.88 | 0.94 | 0.89 | 0.415 | 1.02 | 0.407 | 1.01 | 1.00 | 0.409 | No |
| 201 | 32.97 | 1.84 | 0.89 | 0.95 | 0.89 | 0.415 | 1.02 | 0.407 | 1.01 | 1.00 | 0.409 | No |
| 202 | 33.14 | 1.85 | 0.89 | 0.95 | 0.89 | 0.415 | 1.02 | 0.407 | 1.01 | 1.00 | 0.409 | No |
| 203 | 33.30 | 1.86 | 0.90 | 0.96 | 0.89 | 0.415 | 1.02 | 0.407 | 1.01 | 1.00 | 0.409 | No |
| 204 | 33.47 | 1.86 | 0.90 | 0.96 | 0.89 | 0.415 | 1.02 | 0.407 | 1.01 | 1.00 | 0.410 | No |
| 205 | 33.63 | 1.87 | 0.91 | 0.97 | 0.89 | 0.415 | 1.02 | 0.407 | 1.01 | 1.00 | 0.410 | No |
| 206 | 33.79 | 1.88 | 0.91 | 0.97 | 0.89 | 0.414 | 1.02 | 0.407 | 1.01 | 1.00 | 0.409 | No |
| 207 | 33.96 | 1.89 | 0.92 | 0.97 | 0.89 | 0.414 | 1.02 | 0.407 | 1.01 | 1.00 | 0.410 | No |
| 208 | 34.12 | 1.90 | 0.92 | 0.98 | 0.89 | 0.414 | 1.02 | 0.407 | 1.01 | 1.00 | 0.410 | No |
| 209 | 34.28 | 1.91 | 0.93 | 0.98 | 0.88 | 0.414 | 1.02 | 0.406 | 1.01 | 1.00 | 0.410 | No |
| 210 | 34.45 | 1.92 | 0.93 | 0.99 | 0.88 | 0.414 | 1.02 | 0.406 | 1.01 | 1.00 | 0.410 | No |
| 211 | 34.61 | 1.93 | 0.94 | 0.99 | 0.88 | 0.414 | 1.02 | 0.406 | 1.01 | 1.00 | 0.410 | No |
| 212 | 34.78 | 1.94 | 0.94 | 1.00 | 0.88 | 0.414 | 1.02 | 0.406 | 1.01 | 1.00 | 0.410 | No |
| 213 | 34.94 | 1.95 | 0.95 | 1.00 | 0.88 | 0.413 | 1.02 | 0.406 | 1.01 | 1.00 | 0.410 | No |
| 214 | 35.10 | 1.96 | 0.95 | 1.00 | 0.88 | 0.413 | 1.02 | 0.406 | 1.00 | 1.00 | 0.410 | No |
| 215 | 35.27 | 1.97 | 0.96 | 1.01 | 0.88 | 0.413 | 1.02 | 0.406 | 1.00 | 1.00 | 0.410 | No |
| 216 | 35.43 | 1.98 | 0.97 | 1.01 | 0.88 | 0.413 | 1.02 | 0.405 | 1.00 | 1.00 | 0.410 | No |
| 217 | 35.60 | 1.99 | 0.97 | 1.02 | 0.88 | 0.413 | 1.02 | 0.405 | 1.00 | 1.00 | 0.410 | No |
| 218 | 35.76 | 2.00 | 0.98 | 1.02 | 0.88 | 0.413 | 1.02 | 0.405 | 1.00 | 1.00 | 0.410 | No |
| 219 | 35.92 | 2.01 | 0.98 | 1.03 | 0.88 | 0.413 | 1.02 | 0.405 | 1.00 | 1.00 | 0.410 | No |
| 220 | 36.09 | 2.02 | 0.99 | 1.03 | 0.88 | 0.413 | 1.02 | 0.405 | 1.00 | 1.00 | 0.410 | No |
| 221 | 36.25 | 2.02 | 0.99 | 1.03 | 0.88 | 0.412 | 1.02 | 0.405 | 1.00 | 1.00 | 0.410 | No |
| 222 | 36.42 | 2.03 | 1.00 | 1.04 | 0.87 | 0.412 | 1.02 | 0.405 | 1.00 | 1.00 | 0.410 | No |
| 223 | 36.58 | 2.04 | 1.00 | 1.04 | 0.87 | 0.412 | 1.02 | 0.404 | 1.00 | 1.00 | 0.410 | No |
| 224 | 36.74 | 2.05 | 1.01 | 1.05 | 0.87 | 0.412 | 1.02 | 0.404 | 1.00 | 1.00 | 0.410 | No |
| 225 | 36.91 | 2.06 | 1.01 | 1.05 | 0.87 | 0.412 | 1.02 | 0.404 | 1.00 | 1.00 | 0.410 | No |
| 226 | 37.07 | 2.07 | 1.02 | 1.05 | 0.87 | 0.412 | 1.02 | 0.404 | 1.00 | 1.00 | 0.410 | No |
| 227 | 37.24 | 2.08 | 1.02 | 1.06 | 0.87 | 0.412 | 1.02 | 0.404 | 1.00 | 1.00 | 0.410 | No |
| 228 | 37.40 | 2.09 | 1.03 | 1.06 | 0.87 | 0.412 | 1.02 | 0.404 | 1.00 | 1.00 | 0.410 | No |
| 229 | 37.57 | 2.10 | 1.03 | 1.07 | 0.87 | 0.411 | 1.02 | 0.404 | 1.00 | 1.00 | 0.410 | No |
| 230 | 37.73 | 2.11 | 1.04 | 1.07 | 0.87 | 0.411 | 1.02 | 0.404 | 1.00 | 1.00 | 0.410 | No |
| 231 | 37.89 | 2.12 | 1.04 | 1.08 | 0.87 | 0.411 | 1.02 | 0.403 | 1.00 | 1.00 | 0.410 | No |
| 232 | 38.06 | 2.13 | 1.05 | 1.08 | 0.87 | 0.411 | 1.02 | 0.403 | 1.00 | 1.00 | 0.410 | No |
| 233 | 38.22 | 2.14 | 1.05 | 1.08 | 0.87 | 0.411 | 1.02 | 0.403 | 1.00 | 1.00 | 0.410 | No |
| 234 | 38.39 | 2.14 | 1.06 | 1.09 | 0.87 | 0.411 | 1.02 | 0.403 | 1.00 | 1.00 | 0.410 | No |
| 235 | 38.55 | 2.15 | 1.06 | 1.09 | 0.87 | 0.411 | 1.02 | 0.403 | 1.00 | 1.00 | 0.410 | No |
| 236 | 38.71 | 2.16 | 1.07 | 1.10 | 0.86 | 0.410 | 1.02 | 0.403 | 1.00 | 1.00 | 0.410 | No |
| 237 | 38.88 | 2.17 | 1.07 | 1.10 | 0.86 | 0.410 | 1.02 | 0.403 | 1.00 | 1.00 | 0.410 | No |
| 238 | 39.04 | 2.18 | 1.08 | 1.10 | 0.86 | 0.410 | 1.02 | 0.403 | 1.00 | 1.00 | 0.410 | No |
| 239 | 39.21 | 2.19 | 1.08 | 1.11 | 0.86 | 0.410 | 1.02 | 0.402 | 1.00 | 1.00 | 0.410 | No |
| 240 | 39.37 | 2.20 | 1.09 | 1.11 | 0.86 | 0.410 | 1.02 | 0.402 | 1.00 | 1.00 | 0.410 | No |

**:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)**

| Point ID | Depth (ft) | $\sigma_v$ (tsf) | $u_0$ (tsf) | $\sigma_v'$ (tsf) | $r_d$ | CSR | MSF | $CSR_{eq}$ | $K_\sigma$ | User FS | $CSR^*$ | Belongs to transition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 241 | 39.53 | 2.21 | 1.09 | 1.12 | 0.86 | 0.410 | 1.02 | 0.402 | 1.00 | 1.00 | 0.410 | No |
| 242 | 39.70 | 2.22 | 1.10 | 1.12 | 0.86 | 0.409 | 1.02 | 0.402 | 0.99 | 1.00 | 0.410 | No |
| 243 | 39.86 | 2.23 | 1.10 | 1.12 | 0.86 | 0.409 | 1.02 | 0.402 | 0.99 | 1.00 | 0.410 | No |
| 244 | 40.03 | 2.24 | 1.11 | 1.13 | 0.86 | 0.409 | 1.02 | 0.401 | 0.99 | 1.00 | 0.409 | No |
| 245 | 40.19 | 2.25 | 1.11 | 1.13 | 0.86 | 0.409 | 1.02 | 0.401 | 0.99 | 1.00 | 0.409 | No |
| 246 | 40.35 | 2.26 | 1.12 | 1.14 | 0.86 | 0.408 | 1.02 | 0.401 | 0.99 | 1.00 | 0.409 | No |
| 247 | 40.52 | 2.27 | 1.12 | 1.14 | 0.86 | 0.408 | 1.02 | 0.401 | 0.99 | 1.00 | 0.409 | No |
| 248 | 40.68 | 2.28 | 1.13 | 1.15 | 0.86 | 0.408 | 1.02 | 0.400 | 0.99 | 1.00 | 0.409 | No |
| 249 | 40.85 | 2.29 | 1.13 | 1.15 | 0.85 | 0.407 | 1.02 | 0.400 | 0.99 | 1.00 | 0.409 | No |
| 250 | 41.01 | 2.30 | 1.14 | 1.16 | 0.85 | 0.407 | 1.02 | 0.400 | 0.99 | 1.00 | 0.408 | No |
| 251 | 41.17 | 2.31 | 1.14 | 1.16 | 0.85 | 0.407 | 1.02 | 0.399 | 0.98 | 1.00 | 0.406 | No |
| 252 | 41.34 | 2.32 | 1.15 | 1.17 | 0.85 | 0.406 | 1.02 | 0.399 | 0.98 | 1.00 | 0.405 | No |
| 253 | 41.50 | 2.33 | 1.15 | 1.18 | 0.85 | 0.406 | 1.02 | 0.398 | 0.98 | 1.00 | 0.406 | No |
| 254 | 41.67 | 2.34 | 1.16 | 1.18 | 0.85 | 0.405 | 1.02 | 0.398 | 0.99 | 1.00 | 0.407 | No |
| 255 | 41.83 | 2.35 | 1.16 | 1.19 | 0.85 | 0.405 | 1.02 | 0.397 | 0.97 | 1.00 | 0.408 | No |
| 256 | 41.99 | 2.36 | 1.17 | 1.19 | 0.85 | 0.405 | 1.02 | 0.397 | 0.96 | 1.00 | 0.408 | No |
| 257 | 42.16 | 2.37 | 1.17 | 1.20 | 0.85 | 0.404 | 1.02 | 0.397 | 0.96 | 1.00 | 0.408 | No |

**Abbreviations**

Depth: Depth from free surface, at which CPT was performed (ft)
$\sigma_v$: Total overburden pressure at test point (tsf)
$u_0$: Water pressure at test point (tsf)
$\sigma_v'$: Effective overburden pressure based on GWT during earthquake (tsf)
$r_d$: Nonlinear shear mass factor
CSR: Cyclic Stress Ratio
MSF: Magnitude Scaling Factor
$CSR_{eq}$: CSR adjusted for M=7.5
$K_\sigma$: Effective overburden stress factor
$CSR^*$: CSR fully adjusted

**:: Cyclic Resistance Ratio (CRR) calculation data ::**

| Point ID | Depth (ft) | $q_t$ (tsf) | FC (%) | Ic | m | $C_N$ | $q_{c1N}$ | $\Delta q_{c1N}$ | $q_{c1N,cs}$ | $CRR_{7.5}$ | Belongs to trans. layer | Clay-like behaviour | FS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.16 | 13.93 | 100.00 | 3.00 | 0.55 | 1.70 | 19.89 | 0.00 | 19.89 | 4.000 | No | Yes | 2.00 |
| 2 | 0.33 | 14.08 | 100.00 | 3.04 | 0.52 | 1.70 | 27.26 | 0.00 | 27.26 | 4.000 | No | Yes | 2.00 |
| 3 | 0.49 | 20.67 | 87.56 | 2.81 | 0.55 | 1.70 | 20.66 | 0.00 | 20.66 | 4.000 | No | Yes | 2.00 |
| 4 | 0.66 | 27.31 | 75.17 | 2.65 | 0.46 | 1.70 | 51.62 | 0.00 | 51.62 | 4.000 | No | Yes | 2.00 |
| 5 | 0.82 | 51.61 | 45.87 | 2.29 | 0.46 | 1.70 | 59.32 | 59.74 | 119.06 | 4.000 | No | No | 2.00 |
| 6 | 0.98 | 90.60 | 23.79 | 2.01 | 0.34 | 1.70 | 137.75 | 51.61 | 189.36 | 4.000 | No | No | 2.00 |
| 7 | 1.15 | 120.71 | 13.12 | 1.88 | 0.26 | 1.70 | 239.57 | 25.87 | 265.44 | 4.000 | No | No | 2.00 |
| 8 | 1.31 | 127.09 | 14.06 | 1.89 | 0.29 | 1.70 | 204.41 | 27.78 | 232.19 | 4.000 | No | No | 2.00 |
| 9 | 1.48 | 101.86 | 26.21 | 2.04 | 0.29 | 1.70 | 168.49 | 62.23 | 230.72 | 4.000 | No | No | 2.00 |
| 10 | 1.64 | 75.60 | 39.62 | 2.21 | 0.35 | 1.70 | 117.96 | 70.06 | 188.02 | 4.000 | No | No | 2.00 |
| 11 | 1.80 | 53.00 | 53.52 | 2.38 | 0.41 | 1.70 | 77.83 | 68.17 | 146.00 | 4.000 | No | No | 2.00 |
| 12 | 1.97 | 39.56 | 62.73 | 2.50 | 0.45 | 1.70 | 59.62 | 66.21 | 125.84 | 4.000 | No | No | 2.00 |
| 13 | 2.13 | 33.30 | 65.80 | 2.53 | 0.46 | 1.70 | 53.21 | 65.17 | 118.38 | 4.000 | No | No | 2.00 |
| 14 | 2.30 | 30.70 | 66.25 | 2.54 | 0.47 | 1.70 | 47.77 | 63.71 | 111.48 | 4.000 | No | No | 2.00 |
| 15 | 2.46 | 31.06 | 63.98 | 2.51 | 0.48 | 1.70 | 47.15 | 62.99 | 110.15 | 4.000 | No | No | 2.00 |
| 16 | 2.63 | 30.95 | 62.30 | 2.49 | 0.46 | 1.70 | 54.98 | 64.78 | 119.76 | 4.000 | No | No | 2.00 |
| 17 | 2.79 | 35.45 | 52.43 | 2.37 | 0.48 | 1.70 | 47.20 | 59.47 | 106.67 | 4.000 | No | No | 2.00 |
| 18 | 2.95 | 41.33 | 40.16 | 2.21 | 0.44 | 1.70 | 68.80 | 58.64 | 127.43 | 4.000 | No | No | 2.00 |
| 19 | 3.12 | 46.86 | 28.42 | 2.07 | 0.43 | 1.70 | 83.29 | 50.04 | 133.33 | 4.000 | No | No | 2.00 |
| 20 | 3.28 | 44.63 | 26.42 | 2.04 | 0.46 | 1.70 | 73.79 | 45.34 | 119.13 | 4.000 | No | No | 2.00 |
| 21 | 3.44 | 35.25 | 35.43 | 2.16 | 0.48 | 1.70 | 58.06 | 52.44 | 110.51 | 4.000 | No | No | 2.00 |
| 22 | 3.61 | 25.31 | 51.19 | 2.35 | 0.51 | 1.70 | 38.08 | 56.55 | 94.63 | 4.000 | No | No | 2.00 |
| 23 | 3.77 | 17.51 | 67.28 | 2.55 | 0.54 | 1.70 | 25.85 | 57.62 | 83.47 | 4.000 | No | No | 2.00 |
| 24 | 3.94 | 13.02 | 80.11 | 2.71 | 0.55 | 1.70 | 20.45 | 0.00 | 20.45 | 4.000 | No | Yes | 2.00 |
| 25 | 4.10 | 10.76 | 87.69 | 2.81 | 0.56 | 1.70 | 16.42 | 0.00 | 16.42 | 4.000 | No | Yes | 2.00 |
| 26 | 4.26 | 9.36 | 94.61 | 2.90 | 0.57 | 1.70 | 14.93 | 0.00 | 14.93 | 4.000 | No | Yes | 2.00 |
| 27 | 4.43 | 8.44 | 100.00 | 2.97 | 0.57 | 1.70 | 13.72 | 0.00 | 13.72 | 4.000 | No | Yes | 2.00 |
| 28 | 4.59 | 8.17 | 100.00 | 2.99 | 0.57 | 1.70 | 12.00 | 0.00 | 12.00 | 1.516 | No | Yes | 2.00 |
| 29 | 4.76 | 8.58 | 99.34 | 2.95 | 0.57 | 1.70 | 13.64 | 0.00 | 13.64 | 1.573 | No | Yes | 2.00 |
| 30 | 4.92 | 9.09 | 95.47 | 2.91 | 0.56 | 1.70 | 15.76 | 0.00 | 15.76 | 1.644 | No | Yes | 2.00 |
| 31 | 5.08 | 8.71 | 96.93 | 2.92 | 0.57 | 1.70 | 14.44 | 0.00 | 14.44 | 1.553 | No | Yes | 2.00 |
| 32 | 5.25 | 7.86 | 100.00 | 2.98 | 0.58 | 1.70 | 11.86 | 0.00 | 11.86 | 1.377 | No | Yes | 2.00 |
| 33 | 5.41 | 7.24 | 100.00 | 3.06 | 0.58 | 1.70 | 11.63 | 0.00 | 11.63 | 1.245 | No | Yes | 2.00 |
| 34 | 5.58 | 7.00 | 100.00 | 3.10 | 0.58 | 1.70 | 11.36 | 0.00 | 11.36 | 1.186 | No | Yes | 2.00 |
| 35 | 5.74 | 6.22 | 100.00 | 3.18 | 0.58 | 1.70 | 10.67 | 0.00 | 10.67 | 1.032 | No | Yes | 2.00 |
| 36 | 5.91 | 5.14 | 100.00 | 3.27 | 0.59 | 1.70 | 7.90 | 0.00 | 7.90 | 0.832 | No | Yes | 2.00 |
| 37 | 6.07 | 3.96 | 100.00 | 3.37 | 0.60 | 1.70 | 6.25 | 0.00 | 6.25 | 0.619 | No | Yes | 2.00 |
| 38 | 6.23 | 3.36 | 100.00 | 3.39 | 0.60 | 1.70 | 5.00 | 0.00 | 5.00 | 0.510 | No | Yes | 2.00 |
| 39 | 6.40 | 3.08 | 100.00 | 3.39 | 0.60 | 1.70 | 5.00 | 0.00 | 5.00 | 0.457 | No | Yes | 1.77 |
| 40 | 6.56 | 3.19 | 100.00 | 3.40 | 0.60 | 1.70 | 4.87 | 0.00 | 4.87 | 0.469 | No | Yes | 1.79 |
| 41 | 6.73 | 3.80 | 100.00 | 3.37 | 0.60 | 1.70 | 5.49 | 0.00 | 5.49 | 0.564 | No | Yes | 2.00 |
| 42 | 6.89 | 5.20 | 100.00 | 3.27 | 0.59 | 1.70 | 7.94 | 0.00 | 7.94 | 0.783 | No | Yes | 2.00 |
| 43 | 7.05 | 7.08 | 100.00 | 3.15 | 0.58 | 1.70 | 11.58 | 0.00 | 11.58 | 1.075 | No | Yes | 2.00 |
| 44 | 7.22 | 8.87 | 100.00 | 3.06 | 0.57 | 1.70 | 14.54 | 0.00 | 14.54 | 1.346 | No | Yes | 2.00 |
| 45 | 7.38 | 10.18 | 100.00 | 3.01 | 0.56 | 1.70 | 16.56 | 0.00 | 16.56 | 1.534 | No | Yes | 2.00 |
| 46 | 7.55 | 10.86 | 100.00 | 2.99 | 0.55 | 1.70 | 17.93 | 0.00 | 17.93 | 1.618 | No | Yes | 2.00 |
| 47 | 7.71 | 10.97 | 100.00 | 2.99 | 0.55 | 1.70 | 17.82 | 0.00 | 17.82 | 1.614 | No | Yes | 2.00 |
| 48 | 7.87 | 10.75 | 100.00 | 2.99 | 0.56 | 1.70 | 17.13 | 0.00 | 17.13 | 1.560 | No | Yes | 2.00 |

**:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)**

| Point ID | Depth (ft) | $q_t$ (tsf) | FC (%) | Ic | m | $C_N$ | $q_{c1N}$ | $\Delta q_{c1N}$ | $q_{c1N,cs}$ | $CRR_{7.5}$ | Belongs to trans. layer | Clay-like behaviour | FS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 49 | 8.04 | 10.61 | 100.00 | 2.98 | 0.56 | 1.70 | 16.87 | 0.00 | 16.87 | 1.521 | No | Yes | 2.00 |
| 50 | 8.20 | 10.84 | 100.00 | 2.96 | 0.56 | 1.70 | 17.14 | 0.00 | 17.14 | 1.535 | No | Yes | 2.00 |
| 51 | 8.37 | 11.10 | 99.15 | 2.95 | 0.55 | 1.70 | 18.17 | 0.00 | 18.17 | 1.554 | No | Yes | 2.00 |
| 52 | 8.53 | 11.31 | 98.94 | 2.95 | 0.55 | 1.70 | 18.12 | 0.00 | 18.12 | 1.565 | No | Yes | 2.00 |
| 53 | 8.69 | 11.37 | 98.72 | 2.95 | 0.55 | 1.70 | 18.12 | 0.00 | 18.12 | 1.554 | No | Yes | 2.00 |
| 54 | 8.86 | 11.46 | 97.79 | 2.93 | 0.55 | 1.70 | 18.43 | 0.00 | 18.43 | 1.550 | No | Yes | 2.00 |
| 55 | 9.02 | 11.34 | 97.37 | 2.93 | 0.55 | 1.70 | 18.60 | 0.00 | 18.60 | 1.513 | No | Yes | 2.00 |
| 56 | 9.19 | 10.96 | 98.50 | 2.94 | 0.55 | 1.70 | 17.50 | 0.00 | 17.50 | 1.445 | No | Yes | 2.00 |
| 57 | 9.35 | 10.53 | 99.56 | 2.96 | 0.56 | 1.70 | 16.60 | 0.00 | 16.60 | 1.369 | No | Yes | 2.00 |
| 58 | 9.51 | 10.65 | 98.39 | 2.94 | 0.56 | 1.70 | 16.45 | 0.00 | 16.45 | 1.369 | No | Yes | 2.00 |
| 59 | 9.68 | 11.36 | 94.05 | 2.89 | 0.55 | 1.70 | 18.01 | 0.00 | 18.01 | 1.449 | No | Yes | 2.00 |
| 60 | 9.84 | 12.34 | 88.18 | 2.81 | 0.55 | 1.70 | 20.00 | 0.00 | 20.00 | 1.564 | No | Yes | 2.00 |
| 61 | 10.01 | 13.43 | 80.34 | 2.72 | 0.55 | 1.70 | 21.16 | 0.00 | 21.16 | 1.690 | No | Yes | 2.00 |
| 62 | 10.17 | 13.74 | 77.18 | 2.68 | 0.54 | 1.70 | 23.18 | 0.00 | 23.18 | 1.714 | No | Yes | 2.00 |
| 63 | 10.34 | 13.66 | 77.81 | 2.69 | 0.55 | 1.70 | 21.46 | 0.00 | 21.46 | 1.686 | No | Yes | 2.00 |
| 64 | 10.50 | 13.59 | 80.97 | 2.72 | 0.55 | 1.70 | 20.71 | 0.00 | 20.71 | 1.660 | No | Yes | 2.00 |
| 65 | 10.66 | 14.20 | 80.52 | 2.72 | 0.54 | 1.68 | 22.54 | 0.00 | 22.54 | 1.720 | No | Yes | 2.00 |
| 66 | 10.83 | 14.94 | 79.47 | 2.71 | 0.54 | 1.66 | 23.85 | 0.00 | 23.85 | 1.795 | No | Yes | 2.00 |
| 67 | 10.99 | 15.06 | 80.70 | 2.72 | 0.54 | 1.66 | 23.64 | 0.00 | 23.64 | 1.791 | No | Yes | 2.00 |
| 68 | 11.15 | 14.46 | 83.46 | 2.76 | 0.54 | 1.65 | 22.70 | 0.00 | 22.70 | 1.699 | No | Yes | 2.00 |
| 69 | 11.32 | 13.90 | 84.29 | 2.77 | 0.55 | 1.65 | 20.87 | 0.00 | 20.87 | 1.614 | No | Yes | 2.00 |
| 70 | 11.48 | 13.64 | 82.18 | 2.74 | 0.55 | 1.64 | 20.86 | 0.00 | 20.86 | 1.566 | No | Yes | 2.00 |
| 71 | 11.65 | 13.66 | 80.48 | 2.72 | 0.55 | 1.64 | 21.27 | 0.00 | 21.27 | 1.555 | No | Yes | 2.00 |
| 72 | 11.81 | 13.64 | 81.24 | 2.73 | 0.55 | 1.63 | 20.70 | 0.00 | 20.70 | 1.537 | No | Yes | 2.00 |
| 73 | 11.97 | 13.56 | 83.87 | 2.76 | 0.55 | 1.62 | 20.46 | 0.00 | 20.46 | 1.513 | No | Yes | 2.00 |
| 74 | 12.14 | 13.56 | 85.28 | 2.78 | 0.55 | 1.61 | 20.59 | 0.00 | 20.59 | 1.498 | No | Yes | 2.00 |
| 75 | 12.30 | 13.42 | 86.45 | 2.79 | 0.55 | 1.60 | 20.42 | 0.00 | 20.42 | 1.467 | No | Yes | 2.00 |
| 76 | 12.47 | 13.37 | 86.27 | 2.79 | 0.55 | 1.60 | 19.61 | 0.00 | 19.61 | 1.448 | No | Yes | 2.00 |
| 77 | 12.63 | 13.12 | 86.69 | 2.80 | 0.55 | 1.59 | 20.14 | 0.00 | 20.14 | 1.406 | No | Yes | 2.00 |
| 78 | 12.79 | 12.76 | 87.81 | 2.81 | 0.55 | 1.59 | 19.09 | 0.00 | 19.09 | 1.352 | No | Yes | 2.00 |
| 79 | 12.96 | 11.94 | 91.18 | 2.85 | 0.56 | 1.59 | 17.77 | 0.00 | 17.77 | 1.249 | No | Yes | 2.00 |
| 80 | 13.12 | 11.14 | 94.73 | 2.90 | 0.56 | 1.58 | 16.41 | 0.00 | 16.41 | 1.149 | No | Yes | 2.00 |
| 81 | 13.29 | 10.80 | 95.47 | 2.91 | 0.56 | 1.58 | 15.39 | 0.00 | 15.39 | 1.101 | No | Yes | 2.00 |
| 82 | 13.45 | 10.83 | 94.60 | 2.90 | 0.56 | 1.57 | 16.10 | 0.00 | 16.10 | 1.095 | No | Yes | 2.00 |
| 83 | 13.62 | 11.11 | 92.77 | 2.87 | 0.56 | 1.56 | 16.33 | 0.00 | 16.33 | 1.115 | No | Yes | 2.00 |
| 84 | 13.78 | 11.29 | 92.54 | 2.87 | 0.56 | 1.56 | 16.33 | 0.00 | 16.33 | 1.124 | No | Yes | 2.00 |
| 85 | 13.94 | 11.40 | 92.41 | 2.87 | 0.56 | 1.55 | 16.65 | 0.00 | 16.65 | 1.126 | No | Yes | 2.00 |
| 86 | 14.11 | 11.46 | 92.57 | 2.87 | 0.56 | 1.54 | 16.58 | 0.00 | 16.58 | 1.122 | No | Yes | 2.00 |
| 87 | 14.27 | 11.36 | 93.54 | 2.88 | 0.56 | 1.53 | 16.38 | 0.00 | 16.38 | 1.102 | No | Yes | 2.00 |
| 88 | 14.44 | 11.10 | 95.92 | 2.91 | 0.56 | 1.53 | 16.02 | 0.00 | 16.02 | 1.066 | No | Yes | 2.00 |
| 89 | 14.60 | 10.89 | 95.39 | 2.90 | 0.56 | 1.52 | 15.32 | 0.00 | 15.32 | 1.035 | No | Yes | 2.00 |
| 90 | 14.76 | 10.89 | 96.99 | 2.92 | 0.56 | 1.52 | 15.30 | 0.00 | 15.30 | 1.026 | No | Yes | 2.00 |
| 91 | 14.93 | 11.16 | 95.85 | 2.91 | 0.56 | 1.51 | 15.85 | 0.00 | 15.85 | 1.044 | No | Yes | 2.00 |
| 92 | 15.09 | 8.59 | 100.00 | 3.11 | 0.56 | 1.50 | 16.22 | 0.00 | 16.22 | 0.778 | No | Yes | 2.00 |
| 93 | 15.26 | 8.10 | 100.00 | 3.12 | 0.61 | 1.54 | 4.29 | 0.00 | 4.29 | 0.722 | No | Yes | 2.00 |
| 94 | 15.42 | 7.67 | 100.00 | 3.14 | 0.57 | 1.50 | 13.66 | 0.00 | 13.66 | 0.673 | No | Yes | 1.87 |
| 95 | 15.58 | 10.03 | 98.44 | 2.94 | 0.57 | 1.49 | 14.26 | 0.00 | 14.26 | 0.899 | No | Yes | 2.00 |
| 96 | 15.75 | 10.24 | 97.05 | 2.93 | 0.57 | 1.48 | 14.09 | 0.00 | 14.09 | 0.913 | No | Yes | 2.00 |

**:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)**

| Point ID | Depth (ft) | $q_t$ (tsf) | FC (%) | Ic | m | $C_N$ | $q_{c1N}$ | $\Delta q_{c1N}$ | $q_{c1N,cs}$ | $CRR_{7.5}$ | Belongs to trans. layer | Clay-like behaviour | FS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 97 | 15.91 | 10.64 | 95.47 | 2.91 | 0.57 | 1.48 | 14.34 | 0.00 | 14.34 | 0.944 | No | Yes | 2.00 |
| 98 | 16.08 | 11.46 | 92.41 | 2.87 | 0.56 | 1.47 | 15.67 | 0.00 | 15.67 | 1.016 | No | Yes | 2.00 |
| 99 | 16.24 | 12.42 | 88.49 | 2.82 | 0.56 | 1.46 | 17.23 | 0.00 | 17.23 | 1.099 | No | Yes | 2.00 |
| 100 | 16.40 | 12.95 | 86.09 | 2.79 | 0.56 | 1.45 | 17.98 | 0.00 | 17.98 | 1.140 | No | Yes | 2.00 |
| 101 | 16.57 | 13.12 | 84.53 | 2.77 | 0.56 | 1.45 | 17.61 | 0.00 | 17.61 | 1.147 | No | Yes | 2.00 |
| 102 | 16.73 | 13.08 | 84.43 | 2.77 | 0.56 | 1.44 | 17.69 | 0.00 | 17.69 | 1.134 | No | Yes | 2.00 |
| 103 | 16.90 | 13.07 | 84.93 | 2.77 | 0.56 | 1.43 | 17.60 | 0.00 | 17.60 | 1.125 | No | Yes | 2.00 |
| 104 | 17.06 | 13.22 | 85.05 | 2.78 | 0.56 | 1.43 | 17.37 | 0.00 | 17.37 | 1.130 | No | Yes | 2.00 |
| 105 | 17.22 | 13.80 | 82.59 | 2.74 | 0.56 | 1.42 | 18.06 | 0.00 | 18.06 | 1.175 | No | Yes | 2.00 |
| 106 | 17.39 | 13.43 | 82.62 | 2.75 | 0.55 | 1.41 | 19.66 | 0.00 | 19.66 | 1.132 | No | Yes | 2.00 |
| 107 | 17.55 | 12.44 | 84.55 | 2.77 | 0.56 | 1.42 | 15.79 | 0.00 | 15.79 | 1.034 | No | Yes | 2.00 |
| 108 | 17.72 | 10.82 | 90.72 | 2.85 | 0.57 | 1.42 | 14.02 | 0.00 | 14.02 | 0.882 | No | Yes | 2.00 |
| 109 | 17.88 | 10.18 | 93.14 | 2.88 | 0.57 | 1.41 | 13.23 | 0.00 | 13.23 | 0.818 | No | Yes | 2.00 |
| 110 | 18.05 | 9.86 | 94.07 | 2.89 | 0.57 | 1.41 | 13.08 | 0.00 | 13.08 | 0.784 | No | Yes | 2.00 |
| 111 | 18.21 | 9.27 | 96.17 | 2.91 | 0.57 | 1.41 | 12.64 | 0.00 | 12.64 | 0.727 | No | Yes | 1.93 |
| 112 | 18.37 | 8.54 | 100.00 | 2.97 | 0.58 | 1.41 | 10.85 | 0.00 | 10.85 | 0.658 | No | Yes | 1.74 |
| 113 | 18.54 | 8.86 | 99.55 | 2.96 | 0.58 | 1.40 | 10.14 | 0.00 | 10.14 | 0.681 | No | Yes | 1.80 |
| 114 | 18.70 | 9.86 | 95.63 | 2.91 | 0.57 | 1.39 | 13.74 | 0.00 | 13.74 | 0.762 | No | Yes | 2.00 |
| 115 | 18.86 | 11.12 | 89.98 | 2.84 | 0.57 | 1.38 | 14.51 | 0.00 | 14.51 | 0.865 | No | Yes | 2.00 |
| 116 | 19.03 | 11.34 | 89.00 | 2.83 | 0.57 | 1.38 | 14.82 | 0.00 | 14.82 | 0.878 | No | Yes | 2.00 |
| 117 | 19.19 | 11.46 | 87.72 | 2.81 | 0.57 | 1.37 | 14.45 | 0.00 | 14.45 | 0.882 | No | Yes | 2.00 |
| 118 | 19.36 | 11.45 | 87.14 | 2.80 | 0.57 | 1.37 | 14.79 | 0.00 | 14.79 | 0.875 | No | Yes | 2.00 |
| 119 | 19.52 | 11.05 | 87.80 | 2.81 | 0.57 | 1.36 | 14.64 | 0.00 | 14.64 | 0.836 | No | Yes | 2.00 |
| 120 | 19.68 | 10.02 | 91.11 | 2.85 | 0.57 | 1.36 | 12.79 | 0.00 | 12.79 | 0.744 | No | Yes | 1.94 |
| 121 | 19.85 | 8.78 | 97.65 | 2.93 | 0.58 | 1.36 | 10.77 | 0.00 | 10.77 | 0.636 | No | Yes | 1.65 |
| 122 | 20.01 | 8.66 | 98.61 | 2.95 | 0.58 | 1.36 | 9.84 | 0.00 | 9.84 | 0.622 | No | Yes | 1.61 |
| 123 | 20.18 | 9.42 | 96.42 | 2.92 | 0.57 | 1.35 | 12.20 | 0.00 | 12.20 | 0.680 | No | Yes | 1.76 |
| 124 | 20.34 | 11.00 | 90.68 | 2.85 | 0.57 | 1.34 | 13.48 | 0.00 | 13.48 | 0.804 | No | Yes | 2.00 |
| 125 | 20.50 | 12.44 | 86.78 | 2.80 | 0.56 | 1.33 | 15.62 | 0.00 | 15.62 | 0.915 | No | Yes | 2.00 |
| 126 | 20.67 | 13.98 | 82.66 | 2.75 | 0.56 | 1.33 | 17.37 | 0.00 | 17.37 | 1.033 | No | Yes | 2.00 |
| 127 | 20.83 | 15.14 | 79.21 | 2.70 | 0.56 | 1.32 | 18.95 | 0.00 | 18.95 | 1.119 | No | Yes | 2.00 |
| 128 | 21.00 | 15.01 | 79.54 | 2.71 | 0.55 | 1.31 | 19.66 | 0.00 | 19.66 | 1.102 | No | Yes | 2.00 |
| 129 | 21.16 | 13.78 | 83.23 | 2.75 | 0.56 | 1.31 | 16.77 | 0.00 | 16.77 | 0.997 | No | Yes | 2.00 |
| 130 | 21.32 | 12.44 | 89.72 | 2.83 | 0.57 | 1.31 | 14.35 | 0.00 | 14.35 | 0.885 | No | Yes | 2.00 |
| 131 | 21.49 | 12.61 | 90.67 | 2.85 | 0.57 | 1.31 | 14.63 | 0.00 | 14.63 | 0.892 | No | Yes | 2.00 |
| 132 | 21.65 | 13.87 | 87.80 | 2.81 | 0.56 | 1.30 | 17.17 | 0.00 | 17.17 | 0.984 | No | Yes | 2.00 |
| 133 | 21.82 | 15.01 | 84.11 | 2.76 | 0.55 | 1.29 | 18.69 | 0.00 | 18.69 | 1.066 | No | Yes | 2.00 |
| 134 | 21.98 | 15.41 | 82.10 | 2.74 | 0.56 | 1.29 | 18.54 | 0.00 | 18.54 | 1.089 | No | Yes | 2.00 |
| 135 | 22.15 | 15.21 | 81.45 | 2.73 | 0.56 | 1.29 | 18.39 | 0.00 | 18.39 | 1.067 | No | Yes | 2.00 |
| 136 | 22.31 | 15.10 | 80.92 | 2.72 | 0.56 | 1.28 | 17.83 | 0.00 | 17.83 | 1.052 | No | Yes | 2.00 |
| 137 | 22.47 | 15.16 | 81.60 | 2.73 | 0.56 | 1.28 | 17.95 | 0.00 | 17.95 | 1.050 | No | Yes | 2.00 |
| 138 | 22.64 | 15.56 | 82.75 | 2.75 | 0.56 | 1.27 | 18.38 | 0.00 | 18.38 | 1.073 | No | Yes | 2.00 |
| 139 | 22.80 | 15.89 | 84.20 | 2.76 | 0.55 | 1.27 | 19.04 | 0.00 | 19.04 | 1.091 | No | Yes | 2.00 |
| 140 | 22.97 | 15.91 | 85.49 | 2.78 | 0.55 | 1.26 | 18.91 | 0.00 | 18.91 | 1.085 | No | Yes | 2.00 |
| 141 | 23.13 | 15.49 | 86.60 | 2.79 | 0.56 | 1.26 | 18.27 | 0.00 | 18.27 | 1.047 | No | Yes | 2.00 |
| 142 | 23.29 | 14.91 | 87.46 | 2.81 | 0.56 | 1.26 | 17.42 | 0.00 | 17.42 | 0.998 | No | Yes | 2.00 |
| 143 | 23.46 | 14.52 | 88.57 | 2.82 | 0.56 | 1.25 | 16.72 | 0.00 | 16.72 | 0.964 | No | Yes | 2.00 |
| 144 | 23.62 | 14.38 | 89.40 | 2.83 | 0.56 | 1.25 | 16.73 | 0.00 | 16.73 | 0.947 | No | Yes | 2.00 |

**:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)**

| Point ID | Depth (ft) | $q_t$ (tsf) | FC (%) | Ic | m | $C_N$ | $q_{c1N}$ | $\Delta q_{c1N}$ | $q_{c1N,cs}$ | $CRR_{7.5}$ | Belongs to trans. layer | Clay-like behaviour | FS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 145 | 23.79 | 14.49 | 90.19 | 2.84 | 0.56 | 1.25 | 16.76 | 0.00 | 16.76 | 0.949 | No | Yes | 2.00 |
| 146 | 23.95 | 14.57 | 90.84 | 2.85 | 0.56 | 1.24 | 16.93 | 0.00 | 16.93 | 0.949 | No | Yes | 2.00 |
| 147 | 24.11 | 14.72 | 91.22 | 2.85 | 0.56 | 1.24 | 16.85 | 0.00 | 16.85 | 0.953 | No | Yes | 2.00 |
| 148 | 24.28 | 14.88 | 91.65 | 2.86 | 0.56 | 1.23 | 17.13 | 0.00 | 17.13 | 0.959 | No | Yes | 2.00 |
| 149 | 24.44 | 15.16 | 91.64 | 2.86 | 0.56 | 1.23 | 17.34 | 0.00 | 17.34 | 0.972 | No | Yes | 2.00 |
| 150 | 24.61 | 15.41 | 92.55 | 2.87 | 0.56 | 1.23 | 17.64 | 0.00 | 17.64 | 0.984 | No | Yes | 2.00 |
| 151 | 24.77 | 15.96 | 92.76 | 2.87 | 0.56 | 1.22 | 17.82 | 0.00 | 17.82 | 1.016 | No | Yes | 2.00 |
| 152 | 24.93 | 16.51 | 92.74 | 2.87 | 0.55 | 1.22 | 19.02 | 0.00 | 19.02 | 1.048 | No | Yes | 2.00 |
| 153 | 25.10 | 17.27 | 91.72 | 2.86 | 0.55 | 1.21 | 19.34 | 0.00 | 19.34 | 1.093 | No | Yes | 2.00 |
| 154 | 25.26 | 17.69 | 91.28 | 2.85 | 0.55 | 1.21 | 20.20 | 0.00 | 20.20 | 1.115 | No | Yes | 2.00 |
| 155 | 25.43 | 18.35 | 90.27 | 2.84 | 0.55 | 1.20 | 20.26 | 0.00 | 20.26 | 1.153 | No | Yes | 2.00 |
| 156 | 25.59 | 18.38 | 90.03 | 2.84 | 0.54 | 1.20 | 21.39 | 0.00 | 21.39 | 1.148 | No | Yes | 2.00 |
| 157 | 25.75 | 18.34 | 89.90 | 2.84 | 0.55 | 1.19 | 20.16 | 0.00 | 20.16 | 1.137 | No | Yes | 2.00 |
| 158 | 25.92 | 18.02 | 90.18 | 2.84 | 0.55 | 1.19 | 19.92 | 0.00 | 19.92 | 1.109 | No | Yes | 2.00 |
| 159 | 26.08 | 18.41 | 89.23 | 2.83 | 0.55 | 1.19 | 20.13 | 0.00 | 20.13 | 1.128 | No | Yes | 2.00 |
| 160 | 26.25 | 18.78 | 88.69 | 2.82 | 0.54 | 1.18 | 21.21 | 0.00 | 21.21 | 1.146 | No | Yes | 2.00 |
| 161 | 26.41 | 19.03 | 88.94 | 2.82 | 0.55 | 1.18 | 20.93 | 0.00 | 20.93 | 1.155 | No | Yes | 2.00 |
| 162 | 26.57 | 19.15 | 89.14 | 2.83 | 0.55 | 1.18 | 20.78 | 0.00 | 20.78 | 1.156 | No | Yes | 2.00 |
| 163 | 26.74 | 19.75 | 87.94 | 2.81 | 0.54 | 1.17 | 21.42 | 0.00 | 21.42 | 1.188 | No | Yes | 2.00 |
| 164 | 26.90 | 20.77 | 85.71 | 2.78 | 0.54 | 1.17 | 22.68 | 0.00 | 22.68 | 1.247 | No | Yes | 2.00 |
| 165 | 27.07 | 21.98 | 82.57 | 2.74 | 0.54 | 1.16 | 23.90 | 0.00 | 23.90 | 1.317 | No | Yes | 2.00 |
| 166 | 27.23 | 22.67 | 79.89 | 2.71 | 0.53 | 1.16 | 25.12 | 0.00 | 25.12 | 1.354 | No | Yes | 2.00 |
| 167 | 27.39 | 22.29 | 78.52 | 2.69 | 0.54 | 1.16 | 24.71 | 0.00 | 24.71 | 1.322 | No | Yes | 2.00 |
| 168 | 27.56 | 21.19 | 78.51 | 2.69 | 0.54 | 1.15 | 22.46 | 0.00 | 22.46 | 1.245 | No | Yes | 2.00 |
| 169 | 27.72 | 19.86 | 78.82 | 2.70 | 0.55 | 1.15 | 21.36 | 0.00 | 21.36 | 1.154 | No | Yes | 2.00 |
| 170 | 27.89 | 18.97 | 78.15 | 2.69 | 0.55 | 1.15 | 20.21 | 0.00 | 20.21 | 1.092 | No | Yes | 2.00 |
| 171 | 28.05 | 17.97 | 78.79 | 2.70 | 0.55 | 1.15 | 19.42 | 0.00 | 19.42 | 1.023 | No | Yes | 2.00 |
| 172 | 28.21 | 17.59 | 79.28 | 2.70 | 0.56 | 1.15 | 17.99 | 0.00 | 17.99 | 0.995 | No | Yes | 2.00 |
| 173 | 28.38 | 18.05 | 80.24 | 2.72 | 0.56 | 1.14 | 18.78 | 0.00 | 18.78 | 1.018 | No | Yes | 2.00 |
| 174 | 28.54 | 19.55 | 80.78 | 2.72 | 0.55 | 1.14 | 20.56 | 0.00 | 20.56 | 1.105 | No | Yes | 2.00 |
| 175 | 28.71 | 21.14 | 82.28 | 2.74 | 0.54 | 1.13 | 22.44 | 0.00 | 22.44 | 1.196 | No | Yes | 2.00 |
| 176 | 28.87 | 22.23 | 83.93 | 2.76 | 0.54 | 1.13 | 23.57 | 0.00 | 23.57 | 1.255 | No | Yes | 2.00 |
| 177 | 29.04 | 22.48 | 85.66 | 2.78 | 0.54 | 1.13 | 23.84 | 0.00 | 23.84 | 1.263 | No | Yes | 2.00 |
| 178 | 29.20 | 22.00 | 86.94 | 2.80 | 0.54 | 1.12 | 23.11 | 0.00 | 23.11 | 1.227 | No | Yes | 2.00 |
| 179 | 29.36 | 20.82 | 88.19 | 2.81 | 0.54 | 1.12 | 21.88 | 0.00 | 21.88 | 1.150 | No | Yes | 2.00 |
| 180 | 29.53 | 19.34 | 89.32 | 2.83 | 0.55 | 1.12 | 20.02 | 0.00 | 20.02 | 1.055 | No | Yes | 2.00 |
| 181 | 29.69 | 17.91 | 83.65 | 2.76 | 0.56 | 1.12 | 18.37 | 0.00 | 18.37 | 0.964 | No | Yes | 2.00 |
| 182 | 29.86 | 16.92 | 83.12 | 2.75 | 0.56 | 1.12 | 17.27 | 0.00 | 17.27 | 0.901 | No | Yes | 2.00 |
| 183 | 30.02 | 15.95 | 84.72 | 2.77 | 0.56 | 1.11 | 16.81 | 0.00 | 16.81 | 0.840 | No | Yes | 2.00 |
| 184 | 30.18 | 12.62 | 100.00 | 3.03 | 0.56 | 1.11 | 15.18 | 0.00 | 15.18 | 0.640 | No | Yes | 1.57 |
| 185 | 30.35 | 13.64 | 100.00 | 2.98 | 0.60 | 1.11 | 6.77 | 0.00 | 6.77 | 0.697 | No | Yes | 1.71 |
| 186 | 30.51 | 15.57 | 94.96 | 2.90 | 0.55 | 1.10 | 19.85 | 0.00 | 19.85 | 0.804 | No | Yes | 1.98 |
| 187 | 30.68 | 20.38 | 82.27 | 2.74 | 0.55 | 1.10 | 20.93 | 0.00 | 20.93 | 1.078 | No | Yes | 2.00 |
| 188 | 30.84 | 20.51 | 83.75 | 2.76 | 0.54 | 1.10 | 21.51 | 0.00 | 21.51 | 1.080 | No | Yes | 2.00 |
| 189 | 31.00 | 20.26 | 85.81 | 2.79 | 0.55 | 1.09 | 20.06 | 0.00 | 20.06 | 1.060 | No | Yes | 2.00 |
| 190 | 31.17 | 19.90 | 87.38 | 2.80 | 0.55 | 1.09 | 20.01 | 0.00 | 20.01 | 1.034 | No | Yes | 2.00 |
| 191 | 31.33 | 19.94 | 87.22 | 2.80 | 0.55 | 1.09 | 20.26 | 0.00 | 20.26 | 1.031 | No | Yes | 2.00 |
| 192 | 31.50 | 19.56 | 88.52 | 2.82 | 0.55 | 1.08 | 19.97 | 0.00 | 19.97 | 1.004 | No | Yes | 2.00 |

**:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)**

| Point ID | Depth (ft) | $q_t$ (tsf) | FC (%) | Ic | m | $C_N$ | $q_{c1N}$ | $\Delta q_{c1N}$ | $q_{c1N,cs}$ | $CRR_{7.5}$ | Belongs to trans. layer | Clay-like behaviour | FS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 193 | 31.66 | 18.67 | 91.44 | 2.86 | 0.55 | 1.08 | 18.73 | 0.00 | 18.73 | 0.949 | No | Yes | 2.00 |
| 194 | 31.82 | 17.28 | 94.43 | 2.89 | 0.56 | 1.08 | 17.45 | 0.00 | 17.45 | 0.866 | No | Yes | 2.00 |
| 195 | 31.99 | 16.28 | 94.64 | 2.90 | 0.56 | 1.08 | 15.69 | 0.00 | 15.69 | 0.806 | No | Yes | 1.97 |
| 196 | 32.15 | 15.79 | 92.12 | 2.86 | 0.56 | 1.08 | 15.56 | 0.00 | 15.56 | 0.775 | No | Yes | 1.90 |
| 197 | 32.32 | 16.05 | 89.01 | 2.83 | 0.56 | 1.07 | 15.77 | 0.00 | 15.77 | 0.786 | No | Yes | 1.92 |
| 198 | 32.48 | 16.08 | 88.68 | 2.82 | 0.56 | 1.07 | 16.28 | 0.00 | 16.28 | 0.783 | No | Yes | 1.92 |
| 199 | 32.64 | 15.81 | 90.98 | 2.85 | 0.56 | 1.07 | 15.54 | 0.00 | 15.54 | 0.765 | No | Yes | 1.87 |
| 200 | 32.81 | 15.48 | 93.70 | 2.88 | 0.57 | 1.07 | 14.89 | 0.00 | 14.89 | 0.743 | No | Yes | 1.82 |
| 201 | 32.97 | 15.82 | 94.85 | 2.90 | 0.56 | 1.06 | 15.17 | 0.00 | 15.17 | 0.758 | No | Yes | 1.85 |
| 202 | 33.14 | 16.28 | 95.15 | 2.90 | 0.56 | 1.06 | 16.47 | 0.00 | 16.47 | 0.779 | No | Yes | 1.90 |
| 203 | 33.30 | 16.51 | 95.91 | 2.91 | 0.56 | 1.06 | 16.23 | 0.00 | 16.23 | 0.788 | No | Yes | 1.92 |
| 204 | 33.47 | 16.91 | 94.72 | 2.90 | 0.56 | 1.06 | 15.84 | 0.00 | 15.84 | 0.805 | No | Yes | 1.97 |
| 205 | 33.63 | 18.33 | 90.82 | 2.85 | 0.56 | 1.05 | 17.51 | 0.00 | 17.51 | 0.877 | No | Yes | 2.00 |
| 206 | 33.79 | 19.76 | 88.42 | 2.82 | 0.55 | 1.05 | 20.26 | 0.00 | 20.26 | 0.948 | No | Yes | 2.00 |
| 207 | 33.96 | 20.66 | 88.48 | 2.82 | 0.55 | 1.05 | 19.86 | 0.00 | 19.86 | 0.991 | No | Yes | 2.00 |
| 208 | 34.12 | 20.63 | 90.47 | 2.84 | 0.55 | 1.04 | 20.00 | 0.00 | 20.00 | 0.985 | No | Yes | 2.00 |
| 209 | 34.28 | 20.68 | 91.47 | 2.86 | 0.55 | 1.04 | 20.02 | 0.00 | 20.02 | 0.983 | No | Yes | 2.00 |
| 210 | 34.45 | 20.56 | 92.58 | 2.87 | 0.55 | 1.04 | 19.84 | 0.00 | 19.84 | 0.972 | No | Yes | 2.00 |
| 211 | 34.61 | 20.40 | 93.63 | 2.88 | 0.55 | 1.04 | 19.48 | 0.00 | 19.48 | 0.958 | No | Yes | 2.00 |
| 212 | 34.78 | 20.17 | 93.47 | 2.88 | 0.55 | 1.03 | 19.35 | 0.00 | 19.35 | 0.942 | No | Yes | 2.00 |
| 213 | 34.94 | 19.56 | 93.76 | 2.88 | 0.55 | 1.03 | 19.05 | 0.00 | 19.05 | 0.906 | No | Yes | 2.00 |
| 214 | 35.10 | 18.81 | 94.84 | 2.90 | 0.56 | 1.03 | 17.61 | 0.00 | 17.61 | 0.863 | No | Yes | 2.00 |
| 215 | 35.27 | 17.85 | 97.77 | 2.93 | 0.56 | 1.03 | 17.08 | 0.00 | 17.08 | 0.810 | No | Yes | 1.98 |
| 216 | 35.43 | 17.74 | 98.57 | 2.94 | 0.56 | 1.02 | 16.30 | 0.00 | 16.30 | 0.800 | No | Yes | 1.95 |
| 217 | 35.60 | 17.74 | 98.34 | 2.94 | 0.56 | 1.02 | 17.28 | 0.00 | 17.28 | 0.797 | No | Yes | 1.94 |
| 218 | 35.76 | 18.08 | 96.45 | 2.92 | 0.56 | 1.02 | 17.12 | 0.00 | 17.12 | 0.810 | No | Yes | 1.98 |
| 219 | 35.92 | 18.69 | 94.11 | 2.89 | 0.56 | 1.02 | 17.05 | 0.00 | 17.05 | 0.837 | No | Yes | 2.00 |
| 220 | 36.09 | 21.04 | 87.08 | 2.80 | 0.55 | 1.02 | 18.80 | 0.00 | 18.80 | 0.950 | No | Yes | 2.00 |
| 221 | 36.25 | 23.26 | 81.26 | 2.73 | 0.54 | 1.01 | 23.52 | 0.00 | 23.52 | 1.056 | No | Yes | 2.00 |
| 222 | 36.42 | 24.05 | 78.50 | 2.69 | 0.54 | 1.01 | 23.32 | 0.00 | 23.32 | 1.091 | No | Yes | 2.00 |
| 223 | 36.58 | 23.13 | 79.40 | 2.70 | 0.55 | 1.01 | 20.93 | 0.00 | 20.93 | 1.040 | No | Yes | 2.00 |
| 224 | 36.74 | 22.49 | 80.19 | 2.71 | 0.55 | 1.01 | 20.72 | 0.00 | 20.72 | 1.004 | No | Yes | 2.00 |
| 225 | 36.91 | 21.74 | 81.67 | 2.73 | 0.55 | 1.00 | 21.22 | 0.00 | 21.22 | 0.963 | No | Yes | 2.00 |
| 226 | 37.07 | 21.01 | 82.06 | 2.74 | 0.56 | 1.00 | 18.63 | 0.00 | 18.63 | 0.924 | No | Yes | 2.00 |
| 227 | 37.24 | 19.83 | 84.39 | 2.77 | 0.56 | 1.00 | 18.53 | 0.00 | 18.53 | 0.862 | No | Yes | 2.00 |
| 228 | 37.40 | 19.01 | 86.03 | 2.79 | 0.56 | 1.00 | 17.75 | 0.00 | 17.75 | 0.819 | No | Yes | 2.00 |
| 229 | 37.57 | 18.68 | 90.24 | 2.84 | 0.56 | 1.00 | 16.11 | 0.00 | 16.11 | 0.800 | No | Yes | 1.95 |
| 230 | 37.73 | 22.50 | 82.15 | 2.74 | 0.56 | 0.99 | 17.45 | 0.00 | 17.45 | 0.979 | No | Yes | 2.00 |
| 231 | 37.89 | 23.80 | 80.49 | 2.72 | 0.52 | 0.99 | 28.22 | 0.00 | 28.22 | 1.037 | No | Yes | 2.00 |
| 232 | 38.06 | 23.28 | 79.53 | 2.71 | 0.55 | 0.99 | 20.04 | 0.00 | 20.04 | 1.008 | No | Yes | 2.00 |
| 233 | 38.22 | 18.44 | 89.93 | 2.84 | 0.56 | 0.99 | 16.10 | 0.00 | 16.10 | 0.774 | No | Yes | 1.89 |
| 234 | 38.39 | 16.66 | 93.29 | 2.88 | 0.57 | 0.98 | 14.59 | 0.00 | 14.59 | 0.686 | No | Yes | 1.67 |
| 235 | 38.55 | 16.30 | 95.40 | 2.90 | 0.57 | 0.98 | 14.55 | 0.00 | 14.55 | 0.666 | No | Yes | 1.62 |
| 236 | 38.71 | 16.37 | 96.40 | 2.92 | 0.57 | 0.98 | 14.74 | 0.00 | 14.74 | 0.667 | No | Yes | 1.63 |
| 237 | 38.88 | 16.34 | 97.52 | 2.93 | 0.57 | 0.98 | 14.57 | 0.00 | 14.57 | 0.663 | No | Yes | 1.62 |
| 238 | 39.04 | 16.15 | 98.44 | 2.94 | 0.57 | 0.98 | 14.32 | 0.00 | 14.32 | 0.651 | No | Yes | 1.59 |
| 239 | 39.21 | 16.30 | 98.45 | 2.94 | 0.57 | 0.97 | 14.06 | 0.00 | 14.06 | 0.655 | No | Yes | 1.60 |
| 240 | 39.37 | 17.26 | 95.87 | 2.91 | 0.57 | 0.97 | 14.81 | 0.00 | 14.81 | 0.697 | No | Yes | 1.70 |

**:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)**

| Point ID | Depth (ft) | $q_t$ (tsf) | FC (%) | Ic | m | $C_N$ | $q_{c1N}$ | $\Delta q_{c1N}$ | $q_{c1N,cs}$ | $CRR_{7.5}$ | Belongs to trans. layer | Clay-like behaviour | FS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 241 | 39.53 | 19.17 | 93.32 | 2.88 | 0.56 | 0.97 | 16.73 | 0.00 | 16.73 | 0.782 | No | Yes | 1.91 |
| 242 | 39.70 | 21.79 | 91.74 | 2.86 | 0.55 | 0.97 | 19.14 | 0.00 | 19.14 | 0.898 | No | Yes | 2.00 |
| 243 | 39.86 | 28.32 | 85.80 | 2.78 | 0.54 | 0.97 | 21.73 | 0.00 | 21.73 | 1.193 | No | Yes | 2.00 |
| 244 | 40.03 | 33.66 | 80.72 | 2.72 | 0.51 | 0.97 | 34.35 | 0.00 | 34.35 | 1.431 | No | Yes | 2.00 |
| 245 | 40.19 | 38.43 | 74.62 | 2.65 | 0.51 | 0.97 | 34.08 | 0.00 | 34.08 | 1.641 | No | Yes | 2.00 |
| 246 | 40.35 | 36.59 | 74.50 | 2.64 | 0.50 | 0.96 | 35.32 | 0.00 | 35.32 | 1.550 | No | Yes | 2.00 |
| 247 | 40.52 | 34.67 | 77.47 | 2.68 | 0.52 | 0.96 | 29.77 | 0.00 | 29.77 | 1.457 | No | Yes | 2.00 |
| 248 | 40.68 | 33.13 | 83.97 | 2.76 | 0.52 | 0.96 | 28.56 | 0.00 | 28.56 | 1.382 | No | Yes | 2.00 |
| 249 | 40.85 | 40.02 | 82.92 | 2.75 | 0.52 | 0.96 | 30.55 | 0.00 | 30.55 | 1.682 | No | Yes | 2.00 |
| 250 | 41.01 | 60.60 | 70.73 | 2.60 | 0.47 | 0.96 | 47.87 | 64.71 | 112.58 | 0.157 | No | No | 0.38 |
| 251 | 41.17 | 86.14 | 58.25 | 2.44 | 0.39 | 0.96 | 85.12 | 71.98 | 157.09 | 0.344 | No | No | 0.85 |
| 252 | 41.34 | 102.04 | 52.72 | 2.37 | 0.36 | 0.96 | 101.03 | 74.09 | 175.13 | 0.603 | No | No | 1.49 |
| 253 | 41.50 | 107.33 | 49.97 | 2.34 | 0.38 | 0.96 | 91.99 | 70.35 | 162.35 | 0.397 | No | No | 0.98 |
| 254 | 41.67 | 177.31 | 16.24 | 1.92 | 0.45 | 0.95 | 98.34 | 26.65 | 125.00 | 0.183 | No | No | 0.45 |
| 255 | 41.83 | 299.28 | 0.00 | 1.42 | 0.26 | 0.97 | 294.21 | 0.00 | 294.21 | 4.000 | No | No | 2.00 |
| 256 | 41.99 | 459.14 | 0.00 | 0.91 | 0.26 | 0.97 | 428.01 | 0.00 | 428.01 | 4.000 | No | No | 2.00 |
| 257 | 42.16 | 548.56 | 0.00 | 0.83 | 0.26 | 0.97 | 539.00 | 0.00 | 539.00 | 4.000 | No | No | 2.00 |

**Abbreviations**

Depth: Depth from free surface, at which CPT was performed (ft)
$q_t$: Total cone resistance
FC: Fines content (%)
$I_c$: Soil behavior type index
m: Stress exponent
$C_N$: Overburden correction factor
$q_{c1N}$: Normalized and adjusted cone resistance
$\Delta q_{c1N}$: Cone resistance correction factor due to fines
$q_{c1N,cs}$: Normalized and adjusted cone resistance
$CRR_{7.5}$: Cyclic resistance ratio for $M_w$=7.5
FS: Factor of safety against soil liquefaction

**:: Liquefaction Potential Index calculation data ::**

| Depth (ft) | FS | m(FS) | $H_1$*m(FS) | $d_z$ | $LPI_{ISH}$ | Depth (ft) | FS | m(FS) | $H_1$*m(FS) | $d_z$ | $LPI_{ISH}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 0.33 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 0.49 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 0.66 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 0.82 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 0.98 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 1.15 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 1.31 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 1.48 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 1.64 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 1.80 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 1.97 | 2.00 | 0.00 | 0.00 | 0.17 | 0.00 |
| 2.13 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 2.30 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 2.46 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 2.63 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 2.79 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 2.95 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 3.12 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 3.28 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 3.44 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 3.61 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 3.77 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 3.94 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 4.10 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 4.26 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 4.43 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 4.59 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 4.76 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 4.92 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 5.08 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 5.25 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 5.41 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 5.58 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 5.74 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 5.91 | 2.00 | 0.00 | 0.00 | 0.17 | 0.00 |
| 6.07 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 6.23 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 6.40 | 1.77 | 0.00 | 0.00 | 0.16 | 0.00 | 6.56 | 1.79 | 0.00 | 0.00 | 0.16 | 0.00 |
| 6.73 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 6.89 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 7.05 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 7.22 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 7.38 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 7.55 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 7.71 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 7.87 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 8.04 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 8.20 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 8.37 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 8.53 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 8.69 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 8.86 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 9.02 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 9.19 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 9.35 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 9.51 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 9.68 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 9.84 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 10.01 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 10.17 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 10.34 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 10.50 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 10.66 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 10.83 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 10.99 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 11.15 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 11.32 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 11.48 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 11.65 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 11.81 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 11.97 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 12.14 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 12.30 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 12.47 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 12.63 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 12.79 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 12.96 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 13.12 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 13.29 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 13.45 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 13.62 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 13.78 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 13.94 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 14.11 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 14.27 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 14.44 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 14.60 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 14.76 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 14.93 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 15.09 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 15.26 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 15.42 | 1.87 | 0.00 | 0.00 | 0.16 | 0.00 |
| 15.58 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 15.75 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |

**:: Liquefaction Potential Index calculation data ::**

| Depth (ft) | FS | m(FS) | $H_1$*m(FS) | $d_z$ | $LPI_{ISH}$ | Depth (ft) | FS | m(FS) | $H_1$*m(FS) | $d_z$ | $LPI_{ISH}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15.91 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 16.08 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 16.24 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 16.40 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 16.57 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 16.73 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 16.90 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 17.06 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 17.22 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 17.39 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 17.55 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 17.72 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 17.88 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 18.05 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 18.21 | 1.93 | 0.00 | 0.00 | 0.16 | 0.00 | 18.37 | 1.74 | 0.00 | 0.00 | 0.16 | 0.00 |
| 18.54 | 1.80 | 0.00 | 0.00 | 0.16 | 0.00 | 18.70 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 18.86 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 19.03 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 19.19 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 19.36 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 19.52 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 19.68 | 1.94 | 0.00 | 0.00 | 0.16 | 0.00 |
| 19.85 | 1.65 | 0.00 | 0.00 | 0.16 | 0.00 | 20.01 | 1.61 | 0.00 | 0.00 | 0.16 | 0.00 |
| 20.18 | 1.76 | 0.00 | 0.00 | 0.16 | 0.00 | 20.34 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 20.50 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 20.67 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 20.83 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 21.00 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 21.16 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 21.32 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 21.49 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 21.65 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 21.82 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 21.98 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 22.15 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 22.31 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 22.47 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 22.64 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 22.80 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 22.97 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 23.13 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 23.29 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 23.46 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 23.62 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 23.79 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 23.95 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 24.11 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 24.28 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 24.44 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 24.61 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 24.77 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 24.93 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 25.10 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 25.26 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 25.43 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 25.59 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 25.75 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 25.92 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 26.08 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 26.25 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 26.41 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 26.57 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 26.74 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 26.90 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 27.07 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 27.23 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 27.39 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 27.56 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 27.72 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 27.89 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 28.05 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 28.21 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 28.38 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 28.54 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 28.71 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 28.87 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 29.04 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 29.20 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 29.36 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 29.53 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 29.69 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 29.86 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 30.02 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 30.18 | 1.57 | 0.00 | 0.00 | 0.16 | 0.00 |
| 30.35 | 1.71 | 0.00 | 0.00 | 0.16 | 0.00 | 30.51 | 1.98 | 0.00 | 0.00 | 0.16 | 0.00 |
| 30.68 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 30.84 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 31.00 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 31.17 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 31.33 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 31.50 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |

**:: Liquefaction Potential Index calculation data ::**

| Depth (ft) | FS | m(FS) | $H_1$*m(FS) | $d_z$ | $LPI_{ISH}$ | Depth (ft) | FS | m(FS) | $H_1$*m(FS) | $d_z$ | $LPI_{ISH}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 31.66 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 31.82 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 31.99 | 1.97 | 0.00 | 0.00 | 0.16 | 0.00 | 32.15 | 1.90 | 0.00 | 0.00 | 0.16 | 0.00 |
| 32.32 | 1.92 | 0.00 | 0.00 | 0.16 | 0.00 | 32.48 | 1.92 | 0.00 | 0.00 | 0.16 | 0.00 |
| 32.64 | 1.87 | 0.00 | 0.00 | 0.16 | 0.00 | 32.81 | 1.82 | 0.00 | 0.00 | 0.16 | 0.00 |
| 32.97 | 1.85 | 0.00 | 0.00 | 0.16 | 0.00 | 33.14 | 1.90 | 0.00 | 0.00 | 0.16 | 0.00 |
| 33.30 | 1.92 | 0.00 | 0.00 | 0.16 | 0.00 | 33.47 | 1.97 | 0.00 | 0.00 | 0.16 | 0.00 |
| 33.63 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 33.79 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 33.96 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 34.12 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 34.28 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 34.45 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 34.61 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 34.78 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 34.94 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 35.10 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 35.27 | 1.98 | 0.00 | 0.00 | 0.16 | 0.00 | 35.43 | 1.95 | 0.00 | 0.00 | 0.16 | 0.00 |
| 35.60 | 1.94 | 0.00 | 0.00 | 0.16 | 0.00 | 35.76 | 1.98 | 0.00 | 0.00 | 0.16 | 0.00 |
| 35.92 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 36.09 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 36.25 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 36.42 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 36.58 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 36.74 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 36.91 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 37.07 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 37.24 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 37.40 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 37.57 | 1.95 | 0.00 | 0.00 | 0.16 | 0.00 | 37.73 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 37.89 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 38.06 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 38.22 | 1.89 | 0.00 | 0.00 | 0.16 | 0.00 | 38.39 | 1.67 | 0.00 | 0.00 | 0.16 | 0.00 |
| 38.55 | 1.62 | 0.00 | 0.00 | 0.16 | 0.00 | 38.71 | 1.63 | 0.00 | 0.00 | 0.16 | 0.00 |
| 38.88 | 1.62 | 0.00 | 0.00 | 0.16 | 0.00 | 39.04 | 1.59 | 0.00 | 0.00 | 0.16 | 0.00 |
| 39.21 | 1.60 | 0.00 | 0.00 | 0.16 | 0.00 | 39.37 | 1.70 | 0.00 | 0.00 | 0.16 | 0.00 |
| 39.53 | 1.91 | 0.00 | 0.00 | 0.16 | 0.00 | 39.70 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 39.86 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 40.03 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 40.19 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 40.35 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 40.52 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 40.68 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 40.85 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 41.01 | 0.38 | 0.00 | 0.00 | 0.17 | 0.12 |
| 41.17 | 0.85 | 0.00 | 0.00 | 0.16 | 0.03 | 41.34 | 1.49 | 0.00 | 0.00 | 0.16 | 0.00 |
| 41.50 | 0.98 | 0.00 | 0.00 | 0.16 | 0.00 | 41.67 | 0.45 | 0.00 | 0.00 | 0.16 | 0.10 |
| 41.83 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | 41.99 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| 42.16 | 2.00 | 0.00 | 0.00 | 0.16 | 0.00 | | | | | | |

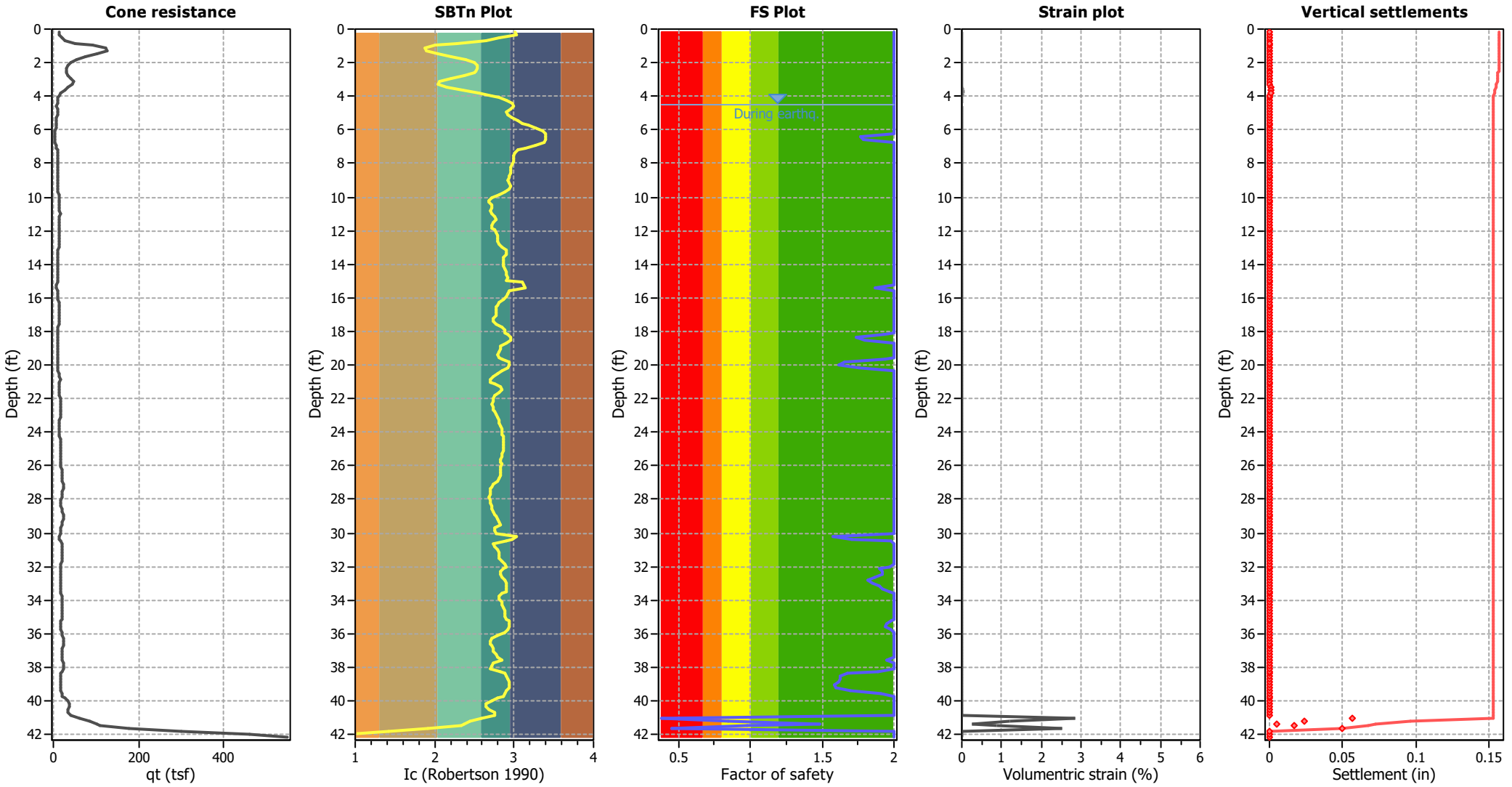
**Overall liquefaction potential: 0.25**

$LPI_{ISH}$ > 5.0 - Liquefaction manifestation is expected

**Abbreviations**

FS: Calculated factor of safety for test point
$d_z$: Layer thickness (ft)
LPI: Liquefaction potential index value for test point

## Estimation of post-earthquake settlements




**Abbreviations**

| | |
|---|---|
| $q_t$: | Total cone resistance (cone resistance $q_c$ corrected for pore water effects) |
| $I_c$: | Soil Behaviour Type Index |
| FS: | Calculated Factor of Safety against liquefaction |
| Volumentric strain: | Post-liquefaction volumentric strain |

**:: Post-earthquake settlement of dry sands ::**

| Depth (ft) | Ic | $Q_{tn}$ | $K_c$ | $Q_{tn,cs}$ | $N_{1,60}$ (blows) | $G_{max}$ (tsf) | CSR | Shear, γ (%) | $e_{vol(15)}$ (%) | $N_c$ | $e_v$ (%) | Settle. (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 3.00 | 22.36 | 8.85 | 197.87 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 0.33 | 3.04 | 22.59 | 9.42 | 212.92 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 0.49 | 2.81 | 33.15 | 5.94 | 196.96 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 0.66 | 2.65 | 43.82 | 4.23 | 185.20 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 0.82 | 2.29 | 82.84 | 1.87 | 155.14 | 36 | 839 | 0.22 | 0.002 | 0.00 | 14.51 | 0.00 | 0.000 |
| 0.98 | 2.01 | 145.47 | 1.32 | 191.38 | 40 | 1039 | 0.21 | 0.001 | 0.00 | 14.51 | 0.00 | 0.000 |
| 1.15 | 1.88 | 193.82 | 1.22 | 236.61 | 47 | 1169 | 0.21 | 0.002 | 0.00 | 14.51 | 0.00 | 0.000 |
| 1.31 | 1.89 | 204.06 | 1.23 | 250.78 | 50 | 1249 | 0.21 | 0.002 | 0.00 | 14.51 | 0.00 | 0.000 |
| 1.48 | 2.04 | 163.50 | 1.34 | 219.81 | 46 | 1213 | 0.21 | 0.002 | 0.00 | 14.51 | 0.00 | 0.000 |
| 1.64 | 2.21 | 121.29 | 1.63 | 198.13 | 45 | 1113 | 0.21 | 0.002 | 0.00 | 14.51 | 0.00 | 0.000 |
| 1.80 | 2.38 | 84.97 | 2.28 | 193.69 | 47 | 971 | 0.22 | 0.003 | 0.00 | 14.51 | 0.00 | 0.000 |
| 1.97 | 2.50 | 63.37 | 2.96 | 187.26 | 48 | 838 | 0.22 | 0.004 | 0.00 | 14.51 | 0.00 | 0.000 |
| 2.13 | 2.53 | 53.29 | 3.23 | 172.11 | 45 | 740 | 0.22 | 0.005 | 0.00 | 14.51 | 0.00 | 0.000 |
| 2.30 | 2.54 | 49.10 | 3.27 | 160.67 | 42 | 687 | 0.22 | 0.006 | 0.00 | 14.51 | 0.00 | 0.000 |
| 2.46 | 2.51 | 49.66 | 3.06 | 152.14 | 39 | 670 | 0.22 | 0.007 | 0.00 | 14.51 | 0.00 | 0.000 |
| 2.63 | 2.49 | 49.46 | 2.92 | 144.37 | 37 | 650 | 0.22 | 0.008 | 0.00 | 14.51 | 0.00 | 0.000 |
| 2.79 | 2.37 | 56.68 | 2.21 | 125.44 | 30 | 637 | 0.22 | 0.008 | 0.00 | 14.51 | 0.00 | 0.000 |
| 2.95 | 2.21 | 66.12 | 1.65 | 109.18 | 25 | 612 | 0.22 | 0.009 | 0.01 | 14.51 | 0.01 | 0.000 |
| 3.12 | 2.07 | 74.98 | 1.38 | 103.13 | 22 | 576 | 0.22 | 0.011 | 0.01 | 14.51 | 0.01 | 0.000 |
| 3.28 | 2.04 | 71.39 | 1.35 | 96.17 | 20 | 531 | 0.22 | 0.013 | 0.01 | 14.51 | 0.01 | 0.000 |
| 3.44 | 2.16 | 56.31 | 1.51 | 85.26 | 19 | 483 | 0.22 | 0.016 | 0.02 | 14.51 | 0.02 | 0.001 |
| 3.61 | 2.35 | 40.31 | 2.14 | 86.31 | 21 | 444 | 0.22 | 0.020 | 0.02 | 14.51 | 0.02 | 0.001 |
| 3.77 | 2.55 | 27.76 | 3.37 | 93.59 | 25 | 395 | 0.22 | 0.027 | 0.02 | 14.51 | 0.02 | 0.001 |
| 3.94 | 2.71 | 20.54 | 4.85 | 99.70 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 4.10 | 2.81 | 16.89 | 5.96 | 100.68 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 4.26 | 2.90 | 14.63 | 7.13 | 104.40 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |
| 4.43 | 2.97 | 13.14 | 8.24 | 108.24 | 0 | 0 | 0.22 | 0.000 | 0.00 | 0.00 | 0.00 | 0.000 |

**Total estimated settlement: 0.00**

**Abbreviations**

$Q_{tn}$: Normalized cone resistance
$K_c$: Fines correction factor
$Q_{tn,cs}$: Equivalent clean sand normalized cone resistance
$G_{max}$: Small strain shear modulus
CSR: Soil cyclic stress ratio
γ: Cyclic shear strain
$e_{vol(15)}$: Volumetric strain after 15 cycles
$N_c$: Equivalent number of cycles
$e_v$: Volumetric strain
Settle.: Calculated settlement

**:: Post-earthquake settlement due to soil liquefaction ::**

| Depth (ft) | $q_{c1N,cs}$ | FS | $e_v$ (%) | DF | Settlement (in) | Depth (ft) | $q_{c1N,cs}$ | FS | $e_v$ (%) | DF | Settlement (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4.59 | 12.00 | 2.00 | 0.00 | 1.00 | 0.00 | 4.76 | 13.64 | 2.00 | 0.00 | 1.00 | 0.00 |
| 4.92 | 15.76 | 2.00 | 0.00 | 1.00 | 0.00 | 5.08 | 14.44 | 2.00 | 0.00 | 1.00 | 0.00 |
| 5.25 | 11.86 | 2.00 | 0.00 | 1.00 | 0.00 | 5.41 | 11.63 | 2.00 | 0.00 | 1.00 | 0.00 |
| 5.58 | 11.36 | 2.00 | 0.00 | 1.00 | 0.00 | 5.74 | 10.67 | 2.00 | 0.00 | 1.00 | 0.00 |
| 5.91 | 7.90 | 2.00 | 0.00 | 1.00 | 0.00 | 6.07 | 6.25 | 2.00 | 0.00 | 1.00 | 0.00 |
| 6.23 | 5.00 | 2.00 | 0.00 | 1.00 | 0.00 | 6.40 | 5.00 | 1.77 | 0.00 | 1.00 | 0.00 |
| 6.56 | 4.87 | 1.79 | 0.00 | 1.00 | 0.00 | 6.73 | 5.49 | 2.00 | 0.00 | 1.00 | 0.00 |
| 6.89 | 7.94 | 2.00 | 0.00 | 1.00 | 0.00 | 7.05 | 11.58 | 2.00 | 0.00 | 1.00 | 0.00 |

**:: Post-earthquake settlement due to soil liquefaction :: (continued)**

| Depth (ft) | $q_{c1N,cs}$ | FS | $e_v$ (%) | DF | Settlement (in) | Depth (ft) | $q_{c1N,cs}$ | FS | $e_v$ (%) | DF | Settlement (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 7.22 | 14.54 | 2.00 | 0.00 | 1.00 | 0.00 | 7.38 | 16.56 | 2.00 | 0.00 | 1.00 | 0.00 |
| 7.55 | 17.93 | 2.00 | 0.00 | 1.00 | 0.00 | 7.71 | 17.82 | 2.00 | 0.00 | 1.00 | 0.00 |
| 7.87 | 17.13 | 2.00 | 0.00 | 1.00 | 0.00 | 8.04 | 16.87 | 2.00 | 0.00 | 1.00 | 0.00 |
| 8.20 | 17.14 | 2.00 | 0.00 | 1.00 | 0.00 | 8.37 | 18.17 | 2.00 | 0.00 | 1.00 | 0.00 |
| 8.53 | 18.12 | 2.00 | 0.00 | 1.00 | 0.00 | 8.69 | 18.12 | 2.00 | 0.00 | 1.00 | 0.00 |
| 8.86 | 18.43 | 2.00 | 0.00 | 1.00 | 0.00 | 9.02 | 18.60 | 2.00 | 0.00 | 1.00 | 0.00 |
| 9.19 | 17.50 | 2.00 | 0.00 | 1.00 | 0.00 | 9.35 | 16.60 | 2.00 | 0.00 | 1.00 | 0.00 |
| 9.51 | 16.45 | 2.00 | 0.00 | 1.00 | 0.00 | 9.68 | 18.01 | 2.00 | 0.00 | 1.00 | 0.00 |
| 9.84 | 20.00 | 2.00 | 0.00 | 1.00 | 0.00 | 10.01 | 21.16 | 2.00 | 0.00 | 1.00 | 0.00 |
| 10.17 | 23.18 | 2.00 | 0.00 | 1.00 | 0.00 | 10.34 | 21.46 | 2.00 | 0.00 | 1.00 | 0.00 |
| 10.50 | 20.71 | 2.00 | 0.00 | 1.00 | 0.00 | 10.66 | 22.54 | 2.00 | 0.00 | 1.00 | 0.00 |
| 10.83 | 23.85 | 2.00 | 0.00 | 1.00 | 0.00 | 10.99 | 23.64 | 2.00 | 0.00 | 1.00 | 0.00 |
| 11.15 | 22.70 | 2.00 | 0.00 | 1.00 | 0.00 | 11.32 | 20.87 | 2.00 | 0.00 | 1.00 | 0.00 |
| 11.48 | 20.86 | 2.00 | 0.00 | 1.00 | 0.00 | 11.65 | 21.27 | 2.00 | 0.00 | 1.00 | 0.00 |
| 11.81 | 20.70 | 2.00 | 0.00 | 1.00 | 0.00 | 11.97 | 20.46 | 2.00 | 0.00 | 1.00 | 0.00 |
| 12.14 | 20.59 | 2.00 | 0.00 | 1.00 | 0.00 | 12.30 | 20.42 | 2.00 | 0.00 | 1.00 | 0.00 |
| 12.47 | 19.61 | 2.00 | 0.00 | 1.00 | 0.00 | 12.63 | 20.14 | 2.00 | 0.00 | 1.00 | 0.00 |
| 12.79 | 19.09 | 2.00 | 0.00 | 1.00 | 0.00 | 12.96 | 17.77 | 2.00 | 0.00 | 1.00 | 0.00 |
| 13.12 | 16.41 | 2.00 | 0.00 | 1.00 | 0.00 | 13.29 | 15.39 | 2.00 | 0.00 | 1.00 | 0.00 |
| 13.45 | 16.10 | 2.00 | 0.00 | 1.00 | 0.00 | 13.62 | 16.33 | 2.00 | 0.00 | 1.00 | 0.00 |
| 13.78 | 16.33 | 2.00 | 0.00 | 1.00 | 0.00 | 13.94 | 16.65 | 2.00 | 0.00 | 1.00 | 0.00 |
| 14.11 | 16.58 | 2.00 | 0.00 | 1.00 | 0.00 | 14.27 | 16.38 | 2.00 | 0.00 | 1.00 | 0.00 |
| 14.44 | 16.02 | 2.00 | 0.00 | 1.00 | 0.00 | 14.60 | 15.32 | 2.00 | 0.00 | 1.00 | 0.00 |
| 14.76 | 15.30 | 2.00 | 0.00 | 1.00 | 0.00 | 14.93 | 15.85 | 2.00 | 0.00 | 1.00 | 0.00 |
| 15.09 | 16.22 | 2.00 | 0.00 | 1.00 | 0.00 | 15.26 | 4.29 | 2.00 | 0.00 | 1.00 | 0.00 |
| 15.42 | 13.66 | 1.87 | 0.00 | 1.00 | 0.00 | 15.58 | 14.26 | 2.00 | 0.00 | 1.00 | 0.00 |
| 15.75 | 14.09 | 2.00 | 0.00 | 1.00 | 0.00 | 15.91 | 14.34 | 2.00 | 0.00 | 1.00 | 0.00 |
| 16.08 | 15.67 | 2.00 | 0.00 | 1.00 | 0.00 | 16.24 | 17.23 | 2.00 | 0.00 | 1.00 | 0.00 |
| 16.40 | 17.98 | 2.00 | 0.00 | 1.00 | 0.00 | 16.57 | 17.61 | 2.00 | 0.00 | 1.00 | 0.00 |
| 16.73 | 17.69 | 2.00 | 0.00 | 1.00 | 0.00 | 16.90 | 17.60 | 2.00 | 0.00 | 1.00 | 0.00 |
| 17.06 | 17.37 | 2.00 | 0.00 | 1.00 | 0.00 | 17.22 | 18.06 | 2.00 | 0.00 | 1.00 | 0.00 |
| 17.39 | 19.66 | 2.00 | 0.00 | 1.00 | 0.00 | 17.55 | 15.79 | 2.00 | 0.00 | 1.00 | 0.00 |
| 17.72 | 14.02 | 2.00 | 0.00 | 1.00 | 0.00 | 17.88 | 13.23 | 2.00 | 0.00 | 1.00 | 0.00 |
| 18.05 | 13.08 | 2.00 | 0.00 | 1.00 | 0.00 | 18.21 | 12.64 | 1.93 | 0.00 | 1.00 | 0.00 |
| 18.37 | 10.85 | 1.74 | 0.00 | 1.00 | 0.00 | 18.54 | 10.14 | 1.80 | 0.00 | 1.00 | 0.00 |
| 18.70 | 13.74 | 2.00 | 0.00 | 1.00 | 0.00 | 18.86 | 14.51 | 2.00 | 0.00 | 1.00 | 0.00 |
| 19.03 | 14.82 | 2.00 | 0.00 | 1.00 | 0.00 | 19.19 | 14.45 | 2.00 | 0.00 | 1.00 | 0.00 |
| 19.36 | 14.79 | 2.00 | 0.00 | 1.00 | 0.00 | 19.52 | 14.64 | 2.00 | 0.00 | 1.00 | 0.00 |
| 19.68 | 12.79 | 1.94 | 0.00 | 1.00 | 0.00 | 19.85 | 10.77 | 1.65 | 0.00 | 1.00 | 0.00 |
| 20.01 | 9.84 | 1.61 | 0.00 | 1.00 | 0.00 | 20.18 | 12.20 | 1.76 | 0.00 | 1.00 | 0.00 |
| 20.34 | 13.48 | 2.00 | 0.00 | 1.00 | 0.00 | 20.50 | 15.62 | 2.00 | 0.00 | 1.00 | 0.00 |
| 20.67 | 17.37 | 2.00 | 0.00 | 1.00 | 0.00 | 20.83 | 18.95 | 2.00 | 0.00 | 1.00 | 0.00 |
| 21.00 | 19.66 | 2.00 | 0.00 | 1.00 | 0.00 | 21.16 | 16.77 | 2.00 | 0.00 | 1.00 | 0.00 |
| 21.32 | 14.35 | 2.00 | 0.00 | 1.00 | 0.00 | 21.49 | 14.63 | 2.00 | 0.00 | 1.00 | 0.00 |
| 21.65 | 17.17 | 2.00 | 0.00 | 1.00 | 0.00 | 21.82 | 18.69 | 2.00 | 0.00 | 1.00 | 0.00 |
| 21.98 | 18.54 | 2.00 | 0.00 | 1.00 | 0.00 | 22.15 | 18.39 | 2.00 | 0.00 | 1.00 | 0.00 |
| 22.31 | 17.83 | 2.00 | 0.00 | 1.00 | 0.00 | 22.47 | 17.95 | 2.00 | 0.00 | 1.00 | 0.00 |
| 22.64 | 18.38 | 2.00 | 0.00 | 1.00 | 0.00 | 22.80 | 19.04 | 2.00 | 0.00 | 1.00 | 0.00 |

**:: Post-earthquake settlement due to soil liquefaction :: (continued)**

| Depth (ft) | $q_{c1N,cs}$ | FS | $e_v$ (%) | DF | Settlement (in) | Depth (ft) | $q_{c1N,cs}$ | FS | $e_v$ (%) | DF | Settlement (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 22.97 | 18.91 | 2.00 | 0.00 | 1.00 | 0.00 | 23.13 | 18.27 | 2.00 | 0.00 | 1.00 | 0.00 |
| 23.29 | 17.42 | 2.00 | 0.00 | 1.00 | 0.00 | 23.46 | 16.72 | 2.00 | 0.00 | 1.00 | 0.00 |
| 23.62 | 16.73 | 2.00 | 0.00 | 1.00 | 0.00 | 23.79 | 16.76 | 2.00 | 0.00 | 1.00 | 0.00 |
| 23.95 | 16.93 | 2.00 | 0.00 | 1.00 | 0.00 | 24.11 | 16.85 | 2.00 | 0.00 | 1.00 | 0.00 |
| 24.28 | 17.13 | 2.00 | 0.00 | 1.00 | 0.00 | 24.44 | 17.34 | 2.00 | 0.00 | 1.00 | 0.00 |
| 24.61 | 17.64 | 2.00 | 0.00 | 1.00 | 0.00 | 24.77 | 17.82 | 2.00 | 0.00 | 1.00 | 0.00 |
| 24.93 | 19.02 | 2.00 | 0.00 | 1.00 | 0.00 | 25.10 | 19.34 | 2.00 | 0.00 | 1.00 | 0.00 |
| 25.26 | 20.20 | 2.00 | 0.00 | 1.00 | 0.00 | 25.43 | 20.26 | 2.00 | 0.00 | 1.00 | 0.00 |
| 25.59 | 21.39 | 2.00 | 0.00 | 1.00 | 0.00 | 25.75 | 20.16 | 2.00 | 0.00 | 1.00 | 0.00 |
| 25.92 | 19.92 | 2.00 | 0.00 | 1.00 | 0.00 | 26.08 | 20.13 | 2.00 | 0.00 | 1.00 | 0.00 |
| 26.25 | 21.21 | 2.00 | 0.00 | 1.00 | 0.00 | 26.41 | 20.93 | 2.00 | 0.00 | 1.00 | 0.00 |
| 26.57 | 20.78 | 2.00 | 0.00 | 1.00 | 0.00 | 26.74 | 21.42 | 2.00 | 0.00 | 1.00 | 0.00 |
| 26.90 | 22.68 | 2.00 | 0.00 | 1.00 | 0.00 | 27.07 | 23.90 | 2.00 | 0.00 | 1.00 | 0.00 |
| 27.23 | 25.12 | 2.00 | 0.00 | 1.00 | 0.00 | 27.39 | 24.71 | 2.00 | 0.00 | 1.00 | 0.00 |
| 27.56 | 22.46 | 2.00 | 0.00 | 1.00 | 0.00 | 27.72 | 21.36 | 2.00 | 0.00 | 1.00 | 0.00 |
| 27.89 | 20.21 | 2.00 | 0.00 | 1.00 | 0.00 | 28.05 | 19.42 | 2.00 | 0.00 | 1.00 | 0.00 |
| 28.21 | 17.99 | 2.00 | 0.00 | 1.00 | 0.00 | 28.38 | 18.78 | 2.00 | 0.00 | 1.00 | 0.00 |
| 28.54 | 20.56 | 2.00 | 0.00 | 1.00 | 0.00 | 28.71 | 22.44 | 2.00 | 0.00 | 1.00 | 0.00 |
| 28.87 | 23.57 | 2.00 | 0.00 | 1.00 | 0.00 | 29.04 | 23.84 | 2.00 | 0.00 | 1.00 | 0.00 |
| 29.20 | 23.11 | 2.00 | 0.00 | 1.00 | 0.00 | 29.36 | 21.88 | 2.00 | 0.00 | 1.00 | 0.00 |
| 29.53 | 20.02 | 2.00 | 0.00 | 1.00 | 0.00 | 29.69 | 18.37 | 2.00 | 0.00 | 1.00 | 0.00 |
| 29.86 | 17.27 | 2.00 | 0.00 | 1.00 | 0.00 | 30.02 | 16.81 | 2.00 | 0.00 | 1.00 | 0.00 |
| 30.18 | 15.18 | 1.57 | 0.00 | 1.00 | 0.00 | 30.35 | 6.77 | 1.71 | 0.00 | 1.00 | 0.00 |
| 30.51 | 19.85 | 1.98 | 0.00 | 1.00 | 0.00 | 30.68 | 20.93 | 2.00 | 0.00 | 1.00 | 0.00 |
| 30.84 | 21.51 | 2.00 | 0.00 | 1.00 | 0.00 | 31.00 | 20.06 | 2.00 | 0.00 | 1.00 | 0.00 |
| 31.17 | 20.01 | 2.00 | 0.00 | 1.00 | 0.00 | 31.33 | 20.26 | 2.00 | 0.00 | 1.00 | 0.00 |
| 31.50 | 19.97 | 2.00 | 0.00 | 1.00 | 0.00 | 31.66 | 18.73 | 2.00 | 0.00 | 1.00 | 0.00 |
| 31.82 | 17.45 | 2.00 | 0.00 | 1.00 | 0.00 | 31.99 | 15.69 | 1.97 | 0.00 | 1.00 | 0.00 |
| 32.15 | 15.56 | 1.90 | 0.00 | 1.00 | 0.00 | 32.32 | 15.77 | 1.92 | 0.00 | 1.00 | 0.00 |
| 32.48 | 16.28 | 1.92 | 0.00 | 1.00 | 0.00 | 32.64 | 15.54 | 1.87 | 0.00 | 1.00 | 0.00 |
| 32.81 | 14.89 | 1.82 | 0.00 | 1.00 | 0.00 | 32.97 | 15.17 | 1.85 | 0.00 | 1.00 | 0.00 |
| 33.14 | 16.47 | 1.90 | 0.00 | 1.00 | 0.00 | 33.30 | 16.23 | 1.92 | 0.00 | 1.00 | 0.00 |
| 33.47 | 15.84 | 1.97 | 0.00 | 1.00 | 0.00 | 33.63 | 17.51 | 2.00 | 0.00 | 1.00 | 0.00 |
| 33.79 | 20.26 | 2.00 | 0.00 | 1.00 | 0.00 | 33.96 | 19.86 | 2.00 | 0.00 | 1.00 | 0.00 |
| 34.12 | 20.00 | 2.00 | 0.00 | 1.00 | 0.00 | 34.28 | 20.02 | 2.00 | 0.00 | 1.00 | 0.00 |
| 34.45 | 19.84 | 2.00 | 0.00 | 1.00 | 0.00 | 34.61 | 19.48 | 2.00 | 0.00 | 1.00 | 0.00 |
| 34.78 | 19.35 | 2.00 | 0.00 | 1.00 | 0.00 | 34.94 | 19.05 | 2.00 | 0.00 | 1.00 | 0.00 |
| 35.10 | 17.61 | 2.00 | 0.00 | 1.00 | 0.00 | 35.27 | 17.08 | 1.98 | 0.00 | 1.00 | 0.00 |
| 35.43 | 16.30 | 1.95 | 0.00 | 1.00 | 0.00 | 35.60 | 17.28 | 1.94 | 0.00 | 1.00 | 0.00 |
| 35.76 | 17.12 | 1.98 | 0.00 | 1.00 | 0.00 | 35.92 | 17.05 | 2.00 | 0.00 | 1.00 | 0.00 |
| 36.09 | 18.80 | 2.00 | 0.00 | 1.00 | 0.00 | 36.25 | 23.52 | 2.00 | 0.00 | 1.00 | 0.00 |
| 36.42 | 23.32 | 2.00 | 0.00 | 1.00 | 0.00 | 36.58 | 20.93 | 2.00 | 0.00 | 1.00 | 0.00 |
| 36.74 | 20.72 | 2.00 | 0.00 | 1.00 | 0.00 | 36.91 | 21.22 | 2.00 | 0.00 | 1.00 | 0.00 |
| 37.07 | 18.63 | 2.00 | 0.00 | 1.00 | 0.00 | 37.24 | 18.53 | 2.00 | 0.00 | 1.00 | 0.00 |
| 37.40 | 17.75 | 2.00 | 0.00 | 1.00 | 0.00 | 37.57 | 16.11 | 1.95 | 0.00 | 1.00 | 0.00 |
| 37.73 | 17.45 | 2.00 | 0.00 | 1.00 | 0.00 | 37.89 | 28.22 | 2.00 | 0.00 | 1.00 | 0.00 |
| 38.06 | 20.04 | 2.00 | 0.00 | 1.00 | 0.00 | 38.22 | 16.10 | 1.89 | 0.00 | 1.00 | 0.00 |
| 38.39 | 14.59 | 1.67 | 0.00 | 1.00 | 0.00 | 38.55 | 14.55 | 1.62 | 0.00 | 1.00 | 0.00 |

**:: Post-earthquake settlement due to soil liquefaction :: (continued)**

| Depth (ft) | $q_{c1N,cs}$ | FS | $e_v$ (%) | DF | Settlement (in) | Depth (ft) | $q_{c1N,cs}$ | FS | $e_v$ (%) | DF | Settlement (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 38.71 | 14.74 | 1.63 | 0.00 | 1.00 | 0.00 | 38.88 | 14.57 | 1.62 | 0.00 | 1.00 | 0.00 |
| 39.04 | 14.32 | 1.59 | 0.00 | 1.00 | 0.00 | 39.21 | 14.06 | 1.60 | 0.00 | 1.00 | 0.00 |
| 39.37 | 14.81 | 1.70 | 0.00 | 1.00 | 0.00 | 39.53 | 16.73 | 1.91 | 0.00 | 1.00 | 0.00 |
| 39.70 | 19.14 | 2.00 | 0.00 | 1.00 | 0.00 | 39.86 | 21.73 | 2.00 | 0.00 | 1.00 | 0.00 |
| 40.03 | 34.35 | 2.00 | 0.00 | 1.00 | 0.00 | 40.19 | 34.08 | 2.00 | 0.00 | 1.00 | 0.00 |
| 40.35 | 35.32 | 2.00 | 0.00 | 1.00 | 0.00 | 40.52 | 29.77 | 2.00 | 0.00 | 1.00 | 0.00 |
| 40.68 | 28.56 | 2.00 | 0.00 | 1.00 | 0.00 | 40.85 | 30.55 | 2.00 | 0.00 | 1.00 | 0.00 |
| 41.01 | 112.58 | 0.38 | 2.84 | 1.00 | 0.06 | 41.17 | 157.09 | 0.85 | 1.22 | 1.00 | 0.02 |
| 41.34 | 175.13 | 1.49 | 0.27 | 1.00 | 0.01 | 41.50 | 162.35 | 0.98 | 0.87 | 1.00 | 0.02 |
| 41.67 | 125.00 | 0.45 | 2.54 | 1.00 | 0.05 | 41.83 | 294.21 | 2.00 | 0.00 | 1.00 | 0.00 |
| 41.99 | 428.01 | 2.00 | 0.00 | 1.00 | 0.00 | 42.16 | 539.00 | 2.00 | 0.00 | 1.00 | 0.00 |

**Total estimated settlement: 0.15**

**Abbreviations**

| | |
|---|---|
| $Q_{tn,cs}$: | Equivalent clean sand normalized cone resistance |
| FS: | Factor of safety against liquefaction |
| $e_v$ (%): | Post-liquefaction volumentric strain |
| DF: | $e_v$ depth weighting factor |
| Settlement: | Calculated settlement |

**:: Strength loss calculation Idriss & Boulanger (2008) ::**

| Depth (ft) | $q_t$ (tsf) | $Q_{tn}$ | $K_c$ | $Q_{tn,cs}$ | $I_c$ | $S_{u(liq)}/\sigma'_v$ | $S_{u(peak)}/\sigma'_v$ |
|---|---|---|---|---|---|---|---|
| 0.16 | 13.93 | 22.36 | 8.85 | 197.87 | 3.00 | 0.09 | 103.11 |
| 0.33 | 14.08 | 22.59 | 9.42 | 212.92 | 3.04 | 0.10 | 51.89 |
| 0.49 | 20.67 | 33.15 | 5.94 | 196.96 | 2.81 | 0.09 | 0.62 |
| 0.66 | 27.31 | 43.82 | 4.23 | 185.20 | 2.65 | 0.13 | 0.63 |
| 0.82 | 51.61 | 82.84 | 1.87 | 155.14 | 2.29 | 0.12 | 0.78 |
| 0.98 | 90.60 | 145.47 | 1.32 | 191.38 | 2.01 | 0.32 | 0.88 |
| 1.15 | 120.71 | 193.82 | 1.22 | 236.61 | 1.88 | 0.92 | 0.95 |
| 1.31 | 127.09 | 204.06 | 1.23 | 250.78 | 1.89 | 0.93 | 0.92 |
| 1.48 | 101.86 | 163.50 | 1.34 | 219.81 | 2.04 | 0.79 | 0.92 |
| 1.64 | 75.60 | 121.29 | 1.63 | 198.13 | 2.21 | 0.29 | 0.87 |
| 1.80 | 53.00 | 84.97 | 2.28 | 193.69 | 2.38 | 0.17 | 0.82 |
| 1.97 | 39.56 | 63.37 | 2.96 | 187.26 | 2.50 | 0.14 | 0.79 |
| 2.13 | 33.30 | 53.29 | 3.23 | 172.11 | 2.53 | 0.13 | 0.78 |
| 2.30 | 30.70 | 49.10 | 3.27 | 160.67 | 2.54 | 0.12 | 0.77 |
| 2.46 | 31.06 | 49.66 | 3.06 | 152.14 | 2.51 | 0.12 | 0.77 |
| 2.63 | 30.95 | 49.46 | 2.92 | 144.37 | 2.49 | 0.13 | 0.78 |
| 2.79 | 35.45 | 56.68 | 2.21 | 125.44 | 2.37 | 0.11 | 0.76 |
| 2.95 | 41.33 | 66.12 | 1.65 | 109.18 | 2.21 | 0.13 | 0.79 |
| 3.12 | 46.86 | 74.98 | 1.38 | 103.13 | 2.07 | 0.14 | 0.80 |
| 3.28 | 44.63 | 71.39 | 1.35 | 96.17 | 2.04 | 0.12 | 0.78 |
| 3.44 | 35.25 | 56.31 | 1.51 | 85.26 | 2.16 | 0.11 | 0.77 |
| 3.61 | 25.31 | 40.31 | 2.14 | 86.31 | 2.35 | 0.10 | 0.74 |
| 3.77 | 17.51 | 27.76 | 3.37 | 93.59 | 2.55 | 0.09 | 0.71 |
| 3.94 | 13.02 | 20.54 | 4.85 | 99.70 | 2.71 | 0.09 | 0.62 |
| 4.10 | 10.76 | 16.89 | 5.96 | 100.68 | 2.81 | 0.08 | 0.62 |
| 4.26 | 9.36 | 14.63 | 7.13 | 104.40 | 2.90 | 0.08 | 0.62 |
| 4.43 | 8.44 | 13.14 | 8.24 | 108.24 | 2.97 | 0.08 | 0.62 |
| 4.59 | 8.17 | 12.69 | 8.58 | 108.88 | 2.99 | 0.08 | 0.62 |
| 4.76 | 8.58 | 13.34 | 8.03 | 107.17 | 2.95 | 0.08 | 0.62 |
| 4.92 | 9.09 | 14.13 | 7.29 | 103.07 | 2.91 | 0.08 | 0.62 |
| 5.08 | 8.71 | 13.52 | 7.56 | 102.27 | 2.92 | 0.08 | 0.62 |
| 5.25 | 7.86 | 12.15 | 8.52 | 103.43 | 2.98 | 0.08 | 0.62 |
| 5.41 | 7.24 | 11.12 | 9.77 | 108.64 | 3.06 | 0.08 | 1.73 |
| 5.58 | 7.00 | 10.73 | 10.67 | 114.42 | 3.10 | 0.08 | 1.65 |
| 5.74 | 6.22 | 9.45 | 12.30 | 116.31 | 3.18 | 0.08 | 1.43 |
| 5.91 | 5.14 | 7.72 | 14.33 | 110.56 | 3.27 | 0.07 | 1.16 |
| 6.07 | 3.96 | 5.80 | 17.07 | 99.08 | 3.37 | 0.07 | 0.86 |
| 6.23 | 3.36 | 4.83 | 17.75 | 85.75 | 3.39 | 0.07 | 0.71 |
| 6.40 | 3.08 | 4.37 | 17.88 | 78.10 | 3.39 | 0.07 | 0.63 |
| 6.56 | 3.19 | 4.53 | 17.89 | 81.01 | 3.40 | 0.07 | 0.65 |
| 6.73 | 3.80 | 5.50 | 17.15 | 94.29 | 3.37 | 0.07 | 0.78 |
| 6.89 | 5.20 | 7.73 | 14.29 | 110.44 | 3.27 | 0.07 | 1.09 |
| 7.05 | 7.08 | 10.73 | 11.53 | 123.76 | 3.15 | 0.08 | 1.49 |
| 7.22 | 8.87 | 13.59 | 9.80 | 133.15 | 3.06 | 0.08 | 1.87 |
| 7.38 | 10.18 | 15.69 | 8.93 | 140.09 | 3.01 | 0.09 | 2.13 |
| 7.55 | 10.86 | 16.76 | 8.61 | 144.25 | 2.99 | 0.09 | 0.62 |
| 7.71 | 10.97 | 16.92 | 8.57 | 144.99 | 2.99 | 0.09 | 0.62 |
| 7.87 | 10.75 | 16.55 | 8.60 | 142.36 | 2.99 | 0.09 | 0.62 |

**:: Strength loss calculation (Idriss & Boulanger (2008) :: (continued)**

| Depth (ft) | $q_t$ (tsf) | $Q_{tn}$ | $K_c$ | $Q_{tn,cs}$ | $I_c$ | $S_{u(liq)}/\sigma'_v$ | $S_{u(peak)}/\sigma'_v$ |
|---|---|---|---|---|---|---|---|
| 8.04 | 10.61 | 16.32 | 8.50 | 138.77 | 2.98 | 0.09 | 0.62 |
| 8.20 | 10.84 | 16.67 | 8.17 | 136.14 | 2.96 | 0.09 | 0.62 |
| 8.37 | 11.10 | 17.08 | 7.99 | 136.54 | 2.95 | 0.09 | 0.62 |
| 8.53 | 11.31 | 17.39 | 7.95 | 138.35 | 2.95 | 0.09 | 0.62 |
| 8.69 | 11.37 | 17.47 | 7.91 | 138.21 | 2.95 | 0.09 | 0.62 |
| 8.86 | 11.46 | 17.62 | 7.73 | 136.14 | 2.93 | 0.09 | 0.62 |
| 9.02 | 11.34 | 17.39 | 7.65 | 133.04 | 2.93 | 0.09 | 0.62 |
| 9.19 | 10.96 | 16.78 | 7.87 | 132.02 | 2.94 | 0.09 | 0.62 |
| 9.35 | 10.53 | 16.07 | 8.08 | 129.77 | 2.96 | 0.09 | 0.62 |
| 9.51 | 10.65 | 16.24 | 7.84 | 127.43 | 2.94 | 0.09 | 0.62 |
| 9.68 | 11.36 | 17.37 | 7.03 | 122.21 | 2.89 | 0.09 | 0.62 |
| 9.84 | 12.34 | 18.94 | 6.04 | 114.38 | 2.81 | 0.09 | 0.62 |
| 10.01 | 13.43 | 20.67 | 4.88 | 100.97 | 2.72 | 0.09 | 0.62 |
| 10.17 | 13.74 | 21.16 | 4.47 | 94.63 | 2.68 | 0.09 | 0.62 |
| 10.34 | 13.66 | 21.01 | 4.55 | 95.66 | 2.69 | 0.09 | 0.62 |
| 10.50 | 13.59 | 20.89 | 4.97 | 103.83 | 2.72 | 0.09 | 0.62 |
| 10.66 | 14.20 | 21.85 | 4.91 | 107.28 | 2.72 | 0.09 | 0.62 |
| 10.83 | 14.94 | 23.03 | 4.77 | 109.79 | 2.71 | 0.09 | 0.62 |
| 10.99 | 15.06 | 23.20 | 4.93 | 114.46 | 2.72 | 0.09 | 0.62 |
| 11.15 | 14.46 | 22.22 | 5.32 | 118.24 | 2.76 | 0.09 | 0.62 |
| 11.32 | 13.90 | 21.31 | 5.44 | 115.96 | 2.77 | 0.09 | 0.62 |
| 11.48 | 13.64 | 20.87 | 5.14 | 107.25 | 2.74 | 0.09 | 0.62 |
| 11.65 | 13.66 | 20.90 | 4.90 | 102.50 | 2.72 | 0.09 | 0.62 |
| 11.81 | 13.64 | 20.86 | 5.01 | 104.44 | 2.73 | 0.09 | 0.62 |
| 11.97 | 13.56 | 20.71 | 5.38 | 111.44 | 2.76 | 0.09 | 0.62 |
| 12.14 | 13.56 | 20.70 | 5.59 | 115.67 | 2.78 | 0.09 | 0.62 |
| 12.30 | 13.42 | 20.45 | 5.77 | 117.92 | 2.79 | 0.09 | 0.62 |
| 12.47 | 13.37 | 20.36 | 5.74 | 116.87 | 2.79 | 0.09 | 0.62 |
| 12.63 | 13.12 | 19.94 | 5.80 | 115.76 | 2.80 | 0.09 | 0.62 |
| 12.79 | 12.76 | 19.34 | 5.98 | 115.68 | 2.81 | 0.09 | 0.62 |
| 12.96 | 11.94 | 18.02 | 6.53 | 117.73 | 2.85 | 0.09 | 0.62 |
| 13.12 | 11.14 | 16.71 | 7.16 | 119.63 | 2.90 | 0.08 | 0.62 |
| 13.29 | 10.80 | 16.16 | 7.29 | 117.81 | 2.91 | 0.08 | 0.62 |
| 13.45 | 10.83 | 16.19 | 7.13 | 115.51 | 2.90 | 0.08 | 0.62 |
| 13.62 | 11.11 | 16.62 | 6.81 | 113.11 | 2.87 | 0.08 | 0.62 |
| 13.78 | 11.29 | 16.89 | 6.77 | 114.32 | 2.87 | 0.08 | 0.62 |
| 13.94 | 11.40 | 17.06 | 6.74 | 115.03 | 2.87 | 0.08 | 0.62 |
| 14.11 | 11.46 | 17.14 | 6.77 | 116.07 | 2.87 | 0.08 | 0.62 |
| 14.27 | 11.36 | 16.96 | 6.94 | 117.77 | 2.88 | 0.08 | 0.62 |
| 14.44 | 11.10 | 16.54 | 7.38 | 121.98 | 2.91 | 0.08 | 0.62 |
| 14.60 | 10.89 | 16.18 | 7.28 | 117.76 | 2.90 | 0.08 | 0.62 |
| 14.76 | 10.89 | 16.17 | 7.58 | 122.52 | 2.92 | 0.08 | 0.62 |
| 14.93 | 11.16 | 16.58 | 7.36 | 122.07 | 2.91 | 0.08 | 0.62 |
| 15.09 | 8.59 | 12.45 | 10.81 | 134.64 | 3.11 | 0.09 | 1.08 |
| 15.26 | 8.10 | 11.65 | 11.10 | 129.29 | 3.12 | 0.07 | 1.00 |
| 15.42 | 7.67 | 10.94 | 11.43 | 124.96 | 3.14 | 0.08 | 0.94 |
| 15.58 | 10.03 | 14.71 | 7.86 | 115.55 | 2.94 | 0.08 | 0.62 |
| 15.75 | 10.24 | 15.04 | 7.59 | 114.14 | 2.93 | 0.08 | 0.62 |

**:: Strength loss calculation (Idriss & Boulanger (2008) :: (continued)**

| Depth (ft) | $q_t$ (tsf) | $Q_{tn}$ | $K_c$ | $Q_{tn,cs}$ | $I_c$ | $S_{u(liq)}/\sigma'_v$ | $S_{u(peak)}/\sigma'_v$ |
|---|---|---|---|---|---|---|---|
| 15.91 | 10.64 | 15.67 | 7.29 | 114.22 | 2.91 | 0.08 | 0.62 |
| 16.08 | 11.46 | 16.98 | 6.74 | 114.49 | 2.87 | 0.08 | 0.62 |
| 16.24 | 12.42 | 18.50 | 6.09 | 112.62 | 2.82 | 0.08 | 0.62 |
| 16.40 | 12.95 | 19.34 | 5.71 | 110.46 | 2.79 | 0.08 | 0.62 |
| 16.57 | 13.12 | 19.59 | 5.48 | 107.33 | 2.77 | 0.08 | 0.62 |
| 16.73 | 13.08 | 19.51 | 5.46 | 106.58 | 2.77 | 0.08 | 0.62 |
| 16.90 | 13.07 | 19.49 | 5.54 | 107.89 | 2.77 | 0.08 | 0.62 |
| 17.06 | 13.22 | 19.71 | 5.55 | 109.47 | 2.78 | 0.08 | 0.62 |
| 17.22 | 13.80 | 20.63 | 5.20 | 107.20 | 2.74 | 0.08 | 0.62 |
| 17.39 | 13.43 | 20.02 | 5.20 | 104.12 | 2.75 | 0.09 | 0.62 |
| 17.55 | 12.44 | 18.41 | 5.48 | 100.89 | 2.77 | 0.08 | 0.62 |
| 17.72 | 10.82 | 15.80 | 6.45 | 102.01 | 2.85 | 0.08 | 0.62 |
| 17.88 | 10.18 | 14.75 | 6.87 | 101.35 | 2.88 | 0.08 | 0.62 |
| 18.05 | 9.86 | 14.22 | 7.04 | 100.08 | 2.89 | 0.08 | 0.62 |
| 18.21 | 9.27 | 13.27 | 7.42 | 98.45 | 2.91 | 0.08 | 0.62 |
| 18.37 | 8.54 | 12.08 | 8.22 | 99.28 | 2.97 | 0.08 | 0.62 |
| 18.54 | 8.86 | 12.59 | 8.07 | 101.62 | 2.96 | 0.08 | 0.62 |
| 18.70 | 9.86 | 14.17 | 7.32 | 103.74 | 2.91 | 0.08 | 0.62 |
| 18.86 | 11.12 | 16.18 | 6.33 | 102.43 | 2.84 | 0.08 | 0.62 |
| 19.03 | 11.34 | 16.52 | 6.17 | 101.98 | 2.83 | 0.08 | 0.62 |
| 19.19 | 11.46 | 16.67 | 5.97 | 99.44 | 2.81 | 0.08 | 0.62 |
| 19.36 | 11.45 | 16.52 | 5.88 | 97.09 | 2.80 | 0.08 | 0.62 |
| 19.52 | 11.05 | 15.81 | 5.98 | 94.52 | 2.81 | 0.08 | 0.62 |
| 19.68 | 10.02 | 14.21 | 6.52 | 92.64 | 2.85 | 0.08 | 0.62 |
| 19.85 | 8.78 | 12.34 | 7.70 | 95.04 | 2.93 | 0.08 | 0.62 |
| 20.01 | 8.66 | 12.10 | 7.89 | 95.46 | 2.95 | 0.08 | 0.62 |
| 20.18 | 9.42 | 13.16 | 7.47 | 98.26 | 2.92 | 0.08 | 0.62 |
| 20.34 | 11.00 | 15.35 | 6.45 | 99.02 | 2.85 | 0.08 | 0.62 |
| 20.50 | 12.44 | 17.31 | 5.82 | 100.74 | 2.80 | 0.08 | 0.62 |
| 20.67 | 13.98 | 19.36 | 5.21 | 100.78 | 2.75 | 0.08 | 0.62 |
| 20.83 | 15.14 | 20.82 | 4.73 | 98.54 | 2.70 | 0.08 | 0.62 |
| 21.00 | 15.01 | 20.52 | 4.78 | 98.00 | 2.71 | 0.08 | 0.62 |
| 21.16 | 13.78 | 18.74 | 5.29 | 99.08 | 2.75 | 0.08 | 0.62 |
| 21.32 | 12.44 | 16.89 | 6.29 | 106.19 | 2.83 | 0.08 | 0.62 |
| 21.49 | 12.61 | 17.07 | 6.45 | 110.04 | 2.85 | 0.08 | 0.62 |
| 21.65 | 13.87 | 18.72 | 5.98 | 111.89 | 2.81 | 0.08 | 0.62 |
| 21.82 | 15.01 | 20.11 | 5.42 | 108.90 | 2.76 | 0.08 | 0.62 |
| 21.98 | 15.41 | 20.47 | 5.13 | 104.94 | 2.74 | 0.08 | 0.62 |
| 22.15 | 15.21 | 20.04 | 5.04 | 100.96 | 2.73 | 0.08 | 0.62 |
| 22.31 | 15.10 | 19.75 | 4.96 | 98.04 | 2.72 | 0.08 | 0.62 |
| 22.47 | 15.16 | 19.74 | 5.06 | 99.82 | 2.73 | 0.08 | 0.62 |
| 22.64 | 15.56 | 20.24 | 5.22 | 105.64 | 2.75 | 0.08 | 0.62 |
| 22.80 | 15.89 | 20.64 | 5.43 | 112.04 | 2.76 | 0.09 | 0.62 |
| 22.97 | 15.91 | 20.59 | 5.62 | 115.73 | 2.78 | 0.09 | 0.62 |
| 23.13 | 15.49 | 19.93 | 5.79 | 115.38 | 2.79 | 0.08 | 0.62 |
| 23.29 | 14.91 | 19.03 | 5.92 | 112.76 | 2.81 | 0.08 | 0.62 |
| 23.46 | 14.52 | 18.42 | 6.10 | 112.39 | 2.82 | 0.08 | 0.62 |
| 23.62 | 14.38 | 18.14 | 6.24 | 113.16 | 2.83 | 0.08 | 0.62 |

**:: Strength loss calculation (Idriss & Boulanger (2008) :: (continued)**

| Depth (ft) | $q_t$ (tsf) | $Q_{tn}$ | $K_c$ | $Q_{tn,cs}$ | $I_c$ | $S_{u(liq)}/\sigma'_v$ | $S_{u(peak)}/\sigma'_v$ |
|---|---|---|---|---|---|---|---|
| 23.79 | 14.49 | 18.21 | 6.37 | 115.92 | 2.84 | 0.08 | 0.62 |
| 23.95 | 14.57 | 18.22 | 6.48 | 118.02 | 2.85 | 0.08 | 0.62 |
| 24.11 | 14.72 | 18.33 | 6.54 | 119.90 | 2.85 | 0.08 | 0.62 |
| 24.28 | 14.88 | 18.46 | 6.61 | 122.07 | 2.86 | 0.08 | 0.62 |
| 24.44 | 15.16 | 18.72 | 6.61 | 123.78 | 2.86 | 0.08 | 0.62 |
| 24.61 | 15.41 | 18.97 | 6.77 | 128.41 | 2.87 | 0.09 | 0.62 |
| 24.77 | 15.96 | 19.60 | 6.81 | 133.39 | 2.87 | 0.09 | 0.62 |
| 24.93 | 16.51 | 20.22 | 6.80 | 137.53 | 2.87 | 0.09 | 0.62 |
| 25.10 | 17.27 | 21.07 | 6.62 | 139.58 | 2.86 | 0.09 | 0.62 |
| 25.26 | 17.69 | 21.48 | 6.55 | 140.66 | 2.85 | 0.09 | 0.62 |
| 25.43 | 18.35 | 22.17 | 6.38 | 141.46 | 2.84 | 0.09 | 0.62 |
| 25.59 | 18.38 | 22.08 | 6.34 | 139.98 | 2.84 | 0.09 | 0.62 |
| 25.75 | 18.34 | 21.88 | 6.32 | 138.22 | 2.84 | 0.09 | 0.62 |
| 25.92 | 18.02 | 21.35 | 6.36 | 135.89 | 2.84 | 0.09 | 0.62 |
| 26.08 | 18.41 | 21.69 | 6.21 | 134.67 | 2.83 | 0.09 | 0.62 |
| 26.25 | 18.78 | 22.01 | 6.12 | 134.73 | 2.82 | 0.09 | 0.62 |
| 26.41 | 19.03 | 22.21 | 6.16 | 136.84 | 2.82 | 0.09 | 0.62 |
| 26.57 | 19.15 | 22.24 | 6.19 | 137.75 | 2.83 | 0.09 | 0.62 |
| 26.74 | 19.75 | 22.82 | 6.00 | 136.92 | 2.81 | 0.09 | 0.62 |
| 26.90 | 20.77 | 23.89 | 5.65 | 135.07 | 2.78 | 0.09 | 0.62 |
| 27.07 | 21.98 | 25.14 | 5.19 | 130.55 | 2.74 | 0.09 | 0.62 |
| 27.23 | 22.67 | 25.76 | 4.82 | 124.27 | 2.71 | 0.09 | 0.62 |
| 27.39 | 22.29 | 25.11 | 4.64 | 116.65 | 2.69 | 0.09 | 0.62 |
| 27.56 | 21.19 | 23.66 | 4.64 | 109.86 | 2.69 | 0.09 | 0.62 |
| 27.72 | 19.86 | 21.95 | 4.68 | 102.79 | 2.70 | 0.09 | 0.62 |
| 27.89 | 18.97 | 20.77 | 4.60 | 95.47 | 2.69 | 0.08 | 0.62 |
| 28.05 | 17.97 | 19.49 | 4.68 | 91.19 | 2.70 | 0.08 | 0.62 |
| 28.21 | 17.59 | 18.97 | 4.74 | 89.96 | 2.70 | 0.08 | 0.62 |
| 28.38 | 18.05 | 19.43 | 4.87 | 94.65 | 2.72 | 0.08 | 0.62 |
| 28.54 | 19.55 | 21.12 | 4.94 | 104.40 | 2.72 | 0.09 | 0.62 |
| 28.71 | 21.14 | 22.90 | 5.15 | 118.01 | 2.74 | 0.09 | 0.62 |
| 28.87 | 22.23 | 24.09 | 5.39 | 129.82 | 2.76 | 0.09 | 0.62 |
| 29.04 | 22.48 | 24.30 | 5.65 | 137.20 | 2.78 | 0.09 | 0.62 |
| 29.20 | 22.00 | 23.63 | 5.84 | 138.11 | 2.80 | 0.09 | 0.62 |
| 29.36 | 20.82 | 22.18 | 6.04 | 133.99 | 2.81 | 0.09 | 0.62 |
| 29.53 | 19.34 | 20.39 | 6.22 | 126.85 | 2.83 | 0.09 | 0.62 |
| 29.69 | 17.91 | 18.54 | 5.35 | 99.15 | 2.76 | 0.08 | 0.62 |
| 29.86 | 16.92 | 17.32 | 5.27 | 91.30 | 2.75 | 0.08 | 0.62 |
| 30.02 | 15.95 | 16.17 | 5.51 | 89.00 | 2.77 | 0.08 | 0.62 |
| 30.18 | 12.62 | 12.45 | 9.29 | 115.63 | 3.03 | 0.08 | 0.89 |
| 30.35 | 13.64 | 13.55 | 8.49 | 115.06 | 2.98 | 0.07 | 0.62 |
| 30.51 | 15.57 | 15.63 | 7.20 | 112.52 | 2.90 | 0.09 | 0.62 |
| 30.68 | 20.38 | 20.73 | 5.15 | 106.80 | 2.74 | 0.09 | 0.62 |
| 30.84 | 20.51 | 20.80 | 5.36 | 111.53 | 2.76 | 0.09 | 0.62 |
| 31.00 | 20.26 | 20.45 | 5.67 | 115.98 | 2.79 | 0.09 | 0.62 |
| 31.17 | 19.90 | 19.98 | 5.91 | 118.13 | 2.80 | 0.09 | 0.62 |
| 31.33 | 19.94 | 19.92 | 5.89 | 117.29 | 2.80 | 0.09 | 0.62 |
| 31.50 | 19.56 | 19.43 | 6.09 | 118.39 | 2.82 | 0.09 | 0.62 |

**:: Strength loss calculation (Idriss & Boulanger (2008) :: (continued)**

| Depth (ft) | $q_t$ (tsf) | $Q_{tn}$ | $K_c$ | $Q_{tn,cs}$ | $I_c$ | $S_{u(liq)}/\sigma'_v$ | $S_{u(peak)}/\sigma'_v$ |
|---|---|---|---|---|---|---|---|
| 31.66 | 18.67 | 18.40 | 6.58 | 121.01 | 2.86 | 0.09 | 0.62 |
| 31.82 | 17.28 | 16.84 | 7.10 | 119.58 | 2.89 | 0.09 | 0.62 |
| 31.99 | 16.28 | 15.67 | 7.14 | 111.89 | 2.90 | 0.08 | 0.62 |
| 32.15 | 15.79 | 15.05 | 6.69 | 100.71 | 2.86 | 0.08 | 0.62 |
| 32.32 | 16.05 | 15.22 | 6.17 | 93.93 | 2.83 | 0.08 | 0.62 |
| 32.48 | 16.08 | 15.18 | 6.12 | 92.86 | 2.82 | 0.08 | 0.62 |
| 32.64 | 15.81 | 14.84 | 6.50 | 96.44 | 2.85 | 0.08 | 0.62 |
| 32.81 | 15.48 | 14.44 | 6.97 | 100.69 | 2.88 | 0.08 | 0.62 |
| 32.97 | 15.82 | 14.74 | 7.18 | 105.80 | 2.90 | 0.08 | 0.62 |
| 33.14 | 16.28 | 15.15 | 7.23 | 109.59 | 2.90 | 0.08 | 0.62 |
| 33.30 | 16.51 | 15.32 | 7.37 | 112.94 | 2.91 | 0.08 | 0.62 |
| 33.47 | 16.91 | 15.65 | 7.15 | 112.00 | 2.90 | 0.08 | 0.62 |
| 33.63 | 18.33 | 17.02 | 6.47 | 110.16 | 2.85 | 0.08 | 0.62 |
| 33.79 | 19.76 | 18.39 | 6.08 | 111.75 | 2.82 | 0.09 | 0.62 |
| 33.96 | 20.66 | 19.23 | 6.09 | 117.01 | 2.82 | 0.09 | 0.62 |
| 34.12 | 20.63 | 19.11 | 6.41 | 122.57 | 2.84 | 0.09 | 0.62 |
| 34.28 | 20.68 | 19.08 | 6.58 | 125.62 | 2.86 | 0.09 | 0.62 |
| 34.45 | 20.56 | 18.88 | 6.77 | 127.89 | 2.87 | 0.09 | 0.62 |
| 34.61 | 20.40 | 18.62 | 6.96 | 129.59 | 2.88 | 0.09 | 0.62 |
| 34.78 | 20.17 | 18.30 | 6.93 | 126.86 | 2.88 | 0.09 | 0.62 |
| 34.94 | 19.56 | 17.60 | 6.98 | 122.91 | 2.88 | 0.09 | 0.62 |
| 35.10 | 18.81 | 16.79 | 7.18 | 120.46 | 2.90 | 0.09 | 0.62 |
| 35.27 | 17.85 | 15.75 | 7.73 | 121.67 | 2.93 | 0.09 | 0.62 |
| 35.43 | 17.74 | 15.56 | 7.88 | 122.61 | 2.94 | 0.09 | 0.62 |
| 35.60 | 17.74 | 15.49 | 7.84 | 121.40 | 2.94 | 0.09 | 0.62 |
| 35.76 | 18.08 | 15.75 | 7.47 | 117.70 | 2.92 | 0.09 | 0.62 |
| 35.92 | 18.69 | 16.27 | 7.04 | 114.58 | 2.89 | 0.09 | 0.62 |
| 36.09 | 21.04 | 18.46 | 5.87 | 108.26 | 2.80 | 0.09 | 0.62 |
| 36.25 | 23.26 | 20.51 | 5.01 | 102.76 | 2.73 | 0.09 | 0.62 |
| 36.42 | 24.05 | 21.18 | 4.64 | 98.29 | 2.69 | 0.09 | 0.62 |
| 36.58 | 23.13 | 20.21 | 4.76 | 96.16 | 2.70 | 0.09 | 0.62 |
| 36.74 | 22.49 | 19.51 | 4.86 | 94.92 | 2.71 | 0.09 | 0.62 |
| 36.91 | 21.74 | 18.72 | 5.07 | 94.87 | 2.73 | 0.09 | 0.62 |
| 37.07 | 21.01 | 17.96 | 5.12 | 91.97 | 2.74 | 0.08 | 0.62 |
| 37.24 | 19.83 | 16.77 | 5.46 | 91.48 | 2.77 | 0.08 | 0.62 |
| 37.40 | 19.01 | 15.93 | 5.70 | 90.82 | 2.79 | 0.08 | 0.62 |
| 37.57 | 18.68 | 15.55 | 6.37 | 99.11 | 2.84 | 0.08 | 0.62 |
| 37.73 | 22.50 | 19.05 | 5.13 | 97.82 | 2.74 | 0.08 | 0.62 |
| 37.89 | 23.80 | 20.18 | 4.90 | 98.99 | 2.72 | 0.10 | 0.62 |
| 38.06 | 23.28 | 19.63 | 4.78 | 93.75 | 2.71 | 0.09 | 0.62 |
| 38.22 | 18.44 | 15.05 | 6.32 | 95.17 | 2.84 | 0.08 | 0.62 |
| 38.39 | 16.66 | 13.35 | 6.90 | 92.09 | 2.88 | 0.08 | 0.62 |
| 38.55 | 16.30 | 12.96 | 7.28 | 94.33 | 2.90 | 0.08 | 0.62 |
| 38.71 | 16.37 | 12.97 | 7.47 | 96.79 | 2.92 | 0.08 | 0.62 |
| 38.88 | 16.34 | 12.89 | 7.68 | 98.92 | 2.93 | 0.08 | 0.62 |
| 39.04 | 16.15 | 12.66 | 7.85 | 99.45 | 2.94 | 0.08 | 0.62 |
| 39.21 | 16.30 | 12.74 | 7.86 | 100.09 | 2.94 | 0.08 | 0.62 |
| 39.37 | 17.26 | 13.55 | 7.37 | 99.78 | 2.91 | 0.08 | 0.62 |

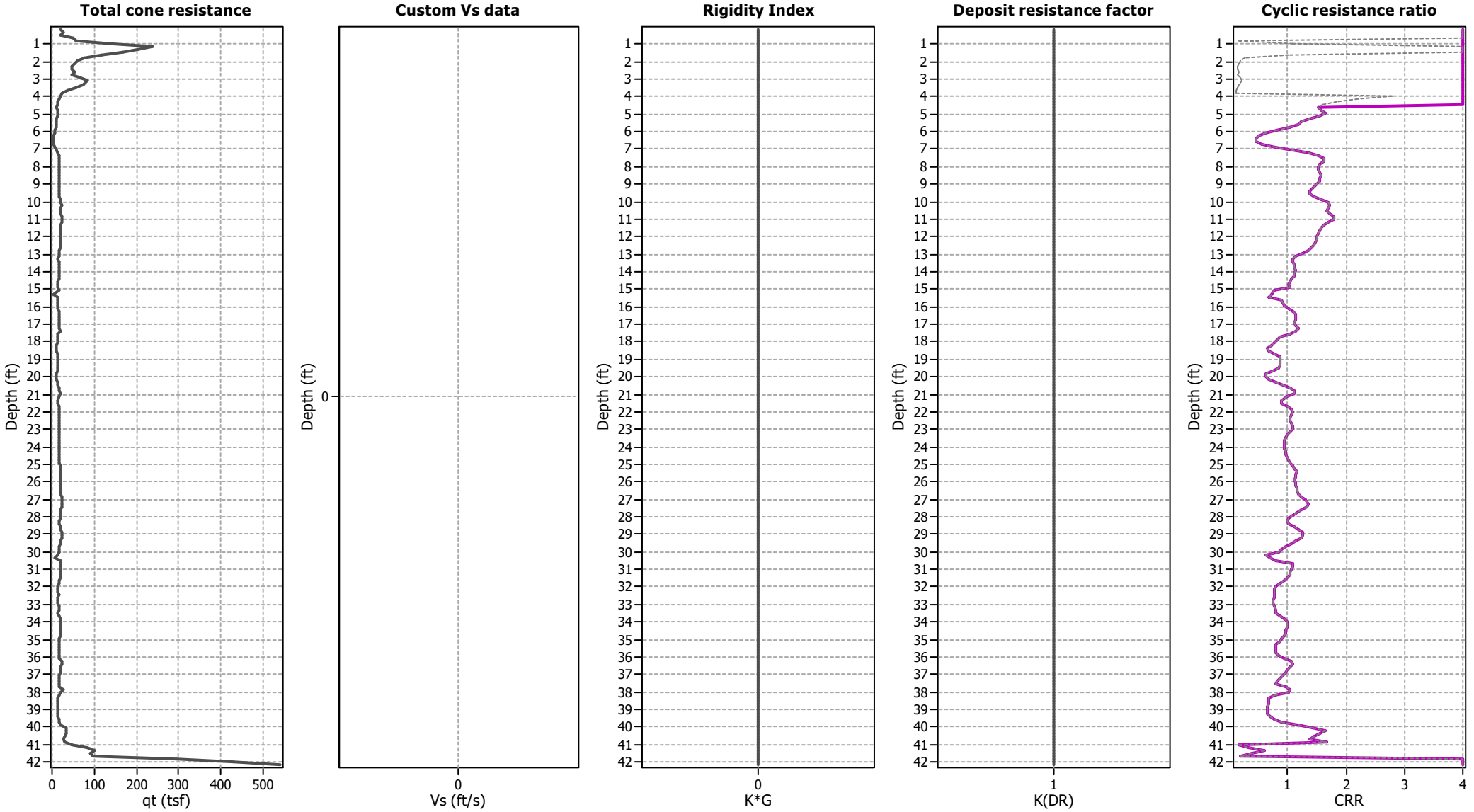
**:: Strength loss calculation (Idriss & Boulanger (2008) :: (continued)**

| Depth (ft) | $q_t$ (tsf) | $Q_{tn}$ | $K_c$ | $Q_{tn,cs}$ | $I_c$ | $S_{u(liq)}/\sigma'_v$ | $S_{u(peak)}/\sigma'_v$ |
|---|---|---|---|---|---|---|---|
| 39.53 | 19.17 | 15.21 | 6.90 | 104.98 | 2.88 | 0.08 | 0.62 |
| 39.70 | 21.79 | 17.48 | 6.63 | 115.84 | 2.86 | 0.09 | 0.62 |
| 39.86 | 28.32 | 23.25 | 5.67 | 131.76 | 2.78 | 0.09 | 0.62 |
| 40.03 | 33.66 | 27.93 | 4.94 | 137.85 | 2.72 | 0.11 | 0.62 |
| 40.19 | 38.43 | 32.10 | 4.16 | 133.56 | 2.65 | 0.10 | 0.62 |
| 40.35 | 36.59 | 30.34 | 4.15 | 125.84 | 2.64 | 0.10 | 0.62 |
| 40.52 | 34.67 | 28.49 | 4.51 | 128.50 | 2.68 | 0.10 | 0.62 |
| 40.68 | 33.13 | 26.96 | 5.40 | 145.46 | 2.76 | 0.10 | 0.62 |
| 40.85 | 40.02 | 32.85 | 5.24 | 172.24 | 2.75 | 0.10 | 0.62 |
| 41.01 | 60.60 | 50.79 | 3.72 | 189.10 | 2.60 | 0.12 | 0.77 |
| 41.17 | 86.14 | 73.13 | 2.60 | 190.11 | 2.44 | 0.19 | 0.84 |
| 41.34 | 102.04 | 86.87 | 2.23 | 193.74 | 2.37 | 0.24 | 0.86 |
| 41.50 | 107.33 | 91.24 | 2.07 | 189.22 | 2.34 | 0.20 | 0.84 |
| 41.67 | 177.31 | 154.17 | 1.25 | 192.28 | 1.92 | 0.14 | 0.79 |
| 41.83 | 299.28 | 266.61 | 1.00 | 266.61 | 1.42 | 0.98 | 0.97 |
| 41.99 | 459.14 | 418.87 | 1.00 | 418.87 | 0.91 | 1.05 | 1.06 |
| 42.16 | 548.56 | 502.35 | 1.00 | 502.35 | 0.83 | 1.08 | 1.13 |

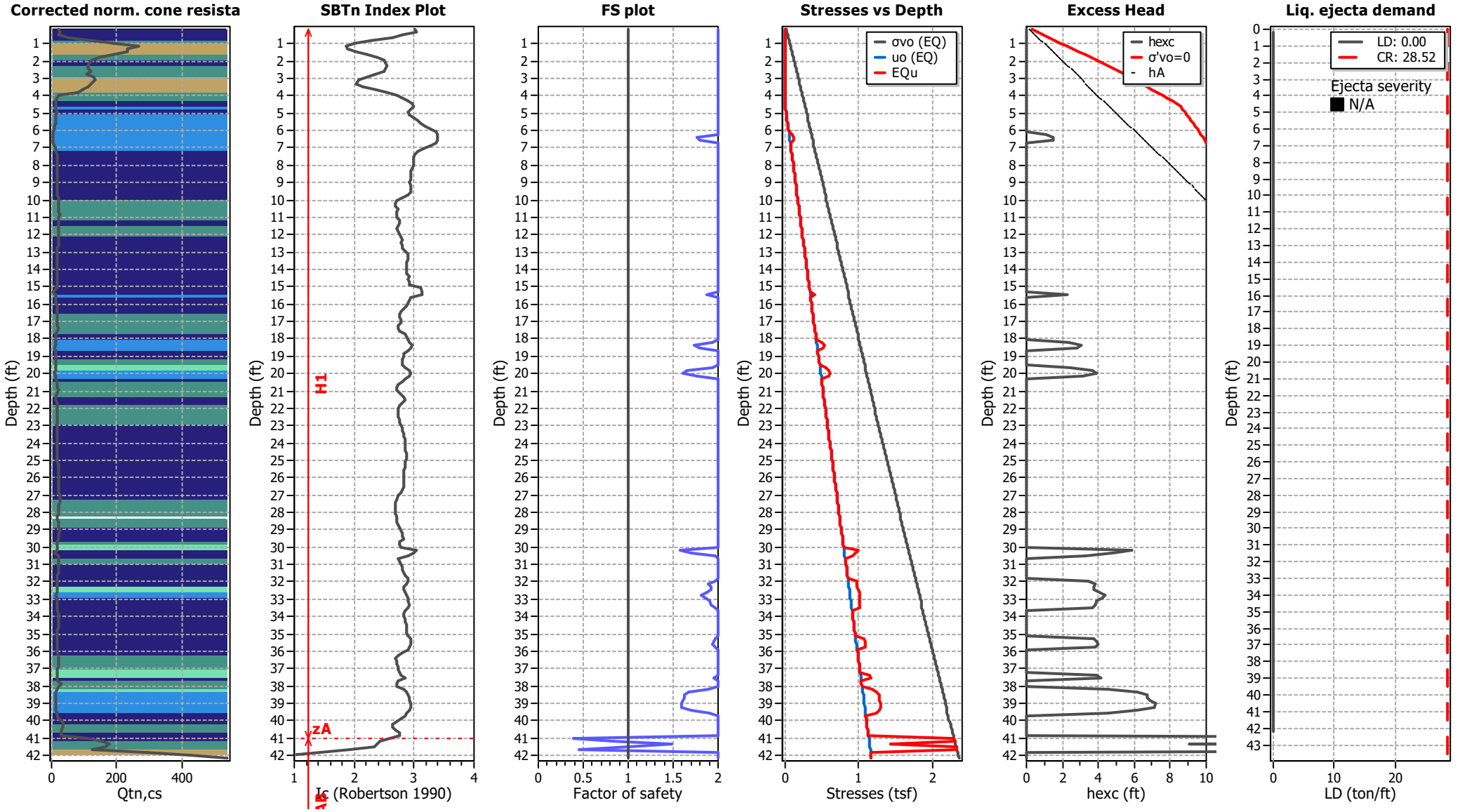
**Abbreviations**

$q_t$: Total cone resistance
$K_c$: Cone resistance correction factor due to fines
$Q_{tn,cs}$: Adjusted and corrected cone resistance due to fines
$I_c$: Soil behavior type index
$S_{u(liq)}/\sigma'_v$: Calculated liquefied undrained strength ratio
$S_{u(peak)}/\sigma'_v$: Calculated peak undrained strength ratio

## Aging Calculation Estimation

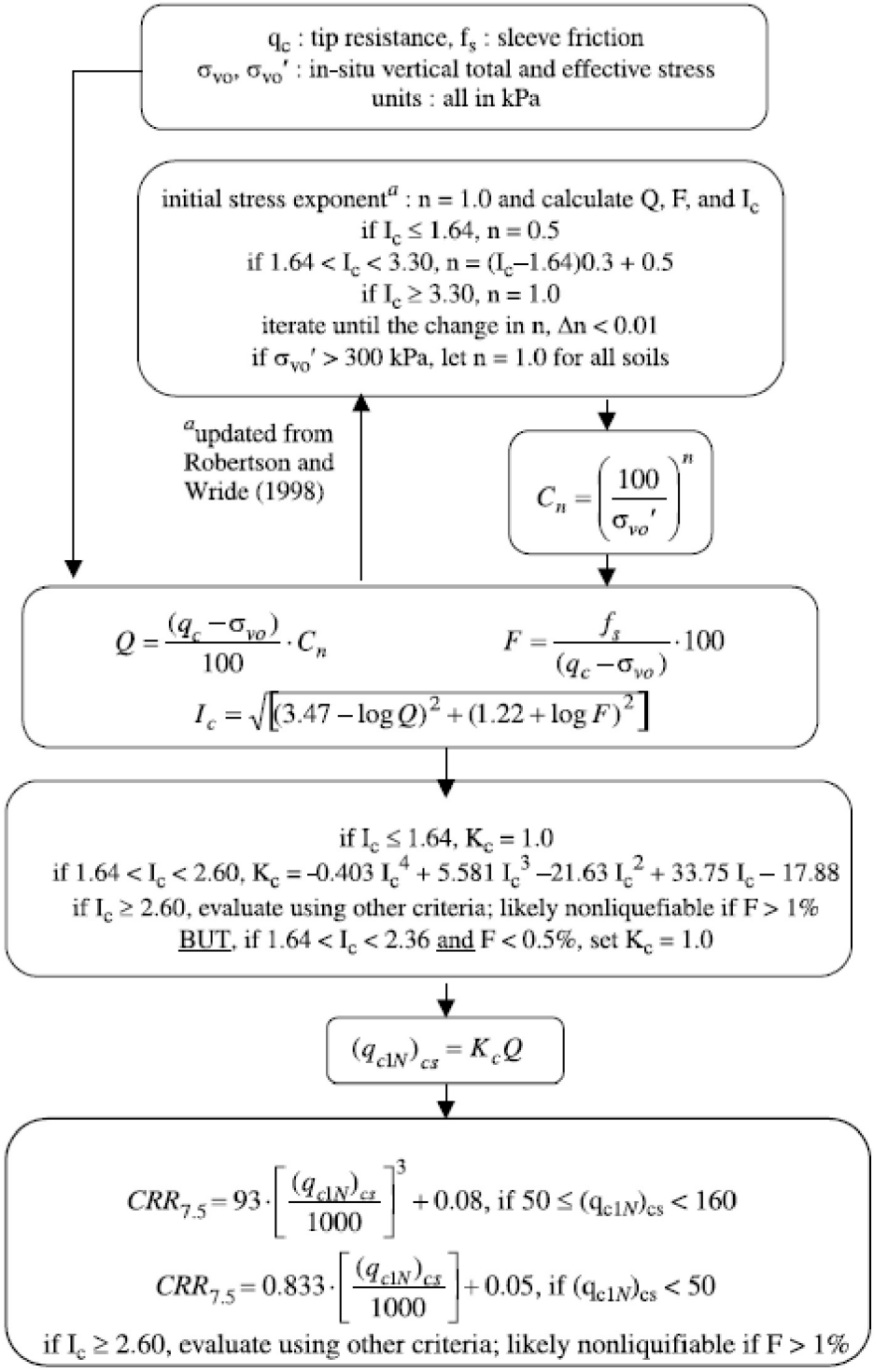


# Ejecta Severity Estimation



## Procedure for the evaluation of soil liquefaction resistance, NCEER (1998)

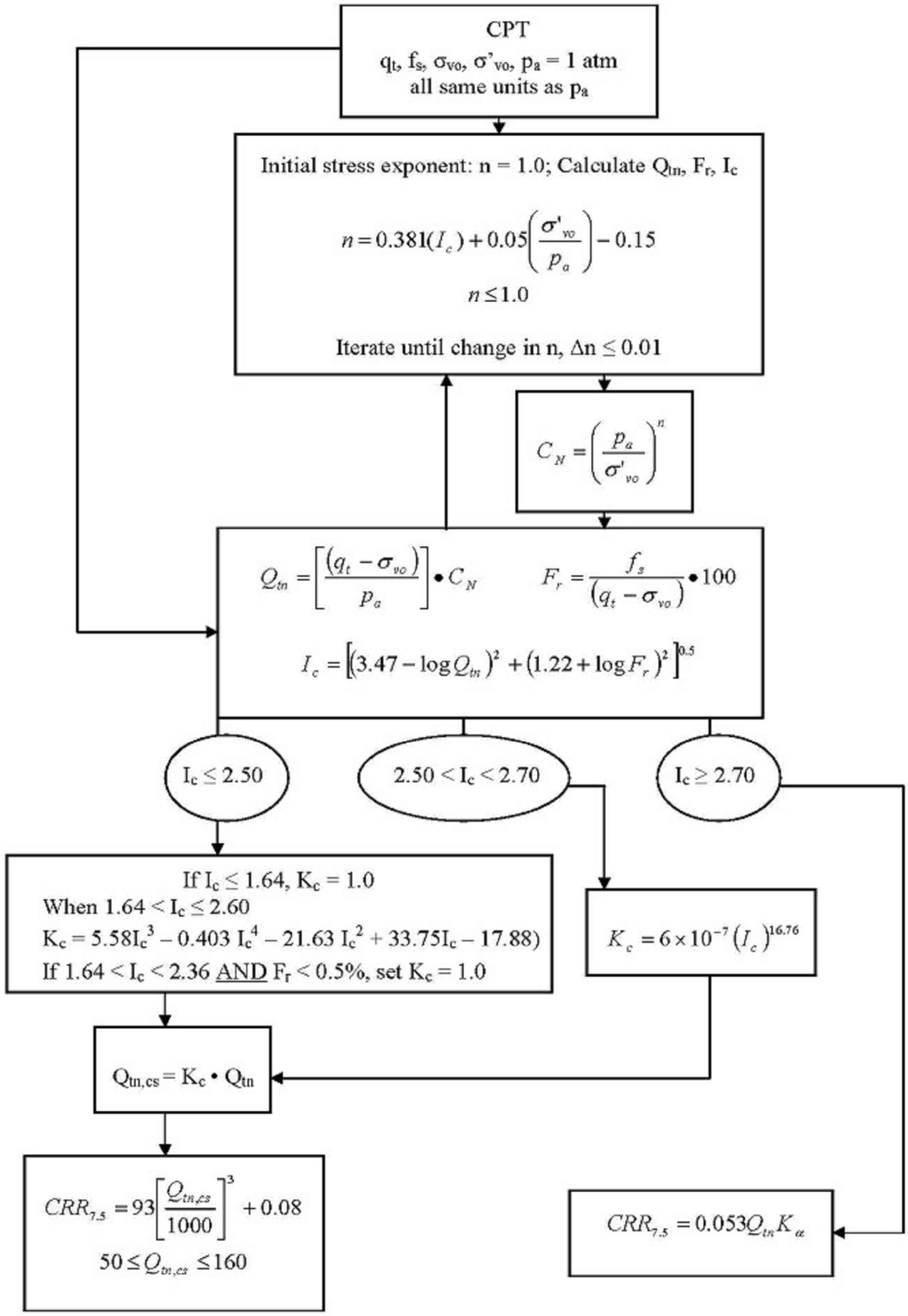
Calculation of soil resistance against liquefaction is performed according to the Robertson & Wride (1998) procedure. The procedure used in the software, slightly differs from the one originally published in NCEER-97-0022 (Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils). The revised procedure is presented below in the form of a flowchart[1]:




[1] "Estimating liquefaction-induced ground settlements from CPT for level ground", G. Zhang, P.K. Robertson, and R.W.I. Brachman

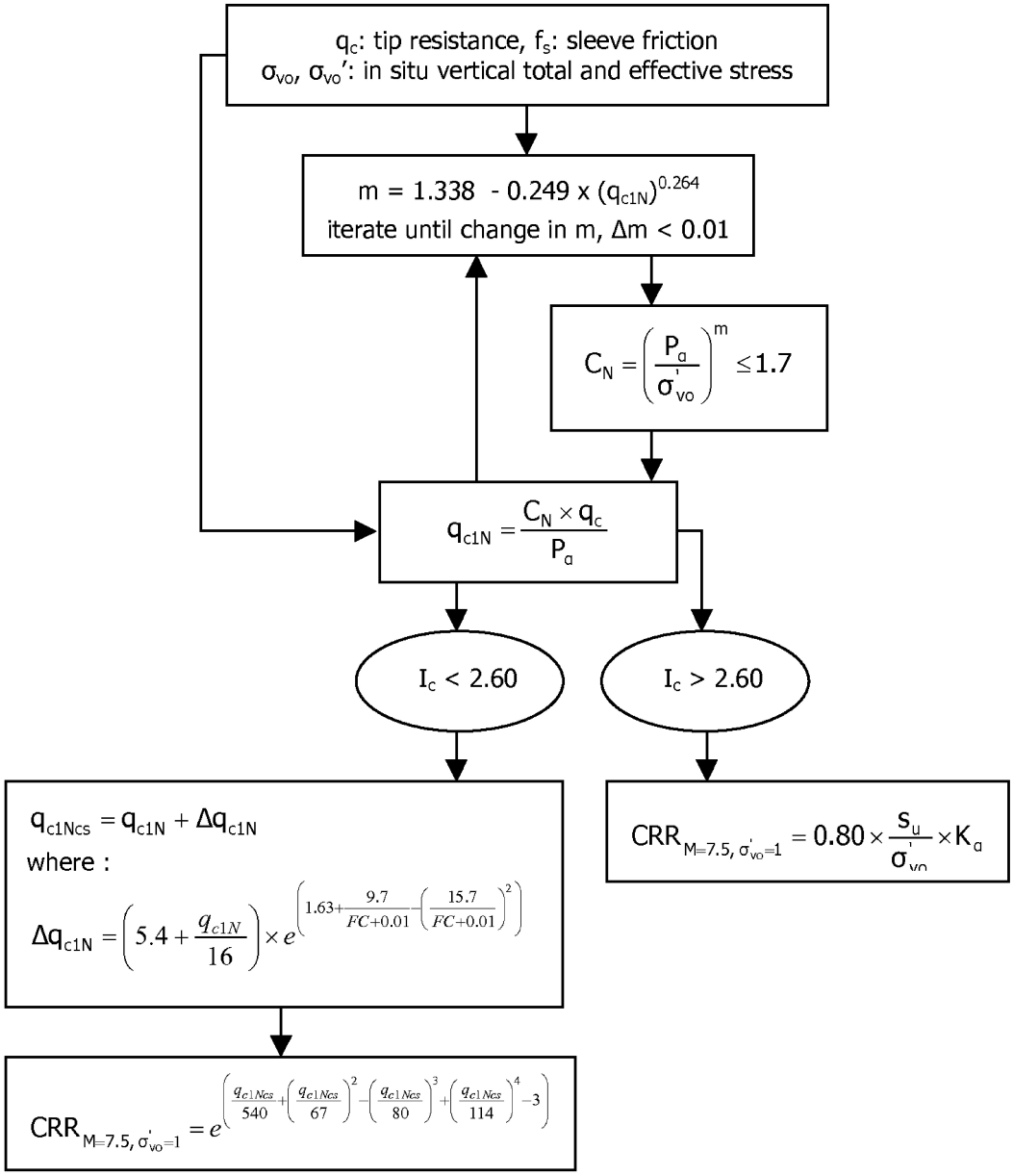
## Procedure for the evaluation of soil liquefaction resistance (all soils), Robertson (2010)

Calculation of soil resistance against liquefaction is performed according to the Robertson & Wride (1998) procedure. This procedure used in the software, slightly differs from the one originally published in NCEER-97-0022 (Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils). The revised procedure is presented below in the form of a flowchart[1]:

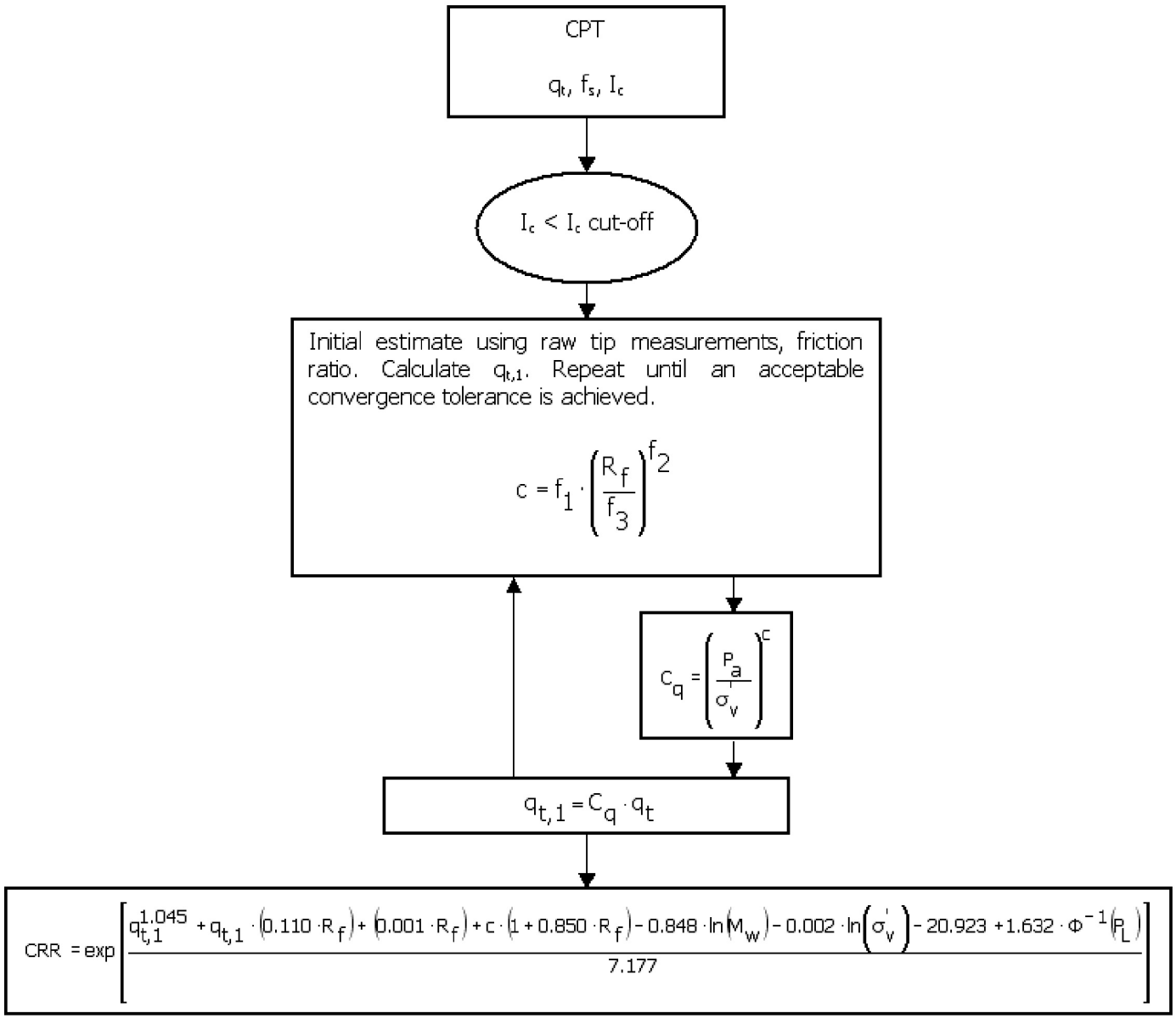



[1] P.K. Robertson, 2009. "Performance based earthquake design using the CPT", Keynote Lecture, International Conference on Performance-based Design in Earthquake Geotechnical Engineering – from case history to practice, IS-Tokyo, June 2009

**Procedure for the evaluation of soil liquefaction resistance, Idriss & Boulanger (2008)**



**Procedure for the evaluation of soil liquefaction resistance (sandy soils), Moss et al. (2006)**



**Procedure for the evaluation of soil liquefaction resistance, Boulanger & Idriss(2014)**

$$FS_{liq} = \frac{CRR_{M=7.5,\sigma'_v=1atm}}{CSR_{M=7.5,\sigma'_v=1atm}}$$

$$CSR_{M=7.5,\sigma'_v=1atm} = 0.65 \frac{\sigma_v}{\sigma'_v} \frac{a_{max}}{g} r_d \frac{1}{MSF} \frac{1}{K_\sigma}$$

$$r_d = \exp\left[\alpha(z) + \beta(z) \cdot M\right]$$

$$\alpha(z) = -1.012 - 1.126 \sin\left(\frac{z}{11.73} + 5.133\right)$$

$$\beta(z) = 0.106 + 0.118 \sin\left(\frac{z}{11.28} + 5.142\right)$$

$$K_\sigma = 1 - C_\sigma \ln\left(\frac{\sigma'_v}{P_a}\right) \le 1.1$$

$$C_\sigma = \frac{1}{37.3 - 8.27\left(q_{c1Ncs}\right)^{0.264}} \le 0.3$$

$$MSF = 1 + \left(MSF_{max} - 1\right)\left(8.64 \exp\left(\frac{-M}{4}\right) - 1.325\right)$$

$$MSF_{max} = 1.09 + \left(\frac{q_{c1Ncs}}{180}\right)^3 \le 2.2$$

$\sigma'_v$ *and* $\sigma_v$ *at start of earthquake shaking*

$$CRR_{M=7.5,\sigma'_v=1atm} = \exp\left(\frac{q_{c1Ncs}}{113} + \left(\frac{q_{c1Ncs}}{1000}\right)^2 - \left(\frac{q_{c1Ncs}}{140}\right)^3 + \left(\frac{q_{c1Ncs}}{137}\right)^4 - 2.80\right)$$

$$q_{c1Ncs} = q_{c1N} + \Delta q_{c1N}$$

$$\Delta q_{c1N} = \left(11.9 + \frac{q_{c1N}}{14.6}\right) \exp\left(1.63 - \frac{9.7}{FC+2} - \left(\frac{15.7}{FC+2}\right)^2\right)$$

$$q_{c1N} = C_{Ne} \frac{q_c}{P_a}$$

$$C_{Ne} = \left(\frac{P_a}{\sigma'_v}\right)^m \le 1.7$$

$$m = 1.338 - 0.249\left(q_{c1Ncs}\right)^{0.264} \quad with \quad 0.264 \le m \le 0.782$$

$$FC = 80\left(I_C + C_{FC}\right) - 137 \quad with \quad 0\% \le FC \le 100\%$$

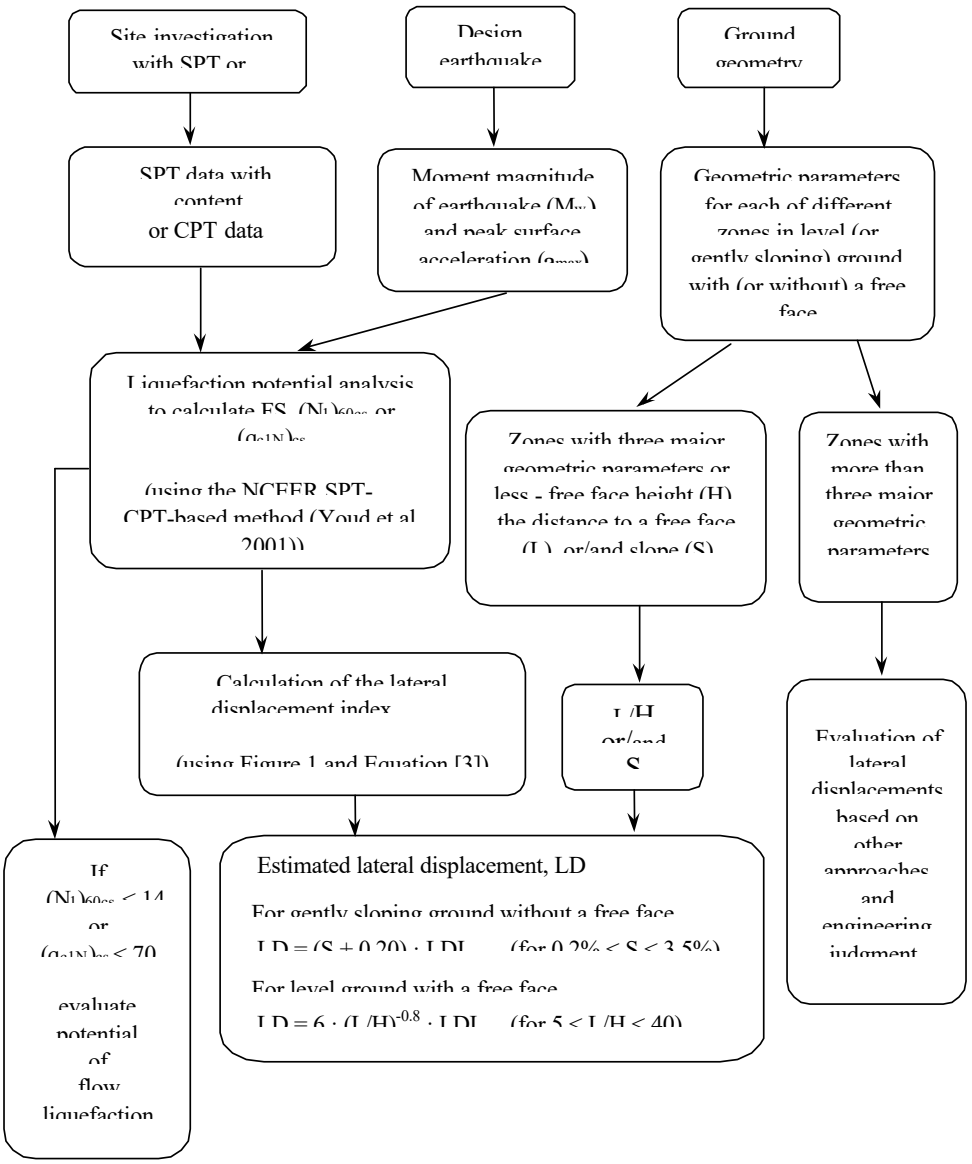
$$I_c = \left[\left(3.47 - \log\left(Q\right)\right)^2 + \left(1.22 + \log\left(F\right)\right)^2\right]^{0.5}$$

$$Q = \left(\frac{q_c - \sigma_{vc}}{P_a}\right)\left(\frac{P_a}{\sigma'_{vc}}\right)^n \; with \; 0.5 \le n \le 1.0 \; per \; Robertson \; \& \; Wride \; (1998)$$

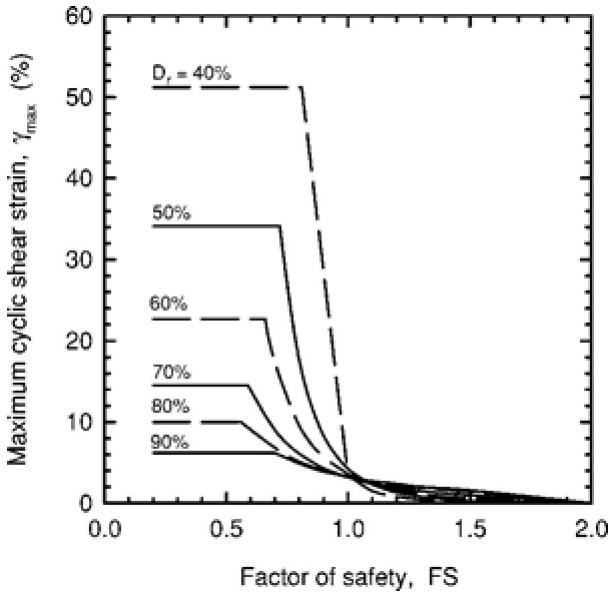
$$F = \left(\frac{f_s}{q_c - \sigma_{vc}}\right) \cdot 100\%$$

$\sigma'_v$ *at time of CPT sounding*

## Procedure for the evaluation of liquefaction-induced lateral spreading displacements




[1] Flow chart illustrating major steps in estimating liquefaction-induced lateral spreading displacements using the proposed approach



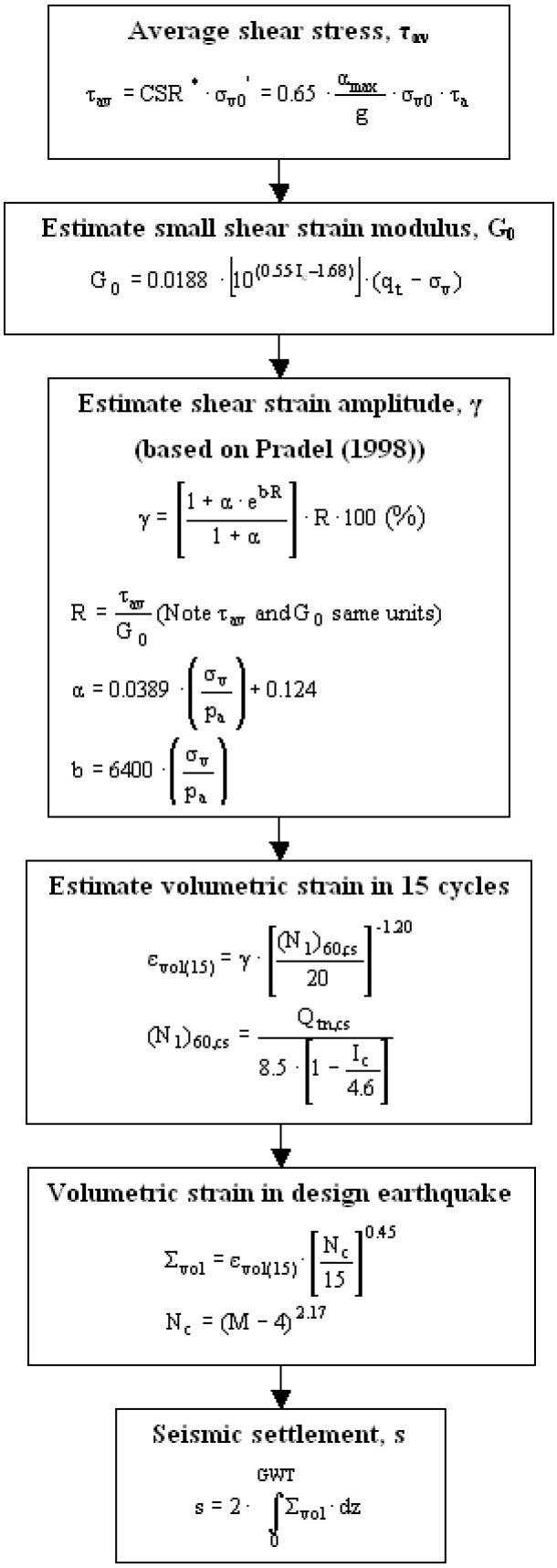

[1] **Figure 1**

$$LDI = \int_0^{z_{max}} \gamma_{max} dz$$

[1] **Equation [3]**

[1] "Estimating liquefaction-induced ground settlements from CPT for level ground", G. Zhang, P.K. Robertson, and R.W.I. Brachman

**Procedure for the estimation of seismic induced settlements in dry sands**




Robertson, P.K. and Lisheng, S., 2010, "Estimation of seismic compression in dry soils using the CPT" FIFTH INTERNATIONAL CONFERENCE ON RECENT ADVANCES IN GEOTECHNICAL EARTHQUAKE ENGINEERING AND SOIL DYNAMICS, Symposium in honor of professor I. M. Idriss, San Diego, CA

## Liquefaction Potential Index (LPI) calculation procedure

Calculation of the Liquefaction Potential Index (LPI) is used to interpret the liquefaction assessment calculations in terms of severity over depth. The calculation procedure is based on the methology developed by Iwasaki (1982) and is adopted by AFPS.

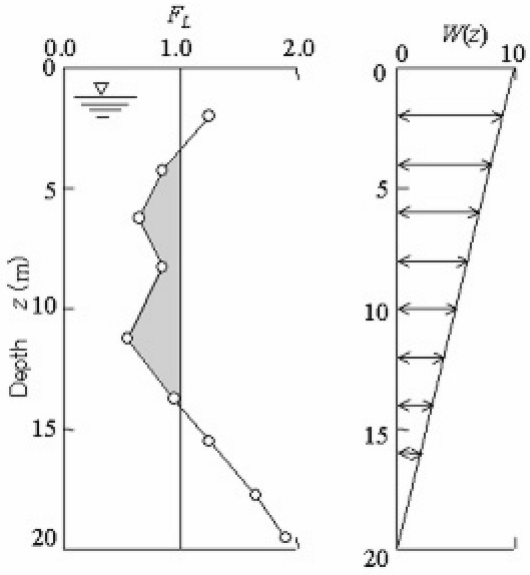
To estimate the severity of liquefaction extent at a given site, LPI is calculated based on the following equation:

$$\mathbf{LPI} = \int_0^{20} (10 - 0{,}5z) \times F_L \times dz$$

where:
$F_L$ = 1 - F.S. when F.S. less than 1
$F_L$ = 0 when F.S. greater than 1
z depth of measurment in meters

Values of LPI range between zero (0) when no test point is characterized as liquefiable and 100 when all points are characterized as susceptible to liquefaction. Iwasaki proposed four (4) discrete categories based on the numeric value of LPI:

- LPI = 0 : Liquefaction risk is very low
- 0 < LPI <= 5 : Liquefaction risk is low
- 5 < LPI <= 15 : Liquefaction risk is high
- LPI > 15 : Liquefaction risk is very high




**Graphical presentation of the LPI calculation procedure**

## Shear-Induced Building Settlement (Ds) calculation procedure

The shear-induced building settlement (Ds) due to liquefaction below the building can be estimated using the relationship developed by Bray and Macedo (2017):

$$Ln(Ds) = c1 + c2 * LBS + 0.58 * Ln\left(Tanh\left(\frac{HL}{6}\right)\right) + 4.59 * Ln(Q) - 0.42 * Ln(Q)^2 - 0.02 * B + 0.84 * Ln(CAVdp) + 0.41 * Ln(Sa1) + \varepsilon$$

where Ds is in the units of mm, c1= -8.35 and c2= 0.072 for LBS ≤ 16, and c1= -7.48 and c2= 0.014 otherwise. Q is the building contact pressure in units of kPa, HL is the cumulative thickness of the liquefiable layers in the units of m, B is the building width in the units of m, CAVdp is a standardized version of the cumulative absolute velocity in the units of g-s, Sa1 is 5%-damped pseudo-acceleration response spectral value at a period of 1 s in the units of g, and ε is a normal random variable with zero mean and 0.50 standard deviation in Ln units. The liquefaction-induced building settlement index (LBS) is:

$$LBS = \sum W * \frac{\varepsilon_{shear}}{z} dz$$

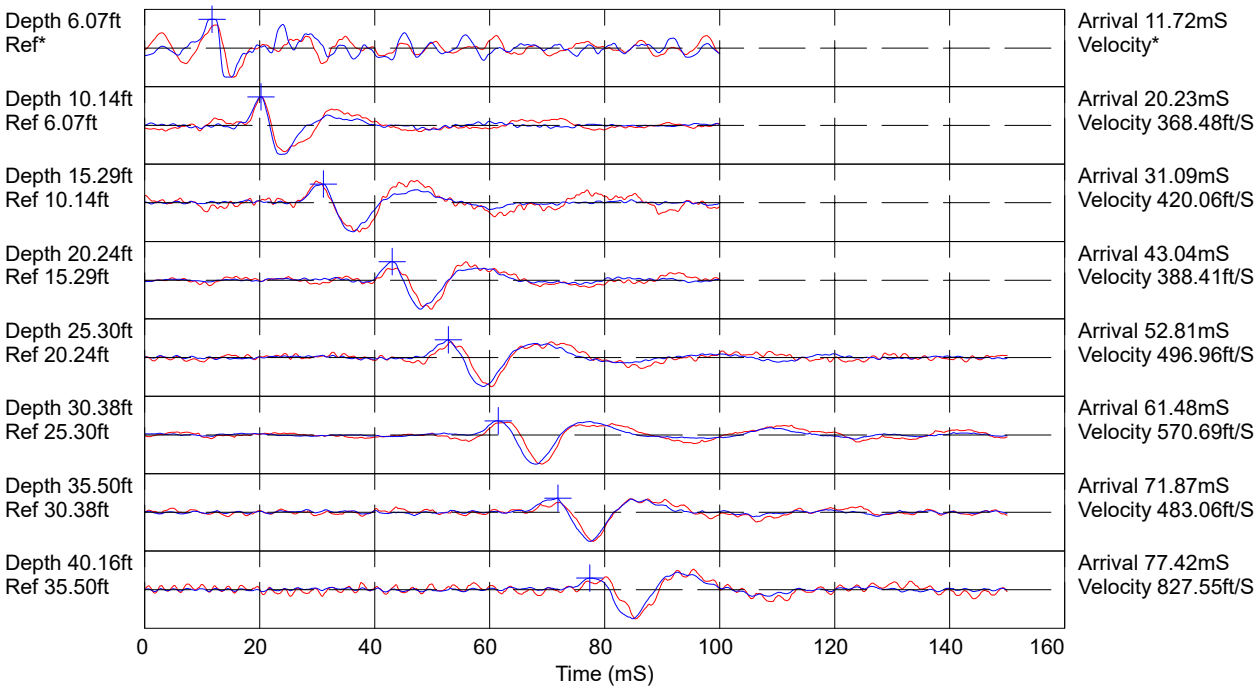
where z (m) is the depth measured from the ground surface > 0, W is a foundation-weighting factor wherein W = 0.0 for z less than Df, which is the embedment depth of the foundation, and W = 1.0 otherwise. The shear strain parameter (ε_shear) is the liquefaction-induced free-field shear strain (in %) estimated using Zhang et al. (2004). It is calculated based on the estimated Dr of the liquefied soil layer and the calculated safety factor against liquefaction triggering (FSL).

## References


- Lunne, T., Robertson, P.K., and Powell, J.J.M 1997. Cone penetration testing in geotechnical practice, E & FN Spon Routledge, 352 p, ISBN 0-7514-0393-8.
- Boulanger, R.W. and Idriss, I. M., 2007. Evaluation of Cyclic Softening in Silts and Clays. ASCE Journal of Geotechnical and Geoenvironmental Engineering June, Vol. 133, No. 6 pp 641-652
- Boulanger, R.W. and Idriss, I. M., 2014. CPT AND SPT BASED LIQUEFACTION TRIGGERING PROCEDURES. DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING COLLEGE OF ENGINEERING UNIVERSITY OF CALIFORNIA AT DAVIS
- Robertson, P.K. and Cabal, K.L., 2007, Guide to Cone Penetration Testing for Geotechnical Engineering. Available at no cost at http://www.geologismiki.gr/
- Robertson, P.K. 1990. Soil classification using the cone penetration test. Canadian Geotechnical Journal, 27 (1), 151-8.
- Robertson, P.K. and Wride, C.E., 1998. Cyclic Liquefaction and its Evaluation based on the CPT Canadian Geotechnical Journal, 1998, Vol. 35, August.
- Youd, T.L., Idriss, I.M., Andrus, R.D., Arango, I., Castro, G., Christian, J.T., Dobry, R., Finn, W.D.L., Harder, L.F., Hynes, M.E., Ishihara, K., Koester, J., Liao, S., Marcuson III, W.F., Martin, G.R., Mitchell, J.K., Moriwaki, Y., Power, M.S., Robertson, P.K., Seed, R., and Stokoe, K.H., Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshop on Evaluation of Liquefaction Resistance of Soils, ASCE, Journal of Geotechnical & Geoenvironmental Engineering, Vol. 127, October, pp 817-833
- Zhang, G., Robertson. P.K., Brachman, R., 2002, Estimating Liquefaction Induced Ground Settlements from the CPT, Canadian Geotechnical Journal, 39: pp 1168-1180
- Zhang, G., Robertson. P.K., Brachman, R., 2004, Estimating Liquefaction Induced Lateral Displacements using the SPT and CPT, ASCE, Journal of Geotechnical & Geoenvironmental Engineering, Vol. 130, No. 8, 861-871
- Pradel, D., 1998, Procedure to Evaluate Earthquake-Induced Settlements in Dry Sandy Soils, ASCE, Journal of Geotechnical & Geoenvironmental Engineering, Vol. 124, No. 4, 364-368
- Iwasaki, T., 1986, Soil liquefaction studies in Japan: state-of-the-art, Soil Dynamics and Earthquake Engineering, Vol. 5, No. 1, 2-70
- Papathanassiou G., 2008, LPI-based approach for calibrating the severity of liquefaction-induced failures and for assessing the probability of liquefaction surface evidence, Eng. Geol. 96:94–104
- P.K. Robertson, 2009, Interpretation of Cone Penetration Tests - a unified approach., Canadian Geotechnical Journal, Vol. 46, No. 11, pp 1337-1355
- P.K. Robertson, 2009. "Performance based earthquake design using the CPT", Keynote Lecture, International Conference on Performance-based Design in Earthquake Geotechnical Engineering - from case history to practice, IS-Tokyo, June 2009
- Robertson, P.K. and Lisheng, S., 2010, "Estimation of seismic compression in dry soils using the CPT" FIFTH INTERNATIONAL CONFERENCE ON RECENT ADVANCES IN GEOTECHNICAL EARTHQUAKE ENGINEERING AND SOIL DYNAMICS, *Symposium in honor of professor I. M. Idriss,* SAN diego, CA
- R. E. S. Moss, R. B. Seed, R. E. Kayen, J. P. Stewart, A. Der Kiureghian, K. O. Cetin, CPT-Based Probabilistic and Deterministic Assessment of In Situ Seismic Soil Liquefaction Potential, Journal of Geotechnical and Geoenvironmental Engineering, Vol. 132, No. 8, August 1, 2006
- I. M. Idriss and R. W. Boulanger, 2008. Soil liquefaction during earthquakes, Earthquake Engineering Research Institute MNO-12
- Jonathan D. Bray & Jorge Macedo, Department of Civil & Environmental Engineering, Univ. of California, Berkeley, CA, USA, Simplified procedure for estimating liquefaction-induced building settlement, *Proceedings of the 19th International Conference*

# CPT-1

## SEISMIC TEST

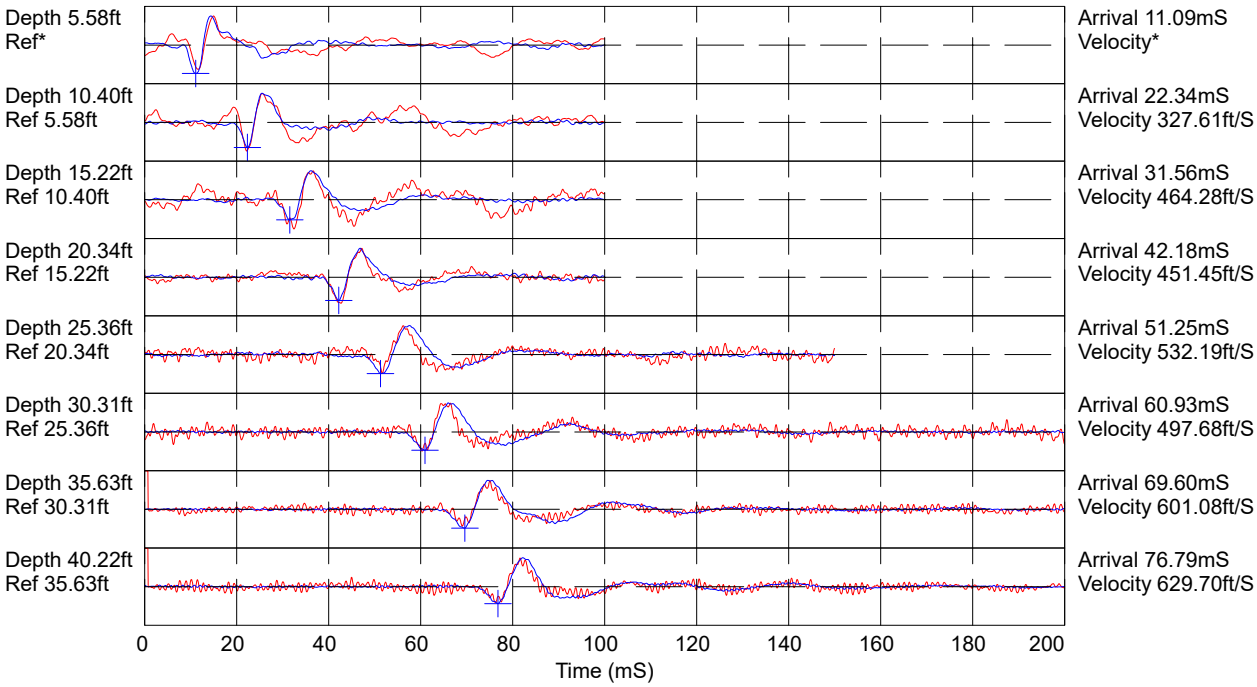



Hammer to Rod String Distance (ft): 6.56
* = Not Determined

COMMENT:

# CPT-2

## SEISMIC TEST




Hammer to Rod String Distance (ft): 6.56
* = Not Determined

COMMENT:

# APPENDIX D

# Previous Subsurface Data and Laboratory Test Results

BSK Associates
399 Lindbergh Avenue
Livermore, CA 94551
Telephone: (925)-315-3151
Fax: (925)-315-3152

# LOG OF BORING NO. B-1

Project Name: **ValleyCare Pleasanton**
Project Number: **G19-040-10L**
Project Location: **5555 W Las Positas Blvd, Pleasanton CA**
Logged by: **O. Khan**
Checked by: **D. Tower**

Surface El.: **342 ft**
Location: **Northwest end of construction trailer**

| Depth, feet | Graphic Log | MATERIAL DESCRIPTION | Samples | Sample Number | Penetration Blows / 6 inches | Pocket Penetrometer, TSF | % Passing No. 200 Sieve | In-Situ Dry Weight (pcf) | In-Situ Moisture Content (%) | Liquid Limit | Plastic Limit | Plasticity Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Sandy Lean CLAY with Gravel (CL):** dark grayish brown, moist, medium plasticity, fine-grained sand, fine subangular gravel | | | | | | | | | | |
| | | | | 2A<br>2B<br>2C | 4<br>14<br>21 | 4.0 | | 86 | 16 | 32 | 18 | 14 |
| | | olive brown, hard, increased sand content, decreased gravel content | | | | | | | | | | |
| | | **Sandy SILT (ML):** olive brown, moist, firm, fine- to medium-grained sand, mottled with clayey sand | | | | | | | | | | |
| 5 | | ▽ 3/1/19, 8:15 AM | | 3A<br>3B<br>3C | 3<br>4<br>4 | | 78 | | | | | |
| | | ▼ 3/1/19, 12:45 PM | | | | | | | | | | |
| | | **Sandy Lean CLAY (CL):** olive brown, moist, medium plasticity, fine-grained sand, mottled with iron oxide staining | | | | | | | | | | |
| | | | | 4A | 4 | | | | | | | |
| 10 | | **Fat CLAY (CH):** dark grayish brown, moist, firm, high plasticity | | 4B<br>4C | 7<br>9 | 2.0 | | | | | | |
| | | **Lean CLAY with Sand (CL):** olive brown, moist, hard, medium plasticity, fine grained sand, manganese oxide staining | | | | | | | | | | |
| | | TXUU (see Figure B-2) c= 1,550 psf | | 5A<br>5B<br>5C | 6<br>9<br>12 | 2.0 | | 102 | 24 | | | |
| 15 | | | | | | | | | | | | |
| | | dark grayish brown to dark olive brown, firm to hard | | 6A<br>6B<br>6C | 9<br>11<br>14 | 2.5 | | | | | | |
| 20 | | | | | | | | | | | | |

**Completion Depth:** 25.0
**Date Started:** 3/1/19
**Date Completed:** 3/1/19
**California Sampler:** 2.5-inch inner diameter
**SPT Sampler:** 1.4-inch inner diameter

**Drilling Equipment:** Exploration GeoServices Mobile B-53
**Drilling Method:** Hollow Stem
**Drive Weight:** 140 lbs
**Hole Diameter:** 8-in
**Drop:** 30-in
**Remarks:** Semi-Automatic Trip Hammer

GEO_TARGET VALLEYCARE PLEASANTON NEW TANKS BORING LOGS.GPJ GEOTECHNICAL 08.GDT 4/12/19

BSK Associates
399 Lindbergh Avenue
Livermore, CA 94551
Telephone: (925)-315-3151
Fax: (925)-315-3152

# LOG OF BORING NO. B-1

Project Name: **ValleyCare Pleasanton**
Project Number: **G19-040-10L**
Project Location: **5555 W Las Positas Blvd, Pleasanton CA**
Logged by: **O. Khan**
Checked by: **D. Tower**

Surface El.: **342 ft**
Location: **Northwest end of construction trailer**

| Depth, feet | Graphic Log | MATERIAL DESCRIPTION | Samples | Sample Number | Penetration Blows / 6 inches | Pocket Penetrometer, TSF | % Passing No. 200 Sieve | In-Situ Dry Weight (pcf) | In-Situ Moisture Content (%) | Liquid Limit | Plastic Limit | Plasticity Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Lean CLAY with Sand (CL):** olive brown, moist, hard, medium plasticity, fine grained sand, manganese oxide staining *(continued)* | | | | | | | | | | |
| | | dark grayish brown, decreased sand content, hard, medium to high plasticity | | 7A<br>7B<br>7C | 10<br>11<br>14 | 2.5 | | | | | | |
| 25 | | Boring terminated at approximately 25 feet. Free groundwater observed at approximately 6 feet. Boring backfilled with cement grout. | | | | | | | | | | |
| 30 | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | |

**Completion Depth:** 25.0
**Date Started:** 3/1/19
**Date Completed:** 3/1/19
**California Sampler:** 2.5-inch inner diameter
**SPT Sampler:** 1.4-inch inner diameter

**Drilling Equipment:** Exploration GeoServices Mobile B-53
**Drilling Method:** Hollow Stem
**Drive Weight:** 140 lbs
**Hole Diameter:** 8-in
**Drop:** 30-in
**Remarks:** Semi-Automatic Trip Hammer

GEO_TARGET VALLEYCARE PLEASANTON NEW TANKS BORING LOGS.GPJ GEOTECHNICAL 08.GDT 4/12/19

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Livermore, CA 94551
Telephone: (925)-315-3151
Fax: (925)-315-3152

# LOG OF BORING NO. B-2

Project Name: **ValleyCare Pleasanton**
Project Number: **G19-040-10L**
Project Location: **5555 W Las Positas Blvd, Pleasanton CA**
Logged by: **O. Khan**
Checked by: **D. Tower**

Surface El.: **343 ft**
Location: **Southeast end of construction trailer**

| Depth, feet | Graphic Log | MATERIAL DESCRIPTION | Samples | Sample Number | Penetration Blows / 6 inches | Pocket Penetrometer, TSF | % Passing No. 200 Sieve | In-Situ Dry Weight (pcf) | In-Situ Moisture Content (%) | Liquid Limit | Plastic Limit | Plasticity Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Clayey SAND with Gravel (SC):** yellowish brown, moist, loose, fine- to medium-grained sand, fine gravel | | | | | | | | | | |
| | | increased sand content, decreased gravel content | | 1A<br>1B<br>1C | 2<br>3<br>4 | | 47 | | | 31 | 15 | 16 |
| 5 | | **Silty SAND (SM):** dark grayish brown, moist, loose, fine- to medium-grained sand | | 2A<br>2B | 5<br>5 | | | | | | | |
| | | **Sandy Lean CLAY (CL):** olive brown to brown, moist, firm, medium plasticity, fine-grained sand, mottled with iron oxide staining | | 2C | 5 | 3.0 | | | | | | |
| 10 | | dark grayish brown, hard, fine- to medium-grained sand | | 3A<br>3B | 4<br>5 | 2.5 | | | | | | |
| | | TXUU (see Figure B-2) c= 1,700 psf | | 3C | 8 | | | 103 | 23 | | | |
| 15 | | **Lean CLAY (CL):** dark grayish brown, moist, hard, medium to high plasticity | | 4A<br>4B<br>4C | 4<br>4<br>7 | 2.5 | | | | | | |
| | | manganese oxide staining, hard, carbonate deposits | | | | | | | | | | |
| 20 | | dark yellowish brown, firm, medium plasticity, mottled with manganese oxide staining, trace fine-grained sand, trace | | 5A<br>5B<br>5C | 3<br>4<br>4 | 1.5 | | 85 | 26 | | | |

**Completion Depth:** 51.5
**Date Started:** 3/1/19
**Date Completed:** 3/1/19
**California Sampler:** 2.5-inch inner diameter
**SPT Sampler:** 1.4-inch inner diameter

**Drilling Equipment:** Exploration GeoServices Mobile B-53
**Drilling Method:** Rotary Wash
**Drive Weight:** 140 lbs
**Hole Diameter:** 8-in
**Drop:** 30-in
**Remarks:** Automatic Trip Hammer

GEO_TARGET VALLEYCARE PLEASANTON NEW TANKS BORING LOGS.GPJ GEOTECHNICAL 08.GDT 4/12/19

BSK Associates
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Livermore, CA 94551
Telephone: (925)-315-3151
Fax: (925)-315-3152

# LOG OF BORING NO. B-2

Project Name: **ValleyCare Pleasanton**
Project Number: **G19-040-10L**
Project Location: **5555 W Las Positas Blvd, Pleasanton CA**
Logged by: **O. Khan**
Checked by: **D. Tower**

Surface El.: **343 ft**
Location: **Southeast end of construction trailer**

| Depth, feet | Graphic Log | MATERIAL DESCRIPTION | Samples | Sample Number | Penetration Blows / 6 inches | Pocket Penetrometer, TSF | % Passing No. 200 Sieve | In-Situ Dry Weight (pcf) | In-Situ Moisture Content (%) | Liquid Limit | Plastic Limit | Plasticity Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | carbonate nodules<br>**Lean CLAY (CL):** dark grayish brown, moist, hard, medium to high plasticity *(continued)* | | | | | | | | | | |
| 25 | | **Lean CLAY with Sand (CL):** very dark grayish brown, moist, firm to hard, medium to high plasticity, fine-grained sand | | 6A<br>6B<br>6C | 3<br>5<br>6 | 1.5 | | | | | | |
| 30 | | **Sandy Lean CLAY (CL):** light olive brown, moist, firm to hard, low to medium plasticity, fine-grained sand, manganese and iron oxide staining, carbonate nodules | | 7A<br>7B<br>7C | 6<br>8<br>9 | 2.5 | | | | | | |
| 35 | | **Lean CLAY with Sand (CL):** light olive brown to olive, moist, hard, medium plasticity, fine-grained sand, mottled with iron oxide staining and carbonate nodules | | 8A<br>8B<br>8C | 4<br>5<br>6 | 3.0 | | | | | | |
| 40 | | firm to hard | | 9A<br>9B<br>9C | 5<br>7<br>8 | 2.0 | | | | | | |

**Completion Depth:** 51.5
**Date Started:** 3/1/19
**Date Completed:** 3/1/19
**California Sampler:** 2.5-inch inner diameter
**SPT Sampler:** 1.4-inch inner diameter

**Drilling Equipment:** Exploration GeoServices Mobile B-53
**Drilling Method:** Rotary Wash
**Drive Weight:** 140 lbs
**Hole Diameter:** 8-in
**Drop:** 30-in
**Remarks:** Automatic Trip Hammer

GEO_TARGET VALLEYCARE PLEASANTON NEW TANKS BORING LOGS.GPJ GEOTECHNICAL 08.GDT 4/12/19

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Telephone: (925)-315-3151
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# LOG OF BORING NO. B-2

Project Name: **ValleyCare Pleasanton**
Project Number: **G19-040-10L**
Project Location: **5555 W Las Positas Blvd, Pleasanton CA**
Logged by: **O. Khan**
Checked by: **D. Tower**

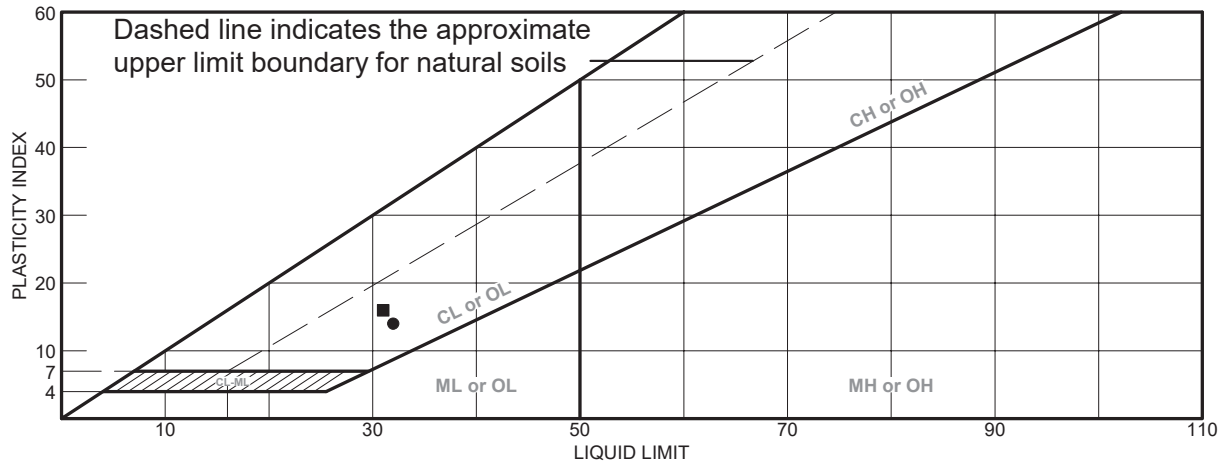
Surface El.: **343 ft**
Location: **Southeast end of construction trailer**

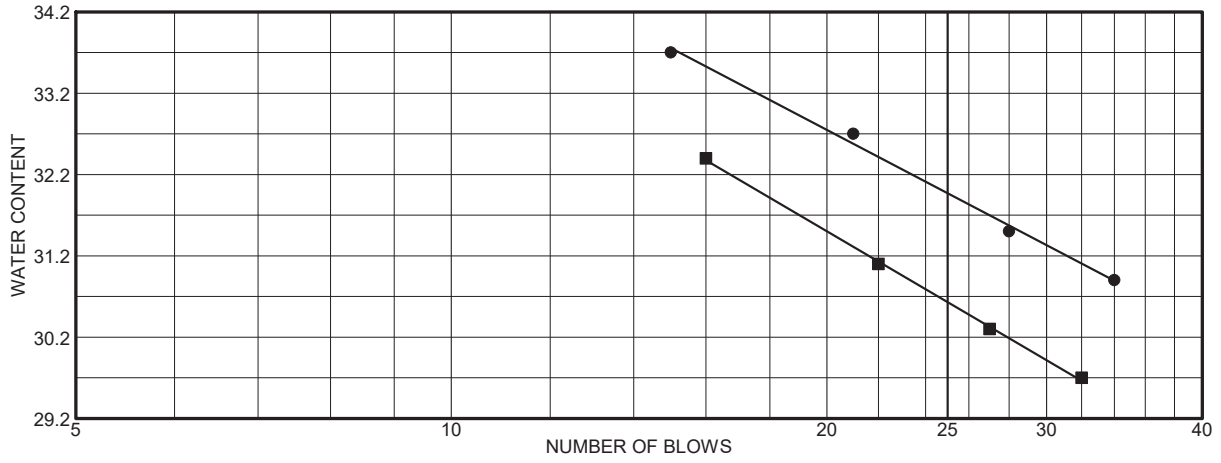
| Depth, feet | Graphic Log | MATERIAL DESCRIPTION | Samples | Sample Number | Penetration Blows / 6 inches | Pocket Penetrometer, TSF | % Passing No. 200 Sieve | In-Situ Dry Weight (pcf) | In-Situ Moisture Content (%) | Liquid Limit | Plastic Limit | Plasticity Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 45 | | **Sandy SILT (ML):** dark yellowish brown, moist, firm, fine-grained sand, iron oxide staining, increased fines content with depth, interbedded with clayey sand towards bottom | | 10A<br>10B<br>10C | 8<br>13<br>13 | | 60 | 93 | 19 | | | |
| 50 | | **Well Graded GRAVEL with Sand (GW):** dark grayish brown, wet, dense, fine- to coarse-grained sand, fine to coarse subangular gravel up to 1½ inch | | 11 | 20<br>20<br>20 | | | | | | | |
| | | Boring terminated at approximately 51½ feet. Groundwater depth obscured by rotary wash drilling method. Boring backfilled with cement grout. | | | | | | | | | | |
| 55 | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | |
| 65 | | | | | | | | | | | | |

**Completion Depth:** 51.5
**Date Started:** 3/1/19
**Date Completed:** 3/1/19
**California Sampler:** 2.5-inch inner diameter
**SPT Sampler:** 1.4-inch inner diameter

**Drilling Equipment:** Exploration GeoServices Mobile B-53
**Drilling Method:** Rotary Wash
**Drive Weight:** 140 lbs
**Hole Diameter:** 8-in
**Drop:** 30-in
**Remarks:** Automatic Trip Hammer

# LIQUID AND PLASTIC LIMITS TEST REPORT




| | MATERIAL DESCRIPTION | LL | PL | PI | %<#40 | %<#200 | USCS |
|---|---|---|---|---|---|---|---|
| ● | Sandy Lean Clay (CL) | 32 | 18 | 14 | | | |
| ■ | Clayey Sand with Gravel (SC) | 31 | 15 | 16 | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Project No.** 664-246 **Client:** BSK Associates

**Project:** New Tanks and Generators at Valley Care Pleasanton - G19-040-10L

● **Source:** B-1 **Sample No.:** 2B **Elev./Depth:** 2.5'

■ **Source:** B-2 **Sample No.:** 1C **Elev./Depth:** 3.0'

**Remarks:**

●

■

LIQUID AND PLASTIC LIMITS TEST REPORT

**COOPER TESTING LABORATORY**

**Figure**

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BSK ASSOCIATES

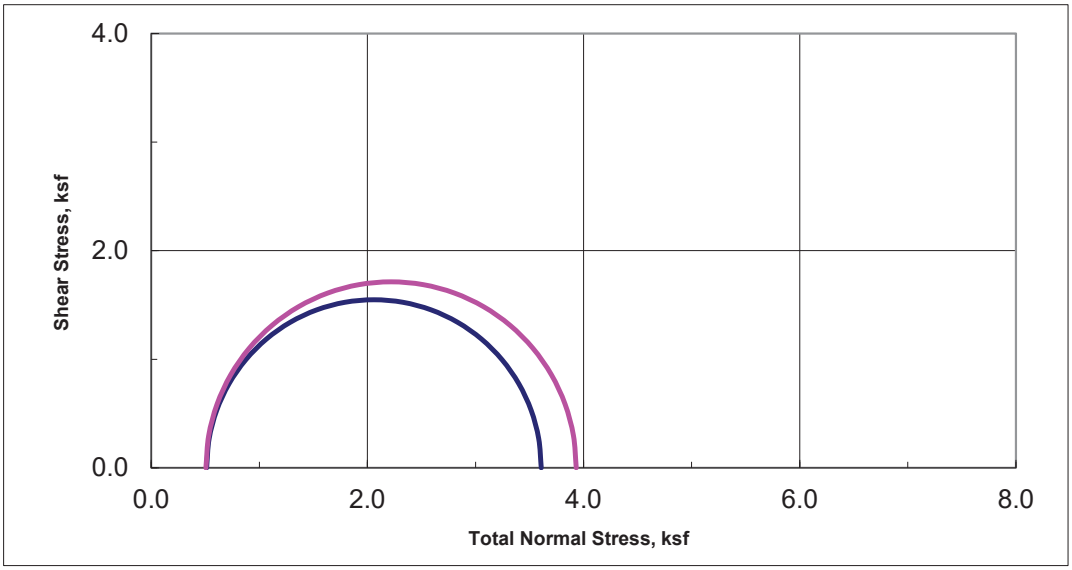
| | |
|---|---|
| **PROJECT NO.** G19-040-10L | ATTERBERG LIMITS |
| **DRAWN:** 04/05/19 | |
| **DRAWN BY:** D. Tower | |
| **CHECKED BY:** O. Khan | **Planned Fuel Oil Tanks & Emergency Generators**<br>**Stanford Health- ValleyCare**<br>**5555 W Las Positas Boulevard**<br>**Pleasanton, Califonira** |
| **FILE NAME:** SitePlan.indd | |

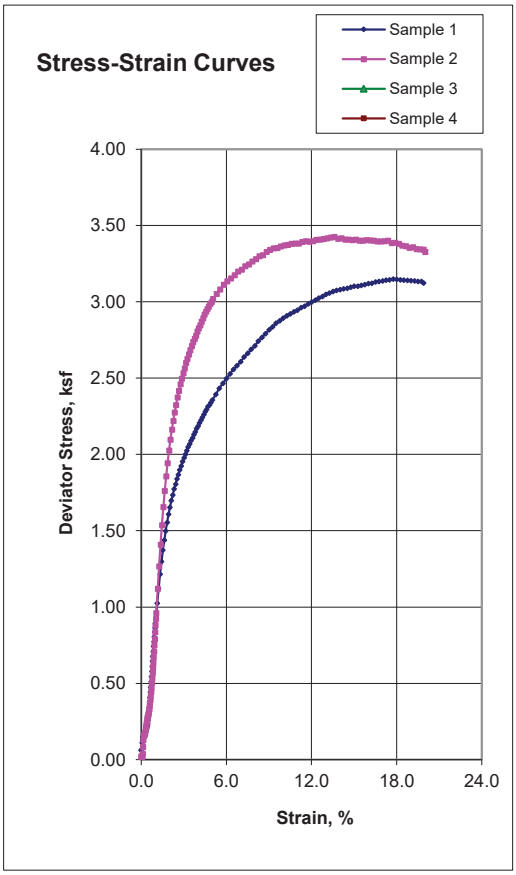
**FIGURE**

B-1

COOPER TESTING LABORATORY

# Unconsolidated-Undrained Triaxial Test
ASTM D2850




| Sample Data | | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Moisture % | 24.0 | 23.3 | | |
| Dry Den,pcf | 102.0 | 102.6 | | |
| Void Ratio | 0.653 | 0.643 | | |
| Saturation % | 99.1 | 97.6 | | |
| Height in | 5.03 | 5.05 | | |
| Diameter in | 2.43 | 2.43 | | |
| Cell psi | 3.6 | 3.5 | | |
| Strain % | 15.00 | 13.61 | | |
| Deviator, ksf | 3.096 | 3.426 | | |
| Rate %/min | 0.99 | 0.35 | | |
| in/min | 0.050 | 0.018 | | |
| Job No.: | 664-246 | | | |
| Client: | BSK Associates | | | |
| Project: | G19-040-10L | | | |
| Boring: | B-1 | B-2 | | |
| Sample: | 5C | 3C | | |
| Depth ft: | 14.5 | 11 | | |

| Visual Soil Description | |
|---|---|
| Sample # | |
| 1 | Olive Brown Lean Clay with Sand (CL) |
| 2 | Dark Grayish Brown Sandy Lean Clay (CL) |
| 3 | |
| 4 | |

Remarks:

Note: Strengths are picked at the peak deviator stress or 15% strain which ever occurs first per ASTM D2850.

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BSK ASSOCIATES

| | |
|---|---|
| PROJECT NO. | G19-040-10L |
| DRAWN: | 04/05/19 |
| DRAWN BY: | D. Tower |
| CHECKED BY: | O. Khan |
| FILE NAME: | SitePlan.indd |

UNCONSOLIDATED-UNDRAINED TRIAXIAL TEST

Planned Fuel Oil Tanks & Emergency Generators
Stanford Health- ValleyCare
5555 W Las Positas Boulevard
Pleasanton, Califonira

FIGURE
B-2

BSK Associates
Engineers & Laboratories

**BSK Associates**
324 Earhart Way
Livermore, CA 94551
P: 925-315-3151 F: 925-315-3152

# LOG OF BORING NO. B-1

Project Name: **ValleyCare Emergency Dept. Addition**
Location: **ValleyCare Medical Center, Pleasanton**
Job Number: **G12-109-10P**
Plate 2

Surface El.:
Location: **See Site Plan, Fig. 2**

| Depth, feet | Graphic Log | MATERIAL DESCRIPTION | Samples | Sample Number | Penetration Blows / Foot | Pocket Penetrometer, TSF | % Passing No. 200 Sieve | In-Situ Dry Weight (pcf) | In-Situ Moisture Content (%) | Liquid Limit | Plastic Limit | Plasticity Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AC = 3" AB = 13.5 | | | | | | | | | | |
| | | Silty CLAY (CL): grey brown, moist, firm to stiff. | | 1 | 8 | 2.5 | | 85 | 28 | 26 | 18 | 8 |
| 5 | | Silty CLAY (CH): grey brown, moist to wet, stiff. | | | | | | | | | | |
| | | | | 2 | 15 | | | | | | | |
| 10 | | Sandy CLAY (CL-CH): olive brown, very moist, firm to stiff. | | 3 | 12 | 3.2 | 48 | 86 | 32 | 49 | 14 | 35 |
| 15 | | Silty CLAY (CH): dark olive brown, moist, firm to stiff. | | | | | | | | | | |
| | | | | 4 | 11 | | | | | | | |
| 20 | | Silty CLAY (CL-CH): dark grey brown, moist, stiff to very stiff. | | | | | | | | | | |
| | | | | 5 | 16 | 3.0 | | 95 | 28 | | | |
| 25 | | | | | | | | | | | | |
| | | | | 6 | 14 | | | | | | | |
| 30 | | Boring terminated at 30 feet and backfilled with tamped cuttings capped with asphalt. | | | | | | | | | | |

Completion Depth: **30.0**
Date Started: **10/4/12**
Date Completed: **10/4/12**
Logged By: **BY**
Checked By: **BY**

Drilling Equipment and Method: Mobile B24

Remarks:

**BSK Associates**
324 Earhart Way
Livermore, CA 94551
P: 925-315-3151 F: 925-315-3152

# LOG OF BORING NO. B-2

Project Name: **ValleyCare Emergency Dept. Addition**
Location: **ValleyCare Medical Center, Pleasanton**
Job Number: **G12-109-10P**
Plate 3

Surface El.:
Location: **See Site Plan, Fig. 2**

| Depth, feet | Graphic Log | MATERIAL DESCRIPTION | Samples | Sample Number | Penetration Blows / Foot | Pocket Penetrometer, TSF | % Passing No. 200 Sieve | In-Situ Dry Weight (pcf) | In-Situ Moisture Content (%) | Liquid Limit | Plastic Limit | Plasticity Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sandy CLAY (CL): grey brown, moist, firm to stiff. | | 1 | | | | | | | | |
| | | | | 2 | | | | | | | | |
| 5 | | Silty SAND (SM): olive brown, moist, medium dense, fine grain. | | 3 | 12 | 2.5 | | 88 | 24 | | | |
| | | Silty CLAY (CH): dark olive brown, moist, stiff. | | | | | | | | | | |
| 10 | | | | 4 | 15 | | | | | | | |
| | | Sandy CLAY (CH): dark grey brown, moist, stiff. | | | | | | | | | | |
| 15 | | | | 5 | 16 | 2.8 | | 85 | 33 | 66 | 17 | 49 |
| | | Silty CLAY (CL-CH): dark grey brown, moist, stiff to very stiff. | | | | | | | | | | |
| 20 | | | | 6 | 18 | | | | | | | |
| | | Boring terminated at 21.5 feet and backfilled with tamped cuttings. | | | | | | | | | | |
| 25 | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | |

Completion Depth: **21.5**
Date Started: **10/4/12**
Date Completed: **10/4/12**
Logged By: **BY**
Checked By: **BY**

Drilling Equipment and Method: Mobile Minuteman

Remarks:

GEOTECHNICAL 08 G1210910P.GPJ GEOTECHNICAL 08.GDT 10/23/12

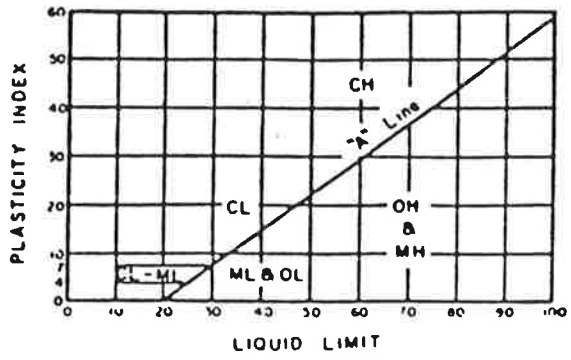
# LEGEND FOR TEST HOLE LOGS

## METHOD OF SOIL CLASSIFICATION
(Unified Soil Classification System)

| MAJOR DIVISIONS | | SYMBOLS | TYPICAL NAMES |
|---|---|---|---|
| COARSE GRAINED SOILS (More than 1/2 of soil > no. 200 sieve size) | GRAVELS (More than 1/2 of coarse fraction > no. 4 sieve size) | GW | Well graded gravels or gravel-sand mixtures, little or no fines |
| | | GP | Poorly graded gravels or gravel-sand mixtures, little or no fines |
| | | GM | Silty gravels, gravel-sand-silt mixtures |
| | | GC | Clayey gravels, gravel-sand-clay mixtures |
| | SANDS (More than 1/2 of coarse fraction < no. 4 sieve size) | SW | Well graded sands or gravelly sands, little or no fines |
| | | SP | Poorly graded sands or gravelly sands, little or no fines |
| | | SM | Silty sands, sand-silt mixtures |
| | | SC | Clayey sands, sand-clay mixtures |
| FINE GRAINED SOILS (More than 1/2 of soil < no. 200 sieve size) | SILTS & CLAYS LL < 50 | ML | Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity |
| | | CL | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays |
| | | OL | Organic silts and organic silty clays of low plasticity |
| | SILTS & CLAYS LL > 50 | MH | Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts |
| | | CH | Inorganic clays of high plasticity, fat clays |
| | | OH | Organic clays of medium to high plasticity, organic silty clays, organic silts |

Note:

PP = Pocket Penetrometer Reading: Unconfined Compressive Strength in tons/ft²




PLASTICITY CHART

Key to Samples

- ■ Indicates depth of undisturbed sample
- ☐ Sample not recovered
- ⊠ Indicates depth of disturbed sample
- ◥ Indicates depth of Standard Penetration Split Spoon Sample

BSK & Associates

DATE: 7/18/86
LOGGED BY: AYE
ELEVATION: 336.0'
WATER LEVEL: 14'-3" (7/18/86) and 12'-10" (7/23/86)
EQUIPMENT: Mobile B-53, 8" Hollow Stem Auger

# LOG DESIGNATION B-5

JOB: P86057
FIGURE: A-6

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | SAMPLES | U.S.C.S. | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | TOPSOIL: 3"-4" thick, loose | |
| | | | | | | ML | SANDY SILT: Light brown, dry, very stiff | |
| | 2.5 | 74 | 6.1 | 101 | 1<br>2 | SM | SILTY SAND: Light Olive brown, damp, dense<br><br>Grading with more silt and medium dense | |
| 5 | 2.5 | 36 | 21 | 88 | 3 | CL<br>CH | SILTY CLAY: Dark gray-brown, stiff | |
| | | | | | | CL | SANDY CLAY: Olive brown, moist, stiff to very stiff | PP = 2.2 tsf |
| | 2.5 | 46 | 25 | 100 | 4<br>5 | CL<br>CH | SILTY CLAY: Dark gray-brown, moist, stiff to very stiff | PP = 2.3 |
| 10 | | | | | | | Grading to medium stiff to stiff | |
| | 2.5 | 28 | 35 | 86 | 6 | | | ▽ |
| 15 | | | | | | | Grading to light gray-brown and stiff | |
| | | | | | | | Initial water level at 19'-3" | |
| 20 | 2.5 | 32 | 23 | 103 | 7 | | | PP = 1.7 |
| | | | | | | CL | SILTY CLAY: Mottled orange gray, moist, stiff to very stiff | PP = 2.2 |
| 25 | | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 7/18/86
LOGGED BY: AYE
ELEVATION: --
WATER LEVEL: --
EQUIPMENT: B-53, 8" Hollow Stem Auger

# LOG DESIGNATION B-5 (Cont'd.)

JOB: P86057
FIGURE: A-6(Cont

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | SAMPLES | U.S.C.S. | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|---|
| 25 | 2.5 | 61 | -- | -- | 8 | | | |
| | | | | | | CL | SILTY CLAY: Olive brown with blue spots, very moist, stiff | |
| 30 | 2.5 | 42 | 27 | 97 | 9 | | | PP = 1.3 tsf |
| | | | | | | | Grading to stiffer | |
| 35 | 2.5 | 54 | -- | -- | 10 | | | PP = 1.5 |
| | | | | | | ML | SANDY SILT: Orange-brown, moist, very stiff | |
| 40 | 2.5 | 65 | 21 | 108 | 11 | | | PP = 3.0 |
| | | | | | | | Grading to stiff | |
| 45 | | | | | | | Grading to very stiff | |
| | 2.5 | 108 | 6.0 | 130 | 12 | GW | SANDY GRAVEL: Grey, subrounded, fine-grained, very dense | |
| 50 | | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 7/18/86
LOGGED BY: AYE
ELEVATION: --
WATER LEVEL: --
EQUIPMENT: B-53, 8" Hollow Stem Auger

# LOG DESIGNATION B-5 (Cont'd.)

JOB: P86057
FIGURE: A-6(Cont

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | SAMPLES | U.S.C.S. | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|---|
| 55 | | | | | | | | Boring terminated at 55' |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 7/22/86
LOGGED BY: AYE

# LOG DESIGNATION B-10

ELEVATION: 338.1'
WATER LEVEL: 14'-0" (7/22/86) and 11'-6" (7/23/86)
EQUIPMENT: Mobile B-53, 8" Hollow Stem Auger

JOB: P86057
FIGURE: A-11

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | SAMPLES | U.S.C.S. | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | TOPSOIL: 2" - 3" | |
| | | | | | | ML | SANDY SILT: Light brown, dry to damp, very stiff | |
| | 2.5 | 62 | -- | -- | 1 | SP | SAND: Light Olive brown, medium-grained, medium dense to dense | |
| | 2.5 | 34 | 24 | 93 | 2 | | | |
| 5 | | | | | | ML/SM | SAND-SILT: Olive brown, with clay lenses, moist, medium dense | |
| | 2.5 | 45 | 24 | 101 | 3 | CL/CH | SILTY CLAY: Dark grey-brown, moist, stiff | PP = 1.8 tsf |
| 10 | | | | | | | Grading to less stiff and light colored | ▽ |
| 15 | 2.5 | 36 | 31 | 93 | 4 | | | PP = 1.4 |
| | | | | | | CL | SANDY CLAY: Light mottled brown, very moist, stiff | |
| | | | | | | | Initial water level at 19' | |
| 20 | 2.5 | 37 | 24 | 103 | 5 | | | PP = 1.2 |
| | | | | | | CL/CH | SILTY CLAY: Olive brown, with occasional gravel, stiff to very stiff | PP = 2.2 |
| 25 | | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 7/22/86
LOGGED BY: AYE
ELEVATION: --
WATER LEVEL: --
EQUIPMENT: Mobile B-53, 8" Hollow Stem Auger

# LOG DESIGNATION B-10 (Cont'd.)

JOB: P86057
FIGURE: A-11(Cont'

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | SAMPLES | U.S.C.S. | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|---|
| 25 | 2.5 | 36 | 29 | 94 | 6 | | | |
| | | | | | | CL | SILTY CLAY: Mottled grey-brown, with blue spots, moist, stiff | |
| 30 | 2.5 | 44 | 27 | 96 | 7 | | | PP = 2.1 tsf |
| | | | | | | | | Boring terminated at 31' |
| 35 | | | | | | | | |
| 40 | | | | | | | | |
| 45 | | | | | | | | |
| 50 | | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 7/23/86
LOGGED BY: AYE
ELEVATION: 337.0'
WATER LEVEL: None at time of drilling
EQUIPMENT: Mobile B-53, 5" Solid Flight Auger

# LOG DESIGNATION R-2

JOB: P86057
FIGURE: A-16

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | SAMPLES | U.S.C.S. | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | 2"-3" of topsoil | |
| | | | | | | ML | SANDY SILT: Light brown, damp very stiff | Bulk Sample 1A at 3"-3' |
| | 2.5 | 41 | 6.5 | 117 | 1<br>2 | SP | SAND: Olive brown, slightly silty, dense | |
| 5 | | | | | | ML/SM | SANDY SILT/SILTY SAND: Olive-brown, alternating layers, moist, medium dense | |
| | 2.5 | 62 | 18 | 103 | 3 | CL | SILTY CLAY: Dark brown, moist, very stiff | Boring terminated at 7' |
| 10 | | | | | | | | |
| 15 | | | | | | | | |
| 20 | | | | | | | | |
| 25 | | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

# APPENDIX E

# Seismic Survey Report by AGS

ADVANCED GEOLOGICAL SERVICES
2255 Morello Ave, Ste 117
Pleasant Hill, CA
94523

September 28, 2024

Cristiano Melo, PE, GE
Geotechnical Engineer/Branch Manager
BSK Associates
399 Lindbergh Avenue, Livermore, CA 94551

Subject:

**MASW Seismic Survey Report**
**Tri-Valley East Wing Hospital Expansion**
**5555 W. Las Positas Rd, Pleasanton, California**

## INTRODUCTION

This letter presents the results of an MASW seismic survey for the Tri-Valley Hospital East Wing Expansion (General location, Fig. 1, line locations, Fig 2). The geophysical survey was completed off hours between 2 am and 8 am on Saturday the 21st of September 2024 by Senior Geophysicist Pierre Armand with oversight by Cristiano Melo of BSK Associates. The survey objective was to assess the average shear-wave velocity of the upper 100 feet (Vs30) on two separate seismic lines (lines 1 and 2).

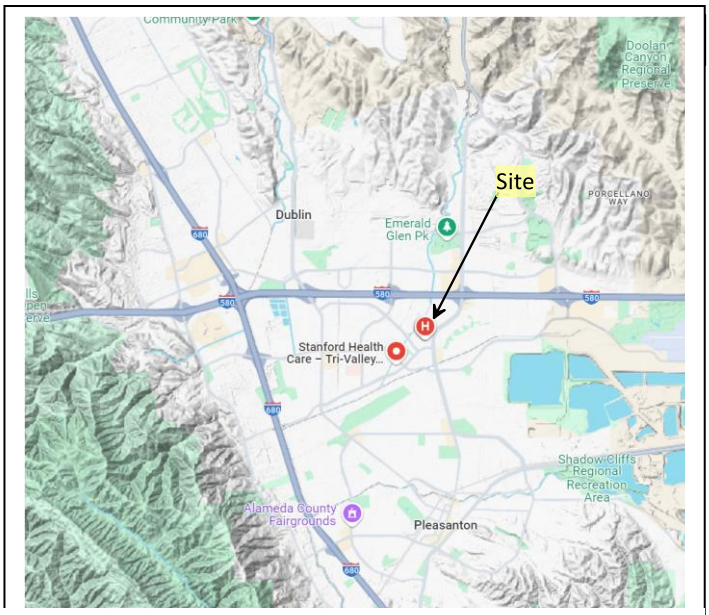



**Figure 1. Seismic Survey Locations**

## SUMMARY OF FINDINGS

The Vs30 determined from line 1 is 700 ft/sec, and 677 ft/sec for line 2. The seismic site class for those velocities is a D (Table 1 stiff soil and Figure 3).

## SITE DESCRIPTION

Both seismic lines were laid out on the asphalt paved perimeter road, northeast of the hospital. The site was flat with no topography. The lengths of lines 1 and 2 were restricted to keep the perimeter road open. Geophones were secured by drilling a ¼" hole 1.5 inches deep into the asphalt.

## SEISMIC SURFACE-WAVE METHOD OVERVIEW

*MASW Data Processing*

The seismic data were processed using the *SeisImager/SW* software by Geometrics, Inc. In general, surface wave data processing entails producing a velocity spectrum image, which shows the phase velocity for the various frequencies of surface waves detected. This image is used as the basis for interpreting ("picking") a dispersion curve, which is a graph that depicts how surface-wave velocity varies with frequency (hence, with depth). The dispersion curve is then used by the modeling software to prepare an initial 1-D model of surface-wave velocity versus depth using a one-third wavelength approximation (i.e., a given phase velocity is assigned to a depth that is one-third of the wavelength of the corresponding surface-wave). The initial velocity layer model is then adjusted using an inversion process until the corresponding synthetic dispersion curve achieves a "best-fit" match to the original dispersion curve (the one that was interpreted from the observed data, i.e., the velocity spectrum image). The degree best fit between the interpreted and synthetic curves (expressed as a RMS percentage error) provides an indication of how well the model represents actual subsurface conditions.

The calculated 1-D shear wave velocity is valid for the center of the geophone array. The seismic Site Classification is determined from the velocity ranges in Table 1.

Table 1: UBC/IBC Site Classification (from Geometrics SeisImager SW_Manual_v30)

| Site class | Soil type | UBC $V_s30$ | IBC $V_s100$ |
|---|---|---|---|
| Class A | hard rock | $V_s30 > 1{,}500$ m/s | $V_s100 > 5{,}000$ ft/s |
| Class B | rock | $760 < V_s30 \leq 1500$ m/s | $2{,}500 < V_s100 \leq 5{,}000$ ft/s |
| Class C | very dense soil, soft rock | $360 < V_s30 \leq 760$ m/s | $1{,}200 < V_s100 \leq 2{,}500$ ft/s |
| Class D | stiff soil | $180 < V_s30 \leq 360$ m/s | $600 < V_s100 \leq 1{,}200$ ft/s |
| Class E | soft soil | $V_s30 < 180$ m/s | $V_s100 < 600$ ft/s |
| Class F | soils requiring site specific evaluation | Non-applicable | Non-applicable |

## FIELD PROCEDURES

Line 1 was 210 feet long, with the 1st three and last three geophones spaced 5 feet apart, the remainder were spaced 10 feet apart. Line 2 was 115 feet long with geophones spaced 5 feet apart. The seismic waves were detected using twenty-four 4.5-Hz geophones made by RT Clark and recorded with a Geometrics Geode seismograph connected to a laptop computer. Active seismic data was created by striking a steel plate with a hammer and stacked 8 times. The data was recorded for 1¼ sec with a 0.125 ms sample rate. Passive data was recorded for 20 minutes using a 2 ms sample rate and a 30-second record length. Passive data is where you record ambient cultural vibrations for approximately 20 minutes. The passive data was not used in this report because it was interpreted to have been affected

by the noise coming from nearby hospital power plant.

***MASW Results***

MASW velocities were obtained by averaging the dispersion curves from both far offset shots for both lines 1 and 2 (Figure 3). The dispersion curves were fairly easy to interpret. The shear wave velocity for line 2 is slightly less than line 1, which may be due to the shorter length of line 2.

Table 3: MASW Results

| Line # | Line Orientation | Vs30 (ft/s) | Sit e Class | Site Conditions |
|---|---|---|---|---|
| 1 | NW-SE | 700 | D | Stiff Soil |
| 2 | NE-SW | 677 | D | Stiff Soil |

**CLOSING**

All geophysical data and field notes collected as a part of this investigation will be archived at the AGS office. The data collection and interpretation methods used in this investigation are consistent with standard practices applied to similar geophysical investigations. The correlation of geophysical responses with probable subsurface features is based on the past results of similar surveys, although it is possible that some variation could exist at this site. Due to the nature of geophysical data, no guarantees can be made or implied regarding the targets identified or the presence or absence of additional objects or targets.

AGS appreciates working for you. We enjoyed this project and look forward to working with you again.

Sincerely,




Pierre Armand, GP 1021
Senior Geophysicist
Advanced Geological Services, Inc.

Figures: Figure 1 Seismic Survey Locations (imbedded in Report text, above)
Figure 2 Location of Seismic Lines
Figure 3 MASW Results Lines 1 and 2

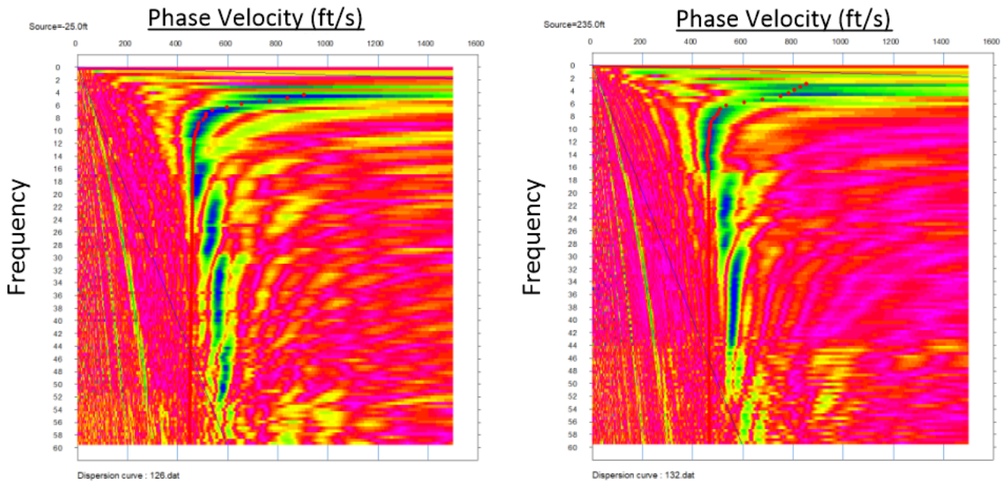



Aerial Photo From Google Earth

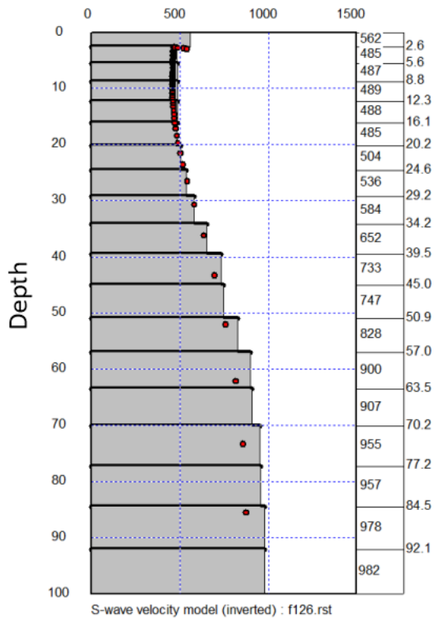
0 ——— 200 ft

| | |
|---|---|
| ADVANCED GEOLOGICAL SERVICES | **Location of Seismic Lines** |
| | **East Wing of Stanford Hospital**<br>**5555 W. Las Positas, Pleasanton, CA** |
| | Client: BSK Associates — **FIGURE 2** |
| 2255 Morello Ave, Ste 117<br>Pleasant Hill, CA 94523<br>(Offices in PA, OH, and CA) | PROJECT #: 24-093-1CA |
| | Date: September 28, 2024 — DRAWN BY: P. Armand |

# Line 1 Dispersion Curves (210 ft long)

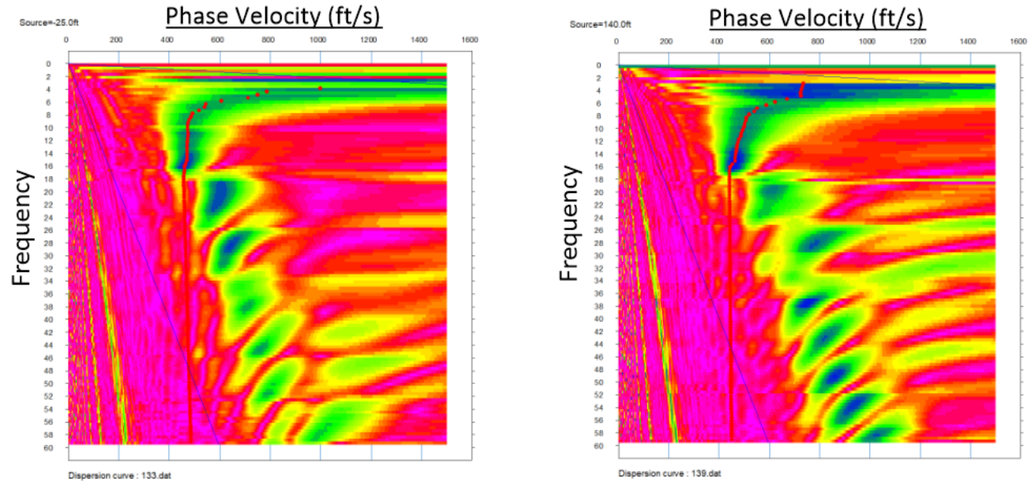



## 1D S-wave Velocity Model (Line 1)

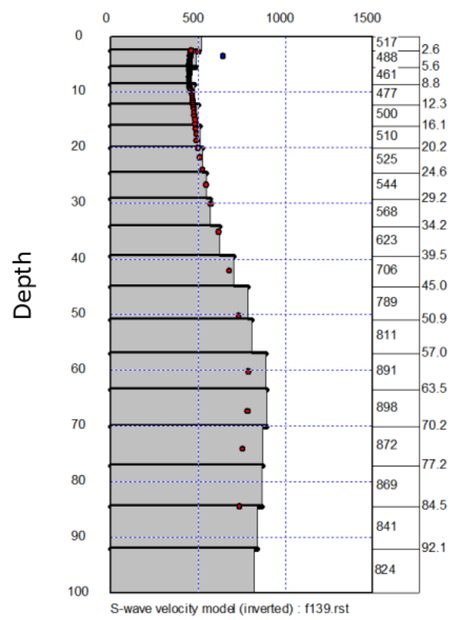



Vs30 = 700 ft/s

# Line 2 Dispersion Curves (115 ft long)




## 1D S-wave Velocity Model (Line 2)




Vs30 = 677 ft/s

ADVANCED GEOLOGICAL SERVICES

2255 Morello Ave., Suite 117
Pleasant Hill, CA 94523
(Offices in PA, OH, and CA)

# MASW Results Lines 1 & 2

Stanford Hospital Proposed East Wing
5555 W. Las Positas Rd., Pleasanton, CA

CLIENT: BSK Associates

FIGURE 3

PROJECT #: 24-092-1CA

DATE: 9/28/2024

DRAWN BY: P. Armand

# APPENDIX F

# Output Files for SHAFT and Lpile Analyses

```
================================================================================

SHAFT for Windows, Version 2017.8.9

Serial Number : 1.36E+08

VERTICALLY LOADED DRILLED SHAFT ANALYSIS
(c) Copyright ENSOFT, Inc., 1987-2017
All Rights Reserved

================================================================================

Path to file locations : C:\Users\c Analyses\
Name of input data file : 12-in CIDH pier.sf8d
Name of output file : 12-in CIDH pier.sf8o
Name of plot output file : 12-in CIDH pier.sf8p
Name of runtime file : 12-in CIDH pier.sf8r

--------------------------------------------------------------------------------
Time and Date of Analysis
--------------------------------------------------------------------------------

Date: September 27, 2023 Time: 14:08:14

G00000369

PROPOSED DEPTH = 45 FT
---------------

NUMBER OF LAYERS = 3
----------------

WATER TABLE DEPTH = 4.5 FT.
-----------------

FACTOR OF SAFETY APPLIED TO THE ULTIMATE SIDE FRICTION CAPACITY = 1
-----------------------------------------------------
FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 1
-----------------------------------------------------

SOIL INFORMATION
-------------

LAYER NO 1----CLAY

AT THE TOP

STRENGTH REDUCTIO FACTOR-AI = 5.50E-01 (*)
END BEARING COEFFICIEI = 6.00E+00 (*)
UNDRAINE SHEAR STRENGTH LB/SQ FT = 5.00E+02
BLOWS PER FOOT FROM STANDARD PENETRAT TEST = 0.00E+00
SOIL UNIT WEIGHT, LB/CU FT = 1.20E+02
```

MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 1.00E+10
DEPTH, FT = 0.00E+00

AT THE BOTTOM

STRENGTH REDUCTIO FACTOR-AI = 5.50E-01 (*)
END BEARING COEFFICIEI = 9.00E+00 (*)
UNDRAINE SHEAR STRENGTH LB/SQ FT = 5.00E+02
BLOWS PER FOOT FROM STANDARD PENETRAT TEST = 0.00E+00
SOIL UNIT WEIGHT, LB/CU FT = 1.20E+02
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 1.00E+10
DEPTH, FT = 6.00E+00

LAYER NO 2----CLAY

AT THE TOP

STRENGTH REDUCTIO FACTOR-AI = 5.50E-01 (*)
END BEARING COEFFICIEI = 9.00E+00 (*)
UNDRAINE SHEAR STRENGTH LB/SQ FT = 1.20E+03
BLOWS PER FOOT FROM STANDARD PENETRAT TEST = 0.00E+00
SOIL UNIT WEIGHT, LB/CU FT = 1.24E+02
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 1.00E+10
DEPTH, FT = 6.00E+00

AT THE BOTTOM

STRENGTH REDUCTIO FACTOR-AI = 5.50E-01 (*)
END BEARING COEFFICIEI = 9.00E+00 (*)
UNDRAINE SHEAR STRENGTH LB/SQ FT = 1.20E+03
BLOWS PER FOOT FROM STANDARD PENETRAT TEST = 0.00E+00
SOIL UNIT WEIGHT, LB/CU FT = 1.24E+02
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 1.00E+10
DEPTH, FT = 4.20E+01

LAYER NO 3----SAND

AT THE TOP

SIDE FRICTION PROCEDUF BETA METHOD
SKIN FRICTION COEFFICIEI BETA = 6.25E-01 (*)
INTERNAL FRICTION ANGLE, DEG. = 4.00E+01
BLOWS PER FOOT FROM STANDARD PENETRAT TEST = 0.00E+00
SOIL UNIT WEIGHT, LB/CU FT = 1.23E+02
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 1.00E+10
DEPTH, FT = 4.20E+01

AT THE BOTTOM

SIDE FRICTION PROCEDUF BETA METHOD
SKIN FRICTION COEFFICIEI BETA = 5.74E-01 (*)
INTERNAL FRICTION ANGLE, DEG. = 4.00E+01
BLOWS PER FOOT FROM STANDARD PENETRAT TEST = 0.00E+00
SOIL UNIT WEIGHT, LB/CU FT = 1.23E+02
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 1.00E+10
DEPTH, FT = 4.70E+01

(*) ESTIMATEI BY THE PROGRAM BASED ON OTHER PARAMETERS

INPUT DRILLED SHAFT INFORMATION
---

MINIMUM SHAFT DIAMETER = 1 FT.
MAXIMUN SHAFT DIAMETER = 1 FT.
RATIO BASE/SHAI DIAMETER = 0 FT.
ANGLE OF BELL = 0 DEG.
IGNORED TOP PORTION = 0 FT.
IGNORED BOTTOM PORTION = 0 FT.
ELASTIC MODULUS Ec = 3.60E+06 LB/SQ IN

COMPUTA RESULTS
---

- CASE ANALYZED : 1
VARIATION LENGTH : 1
VARIATION DIAMETER : 1

DRILLED SHAFT INFORMATION

---

DIAMETER OF STEM = 1 FT.
DIAMETER OF BASE = 1 FT.
END OF STEM TO BASE = 0 FT.
ANGLE OF BELL = 0 DEG.
IGNORED TOP PORTION = 0 FT.
IGNORED BOTTOM PORTION = 0 FT.
AREA OF ONE PERCENT STEEL = 1.131 SQ.IN.
ELASTIC MODULUS Ec = 3.60E+06 LB/SQ IN
VOLUME OF UNDERREA = 0 CU.YDS.
SHAFT LENGTH = 45 FT.

PREDICTEI RESULTS
---

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
QBD = TOTAL ALLOWABI LOAD USING A FACTOR OF SAFETY
APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN = TOTAL ALLOWABI LOAD USING FACTORS OF SAFETY

APPLIED TO THE ULTIMATE BASE RESISTANCE AND THE ULTIMATE SIDE RESISTANCE.

| LENGTH (FT) | VOLUME (CU.YDS) | QS (TONS) | QB (TONS) | QU (TONS) | QBD (TONS) | QDN (TONS) | QU/VOLUME (TONS/CU.YDS) |
|---|---|---|---|---|---|---|---|
| 1 | 0.03 | 0.43 | 1.77 | 2.2 | 2.2 | 2.2 | 75.6 |
| 2 | 0.06 | 0.86 | 1.77 | 2.63 | 2.63 | 2.63 | 45.22 |
| 3 | 0.09 | 1.3 | 1.77 | 3.06 | 3.06 | 3.06 | 35.1 |
| 4 | 0.12 | 1.73 | 1.77 | 3.5 | 3.5 | 3.5 | 30.04 |
| 5 | 0.15 | 2.16 | 4.24 | 6.4 | 6.4 | 6.4 | 44.01 |
| 6 | 0.17 | 2.59 | 4.24 | 6.83 | 6.83 | 6.83 | 39.15 |
| 7 | 0.2 | 3.63 | 4.24 | 7.87 | 7.87 | 7.87 | 38.65 |
| 8 | 0.23 | 4.67 | 4.24 | 8.91 | 8.91 | 8.91 | 38.27 |
| 9 | 0.26 | 5.7 | 4.24 | 9.94 | 9.94 | 9.94 | 37.98 |
| 10 | 0.29 | 6.74 | 4.24 | 10.98 | 10.98 | 10.98 | 37.75 |
| 11 | 0.32 | 7.78 | 4.24 | 12.02 | 12.02 | 12.02 | 37.55 |
| 12 | 0.35 | 8.81 | 4.24 | 13.06 | 13.06 | 13.06 | 37.4 |
| 13 | 0.38 | 9.85 | 4.24 | 14.09 | 14.09 | 14.09 | 37.26 |
| 14 | 0.41 | 10.89 | 4.24 | 15.13 | 15.13 | 15.13 | 37.14 |
| 15 | 0.44 | 11.92 | 4.24 | 16.17 | 16.17 | 16.17 | 37.04 |
| 16 | 0.47 | 12.96 | 4.24 | 17.2 | 17.2 | 17.2 | 36.96 |
| 17 | 0.49 | 14 | 4.24 | 18.24 | 18.24 | 18.24 | 36.88 |
| 18 | 0.52 | 15.03 | 4.24 | 19.28 | 19.28 | 19.28 | 36.81 |
| 19 | 0.55 | 16.07 | 4.24 | 20.31 | 20.31 | 20.31 | 36.75 |
| 20 | 0.58 | 17.11 | 4.24 | 21.35 | 21.35 | 21.35 | 36.69 |
| 21 | 0.61 | 18.15 | 4.24 | 22.39 | 22.39 | 22.39 | 36.64 |
| 22 | 0.64 | 19.18 | 4.24 | 23.42 | 23.42 | 23.42 | 36.6 |
| 23 | 0.67 | 20.22 | 4.24 | 24.46 | 24.46 | 24.46 | 36.56 |
| 24 | 0.7 | 21.26 | 4.24 | 25.5 | 25.5 | 25.5 | 36.52 |
| 25 | 0.73 | 22.29 | 4.24 | 26.53 | 26.53 | 26.53 | 36.48 |
| 26 | 0.76 | 23.33 | 4.24 | 27.57 | 27.57 | 27.57 | 36.45 |
| 27 | 0.79 | 24.37 | 4.24 | 28.61 | 28.61 | 28.61 | 36.42 |
| 28 | 0.81 | 25.4 | 4.24 | 29.64 | 29.64 | 29.64 | 36.39 |
| 29 | 0.84 | 26.44 | 4.24 | 30.68 | 30.68 | 30.68 | 36.37 |
| 30 | 0.87 | 27.48 | 4.24 | 31.72 | 31.72 | 31.72 | 36.34 |
| 31 | 0.9 | 28.51 | 4.24 | 32.76 | 32.76 | 32.76 | 36.32 |
| 32 | 0.93 | 29.55 | 4.24 | 33.79 | 33.79 | 33.79 | 36.3 |
| 33 | 0.96 | 30.59 | 4.24 | 34.83 | 34.83 | 34.83 | 36.28 |
| 34 | 0.99 | 31.62 | 4.24 | 35.87 | 35.87 | 35.87 | 36.26 |
| 35 | 1.02 | 32.66 | 4.24 | 36.9 | 36.9 | 36.9 | 36.24 |
| 36 | 1.05 | 33.7 | 4.24 | 37.94 | 37.94 | 37.94 | 36.22 |
| 37 | 1.08 | 34.73 | 4.24 | 38.98 | 38.98 | 38.98 | 36.21 |
| 38 | 1.11 | 35.77 | 4.24 | 40.01 | 40.01 | 40.01 | 36.19 |
| 39 | 1.13 | 36.81 | 4.24 | 41.05 | 41.05 | 41.05 | 36.18 |
| 40 | 1.16 | 37.85 | 4.24 | 42.09 | 42.09 | 42.09 | 36.17 |
| 41 | 1.19 | 38.88 | 21.37 | 60.25 | 60.25 | 60.25 | 50.51 |
| 42 | 1.22 | 39.92 | 21.37 | 61.28 | 61.28 | 61.28 | 50.16 |
| 43 | 1.25 | 42.66 | 21.37 | 64.03 | 64.03 | 64.03 | 51.18 |
| 44 | 1.28 | 45.42 | 21.37 | 66.78 | 66.78 | 66.78 | 52.17 |

AXIAL LOAD VS SETTLEMEI CURVES

---

RESULT FROM TREND (AVERAGEI LINE

TOP LOAD TOP MOVEMEN TIP LOAD TIP MOVEMENT

| TON | IN. | TON | IN. |
|---|---|---|---|
| 3.63E-02 | 5.12E-05 | 6.23E-04 | 1.00E-05 |
| 1.81E-01 | 2.56E-04 | 3.12E-03 | 5.00E-05 |
| 3.63E-01 | 5.12E-04 | 6.23E-03 | 1.00E-04 |
| 1.71E+01 | 2.54E-02 | 3.12E-01 | 5.00E-03 |
| 2.28E+01 | 3.61E-02 | 4.67E-01 | 7.50E-03 |
| 2.72E+01 | 4.53E-02 | 6.23E-01 | 1.00E-02 |
| 3.86E+01 | 8.07E-02 | 1.56E+00 | 2.50E-02 |
| 4.38E+01 | 1.17E-01 | 3.12E+00 | 5.00E-02 |
| 4.62E+01 | 1.48E-01 | 4.65E+00 | 7.50E-02 |
| 4.74E+01 | 1.77E-01 | 6.16E+00 | 1.00E-01 |
| 4.96E+01 | 3.37E-01 | 1.23E+01 | 2.50E-01 |
| 5.66E+01 | 6.05E-01 | 1.93E+01 | 5.00E-01 |
| 5.94E+01 | 7.38E-01 | 2.21E+01 | 6.25E-01 |
| 6.19E+01 | 9.00E-01 | 2.46E+01 | 7.81E-01 |
| 6.49E+01 | 1.10E+00 | 2.77E+01 | 9.77E-01 |

RESULT FROM UPPER-BO LINE

| TOP LOAD | | TOP | MOVEMEN TIP | LOAD | TIP | MOVEMENT |
|---|---|---|---|---|---|---|
| TON | IN. | TON | IN. | | | |
| 6.71E-02 | 7.98E-05 | 8.90E-04 | 1.00E-05 | | | |
| 3.35E-01 | 3.99E-04 | 4.45E-03 | 5.00E-05 | | | |
| 6.81E-01 | 8.03E-04 | 8.90E-03 | 1.00E-04 | | | |
| 2.67E+01 | 3.71E-02 | 4.45E-01 | 5.00E-03 | | | |
| 3.27E+01 | 4.99E-02 | 6.68E-01 | 7.50E-03 | | | |
| 3.65E+01 | 5.97E-02 | 8.90E-01 | 1.00E-02 | | | |
| 4.45E+01 | 9.12E-02 | 2.23E+00 | 2.50E-02 | | | |
| 4.88E+01 | 1.26E-01 | 4.45E+00 | 5.00E-02 | | | |
| 5.12E+01 | 1.58E-01 | 6.57E+00 | 7.50E-02 | | | |
| 5.28E+01 | 1.88E-01 | 8.62E+00 | 1.00E-01 | | | |
| 5.63E+01 | 3.51E-01 | 1.54E+01 | 2.50E-01 | | | |
| 6.18E+01 | 6.15E-01 | 2.09E+01 | 5.00E-01 | | | |
| 6.44E+01 | 7.46E-01 | 2.35E+01 | 6.25E-01 | | | |
| 6.71E+01 | 9.10E-01 | 2.63E+01 | 7.81E-01 | | | |
| 7.09E+01 | 1.12E+00 | 3.00E+01 | 9.77E-01 | | | |

RESULT FROM LOWER-BC LINE

| TOP LOAD | | TOP | MOVEMEN TIP | LOAD | TIP | MOVEMENT |
|---|---|---|---|---|---|---|
| TON | IN. | TON | IN. | | | |
| 1.61E-02 | 3.02E-05 | 3.56E-04 | 1.00E-05 | | | |
| 8.03E-02 | 1.51E-04 | 1.78E-03 | 5.00E-05 | | | |
| 1.61E-01 | 3.02E-04 | 3.56E-03 | 1.00E-04 | | | |
| 8.14E+00 | 1.52E-02 | 1.78E-01 | 5.00E-03 | | | |
| 1.19E+01 | 2.27E-02 | 2.67E-01 | 7.50E-03 | | | |
| 1.54E+01 | 2.99E-02 | 3.56E-01 | 1.00E-02 | | | |
| 2.95E+01 | 6.58E-02 | 8.90E-01 | 2.50E-02 | | | |
| 3.82E+01 | 1.07E-01 | 1.78E+00 | 5.00E-02 | | | |
| 4.12E+01 | 1.39E-01 | 2.72E+00 | 7.50E-02 | | | |
| 4.21E+01 | 1.67E-01 | 3.70E+00 | 1.00E-01 | | | |
| 4.29E+01 | 3.24E-01 | 9.15E+00 | 2.50E-01 | | | |
| 5.13E+01 | 5.96E-01 | 1.76E+01 | 5.00E-01 | | | |
| 5.43E+01 | 7.29E-01 | 2.07E+01 | 6.25E-01 | | | |
| 5.66E+01 | 8.91E-01 | 2.29E+01 | 7.81E-01 | | | |
| 5.91E+01 | 1.09E+00 | 2.54E+01 | 9.77E-01 | | | |

LPile for Windows, Version 2018-10.007

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using p-y Method
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---

## Files Used for Analysis

---

Path to file locations:
\Users\cm Analyses\

Name of input data file:
18-inch CIDH pier.lp10

Name of output report file:
18-inch CIDH pier.lp10

Name of plot output file:
18-inch CIDH pier.lp10

Name of runtime message file:
18-inch CIDH pier.lp10

---

## Date and Time of Analysis

---

Date: September 24, 2023 Time: 4:49:23

---

## Problem Title

---

Project Name:
Job Number: G00000369
Client:
Engineer: C Melo
Description:

---

## Program Options and Settings

---

Computati Options:
- Use unfactored loads in computati (conventio analysis)
Engineerin Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:
- Maximum number of iterations allowed = 500
- Deflection tolerance for convergen = 1.00E-05 in
- Maximum allowable deflection = 100 in
- Number of pile increment = 100

Loading Type and Number of Cycles of Loading:
- Static loading specified

- Use of p-y modificatic factors for p-y curves not selected
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movement acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Computati of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and
soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specif depths
- Print using wide report formats

---
Pile Structural Properties and Geometry
---

Number of pile sections defined = 1
Total length of pile = 35 ft
Depth of ground surface below top of pile = 0 ft

Pile diameters used for p-y curve computatio are defined using 2 points.

p-y curves are computed using pile diameter values interpolate with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

| Point | Depth Pile Head No. | Below Pile feet | Pile Diameter inches |
|---|---|---|---|
| 1 | 0 | 18 |
| 2 | 35 | 18 |

Input Structural Properties for Pile Sections:
---

Pile Section No. 1:00

Section 1 is an elastic pile
Cross-secti Shape = Circular Pile
Length of section = 35 ft
Width of top of section = 18 in
Width of bottom of section = 18 in
Top Area = 254.469 sq. in
Bottom Area = 254.469 sq. in
Moment of Inertia at Top = 5153 in^4
Moment of Inertia at Bottom = 5153 in^4
Elastic Modulus = 2400000 psi

---
Ground Slope and Pile Batter Angles
---

Ground Slope Angle = 0 degrees
= 0 radians

Pile Batter Angle = 0 degrees
= 0 radians

---
Soil and Rock Layering Information
---

The soil profile is modelled using 4 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer = 0 ft
Distance from top of pile to bottom of layer = 4.5 ft
Effective unit weight at top of layer = 120 pcf
Effective unit weight at bottom of layer = 120 pcf
Undrained cohesion at top of layer = 500 psf
Undrained cohesion at bottom of layer = 500 psf
Epsilon-50 at top of layer = 0
Epsilon-50 at bottom of layer = 0

NOTE: Default values for Epsilon-50 will be computed for this layer.

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer = 4.5 ft
Distance from top of pile to bottom of layer = 6 ft
Effective unit weight at top of layer = 57.6 pcf
Effective unit weight at bottom of layer = 57.6 pcf
Undrained cohesion at top of layer = 500 psf
Undrained cohesion at bottom of layer = 500 psf
Epsilon-50 at top of layer = 0
Epsilon-50 at bottom of layer = 0

NOTE: Default values for Epsilon-50 will be computed for this layer.

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer = 6 ft
Distance from top of pile to bottom of layer = 42 ft
Effective unit weight at top of layer = 61.6 pcf
Effective unit weight at bottom of layer = 61.6 pcf
Undrained cohesion at top of layer = 1200 psf
Undrained cohesion at bottom of layer = 1200 psf
Epsilon-50 at top of layer = 0
Epsilon-50 at bottom of layer = 0

NOTE: Default values for Epsilon-50 will be computed for this layer.

Layer 4 is sand, p-y criteria by API RP-2A, 1987

Distance from top of pile to top of layer = 42 ft
Distance from top of pile to bottom of layer = 47 ft
Effective unit weight at top of layer = 60.6 pcf
Effective unit weight at bottom of layer = 60.6 pcf
Friction angle at top of layer = 40 deg.
Friction angle at bottom of layer = 40 deg.
Subgrade k at top of layer = 0 pci
Subgrade k at bottom of layer = 0 pci

NOTE: Default values for subgrade k will be computed for this layer.

(Depth of the lowest soil layer extends 12 ft below the pile tip)

---

Summary of Input Soil Properties

---

| Layer Num. | Soil Name | Type Depth (p-y | Layer Unit Curve | Effective Wt. Type) | Undrained Cohesion | Angle Friction | of or | E50 kpy krm | pci |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | Soft | 0 | 120 | 500 | -- | default | -- | |
| | Clay | 4.5 | 120 | 500 | -- | default | -- | | |
| | 2 | Soft | 4.5 | 57.6 | 500 | -- | default | -- | |
| | Clay | 6 | 57.6 | 500 | -- | default | -- | | |
| | 3 | Stiff | Clay | 6 | 61.6 | 1200 | -- | default | -- |
| w/o | Free | Water | 42 | 61.6 | 1200 | -- | default | -- | |
| | 4 | API | 42 | 60.6 | -- | 40 | -- | default | |
| | Sand | 47 | 60.6 | -- | 40 | -- | default | | |

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Static Loading Type

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Static loading criteria were used when computing p-y curves for all analyses.

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Pile-head Loading and Pile-head Fixity Conditions

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Number of loads specified = 8

| Load No. | Load Type | Condition 1 | Condition 2 | Axial Thrust Force, lbs | | Compute vs. | Top Pile | y Length | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 | y | = | 0.25 | in | M | = | 0 | in-lbs | 100000 | N.A. |
| 2 | 4 | y | = | 0.5 | in | M | = | 0 | in-lbs | 100000 | N.A. |
| 3 | 4 | y | = | 0.75 | in | M | = | 0 | in-lbs | 100000 | N.A. |
| 4 | 4 | y | = | 1 | in | M | = | 0 | in-lbs | 100000 | N.A. |
| 5 | 5 | y | = | 0.25 | in | S | = | 0 | in/in | 100000 | N.A. |
| 6 | 5 | y | = | 0.5 | in | S | = | 0 | in/in | 100000 | N.A. |
| 7 | 5 | y | = | 0.75 | in | S | = | 0 | in/in | 100000 | N.A. |
| 8 | 5 | y | = | 1 | in | S | = | 0 | in/in | 100000 | N.A. |

V = shear force applied normal to pile head axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

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Computati of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determine from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:00

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Moment-c properties were derived from elastic section properties

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Layering Correction Equivalent Depths of Soil & Rock Layers

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| Layer No. | Top Layer Below Pile ft | of Top Pile ft | Equivalent Depth Type Head Above Grnd | Same As Rock Surf | Layer Rock Layer | Layer or is lbs | is Integral lbs | F0 Integral Below | for | Layer | for | F1 Layer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | N.A. | No | No | 0 | 14479 | | | | | |
| 2 | 4.5 | 4.5 | Yes | No | No | 14479 | 6669 | | | | | |
| 3 | 6 | 3.1992 | No | No | No | 21148 | 419869 | | | | | |
| 4 | 42 | 42 | No | No | No | 441016 | N.A. | | | | | |

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals
for Layer n. Layering Correction equivalent depths are computed only
for soil types with both shallow-de and deep-dept expression for
peak lateral load transfer. These soil types are soft and stiff clays,
non-liquefi sands, and cemented c-phi soil.

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Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

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Pile-head conditions are Displacem and Moment (Loading Type 4)
Displacem of pile head = 0.25 inches
Moment at pile head = 0 in-lbs

Axial load at pile head = 100000 lbs

| Depth X feet | Deflect. y inches | Bending Moment in-lbs | Shear Force lbs | Slope S radians | Total Stress psi* | Bending Stiffness in-lb^2 | Soil p lb/inch | Res. Es*h lb/inch | Soil Lat. lb/inch | Spr. Load | Distrib. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.25 | 0 | 8594 | -0.00324 | 392.9752 | 1.24E+10 | -77.0691 | 647.3807 | | 0 | |
| 0.35 | 0.2364 | 36779 | 8263 | -0.00324 | 457.2112 | 1.24E+10 | -80.7036 | 1434 | | 0 | |
| 0.7 | 0.2228 | 72128 | 7917 | -0.00322 | 518.9516 | 1.24E+10 | -84.0907 | 1585 | | 0 | |
| 1.05 | 0.2094 | 105985 | 7557 | -0.00319 | 578.0834 | 1.24E+10 | -87.2212 | 1750 | | 0 | |
| 1.4 | 0.196 | 138287 | 7185 | -0.00315 | 634.5014 | 1.24E+10 | -90.0863 | 1930 | | 0 | |
| 1.75 | 0.1829 | 168981 | 6801 | -0.00309 | 688.1096 | 1.24E+10 | -92.677 | 2128 | | 0 | |
| 2.1 | 0.1701 | 198015 | 6407 | -0.00303 | 738.8203 | 1.24E+10 | -94.9844 | 2346 | | 0 | |
| 2.45 | 0.1575 | 225346 | 6004 | -0.00296 | 786.5553 | 1.24E+10 | -96.9997 | 2587 | | 0 | |
| 2.8 | 0.1452 | 250934 | 5593 | -0.00288 | 831.2457 | 1.24E+10 | -98.7141 | 2855 | | 0 | |
| 3.15 | 0.1333 | 274745 | 5175 | -0.00279 | 872.8323 | 1.24E+10 | -100.119 | 3155 | | 0 | |
| 3.5 | 0.1218 | 296750 | 4753 | -0.00269 | 911.2658 | 1.24E+10 | -101.204 | 3490 | | 0 | |
| 3.85 | 0.1107 | 316928 | 4326 | -0.00259 | 946.5074 | 1.24E+10 | -101.962 | 3869 | | 0 | |
| 4.2 | 0.1 | 335262 | 3897 | -0.00248 | 978.5287 | 1.24E+10 | -102.383 | 4298 | | 0 | |
| 4.55 | 0.08988 | 351742 | 3467 | -0.00236 | 1007 | 1.24E+10 | -102.344 | 4782 | | 0 | |
| 4.9 | 0.08022 | 366366 | 3039 | -0.00224 | 1033 | 1.24E+10 | -101.298 | 5304 | | 0 | |
| 5.25 | 0.07108 | 379152 | 2617 | -0.00211 | 1055 | 1.24E+10 | -99.9479 | 5906 | | 0 | |
| 5.6 | 0.06248 | 390120 | 2200 | -0.00198 | 1074 | 1.24E+10 | -98.2844 | 6607 | | 0 | |
| 5.95 | 0.05443 | 399299 | 1792 | -0.00185 | 1090 | 1.24E+10 | -96.2997 | 7430 | | 0 | |
| 6.3 | 0.04696 | 406722 | 1152 | -0.00171 | 1103 | 1.24E+10 | -208.106 | 18612 | | 0 | |
| 6.65 | 0.04007 | 410416 | 282.2706 | -0.00157 | 1110 | 1.24E+10 | -206.27 | 21622 | | 0 | |
| 7 | 0.03376 | 410413 | -578.46 | -0.00143 | 1110 | 1.24E+10 | -203.602 | 25330 | | 0 | |
| 7.35 | 0.02804 | 406760 | -1426 | -0.00129 | 1103 | 1.24E+10 | -200.056 | 29969 | | 0 | |
| 7.7 | 0.02289 | 399520 | -2257 | -0.00116 | 1091 | 1.24E+10 | -195.575 | 35877 | | 0 | |
| 8.05 | 0.01832 | 388773 | -3067 | -0.00102 | 1072 | 1.24E+10 | -190.079 | 43571 | | 0 | |
| 8.4 | 0.0143 | 374618 | -3851 | -8.93E-04 | 1047 | 1.24E+10 | -183.463 | 53866 | | 0 | |
| 8.75 | 0.01082 | 357172 | -4605 | -7.69E-04 | 1017 | 1.24E+10 | -175.567 | 68141 | | 0 | |
| 9.1 | 0.00785 | 336579 | -5323 | -6.51E-04 | 980.8299 | 1.24E+10 | -166.145 | 88923 | | 0 | |
| 9.45 | 0.00535 | 313007 | -5997 | -5.41E-04 | 939.6602 | 1.24E+10 | -154.77 | 121423 | | 0 | |
| 9.8 | 0.00331 | 286661 | -6617 | -4.39E-04 | 893.6443 | 1.24E+10 | -140.592 | 178613 | | 0 | |
| 10.15 | 0.00167 | 257793 | -7167 | -3.46E-04 | 843.2254 | 1.24E+10 | -121.474 | 305987 | | 0 | |
| 10.5 | 3.96E-04 | 226746 | -7607 | -2.64E-04 | 788.9997 | 1.24E+10 | -87.792 | 930022 | | 0 | |
| 10.85 | -5.51E-04 | 194118 | -7592 | -1.93E-04 | 732.0128 | 1.24E+10 | 94.9293 | 723599 | | 0 | |
| 11.2 | -0.00122 | 163136 | -7142 | -1.32E-04 | 677.9022 | 1.24E+10 | 119.0758 | 409399 | | 0 | |
| 11.55 | -0.00166 | 134232 | -6616 | -8.15E-05 | 627.4196 | 1.24E+10 | 131.4769 | 332755 | | 0 | |
| 11.9 | -0.00191 | 107628 | -6048 | -4.04E-05 | 580.9542 | 1.24E+10 | 139.028 | 306370 | | 0 | |
| 12.25 | -0.002 | 83462 | -5455 | -7.95E-06 | 538.7454 | 1.24E+10 | 143.6083 | 301752 | | 0 | |
| 12.6 | -0.00197 | 61816 | -4846 | 1.67E-05 | 500.9403 | 1.24E+10 | 146.0228 | 310888 | | 0 | |
| 12.95 | -0.00186 | 42737 | -4232 | 3.45E-05 | 467.6186 | 1.24E+10 | 146.691 | 331519 | | 0 | |
| 13.3 | -0.00168 | 26241 | -3617 | 4.62E-05 | 438.8057 | 1.24E+10 | 145.8559 | 363953 | | 0 | |
| 13.65 | -0.00147 | 12313 | -3009 | 5.27E-05 | 414.48 | 1.24E+10 | 143.6666 | 410341 | | 0 | |
| 14 | -0.00124 | 917.4185 | -2413 | 5.50E-05 | 394.5775 | 1.24E+10 | 140.2163 | 474835 | | 0 | |
| 14.35 | -0.00101 | -8005 | -1834 | 5.38E-05 | 406.9556 | 1.24E+10 | 135.5602 | 564452 | | 0 | |
| 14.7 | -7.89E-04 | -14534 | -1277 | 4.99E-05 | 418.3599 | 1.24E+10 | 129.7226 | 690937 | | 0 | |
| 15.05 | -5.89E-04 | -18773 | -746.927 | 4.43E-05 | 425.7639 | 1.24E+10 | 122.6951 | 874700 | | 0 | |
| 15.4 | -4.17E-04 | -20846 | -248.992 | 3.76E-05 | 429.3831 | 1.24E+10 | 114.4168 | 1153758 | | 0 | |
| 15.75 | -2.74E-04 | -20896 | 170.8183 | 3.05E-05 | 429.472 | 1.24E+10 | 85.4926 | 1312323 | | 0 | |
| 16.1 | -1.61E-04 | -19436 | 457.4307 | 2.36E-05 | 426.9217 | 1.24E+10 | 50.9896 | 1334116 | | 0 | |
| 16.45 | -7.52E-05 | -17074 | 615.4607 | 1.74E-05 | 422.7957 | 1.24E+10 | 24.2628 | 1355904 | | 0 | |
| 16.8 | -1.41E-05 | -14281 | 676.154 | 1.21E-05 | 417.9178 | 1.24E+10 | 4.6388 | 1377686 | | 0 | |
| 17.15 | 2.65E-05 | -11404 | 667.351 | 7.74E-06 | 412.8935 | 1.24E+10 | -8.8307 | 1399463 | | 0 | |
| 17.5 | 5.09E-05 | -8682 | 612.6506 | 4.33E-06 | 408.1384 | 1.24E+10 | -17.2171 | 1421235 | | 0 | |
| 17.85 | 6.29E-05 | -6262 | 531.1313 | 1.79E-06 | 403.9116 | 1.24E+10 | -21.6016 | 1443003 | | 0 | |
| 18.2 | 6.59E-05 | -4222 | 438.0322 | 1.23E-08 | 400.3488 | 1.24E+10 | -22.7312 | 1447933 | | 0 | |
| 18.55 | 6.30E-05 | -2582 | 344.7033 | -1.14E-06 | 397.4852 | 1.24E+10 | -21.7111 | 1447933 | | 0 | |
| 18.9 | 5.63E-05 | -1325 | 258.3257 | -1.81E-06 | 395.2899 | 1.24E+10 | -19.4211 | 1447933 | | 0 | |
| 19.25 | 4.78E-05 | -410.812 | 182.9345 | -2.10E-06 | 393.6927 | 1.24E+10 | -16.4795 | 1447933 | | 0 | |
| 19.6 | 3.87E-05 | 213.0763 | 120.3225 | -2.13E-06 | 393.3473 | 1.24E+10 | -13.3358 | 1447933 | | 0 | |
| 19.95 | 2.99E-05 | 601.6905 | 70.6938 | -2.00E-06 | 394.0261 | 1.24E+10 | -10.2969 | 1447933 | | 0 | |
| 20.3 | 2.19E-05 | 808.5816 | 33.2072 | -1.76E-06 | 394.3874 | 1.24E+10 | -7.5539 | 1447933 | | 0 | |
| 20.65 | 1.51E-05 | 882.1069 | 6.4063 | -1.47E-06 | 394.5158 | 1.24E+10 | -5.2085 | 1447933 | | 0 | |
| 21 | 9.56E-06 | 863.6293 | -11.4547 | -1.17E-06 | 394.4835 | 1.24E+10 | -3.2968 | 1447933 | | 0 | |
| 21.35 | 5.25E-06 | 786.8729 | -22.1786 | -8.93E-07 | 394.3495 | 1.24E+10 | -1.8098 | 1447933 | | 0 | |
| 21.7 | 2.06E-06 | 678.0793 | -27.4697 | -6.45E-07 | 394.1595 | 1.24E+10 | -0.7097 | 1447933 | | 0 | |
| 22.05 | -1.65E-07 | 556.6691 | -28.8407 | -4.35E-07 | 393.9474 | 1.24E+10 | 0.05688 | 1447933 | | 0 | |
| 22.4 | -1.59E-06 | 436.1828 | -27.5667 | -2.66E-07 | 393.737 | 1.24E+10 | 0.5498 | 1447933 | | 0 | |
| 22.75 | -2.40E-06 | 325.3323 | -24.673 | -1.37E-07 | 393.5434 | 1.24E+10 | 0.8282 | 1447933 | | 0 | |
| 23.1 | -2.75E-06 | 229.0447 | -20.9459 | -4.29E-08 | 393.3752 | 1.24E+10 | 0.9466 | 1447933 | | 0 | |
| 23.45 | -2.76E-06 | 149.4229 | -16.9579 | 2.14E-08 | 393.2361 | 1.24E+10 | 0.9524 | 1447933 | | 0 | |
| 23.8 | -2.57E-06 | 86.5807 | -13.0997 | 6.14E-08 | 393.1264 | 1.24E+10 | 0.8848 | 1447933 | | 0 | |
| 24.15 | -2.25E-06 | 39.3335 | -9.6152 | 8.28E-08 | 393.0439 | 1.24E+10 | 0.7745 | 1447933 | | 0 | |
| 24.5 | -1.87E-06 | 5.7433 | -6.6343 | 9.05E-08 | 392.9852 | 1.24E+10 | 0.6449 | 1447933 | | 0 | |
| 24.85 | -1.49E-06 | -16.4708 | -4.2036 | 8.86E-08 | 393.0039 | 1.24E+10 | 0.5125 | 1447933 | | 0 | |
| 25.2 | -1.13E-06 | -29.6415 | -2.312 | 8.08E-08 | 393.0269 | 1.24E+10 | 0.3882 | 1447933 | | 0 | |
| 25.55 | -8.08E-07 | -35.9595 | -0.9119 | 6.97E-08 | 393.038 | 1.24E+10 | 0.2785 | 1447933 | | 0 | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 25.9 | -5.41E-07 | -37.3596 | 0.06453 | 5.72E-08 | 393.0404 | 1.24E+10 | 0.1864 | 1447933 | | 0 |
| 26.25 | -3.27E-07 | -35.4655 | 0.6929 | 4.49E-08 | 393.0371 | 1.24E+10 | 0.1128 | 1447933 | | 0 |
| 26.6 | -1.64E-07 | -31.5771 | 1.0484 | 3.35E-08 | 393.0303 | 1.24E+10 | 0.05653 | 1447933 | | 0 |
| 26.95 | -4.59E-08 | -26.6869 | 1.2004 | 2.36E-08 | 393.0218 | 1.24E+10 | 0.01582 | 1447933 | | 0 |
| 27.3 | 3.41E-08 | -21.5139 | 1.2089 | 1.54E-08 | 393.0127 | 1.24E+10 | -0.01177 | 1447933 | | 0 |
| 27.65 | 8.35E-08 | -16.5455 | 1.1237 | 8.94E-09 | 393.0041 | 1.24E+10 | -0.02878 | 1447933 | | 0 |
| 28 | 1.09E-07 | -12.0823 | 0.9842 | 4.08E-09 | 392.9963 | 1.24E+10 | -0.03765 | 1447933 | | 0 |
| 28.35 | 1.18E-07 | -8.2817 | 0.8199 | 6.19E-10 | 392.9896 | 1.24E+10 | -0.04059 | 1447933 | | 0 |
| 28.7 | 1.14E-07 | -5.1958 | 0.6518 | -1.67E-09 | 392.9842 | 1.24E+10 | -0.03945 | 1447933 | | 0 |
| 29.05 | 1.04E-07 | -2.805 | 0.4939 | -3.03E-09 | 392.9801 | 1.24E+10 | -0.03575 | 1447933 | | 0 |
| 29.4 | 8.90E-08 | -1.0446 | 0.3544 | -3.68E-09 | 392.977 | 1.24E+10 | -0.03068 | 1447933 | | 0 |
| 29.75 | 7.28E-08 | 0.1749 | 0.2373 | -3.83E-09 | 392.9755 | 1.24E+10 | -0.02509 | 1447933 | | 0 |
| 30.1 | 5.68E-08 | 0.9517 | 0.1434 | -3.64E-09 | 392.9768 | 1.24E+10 | -0.01959 | 1447933 | | 0 |
| 30.45 | 4.22E-08 | 1.3828 | 0.07172 | -3.24E-09 | 392.9776 | 1.24E+10 | -0.01456 | 1447933 | | 0 |
| 30.8 | 2.96E-08 | 1.5569 | 0.01972 | -2.74E-09 | 392.9779 | 1.24E+10 | -0.0102 | 1447933 | | 0 |
| 31.15 | 1.92E-08 | 1.5508 | -0.0156 | -2.21E-09 | 392.9779 | 1.24E+10 | -0.00662 | 1447933 | | 0 |
| 31.5 | 1.10E-08 | 1.4277 | -0.03745 | -1.71E-09 | 392.9777 | 1.24E+10 | -0.00379 | 1447933 | | 0 |
| 31.85 | 4.84E-09 | 1.2376 | -0.04891 | -1.26E-09 | 392.9773 | 1.24E+10 | -0.00167 | 1447933 | | 0 |
| 32.2 | 4.43E-10 | 1.0179 | -0.05273 | -8.73E-10 | 392.9769 | 1.24E+10 | -1.53E-04 | 1447933 | | 0 |
| 32.55 | -2.50E-09 | 0.7954 | -0.05125 | -5.65E-10 | 392.9766 | 1.24E+10 | 8.62E-04 | 1447933 | | 0 |
| 32.9 | -4.31E-09 | 0.5879 | -0.04632 | -3.30E-10 | 392.9762 | 1.24E+10 | 0.00148 | 1447933 | | 0 |
| 33.25 | -5.28E-09 | 0.4066 | -0.03938 | -1.62E-10 | 392.9759 | 1.24E+10 | 0.00182 | 1447933 | | 0 |
| 33.6 | -5.66E-09 | 0.2572 | -0.03146 | -4.89E-11 | 392.9756 | 1.24E+10 | 0.00195 | 1447933 | | 0 |
| 33.95 | -5.69E-09 | 0.1423 | -0.02325 | 1.90E-11 | 392.9754 | 1.24E+10 | 0.00196 | 1447933 | | 0 |
| 34.3 | -5.50E-09 | 0.06196 | -0.01514 | 5.36E-11 | 392.9753 | 1.24E+10 | 0.0019 | 1447933 | | 0 |
| 34.65 | -5.24E-09 | 0.01506 | -0.00737 | 6.67E-11 | 392.9752 | 1.24E+10 | 0.0018 | 1447933 | | 0 |
| 35 | -4.94E-09 | 0 | 0 | 6.93E-11 | 392.9752 | 1.24E+10 | 0.0017 | 723967 | | 0 |

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:00

Pile-head deflection = 0.25 inches
Computed slope at pile head = -0.00324 radians
Maximum bending moment = 410416 inch-lbs
Maximum shear force = 8594 lbs
Depth of maximum bending moment = 6.65 feet below pile head
Depth of maximum shear force = 0 feet below pile head
Number of iterations = 14
Number of zero deflection points = 5

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Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 2

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Pile-head conditions are Displacem and Moment (Loading Type 4)
Displacem of pile head = 0.5 inches
Moment at pile head = 0 in-lbs
Axial load at pile head = 100000 lbs

| Depth X feet | Deflect. y inches | Bending Moment in-lbs | Shear Force lbs | Slope S radians | Total Stress psi* | Bending Stiffness in-lb^2 | Soil p lb/inch | Res. Es*h lb/inch | Soil Lat. lb/inch | Spr. Load | Distrib. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.5 | 0 | 12661 | -0.00589 | 392.9752 | 1.24E+10 | -97.101 | 407.8243 | | 0 | |
| 0.35 | 0.4752 | 54796 | 12243 | -0.00589 | 488.6788 | 1.24E+10 | -101.857 | 900.1738 | | 0 | |
| 0.7 | 0.4506 | 107787 | 11806 | -0.00586 | 581.2306 | 1.24E+10 | -106.336 | 991.2333 | | 0 | |
| 1.05 | 0.426 | 158887 | 11351 | -0.00581 | 670.4795 | 1.24E+10 | -110.528 | 1090 | | 0 | |
| 1.4 | 0.4017 | 208014 | 10878 | -0.00575 | 756.2835 | 1.24E+10 | -114.424 | 1196 | | 0 | |
| 1.75 | 0.3777 | 255093 | 10390 | -0.00567 | 838.5103 | 1.24E+10 | -118.013 | 1312 | | 0 | |
| 2.1 | 0.3541 | 300055 | 9888 | -0.00558 | 917.0377 | 1.24E+10 | -121.288 | 1439 | | 0 | |
| 2.45 | 0.3309 | 342834 | 9372 | -0.00547 | 991.7536 | 1.24E+10 | -124.237 | 1577 | | 0 | |
| 2.8 | 0.3082 | 383372 | 8845 | -0.00535 | 1063 | 1.24E+10 | -126.853 | 1729 | | 0 | |
| 3.15 | 0.286 | 421618 | 8307 | -0.00521 | 1129 | 1.24E+10 | -129.126 | 1896 | | 0 | |
| 3.5 | 0.2644 | 457527 | 7761 | -0.00506 | 1192 | 1.24E+10 | -131.046 | 2082 | | 0 | |
| 3.85 | 0.2435 | 491058 | 7207 | -0.0049 | 1251 | 1.24E+10 | -132.605 | 2287 | | 0 | |
| 4.2 | 0.2233 | 522180 | 6648 | -0.00473 | 1305 | 1.24E+10 | -133.792 | 2517 | | 0 | |
| 4.55 | 0.2038 | 550868 | 6084 | -0.00454 | 1355 | 1.24E+10 | -134.449 | 2771 | | 0 | |
| 4.9 | 0.1851 | 577105 | 5521 | -0.00435 | 1401 | 1.24E+10 | -133.855 | 3037 | | 0 | |
| 5.25 | 0.1672 | 600899 | 4961 | -0.00415 | 1442 | 1.24E+10 | -132.929 | 3339 | | 0 | |
| 5.6 | 0.1502 | 622262 | 4405 | -0.00394 | 1480 | 1.24E+10 | -131.664 | 3681 | | 0 | |
| 5.95 | 0.1341 | 641214 | 3855 | -0.00373 | 1513 | 1.24E+10 | -130.052 | 4073 | | 0 | |
| 6.3 | 0.1189 | 657780 | 3031 | -0.00351 | 1542 | 1.24E+10 | -262.484 | 9273 | | 0 | |
| 6.65 | 0.1046 | 669622 | 1929 | -0.00328 | 1563 | 1.24E+10 | -262.179 | 10525 | | 0 | |
| 7 | 0.0913 | 676744 | 830.4367 | -0.00306 | 1575 | 1.24E+10 | -261.067 | 12009 | | 0 | |
| 7.35 | 0.07895 | 679164 | -261.948 | -0.00283 | 1579 | 1.24E+10 | -259.117 | 13784 | | 0 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 7.7 | 0.06757 | 676917 | -1344 | -0.00259 | 1575 | 1.24E+10 | -256.293 | 15930 | 0 |
| 8.05 | 0.05716 | 670052 | -2413 | -0.00237 | 1563 | 1.24E+10 | -252.55 | 18558 | 0 |
| 8.4 | 0.0477 | 658636 | -3464 | -0.00214 | 1543 | 1.24E+10 | -247.833 | 21823 | 0 |
| 8.75 | 0.03918 | 642755 | -4492 | -0.00192 | 1516 | 1.24E+10 | -242.068 | 25950 | 0 |
| 9.1 | 0.03157 | 622512 | -5495 | -0.0017 | 1480 | 1.24E+10 | -235.161 | 31281 | 0 |
| 9.45 | 0.02486 | 598032 | -6465 | -0.0015 | 1437 | 1.24E+10 | -226.978 | 38348 | 0 |
| 9.8 | 0.019 | 569462 | -7398 | -0.0013 | 1388 | 1.24E+10 | -217.325 | 48049 | 0 |
| 10.15 | 0.01395 | 536978 | -8287 | -0.00111 | 1331 | 1.24E+10 | -205.899 | 62007 | 0 |
| 10.5 | 0.00966 | 500785 | -9123 | -9.35E-04 | 1268 | 1.24E+10 | -192.177 | 83537 | 0 |
| 10.85 | 0.00609 | 461131 | -9894 | -7.72E-04 | 1198 | 1.24E+10 | -175.135 | 120741 | 0 |
| 11.2 | 0.00318 | 418322 | -10582 | -6.22E-04 | 1124 | 1.24E+10 | -152.25 | 201095 | 0 |
| 11.55 | 8.64E-04 | 372767 | -11139 | -4.88E-04 | 1044 | 1.24E+10 | -112.861 | 548475 | 0 |
| 11.9 | -9.20E-04 | 325168 | -11133 | -3.70E-04 | 960.8998 | 1.24E+10 | 115.4215 | 527117 | 0 |
| 12.25 | -0.00224 | 279559 | -10581 | -2.67E-04 | 881.2409 | 1.24E+10 | 147.7132 | 276991 | 0 |
| 12.6 | -0.00316 | 236516 | -9925 | -1.79E-04 | 806.0633 | 1.24E+10 | 164.3581 | 218373 | 0 |
| 12.95 | -0.00375 | 196338 | -9213 | -1.06E-04 | 735.8904 | 1.24E+10 | 174.895 | 196138 | 0 |
| 13.3 | -0.00405 | 159217 | -8464 | -4.53E-05 | 671.0571 | 1.24E+10 | 181.7996 | 188576 | 0 |
| 13.65 | -0.00413 | 125281 | -7691 | 2.98E-06 | 611.7852 | 1.24E+10 | 186.1166 | 189459 | 0 |
| 14 | -0.00402 | 94610 | -6905 | 4.03E-05 | 558.2162 | 1.24E+10 | 188.3871 | 196623 | 0 |
| 14.35 | -0.00379 | 67248 | -6112 | 6.78E-05 | 510.4277 | 1.24E+10 | 188.9242 | 209513 | 0 |
| 14.7 | -0.00345 | 43210 | -5321 | 8.66E-05 | 468.4431 | 1.24E+10 | 187.921 | 228471 | 0 |
| 15.05 | -0.00306 | 22480 | -4537 | 9.77E-05 | 432.2374 | 1.24E+10 | 185.4998 | 254590 | 0 |
| 15.4 | -0.00263 | 5019 | -3766 | 1.02E-04 | 401.7412 | 1.24E+10 | 181.7366 | 289806 | 0 |
| 15.75 | -0.0022 | -9237 | -3013 | 1.02E-04 | 409.1074 | 1.24E+10 | 176.6739 | 337250 | 0 |
| 16.1 | -0.00178 | -20374 | -2284 | 9.66E-05 | 428.5601 | 1.24E+10 | 170.3257 | 401927 | 0 |
| 16.45 | -0.00139 | -28505 | -1585 | 8.83E-05 | 442.7602 | 1.24E+10 | 162.677 | 492068 | 0 |
| 16.8 | -0.00104 | -33761 | -920.517 | 7.78E-05 | 451.9413 | 1.24E+10 | 153.6741 | 621898 | 0 |
| 17.15 | -7.35E-04 | -36302 | -297.082 | 6.59E-05 | 456.3793 | 1.24E+10 | 143.1997 | 817926 | 0 |
| 17.5 | -4.85E-04 | -36312 | 278.7476 | 5.35E-05 | 456.3964 | 1.24E+10 | 131.005 | 1135451 | 0 |
| 17.85 | -2.86E-04 | -34006 | 759.9473 | 4.16E-05 | 452.3683 | 1.24E+10 | 98.1377 | 1443003 | 0 |
| 18.2 | -1.35E-04 | -29964 | 1064 | 3.07E-05 | 445.3082 | 1.24E+10 | 46.6094 | 1447933 | 0 |
| 18.55 | -2.75E-05 | -25095 | 1182 | 2.14E-05 | 436.8046 | 1.24E+10 | 9.4797 | 1447933 | 0 |
| 18.9 | 4.44E-05 | -20055 | 1169 | 1.37E-05 | 428.0027 | 1.24E+10 | -15.3101 | 1447933 | 0 |
| 19.25 | 8.77E-05 | -15283 | 1074 | 7.71E-06 | 419.6675 | 1.24E+10 | -30.2382 | 1447933 | 0 |
| 19.6 | 1.09E-04 | -11042 | 931.2403 | 3.24E-06 | 412.2601 | 1.24E+10 | -37.6512 | 1447933 | 0 |
| 19.95 | 1.15E-04 | -7463 | 768.9399 | 1.03E-07 | 406.01 | 1.24E+10 | -39.6347 | 1447933 | 0 |
| 20.3 | 1.10E-04 | -4583 | 606.0155 | -1.94E-06 | 400.9791 | 1.24E+10 | -37.9484 | 1447933 | 0 |
| 20.65 | 9.86E-05 | -2371 | 454.9059 | -3.12E-06 | 397.1162 | 1.24E+10 | -34.0086 | 1447933 | 0 |
| 21 | 8.38E-05 | -758.849 | 322.7918 | -3.66E-06 | 394.3005 | 1.24E+10 | -28.9029 | 1447933 | 0 |
| 21.35 | 6.79E-05 | 343.542 | 212.9051 | -3.73E-06 | 393.5752 | 1.24E+10 | -23.4241 | 1447933 | 0 |
| 21.7 | 5.25E-05 | 1033 | 125.6747 | -3.49E-06 | 394.7788 | 1.24E+10 | -18.1142 | 1447933 | 0 |
| 22.05 | 3.86E-05 | 1402 | 59.6795 | -3.08E-06 | 395.4241 | 1.24E+10 | -13.3121 | 1447933 | 0 |
| 22.4 | 2.67E-05 | 1537 | 12.4051 | -2.58E-06 | 395.6589 | 1.24E+10 | -9.1995 | 1447933 | 0 |
| 22.75 | 1.69E-05 | 1509 | -19.183 | -2.06E-06 | 395.6099 | 1.24E+10 | -5.8425 | 1447933 | 0 |
| 23.1 | 9.36E-06 | 1377 | -38.2294 | -1.57E-06 | 395.3805 | 1.24E+10 | -3.2272 | 1447933 | 0 |
| 23.45 | 3.74E-06 | 1189 | -47.7138 | -1.14E-06 | 395.0513 | 1.24E+10 | -1.2892 | 1447933 | 0 |
| 23.8 | -1.87E-07 | 977.3304 | -50.2859 | -7.69E-07 | 394.6821 | 1.24E+10 | 0.06436 | 1447933 | 0 |
| 24.15 | -2.72E-06 | 766.9506 | -48.1824 | -4.73E-07 | 394.3147 | 1.24E+10 | 0.9373 | 1447933 | 0 |
| 24.5 | -4.16E-06 | 572.9956 | -43.2044 | -2.45E-07 | 393.9759 | 1.24E+10 | 1.4331 | 1447933 | 0 |
| 24.85 | -4.78E-06 | 404.2393 | -36.7358 | -7.92E-08 | 393.6812 | 1.24E+10 | 1.6472 | 1447933 | 0 |
| 25.2 | -4.82E-06 | 264.4816 | -29.7855 | 3.44E-08 | 393.4371 | 1.24E+10 | 1.6625 | 1447933 | 0 |
| 25.55 | -4.49E-06 | 154.0121 | -23.0442 | 1.05E-07 | 393.2442 | 1.24E+10 | 1.5477 | 1447933 | 0 |
| 25.9 | -3.94E-06 | 70.8219 | -16.9439 | 1.44E-07 | 393.0989 | 1.24E+10 | 1.3572 | 1447933 | 0 |
| 26.25 | -3.28E-06 | 11.5624 | -11.717 | 1.58E-07 | 392.9954 | 1.24E+10 | 1.1319 | 1447933 | 0 |
| 26.6 | -2.61E-06 | -27.7329 | -7.4483 | 1.55E-07 | 393.0236 | 1.24E+10 | 0.9008 | 1447933 | 0 |
| 26.95 | -1.98E-06 | -51.1335 | -4.1213 | 1.41E-07 | 393.0645 | 1.24E+10 | 0.6835 | 1447933 | 0 |
| 27.3 | -1.42E-06 | -62.4707 | -1.6545 | 1.22E-07 | 393.0843 | 1.24E+10 | 0.4912 | 1447933 | 0 |
| 27.65 | -9.56E-07 | -65.1338 | 0.06946 | 1.00E-07 | 393.0889 | 1.24E+10 | 0.3297 | 1447933 | 0 |
| 28 | -5.81E-07 | -61.9716 | 1.1823 | 7.89E-08 | 393.0834 | 1.24E+10 | 0.2002 | 1447933 | 0 |
| 28.35 | -2.94E-07 | -55.2688 | 1.8153 | 5.90E-08 | 393.0717 | 1.24E+10 | 0.1012 | 1447933 | 0 |
| 28.7 | -8.52E-08 | -46.7729 | 2.0894 | 4.17E-08 | 393.0569 | 1.24E+10 | 0.02936 | 1447933 | 0 |
| 29.05 | 5.65E-08 | -37.7525 | 2.1102 | 2.73E-08 | 393.0411 | 1.24E+10 | -0.01948 | 1447933 | 0 |
| 29.4 | 1.44E-07 | -29.0703 | 1.9648 | 1.60E-08 | 393.0259 | 1.24E+10 | -0.04975 | 1447933 | 0 |
| 29.75 | 1.91E-07 | -21.2616 | 1.7223 | 7.43E-09 | 393.0123 | 1.24E+10 | -0.06573 | 1447933 | 0 |
| 30.1 | 2.07E-07 | -14.6093 | 1.4346 | 1.34E-09 | 393.0007 | 1.24E+10 | -0.07126 | 1447933 | 0 |
| 30.45 | 2.02E-07 | -9.212 | 1.1388 | -2.71E-09 | 392.9913 | 1.24E+10 | -0.0696 | 1447933 | 0 |
| 30.8 | 1.84E-07 | -5.0411 | 0.8595 | -5.13E-09 | 392.984 | 1.24E+10 | -0.06341 | 1447933 | 0 |
| 31.15 | 1.59E-07 | -1.988 | 0.6114 | -6.32E-09 | 392.9786 | 1.24E+10 | -0.05474 | 1447933 | 0 |
| 31.5 | 1.31E-07 | 0.09969 | 0.4017 | -6.64E-09 | 392.9753 | 1.24E+10 | -0.0451 | 1447933 | 0 |
| 31.85 | 1.03E-07 | 1.3919 | 0.2324 | -6.39E-09 | 392.9776 | 1.24E+10 | -0.0355 | 1447933 | 0 |
| 32.2 | 7.71E-08 | 2.0576 | 0.1021 | -5.81E-09 | 392.9788 | 1.24E+10 | -0.02659 | 1447933 | 0 |
| 32.55 | 5.42E-08 | 2.254 | 0.00697 | -5.07E-09 | 392.9791 | 1.24E+10 | -0.01869 | 1447933 | 0 |
| 32.9 | 3.45E-08 | 2.1204 | -0.05727 | -4.33E-09 | 392.9789 | 1.24E+10 | -0.0119 | 1447933 | 0 |
| 33.25 | 1.78E-08 | 1.7766 | -0.09517 | -3.67E-09 | 392.9783 | 1.24E+10 | -0.00615 | 1447933 | 0 |
| 33.6 | 3.70E-09 | 1.3241 | -0.1108 | -3.14E-09 | 392.9775 | 1.24E+10 | -0.00127 | 1447933 | 0 |
| 33.95 | -8.56E-09 | 0.8489 | -0.1072 | -2.77E-09 | 392.9767 | 1.24E+10 | 0.00295 | 1447933 | 0 |
| 34.3 | -1.96E-08 | 0.4256 | -0.08685 | -2.56E-09 | 392.9759 | 1.24E+10 | 0.00676 | 1447933 | 0 |
| 34.65 | -3.00E-08 | 0.1215 | -0.05092 | -2.46E-09 | 392.9754 | 1.24E+10 | 0.01035 | 1447933 | 0 |
| 35 | -4.03E-08 | 0 | 0 | -2.44E-09 | 392.9752 | 1.24E+10 | 0.01389 | 723967 | 0 |

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 2:00

Pile-head deflection = 0.5 inches
Computed slope at pile head = -0.00589 radians
Maximum bending moment = 679164 inch-lbs
Maximum shear force = 12661 lbs
Depth of maximum bending moment = 7.35 feet below pile head
Depth of maximum shear force = 0 feet below pile head
Number of iterations = 18
Number of zero deflection points = 5

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Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 3

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Pile-head conditions are Displacem and Moment (Loading Type 4)
Displacem of pile head = 0.75 inches
Moment at pile head = 0 in-lbs
Axial load at pile head = 100000 lbs

| Depth X feet | Deflect. y inches | Bending Moment in-lbs | Shear Force lbs | Slope S radians | Total Stress psi* | Bending Stiffness in-lb^2 | Soil p lb/inch | Res. Es*h lb/inch | Soil Lat. lb/inch | Spr. Load | Distrib. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.75 | 0 | 15855 | -0.00836 | 392.9752 | 1.24E+10 | -111.153 | 311.2282 | | 0 | |
| 0.35 | 0.7149 | 69119 | 15376 | -0.00834 | 513.696 | 1.24E+10 | -116.709 | 685.6501 | | 0 | |
| 0.7 | 0.6799 | 136170 | 14875 | -0.00831 | 630.804 | 1.24E+10 | -121.968 | 753.4288 | | 0 | |
| 1.05 | 0.6451 | 201050 | 14352 | -0.00825 | 744.1202 | 1.24E+10 | -126.922 | 826.3205 | | 0 | |
| 1.4 | 0.6106 | 263662 | 13810 | -0.00817 | 853.4761 | 1.24E+10 | -131.559 | 904.925 | | 0 | |
| 1.75 | 0.5765 | 323916 | 13248 | -0.00807 | 958.713 | 1.24E+10 | -135.871 | 989.927 | | 0 | |
| 2.1 | 0.5428 | 381727 | 12669 | -0.00795 | 1060 | 1.24E+10 | -139.847 | 1082 | | 0 | |
| 2.45 | 0.5097 | 437017 | 12074 | -0.00781 | 1156 | 1.24E+10 | -143.479 | 1182 | | 0 | |
| 2.8 | 0.4772 | 489713 | 11465 | -0.00766 | 1248 | 1.24E+10 | -146.756 | 1292 | | 0 | |
| 3.15 | 0.4453 | 539751 | 10842 | -0.00748 | 1336 | 1.24E+10 | -149.669 | 1412 | | 0 | |
| 3.5 | 0.4143 | 587071 | 10208 | -0.00729 | 1418 | 1.24E+10 | -152.208 | 1543 | | 0 | |
| 3.85 | 0.3841 | 631623 | 9564 | -0.00708 | 1496 | 1.24E+10 | -154.365 | 1688 | | 0 | |
| 4.2 | 0.3548 | 673362 | 8912 | -0.00686 | 1569 | 1.24E+10 | -156.129 | 1848 | | 0 | |
| 4.55 | 0.3265 | 712251 | 8254 | -0.00663 | 1637 | 1.24E+10 | -157.315 | 2024 | | 0 | |
| 4.9 | 0.2991 | 748263 | 7594 | -0.00638 | 1700 | 1.24E+10 | -157.08 | 2205 | | 0 | |
| 5.25 | 0.2729 | 781397 | 6935 | -0.00612 | 1758 | 1.24E+10 | -156.495 | 2409 | | 0 | |
| 5.6 | 0.2477 | 811660 | 6280 | -0.00585 | 1811 | 1.24E+10 | -155.555 | 2637 | | 0 | |
| 5.95 | 0.2238 | 839062 | 5629 | -0.00557 | 1858 | 1.24E+10 | -154.251 | 2895 | | 0 | |
| 6.3 | 0.201 | 863624 | 4677 | -0.00528 | 1901 | 1.24E+10 | -299.287 | 6255 | | 0 | |
| 6.65 | 0.1794 | 882783 | 3418 | -0.00498 | 1935 | 1.24E+10 | -300.017 | 7023 | | 0 | |
| 7 | 0.1591 | 896525 | 2159 | -0.00468 | 1959 | 1.24E+10 | -299.946 | 7917 | | 0 | |
| 7.35 | 0.1401 | 904847 | 900.6707 | -0.00437 | 1973 | 1.24E+10 | -299.049 | 8965 | | 0 | |
| 7.7 | 0.1224 | 907765 | -351.655 | -0.00407 | 1978 | 1.24E+10 | -297.297 | 10204 | | 0 | |
| 8.05 | 0.1059 | 905309 | -1595 | -0.00376 | 1974 | 1.24E+10 | -294.656 | 11682 | | 0 | |
| 8.4 | 0.0908 | 897526 | -2825 | -0.00345 | 1961 | 1.24E+10 | -291.084 | 13465 | | 0 | |
| 8.75 | 0.07694 | 884481 | -4038 | -0.00315 | 1938 | 1.24E+10 | -286.529 | 15642 | | 0 | |
| 9.1 | 0.06434 | 866255 | -5229 | -0.00285 | 1906 | 1.24E+10 | -280.926 | 18339 | | 0 | |
| 9.45 | 0.05297 | 842950 | -6395 | -0.00256 | 1865 | 1.24E+10 | -274.193 | 21739 | | 0 | |
| 9.8 | 0.04281 | 814687 | -7530 | -0.00228 | 1816 | 1.24E+10 | -266.218 | 26117 | | 0 | |
| 10.15 | 0.03381 | 781613 | -8629 | -0.00201 | 1758 | 1.24E+10 | -256.848 | 31904 | | 0 | |
| 10.5 | 0.02593 | 743896 | -9684 | -0.00175 | 1692 | 1.24E+10 | -245.854 | 39825 | | 0 | |
| 10.85 | 0.0191 | 701737 | -10690 | -0.00151 | 1619 | 1.24E+10 | -232.882 | 51198 | | 0 | |
| 11.2 | 0.01328 | 655369 | -11635 | -0.00128 | 1538 | 1.24E+10 | -217.316 | 68720 | | 0 | |
| 11.55 | 0.00839 | 605074 | -12507 | -0.00106 | 1450 | 1.24E+10 | -197.944 | 99042 | | 0 | |
| 11.9 | 0.00437 | 551201 | -13283 | -8.65E-04 | 1356 | 1.24E+10 | -171.748 | 165092 | | 0 | |
| 12.25 | 0.00113 | 494220 | -13907 | -6.87E-04 | 1256 | 1.24E+10 | -125.466 | 466001 | | 0 | |
| 12.6 | -0.0014 | 434956 | -13890 | -5.29E-04 | 1153 | 1.24E+10 | 133.8526 | 400764 | | 0 | |
| 12.95 | -0.00332 | 377990 | -13253 | -3.91E-04 | 1053 | 1.24E+10 | 169.6167 | 214837 | | 0 | |
| 13.3 | -0.00469 | 323963 | -12500 | -2.72E-04 | 958.7943 | 1.24E+10 | 188.6242 | 168918 | | 0 | |
| 13.65 | -0.0056 | 273216 | -11682 | -1.71E-04 | 870.163 | 1.24E+10 | 200.9511 | 150661 | | 0 | |
| 14 | -0.00612 | 225976 | -10821 | -8.60E-05 | 787.6547 | 1.24E+10 | 209.3014 | 143540 | | 0 | |
| 14.35 | -0.00632 | 182395 | -9930 | -1.66E-05 | 711.5386 | 1.24E+10 | 214.8309 | 142675 | | 0 | |
| 14.7 | -0.00626 | 142578 | -9021 | 3.86E-05 | 641.9958 | 1.24E+10 | 218.1433 | 146268 | | 0 | |
| 15.05 | -0.006 | 106589 | -8101 | 8.09E-05 | 579.1383 | 1.24E+10 | 219.591 | 153707 | | 0 | |
| 15.4 | -0.00558 | 74458 | -7180 | 1.12E-04 | 523.0197 | 1.24E+10 | 219.3941 | 164998 | | 0 | |
| 15.75 | -0.00506 | 46186 | -6262 | 1.32E-04 | 473.642 | 1.24E+10 | 217.6946 | 180596 | | 0 | |
| 16.1 | -0.00448 | 21748 | -5354 | 1.44E-04 | 430.9597 | 1.24E+10 | 214.5844 | 201394 | | 0 | |
| 16.45 | -0.00386 | 1092 | -4462 | 1.48E-04 | 394.8832 | 1.24E+10 | 210.1205 | 228846 | | 0 | |
| 16.8 | -0.00324 | -15857 | -3592 | 1.45E-04 | 420.6703 | 1.24E+10 | 204.3322 | 265199 | | 0 | |
| 17.15 | -0.00264 | -29200 | -2748 | 1.37E-04 | 443.9741 | 1.24E+10 | 197.2245 | 313961 | | 0 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 17.5 | -0.00208 | -39059 | -1938 | 1.26E-04 | 461.1943 | 1.24E+10 | 188.776 | 380756 | 0 |
| 17.85 | -0.00158 | -45583 | -1166 | 1.11E-04 | 472.5888 | 1.24E+10 | 178.93 | 475032 | 0 |
| 18.2 | -0.00115 | -48944 | -442.044 | 9.53E-05 | 478.4592 | 1.24E+10 | 165.6477 | 606709 | 0 |
| 18.55 | -7.81E-04 | -49376 | 221.8092 | 7.86E-05 | 479.2139 | 1.24E+10 | 150.473 | 808970 | 0 |
| 18.9 | -4.86E-04 | -47147 | 818.404 | 6.22E-05 | 475.3204 | 1.24E+10 | 133.6197 | 1154349 | 0 |
| 19.25 | -2.58E-04 | -42554 | 1286 | 4.70E-05 | 467.2984 | 1.24E+10 | 89.0662 | 1447933 | 0 |
| 19.6 | -9.12E-05 | -36384 | 1539 | 3.36E-05 | 456.5217 | 1.24E+10 | 31.4544 | 1447933 | 0 |
| 19.95 | 2.40E-05 | -29654 | 1588 | 2.24E-05 | 444.7669 | 1.24E+10 | -8.2663 | 1447933 | 0 |
| 20.3 | 9.69E-05 | -23065 | 1500 | 1.34E-05 | 433.2594 | 1.24E+10 | -33.4055 | 1447933 | 0 |
| 20.65 | 1.37E-04 | -17062 | 1331 | 6.63E-06 | 422.7753 | 1.24E+10 | -47.2029 | 1447933 | 0 |
| 21 | 1.53E-04 | -11890 | 1121 | 1.72E-06 | 413.7412 | 1.24E+10 | -52.6104 | 1447933 | 0 |
| 21.35 | 1.51E-04 | -7644 | 901.3949 | -1.60E-06 | 406.3251 | 1.24E+10 | -52.1713 | 1447933 | 0 |
| 21.7 | 1.39E-04 | -4317 | 691.0908 | -3.63E-06 | 400.5145 | 1.24E+10 | -47.9736 | 1447933 | 0 |
| 22.05 | 1.21E-04 | -1835 | 502.8744 | -4.68E-06 | 396.1807 | 1.24E+10 | -41.6533 | 1447933 | 0 |
| 22.4 | 9.99E-05 | -88.5869 | 343.0986 | -5.00E-06 | 393.1299 | 1.24E+10 | -34.4305 | 1447933 | 0 |
| 22.75 | 7.88E-05 | 1051 | 213.75 | -4.84E-06 | 394.8106 | 1.24E+10 | -27.1641 | 1447933 | 0 |
| 23.1 | 5.92E-05 | 1711 | 113.8351 | -4.37E-06 | 395.9635 | 1.24E+10 | -20.4144 | 1447933 | 0 |
| 23.45 | 4.21E-05 | 2011 | 40.5019 | -3.74E-06 | 396.487 | 1.24E+10 | -14.5061 | 1447933 | 0 |
| 23.8 | 2.78E-05 | 2054 | -10.0928 | -3.05E-06 | 396.5632 | 1.24E+10 | -9.5866 | 1447933 | 0 |
| 24.15 | 1.65E-05 | 1929 | -42.1468 | -2.37E-06 | 396.3434 | 1.24E+10 | -5.6772 | 1447933 | 0 |
| 24.5 | 7.88E-06 | 1702 | -59.7729 | -1.76E-06 | 395.9483 | 1.24E+10 | -2.7162 | 1447933 | 0 |
| 24.85 | 1.72E-06 | 1428 | -66.7203 | -1.22E-06 | 395.4691 | 1.24E+10 | -0.5922 | 1447933 | 0 |
| 25.2 | -2.41E-06 | 1143 | -66.2215 | -7.88E-07 | 394.9713 | 1.24E+10 | 0.8297 | 1447933 | 0 |
| 25.55 | -4.90E-06 | 872.3102 | -60.9312 | -4.46E-07 | 394.4987 | 1.24E+10 | 1.6895 | 1447933 | 0 |
| 25.9 | -6.15E-06 | 631.4261 | -52.9301 | -1.90E-07 | 394.078 | 1.24E+10 | 2.1205 | 1447933 | 0 |
| 26.25 | -6.50E-06 | 427.857 | -43.7713 | -1.05E-08 | 393.7224 | 1.24E+10 | 2.2409 | 1447933 | 0 |
| 26.6 | -6.24E-06 | 263.7562 | -34.5484 | 1.07E-07 | 393.4358 | 1.24E+10 | 2.1509 | 1447933 | 0 |
| 26.95 | -5.60E-06 | 137.5603 | -25.9758 | 1.75E-07 | 393.2154 | 1.24E+10 | 1.9313 | 1447933 | 0 |
| 27.3 | -4.77E-06 | 45.4124 | -18.4678 | 2.06E-07 | 393.0545 | 1.24E+10 | 1.644 | 1447933 | 0 |
| 27.65 | -3.87E-06 | -17.7424 | -12.2133 | 2.11E-07 | 393.0062 | 1.24E+10 | 1.3343 | 1447933 | 0 |
| 28 | -3.00E-06 | -57.3568 | -7.241 | 1.98E-07 | 393.0753 | 1.24E+10 | 1.0334 | 1447933 | 0 |
| 28.35 | -2.21E-06 | -78.7332 | -3.4733 | 1.75E-07 | 393.1127 | 1.24E+10 | 0.7607 | 1447933 | 0 |
| 28.7 | -1.53E-06 | -86.6791 | -0.7696 | 1.47E-07 | 393.1266 | 1.24E+10 | 0.5267 | 1447933 | 0 |
| 29.05 | -9.73E-07 | -85.3209 | 1.0409 | 1.18E-07 | 393.1242 | 1.24E+10 | 0.3354 | 1447933 | 0 |
| 29.4 | -5.39E-07 | -78.0345 | 2.1357 | 8.99E-08 | 393.1115 | 1.24E+10 | 0.186 | 1447933 | 0 |
| 29.75 | -2.17E-07 | -67.4564 | 2.6836 | 6.52E-08 | 393.093 | 1.24E+10 | 0.07493 | 1447933 | 0 |
| 30.1 | 8.52E-09 | -55.547 | 2.8348 | 4.43E-08 | 393.0722 | 1.24E+10 | -0.00294 | 1447933 | 0 |
| 30.45 | 1.55E-07 | -43.6815 | 2.7163 | 2.75E-08 | 393.0515 | 1.24E+10 | -0.05349 | 1447933 | 0 |
| 30.8 | 2.39E-07 | -32.7533 | 2.4306 | 1.45E-08 | 393.0324 | 1.24E+10 | -0.08257 | 1447933 | 0 |
| 31.15 | 2.77E-07 | -23.2769 | 2.0566 | 5.00E-09 | 393.0158 | 1.24E+10 | -0.09553 | 1447933 | 0 |
| 31.5 | 2.82E-07 | -15.4824 | 1.6521 | -1.58E-09 | 393.0022 | 1.24E+10 | -0.09706 | 1447933 | 0 |
| 31.85 | 2.64E-07 | -9.3977 | 1.2573 | -5.80E-09 | 392.9916 | 1.24E+10 | -0.09097 | 1447933 | 0 |
| 32.2 | 2.33E-07 | -4.9164 | 0.8977 | -8.23E-09 | 392.9838 | 1.24E+10 | -0.08025 | 1447933 | 0 |
| 32.55 | 1.95E-07 | -1.85 | 0.5882 | -9.38E-09 | 392.9784 | 1.24E+10 | -0.06712 | 1447933 | 0 |
| 32.9 | 1.54E-07 | 0.03251 | 0.3358 | -9.69E-09 | 392.9752 | 1.24E+10 | -0.05309 | 1447933 | 0 |
| 33.25 | 1.13E-07 | 0.9786 | 0.1423 | -9.52E-09 | 392.9769 | 1.24E+10 | -0.03906 | 1447933 | 0 |
| 33.6 | 7.40E-08 | 1.2355 | 0.00664 | -9.14E-09 | 392.9773 | 1.24E+10 | -0.02552 | 1447933 | 0 |
| 33.95 | 3.65E-08 | 1.0421 | -0.07338 | -8.76E-09 | 392.977 | 1.24E+10 | -0.01259 | 1447933 | 0 |
| 34.3 | 4.77E-10 | 0.6265 | -0.1002 | -8.47E-09 | 392.9763 | 1.24E+10 | -1.64E-04 | 1447933 | 0 |
| 34.65 | -3.47E-08 | 0.2079 | -0.07541 | -8.33E-09 | 392.9755 | 1.24E+10 | 0.01195 | 1447933 | 0 |
| 35 | -6.95E-08 | 0 | 0 | -8.30E-09 | 392.9752 | 1.24E+10 | 0.02396 | 723967 | 0 |

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 3:00

Pile-head deflection = 0.75 inches
Computed slope at pile head = -0.00836 radians
Maximum bending moment = 907765 inch-lbs
Maximum shear force = 15855 lbs
Depth of maximum bending moment = 7.7 feet below pile head
Depth of maximum shear force = 0 feet below pile head
Number of iterations = 20
Number of zero deflection points = 5

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Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 4

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Pile-head conditions are Displacem and Moment (Loading Type 4)
Displacem of pile head = 1 inches
Moment at pile head = 0 in-lbs
Axial load at pile head = 100000 lbs

| Depth X | Deflect. y | Bending Moment | Shear Force | Slope S | Total Stress | Bending Stiffness | Soil p | Res. Es*h | Soil Lat. | Spr. Load | Distrib. |
|---|---|---|---|---|---|---|---|---|---|---|---|

| | feet | inches | in-lbs | lbs | radians | psi* | in-lb^2 | lb/inch | lb/inch | lb/inch |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 0 | 18576 | -0.01069 | 392.9752 | 1.24E+10 | -122.34 | 256.9132 | 0 |
| | 0.35 | 0.9551 | 81433 | 18050 | -0.01068 | 535.2032 | 1.24E+10 | -128.539 | 565.25 | 0 |
| | 0.7 | 0.9103 | 160588 | 17497 | -0.01064 | 673.4508 | 1.24E+10 | -134.428 | 620.2381 | 0 |
| | 1.05 | 0.8657 | 237348 | 16921 | -0.01057 | 807.5167 | 1.24E+10 | -139.996 | 679.184 | 0 |
| | 1.4 | 0.8215 | 311605 | 16322 | -0.01048 | 937.2104 | 1.24E+10 | -145.234 | 742.5326 | 0 |
| | 1.75 | 0.7777 | 383255 | 15702 | -0.01036 | 1062 | 1.24E+10 | -150.132 | 810.7885 | 0 |
| | 2.1 | 0.7345 | 452203 | 15062 | -0.01022 | 1183 | 1.24E+10 | -154.68 | 884.5263 | 0 |
| | 2.45 | 0.6919 | 518357 | 14403 | -0.01005 | 1298 | 1.24E+10 | -158.868 | 964.4028 | 0 |
| | 2.8 | 0.65 | 581635 | 13728 | -0.00987 | 1409 | 1.24E+10 | -162.686 | 1051 | 0 |
| | 3.15 | 0.609 | 641960 | 13038 | -0.00966 | 1514 | 1.24E+10 | -166.126 | 1146 | 0 |
| | 3.5 | 0.5689 | 699263 | 12333 | -0.00943 | 1614 | 1.24E+10 | -169.176 | 1249 | 0 |
| | 3.85 | 0.5298 | 753483 | 11617 | -0.00918 | 1709 | 1.24E+10 | -171.828 | 1362 | 0 |
| | 4.2 | 0.4917 | 804563 | 10891 | -0.00892 | 1798 | 1.24E+10 | -174.073 | 1487 | 0 |
| | 4.55 | 0.4548 | 852459 | 10156 | -0.00864 | 1882 | 1.24E+10 | -175.704 | 1622 | 0 |
| | 4.9 | 0.4192 | 897133 | 9418 | -0.00834 | 1960 | 1.24E+10 | -175.776 | 1761 | 0 |
| | 5.25 | 0.3848 | 938579 | 8681 | -0.00803 | 2032 | 1.24E+10 | -175.488 | 1915 | 0 |
| | 5.6 | 0.3517 | 976795 | 7945 | -0.0077 | 2099 | 1.24E+10 | -174.831 | 2088 | 0 |
| | 5.95 | 0.3201 | 1011787 | 7213 | -0.00737 | 2160 | 1.24E+10 | -173.798 | 2281 | 0 |
| | 6.3 | 0.2898 | 1043570 | 6159 | -0.00702 | 2216 | 1.24E+10 | -327.979 | 4753 | 0 |
| | 6.65 | 0.2611 | 1069419 | 4778 | -0.00666 | 2261 | 1.24E+10 | -329.525 | 5300 | 0 |
| | 7 | 0.2339 | 1089301 | 3393 | -0.00629 | 2296 | 1.24E+10 | -330.273 | 5930 | 0 |
| | 7.35 | 0.2083 | 1103203 | 2006 | -0.00592 | 2320 | 1.24E+10 | -330.203 | 6659 | 0 |
| | 7.7 | 0.1842 | 1111123 | 620.8052 | -0.00554 | 2334 | 1.24E+10 | -329.289 | 7509 | 0 |
| | 8.05 | 0.1617 | 1113075 | -758.459 | -0.00517 | 2337 | 1.24E+10 | -327.504 | 8507 | 0 |
| | 8.4 | 0.1408 | 1109091 | -2128 | -0.00479 | 2330 | 1.24E+10 | -324.811 | 9690 | 0 |
| | 8.75 | 0.1215 | 1099220 | -3485 | -0.00441 | 2313 | 1.24E+10 | -321.17 | 11106 | 0 |
| | 9.1 | 0.1037 | 1083526 | -4824 | -0.00404 | 2285 | 1.24E+10 | -316.53 | 12819 | 0 |
| | 9.45 | 0.0875 | 1062094 | -6142 | -0.00368 | 2248 | 1.24E+10 | -310.83 | 14920 | 0 |
| | 9.8 | 0.0728 | 1035028 | -7433 | -0.00332 | 2201 | 1.24E+10 | -303.99 | 17537 | 0 |
| | 10.15 | 0.05958 | 1002451 | -8692 | -0.00298 | 2144 | 1.24E+10 | -295.908 | 20858 | 0 |
| | 10.5 | 0.0478 | 964512 | -9915 | -0.00264 | 2078 | 1.24E+10 | -286.443 | 25171 | 0 |
| | 10.85 | 0.03738 | 921383 | -11095 | -0.00232 | 2002 | 1.24E+10 | -275.395 | 30940 | 0 |
| | 11.2 | 0.02829 | 873264 | -12225 | -0.00202 | 1918 | 1.24E+10 | -262.46 | 38972 | 0 |
| | 11.55 | 0.02043 | 820390 | -13295 | -0.00173 | 1826 | 1.24E+10 | -247.143 | 50802 | 0 |
| | 11.9 | 0.01375 | 763040 | -14294 | -0.00146 | 1726 | 1.24E+10 | -228.542 | 69813 | 0 |
| | 12.25 | 0.00815 | 701550 | -15204 | -0.00121 | 1618 | 1.24E+10 | -204.717 | 105435 | 0 |
| | 12.6 | 0.00356 | 636348 | -15990 | -9.86E-04 | 1504 | 1.24E+10 | -169.902 | 200382 | 0 |
| | 12.95 | -1.25E-04 | 568059 | -16276 | -7.81E-04 | 1385 | 1.24E+10 | 33.849 | 1137719 | 0 |
| | 13.3 | -0.003 | 500286 | -15851 | -6.00E-04 | 1267 | 1.24E+10 | 168.5534 | 235912 | 0 |
| | 13.65 | -0.00516 | 435414 | -15084 | -4.41E-04 | 1153 | 1.24E+10 | 196.8392 | 160123 | 0 |
| | 14 | -0.0067 | 373953 | -14221 | -3.03E-04 | 1046 | 1.24E+10 | 214.0608 | 134102 | 0 |
| | 14.35 | -0.00771 | 316215 | -13297 | -1.86E-04 | 945.2617 | 1.24E+10 | 225.7345 | 122935 | 0 |
| | 14.7 | -0.00827 | 262413 | -12332 | -8.80E-05 | 851.2939 | 1.24E+10 | 233.8056 | 118757 | 0 |
| | 15.05 | -0.00845 | 212698 | -11339 | -7.33E-06 | 764.4642 | 1.24E+10 | 239.2013 | 118874 | 0 |
| | 15.4 | -0.00833 | 167172 | -10327 | 5.72E-05 | 684.9511 | 1.24E+10 | 242.4363 | 122231 | 0 |
| | 15.75 | -0.00797 | 125899 | -9306 | 1.07E-04 | 612.8657 | 1.24E+10 | 243.8235 | 128472 | 0 |
| | 16.1 | -0.00743 | 88910 | -8283 | 1.43E-04 | 548.2609 | 1.24E+10 | 243.5637 | 137641 | 0 |
| | 16.45 | -0.00677 | 56204 | -7264 | 1.68E-04 | 491.1379 | 1.24E+10 | 241.7895 | 150082 | 0 |
| | 16.8 | -0.00602 | 27755 | -6255 | 1.82E-04 | 441.4504 | 1.24E+10 | 238.589 | 166444 | 0 |
| | 17.15 | -0.00523 | 3511 | -5262 | 1.88E-04 | 399.1066 | 1.24E+10 | 234.0179 | 187751 | 0 |
| | 17.5 | -0.00444 | -16606 | -4292 | 1.85E-04 | 421.9784 | 1.24E+10 | 228.1071 | 215559 | 0 |
| | 17.85 | -0.00368 | -32696 | -3349 | 1.77E-04 | 450.0812 | 1.24E+10 | 220.8652 | 252234 | 0 |
| | 18.2 | -0.00296 | -44886 | -2444 | 1.64E-04 | 471.3711 | 1.24E+10 | 209.8376 | 297995 | 0 |
| | 18.55 | -0.0023 | -53368 | -1590 | 1.47E-04 | 486.1849 | 1.24E+10 | 197.0464 | 359616 | 0 |
| | 18.9 | -0.00172 | -58366 | -791.51 | 1.28E-04 | 494.9146 | 1.24E+10 | 183.2043 | 447023 | 0 |
| | 19.25 | -0.00122 | -60124 | -53.5618 | 1.08E-04 | 497.9853 | 1.24E+10 | 168.1995 | 576915 | 0 |
| | 19.6 | -8.13E-04 | -58907 | 618.3997 | 8.79E-05 | 495.8589 | 1.24E+10 | 151.7821 | 783650 | 0 |
| | 19.95 | -4.86E-04 | -55003 | 1217 | 6.85E-05 | 489.0416 | 1.24E+10 | 133.3719 | 1151471 | 0 |
| | 20.3 | -2.38E-04 | -48740 | 1670 | 5.09E-05 | 478.1015 | 1.24E+10 | 82.0231 | 1447933 | 0 |
| | 20.65 | -5.89E-05 | -41022 | 1884 | 3.57E-05 | 464.6221 | 1.24E+10 | 20.3026 | 1447933 | 0 |
| | 21 | 6.16E-05 | -32940 | 1882 | 2.31E-05 | 450.5071 | 1.24E+10 | -21.2463 | 1447933 | 0 |
| | 21.35 | 1.35E-04 | -25229 | 1740 | 1.32E-05 | 437.0384 | 1.24E+10 | -46.5975 | 1447933 | 0 |
| | 21.7 | 1.73E-04 | -18335 | 1517 | 5.83E-06 | 424.9991 | 1.24E+10 | -59.5431 | 1447933 | 0 |
| | 22.05 | 1.84E-04 | -12490 | 1259 | 5.93E-07 | 414.7897 | 1.24E+10 | -63.4725 | 1447933 | 0 |
| | 22.4 | 1.78E-04 | -7762 | 996.8157 | -2.85E-06 | 406.5327 | 1.24E+10 | -61.2603 | 1447933 | 0 |
| | 22.75 | 1.60E-04 | -4114 | 752.184 | -4.86E-06 | 400.1611 | 1.24E+10 | -55.231 | 1447933 | 0 |
| | 23.1 | 1.37E-04 | -1440 | 537.124 | -5.81E-06 | 395.4902 | 1.24E+10 | -47.1786 | 1447933 | 0 |
| | 23.45 | 1.11E-04 | 402.3597 | 357.3711 | -5.98E-06 | 393.6779 | 1.24E+10 | -38.418 | 1447933 | 0 |
| | 23.8 | 8.66E-05 | 1567 | 213.9969 | -5.65E-06 | 395.7119 | 1.24E+10 | -29.8554 | 1447933 | 0 |
| | 24.15 | 6.40E-05 | 2205 | 104.9677 | -5.01E-06 | 396.8258 | 1.24E+10 | -22.0632 | 1447933 | 0 |
| | 24.5 | 4.45E-05 | 2453 | 26.389 | -4.22E-06 | 397.2593 | 1.24E+10 | -15.3552 | 1447933 | 0 |
| | 24.85 | 2.86E-05 | 2430 | -26.5489 | -3.39E-06 | 397.2191 | 1.24E+10 | -9.8533 | 1447933 | 0 |
| | 25.2 | 1.61E-05 | 2233 | -58.8881 | -2.60E-06 | 396.8747 | 1.24E+10 | -5.5463 | 1447933 | 0 |
| | 25.55 | 6.78E-06 | 1937 | -75.4434 | -1.89E-06 | 396.359 | 1.24E+10 | -2.3372 | 1447933 | 0 |
| | 25.9 | 2.34E-07 | 1601 | -80.5209 | -1.29E-06 | 395.7707 | 1.24E+10 | -0.08071 | 1447933 | 0 |
| | 26.25 | -4.03E-06 | 1262 | -77.7742 | -8.01E-07 | 395.1795 | 1.24E+10 | 1.3887 | 1447933 | 0 |
| | 26.6 | -6.49E-06 | 947.9542 | -70.1593 | -4.25E-07 | 394.6308 | 1.24E+10 | 2.2375 | 1447933 | 0 |
| | 26.95 | -7.60E-06 | 673.1305 | -59.9584 | -1.50E-07 | 394.1508 | 1.24E+10 | 2.6201 | 1447933 | 0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 27.3 | -7.75E-06 | 444.4294 | -48.8456 | 3.98E-08 | 393.7514 | 1.24E+10 | 2.6717 | 1447933 | 0 |
| 27.65 | -7.27E-06 | 262.7945 | -37.9747 | 1.60E-07 | 393.4342 | 1.24E+10 | 2.5048 | 1447933 | 0 |
| 28 | -6.41E-06 | 125.3075 | -28.0762 | 2.26E-07 | 393.194 | 1.24E+10 | 2.2087 | 1447933 | 0 |
| 28.35 | -5.37E-06 | 26.7645 | -19.5508 | 2.52E-07 | 393.0219 | 1.24E+10 | 1.851 | 1447933 | 0 |
| 28.7 | -4.29E-06 | -39.1309 | -12.5556 | 2.50E-07 | 393.0435 | 1.24E+10 | 1.4801 | 1447933 | 0 |
| 29.05 | -3.27E-06 | -78.912 | -7.0777 | 2.29E-07 | 393.113 | 1.24E+10 | 1.1284 | 1447933 | 0 |
| 29.4 | -2.37E-06 | -98.7764 | -2.9953 | 1.99E-07 | 393.1477 | 1.24E+10 | 0.8156 | 1447933 | 0 |
| 29.75 | -1.60E-06 | -104.24 | -0.1249 | 1.65E-07 | 393.1572 | 1.24E+10 | 0.5513 | 1447933 | 0 |
| 30.1 | -9.81E-07 | -99.964 | 1.7432 | 1.30E-07 | 393.1498 | 1.24E+10 | 0.3383 | 1447933 | 0 |
| 30.45 | -5.06E-07 | -89.7068 | 2.8198 | 9.79E-08 | 393.1318 | 1.24E+10 | 0.1744 | 1447933 | 0 |
| 30.8 | -1.58E-07 | -76.3604 | 3.3007 | 6.97E-08 | 393.1085 | 1.24E+10 | 0.05464 | 1447933 | 0 |
| 31.15 | 8.00E-08 | -62.0393 | 3.3576 | 4.62E-08 | 393.0835 | 1.24E+10 | -0.02757 | 1447933 | 0 |
| 31.5 | 2.30E-07 | -48.1958 | 3.1332 | 2.75E-08 | 393.0593 | 1.24E+10 | -0.07928 | 1447933 | 0 |
| 31.85 | 3.11E-07 | -35.7438 | 2.7414 | 1.33E-08 | 393.0376 | 1.24E+10 | -0.1073 | 1447933 | 0 |
| 32.2 | 3.41E-07 | -25.1792 | 2.2689 | 2.93E-09 | 393.0191 | 1.24E+10 | -0.1177 | 1447933 | 0 |
| 32.55 | 3.36E-07 | -16.6873 | 1.7787 | -4.18E-09 | 393.0043 | 1.24E+10 | -0.1158 | 1447933 | 0 |
| 32.9 | 3.06E-07 | -10.2349 | 1.3138 | -8.75E-09 | 392.993 | 1.24E+10 | -0.1056 | 1447933 | 0 |
| 33.25 | 2.62E-07 | -5.6437 | 0.9022 | -1.15E-08 | 392.985 | 1.24E+10 | -0.0904 | 1447933 | 0 |
| 33.6 | 2.10E-07 | -2.6464 | 0.5603 | -1.29E-08 | 392.9798 | 1.24E+10 | -0.07243 | 1447933 | 0 |
| 33.95 | 1.54E-07 | -0.9264 | 0.2965 | -1.35E-08 | 392.9768 | 1.24E+10 | -0.05316 | 1447933 | 0 |
| 34.3 | 9.70E-08 | -0.1441 | 0.1147 | -1.36E-08 | 392.9754 | 1.24E+10 | -0.03344 | 1447933 | 0 |
| 34.65 | 3.96E-08 | 0.0483 | 0.01579 | -1.37E-08 | 392.9753 | 1.24E+10 | -0.01365 | 1447933 | 0 |
| 35 | -1.78E-08 | 0 | 0 | -1.37E-08 | 392.9752 | 1.24E+10 | 0.00613 | 723967 | 0 |

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 4:00

Pile-head deflection = 1 inches
Computed slope at pile head = -0.01069 radians
Maximum bending moment = 1113075 inch-lbs
Maximum shear force = 18576 lbs
Depth of maximum bending moment = 8.05 feet below pile head
Depth of maximum shear force = 0 feet below pile head
Number of iterations = 16
Number of zero deflection points = 5

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Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 5

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Pile-head conditions are Displacem and Pile-head Rotation (Loading Type 5)
Displacem of pile head = 0.25 inches
Rotation of pile head = 0.00E+00 radians
Axial load on pile head = 100000 lbs

| Depth X feet | Deflect. y inches | Bending Moment in-lbs | Shear Force lbs | Slope S radians | Total Stress psi* | Bending Stiffness in-lb^2 | Soil p lb/inch | Res. Es*h lb/inch | Soil Lat. lb/inch | Spr. Load | Distrib. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.25 | -1046731 | 19593 | 0 | 2221 | 1.24E+10 | -77.0691 | 647.3807 | | 0 | |
| 0.35 | 0.2493 | -965097 | 19247 | -3.42E-04 | 2079 | 1.24E+10 | -82.1423 | 1384 | | 0 | |
| 0.7 | 0.2471 | -884773 | 18891 | -6.56E-04 | 1938 | 1.24E+10 | -87.0437 | 1479 | | 0 | |
| 1.05 | 0.2437 | -805859 | 18516 | -9.43E-04 | 1800 | 1.24E+10 | -91.7562 | 1581 | | 0 | |
| 1.4 | 0.2392 | -728448 | 18121 | -0.0012 | 1665 | 1.24E+10 | -96.2635 | 1690 | | 0 | |
| 1.75 | 0.2336 | -652632 | 17708 | -0.00144 | 1533 | 1.24E+10 | -100.55 | 1808 | | 0 | |
| 2.1 | 0.2271 | -578496 | 17277 | -0.00165 | 1403 | 1.24E+10 | -104.601 | 1934 | | 0 | |
| 2.45 | 0.2198 | -506123 | 16830 | -0.00183 | 1277 | 1.24E+10 | -108.402 | 2071 | | 0 | |
| 2.8 | 0.2118 | -435590 | 16367 | -0.00199 | 1154 | 1.24E+10 | -111.94 | 2220 | | 0 | |
| 3.15 | 0.2031 | -366969 | 15890 | -0.00213 | 1034 | 1.24E+10 | -115.2 | 2383 | | 0 | |
| 3.5 | 0.1939 | -300328 | 15400 | -0.00224 | 917.5153 | 1.24E+10 | -118.171 | 2560 | | 0 | |
| 3.85 | 0.1843 | -235729 | 14898 | -0.00233 | 804.6893 | 1.24E+10 | -120.839 | 2754 | | 0 | |
| 4.2 | 0.1743 | -173228 | 14385 | -0.0024 | 695.5274 | 1.24E+10 | -123.193 | 2969 | | 0 | |
| 4.55 | 0.1641 | -112875 | 13864 | -0.00245 | 590.1179 | 1.24E+10 | -125.08 | 3202 | | 0 | |
| 4.9 | 0.1537 | -54713 | 13337 | -0.00248 | 488.5339 | 1.24E+10 | -125.818 | 3438 | | 0 | |
| 5.25 | 0.1433 | 1238 | 12808 | -0.00249 | 395.1377 | 1.24E+10 | -126.251 | 3701 | | 0 | |
| 5.6 | 0.1328 | 54962 | 12277 | -0.00248 | 488.9689 | 1.24E+10 | -126.372 | 3996 | | 0 | |
| 5.95 | 0.1225 | 106448 | 11747 | -0.00245 | 578.8931 | 1.24E+10 | -126.175 | 4327 | | 0 | |
| 6.3 | 0.1122 | 155694 | 10939 | -0.00241 | 664.9034 | 1.24E+10 | -258.735 | 9681 | | 0 | |
| 6.65 | 0.1023 | 200353 | 9848 | -0.00235 | 742.9035 | 1.24E+10 | -260.681 | 10707 | | 0 | |
| 7 | 0.09255 | 240386 | 8750 | -0.00227 | 812.8222 | 1.24E+10 | -261.946 | 11888 | | 0 | |
| 7.35 | 0.08318 | 275763 | 7649 | -0.00218 | 874.6108 | 1.24E+10 | -262.513 | 13255 | | 0 | |
| 7.7 | 0.07421 | 306470 | 6547 | -0.00208 | 928.2428 | 1.24E+10 | -262.361 | 14848 | | 0 | |
| 8.05 | 0.06568 | 332506 | 5447 | -0.00198 | 973.7154 | 1.24E+10 | -261.468 | 16720 | | 0 | |
| 8.4 | 0.05762 | 353882 | 4352 | -0.00186 | 1011 | 1.24E+10 | -259.809 | 18938 | | 0 | |
| 8.75 | 0.05006 | 370624 | 3266 | -0.00174 | 1040 | 1.24E+10 | -257.355 | 21590 | | 0 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 9.1 | 0.04304 | 382774 | 2192 | -0.00161 | 1062 | 1.24E+10 | -254.072 | 24795 | 0 |
| 9.45 | 0.03656 | 390387 | 1134 | -0.00148 | 1075 | 1.24E+10 | -249.923 | 28713 | 0 |
| 9.8 | 0.03063 | 393536 | 94.511 | -0.00134 | 1080 | 1.24E+10 | -244.862 | 33571 | 0 |
| 10.15 | 0.02527 | 392309 | -921.246 | -0.00121 | 1078 | 1.24E+10 | -238.832 | 39691 | 0 |
| 10.5 | 0.02047 | 386814 | -1909 | -0.00108 | 1069 | 1.24E+10 | -231.761 | 47552 | 0 |
| 10.85 | 0.01622 | 377175 | -2866 | -9.48E-04 | 1052 | 1.24E+10 | -223.553 | 57889 | 0 |
| 11.2 | 0.01251 | 363539 | -3785 | -8.22E-04 | 1028 | 1.24E+10 | -214.077 | 71891 | 0 |
| 11.55 | 0.00931 | 346074 | -4661 | -7.02E-04 | 997.4136 | 1.24E+10 | -203.131 | 91613 | 0 |
| 11.9 | 0.00661 | 324977 | -5487 | -5.88E-04 | 960.5666 | 1.24E+10 | -190.397 | 120941 | 0 |
| 12.25 | 0.00438 | 300476 | -6255 | -4.82E-04 | 917.7726 | 1.24E+10 | -175.297 | 168283 | 0 |
| 12.6 | 0.00257 | 272839 | -6952 | -3.84E-04 | 869.503 | 1.24E+10 | -156.612 | 256273 | 0 |
| 12.95 | 0.00115 | 242400 | -7556 | -2.97E-04 | 816.3403 | 1.24E+10 | -130.882 | 479067 | 0 |
| 13.3 | 7.40E-05 | 209618 | -7874 | -2.20E-04 | 759.0849 | 1.24E+10 | -20.4236 | 1159575 | 0 |
| 13.65 | -7.01E-04 | 176446 | -7667 | -1.54E-04 | 701.148 | 1.24E+10 | 118.8033 | 712301 | 0 |
| 14 | -0.00122 | 145344 | -7125 | -9.98E-05 | 646.8274 | 1.24E+10 | 139.5146 | 478993 | 0 |
| 14.35 | -0.00154 | 116683 | -6515 | -5.53E-05 | 596.7689 | 1.24E+10 | 150.5651 | 410948 | 0 |
| 14.7 | -0.00169 | 90661 | -5870 | -2.01E-05 | 551.3202 | 1.24E+10 | 156.8901 | 390394 | 0 |
| 15.05 | -0.00171 | 67394 | -5204 | 6.74E-06 | 510.6825 | 1.24E+10 | 160.128 | 393842 | 0 |
| 15.4 | -0.00163 | 46942 | -4530 | 2.62E-05 | 474.9615 | 1.24E+10 | 161.0387 | 414627 | 0 |
| 15.75 | -0.00149 | 29323 | -3855 | 3.91E-05 | 444.1902 | 1.24E+10 | 160.0371 | 451741 | 0 |
| 16.1 | -0.0013 | 14524 | -3189 | 4.66E-05 | 418.3423 | 1.24E+10 | 157.371 | 507350 | 0 |
| 16.45 | -0.0011 | 2499 | -2537 | 4.94E-05 | 397.3393 | 1.24E+10 | 153.1959 | 586588 | 0 |
| 16.8 | -8.87E-04 | -6825 | -1905 | 4.87E-05 | 404.8949 | 1.24E+10 | 147.6086 | 698580 | 0 |
| 17.15 | -6.88E-04 | -13543 | -1300 | 4.52E-05 | 416.6293 | 1.24E+10 | 140.6622 | 859009 | 0 |
| 17.5 | -5.07E-04 | -17779 | -726.165 | 3.99E-05 | 424.0267 | 1.24E+10 | 132.3647 | 1095733 | 0 |
| 17.85 | -3.52E-04 | -19677 | -193.991 | 3.36E-05 | 427.3415 | 1.24E+10 | 121.0518 | 1443003 | 0 |
| 18.2 | -2.25E-04 | -19436 | 223.3791 | 2.69E-05 | 426.922 | 1.24E+10 | 77.6957 | 1447933 | 0 |
| 18.55 | -1.26E-04 | -17823 | 477.8555 | 2.06E-05 | 424.1038 | 1.24E+10 | 43.4835 | 1447933 | 0 |
| 18.9 | -5.23E-05 | -15440 | 607.0451 | 1.50E-05 | 419.9416 | 1.24E+10 | 18.0354 | 1447933 | 0 |
| 19.25 | -5.20E-07 | -12736 | 645.2961 | 1.02E-05 | 415.2198 | 1.24E+10 | 0.1794 | 1447933 | 0 |
| 19.6 | 3.31E-05 | -10028 | 621.704 | 6.30E-06 | 410.4893 | 1.24E+10 | -11.4138 | 1447933 | 0 |
| 19.95 | 5.24E-05 | -7519 | 559.7757 | 3.32E-06 | 406.108 | 1.24E+10 | -18.0759 | 1447933 | 0 |
| 20.3 | 6.10E-05 | -5328 | 477.6308 | 1.14E-06 | 402.2817 | 1.24E+10 | -21.0407 | 1447933 | 0 |
| 20.65 | 6.20E-05 | -3508 | 388.5363 | -3.58E-07 | 399.1023 | 1.24E+10 | -21.3853 | 1447933 | 0 |
| 21 | 5.80E-05 | -2064 | 301.6171 | -1.30E-06 | 396.5809 | 1.24E+10 | -20.0048 | 1447933 | 0 |
| 21.35 | 5.11E-05 | -973.429 | 222.6278 | -1.82E-06 | 394.6753 | 1.24E+10 | -17.6092 | 1447933 | 0 |
| 21.7 | 4.27E-05 | -192.871 | 154.7053 | -2.02E-06 | 393.312 | 1.24E+10 | -14.7349 | 1447933 | 0 |
| 22.05 | 3.41E-05 | 327.7908 | 99.054 | -1.99E-06 | 393.5477 | 1.24E+10 | -11.7657 | 1447933 | 0 |
| 22.4 | 2.60E-05 | 640.8585 | 55.5346 | -1.83E-06 | 394.0945 | 1.24E+10 | -8.9578 | 1447933 | 0 |
| 22.75 | 1.88E-05 | 795.8194 | 23.1469 | -1.59E-06 | 394.3651 | 1.24E+10 | -6.465 | 1447933 | 0 |
| 23.1 | 1.27E-05 | 836.6247 | 0.4071 | -1.31E-06 | 394.4364 | 1.24E+10 | -4.3635 | 1447933 | 0 |
| 23.45 | 7.75E-06 | 800.339 | -14.3703 | -1.03E-06 | 394.373 | 1.24E+10 | -2.6734 | 1447933 | 0 |
| 23.8 | 3.99E-06 | 716.7808 | -22.8757 | -7.74E-07 | 394.2271 | 1.24E+10 | -1.3768 | 1447933 | 0 |
| 24.15 | 1.26E-06 | 608.8331 | -26.6758 | -5.49E-07 | 394.0385 | 1.24E+10 | -0.4327 | 1447933 | 0 |
| 24.5 | -6.15E-07 | 493.1649 | -27.1394 | -3.62E-07 | 393.8365 | 1.24E+10 | 0.212 | 1447933 | 0 |
| 24.85 | -1.78E-06 | 381.1654 | -25.4046 | -2.13E-07 | 393.6409 | 1.24E+10 | 0.6142 | 1447933 | 0 |
| 25.2 | -2.40E-06 | 279.9454 | -22.3741 | -1.01E-07 | 393.4641 | 1.24E+10 | 0.8289 | 1447933 | 0 |
| 25.55 | -2.63E-06 | 193.3078 | -18.7306 | -2.04E-08 | 393.3128 | 1.24E+10 | 0.906 | 1447933 | 0 |
| 25.9 | -2.58E-06 | 122.6252 | -14.9629 | 3.32E-08 | 393.1893 | 1.24E+10 | 0.8881 | 1447933 | 0 |
| 26.25 | -2.35E-06 | 67.5912 | -11.3972 | 6.55E-08 | 393.0932 | 1.24E+10 | 0.8099 | 1447933 | 0 |
| 26.6 | -2.03E-06 | 26.8335 | -8.2299 | 8.15E-08 | 393.022 | 1.24E+10 | 0.6984 | 1447933 | 0 |
| 26.95 | -1.66E-06 | -1.6086 | -5.5585 | 8.58E-08 | 392.978 | 1.24E+10 | 0.5737 | 1447933 | 0 |
| 27.3 | -1.30E-06 | -19.9303 | -3.4091 | 8.22E-08 | 393.01 | 1.24E+10 | 0.4498 | 1447933 | 0 |
| 27.65 | -9.74E-07 | -30.3142 | -1.7594 | 7.36E-08 | 393.0281 | 1.24E+10 | 0.3357 | 1447933 | 0 |
| 28 | -6.86E-07 | -34.7712 | -0.5576 | 6.26E-08 | 393.0359 | 1.24E+10 | 0.2366 | 1447933 | 0 |
| 28.35 | -4.48E-07 | -35.0502 | 0.2637 | 5.07E-08 | 393.0364 | 1.24E+10 | 0.1545 | 1447933 | 0 |
| 28.7 | -2.60E-07 | -32.599 | 0.7764 | 3.92E-08 | 393.0321 | 1.24E+10 | 0.08965 | 1447933 | 0 |
| 29.05 | -1.18E-07 | -28.5618 | 1.0504 | 2.89E-08 | 393.0251 | 1.24E+10 | 0.04084 | 1447933 | 0 |
| 29.4 | -1.76E-08 | -23.8001 | 1.1489 | 2.00E-08 | 393.0167 | 1.24E+10 | 0.00607 | 1447933 | 0 |
| 29.75 | 4.93E-08 | -18.9279 | 1.1259 | 1.27E-08 | 393.0082 | 1.24E+10 | -0.01699 | 1447933 | 0 |
| 30.1 | 8.92E-08 | -14.3528 | 1.0257 | 7.06E-09 | 393.0002 | 1.24E+10 | -0.03075 | 1447933 | 0 |
| 30.45 | 1.09E-07 | -10.3182 | 0.8825 | 2.87E-09 | 392.9932 | 1.24E+10 | -0.03745 | 1447933 | 0 |
| 30.8 | 1.13E-07 | -6.9427 | 0.7217 | -5.64E-11 | 392.9873 | 1.24E+10 | -0.03908 | 1447933 | 0 |
| 31.15 | 1.08E-07 | -4.2555 | 0.5614 | -1.96E-09 | 392.9826 | 1.24E+10 | -0.03729 | 1447933 | 0 |
| 31.5 | 9.69E-08 | -2.2254 | 0.4129 | -3.06E-09 | 392.9791 | 1.24E+10 | -0.03341 | 1447933 | 0 |
| 31.85 | 8.25E-08 | -0.7843 | 0.2831 | -3.57E-09 | 392.9765 | 1.24E+10 | -0.02843 | 1447933 | 0 |
| 32.2 | 6.69E-08 | 0.1554 | 0.1749 | -3.68E-09 | 392.9754 | 1.24E+10 | -0.02307 | 1447933 | 0 |
| 32.55 | 5.16E-08 | 0.6881 | 0.08913 | -3.53E-09 | 392.9764 | 1.24E+10 | -0.01778 | 1447933 | 0 |
| 32.9 | 3.72E-08 | 0.907 | 0.02482 | -3.26E-09 | 392.9768 | 1.24E+10 | -0.01284 | 1447933 | 0 |
| 33.25 | 2.42E-08 | 0.8993 | -0.01966 | -2.96E-09 | 392.9767 | 1.24E+10 | -0.00834 | 1447933 | 0 |
| 33.6 | 1.24E-08 | 0.7444 | -0.04616 | -2.68E-09 | 392.9765 | 1.24E+10 | -0.00428 | 1447933 | 0 |
| 33.95 | 1.71E-09 | 0.5139 | -0.05638 | -2.46E-09 | 392.9761 | 1.24E+10 | -5.88E-04 | 1447933 | 0 |
| 34.3 | -8.27E-09 | 0.2729 | -0.05163 | -2.33E-09 | 392.9756 | 1.24E+10 | 0.00285 | 1447933 | 0 |
| 34.65 | -1.79E-08 | 0.08215 | -0.03271 | -2.27E-09 | 392.9753 | 1.24E+10 | 0.00616 | 1447933 | 0 |
| 35 | -2.73E-08 | 0 | 0 | -2.25E-09 | 392.9752 | 1.24E+10 | 0.00942 | 723967 | 0 |

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 5:00

Pile-head deflection = 0.25 inches
Computed slope at pile head = 0 radians
Maximum bending moment = -1046731 inch-lbs
Maximum shear force = 19593 lbs
Depth of maximum bending moment = 0 feet below pile head
Depth of maximum shear force = 0 feet below pile head
Number of iterations = 15
Number of zero deflection points = 5

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Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 6

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Pile-head conditions are Displacem and Pile-head Rotation (Loading Type 5)
Displacem of pile head = 0.5 inches
Rotation of pile head = 0.00E+00 radians
Axial load on pile head = 100000 lbs

| Depth X feet | Deflect. y inches | Bending Moment in-lbs | Shear Force lbs | Slope S radians | Total Stress psi* | Bending Stiffness in-lb^2 | Soil p lb/inch | Res. Es*h lb/inch | Soil Lat. lb/inch | Spr. Load | Distrib. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.5 | -1715820 | 28959 | 0 | 3390 | 1.24E+10 | -97.101 | 407.8243 | 0 | | |
| 0.35 | 0.4988 | -1594992 | 28522 | -5.62E-04 | 3179 | 1.24E+10 | -103.511 | 871.6291 | 0 | | |
| 0.7 | 0.4953 | -1475761 | 28074 | -0.00108 | 2970 | 1.24E+10 | -109.743 | 930.6333 | 0 | | |
| 1.05 | 0.4897 | -1358256 | 27601 | -0.00156 | 2765 | 1.24E+10 | -115.778 | 993.0421 | 0 | | |
| 1.4 | 0.4821 | -1242600 | 27102 | -0.00201 | 2563 | 1.24E+10 | -121.597 | 1059 | 0 | | |
| 1.75 | 0.4728 | -1128911 | 26580 | -0.00241 | 2365 | 1.24E+10 | -127.184 | 1130 | 0 | | |
| 2.1 | 0.4619 | -1017305 | 26035 | -0.00277 | 2170 | 1.24E+10 | -132.523 | 1205 | 0 | | |
| 2.45 | 0.4495 | -907892 | 25467 | -0.0031 | 1979 | 1.24E+10 | -137.597 | 1286 | 0 | | |
| 2.8 | 0.4359 | -800776 | 24879 | -0.00339 | 1792 | 1.24E+10 | -142.393 | 1372 | 0 | | |
| 3.15 | 0.421 | -696058 | 24272 | -0.00364 | 1609 | 1.24E+10 | -146.894 | 1465 | 0 | | |
| 3.5 | 0.4052 | -593831 | 23646 | -0.00386 | 1430 | 1.24E+10 | -151.089 | 1566 | 0 | | |
| 3.85 | 0.3886 | -494186 | 23003 | -0.00405 | 1256 | 1.24E+10 | -154.962 | 1675 | 0 | | |
| 4.2 | 0.3712 | -397203 | 22345 | -0.0042 | 1087 | 1.24E+10 | -158.501 | 1793 | 0 | | |
| 4.55 | 0.3533 | -302959 | 21673 | -0.00432 | 922.1108 | 1.24E+10 | -161.513 | 1920 | 0 | | |
| 4.9 | 0.3349 | -211522 | 20991 | -0.00441 | 762.4099 | 1.24E+10 | -163.112 | 2045 | 0 | | |
| 5.25 | 0.3163 | -122931 | 20304 | -0.00446 | 607.6817 | 1.24E+10 | -164.388 | 2183 | 0 | | |
| 5.6 | 0.2975 | -37223 | 19611 | -0.00449 | 457.9875 | 1.24E+10 | -165.332 | 2334 | 0 | | |
| 5.95 | 0.2786 | 45574 | 18915 | -0.00449 | 472.5725 | 1.24E+10 | -165.937 | 2502 | 0 | | |
| 6.3 | 0.2598 | 125437 | 17897 | -0.00446 | 612.0585 | 1.24E+10 | -319.111 | 5160 | 0 | | |
| 6.65 | 0.2411 | 199654 | 16548 | -0.0044 | 741.6816 | 1.24E+10 | -323.021 | 5627 | 0 | | |
| 7 | 0.2228 | 268144 | 15185 | -0.00433 | 861.303 | 1.24E+10 | -326.26 | 6152 | 0 | | |
| 7.35 | 0.2048 | 330840 | 13809 | -0.00422 | 970.8057 | 1.24E+10 | -328.812 | 6744 | 0 | | |
| 7.7 | 0.1873 | 387689 | 12424 | -0.0041 | 1070 | 1.24E+10 | -330.661 | 7416 | 0 | | |
| 8.05 | 0.1703 | 438650 | 11033 | -0.00396 | 1159 | 1.24E+10 | -331.789 | 8181 | 0 | | |
| 8.4 | 0.154 | 483695 | 9639 | -0.0038 | 1238 | 1.24E+10 | -332.177 | 9059 | 0 | | |
| 8.75 | 0.1384 | 522812 | 8245 | -0.00363 | 1306 | 1.24E+10 | -331.802 | 10071 | 0 | | |
| 9.1 | 0.1235 | 556001 | 6853 | -0.00345 | 1364 | 1.24E+10 | -330.641 | 11246 | 0 | | |
| 9.45 | 0.1094 | 583279 | 5469 | -0.00326 | 1412 | 1.24E+10 | -328.667 | 12619 | 0 | | |
| 9.8 | 0.09613 | 604675 | 4094 | -0.00306 | 1449 | 1.24E+10 | -325.851 | 14237 | 0 | | |
| 10.15 | 0.08373 | 620238 | 2734 | -0.00285 | 1476 | 1.24E+10 | -322.159 | 16161 | 0 | | |
| 10.5 | 0.07221 | 630029 | 1390 | -0.00263 | 1493 | 1.24E+10 | -317.552 | 18470 | 0 | | |
| 10.85 | 0.06159 | 634128 | 68.1204 | -0.00242 | 1501 | 1.24E+10 | -311.986 | 21274 | 0 | | |
| 11.2 | 0.05188 | 632634 | -1228 | -0.00221 | 1498 | 1.24E+10 | -305.405 | 24725 | 0 | | |
| 11.55 | 0.04307 | 625662 | -2495 | -0.00199 | 1486 | 1.24E+10 | -297.741 | 29035 | 0 | | |
| 11.9 | 0.03515 | 613349 | -3727 | -0.00178 | 1464 | 1.24E+10 | -288.909 | 34520 | 0 | | |
| 12.25 | 0.02811 | 595852 | -4919 | -0.00158 | 1434 | 1.24E+10 | -278.791 | 41658 | 0 | | |
| 12.6 | 0.02192 | 573352 | -6066 | -0.00138 | 1394 | 1.24E+10 | -267.226 | 51214 | 0 | | |
| 12.95 | 0.01654 | 546056 | -7160 | -0.00119 | 1347 | 1.24E+10 | -253.972 | 64492 | 0 | | |
| 13.3 | 0.01194 | 514202 | -8195 | -0.00101 | 1291 | 1.24E+10 | -238.643 | 83923 | 0 | | |
| 13.65 | 0.00808 | 478066 | -9159 | -8.39E-04 | 1228 | 1.24E+10 | -220.554 | 114644 | 0 | | |
| 14 | 0.0049 | 437970 | -10039 | -6.83E-04 | 1158 | 1.24E+10 | -198.295 | 170006 | 0 | | |
| 14.35 | 0.00234 | 394315 | -10808 | -5.42E-04 | 1082 | 1.24E+10 | -168.067 | 301353 | 0 | | |
| 14.7 | 3.48E-04 | 347638 | -11378 | -4.16E-04 | 1000 | 1.24E+10 | -103.407 | 1246906 | 0 | | |
| 15.05 | -0.00115 | 299087 | -11291 | -3.06E-04 | 915.3482 | 1.24E+10 | 144.7722 | 528778 | 0 | | |
| 15.4 | -0.00222 | 253048 | -10622 | -2.12E-04 | 834.938 | 1.24E+10 | 173.9679 | 328905 | 0 | | |
| 15.75 | -0.00293 | 210042 | -9858 | -1.34E-04 | 759.8246 | 1.24E+10 | 189.72 | 271752 | 0 | | |
| 16.1 | -0.00334 | 170352 | -9041 | -6.89E-05 | 690.504 | 1.24E+10 | 199.345 | 250429 | 0 | | |
| 16.45 | -0.00351 | 134154 | -8192 | -1.72E-05 | 627.2827 | 1.24E+10 | 205.1195 | 245348 | 0 | | |
| 16.8 | -0.00349 | 101555 | -7324 | 2.28E-05 | 570.3474 | 1.24E+10 | 208.0743 | 250542 | 0 | | |
| 17.15 | -0.00332 | 72613 | -6449 | 5.24E-05 | 519.7975 | 1.24E+10 | 208.7659 | 264103 | 0 | | |
| 17.5 | -0.00305 | 47342 | -5574 | 7.27E-05 | 475.6615 | 1.24E+10 | 207.5263 | 285934 | 0 | | |
| 17.85 | -0.00271 | 25726 | -4709 | 8.51E-05 | 437.9074 | 1.24E+10 | 204.5652 | 317145 | 0 | | |
| 18.2 | -0.00233 | 7715 | -3864 | 9.08E-05 | 406.4493 | 1.24E+10 | 197.7184 | 355916 | 0 | | |
| 18.55 | -0.00195 | -6810 | -3052 | 9.10E-05 | 404.8694 | 1.24E+10 | 188.9294 | 407704 | 0 | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 18.9 | -0.00157 | -18001 | -2280 | 8.68E-05 | 424.4154 | 1.24E+10 | 178.9909 | 479110 | 0 |
| 19.25 | -0.00122 | -26032 | -1551 | 7.93E-05 | 438.4422 | 1.24E+10 | 167.9544 | 579362 | 0 |
| 19.6 | -9.03E-04 | -31097 | -871.176 | 6.96E-05 | 447.2881 | 1.24E+10 | 155.8225 | 724616 | 0 |
| 19.95 | -6.33E-04 | -33409 | -244.651 | 5.86E-05 | 451.3254 | 1.24E+10 | 142.5226 | 945436 | 0 |
| 20.3 | -4.11E-04 | -33201 | 323.0955 | 4.73E-05 | 450.9634 | 1.24E+10 | 127.8328 | 1307075 | 0 |
| 20.65 | -2.36E-04 | -30734 | 762.213 | 3.65E-05 | 446.6546 | 1.24E+10 | 81.2707 | 1447933 | 0 |
| 21 | -1.05E-04 | -26829 | 1009 | 2.67E-05 | 439.8344 | 1.24E+10 | 36.0457 | 1447933 | 0 |
| 21.35 | -1.16E-05 | -22285 | 1093 | 1.83E-05 | 431.8969 | 1.24E+10 | 4.0134 | 1447933 | 0 |
| 21.7 | 4.95E-05 | -17666 | 1065 | 1.16E-05 | 423.8302 | 1.24E+10 | -17.0607 | 1447933 | 0 |
| 22.05 | 8.54E-05 | -13346 | 967.6344 | 6.29E-06 | 416.2847 | 1.24E+10 | -29.4478 | 1447933 | 0 |
| 22.4 | 1.02E-04 | -9543 | 831.7222 | 2.40E-06 | 409.6431 | 1.24E+10 | -35.2723 | 1447933 | 0 |
| 22.75 | 1.06E-04 | -6362 | 681.2019 | -2.99E-07 | 404.0859 | 1.24E+10 | -36.404 | 1447933 | 0 |
| 23.1 | 9.98E-05 | -3821 | 532.4974 | -2.03E-06 | 399.6487 | 1.24E+10 | -34.4076 | 1447933 | 0 |
| 23.45 | 8.86E-05 | -1887 | 396.1236 | -3.00E-06 | 396.2707 | 1.24E+10 | -30.5323 | 1447933 | 0 |
| 23.8 | 7.46E-05 | -491.038 | 277.9744 | -3.40E-06 | 393.8328 | 1.24E+10 | -25.7292 | 1447933 | 0 |
| 24.15 | 6.00E-05 | 450.9866 | 180.5054 | -3.41E-06 | 393.7628 | 1.24E+10 | -20.6846 | 1447933 | 0 |
| 24.5 | 4.60E-05 | 1028 | 103.758 | -3.16E-06 | 394.7708 | 1.24E+10 | -15.8618 | 1447933 | 0 |
| 24.85 | 3.35E-05 | 1325 | 46.2048 | -2.76E-06 | 395.2897 | 1.24E+10 | -11.5445 | 1447933 | 0 |
| 25.2 | 2.29E-05 | 1419 | 5.4158 | -2.29E-06 | 395.4527 | 1.24E+10 | -7.8788 | 1447933 | 0 |
| 25.55 | 1.42E-05 | 1373 | -21.4423 | -1.82E-06 | 395.3725 | 1.24E+10 | -4.9107 | 1447933 | 0 |
| 25.9 | 7.59E-06 | 1240 | -37.2517 | -1.37E-06 | 395.1408 | 1.24E+10 | -2.6176 | 1447933 | 0 |
| 26.25 | 2.71E-06 | 1061 | -44.7101 | -9.83E-07 | 394.828 | 1.24E+10 | -0.9341 | 1447933 | 0 |
| 26.6 | -6.61E-07 | 865.1768 | -46.1935 | -6.55E-07 | 394.4862 | 1.24E+10 | 0.2277 | 1447933 | 0 |
| 26.95 | -2.80E-06 | 673.3861 | -43.6907 | -3.94E-07 | 394.1513 | 1.24E+10 | 0.9641 | 1447933 | 0 |
| 27.3 | -3.97E-06 | 498.5058 | -38.7905 | -1.95E-07 | 393.8458 | 1.24E+10 | 1.3693 | 1447933 | 0 |
| 27.65 | -4.44E-06 | 347.7095 | -32.7031 | -5.15E-08 | 393.5825 | 1.24E+10 | 1.5295 | 1447933 | 0 |
| 28 | -4.40E-06 | 223.8431 | -26.3022 | 4.55E-08 | 393.3661 | 1.24E+10 | 1.5186 | 1447933 | 0 |
| 28.35 | -4.05E-06 | 126.7327 | -20.1781 | 1.05E-07 | 393.1965 | 1.24E+10 | 1.3977 | 1447933 | 0 |
| 28.7 | -3.52E-06 | 54.259 | -14.6927 | 1.36E-07 | 393.0699 | 1.24E+10 | 1.2144 | 1447933 | 0 |
| 29.05 | -2.91E-06 | 3.1996 | -10.0331 | 1.46E-07 | 392.9808 | 1.24E+10 | 1.0045 | 1447933 | 0 |
| 29.4 | -2.30E-06 | -30.1412 | -6.2584 | 1.41E-07 | 393.0278 | 1.24E+10 | 0.793 | 1447933 | 0 |
| 29.75 | -1.73E-06 | -49.4896 | -3.341 | 1.27E-07 | 393.0616 | 1.24E+10 | 0.5963 | 1447933 | 0 |
| 30.1 | -1.23E-06 | -58.3125 | -1.1985 | 1.09E-07 | 393.077 | 1.24E+10 | 0.4239 | 1447933 | 0 |
| 30.45 | -8.13E-07 | -59.6487 | 0.2803 | 8.91E-08 | 393.0793 | 1.24E+10 | 0.2803 | 1447933 | 0 |
| 30.8 | -4.81E-07 | -56.0324 | 1.2174 | 6.95E-08 | 393.073 | 1.24E+10 | 0.1659 | 1447933 | 0 |
| 31.15 | -2.30E-07 | -49.4812 | 1.732 | 5.15E-08 | 393.0616 | 1.24E+10 | 0.07914 | 1447933 | 0 |
| 31.5 | -4.84E-08 | -41.5269 | 1.9332 | 3.61E-08 | 393.0477 | 1.24E+10 | 0.01668 | 1447933 | 0 |
| 31.85 | 7.36E-08 | -33.2726 | 1.915 | 2.34E-08 | 393.0333 | 1.24E+10 | -0.02536 | 1447933 | 0 |
| 32.2 | 1.48E-07 | -25.4608 | 1.7545 | 1.34E-08 | 393.0196 | 1.24E+10 | -0.05104 | 1447933 | 0 |
| 32.55 | 1.86E-07 | -18.5457 | 1.5126 | 5.94E-09 | 393.0076 | 1.24E+10 | -0.06419 | 1447933 | 0 |
| 32.9 | 1.98E-07 | -12.7603 | 1.2345 | 6.22E-10 | 392.9975 | 1.24E+10 | -0.06823 | 1447933 | 0 |
| 33.25 | 1.91E-07 | -8.1767 | 0.9526 | -2.93E-09 | 392.9894 | 1.24E+10 | -0.06599 | 1447933 | 0 |
| 33.6 | 1.73E-07 | -4.7561 | 0.6886 | -5.13E-09 | 392.9835 | 1.24E+10 | -0.05974 | 1447933 | 0 |
| 33.95 | 1.48E-07 | -2.3885 | 0.4557 | -6.34E-09 | 392.9793 | 1.24E+10 | -0.05114 | 1447933 | 0 |
| 34.3 | 1.20E-07 | -0.9228 | 0.2614 | -6.90E-09 | 392.9768 | 1.24E+10 | -0.04137 | 1447933 | 0 |
| 34.65 | 9.03E-08 | -0.1867 | 0.1091 | -7.09E-09 | 392.9755 | 1.24E+10 | -0.03115 | 1447933 | 0 |
| 35 | 6.04E-08 | 0 | 0 | -7.12E-09 | 392.9752 | 1.24E+10 | -0.02083 | 723967 | 0 |

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 6:00

Pile-head deflection = 0.5 inches
Computed slope at pile head = 0 radians
Maximum bending moment = -1715820 inch-lbs
Maximum shear force = 28959 lbs
Depth of maximum bending moment = 0 feet below pile head
Depth of maximum shear force = 0 feet below pile head
Number of iterations = 16
Number of zero deflection points = 4

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Computed Values of Pile Loading and Deflection for Lateral Loading for Load and Case Number 7

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Pile-head conditions are Displacem and Pile-head Rotation (Loading Type 5)
Displacem of pile head = 0.75 inches
Rotation of pile head = 0.00E+00 radians
Axial load on pile head = 100000 lbs

| Depth X | Deflect. y | Bending Moment | Shear Force | Slope S | Total Stress | Bending Stiffness | Soil p | Res. Es*h | Soil Lat. | Spr. Load | Distrib. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| feet | inches | in-lbs | lbs | radians | psi* | in-lb^2 | lb/inch | lb/inch | lb/inch | | |
| 0 | 0.75 | -2285020 | 36294 | 0 | 4384 | 1.24E+10 | -111.153 | 311.2282 | 0 | | |
| 0.35 | 0.7484 | -2133478 | 35794 | -7.50E-04 | 4119 | 1.24E+10 | -118.502 | 665.0555 | 0 | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0.7 | 0.7437 | -1983723 | 35281 | -0.00145 | 3858 | 1.24E+10 | -125.669 | 709.7087 | 0 |
| 1.05 | 0.7362 | -1835902 | 34738 | -0.0021 | 3599 | 1.24E+10 | -132.634 | 756.6764 | 0 |
| 1.4 | 0.7261 | -1690158 | 34167 | -0.0027 | 3345 | 1.24E+10 | -139.378 | 806.237 | 0 |
| 1.75 | 0.7135 | -1546632 | 33568 | -0.00325 | 3094 | 1.24E+10 | -145.884 | 858.6913 | 0 |
| 2.1 | 0.6988 | -1405459 | 32942 | -0.00375 | 2848 | 1.24E+10 | -152.135 | 914.3674 | 0 |
| 2.45 | 0.6821 | -1266768 | 32291 | -0.0042 | 2605 | 1.24E+10 | -158.113 | 973.6264 | 0 |
| 2.8 | 0.6635 | -1130687 | 31615 | -0.00461 | 2368 | 1.24E+10 | -163.804 | 1037 | 0 |
| 3.15 | 0.6434 | -997333 | 30915 | -0.00497 | 2135 | 1.24E+10 | -169.192 | 1105 | 0 |
| 3.5 | 0.6218 | -866822 | 30194 | -0.00529 | 1907 | 1.24E+10 | -174.263 | 1177 | 0 |
| 3.85 | 0.5989 | -739261 | 29452 | -0.00556 | 1684 | 1.24E+10 | -179.002 | 1255 | 0 |
| 4.2 | 0.5751 | -614753 | 28691 | -0.00579 | 1467 | 1.24E+10 | -183.397 | 1339 | 0 |
| 4.55 | 0.5503 | -493391 | 27913 | -0.00598 | 1255 | 1.24E+10 | -187.224 | 1429 | 0 |
| 4.9 | 0.5249 | -375262 | 27122 | -0.00612 | 1048 | 1.24E+10 | -189.456 | 1516 | 0 |
| 5.25 | 0.4989 | -260422 | 26322 | -0.00623 | 847.8168 | 1.24E+10 | -191.353 | 1611 | 0 |
| 5.6 | 0.4725 | -148920 | 25515 | -0.0063 | 653.072 | 1.24E+10 | -192.908 | 1715 | 0 |
| 5.95 | 0.4459 | -40799 | 24703 | -0.00633 | 464.2334 | 1.24E+10 | -194.112 | 1828 | 0 |
| 6.3 | 0.4193 | 63903 | 23540 | -0.00633 | 504.5853 | 1.24E+10 | -359.692 | 3603 | 0 |
| 6.65 | 0.3928 | 162251 | 22018 | -0.00629 | 676.3558 | 1.24E+10 | -364.927 | 3902 | 0 |
| 7 | 0.3664 | 254139 | 20476 | -0.00622 | 836.8428 | 1.24E+10 | -369.494 | 4235 | 0 |
| 7.35 | 0.3405 | 339472 | 18916 | -0.00612 | 985.8827 | 1.24E+10 | -373.38 | 4606 | 0 |
| 7.7 | 0.315 | 418171 | 17341 | -0.00599 | 1123 | 1.24E+10 | -376.571 | 5020 | 0 |
| 8.05 | 0.2902 | 490167 | 15754 | -0.00584 | 1249 | 1.24E+10 | -379.052 | 5487 | 0 |
| 8.4 | 0.266 | 555407 | 14158 | -0.00566 | 1363 | 1.24E+10 | -380.803 | 6013 | 0 |
| 8.75 | 0.2426 | 613851 | 12557 | -0.00546 | 1465 | 1.24E+10 | -381.808 | 6609 | 0 |
| 9.1 | 0.2201 | 665471 | 10953 | -0.00524 | 1555 | 1.24E+10 | -382.044 | 7290 | 0 |
| 9.45 | 0.1986 | 710258 | 9349 | -0.00501 | 1633 | 1.24E+10 | -381.491 | 8069 | 0 |
| 9.8 | 0.178 | 748214 | 7750 | -0.00476 | 1700 | 1.24E+10 | -380.123 | 8968 | 0 |
| 10.15 | 0.1586 | 779357 | 6158 | -0.0045 | 1754 | 1.24E+10 | -377.915 | 10010 | 0 |
| 10.5 | 0.1402 | 803723 | 4577 | -0.00423 | 1797 | 1.24E+10 | -374.836 | 11229 | 0 |
| 10.85 | 0.123 | 821363 | 3011 | -0.00396 | 1828 | 1.24E+10 | -370.854 | 12664 | 0 |
| 11.2 | 0.1069 | 832343 | 1464 | -0.00368 | 1847 | 1.24E+10 | -365.931 | 14371 | 0 |
| 11.55 | 0.09209 | 836750 | -60.5435 | -0.00339 | 1854 | 1.24E+10 | -360.022 | 16419 | 0 |
| 11.9 | 0.07843 | 834686 | -1558 | -0.00311 | 1851 | 1.24E+10 | -353.075 | 18907 | 0 |
| 12.25 | 0.06596 | 826275 | -3024 | -0.00283 | 1836 | 1.24E+10 | -345.027 | 21969 | 0 |
| 12.6 | 0.05467 | 811660 | -4454 | -0.00255 | 1811 | 1.24E+10 | -335.796 | 25797 | 0 |
| 12.95 | 0.04454 | 791006 | -5842 | -0.00228 | 1775 | 1.24E+10 | -325.279 | 30675 | 0 |
| 13.3 | 0.03553 | 764501 | -7183 | -0.00201 | 1728 | 1.24E+10 | -313.334 | 37038 | 0 |
| 13.65 | 0.02762 | 732360 | -8471 | -0.00176 | 1672 | 1.24E+10 | -299.758 | 45590 | 0 |
| 14 | 0.02074 | 694826 | -9697 | -0.00152 | 1607 | 1.24E+10 | -284.246 | 57549 | 0 |
| 14.35 | 0.01487 | 652179 | -10853 | -0.00129 | 1532 | 1.24E+10 | -266.296 | 75239 | 0 |
| 14.7 | 0.00992 | 604742 | -11927 | -0.00108 | 1449 | 1.24E+10 | -244.993 | 103771 | 0 |
| 15.05 | 0.00583 | 552897 | -12900 | -8.79E-04 | 1359 | 1.24E+10 | -218.361 | 157336 | 0 |
| 15.4 | 0.00253 | 497121 | -13738 | -7.01E-04 | 1261 | 1.24E+10 | -180.525 | 299585 | 0 |
| 15.75 | -5.82E-05 | 438090 | -14078 | -5.42E-04 | 1158 | 1.24E+10 | 18.1989 | 1312323 | 0 |
| 16.1 | -0.00202 | 379318 | -13672 | -4.03E-04 | 1055 | 1.24E+10 | 175.5708 | 364602 | 0 |
| 16.45 | -0.00345 | 323588 | -12874 | -2.84E-04 | 958.1395 | 1.24E+10 | 204.0932 | 248774 | 0 |
| 16.8 | -0.00441 | 271412 | -11982 | -1.83E-04 | 867.0118 | 1.24E+10 | 220.6116 | 210235 | 0 |
| 17.15 | -0.00498 | 223089 | -11034 | -9.89E-05 | 782.6133 | 1.24E+10 | 231.1044 | 194837 | 0 |
| 17.5 | -0.00524 | 178811 | -10049 | -3.07E-05 | 705.2795 | 1.24E+10 | 237.6772 | 190574 | 0 |
| 17.85 | -0.00524 | 138701 | -9043 | 2.33E-05 | 635.2237 | 1.24E+10 | 241.3361 | 193461 | 0 |
| 18.2 | -0.00504 | 102827 | -8033 | 6.43E-05 | 572.5688 | 1.24E+10 | 239.8531 | 199768 | 0 |
| 18.55 | -0.0047 | 71170 | -7034 | 9.38E-05 | 517.2779 | 1.24E+10 | 235.654 | 210606 | 0 |
| 18.9 | -0.00425 | 43660 | -6057 | 1.13E-04 | 469.2297 | 1.24E+10 | 229.8553 | 226898 | 0 |
| 19.25 | -0.00375 | 20198 | -5106 | 1.24E-04 | 428.2522 | 1.24E+10 | 222.6604 | 249532 | 0 |
| 19.6 | -0.00321 | 661.0308 | -4189 | 1.28E-04 | 394.1297 | 1.24E+10 | 214.2133 | 280117 | 0 |
| 19.95 | -0.00268 | -15097 | -3310 | 1.25E-04 | 419.3436 | 1.24E+10 | 204.6144 | 321256 | 0 |
| 20.3 | -0.00216 | -27244 | -2473 | 1.18E-04 | 440.5587 | 1.24E+10 | 193.927 | 377115 | 0 |
| 20.65 | -0.00168 | -35966 | -1683 | 1.07E-04 | 455.7923 | 1.24E+10 | 182.1785 | 454525 | 0 |
| 21 | -0.00126 | -41470 | -944.554 | 9.42E-05 | 465.4041 | 1.24E+10 | 169.3515 | 565265 | 0 |
| 21.35 | -8.92E-04 | -43980 | -262.664 | 7.97E-05 | 469.7881 | 1.24E+10 | 155.3583 | 731215 | 0 |
| 21.7 | -5.89E-04 | -43743 | 357.5363 | 6.48E-05 | 469.3746 | 1.24E+10 | 139.9751 | 997889 | 0 |
| 22.05 | -3.48E-04 | -41031 | 903.6518 | 5.04E-05 | 464.6376 | 1.24E+10 | 120.0799 | 1447933 | 0 |
| 22.4 | -1.66E-04 | -36195 | 1276 | 3.73E-05 | 456.1909 | 1.24E+10 | 57.2325 | 1447933 | 0 |
| 22.75 | -3.53E-05 | -30344 | 1422 | 2.60E-05 | 445.9719 | 1.24E+10 | 12.1831 | 1447933 | 0 |
| 23.1 | 5.21E-05 | -24273 | 1410 | 1.67E-05 | 435.37 | 1.24E+10 | -17.9455 | 1447933 | 0 |
| 23.45 | 1.05E-04 | -18516 | 1296 | 9.42E-06 | 425.3149 | 1.24E+10 | -36.1382 | 1447933 | 0 |
| 23.8 | 1.31E-04 | -13394 | 1125 | 4.00E-06 | 416.3685 | 1.24E+10 | -45.2258 | 1447933 | 0 |
| 24.15 | 1.38E-04 | -9068 | 930.0381 | 1.88E-07 | 408.8123 | 1.24E+10 | -47.7273 | 1447933 | 0 |
| 24.5 | 1.33E-04 | -5582 | 733.694 | -2.30E-06 | 402.7242 | 1.24E+10 | -45.7699 | 1447933 | 0 |
| 24.85 | 1.19E-04 | -2903 | 551.335 | -3.74E-06 | 398.0448 | 1.24E+10 | -41.0678 | 1447933 | 0 |
| 25.2 | 1.01E-04 | -947.485 | 391.7223 | -4.39E-06 | 394.63 | 1.24E+10 | -34.9383 | 1447933 | 0 |
| 25.55 | 8.22E-05 | 391.506 | 258.8317 | -4.49E-06 | 393.659 | 1.24E+10 | -28.3429 | 1447933 | 0 |
| 25.9 | 6.36E-05 | 1230 | 153.2375 | -4.21E-06 | 395.1243 | 1.24E+10 | -21.9401 | 1447933 | 0 |
| 26.25 | 4.68E-05 | 1682 | 73.2645 | -3.72E-06 | 395.9133 | 1.24E+10 | -16.1423 | 1447933 | 0 |
| 26.6 | 3.24E-05 | 1849 | 15.9052 | -3.12E-06 | 396.2046 | 1.24E+10 | -11.1717 | 1447933 | 0 |
| 26.95 | 2.06E-05 | 1818 | -22.487 | -2.50E-06 | 396.1512 | 1.24E+10 | -7.1103 | 1447933 | 0 |
| 27.3 | 1.14E-05 | 1662 | -45.6992 | -1.91E-06 | 395.8783 | 1.24E+10 | -3.9431 | 1447933 | 0 |
| 27.65 | 4.62E-06 | 1436 | -57.3258 | -1.38E-06 | 395.4836 | 1.24E+10 | -1.5933 | 1447933 | 0 |
| 28 | -1.46E-07 | 1182 | -60.5663 | -9.34E-07 | 395.0393 | 1.24E+10 | 0.05026 | 1447933 | 0 |
| 28.35 | -3.23E-06 | 928.2185 | -58.124 | -5.76E-07 | 394.5964 | 1.24E+10 | 1.1127 | 1447933 | 0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 28.7 | -4.99E-06 | 694.0876 | -52.178 | -3.01E-07 | 394.1874 | 1.24E+10 | 1.7187 | 1447933 | 0 |
| 29.05 | -5.75E-06 | 490.1758 | -44.4035 | -9.96E-08 | 393.8313 | 1.24E+10 | 1.9834 | 1447933 | 0 |
| 29.4 | -5.82E-06 | 321.1819 | -36.0234 | 3.82E-08 | 393.5361 | 1.24E+10 | 2.0071 | 1447933 | 0 |
| 29.75 | -5.43E-06 | 187.5474 | -27.8755 | 1.25E-07 | 393.3027 | 1.24E+10 | 1.8728 | 1447933 | 0 |
| 30.1 | -4.78E-06 | 86.9231 | -20.4852 | 1.71E-07 | 393.127 | 1.24E+10 | 1.6464 | 1447933 | 0 |
| 30.45 | -3.99E-06 | 15.3282 | -14.1358 | 1.89E-07 | 393.0019 | 1.24E+10 | 1.3771 | 1447933 | 0 |
| 30.8 | -3.19E-06 | -31.9763 | -8.9331 | 1.86E-07 | 393.031 | 1.24E+10 | 1.1004 | 1447933 | 0 |
| 31.15 | -2.43E-06 | -59.8657 | -4.8597 | 1.70E-07 | 393.0797 | 1.24E+10 | 0.8393 | 1447933 | 0 |
| 31.5 | -1.76E-06 | -72.9408 | -1.8209 | 1.48E-07 | 393.1026 | 1.24E+10 | 0.6077 | 1447933 | 0 |
| 31.85 | -1.20E-06 | -75.2852 | 0.3205 | 1.22E-07 | 393.1067 | 1.24E+10 | 0.412 | 1447933 | 0 |
| 32.2 | -7.35E-07 | -70.3513 | 1.7176 | 9.77E-08 | 393.098 | 1.24E+10 | 0.2533 | 1447933 | 0 |
| 32.55 | -3.75E-07 | -60.9395 | 2.5207 | 7.54E-08 | 393.0816 | 1.24E+10 | 0.1292 | 1447933 | 0 |
| 32.9 | -1.02E-07 | -49.2408 | 2.8654 | 5.67E-08 | 393.0612 | 1.24E+10 | 0.035 | 1447933 | 0 |
| 33.25 | 1.01E-07 | -36.9176 | 2.8655 | 4.20E-08 | 393.0396 | 1.24E+10 | -0.03494 | 1447933 | 0 |
| 33.6 | 2.52E-07 | -25.2055 | 2.61 | 3.15E-08 | 393.0192 | 1.24E+10 | -0.08673 | 1447933 | 0 |
| 33.95 | 3.66E-07 | -15.0197 | 2.163 | 2.47E-08 | 393.0014 | 1.24E+10 | -0.1261 | 1447933 | 0 |
| 34.3 | 4.59E-07 | -7.0566 | 1.5661 | 2.09E-08 | 392.9875 | 1.24E+10 | -0.1581 | 1447933 | 0 |
| 34.65 | 5.41E-07 | -1.882 | 0.842 | 1.94E-08 | 392.9785 | 1.24E+10 | -0.1867 | 1447933 | 0 |
| 35 | 6.22E-07 | 0 | 0 | 1.91E-08 | 392.9752 | 1.24E+10 | -0.2143 | 723967 | 0 |

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 7:00

Pile-head deflection = 0.75 inches
Computed slope at pile head = 0 radians
Maximum bending moment = -2285020 inch-lbs
Maximum shear force = 36294 lbs
Depth of maximum bending moment = 0 feet below pile head
Depth of maximum shear force = 0 feet below pile head
Number of iterations = 17
Number of zero deflection points = 4

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Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 8

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Pile-head conditions are Displacem and Pile-head Rotation (Loading Type 5)
Displacem of pile head = 1 inches
Rotation of pile head = 0.00E+00 radians
Axial load on pile head = 100000 lbs

| Depth X feet | Deflect. y inches | Bending Moment in-lbs | Shear Force lbs | Slope S radians | Total Stress psi* | Bending Stiffness in-lb^2 | Soil p lb/inch | Res. Es*h lb/inch | Soil Lat. lb/inch | Spr. Load | Distrib. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | -2797988 | 42556 | 0 | 5280 | 1.24E+10 | -122.34 | 256.9132 | | 0 | |
| 0.35 | 0.998 | -2620215 | 42006 | -9.20E-04 | 4969 | 1.24E+10 | -130.436 | 548.9261 | | 0 | |
| 0.7 | 0.9923 | -2444369 | 41441 | -0.00178 | 4662 | 1.24E+10 | -138.348 | 585.5859 | | 0 | |
| 1.05 | 0.9831 | -2270615 | 40844 | -0.00258 | 4359 | 1.24E+10 | -146.055 | 624.0046 | | 0 | |
| 1.4 | 0.9706 | -2099113 | 40215 | -0.00332 | 4059 | 1.24E+10 | -153.537 | 664.3929 | | 0 | |
| 1.75 | 0.9551 | -1930020 | 39555 | -0.00401 | 3764 | 1.24E+10 | -160.777 | 706.9765 | | 0 | |
| 2.1 | 0.9369 | -1763488 | 38865 | -0.00463 | 3473 | 1.24E+10 | -167.756 | 751.9997 | | 0 | |
| 2.45 | 0.9162 | -1599664 | 38146 | -0.00521 | 3187 | 1.24E+10 | -174.458 | 799.7291 | | 0 | |
| 2.8 | 0.8932 | -1438689 | 37400 | -0.00572 | 2906 | 1.24E+10 | -180.867 | 850.4574 | | 0 | |
| 3.15 | 0.8682 | -1280700 | 36627 | -0.00618 | 2630 | 1.24E+10 | -186.966 | 904.5082 | | 0 | |
| 3.5 | 0.8413 | -1125825 | 35830 | -0.00659 | 2359 | 1.24E+10 | -192.741 | 962.2412 | | 0 | |
| 3.85 | 0.8128 | -974191 | 35009 | -0.00695 | 2094 | 1.24E+10 | -198.178 | 1024 | | 0 | |
| 4.2 | 0.7829 | -825913 | 34166 | -0.00725 | 1835 | 1.24E+10 | -203.261 | 1090 | | 0 | |
| 4.55 | 0.7519 | -681102 | 33303 | -0.00751 | 1583 | 1.24E+10 | -207.747 | 1161 | | 0 | |
| 4.9 | 0.7198 | -539860 | 32425 | -0.00772 | 1336 | 1.24E+10 | -210.492 | 1228 | | 0 | |
| 5.25 | 0.687 | -402253 | 31536 | -0.00788 | 1096 | 1.24E+10 | -212.895 | 1301 | | 0 | |
| 5.6 | 0.6537 | -268345 | 30637 | -0.00799 | 861.654 | 1.24E+10 | -214.947 | 1381 | | 0 | |
| 5.95 | 0.6199 | -138189 | 29731 | -0.00806 | 634.3308 | 1.24E+10 | -216.64 | 1468 | | 0 | |
| 6.3 | 0.586 | -11836 | 28455 | -0.00809 | 413.6476 | 1.24E+10 | -391.08 | 2803 | | 0 | |
| 6.65 | 0.552 | 107620 | 26799 | -0.00807 | 580.9401 | 1.24E+10 | -397.335 | 3023 | | 0 | |
| 7 | 0.5182 | 220052 | 25118 | -0.00801 | 777.3089 | 1.24E+10 | -402.924 | 3266 | | 0 | |
| 7.35 | 0.4847 | 325345 | 23416 | -0.00792 | 961.2092 | 1.24E+10 | -407.835 | 3534 | | 0 | |
| 7.7 | 0.4517 | 423398 | 21694 | -0.00779 | 1132 | 1.24E+10 | -412.055 | 3832 | | 0 | |
| 8.05 | 0.4192 | 514121 | 19956 | -0.00763 | 1291 | 1.24E+10 | -415.569 | 4163 | | 0 | |
| 8.4 | 0.3875 | 597441 | 18205 | -0.00745 | 1436 | 1.24E+10 | -418.36 | 4534 | | 0 | |
| 8.75 | 0.3567 | 673295 | 16443 | -0.00723 | 1569 | 1.24E+10 | -420.412 | 4950 | | 0 | |
| 9.1 | 0.3268 | 741637 | 14675 | -0.00699 | 1688 | 1.24E+10 | -421.705 | 5420 | | 0 | |
| 9.45 | 0.298 | 802435 | 12903 | -0.00673 | 1794 | 1.24E+10 | -422.22 | 5951 | | 0 | |
| 9.8 | 0.2703 | 855670 | 11130 | -0.00645 | 1887 | 1.24E+10 | -421.935 | 6556 | | 0 | |
| 10.15 | 0.2438 | 901340 | 9360 | -0.00615 | 1967 | 1.24E+10 | -420.826 | 7249 | | 0 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 10.5 | 0.2186 | 939458 | 7597 | -0.00583 | 2034 | 1.24E+10 | -418.867 | 8046 | 0 |
| 10.85 | 0.1948 | 970054 | 5843 | -0.00551 | 2087 | 1.24E+10 | -416.03 | 8969 | 0 |
| 11.2 | 0.1724 | 993172 | 4104 | -0.00518 | 2128 | 1.24E+10 | -412.284 | 10046 | 0 |
| 11.55 | 0.1513 | 1008876 | 2382 | -0.00484 | 2155 | 1.24E+10 | -407.593 | 11313 | 0 |
| 11.9 | 0.1317 | 1017246 | 682.2581 | -0.00449 | 2170 | 1.24E+10 | -401.916 | 12815 | 0 |
| 12.25 | 0.1136 | 1018381 | -991.697 | -0.00415 | 2172 | 1.24E+10 | -395.206 | 14614 | 0 |
| 12.6 | 0.09688 | 1012400 | -2635 | -0.0038 | 2161 | 1.24E+10 | -387.405 | 16794 | 0 |
| 12.95 | 0.08164 | 999440 | -4243 | -0.00346 | 2139 | 1.24E+10 | -378.444 | 19470 | 0 |
| 13.3 | 0.06781 | 979662 | -5811 | -0.00313 | 2104 | 1.24E+10 | -368.235 | 22807 | 0 |
| 13.65 | 0.05538 | 953249 | -7334 | -0.0028 | 2058 | 1.24E+10 | -356.662 | 27047 | 0 |
| 14 | 0.04432 | 920408 | -8804 | -0.00248 | 2001 | 1.24E+10 | -343.568 | 32561 | 0 |
| 14.35 | 0.03456 | 881375 | -10216 | -0.00217 | 1932 | 1.24E+10 | -328.73 | 39947 | 0 |
| 14.7 | 0.02607 | 836418 | -11561 | -0.00188 | 1854 | 1.24E+10 | -311.806 | 50243 | 0 |
| 15.05 | 0.01876 | 785841 | -12830 | -0.00161 | 1765 | 1.24E+10 | -292.237 | 65423 | 0 |
| 15.4 | 0.01258 | 729998 | -14008 | -0.00135 | 1668 | 1.24E+10 | -269.004 | 89827 | 0 |
| 15.75 | 0.00744 | 669304 | -15077 | -0.00111 | 1562 | 1.24E+10 | -239.905 | 135509 | 0 |
| 16.1 | 0.00325 | 604284 | -15997 | -8.94E-04 | 1448 | 1.24E+10 | -198.388 | 256518 | 0 |
| 16.45 | -7.72E-05 | 535677 | -16362 | -7.01E-04 | 1329 | 1.24E+10 | 24.9365 | 1355904 | 0 |
| 16.8 | -0.00264 | 467434 | -15902 | -5.30E-04 | 1209 | 1.24E+10 | 194.0612 | 308890 | 0 |
| 17.15 | -0.00453 | 402548 | -15020 | -3.83E-04 | 1096 | 1.24E+10 | 225.8022 | 209198 | 0 |
| 17.5 | -0.00585 | 341587 | -14032 | -2.56E-04 | 989.5766 | 1.24E+10 | 244.4871 | 175413 | 0 |
| 17.85 | -0.00669 | 284891 | -12980 | -1.50E-04 | 890.5528 | 1.24E+10 | 256.6463 | 161192 | 0 |
| 18.2 | -0.00711 | 232681 | -11892 | -6.21E-05 | 799.3651 | 1.24E+10 | 261.5452 | 154410 | 0 |
| 18.55 | -0.00721 | 185051 | -10792 | 8.79E-06 | 716.1774 | 1.24E+10 | 262.4156 | 152882 | 0 |
| 18.9 | -0.00704 | 142024 | -9693 | 6.43E-05 | 641.0285 | 1.24E+10 | 260.8623 | 155623 | 0 |
| 19.25 | -0.00667 | 103579 | -8604 | 1.06E-04 | 573.8812 | 1.24E+10 | 257.3455 | 162077 | 0 |
| 19.6 | -0.00615 | 69658 | -7534 | 1.35E-04 | 514.6367 | 1.24E+10 | 252.1753 | 172230 | 0 |
| 19.95 | -0.00553 | 40176 | -6489 | 1.54E-04 | 463.1441 | 1.24E+10 | 245.5694 | 186475 | 0 |
| 20.3 | -0.00486 | 15019 | -5474 | 1.63E-04 | 419.2074 | 1.24E+10 | 237.6844 | 205613 | 0 |
| 20.65 | -0.00416 | -5946 | -4495 | 1.65E-04 | 403.3605 | 1.24E+10 | 228.6331 | 230953 | 0 |
| 21 | -0.00347 | -22878 | -3556 | 1.60E-04 | 432.9326 | 1.24E+10 | 218.4939 | 264536 | 0 |
| 21.35 | -0.00281 | -35952 | -2662 | 1.50E-04 | 455.7674 | 1.24E+10 | 207.315 | 309557 | 0 |
| 21.7 | -0.00221 | -45364 | -1817 | 1.36E-04 | 472.206 | 1.24E+10 | 195.1135 | 371157 | 0 |
| 22.05 | -0.00167 | -51328 | -1025 | 1.20E-04 | 482.622 | 1.24E+10 | 181.8668 | 458021 | 0 |
| 22.4 | -0.0012 | -54076 | -291.501 | 1.02E-04 | 487.422 | 1.24E+10 | 167.4913 | 585873 | 0 |
| 22.75 | -8.11E-04 | -53862 | 378.9858 | 8.37E-05 | 487.0483 | 1.24E+10 | 151.7882 | 786224 | 0 |
| 23.1 | -4.98E-04 | -50963 | 979.7622 | 6.59E-05 | 481.9846 | 1.24E+10 | 134.2958 | 1133024 | 0 |
| 23.45 | -2.57E-04 | -45687 | 1448 | 4.95E-05 | 472.7708 | 1.24E+10 | 88.7653 | 1447933 | 0 |
| 23.8 | -8.23E-05 | -38840 | 1694 | 3.51E-05 | 460.8107 | 1.24E+10 | 28.3749 | 1447933 | 0 |
| 24.15 | 3.75E-05 | -31486 | 1727 | 2.32E-05 | 447.9668 | 1.24E+10 | -12.9169 | 1447933 | 0 |
| 24.5 | 1.12E-04 | -24355 | 1618 | 1.37E-05 | 435.5129 | 1.24E+10 | -38.7262 | 1447933 | 0 |
| 24.85 | 1.52E-04 | -17904 | 1426 | 6.51E-06 | 424.2462 | 1.24E+10 | -52.5594 | 1447933 | 0 |
| 25.2 | 1.67E-04 | -12378 | 1195 | 1.37E-06 | 414.5943 | 1.24E+10 | -57.5884 | 1447933 | 0 |
| 25.55 | 1.64E-04 | -7866 | 955.5357 | -2.07E-06 | 406.7135 | 1.24E+10 | -56.5307 | 1447933 | 0 |
| 25.9 | 1.50E-04 | -4350 | 728.4504 | -4.14E-06 | 400.5725 | 1.24E+10 | -51.6051 | 1447933 | 0 |
| 26.25 | 1.29E-04 | -1744 | 526.5445 | -5.18E-06 | 396.0203 | 1.24E+10 | -44.5405 | 1447933 | 0 |
| 26.6 | 1.06E-04 | 77.4305 | 356.1103 | -5.46E-06 | 393.1104 | 1.24E+10 | -36.6186 | 1447933 | 0 |
| 26.95 | 8.34E-05 | 1252 | 218.8681 | -5.23E-06 | 395.1626 | 1.24E+10 | -28.7348 | 1447933 | 0 |
| 27.3 | 6.23E-05 | 1920 | 113.4448 | -4.69E-06 | 396.3291 | 1.24E+10 | -21.4668 | 1447933 | 0 |
| 27.65 | 4.39E-05 | 2209 | 36.564 | -3.99E-06 | 396.8338 | 1.24E+10 | -15.1431 | 1447933 | 0 |
| 28 | 2.87E-05 | 2231 | -16.0385 | -3.24E-06 | 396.8714 | 1.24E+10 | -9.9057 | 1447933 | 0 |
| 28.35 | 1.67E-05 | 2077 | -48.9477 | -2.51E-06 | 396.6033 | 1.24E+10 | -5.7653 | 1447933 | 0 |
| 28.7 | 7.68E-06 | 1822 | -66.6124 | -1.84E-06 | 396.157 | 1.24E+10 | -2.6464 | 1447933 | 0 |
| 29.05 | 1.23E-06 | 1519 | -73.0588 | -1.28E-06 | 395.6287 | 1.24E+10 | -0.4233 | 1447933 | 0 |
| 29.4 | -3.05E-06 | 1209 | -71.737 | -8.14E-07 | 395.087 | 1.24E+10 | 1.0527 | 1447933 | 0 |
| 29.75 | -5.61E-06 | 917.3782 | -65.4644 | -4.53E-07 | 394.5774 | 1.24E+10 | 1.9342 | 1447933 | 0 |
| 30.1 | -6.86E-06 | 659.6126 | -56.4369 | -1.85E-07 | 394.1272 | 1.24E+10 | 2.3646 | 1447933 | 0 |
| 30.45 | -7.17E-06 | 443.4642 | -46.2829 | 2.08E-09 | 393.7497 | 1.24E+10 | 2.4706 | 1447933 | 0 |
| 30.8 | -6.84E-06 | 270.8341 | -36.1417 | 1.23E-07 | 393.4482 | 1.24E+10 | 2.3586 | 1447933 | 0 |
| 31.15 | -6.13E-06 | 139.7704 | -26.7507 | 1.93E-07 | 393.2193 | 1.24E+10 | 2.1133 | 1447933 | 0 |
| 31.5 | -5.22E-06 | 45.9662 | -18.5339 | 2.25E-07 | 393.0555 | 1.24E+10 | 1.7994 | 1447933 | 0 |
| 31.85 | -4.24E-06 | -16.1033 | -11.6833 | 2.30E-07 | 393.0033 | 1.24E+10 | 1.4628 | 1447933 | 0 |
| 32.2 | -3.29E-06 | -52.3661 | -6.2295 | 2.18E-07 | 393.0666 | 1.24E+10 | 1.1342 | 1447933 | 0 |
| 32.55 | -2.41E-06 | -68.6141 | -2.1019 | 1.98E-07 | 393.095 | 1.24E+10 | 0.8313 | 1447933 | 0 |
| 32.9 | -1.63E-06 | -70.1878 | 0.8244 | 1.74E-07 | 393.0978 | 1.24E+10 | 0.5622 | 1447933 | 0 |
| 33.25 | -9.50E-07 | -61.8349 | 2.6928 | 1.52E-07 | 393.0832 | 1.24E+10 | 0.3275 | 1447933 | 0 |
| 33.6 | -3.58E-07 | -47.6954 | 3.6396 | 1.33E-07 | 393.0585 | 1.24E+10 | 0.1233 | 1447933 | 0 |
| 33.95 | 1.67E-07 | -31.3739 | 3.7779 | 1.20E-07 | 393.03 | 1.24E+10 | -0.05746 | 1447933 | 0 |
| 34.3 | 6.46E-07 | -16.0616 | 3.1893 | 1.11E-07 | 393.0032 | 1.24E+10 | -0.2228 | 1447933 | 0 |
| 34.65 | 1.10E-06 | -4.6773 | 1.9229 | 1.08E-07 | 392.9833 | 1.24E+10 | -0.3803 | 1447933 | 0 |
| 35 | 1.55E-06 | 0 | 0 | 1.07E-07 | 392.9752 | 1.24E+10 | -0.5354 | 723967 | 0 |

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 8:00

Pile-head deflection = 1 inches
Computed slope at pile head = 0 radians
Maximum bending moment = -2797988 inch-lbs

Maximum shear force = 42556 lbs
Depth of maximum bending moment = 0 feet below pile head
Depth of maximum shear force = 0 feet below pile head
Number of iterations = 18
Number of zero deflection points = 4

---

Summary of Pile-head Responses for Conventio Analyses

---

Definitions of Pile-head Loading Conditions:

Load Type 1:00 Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2:00 Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3:00 Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4:00 Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5:00 Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

| Load Case No. | Load Type | Load Pile-head 1 | Axial Load 1 | Pile-head Pile-head 1 | Pile-head Loading 2 | Max Deflection Load 2 | Shear Rotation 2 | Max in lbs | Moment Pile inches | in radians | Pile lbs | in-lbs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | y, | in | 0.25 | M, | in-lb | 0 | 100000 | 0.25 | -0.00324 | 8594 | 410416 |
| 2 | y, | in | 0.5 | M, | in-lb | 0 | 100000 | 0.5 | -0.00589 | 12661 | 679164 |
| 3 | y, | in | 0.75 | M, | in-lb | 0 | 100000 | 0.75 | -0.00836 | 15855 | 907765 |
| 4 | y, | in | 1 | M, | in-lb | 0 | 100000 | 1 | -0.01069 | 18576 | 1113075 |
| 5 | y, | in | 0.25 | S, | rad | 0 | 100000 | 0.25 | 0 | 19593 | -1046731 |
| 6 | y, | in | 0.5 | S, | rad | 0 | 100000 | 0.5 | 0 | 28959 | -1715820 |
| 7 | y, | in | 0.75 | S, | rad | 0 | 100000 | 0.75 | 0 | 36294 | -2285020 |
| 8 | y, | in | 1 | S, | rad | 0 | 100000 | 1 | 0 | 42556 | -2797988 |

Maximum pile-head deflection = 1 inches
Maximum pile-head rotation = -0.01069 radians = -0.6127 deg.

The analysis ended normally.

LPile for Windows, Version 2018-10.007

Analysis of Individual Piles and Drilled Shafts Subjected to Lateral Loading Using the p-y Method
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## Files Used for Analysis

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Path to file locations:
\Users\cm Analyses\

Name of input data file:
24-inch CIDH pier.lp10

Name of output report file:
24-inch CIDH pier.lp10

Name of plot output file:
24-inch CIDH pier.lp10

Name of runtime message file:
24-inch CIDH pier.lp10

---

## Date and Time of Analysis

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Date: September 24, 2023 Time: 4:51:12

---

## Problem Title

---

Project Name:
Job Number: G00000369
Client:
Engineer: C Melo
Description:

---

## Program Options and Settings

---

Computati Options:
- Use unfactored loads in computati (conventio analysis)
Engineerin Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:
- Maximum number of iterations allowed = 500
- Deflection tolerance for convergen = 1.00E-05 in
- Maximum allowable deflection = 100 in
- Number of pile increment = 100

Loading Type and Number of Cycles of Loading:
- Static loading specified

- Use of p-y modificatic factors for p-y curves not selected
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movement acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Computati of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and
soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specif depths
- Print using wide report formats

---
Pile Structural Properties and Geometry
---

Number of pile sections defined = 1
Total length of pile = 44 ft
Depth of ground surface below top of pile = 0 ft

Pile diameters used for p-y curve computatio are defined using 2 points.

p-y curves are computed using pile diameter values interpolate with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

| Point | Depth Pile Head No. | Below Pile feet | Pile Diameter inches |
|---|---|---|---|
| 1 | 0 | 24 |
| 2 | 44 | 24 |

Input Structural Properties for Pile Sections:
---

Pile Section No. 1:00

Section 1 is an elastic pile
Cross-secti Shape = Circular Pile
Length of section = 44 ft
Width of top of section = 24 in
Width of bottom of section = 24 in
Top Area = 452.3893 sq. in
Bottom Area = 452.3893 sq. in
Moment of Inertia at Top = 16286 in^4
Moment of Inertia at Bottom = 16286 in^4
Elastic Modulus = 2400000 psi

---
Ground Slope and Pile Batter Angles
---

Ground Slope Angle = 0 degrees
= 0 radians

Pile Batter Angle = 0 degrees
= 0 radians

---
Soil and Rock Layering Information
---

The soil profile is modelled using 4 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer = 0 ft
Distance from top of pile to bottom of layer = 4.5 ft
Effective unit weight at top of layer = 120 pcf
Effective unit weight at bottom of layer = 120 pcf
Undrained cohesion at top of layer = 500 psf
Undrained cohesion at bottom of layer = 500 psf
Epsilon-50 at top of layer = 0
Epsilon-50 at bottom of layer = 0

NOTE: Default values for Epsilon-50 will be computed for this layer.

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer = 4.5 ft
Distance from top of pile to bottom of layer = 6 ft
Effective unit weight at top of layer = 57.6 pcf
Effective unit weight at bottom of layer = 57.6 pcf
Undrained cohesion at top of layer = 500 psf
Undrained cohesion at bottom of layer = 500 psf
Epsilon-50 at top of layer = 0
Epsilon-50 at bottom of layer = 0

NOTE: Default values for Epsilon-50 will be computed for this layer.

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer = 6 ft
Distance from top of pile to bottom of layer = 42 ft
Effective unit weight at top of layer = 61.6 pcf
Effective unit weight at bottom of layer = 61.6 pcf
Undrained cohesion at top of layer = 1200 psf
Undrained cohesion at bottom of layer = 1200 psf
Epsilon-50 at top of layer = 0
Epsilon-50 at bottom of layer = 0

NOTE: Default values for Epsilon-50 will be computed for this layer.

Layer 4 is sand, p-y criteria by API RP-2A, 1987

Distance from top of pile to top of layer = 42 ft
Distance from top of pile to bottom of layer = 47 ft
Effective unit weight at top of layer = 60.6 pcf
Effective unit weight at bottom of layer = 60.6 pcf
Friction angle at top of layer = 40 deg.
Friction angle at bottom of layer = 40 deg.
Subgrade k at top of layer = 0 pci
Subgrade k at bottom of layer = 0 pci

NOTE: Default values for subgrade k will be computed for this layer.

(Depth of the lowest soil layer extends 3 ft below the pile tip)

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Summary of Input Soil Properties

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| Layer Num. | Soil Name | Type Depth (p-y) | Layer Unit Curve | Effective Wt. Type) | Undrained Cohesion ft | Angle Friction pcf | of or psf | E50 kpy deg. | krm | pci |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Soft Clay | 0 4.5 | 120 120 | 500 500 | -- -- | | default default | -- -- | | |
| 2 | Soft Clay | 4.5 6 | 57.6 57.6 | 500 500 | -- -- | | default default | -- -- | | |
| 3 | Stiff w/o Free | Clay Water | 6 42 | 61.6 61.6 | 1200 1200 | -- -- | | default default | -- -- | |
| 4 | API Sand | 42 47 | 60.6 60.6 | -- -- | | 40 40 | -- -- | default default | | |

---

Static Loading Type

---

Static loading criteria were used when computing p-y curves for all analyses.

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Pile-head Loading and Pile-head Fixity Conditions

---

Number of loads specified = 8

| Load No. | Load Type | Condition 1 | Condition 2 | Axial Thrust Force, lbs | | Compute vs. | Top Pile | y Length | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 | y | = | 0.25 | in | M | = | 0 | in-lbs | 100000 | N.A. |
| 2 | 4 | y | = | 0.5 | in | M | = | 0 | in-lbs | 100000 | N.A. |
| 3 | 4 | y | = | 0.75 | in | M | = | 0 | in-lbs | 100000 | N.A. |
| 4 | 4 | y | = | 1 | in | M | = | 0 | in-lbs | 100000 | N.A. |
| 5 | 5 | y | = | 0.25 | in | S | = | 0 | in/in | 100000 | N.A. |
| 6 | 5 | y | = | 0.5 | in | S | = | 0 | in/in | 100000 | N.A. |
| 7 | 5 | y | = | 0.75 | in | S | = | 0 | in/in | 100000 | N.A. |
| 8 | 5 | y | = | 1 | in | S | = | 0 | in/in | 100000 | N.A. |

V = shear force applied normal to pile head axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

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Computati of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determine from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:00

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Moment-c properties were derived from elastic section properties

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Layering Correction Equivalent Depths of Soil & Rock Layers

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| Layer No. | Top Layer Below Pile ft | of Top Pile ft | Equivalent Depth Type Head Above Grnd ft | Same As Rock | Layer Rock Surf | Layer or Layer lbs | is Integral is lbs | F0 Integral Below | for | Layer | for | Layer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | N.A. | No | 0 | 18461 | | | | | | |
| 2 | 4.5 | 4.5 | Yes | No | 18461 | 8234 | | | | | | |
| 3 | 6 | 3.1503 | No | No | 26695 | 682219 | | | | | | |
| 4 | 42 | 18.5855 | No | No | 708915 | N.A. | | | | | | |

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals
for Layer n. Layering correction equivalent depths are computed only
for soil types with both shallow-de and deep-dept expression for
peak lateral load transfer. These soil types are soft and stiff clays,
non-liquefi sands, and cemented c-phi soil.

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Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

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Pile-head conditions are Displacem and Moment (Loading Type 4)
Displacem of pile head = 0.25 inches
Moment at pile head = 0 in-lbs

Axial load at pile head = 100000 lbs

| Depth X feet | Deflect. y inches | Bending Moment in-lbs | Shear Force lbs | Slope S radians | Total Stress psi* | Bending Stiffness in-lb^2 | Soil p lb/inch | Res. Es*h lb/inch | Soil Lat. lb/inch | Spr. Load | Distrib. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.25 | 0 | 14767 | -0.00266 | 221.0485 | 3.91E+10 | -93.3626 | 985.909 | | 0 | |
| 0.44 | 0.236 | 78071 | 14261 | -0.00265 | 278.5734 | 3.91E+10 | -98.165 | 2196 | | 0 | |
| 0.88 | 0.222 | 153400 | 13731 | -0.00264 | 334.0777 | 3.91E+10 | -102.638 | 2441 | | 0 | |
| 1.32 | 0.2081 | 225856 | 13178 | -0.00261 | 387.4656 | 3.91E+10 | -106.769 | 2708 | | 0 | |
| 1.76 | 0.1944 | 295320 | 12605 | -0.00257 | 438.6484 | 3.91E+10 | -110.544 | 3002 | | 0 | |
| 2.2 | 0.181 | 361680 | 12012 | -0.00253 | 487.545 | 3.91E+10 | -113.951 | 3325 | | 0 | |
| 2.64 | 0.1677 | 424839 | 11402 | -0.00248 | 534.0818 | 3.91E+10 | -116.978 | 3682 | | 0 | |
| 3.08 | 0.1548 | 484706 | 10778 | -0.00242 | 578.1934 | 3.91E+10 | -119.612 | 4080 | | 0 | |
| 3.52 | 0.1422 | 541203 | 10140 | -0.00235 | 619.8224 | 3.91E+10 | -121.84 | 4523 | | 0 | |
| 3.96 | 0.13 | 594266 | 9492 | -0.00227 | 658.9203 | 3.91E+10 | -123.65 | 5021 | | 0 | |
| 4.4 | 0.1183 | 643838 | 8836 | -0.00219 | 695.4469 | 3.91E+10 | -125.029 | 5582 | | 0 | |
| 4.84 | 0.1069 | 689880 | 8176 | -0.0021 | 729.3715 | 3.91E+10 | -124.969 | 6170 | | 0 | |
| 5.28 | 0.09613 | 732388 | 7518 | -0.002 | 760.6927 | 3.91E+10 | -124.242 | 6824 | | 0 | |
| 5.72 | 0.08583 | 771380 | 6865 | -0.0019 | 789.4233 | 3.91E+10 | -123.14 | 7575 | | 0 | |
| 6.16 | 0.07608 | 806884 | 5831 | -0.00179 | 815.5838 | 3.91E+10 | -268.316 | 18621 | | 0 | |
| 6.6 | 0.06691 | 834851 | 4414 | -0.00168 | 836.1904 | 3.91E+10 | -268.634 | 21198 | | 0 | |
| 7.04 | 0.05833 | 855269 | 2997 | -0.00157 | 851.2349 | 3.91E+10 | -268.03 | 24260 | | 0 | |
| 7.48 | 0.05037 | 868153 | 1586 | -0.00145 | 860.7287 | 3.91E+10 | -266.478 | 27935 | | 0 | |
| 7.92 | 0.04302 | 873547 | 185.5818 | -0.00133 | 864.7029 | 3.91E+10 | -263.944 | 32394 | | 0 | |
| 8.36 | 0.0363 | 871520 | -1199 | -0.00121 | 863.2094 | 3.91E+10 | -260.383 | 37877 | | 0 | |
| 8.8 | 0.03019 | 862172 | -2561 | -0.0011 | 856.3215 | 3.91E+10 | -255.739 | 44720 | | 0 | |
| 9.24 | 0.02471 | 845633 | -3896 | -9.82E-04 | 844.1349 | 3.91E+10 | -249.939 | 53414 | | 0 | |
| 9.68 | 0.01982 | 822066 | -5197 | -8.70E-04 | 826.7698 | 3.91E+10 | -242.888 | 64697 | | 0 | |
| 10.12 | 0.01552 | 791668 | -6457 | -7.61E-04 | 804.3722 | 3.91E+10 | -234.452 | 79739 | | 0 | |
| 10.56 | 0.01179 | 754678 | -7669 | -6.56E-04 | 777.1169 | 3.91E+10 | -224.438 | 100501 | | 0 | |
| 11 | 0.0086 | 711377 | -8823 | -5.57E-04 | 745.2117 | 3.91E+10 | -212.541 | 130547 | | 0 | |
| 11.44 | 0.00591 | 662101 | -9907 | -4.64E-04 | 708.9031 | 3.91E+10 | -198.242 | 177150 | | 0 | |
| 11.88 | 0.00369 | 607250 | -10907 | -3.79E-04 | 668.4875 | 3.91E+10 | -180.521 | 258077 | | 0 | |
| 12.32 | 0.00191 | 547323 | -11798 | -3.01E-04 | 624.3319 | 3.91E+10 | -156.871 | 433420 | | 0 | |
| 12.76 | 5.19E-04 | 482984 | -12520 | -2.31E-04 | 576.925 | 3.91E+10 | -116.872 | 1188642 | | 0 | |
| 13.2 | -5.28E-04 | 415353 | -12520 | -1.70E-04 | 527.0921 | 3.91E+10 | 116.9644 | 1169122 | | 0 | |
| 13.64 | -0.00128 | 350952 | -11815 | -1.19E-04 | 479.64 | 3.91E+10 | 150.1185 | 619543 | | 0 | |
| 14.08 | -0.00178 | 290712 | -10979 | -7.52E-05 | 435.2531 | 3.91E+10 | 166.6994 | 494426 | | 0 | |
| 14.52 | -0.00207 | 235098 | -10072 | -3.97E-05 | 394.2752 | 3.91E+10 | 176.8308 | 450250 | | 0 | |
| 14.96 | -0.0022 | 184397 | -9121 | -1.14E-05 | 356.9173 | 3.91E+10 | 183.1028 | 439557 | | 0 | |
| 15.4 | -0.00219 | 138787 | -8145 | 1.05E-05 | 323.311 | 3.91E+10 | 186.6034 | 449132 | | 0 | |
| 15.84 | -0.00209 | 98370 | -7157 | 2.65E-05 | 293.5305 | 3.91E+10 | 187.8953 | 474913 | | 0 | |
| 16.28 | -0.00191 | 63184 | -6166 | 3.74E-05 | 267.6045 | 3.91E+10 | 187.3047 | 516675 | | 0 | |
| 16.72 | -0.00169 | 33216 | -5183 | 4.39E-05 | 245.5227 | 3.91E+10 | 185.0339 | 576678 | | 0 | |
| 17.16 | -0.00145 | 8403 | -4216 | 4.67E-05 | 227.24 | 3.91E+10 | 181.2129 | 659635 | | 0 | |
| 17.6 | -0.0012 | -11358 | -3273 | 4.65E-05 | 229.4177 | 3.91E+10 | 175.9243 | 773508 | | 0 | |
| 18.04 | -9.59E-04 | -26214 | -2362 | 4.40E-05 | 240.364 | 3.91E+10 | 169.2153 | 931333 | | 0 | |
| 18.48 | -7.36E-04 | -36351 | -1490 | 3.97E-05 | 247.833 | 3.91E+10 | 161.0987 | 1154936 | | 0 | |
| 18.92 | -5.40E-04 | -41994 | -664.938 | 3.45E-05 | 251.9908 | 3.91E+10 | 151.5396 | 1482873 | | 0 | |
| 19.36 | -3.73E-04 | -43409 | 42.5172 | 2.87E-05 | 253.0336 | 3.91E+10 | 116.4357 | 1649882 | | 0 | |
| 19.8 | -2.37E-04 | -41575 | 548.2969 | 2.29E-05 | 251.6823 | 3.91E+10 | 75.1475 | 1676839 | | 0 | |
| 20.24 | -1.30E-04 | -37643 | 857.6702 | 1.76E-05 | 248.7852 | 3.91E+10 | 42.0393 | 1703791 | | 0 | |
| 20.68 | -5.08E-05 | -32537 | 1013 | 1.29E-05 | 245.0226 | 3.91E+10 | 16.6464 | 1730736 | | 0 | |
| 21.12 | 5.50E-06 | -26964 | 1052 | 8.84E-06 | 240.9163 | 3.91E+10 | -1.8324 | 1757676 | | 0 | |
| 21.56 | 4.26E-05 | -21440 | 1009 | 5.57E-06 | 236.8462 | 3.91E+10 | -14.3853 | 1784611 | | 0 | |
| 22 | 6.43E-05 | -16316 | 912.6534 | 3.02E-06 | 233.0705 | 3.91E+10 | -22.0696 | 1811541 | | 0 | |
| 22.44 | 7.45E-05 | -11806 | 786.6289 | 1.12E-06 | 229.7473 | 3.91E+10 | -25.667 | 1820259 | | 0 | |
| 22.88 | 7.62E-05 | -8010 | 649.5542 | -2.18E-07 | 226.9507 | 3.91E+10 | -26.2553 | 1820259 | | 0 | |
| 23.32 | 7.22E-05 | -4946 | 514.5731 | -1.09E-06 | 224.693 | 3.91E+10 | -24.8739 | 1820259 | | 0 | |
| 23.76 | 6.46E-05 | -2575 | 390.0962 | -1.60E-06 | 222.946 | 3.91E+10 | -22.2764 | 1820259 | | 0 | |
| 24.2 | 5.52E-05 | -825.044 | 281.0061 | -1.83E-06 | 221.6564 | 3.91E+10 | -19.0456 | 1820259 | | 0 | |
| 24.64 | 4.53E-05 | 394.1835 | 189.51 | -1.86E-06 | 221.339 | 3.91E+10 | -15.612 | 1820259 | | 0 | |
| 25.08 | 3.56E-05 | 1178 | 115.8876 | -1.75E-06 | 221.9166 | 3.91E+10 | -12.2753 | 1820259 | | 0 | |
| 25.52 | 2.68E-05 | 1620 | 59.1182 | -1.56E-06 | 222.2421 | 3.91E+10 | -9.2283 | 1820259 | | 0 | |
| 25.96 | 1.91E-05 | 1804 | 17.3855 | -1.33E-06 | 222.3778 | 3.91E+10 | -6.5796 | 1820259 | | 0 | |
| 26.4 | 1.27E-05 | 1805 | -11.5331 | -1.09E-06 | 222.3784 | 3.91E+10 | -4.3745 | 1820259 | | 0 | |
| 26.84 | 7.58E-06 | 1683 | -29.9804 | -8.54E-07 | 222.2889 | 3.91E+10 | -2.6131 | 1820259 | | 0 | |
| 27.28 | 3.67E-06 | 1489 | -40.2206 | -6.40E-07 | 222.1458 | 3.91E+10 | -1.2657 | 1820259 | | 0 | |
| 27.72 | 8.25E-07 | 1259 | -44.3133 | -4.54E-07 | 221.9765 | 3.91E+10 | -0.2845 | 1820259 | | 0 | |
| 28.16 | -1.12E-06 | 1022 | -44.0427 | -3.00E-07 | 221.8013 | 3.91E+10 | 0.387 | 1820259 | | 0 | |
| 28.6 | -2.34E-06 | 794.6177 | -40.8896 | -1.77E-07 | 221.634 | 3.91E+10 | 0.8074 | 1820259 | | 0 | |
| 29.04 | -2.99E-06 | 590.04 | -36.0328 | -8.37E-08 | 221.4833 | 3.91E+10 | 1.0323 | 1820259 | | 0 | |
| 29.48 | -3.23E-06 | 414.1994 | -30.3714 | -1.59E-08 | 221.3537 | 3.91E+10 | 1.1122 | 1820259 | | 0 | |
| 29.92 | -3.16E-06 | 269.335 | -24.5571 | 3.03E-08 | 221.247 | 3.91E+10 | 1.0902 | 1820259 | | 0 | |
| 30.36 | -2.91E-06 | 154.8441 | -19.0338 | 5.89E-08 | 221.1626 | 3.91E+10 | 1.002 | 1820259 | | 0 | |
| 30.8 | -2.54E-06 | 68.2758 | -14.0767 | 7.40E-08 | 221.0988 | 3.91E+10 | 0.8757 | 1820259 | | 0 | |
| 31.24 | -2.13E-06 | 6.1157 | -9.8308 | 7.90E-08 | 221.053 | 3.91E+10 | 0.7326 | 1820259 | | 0 | |
| 31.68 | -1.71E-06 | -35.6205 | -6.3442 | 7.70E-08 | 221.0748 | 3.91E+10 | 0.588 | 1820259 | | 0 | |
| 32.12 | -1.31E-06 | -60.9603 | -3.5979 | 7.05E-08 | 221.0934 | 3.91E+10 | 0.4522 | 1820259 | | 0 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 32.56 | -9.61E-07 | -73.6884 | -1.5291 | 6.14E-08 | 221.1028 | 3.91E+10 | 0.3314 | 1820259 | 0 |
| 33 | -6.63E-07 | -77.1723 | -0.05044 | 5.12E-08 | 221.1054 | 3.91E+10 | 0.2287 | 1820259 | 0 |
| 33.44 | -4.20E-07 | -74.2751 | 0.936 | 4.10E-08 | 221.1033 | 3.91E+10 | 0.145 | 1820259 | 0 |
| 33.88 | -2.31E-07 | -67.3315 | 1.5285 | 3.14E-08 | 221.0981 | 3.91E+10 | 0.07949 | 1820259 | 0 |
| 34.32 | -8.87E-08 | -58.1671 | 1.8191 | 2.29E-08 | 221.0914 | 3.91E+10 | 0.03057 | 1820259 | 0 |
| 34.76 | 1.17E-08 | -48.1462 | 1.8891 | 1.58E-08 | 221.084 | 3.91E+10 | -0.00404 | 1820259 | 0 |
| 35.2 | 7.78E-08 | -38.2345 | 1.8077 | 9.93E-09 | 221.0767 | 3.91E+10 | -0.02681 | 1820259 | 0 |
| 35.64 | 1.17E-07 | -29.0674 | 1.6308 | 5.38E-09 | 221.0699 | 3.91E+10 | -0.04018 | 1820259 | 0 |
| 36.08 | 1.35E-07 | -21.0184 | 1.4023 | 2.00E-09 | 221.064 | 3.91E+10 | -0.0464 | 1820259 | 0 |
| 36.52 | 1.38E-07 | -14.2616 | 1.1545 | -3.84E-10 | 221.059 | 3.91E+10 | -0.04746 | 1820259 | 0 |
| 36.96 | 1.31E-07 | -8.8268 | 0.9104 | -1.94E-09 | 221.055 | 3.91E+10 | -0.04501 | 1820259 | 0 |
| 37.4 | 1.17E-07 | -4.6462 | 0.6849 | -2.85E-09 | 221.052 | 3.91E+10 | -0.04039 | 1820259 | 0 |
| 37.84 | 1.00E-07 | -1.5912 | 0.4869 | -3.27E-09 | 221.0497 | 3.91E+10 | -0.03462 | 1820259 | 0 |
| 38.28 | 8.26E-08 | 0.4988 | 0.3203 | -3.35E-09 | 221.0489 | 3.91E+10 | -0.02847 | 1820259 | 0 |
| 38.72 | 6.51E-08 | 1.7951 | 0.186 | -3.19E-09 | 221.0499 | 3.91E+10 | -0.02243 | 1820259 | 0 |
| 39.16 | 4.89E-08 | 2.4659 | 0.08228 | -2.91E-09 | 221.0503 | 3.91E+10 | -0.01684 | 1820259 | 0 |
| 39.6 | 3.44E-08 | 2.6671 | 0.00651 | -2.56E-09 | 221.0505 | 3.91E+10 | -0.01186 | 1820259 | 0 |
| 40.04 | 2.18E-08 | 2.5374 | -0.04466 | -2.21E-09 | 221.0504 | 3.91E+10 | -0.00753 | 1820259 | 0 |
| 40.48 | 1.11E-08 | 2.1978 | -0.07462 | -1.89E-09 | 221.0502 | 3.91E+10 | -0.00382 | 1820259 | 0 |
| 40.92 | 1.90E-09 | 1.7515 | -0.08644 | -1.62E-09 | 221.0498 | 3.91E+10 | -6.57E-04 | 1820259 | 0 |
| 41.36 | -6.03E-09 | 1.2867 | -0.08269 | -1.42E-09 | 221.0495 | 3.91E+10 | 0.00208 | 1820259 | 0 |
| 41.8 | -1.30E-08 | 0.8798 | -0.06534 | -1.27E-09 | 221.0492 | 3.91E+10 | 0.0045 | 1820259 | 0 |
| 42.24 | -1.94E-08 | 0.5981 | -0.04967 | -1.17E-09 | 221.049 | 3.91E+10 | 0.00144 | 391296 | 0 |
| 42.68 | -2.54E-08 | 0.3565 | -0.04085 | -1.10E-09 | 221.0488 | 3.91E+10 | 0.0019 | 395372 | 0 |
| 43.12 | -3.11E-08 | 0.1679 | -0.02962 | -1.07E-09 | 221.0487 | 3.91E+10 | 0.00235 | 399448 | 0 |
| 43.56 | -3.67E-08 | 0.04489 | -0.01601 | -1.05E-09 | 221.0486 | 3.91E+10 | 0.0028 | 403524 | 0 |
| 44 | -4.22E-08 | 0 | 0 | -1.05E-09 | 221.0485 | 3.91E+10 | 0.00326 | 203800 | 0 |

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:00

Pile-head deflection = 0.25 inches
Computed slope at pile head = -0.00266 radians
Maximum bending moment = 873547 inch-lbs
Maximum shear force = 14767 lbs
Depth of maximum bending moment = 7.92 feet below pile head
Depth of maximum shear force = 0 feet below pile head
Number of iterations = 14
Number of zero deflection points = 5

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Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

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Pile-head conditions are Displacem and Moment (Loading Type 4)
Displacem of pile head = 0.5 inches
Moment at pile head = 0 in-lbs
Axial load at pile head = 100000 lbs

| Depth X feet | Deflect. y inches | Bending Moment in-lbs | Shear Force lbs | Slope S radians | Total Stress psi* | Bending Stiffness in-lb^2 | Soil p lb/inch | Res. Es*h lb/inch | Soil Lat. lb/inch | Spr. Load | Distrib. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.5 | 0 | 21720 | -0.0048 | 221.0485 | 3.91E+10 | -117.63 | 621.0838 | | 0 | |
| 0.44 | 0.4746 | 115576 | 21082 | -0.0048 | 306.2079 | 3.91E+10 | -123.915 | 1378 | | 0 | |
| 0.88 | 0.4494 | 227688 | 20412 | -0.00477 | 388.8159 | 3.91E+10 | -129.833 | 1526 | | 0 | |
| 1.32 | 0.4242 | 336166 | 19712 | -0.00473 | 468.7448 | 3.91E+10 | -135.371 | 1685 | | 0 | |
| 1.76 | 0.3994 | 440845 | 18984 | -0.00468 | 545.8754 | 3.91E+10 | -140.515 | 1858 | | 0 | |
| 2.2 | 0.3748 | 541575 | 18229 | -0.00462 | 620.0964 | 3.91E+10 | -145.253 | 2046 | | 0 | |
| 2.64 | 0.3506 | 638217 | 17451 | -0.00454 | 691.3053 | 3.91E+10 | -149.571 | 2252 | | 0 | |
| 3.08 | 0.3269 | 730644 | 16651 | -0.00444 | 759.4081 | 3.91E+10 | -153.457 | 2478 | | 0 | |
| 3.52 | 0.3037 | 818741 | 15831 | -0.00434 | 824.3203 | 3.91E+10 | -156.898 | 2728 | | 0 | |
| 3.96 | 0.2811 | 902405 | 14995 | -0.00422 | 885.9665 | 3.91E+10 | -159.88 | 3003 | | 0 | |
| 4.4 | 0.2591 | 981548 | 14144 | -0.00409 | 944.2811 | 3.91E+10 | -162.392 | 3309 | | 0 | |
| 4.84 | 0.2379 | 1056094 | 13285 | -0.00396 | 999.2084 | 3.91E+10 | -163.123 | 3621 | | 0 | |
| 5.28 | 0.2174 | 1126016 | 12424 | -0.00381 | 1051 | 3.91E+10 | -163.064 | 3961 | | 0 | |
| 5.72 | 0.1976 | 1191312 | 11564 | -0.00365 | 1099 | 3.91E+10 | -162.602 | 4344 | | 0 | |
| 6.16 | 0.1788 | 1251991 | 10258 | -0.00349 | 1144 | 3.91E+10 | -332.183 | 9811 | | 0 | |
| 6.6 | 0.1608 | 1303319 | 8498 | -0.00332 | 1181 | 3.91E+10 | -334.45 | 10982 | | 0 | |
| 7.04 | 0.1438 | 1345230 | 6728 | -0.00314 | 1212 | 3.91E+10 | -335.798 | 12333 | | 0 | |
| 7.48 | 0.1277 | 1377684 | 4954 | -0.00295 | 1236 | 3.91E+10 | -336.211 | 13904 | | 0 | |
| 7.92 | 0.1126 | 1400667 | 3181 | -0.00277 | 1253 | 3.91E+10 | -335.665 | 15743 | | 0 | |
| 8.36 | 0.09848 | 1414191 | 1412 | -0.00258 | 1263 | 3.91E+10 | -334.132 | 17915 | | 0 | |
| 8.8 | 0.08539 | 1418300 | -345.106 | -0.00238 | 1266 | 3.91E+10 | -331.577 | 20504 | | 0 | |
| 9.24 | 0.07331 | 1413064 | -2086 | -0.00219 | 1262 | 3.91E+10 | -327.957 | 23622 | | 0 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 9.68 | 0.06223 | 1398585 | -3805 | -0.002 | 1252 | 3.91E+10 | -323.22 | 27423 | 0 |
| 10.12 | 0.05216 | 1374994 | -5496 | -0.00182 | 1234 | 3.91E+10 | -317.299 | 32120 | 0 |
| 10.56 | 0.04306 | 1342460 | -7153 | -0.00163 | 1210 | 3.91E+10 | -310.111 | 38022 | 0 |
| 11 | 0.03493 | 1301185 | -8767 | -0.00145 | 1180 | 3.91E+10 | -301.546 | 45584 | 0 |
| 11.44 | 0.02772 | 1251410 | -10333 | -0.00128 | 1143 | 3.91E+10 | -291.454 | 55516 | 0 |
| 11.88 | 0.0214 | 1193420 | -11841 | -0.00112 | 1100 | 3.91E+10 | -279.618 | 68978 | 0 |
| 12.32 | 0.01594 | 1127551 | -13280 | -9.59E-04 | 1052 | 3.91E+10 | -265.705 | 88019 | 0 |
| 12.76 | 0.01128 | 1054193 | -14640 | -8.11E-04 | 997.808 | 3.91E+10 | -249.163 | 116646 | 0 |
| 13.2 | 0.00737 | 973814 | -15902 | -6.74E-04 | 938.5824 | 3.91E+10 | -228.953 | 164029 | 0 |
| 13.64 | 0.00416 | 886983 | -17041 | -5.49E-04 | 874.6026 | 3.91E+10 | -202.727 | 257561 | 0 |
| 14.08 | 0.00157 | 794436 | -18006 | -4.35E-04 | 806.4118 | 3.91E+10 | -162.649 | 545409 | 0 |
| 14.52 | -4.40E-04 | 697299 | -18138 | -3.34E-04 | 734.8382 | 3.91E+10 | 112.7668 | 1352785 | 0 |
| 14.96 | -0.00196 | 603256 | -17370 | -2.47E-04 | 665.5444 | 3.91E+10 | 177.8787 | 479797 | 0 |
| 15.4 | -0.00304 | 514128 | -16366 | -1.71E-04 | 599.8728 | 3.91E+10 | 202.7018 | 351532 | 0 |
| 15.84 | -0.00376 | 430615 | -15255 | -1.07E-04 | 538.3379 | 3.91E+10 | 217.9248 | 305619 | 0 |
| 16.28 | -0.00418 | 353147 | -14078 | -5.44E-05 | 481.257 | 3.91E+10 | 227.9192 | 288021 | 0 |
| 16.72 | -0.00434 | 282007 | -12858 | -1.15E-05 | 428.8394 | 3.91E+10 | 234.3585 | 285146 | 0 |
| 17.16 | -0.0043 | 217381 | -11611 | 2.22E-05 | 381.221 | 3.91E+10 | 238.0699 | 292341 | 0 |
| 17.6 | -0.0041 | 159376 | -10350 | 4.77E-05 | 338.4815 | 3.91E+10 | 239.5202 | 308082 | 0 |
| 18.04 | -0.0038 | 108038 | -9086 | 6.57E-05 | 300.6538 | 3.91E+10 | 238.9948 | 332385 | 0 |
| 18.48 | -0.00341 | 63354 | -7831 | 7.73E-05 | 267.7297 | 3.91E+10 | 236.6751 | 366366 | 0 |
| 18.92 | -0.00298 | 25264 | -6592 | 8.33E-05 | 239.664 | 3.91E+10 | 232.6774 | 412236 | 0 |
| 19.36 | -0.00253 | -6341 | -5378 | 8.46E-05 | 225.7205 | 3.91E+10 | 227.073 | 473627 | 0 |
| 19.8 | -0.00209 | -31615 | -4198 | 8.20E-05 | 244.3432 | 3.91E+10 | 219.8976 | 556284 | 0 |
| 20.24 | -0.00167 | -50756 | -3060 | 7.64E-05 | 258.4472 | 3.91E+10 | 211.1544 | 669414 | 0 |
| 20.68 | -0.00128 | -64007 | -1972 | 6.87E-05 | 268.2111 | 3.91E+10 | 200.8079 | 828339 | 0 |
| 21.12 | -9.40E-04 | -71656 | -943.792 | 5.95E-05 | 273.8466 | 3.91E+10 | 188.7651 | 1060125 | 0 |
| 21.56 | -6.51E-04 | -74037 | 16.0875 | 4.97E-05 | 275.6009 | 3.91E+10 | 174.8255 | 1417014 | 0 |
| 22 | -4.16E-04 | -71538 | 853.9786 | 3.99E-05 | 273.7601 | 3.91E+10 | 142.5575 | 1811541 | 0 |
| 22.44 | -2.31E-04 | -65061 | 1440 | 3.06E-05 | 268.9872 | 3.91E+10 | 79.5012 | 1820259 | 0 |
| 22.88 | -9.21E-05 | -56362 | 1734 | 2.24E-05 | 262.5778 | 3.91E+10 | 31.7568 | 1820259 | 0 |
| 23.32 | 6.17E-06 | -46774 | 1812 | 1.55E-05 | 255.5131 | 3.91E+10 | -2.1288 | 1820259 | 0 |
| 23.76 | 7.11E-05 | -37242 | 1742 | 9.78E-06 | 248.4896 | 3.91E+10 | -24.513 | 1820259 | 0 |
| 24.2 | 1.09E-04 | -28391 | 1577 | 5.35E-06 | 241.9678 | 3.91E+10 | -37.7398 | 1820259 | 0 |
| 24.64 | 1.28E-04 | -20590 | 1362 | 2.04E-06 | 236.2196 | 3.91E+10 | -43.9855 | 1820259 | 0 |
| 25.08 | 1.31E-04 | -14013 | 1126 | -2.97E-07 | 231.374 | 3.91E+10 | -45.1685 | 1820259 | 0 |
| 25.52 | 1.24E-04 | -8695 | 893.8335 | -1.83E-06 | 227.4554 | 3.91E+10 | -42.9057 | 1820259 | 0 |
| 25.96 | 1.12E-04 | -4573 | 678.91 | -2.73E-06 | 224.4177 | 3.91E+10 | -38.5048 | 1820259 | 0 |
| 26.4 | 9.57E-05 | -1523 | 490.1913 | -3.14E-06 | 222.1707 | 3.91E+10 | -32.9796 | 1820259 | 0 |
| 26.84 | 7.86E-05 | 607.2173 | 331.6343 | -3.20E-06 | 221.4959 | 3.91E+10 | -27.0799 | 1820259 | 0 |
| 27.28 | 6.19E-05 | 1982 | 203.8336 | -3.03E-06 | 222.5093 | 3.91E+10 | -21.3295 | 1820259 | 0 |
| 27.72 | 4.66E-05 | 2763 | 105.108 | -2.70E-06 | 223.0843 | 3.91E+10 | -16.0666 | 1820259 | 0 |
| 28.16 | 3.33E-05 | 3095 | 32.3771 | -2.31E-06 | 223.3292 | 3.91E+10 | -11.483 | 1820259 | 0 |
| 28.6 | 2.22E-05 | 3107 | -18.162 | -1.89E-06 | 223.338 | 3.91E+10 | -7.6606 | 1820259 | 0 |
| 29.04 | 1.33E-05 | 2905 | -50.5354 | -1.48E-06 | 223.1893 | 3.91E+10 | -4.6021 | 1820259 | 0 |
| 29.48 | 6.55E-06 | 2575 | -68.6464 | -1.11E-06 | 222.946 | 3.91E+10 | -2.2581 | 1820259 | 0 |
| 29.92 | 1.59E-06 | 2182 | -76.0528 | -7.93E-07 | 222.6561 | 3.91E+10 | -0.5473 | 1820259 | 0 |
| 30.36 | -1.82E-06 | 1773 | -75.8423 | -5.25E-07 | 222.3548 | 3.91E+10 | 0.627 | 1820259 | 0 |
| 30.8 | -3.96E-06 | 1381 | -70.5821 | -3.12E-07 | 222.0664 | 3.91E+10 | 1.3654 | 1820259 | 0 |
| 31.24 | -5.12E-06 | 1028 | -62.3199 | -1.50E-07 | 221.8059 | 3.91E+10 | 1.7642 | 1820259 | 0 |
| 31.68 | -5.54E-06 | 723.4347 | -52.6195 | -3.14E-08 | 221.5816 | 3.91E+10 | 1.9102 | 1820259 | 0 |
| 32.12 | -5.45E-06 | 472.2212 | -42.6178 | 4.94E-08 | 221.3965 | 3.91E+10 | 1.8783 | 1820259 | 0 |
| 32.56 | -5.02E-06 | 273.3385 | -33.091 | 9.98E-08 | 221.2499 | 3.91E+10 | 1.7303 | 1820259 | 0 |
| 33 | -4.39E-06 | 122.6753 | -24.523 | 1.27E-07 | 221.1389 | 3.91E+10 | 1.5151 | 1820259 | 0 |
| 33.44 | -3.68E-06 | 14.2425 | -17.1709 | 1.36E-07 | 221.059 | 3.91E+10 | 1.2698 | 1820259 | 0 |
| 33.88 | -2.96E-06 | -58.7923 | -11.1235 | 1.33E-07 | 221.0919 | 3.91E+10 | 1.0209 | 1820259 | 0 |
| 34.32 | -2.28E-06 | -103.362 | -6.3521 | 1.22E-07 | 221.1247 | 3.91E+10 | 0.7865 | 1820259 | 0 |
| 34.76 | -1.68E-06 | -125.999 | -2.7513 | 1.06E-07 | 221.1414 | 3.91E+10 | 0.5775 | 1820259 | 0 |
| 35.2 | -1.16E-06 | -132.528 | -0.1721 | 8.88E-08 | 221.1462 | 3.91E+10 | 0.3995 | 1820259 | 0 |
| 35.64 | -7.37E-07 | -127.911 | 1.5531 | 7.13E-08 | 221.1428 | 3.91E+10 | 0.254 | 1820259 | 0 |
| 36.08 | -4.06E-07 | -116.203 | 2.5935 | 5.48E-08 | 221.1342 | 3.91E+10 | 0.1401 | 1820259 | 0 |
| 36.52 | -1.59E-07 | -100.582 | 3.1075 | 4.01E-08 | 221.1226 | 3.91E+10 | 0.05465 | 1820259 | 0 |
| 36.96 | 1.75E-08 | -83.4296 | 3.2359 | 2.77E-08 | 221.11 | 3.91E+10 | -0.00602 | 1820259 | 0 |
| 37.4 | 1.34E-07 | -66.4395 | 3.0981 | 1.76E-08 | 221.0975 | 3.91E+10 | -0.04618 | 1820259 | 0 |
| 37.84 | 2.03E-07 | -50.732 | 2.7914 | 9.66E-09 | 221.0859 | 3.91E+10 | -0.07 | 1820259 | 0 |
| 38.28 | 2.36E-07 | -36.9722 | 2.3919 | 3.74E-09 | 221.0758 | 3.91E+10 | -0.08134 | 1820259 | 0 |
| 38.72 | 2.42E-07 | -25.4775 | 1.9565 | -4.82E-10 | 221.0673 | 3.91E+10 | -0.0836 | 1820259 | 0 |
| 39.16 | 2.31E-07 | -16.3114 | 1.5257 | -3.30E-09 | 221.0606 | 3.91E+10 | -0.07959 | 1820259 | 0 |
| 39.6 | 2.08E-07 | -9.3629 | 1.1266 | -5.04E-09 | 221.0554 | 3.91E+10 | -0.07156 | 1820259 | 0 |
| 40.04 | 1.78E-07 | -4.4089 | 0.776 | -5.97E-09 | 221.0518 | 3.91E+10 | -0.06124 | 1820259 | 0 |
| 40.48 | 1.45E-07 | -1.1618 | 0.4828 | -6.35E-09 | 221.0494 | 3.91E+10 | -0.04983 | 1820259 | 0 |
| 40.92 | 1.11E-07 | 0.696 | 0.2505 | -6.38E-09 | 221.049 | 3.91E+10 | -0.03814 | 1820259 | 0 |
| 41.36 | 7.72E-08 | 1.4905 | 0.07956 | -6.23E-09 | 221.0496 | 3.91E+10 | -0.02662 | 1820259 | 0 |
| 41.8 | 4.49E-08 | 1.5428 | -0.03154 | -6.02E-09 | 221.0497 | 3.91E+10 | -0.01546 | 1820259 | 0 |
| 42.24 | 1.36E-08 | 1.1638 | -0.07503 | -5.84E-09 | 221.0494 | 3.91E+10 | -0.00101 | 391296 | 0 |
| 42.68 | -1.68E-08 | 0.7566 | -0.07436 | -5.71E-09 | 221.0491 | 3.91E+10 | 0.00126 | 395372 | 0 |
| 43.12 | -4.67E-08 | 0.3845 | -0.06171 | -5.63E-09 | 221.0488 | 3.91E+10 | 0.00353 | 399448 | 0 |
| 43.56 | -7.63E-08 | 0.111 | -0.03698 | -5.60E-09 | 221.0486 | 3.91E+10 | 0.00583 | 403524 | 0 |
| 44 | -1.06E-07 | 0 | 0 | -5.59E-09 | 221.0485 | 3.91E+10 | 0.00817 | 203800 | 0 |

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 2:00

Pile-head deflection = 0.5 inches
Computed slope at pile head = -0.0048 radians
Maximum bending moment = 1418300 inch-lbs
Maximum shear force = 21720 lbs
Depth of maximum bending moment = 8.8 feet below pile head
Depth of maximum shear force = 0 feet below pile head
Number of iterations = 18
Number of zero deflection points = 5

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Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

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Pile-head conditions are Displacem and Moment (Loading Type 4)
Displacem of pile head = 0.75 inches
Moment at pile head = 0 in-lbs
Axial load at pile head = 100000 lbs

| Depth X feet | Deflect. y inches | Bending Moment in-lbs | Shear Force lbs | Slope S radians | Total Stress psi* | Bending Stiffness in-lb^2 | Soil p lb/inch | Res. Es*h lb/inch | Soil Lat. lb/inch | Spr. Load | Distrib. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.75 | 0 | 27161 | -0.00679 | 221.0485 | 3.91E+10 | -134.652 | 473.9756 | | 0 | |
| 0.44 | 0.7142 | 145118 | 26431 | -0.00678 | 327.9753 | 3.91E+10 | -141.993 | 1050 | | 0 | |
| 0.88 | 0.6784 | 286266 | 25663 | -0.00675 | 431.9778 | 3.91E+10 | -148.944 | 1159 | | 0 | |
| 1.32 | 0.6429 | 423242 | 24859 | -0.0067 | 532.9056 | 3.91E+10 | -155.491 | 1277 | | 0 | |
| 1.76 | 0.6077 | 555853 | 24022 | -0.00663 | 630.6171 | 3.91E+10 | -161.619 | 1404 | | 0 | |
| 2.2 | 0.5729 | 683919 | 23154 | -0.00655 | 724.9796 | 3.91E+10 | -167.317 | 1542 | | 0 | |
| 2.64 | 0.5385 | 807271 | 22256 | -0.00645 | 815.8691 | 3.91E+10 | -172.571 | 1692 | | 0 | |
| 3.08 | 0.5048 | 925755 | 21332 | -0.00633 | 903.1713 | 3.91E+10 | -177.368 | 1855 | | 0 | |
| 3.52 | 0.4717 | 1039228 | 20385 | -0.0062 | 986.7814 | 3.91E+10 | -181.694 | 2034 | | 0 | |
| 3.96 | 0.4393 | 1147562 | 19415 | -0.00605 | 1067 | 3.91E+10 | -185.538 | 2230 | | 0 | |
| 4.4 | 0.4078 | 1250641 | 18427 | -0.00589 | 1143 | 3.91E+10 | -188.885 | 2446 | | 0 | |
| 4.84 | 0.3771 | 1348365 | 17426 | -0.00571 | 1215 | 3.91E+10 | -190.211 | 2663 | | 0 | |
| 5.28 | 0.3475 | 1440690 | 16420 | -0.00553 | 1283 | 3.91E+10 | -190.664 | 2897 | | 0 | |
| 5.72 | 0.3188 | 1527597 | 15413 | -0.00532 | 1347 | 3.91E+10 | -190.694 | 3158 | | 0 | |
| 6.16 | 0.2912 | 1609079 | 13919 | -0.00511 | 1407 | 3.91E+10 | -375.281 | 6804 | | 0 | |
| 6.6 | 0.2648 | 1679984 | 11928 | -0.00489 | 1459 | 3.91E+10 | -378.867 | 7554 | | 0 | |
| 7.04 | 0.2396 | 1740207 | 9921 | -0.00466 | 1503 | 3.91E+10 | -381.529 | 8408 | | 0 | |
| 7.48 | 0.2156 | 1789669 | 7902 | -0.00442 | 1540 | 3.91E+10 | -383.256 | 9386 | | 0 | |
| 7.92 | 0.1929 | 1828319 | 5876 | -0.00418 | 1568 | 3.91E+10 | -384.03 | 10512 | | 0 | |
| 8.36 | 0.1715 | 1856133 | 3849 | -0.00393 | 1589 | 3.91E+10 | -383.828 | 11818 | | 0 | |
| 8.8 | 0.1514 | 1873114 | 1826 | -0.00368 | 1601 | 3.91E+10 | -382.622 | 13343 | | 0 | |
| 9.24 | 0.1327 | 1879294 | -188.663 | -0.00342 | 1606 | 3.91E+10 | -380.379 | 15138 | | 0 | |
| 9.68 | 0.1153 | 1874736 | -2188 | -0.00317 | 1602 | 3.91E+10 | -377.059 | 17271 | | 0 | |
| 10.12 | 0.09921 | 1859532 | -4167 | -0.00292 | 1591 | 3.91E+10 | -372.612 | 19831 | | 0 | |
| 10.56 | 0.08447 | 1833808 | -6120 | -0.00267 | 1572 | 3.91E+10 | -366.979 | 22939 | | 0 | |
| 11 | 0.07104 | 1797722 | -8039 | -0.00242 | 1546 | 3.91E+10 | -360.089 | 26763 | | 0 | |
| 11.44 | 0.05889 | 1751469 | -9919 | -0.00218 | 1512 | 3.91E+10 | -351.847 | 31544 | | 0 | |
| 11.88 | 0.048 | 1695283 | -11751 | -0.00195 | 1470 | 3.91E+10 | -342.132 | 37638 | | 0 | |
| 12.32 | 0.03831 | 1629437 | -13528 | -0.00172 | 1422 | 3.91E+10 | -330.776 | 45593 | | 0 | |
| 12.76 | 0.02978 | 1554254 | -15239 | -0.00151 | 1366 | 3.91E+10 | -317.54 | 56301 | | 0 | |
| 13.2 | 0.02236 | 1470107 | -16875 | -0.00131 | 1304 | 3.91E+10 | -302.056 | 71322 | | 0 | |
| 13.64 | 0.01599 | 1377435 | -18421 | -0.00111 | 1236 | 3.91E+10 | -283.72 | 93677 | | 0 | |
| 14.08 | 0.0106 | 1276755 | -19860 | -9.34E-04 | 1162 | 3.91E+10 | -261.414 | 130160 | | 0 | |
| 14.52 | 0.00613 | 1168695 | -21165 | -7.69E-04 | 1082 | 3.91E+10 | -232.657 | 200467 | | 0 | |
| 14.96 | 0.00248 | 1054067 | -22279 | -6.19E-04 | 997.715 | 3.91E+10 | -189.6 | 402878 | | 0 | |
| 15.4 | -4.06E-04 | 934077 | -22494 | -4.84E-04 | 909.3033 | 3.91E+10 | 108.27 | 1406902 | | 0 | |
| 15.84 | -0.00263 | 817040 | -21683 | -3.66E-04 | 823.0666 | 3.91E+10 | 199.092 | 399505 | | 0 | |
| 16.28 | -0.00427 | 705494 | -20552 | -2.63E-04 | 740.8766 | 3.91E+10 | 229.1571 | 283131 | | 0 | |
| 16.72 | -0.00541 | 600287 | -19293 | -1.75E-04 | 663.3567 | 3.91E+10 | 247.6579 | 241597 | | 0 | |
| 17.16 | -0.00612 | 501941 | -17953 | -1.01E-04 | 590.8926 | 3.91E+10 | 260.0819 | 224264 | | 0 | |
| 17.6 | -0.00648 | 410810 | -16558 | -3.91E-05 | 523.7447 | 3.91E+10 | 268.4644 | 218880 | | 0 | |
| 18.04 | -0.00654 | 327133 | -15126 | 1.08E-05 | 462.0898 | 3.91E+10 | 273.7975 | 221184 | | 0 | |
| 18.48 | -0.00636 | 251067 | -13673 | 4.98E-05 | 406.042 | 3.91E+10 | 276.6386 | 229574 | | 0 | |
| 18.92 | -0.00601 | 182695 | -12210 | 7.91E-05 | 355.6635 | 3.91E+10 | 277.3286 | 243649 | | 0 | |
| 19.36 | -0.00553 | 122042 | -10749 | 9.97E-05 | 310.9723 | 3.91E+10 | 276.0861 | 263749 | | 0 | |
| 19.8 | -0.00496 | 69076 | -9300 | 1.13E-04 | 271.9459 | 3.91E+10 | 273.0545 | 290844 | | 0 | |
| 20.24 | -0.00434 | 23718 | -7870 | 1.19E-04 | 238.5248 | 3.91E+10 | 268.3266 | 326606 | | 0 | |
| 20.68 | -0.0037 | -14161 | -6470 | 1.20E-04 | 231.4827 | 3.91E+10 | 261.9581 | 373647 | | 0 | |
| 21.12 | -0.00308 | -44736 | -5108 | 1.16E-04 | 254.0114 | 3.91E+10 | 253.9739 | 435992 | | 0 | |
| 21.56 | -0.00248 | -68228 | -3793 | 1.08E-04 | 271.3207 | 3.91E+10 | 244.3689 | 519935 | | 0 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 22 | -0.00194 | -84902 | -2532 | 9.76E-05 | 283.6067 | 3.91E+10 | 233.1025 | 635686 | 0 |
| 22.44 | -0.00145 | -95071 | -1342 | 8.54E-05 | 291.0999 | 3.91E+10 | 217.9027 | 792780 | 0 |
| 22.88 | -0.00103 | -99159 | -237.917 | 7.23E-05 | 294.1121 | 3.91E+10 | 200.1616 | 1021929 | 0 |
| 23.32 | -6.88E-04 | -97660 | 767.5652 | 5.90E-05 | 293.0074 | 3.91E+10 | 180.7029 | 1387154 | 0 |
| 23.76 | -4.11E-04 | -91116 | 1619 | 4.63E-05 | 288.1856 | 3.91E+10 | 141.7319 | 1820259 | 0 |
| 24.2 | -1.99E-04 | -80615 | 2174 | 3.47E-05 | 280.4477 | 3.91E+10 | 68.7455 | 1820259 | 0 |
| 24.64 | -4.52E-05 | -68191 | 2397 | 2.46E-05 | 271.2934 | 3.91E+10 | 15.5814 | 1820259 | 0 |
| 25.08 | 6.04E-05 | -55327 | 2383 | 1.63E-05 | 261.8154 | 3.91E+10 | -20.8153 | 1820259 | 0 |
| 25.52 | 1.26E-04 | -43041 | 2213 | 9.61E-06 | 252.7621 | 3.91E+10 | -43.6076 | 1820259 | 0 |
| 25.96 | 1.62E-04 | -31966 | 1951 | 4.55E-06 | 244.6023 | 3.91E+10 | -55.8165 | 1820259 | 0 |
| 26.4 | 1.75E-04 | -22446 | 1645 | 8.73E-07 | 237.5874 | 3.91E+10 | -60.1653 | 1820259 | 0 |
| 26.84 | 1.71E-04 | -14601 | 1330 | -1.63E-06 | 231.8072 | 3.91E+10 | -58.9948 | 1820259 | 0 |
| 27.28 | 1.57E-04 | -8400 | 1031 | -3.18E-06 | 227.2381 | 3.91E+10 | -54.2339 | 1820259 | 0 |
| 27.72 | 1.38E-04 | -3711 | 762.6711 | -4.00E-06 | 223.7826 | 3.91E+10 | -47.4076 | 1820259 | 0 |
| 28.16 | 1.15E-04 | -342.206 | 532.7894 | -4.27E-06 | 221.3007 | 3.91E+10 | -39.6688 | 1820259 | 0 |
| 28.6 | 9.24E-05 | 1920 | 343.9904 | -4.17E-06 | 222.4634 | 3.91E+10 | -31.8459 | 1820259 | 0 |
| 29.04 | 7.11E-05 | 3295 | 195.2497 | -3.82E-06 | 223.4762 | 3.91E+10 | -24.4952 | 1820259 | 0 |
| 29.48 | 5.21E-05 | 3986 | 83.182 | -3.32E-06 | 223.9856 | 3.91E+10 | -17.9546 | 1820259 | 0 |
| 29.92 | 3.60E-05 | 4177 | 3.061 | -2.77E-06 | 224.126 | 3.91E+10 | -12.3942 | 1820259 | 0 |
| 30.36 | 2.28E-05 | 4021 | -50.4122 | -2.22E-06 | 224.0116 | 3.91E+10 | -7.8608 | 1820259 | 0 |
| 30.8 | 1.25E-05 | 3647 | -82.5593 | -1.70E-06 | 223.7355 | 3.91E+10 | -4.3162 | 1820259 | 0 |
| 31.24 | 4.84E-06 | 3151 | -98.358 | -1.24E-06 | 223.3705 | 3.91E+10 | -1.6682 | 1820259 | 0 |
| 31.68 | -5.94E-07 | 2609 | -102.221 | -8.53E-07 | 222.9711 | 3.91E+10 | 0.2049 | 1820259 | 0 |
| 32.12 | -4.17E-06 | 2073 | -97.8884 | -5.37E-07 | 222.5758 | 3.91E+10 | 1.4363 | 1820259 | 0 |
| 32.56 | -6.26E-06 | 1576 | -88.399 | -2.90E-07 | 222.2099 | 3.91E+10 | 2.1581 | 1820259 | 0 |
| 33 | -7.23E-06 | 1140 | -76.1216 | -1.07E-07 | 221.8882 | 3.91E+10 | 2.4924 | 1820259 | 0 |
| 33.44 | -7.39E-06 | 772.4214 | -62.8191 | 2.25E-08 | 221.6177 | 3.91E+10 | 2.5464 | 1820259 | 0 |
| 33.88 | -6.99E-06 | 476.192 | -49.7329 | 1.07E-07 | 221.3994 | 3.91E+10 | 2.4105 | 1820259 | 0 |
| 34.32 | -6.26E-06 | 247.1296 | -37.6733 | 1.56E-07 | 221.2306 | 3.91E+10 | 2.1575 | 1820259 | 0 |
| 34.76 | -5.35E-06 | 78.1978 | -27.1099 | 1.78E-07 | 221.1062 | 3.91E+10 | 1.8438 | 1820259 | 0 |
| 35.2 | -4.38E-06 | -39.3387 | -18.254 | 1.80E-07 | 221.0775 | 3.91E+10 | 1.5108 | 1820259 | 0 |
| 35.64 | -3.44E-06 | -114.755 | -11.1307 | 1.70E-07 | 221.1331 | 3.91E+10 | 1.1874 | 1820259 | 0 |
| 36.08 | -2.59E-06 | -157.058 | -5.64 | 1.52E-07 | 221.1643 | 3.91E+10 | 0.8924 | 1820259 | 0 |
| 36.52 | -1.84E-06 | -174.473 | -1.6055 | 1.29E-07 | 221.1771 | 3.91E+10 | 0.6359 | 1820259 | 0 |
| 36.96 | -1.22E-06 | -174.149 | 1.188 | 1.06E-07 | 221.1769 | 3.91E+10 | 0.4223 | 1820259 | 0 |
| 37.4 | -7.30E-07 | -162.039 | 2.9669 | 8.29E-08 | 221.1679 | 3.91E+10 | 0.2515 | 1820259 | 0 |
| 37.84 | -3.50E-07 | -142.906 | 3.9494 | 6.23E-08 | 221.1538 | 3.91E+10 | 0.1206 | 1820259 | 0 |
| 38.28 | -7.21E-08 | -120.399 | 4.3335 | 4.45E-08 | 221.1372 | 3.91E+10 | 0.02485 | 1820259 | 0 |
| 38.72 | 1.20E-07 | -97.1911 | 4.29 | 2.98E-08 | 221.1201 | 3.91E+10 | -0.04132 | 1820259 | 0 |
| 39.16 | 2.42E-07 | -75.1282 | 3.9602 | 1.81E-08 | 221.1039 | 3.91E+10 | -0.08359 | 1820259 | 0 |
| 39.6 | 3.11E-07 | -55.3903 | 3.456 | 9.33E-09 | 221.0893 | 3.91E+10 | -0.1074 | 1820259 | 0 |
| 40.04 | 3.41E-07 | -38.6422 | 2.8622 | 2.98E-09 | 221.077 | 3.91E+10 | -0.1176 | 1820259 | 0 |
| 40.48 | 3.43E-07 | -25.169 | 2.2396 | -1.33E-09 | 221.0671 | 3.91E+10 | -0.1182 | 1820259 | 0 |
| 40.92 | 3.27E-07 | -14.9903 | 1.6299 | -4.04E-09 | 221.0596 | 3.91E+10 | -0.1127 | 1820259 | 0 |
| 41.36 | 3.00E-07 | -7.9533 | 1.059 | -5.59E-09 | 221.0544 | 3.91E+10 | -0.1035 | 1820259 | 0 |
| 41.8 | 2.68E-07 | -3.8019 | 0.5418 | -6.38E-09 | 221.0513 | 3.91E+10 | -0.09237 | 1820259 | 0 |
| 42.24 | 2.33E-07 | -2.2255 | 0.2523 | -6.79E-09 | 221.0502 | 3.91E+10 | -0.01726 | 391296 | 0 |
| 42.68 | 1.96E-07 | -1.1301 | 0.168 | -7.02E-09 | 221.0494 | 3.91E+10 | -0.01469 | 395372 | 0 |
| 43.12 | 1.59E-07 | -0.4443 | 0.09748 | -7.12E-09 | 221.0489 | 3.91E+10 | -0.01201 | 399448 | 0 |
| 43.56 | 1.21E-07 | -0.09325 | 0.04136 | -7.16E-09 | 221.0486 | 3.91E+10 | -0.00925 | 403524 | 0 |
| 44 | 8.31E-08 | 0 | 0 | -7.17E-09 | 221.0485 | 3.91E+10 | -0.00642 | 203800 | 0 |

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 3:00

Pile-head deflection = 0.75 inches
Computed slope at pile head = -0.00679 radians
Maximum bending moment = 1879294 inch-lbs
Maximum shear force = 27161 lbs
Depth of maximum bending moment = 9.24 feet below pile head
Depth of maximum shear force = 0 feet below pile head
Number of iterations = 18
Number of zero deflection points = 4

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Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 4

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Pile-head conditions are Displacem and Moment (Loading Type 4)
Displacem of pile head = 1 inches
Moment at pile head = 0 in-lbs
Axial load at pile head = 100000 lbs

| Depth X | Deflect. y | Bending Moment | Shear Force | Slope S | Total Stress | Bending Stiffness | Soil p | Res. Es*h | Soil Lat. | Spr. Load | Distrib. |
|---|---|---|---|---|---|---|---|---|---|---|---|

| | feet | inches | in-lbs | lbs | radians | psi* | in-lb^2 | lb/inch | lb/inch | lb/inch |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 0 | 31810 | -0.00867 | 221.0485 | 3.91E+10 | -148.204 | 391.2583 | 0 |
| | 0.44 | 0.9542 | 170472 | 31006 | -0.00866 | 346.6571 | 3.91E+10 | -156.392 | 865.3782 | 0 |
| | 0.88 | 0.9085 | 336572 | 30160 | -0.00863 | 469.0442 | 3.91E+10 | -164.172 | 954.0924 | 0 |
| | 1.32 | 0.8631 | 498071 | 29274 | -0.00857 | 588.0412 | 3.91E+10 | -171.529 | 1049 | 0 |
| | 1.76 | 0.818 | 654752 | 28350 | -0.00849 | 703.4886 | 3.91E+10 | -178.451 | 1152 | 0 |
| | 2.2 | 0.7734 | 806412 | 27390 | -0.00839 | 815.2359 | 3.91E+10 | -184.923 | 1262 | 0 |
| | 2.64 | 0.7294 | 952859 | 26398 | -0.00828 | 923.1421 | 3.91E+10 | -190.933 | 1382 | 0 |
| | 3.08 | 0.686 | 1093915 | 25375 | -0.00814 | 1027 | 3.91E+10 | -196.466 | 1512 | 0 |
| | 3.52 | 0.6435 | 1229416 | 24325 | -0.00798 | 1127 | 3.91E+10 | -201.51 | 1654 | 0 |
| | 3.96 | 0.6018 | 1359211 | 23249 | -0.00781 | 1223 | 3.91E+10 | -206.052 | 1808 | 0 |
| | 4.4 | 0.561 | 1483166 | 22150 | -0.00761 | 1314 | 3.91E+10 | -210.079 | 1977 | 0 |
| | 4.84 | 0.5214 | 1601157 | 21036 | -0.00741 | 1401 | 3.91E+10 | -211.892 | 2146 | 0 |
| | 5.28 | 0.4828 | 1713127 | 19915 | -0.00718 | 1483 | 3.91E+10 | -212.766 | 2327 | 0 |
| | 5.72 | 0.4455 | 1819044 | 18791 | -0.00694 | 1561 | 3.91E+10 | -213.202 | 2527 | 0 |
| | 6.16 | 0.4095 | 1918887 | 17149 | -0.00669 | 1635 | 3.91E+10 | -408.665 | 5269 | 0 |
| | 6.6 | 0.3749 | 2007200 | 14979 | -0.00642 | 1700 | 3.91E+10 | -413.265 | 5821 | 0 |
| | 7.04 | 0.3417 | 2083849 | 12787 | -0.00615 | 1756 | 3.91E+10 | -416.933 | 6443 | 0 |
| | 7.48 | 0.31 | 2148726 | 10579 | -0.00586 | 1804 | 3.91E+10 | -419.662 | 7149 | 0 |
| | 7.92 | 0.2798 | 2201750 | 8358 | -0.00557 | 1843 | 3.91E+10 | -421.436 | 7954 | 0 |
| | 8.36 | 0.2511 | 2242868 | 6131 | -0.00527 | 1874 | 3.91E+10 | -422.235 | 8877 | 0 |
| | 8.8 | 0.2241 | 2272055 | 3902 | -0.00496 | 1895 | 3.91E+10 | -422.035 | 9942 | 0 |
| | 9.24 | 0.1987 | 2289314 | 1677 | -0.00466 | 1908 | 3.91E+10 | -420.807 | 11180 | 0 |
| | 9.68 | 0.175 | 2294678 | -538.999 | -0.00435 | 1912 | 3.91E+10 | -418.514 | 12630 | 0 |
| | 10.12 | 0.1528 | 2288211 | -2740 | -0.00404 | 1907 | 3.91E+10 | -415.116 | 14341 | 0 |
| | 10.56 | 0.1323 | 2270009 | -4920 | -0.00373 | 1894 | 3.91E+10 | -410.563 | 16381 | 0 |
| | 11 | 0.1135 | 2240198 | -7072 | -0.00342 | 1872 | 3.91E+10 | -404.795 | 18838 | 0 |
| | 11.44 | 0.09618 | 2198943 | -9191 | -0.00312 | 1841 | 3.91E+10 | -397.739 | 21835 | 0 |
| | 11.88 | 0.08047 | 2146442 | -11269 | -0.00283 | 1803 | 3.91E+10 | -389.303 | 25544 | 0 |
| | 12.32 | 0.06629 | 2082936 | -13298 | -0.00255 | 1756 | 3.91E+10 | -379.366 | 30217 | 0 |
| | 12.76 | 0.05359 | 2008704 | -15270 | -0.00227 | 1701 | 3.91E+10 | -367.766 | 36232 | 0 |
| | 13.2 | 0.04233 | 1924077 | -17177 | -0.002 | 1639 | 3.91E+10 | -354.277 | 44189 | 0 |
| | 13.64 | 0.03244 | 1829435 | -19006 | -0.00175 | 1569 | 3.91E+10 | -338.562 | 55103 | 0 |
| | 14.08 | 0.02386 | 1725225 | -20744 | -0.00151 | 1492 | 3.91E+10 | -320.084 | 70843 | 0 |
| | 14.52 | 0.0165 | 1611968 | -22376 | -0.00128 | 1409 | 3.91E+10 | -297.907 | 95321 | 0 |
| | 14.96 | 0.0103 | 1490291 | -23876 | -0.00107 | 1319 | 3.91E+10 | -270.134 | 138518 | 0 |
| | 15.4 | 0.00516 | 1360977 | -25201 | -8.82E-04 | 1224 | 3.91E+10 | -231.822 | 237440 | 0 |
| | 15.84 | 9.84E-04 | 1225103 | -26227 | -7.07E-04 | 1124 | 3.91E+10 | -156.971 | 842310 | 0 |
| | 16.28 | -0.00231 | 1084765 | -26123 | -5.51E-04 | 1020 | 3.91E+10 | 196.2763 | 447988 | 0 |
| | 16.72 | -0.00484 | 949822 | -24970 | -4.14E-04 | 920.9046 | 3.91E+10 | 240.7211 | 262773 | 0 |
| | 17.16 | -0.00668 | 821522 | -23632 | -2.94E-04 | 826.3696 | 3.91E+10 | 265.8186 | 210013 | 0 |
| | 17.6 | -0.00794 | 700574 | -22185 | -1.91E-04 | 737.2517 | 3.91E+10 | 282.5416 | 187811 | 0 |
| | 18.04 | -0.0087 | 587453 | -20662 | -1.04E-04 | 653.9009 | 3.91E+10 | 294.1595 | 178449 | 0 |
| | 18.48 | -0.00905 | 482491 | -19088 | -3.21E-05 | 576.5617 | 3.91E+10 | 302.1262 | 176363 | 0 |
| | 18.92 | -0.00904 | 385917 | -17479 | 2.66E-05 | 505.4034 | 3.91E+10 | 307.2193 | 179389 | 0 |
| | 19.36 | -0.00876 | 297881 | -15850 | 7.28E-05 | 440.5355 | 3.91E+10 | 309.9015 | 186692 | 0 |
| | 19.8 | -0.00827 | 218462 | -14212 | 1.08E-04 | 382.0178 | 3.91E+10 | 310.4667 | 198118 | 0 |
| | 20.24 | -0.00763 | 147684 | -12577 | 1.32E-04 | 329.8661 | 3.91E+10 | 309.1092 | 213961 | 0 |
| | 20.68 | -0.00688 | 85512 | -10953 | 1.48E-04 | 284.0563 | 3.91E+10 | 305.9591 | 234926 | 0 |
| | 21.12 | -0.00606 | 31864 | -9350 | 1.56E-04 | 244.5268 | 3.91E+10 | 301.1025 | 262176 | 0 |
| | 21.56 | -0.00523 | -13392 | -7778 | 1.57E-04 | 230.9162 | 3.91E+10 | 294.5926 | 297482 | 0 |
| | 22 | -0.0044 | -50434 | -6244 | 1.53E-04 | 258.2101 | 3.91E+10 | 286.4547 | 343510 | 0 |
| | 22.44 | -0.00361 | -79487 | -4764 | 1.44E-04 | 279.6171 | 3.91E+10 | 273.9471 | 400311 | 0 |
| | 22.88 | -0.00288 | -100897 | -3358 | 1.32E-04 | 295.3926 | 3.91E+10 | 258.8409 | 474498 | 0 |
| | 23.32 | -0.00222 | -115084 | -2034 | 1.17E-04 | 305.8458 | 3.91E+10 | 242.4954 | 576954 | 0 |
| | 23.76 | -0.00164 | -122502 | -800.439 | 1.01E-04 | 311.3117 | 3.91E+10 | 224.8293 | 723744 | 0 |
| | 24.2 | -0.00115 | -123644 | 336.0325 | 8.48E-05 | 312.1528 | 3.91E+10 | 205.6525 | 945351 | 0 |
| | 24.64 | -7.45E-04 | -119043 | 1366 | 6.84E-05 | 308.763 | 3.91E+10 | 184.5452 | 1307568 | 0 |
| | 25.08 | -4.27E-04 | -109289 | 2242 | 5.29E-05 | 301.5761 | 3.91E+10 | 147.1002 | 1820259 | 0 |
| | 25.52 | -1.86E-04 | -95427 | 2799 | 3.91E-05 | 291.3618 | 3.91E+10 | 64.169 | 1820259 | 0 |
| | 25.96 | -1.36E-05 | -79769 | 2981 | 2.73E-05 | 279.8243 | 3.91E+10 | 4.7023 | 1820259 | 0 |
| | 26.4 | 1.02E-04 | -63973 | 2901 | 1.76E-05 | 268.186 | 3.91E+10 | -35.1501 | 1820259 | 0 |
| | 26.84 | 1.72E-04 | -49154 | 2652 | 9.93E-06 | 257.2664 | 3.91E+10 | -59.2721 | 1820259 | 0 |
| | 27.28 | 2.07E-04 | -35983 | 2307 | 4.18E-06 | 247.5618 | 3.91E+10 | -71.3076 | 1820259 | 0 |
| | 27.72 | 2.16E-04 | -24798 | 1922 | 7.63E-08 | 239.3201 | 3.91E+10 | -74.4953 | 1820259 | 0 |
| | 28.16 | 2.08E-04 | -15687 | 1536 | -2.66E-06 | 232.6073 | 3.91E+10 | -71.5855 | 1820259 | 0 |
| | 28.6 | 1.88E-04 | -8571 | 1176 | -4.30E-06 | 227.3641 | 3.91E+10 | -64.8184 | 1820259 | 0 |
| | 29.04 | 1.62E-04 | -3262 | 857.3902 | -5.10E-06 | 223.452 | 3.91E+10 | -55.9437 | 1820259 | 0 |
| | 29.48 | 1.34E-04 | 488.1265 | 587.5541 | -5.28E-06 | 221.4082 | 3.91E+10 | -46.2669 | 1820259 | 0 |
| | 29.92 | 1.06E-04 | 2948 | 368.4944 | -5.05E-06 | 223.2209 | 3.91E+10 | -36.7102 | 1820259 | 0 |
| | 30.36 | 8.09E-05 | 4385 | 197.9805 | -4.56E-06 | 224.2793 | 3.91E+10 | -27.8784 | 1820259 | 0 |
| | 30.8 | 5.84E-05 | 5044 | 71.2519 | -3.92E-06 | 224.7649 | 3.91E+10 | -20.1248 | 1820259 | 0 |
| | 31.24 | 3.95E-05 | 5141 | -17.8116 | -3.23E-06 | 224.8368 | 3.91E+10 | -13.6114 | 1820259 | 0 |
| | 31.68 | 2.43E-05 | 4859 | -75.8218 | -2.56E-06 | 224.6288 | 3.91E+10 | -8.3622 | 1820259 | 0 |
| | 32.12 | 1.25E-05 | 4343 | -109.271 | -1.93E-06 | 224.2488 | 3.91E+10 | -4.3078 | 1820259 | 0 |
| | 32.56 | 3.83E-06 | 3707 | -124.131 | -1.39E-06 | 223.7801 | 3.91E+10 | -1.3213 | 1820259 | 0 |
| | 33 | -2.19E-06 | 3034 | -125.63 | -9.35E-07 | 223.2841 | 3.91E+10 | 0.7535 | 1820259 | 0 |
| | 33.44 | -6.04E-06 | 2382 | -118.144 | -5.69E-07 | 222.8033 | 3.91E+10 | 2.0824 | 1820259 | 0 |
| | 33.88 | -8.20E-06 | 1787 | -105.186 | -2.88E-07 | 222.3652 | 3.91E+10 | 2.8256 | 1820259 | 0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 34.32 | -9.08E-06 | 1271 | -89.465 | -8.11E-08 | 221.9851 | 3.91E+10 | 3.1295 | 1820259 | 0 |
| 34.76 | -9.05E-06 | 842.3231 | -72.9645 | 6.17E-08 | 221.6692 | 3.91E+10 | 3.1207 | 1820259 | 0 |
| 35.2 | -8.43E-06 | 500.5084 | -57.0568 | 1.52E-07 | 221.4173 | 3.91E+10 | 2.9049 | 1820259 | 0 |
| 35.64 | -7.44E-06 | 239.6425 | -42.6135 | 2.02E-07 | 221.2251 | 3.91E+10 | 2.566 | 1820259 | 0 |
| 36.08 | -6.29E-06 | 50.2959 | -30.1152 | 2.22E-07 | 221.0856 | 3.91E+10 | 2.1682 | 1820259 | 0 |
| 36.52 | -5.10E-06 | -78.6083 | -19.75 | 2.20E-07 | 221.1065 | 3.91E+10 | 1.758 | 1820259 | 0 |
| 36.96 | -3.97E-06 | -158.497 | -11.4996 | 2.04E-07 | 221.1653 | 3.91E+10 | 1.3671 | 1820259 | 0 |
| 37.4 | -2.94E-06 | -200.26 | -5.2101 | 1.80E-07 | 221.1961 | 3.91E+10 | 1.0153 | 1820259 | 0 |
| 37.84 | -2.07E-06 | -213.705 | -0.6485 | 1.52E-07 | 221.206 | 3.91E+10 | 0.7126 | 1820259 | 0 |
| 38.28 | -1.34E-06 | -207.268 | 2.4539 | 1.23E-07 | 221.2013 | 3.91E+10 | 0.4625 | 1820259 | 0 |
| 38.72 | -7.64E-07 | -187.922 | 4.3702 | 9.67E-08 | 221.187 | 3.91E+10 | 0.2634 | 1820259 | 0 |
| 39.16 | -3.20E-07 | -161.22 | 5.3572 | 7.31E-08 | 221.1673 | 3.91E+10 | 0.1105 | 1820259 | 0 |
| 39.6 | 8.20E-09 | -131.428 | 5.6413 | 5.34E-08 | 221.1454 | 3.91E+10 | -0.00283 | 1820259 | 0 |
| 40.04 | 2.43E-07 | -101.704 | 5.4126 | 3.76E-08 | 221.1235 | 3.91E+10 | -0.08379 | 1820259 | 0 |
| 40.48 | 4.05E-07 | -74.3099 | 4.8225 | 2.57E-08 | 221.1033 | 3.91E+10 | -0.1397 | 1820259 | 0 |
| 40.92 | 5.15E-07 | -50.8061 | 3.9851 | 1.73E-08 | 221.086 | 3.91E+10 | -0.1774 | 1820259 | 0 |
| 41.36 | 5.88E-07 | -32.2452 | 2.9818 | 1.17E-08 | 221.0723 | 3.91E+10 | -0.2026 | 1820259 | 0 |
| 41.8 | 6.38E-07 | -19.331 | 1.8663 | 8.18E-09 | 221.0628 | 3.91E+10 | -0.2199 | 1820259 | 0 |
| 42.24 | 6.74E-07 | -12.5457 | 1.1539 | 6.03E-09 | 221.0578 | 3.91E+10 | -0.04996 | 391296 | 0 |
| 42.68 | 7.01E-07 | -7.1522 | 0.8833 | 4.70E-09 | 221.0538 | 3.91E+10 | -0.05253 | 395372 | 0 |
| 43.12 | 7.24E-07 | -3.2226 | 0.6001 | 3.99E-09 | 221.0509 | 3.91E+10 | -0.05475 | 399448 | 0 |
| 43.56 | 7.44E-07 | -0.8191 | 0.3055 | 3.72E-09 | 221.0491 | 3.91E+10 | -0.05683 | 403524 | 0 |
| 44 | 7.63E-07 | 0 | 0 | 3.67E-09 | 221.0485 | 3.91E+10 | -0.0589 | 203800 | 0 |

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 4:00

Pile-head deflection = 1 inches
Computed slope at pile head = -0.00867 radians
Maximum bending moment = 2294678 inch-lbs
Maximum shear force = 31810 lbs
Depth of maximum bending moment = 9.68 feet below pile head
Depth of maximum shear force = 0 feet below pile head
Number of iterations = 20
Number of zero deflection points = 4

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Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 5

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Pile-head conditions are Displacem and Pile-head Rotation (Loading Type 5)
Displacem of pile head = 0.25 inches
Rotation of pile head = 0.00E+00 radians
Axial load on pile head = 100000 lbs

| Depth X feet | Deflect. y inches | Bending Moment in-lbs | Shear Force lbs | Slope S radians | Total Stress psi* | Bending Stiffness in-lb^2 | Soil p lb/inch | Res. Es*h lb/inch | Soil Lat. lb/inch | Spr. Load | Distrib. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.25 | -2201452 | 33478 | 0 | 1843 | 3.91E+10 | -93.3626 | 985.909 | 0 | | |
| 0.44 | 0.2492 | -2026009 | 32949 | -2.86E-04 | 1714 | 3.91E+10 | -99.9674 | 2118 | 0 | | |
| 0.88 | 0.247 | -1853209 | 32404 | -5.48E-04 | 1587 | 3.91E+10 | -106.351 | 2274 | 0 | | |
| 1.32 | 0.2434 | -1683241 | 31827 | -7.86E-04 | 1461 | 3.91E+10 | -112.489 | 2440 | 0 | | |
| 1.76 | 0.2387 | -1516289 | 31217 | -0.001 | 1338 | 3.91E+10 | -118.359 | 2618 | 0 | | |
| 2.2 | 0.2328 | -1352529 | 30577 | -0.0012 | 1218 | 3.91E+10 | -123.939 | 2810 | 0 | | |
| 2.64 | 0.226 | -1192128 | 29909 | -0.00137 | 1099 | 3.91E+10 | -129.209 | 3018 | 0 | | |
| 3.08 | 0.2184 | -1035244 | 29214 | -0.00152 | 983.8455 | 3.91E+10 | -134.15 | 3243 | 0 | | |
| 3.52 | 0.21 | -882025 | 28493 | -0.00165 | 870.9499 | 3.91E+10 | -138.741 | 3488 | 0 | | |
| 3.96 | 0.201 | -732612 | 27750 | -0.00176 | 760.858 | 3.91E+10 | -142.965 | 3756 | 0 | | |
| 4.4 | 0.1915 | -587132 | 26985 | -0.00185 | 653.6643 | 3.91E+10 | -146.806 | 4049 | 0 | | |
| 4.84 | 0.1815 | -445703 | 26204 | -0.00192 | 549.4553 | 3.91E+10 | -149.059 | 4336 | 0 | | |
| 5.28 | 0.1712 | -308398 | 25413 | -0.00197 | 448.2849 | 3.91E+10 | -150.6 | 4644 | 0 | | |
| 5.72 | 0.1607 | -175269 | 24614 | -0.002 | 350.1918 | 3.91E+10 | -151.774 | 4986 | 0 | | |
| 6.16 | 0.1501 | -46359 | 23374 | -0.00201 | 255.2071 | 3.91E+10 | -317.98 | 11185 | 0 | | |
| 6.6 | 0.1395 | 73690 | 21683 | -0.00201 | 275.3452 | 3.91E+10 | -322.748 | 12220 | 0 | | |
| 7.04 | 0.1289 | 184735 | 19968 | -0.002 | 357.1669 | 3.91E+10 | -326.73 | 13389 | 0 | | |
| 7.48 | 0.1184 | 286659 | 18235 | -0.00196 | 432.2673 | 3.91E+10 | -329.914 | 14715 | 0 | | |
| 7.92 | 0.1081 | 379365 | 16486 | -0.00192 | 500.5756 | 3.91E+10 | -332.286 | 16228 | 0 | | |
| 8.36 | 0.09812 | 462780 | 14728 | -0.00186 | 562.0384 | 3.91E+10 | -333.827 | 17963 | 0 | | |
| 8.8 | 0.08846 | 536856 | 12963 | -0.00179 | 616.6195 | 3.91E+10 | -334.516 | 19967 | 0 | | |
| 9.24 | 0.07918 | 601568 | 11198 | -0.00172 | 664.3008 | 3.91E+10 | -334.33 | 22295 | 0 | | |
| 9.68 | 0.07032 | 656916 | 9435 | -0.00163 | 705.0829 | 3.91E+10 | -333.243 | 25020 | 0 | | |
| 10.12 | 0.06194 | 702927 | 7681 | -0.00154 | 738.9851 | 3.91E+10 | -331.223 | 28234 | 0 | | |
| 10.56 | 0.05406 | 739654 | 5940 | -0.00144 | 766.0466 | 3.91E+10 | -328.239 | 32060 | 0 | | |
| 11 | 0.0467 | 767177 | 4217 | -0.00134 | 786.3266 | 3.91E+10 | -324.25 | 36658 | 0 | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 11.44 | 0.0399 | 785606 | 2519 | -0.00124 | 799.9056 | 3.91E+10 | -319.214 | 42246 | 0 |
| 11.88 | 0.03365 | 795080 | 849.4558 | -0.00113 | 806.8863 | 3.91E+10 | -313.076 | 49127 | 0 |
| 12.32 | 0.02797 | 795769 | -784.302 | -0.00102 | 807.394 | 3.91E+10 | -305.772 | 57725 | 0 |
| 12.76 | 0.02286 | 787877 | -2376 | -9.15E-04 | 801.5789 | 3.91E+10 | -297.223 | 68663 | 0 |
| 13.2 | 0.0183 | 771643 | -3919 | -8.10E-04 | 789.617 | 3.91E+10 | -287.322 | 82877 | 0 |
| 13.64 | 0.0143 | 747343 | -5406 | -7.07E-04 | 771.7125 | 3.91E+10 | -275.926 | 101847 | 0 |
| 14.08 | 0.01084 | 715298 | -6829 | -6.08E-04 | 748.1007 | 3.91E+10 | -262.826 | 128050 | 0 |
| 14.52 | 0.00788 | 675875 | -8176 | -5.14E-04 | 719.0525 | 3.91E+10 | -247.698 | 165965 | 0 |
| 14.96 | 0.00541 | 629498 | -9438 | -4.26E-04 | 684.8806 | 3.91E+10 | -229.988 | 224658 | 0 |
| 15.4 | 0.00338 | 576665 | -10595 | -3.45E-04 | 645.9514 | 3.91E+10 | -208.613 | 325955 | 0 |
| 15.84 | 0.00176 | 517974 | -11624 | -2.71E-04 | 602.7066 | 3.91E+10 | -180.945 | 541448 | 0 |
| 16.28 | 5.19E-04 | 454202 | -12462 | -2.05E-04 | 555.7177 | 3.91E+10 | -136.536 | 1388413 | 0 |
| 16.72 | -4.02E-04 | 386592 | -12523 | -1.48E-04 | 505.9003 | 3.91E+10 | 113.3121 | 1487981 | 0 |
| 17.16 | -0.00105 | 322112 | -11784 | -1.01E-04 | 458.3901 | 3.91E+10 | 166.8063 | 840672 | 0 |
| 17.6 | -0.00146 | 262260 | -10856 | -6.10E-05 | 414.2895 | 3.91E+10 | 184.7874 | 666679 | 0 |
| 18.04 | -0.00169 | 207541 | -9853 | -2.93E-05 | 373.971 | 3.91E+10 | 195.0617 | 608609 | 0 |
| 18.48 | -0.00177 | 158246 | -8808 | -4.60E-06 | 337.6484 | 3.91E+10 | 200.7847 | 597935 | 0 |
| 18.92 | -0.00174 | 114536 | -7741 | 1.38E-05 | 305.4419 | 3.91E+10 | 203.2682 | 616501 | 0 |
| 19.36 | -0.00163 | 76485 | -6668 | 2.67E-05 | 277.4049 | 3.91E+10 | 203.1906 | 659374 | 0 |
| 19.8 | -0.00146 | 44093 | -5601 | 3.49E-05 | 253.5377 | 3.91E+10 | 200.9479 | 727364 | 0 |
| 20.24 | -0.00126 | 17300 | -4551 | 3.90E-05 | 233.7959 | 3.91E+10 | 196.7894 | 825376 | 0 |
| 20.68 | -0.00105 | -4008 | -3528 | 3.99E-05 | 224.0014 | 3.91E+10 | 190.8787 | 962854 | 0 |
| 21.12 | -8.37E-04 | -19994 | -2540 | 3.83E-05 | 235.7805 | 3.91E+10 | 183.3224 | 1155861 | 0 |
| 21.56 | -6.42E-04 | -30868 | -1596 | 3.49E-05 | 243.7928 | 3.91E+10 | 174.1801 | 1431659 | 0 |
| 22 | -4.69E-04 | -36884 | -710.984 | 3.03E-05 | 248.2256 | 3.91E+10 | 161.0344 | 1811541 | 0 |
| 22.44 | -3.23E-04 | -38408 | 7.7934 | 2.52E-05 | 249.3485 | 3.91E+10 | 111.2298 | 1820259 | 0 |
| 22.88 | -2.03E-04 | -36828 | 486.4886 | 2.01E-05 | 248.1845 | 3.91E+10 | 70.0942 | 1820259 | 0 |
| 23.32 | -1.10E-04 | -33292 | 771.895 | 1.54E-05 | 245.5788 | 3.91E+10 | 38.0143 | 1820259 | 0 |
| 23.76 | -4.10E-05 | -28693 | 909.5309 | 1.12E-05 | 242.1904 | 3.91E+10 | 14.1205 | 1820259 | 0 |
| 24.2 | 7.88E-06 | -23699 | 939.6337 | 7.65E-06 | 238.5105 | 3.91E+10 | -2.7179 | 1820259 | 0 |
| 24.64 | 3.98E-05 | -18779 | 896.2135 | 4.78E-06 | 234.8852 | 3.91E+10 | -13.7291 | 1820259 | 0 |
| 25.08 | 5.84E-05 | -14240 | 806.8447 | 2.55E-06 | 231.5409 | 3.91E+10 | -20.1227 | 1820259 | 0 |
| 25.52 | 6.68E-05 | -10261 | 692.9613 | 8.96E-07 | 228.6092 | 3.91E+10 | -23.0149 | 1820259 | 0 |
| 25.96 | 6.78E-05 | -6923 | 570.468 | -2.65E-07 | 226.1497 | 3.91E+10 | -23.384 | 1820259 | 0 |
| 26.4 | 6.40E-05 | -4237 | 450.52 | -1.02E-06 | 224.1702 | 3.91E+10 | -22.0508 | 1820259 | 0 |
| 26.84 | 5.71E-05 | -2165 | 340.3616 | -1.45E-06 | 222.6435 | 3.91E+10 | -19.6758 | 1820259 | 0 |
| 27.28 | 4.86E-05 | -640.902 | 244.1483 | -1.64E-06 | 221.5208 | 3.91E+10 | -16.7686 | 1820259 | 0 |
| 27.72 | 3.98E-05 | 415.3489 | 163.7012 | -1.66E-06 | 221.3546 | 3.91E+10 | -13.7038 | 1820259 | 0 |
| 28.16 | 3.12E-05 | 1090 | 99.1667 | -1.55E-06 | 221.8513 | 3.91E+10 | -10.7411 | 1820259 | 0 |
| 28.6 | 2.33E-05 | 1464 | 49.568 | -1.38E-06 | 222.1274 | 3.91E+10 | -8.0463 | 1820259 | 0 |
| 29.04 | 1.66E-05 | 1614 | 13.2473 | -1.17E-06 | 222.2381 | 3.91E+10 | -5.7115 | 1820259 | 0 |
| 29.48 | 1.09E-05 | 1605 | -11.7939 | -9.56E-07 | 222.2314 | 3.91E+10 | -3.7738 | 1820259 | 0 |
| 29.92 | 6.47E-06 | 1491 | -27.6458 | -7.47E-07 | 222.1471 | 3.91E+10 | -2.2307 | 1820259 | 0 |
| 30.36 | 3.06E-06 | 1314 | -36.3181 | -5.58E-07 | 222.0169 | 3.91E+10 | -1.0543 | 1820259 | 0 |
| 30.8 | 5.83E-07 | 1108 | -39.6318 | -3.94E-07 | 221.8649 | 3.91E+10 | -0.2009 | 1820259 | 0 |
| 31.24 | -1.10E-06 | 896.0755 | -39.1592 | -2.59E-07 | 221.7088 | 3.91E+10 | 0.3799 | 1820259 | 0 |
| 31.68 | -2.15E-06 | 694.7153 | -36.2013 | -1.51E-07 | 221.5604 | 3.91E+10 | 0.7405 | 1820259 | 0 |
| 32.12 | -2.70E-06 | 513.9489 | -31.7908 | -6.95E-08 | 221.4272 | 3.91E+10 | 0.9302 | 1820259 | 0 |
| 32.56 | -2.88E-06 | 359.0782 | -26.7121 | -1.05E-08 | 221.3131 | 3.91E+10 | 0.9935 | 1820259 | 0 |
| 33 | -2.81E-06 | 231.88 | -21.5321 | 2.94E-08 | 221.2194 | 3.91E+10 | 0.9686 | 1820259 | 0 |
| 33.44 | -2.57E-06 | 131.668 | -16.6344 | 5.39E-08 | 221.1455 | 3.91E+10 | 0.8866 | 1820259 | 0 |
| 33.88 | -2.24E-06 | 56.1641 | -12.2549 | 6.66E-08 | 221.0899 | 3.91E+10 | 0.7723 | 1820259 | 0 |
| 34.32 | -1.87E-06 | 2.1859 | -8.5156 | 7.06E-08 | 221.0501 | 3.91E+10 | 0.6441 | 1820259 | 0 |
| 34.76 | -1.50E-06 | -33.8354 | -5.4544 | 6.84E-08 | 221.0735 | 3.91E+10 | 0.5154 | 1820259 | 0 |
| 35.2 | -1.15E-06 | -55.485 | -3.0507 | 6.24E-08 | 221.0894 | 3.91E+10 | 0.3951 | 1820259 | 0 |
| 35.64 | -8.36E-07 | -66.1171 | -1.2466 | 5.42E-08 | 221.0972 | 3.91E+10 | 0.2883 | 1820259 | 0 |
| 36.08 | -5.74E-07 | -68.7064 | 0.03691 | 4.51E-08 | 221.0992 | 3.91E+10 | 0.1979 | 1820259 | 0 |
| 36.52 | -3.60E-07 | -65.7749 | 0.8873 | 3.60E-08 | 221.097 | 3.91E+10 | 0.1243 | 1820259 | 0 |
| 36.96 | -1.94E-07 | -59.374 | 1.392 | 2.75E-08 | 221.0923 | 3.91E+10 | 0.06688 | 1820259 | 0 |
| 37.4 | -6.98E-08 | -51.1045 | 1.6321 | 2.01E-08 | 221.0862 | 3.91E+10 | 0.02407 | 1820259 | 0 |
| 37.84 | 1.79E-08 | -42.1603 | 1.6794 | 1.38E-08 | 221.0796 | 3.91E+10 | -0.00617 | 1820259 | 0 |
| 38.28 | 7.55E-08 | -33.385 | 1.5943 | 8.66E-09 | 221.0731 | 3.91E+10 | -0.02604 | 1820259 | 0 |
| 38.72 | 1.09E-07 | -25.3331 | 1.4261 | 4.70E-09 | 221.0672 | 3.91E+10 | -0.0377 | 1820259 | 0 |
| 39.16 | 1.25E-07 | -18.3305 | 1.2127 | 1.75E-09 | 221.062 | 3.91E+10 | -0.04313 | 1820259 | 0 |
| 39.6 | 1.28E-07 | -12.5291 | 0.9825 | -3.38E-10 | 221.0578 | 3.91E+10 | -0.04406 | 1820259 | 0 |
| 40.04 | 1.22E-07 | -7.955 | 0.7556 | -1.72E-09 | 221.0544 | 3.91E+10 | -0.0419 | 1820259 | 0 |
| 40.48 | 1.10E-07 | -4.5486 | 0.5452 | -2.57E-09 | 221.0519 | 3.91E+10 | -0.03779 | 1820259 | 0 |
| 40.92 | 9.45E-08 | -2.1954 | 0.3594 | -3.02E-09 | 221.0501 | 3.91E+10 | -0.03256 | 1820259 | 0 |
| 41.36 | 7.77E-08 | -0.7498 | 0.2027 | -3.22E-09 | 221.0491 | 3.91E+10 | -0.02679 | 1820259 | 0 |
| 41.8 | 6.04E-08 | -0.05117 | 0.07698 | -3.27E-09 | 221.0486 | 3.91E+10 | -0.02084 | 1820259 | 0 |
| 42.24 | 4.31E-08 | 0.06653 | 0.01352 | -3.27E-09 | 221.0486 | 3.91E+10 | -0.0032 | 391296 | 0 |
| 42.68 | 2.59E-08 | 0.09509 | -3.41E-05 | -3.26E-09 | 221.0486 | 3.91E+10 | -0.00194 | 395372 | 0 |
| 43.12 | 8.69E-09 | 0.06962 | -0.00689 | -3.25E-09 | 221.0486 | 3.91E+10 | -6.57E-04 | 399448 | 0 |
| 43.56 | -8.45E-09 | 0.02581 | -0.00692 | -3.24E-09 | 221.0486 | 3.91E+10 | 6.46E-04 | 403524 | 0 |
| 44 | -2.56E-08 | 0 | 0 | -3.24E-09 | 221.0485 | 3.91E+10 | 0.00197 | 203800 | 0 |

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 5:00

Pile-head deflection = 0.25 inches
Computed slope at pile head = 0 radians
Maximum bending moment = -2201452 inch-lbs
Maximum shear force = 33478 lbs
Depth of maximum bending moment = 0 feet below pile head
Depth of maximum shear force = 0 feet below pile head
Number of iterations = 15
Number of zero deflection points = 5

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Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 6

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Pile-head conditions are Displacem and Pile-head Rotation (Loading Type 5)
Displacem of pile head = 0.5 inches
Rotation of pile head = 0.00E+00 radians
Axial load on pile head = 100000 lbs

| Depth X feet | Deflect. y inches | Bending Moment in-lbs | Shear Force lbs | Slope S radians | Total Stress psi* | Bending Stiffness in-lb^2 | Soil p lb/inch | Res. Es*h lb/inch | Soil Lat. lb/inch | Spr. Load | Distrib. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.5 | -3573167 | 49035 | 0 | 2854 | 3.91E+10 | -117.63 | 621.0838 | 0 | | |
| 0.44 | 0.4987 | -3315899 | 48368 | -4.65E-04 | 2664 | 3.91E+10 | -125.976 | 1334 | 0 | | |
| 0.88 | 0.4951 | -3061907 | 47682 | -8.96E-04 | 2477 | 3.91E+10 | -134.095 | 1430 | 0 | | |
| 1.32 | 0.4893 | -2811434 | 46953 | -0.00129 | 2293 | 3.91E+10 | -141.96 | 1532 | 0 | | |
| 1.76 | 0.4814 | -2564719 | 46183 | -0.00166 | 2111 | 3.91E+10 | -149.546 | 1640 | 0 | | |
| 2.2 | 0.4718 | -2321990 | 45375 | -0.00199 | 1932 | 3.91E+10 | -156.831 | 1755 | 0 | | |
| 2.64 | 0.4605 | -2083467 | 44528 | -0.00228 | 1756 | 3.91E+10 | -163.792 | 1878 | 0 | | |
| 3.08 | 0.4477 | -1849362 | 43646 | -0.00255 | 1584 | 3.91E+10 | -170.408 | 2010 | 0 | | |
| 3.52 | 0.4335 | -1619876 | 42730 | -0.00278 | 1415 | 3.91E+10 | -176.658 | 2151 | 0 | | |
| 3.96 | 0.4183 | -1395199 | 41781 | -0.00299 | 1249 | 3.91E+10 | -182.524 | 2304 | 0 | | |
| 4.4 | 0.402 | -1175511 | 40803 | -0.00316 | 1087 | 3.91E+10 | -187.987 | 2469 | 0 | | |
| 4.84 | 0.3849 | -960980 | 39801 | -0.00331 | 929.1259 | 3.91E+10 | -191.504 | 2627 | 0 | | |
| 5.28 | 0.3671 | -751719 | 38783 | -0.00342 | 774.9367 | 3.91E+10 | -194.191 | 2793 | 0 | | |
| 5.72 | 0.3488 | -547819 | 37752 | -0.00351 | 624.6969 | 3.91E+10 | -196.491 | 2975 | 0 | | |
| 6.16 | 0.33 | -349357 | 36211 | -0.00357 | 478.4647 | 3.91E+10 | -387.205 | 6194 | 0 | | |
| 6.6 | 0.3111 | -161665 | 34147 | -0.0036 | 340.1678 | 3.91E+10 | -394.43 | 6695 | 0 | | |
| 7.04 | 0.292 | 15043 | 32048 | -0.00361 | 232.1323 | 3.91E+10 | -400.871 | 7249 | 0 | | |
| 7.48 | 0.2729 | 180573 | 29916 | -0.0036 | 354.1001 | 3.91E+10 | -406.52 | 7865 | 0 | | |
| 7.92 | 0.254 | 334758 | 27757 | -0.00357 | 467.7079 | 3.91E+10 | -411.365 | 8552 | 0 | | |
| 8.36 | 0.2353 | 477451 | 25574 | -0.00351 | 572.8479 | 3.91E+10 | -415.394 | 9322 | 0 | | |
| 8.8 | 0.2169 | 608529 | 23372 | -0.00344 | 669.43 | 3.91E+10 | -418.588 | 10190 | 0 | | |
| 9.24 | 0.199 | 727894 | 21156 | -0.00335 | 757.3816 | 3.91E+10 | -420.93 | 11170 | 0 | | |
| 9.68 | 0.1816 | 835473 | 18930 | -0.00324 | 836.6485 | 3.91E+10 | -422.397 | 12284 | 0 | | |
| 10.12 | 0.1647 | 931216 | 16698 | -0.00312 | 907.1947 | 3.91E+10 | -422.968 | 13556 | 0 | | |
| 10.56 | 0.1486 | 1015101 | 14466 | -0.00299 | 969.0035 | 3.91E+10 | -422.617 | 15017 | 0 | | |
| 11 | 0.1332 | 1087131 | 12238 | -0.00285 | 1022 | 3.91E+10 | -421.316 | 16706 | 0 | | |
| 11.44 | 0.1185 | 1147339 | 10019 | -0.0027 | 1066 | 3.91E+10 | -419.035 | 18670 | 0 | | |
| 11.88 | 0.1047 | 1195782 | 7815 | -0.00254 | 1102 | 3.91E+10 | -415.74 | 20971 | 0 | | |
| 12.32 | 0.09169 | 1232551 | 5632 | -0.00238 | 1129 | 3.91E+10 | -411.395 | 23690 | 0 | | |
| 12.76 | 0.07959 | 1257762 | 3474 | -0.00221 | 1148 | 3.91E+10 | -405.954 | 26932 | 0 | | |
| 13.2 | 0.06838 | 1271566 | 1348 | -0.00204 | 1158 | 3.91E+10 | -399.37 | 30837 | 0 | | |
| 13.64 | 0.05808 | 1274146 | -740.248 | -0.00186 | 1160 | 3.91E+10 | -391.583 | 35597 | 0 | | |
| 14.08 | 0.04869 | 1265718 | -2784 | -0.00169 | 1154 | 3.91E+10 | -382.52 | 41479 | 0 | | |
| 14.52 | 0.0402 | 1246536 | -4776 | -0.00152 | 1140 | 3.91E+10 | -372.093 | 48866 | 0 | | |
| 14.96 | 0.03261 | 1216891 | -6709 | -0.00136 | 1118 | 3.91E+10 | -360.184 | 58324 | 0 | | |
| 15.4 | 0.02588 | 1177119 | -8575 | -0.0012 | 1088 | 3.91E+10 | -346.635 | 70729 | 0 | | |
| 15.84 | 0.01999 | 1127599 | -10365 | -0.00104 | 1052 | 3.91E+10 | -331.221 | 87504 | 0 | | |
| 16.28 | 0.0149 | 1068764 | -12067 | -8.91E-04 | 1009 | 3.91E+10 | -313.599 | 111132 | 0 | | |
| 16.72 | 0.01058 | 1001111 | -13669 | -7.51E-04 | 958.6954 | 3.91E+10 | -293.203 | 146389 | 0 | | |
| 17.16 | 0.00697 | 925212 | -15153 | -6.21E-04 | 902.771 | 3.91E+10 | -268.991 | 203908 | 0 | | |
| 17.6 | 0.00402 | 841748 | -16494 | -5.02E-04 | 841.2725 | 3.91E+10 | -238.674 | 313864 | 0 | | |
| 18.04 | 0.00167 | 751570 | -17639 | -3.94E-04 | 774.827 | 3.91E+10 | -195.198 | 618884 | 0 | | |
| 18.48 | -1.48E-04 | 655897 | -18036 | -2.99E-04 | 704.3324 | 3.91E+10 | 44.8548 | 1595947 | 0 | | |
| 18.92 | -0.00149 | 561428 | -17402 | -2.17E-04 | 634.7246 | 3.91E+10 | 195.4053 | 690449 | 0 | | |
| 19.36 | -0.00244 | 472366 | -16292 | -1.47E-04 | 569.1013 | 3.91E+10 | 224.8148 | 486530 | 0 | | |
| 19.8 | -0.00305 | 389538 | -15061 | -8.89E-05 | 508.0712 | 3.91E+10 | 241.6606 | 418580 | 0 | | |
| 20.24 | -0.00338 | 313419 | -13757 | -4.15E-05 | 451.9848 | 3.91E+10 | 251.9912 | 393755 | 0 | | |
| 20.68 | -0.00349 | 244303 | -12411 | -3.80E-06 | 401.0581 | 3.91E+10 | 258.0014 | 390753 | 0 | | |
| 21.12 | -0.00342 | 182363 | -11042 | 2.50E-05 | 355.4184 | 3.91E+10 | 260.7536 | 402669 | 0 | | |
| 21.56 | -0.00322 | 127678 | -9665 | 4.60E-05 | 315.1254 | 3.91E+10 | 260.8446 | 427457 | 0 | | |
| 22 | -0.00293 | 80257 | -8293 | 6.00E-05 | 280.1839 | 3.91E+10 | 258.6401 | 465483 | 0 | | |
| 22.44 | -0.00259 | 40040 | -6945 | 6.81E-05 | 250.551 | 3.91E+10 | 251.8558 | 513772 | 0 | | |
| 22.88 | -0.00221 | 6841 | -5641 | 7.13E-05 | 226.0895 | 3.91E+10 | 242.1978 | 577524 | 0 | | |
| 23.32 | -0.00184 | -19605 | -4392 | 7.04E-05 | 235.4942 | 3.91E+10 | 231.0716 | 664740 | 0 | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 23.76 | -0.00147 | -39609 | -3205 | 6.64E-05 | 250.2333 | 3.91E+10 | 218.5846 | 784865 | 0 |
| 24.2 | -0.00113 | -53515 | -2087 | 6.01E-05 | 260.4803 | 3.91E+10 | 204.7931 | 953690 | 0 |
| 24.64 | -8.35E-04 | -61709 | -1045 | 5.24E-05 | 266.5176 | 3.91E+10 | 189.691 | 1199021 | 0 |
| 25.08 | -5.81E-04 | -64610 | -87.4482 | 4.38E-05 | 268.6551 | 3.91E+10 | 173.1681 | 1574139 | 0 |
| 25.52 | -3.72E-04 | -62679 | 708.6908 | 3.52E-05 | 267.2321 | 3.91E+10 | 128.3997 | 1820259 | 0 |
| 25.96 | -2.09E-04 | -57164 | 1238 | 2.71E-05 | 263.1683 | 3.91E+10 | 71.9682 | 1820259 | 0 |
| 26.4 | -8.58E-05 | -49638 | 1506 | 1.99E-05 | 257.6231 | 3.91E+10 | 29.5926 | 1820259 | 0 |
| 26.84 | 1.67E-06 | -41284 | 1582 | 1.38E-05 | 251.4674 | 3.91E+10 | -0.5774 | 1820259 | 0 |
| 27.28 | 5.97E-05 | -32942 | 1526 | 8.77E-06 | 245.3215 | 3.91E+10 | -20.5963 | 1820259 | 0 |
| 27.72 | 9.43E-05 | -25173 | 1386 | 4.85E-06 | 239.5968 | 3.91E+10 | -32.5149 | 1820259 | 0 |
| 28.16 | 1.11E-04 | -18309 | 1199 | 1.91E-06 | 234.5388 | 3.91E+10 | -38.2437 | 1820259 | 0 |
| 28.6 | 1.14E-04 | -12509 | 994.3015 | -1.71E-07 | 230.2654 | 3.91E+10 | -39.4706 | 1820259 | 0 |
| 29.04 | 1.09E-04 | -7809 | 790.7777 | -1.54E-06 | 226.8021 | 3.91E+10 | -37.6217 | 1820259 | 0 |
| 29.48 | 9.82E-05 | -4157 | 602.0849 | -2.35E-06 | 224.1112 | 3.91E+10 | -33.8528 | 1820259 | 0 |
| 29.92 | 8.43E-05 | -1448 | 435.9903 | -2.73E-06 | 222.1155 | 3.91E+10 | -29.0618 | 1820259 | 0 |
| 30.36 | 6.94E-05 | 450.3634 | 296.1322 | -2.80E-06 | 221.3804 | 3.91E+10 | -23.9147 | 1820259 | 0 |
| 30.8 | 5.48E-05 | 1682 | 183.1582 | -2.65E-06 | 222.2879 | 3.91E+10 | -18.8784 | 1820259 | 0 |
| 31.24 | 4.14E-05 | 2387 | 95.6842 | -2.38E-06 | 222.8076 | 3.91E+10 | -14.2557 | 1820259 | 0 |
| 31.68 | 2.96E-05 | 2695 | 31.0683 | -2.04E-06 | 223.0343 | 3.91E+10 | -10.22 | 1820259 | 0 |
| 32.12 | 1.99E-05 | 2718 | -13.9884 | -1.67E-06 | 223.0509 | 3.91E+10 | -6.847 | 1820259 | 0 |
| 32.56 | 1.20E-05 | 2549 | -42.9996 | -1.31E-06 | 222.9267 | 3.91E+10 | -4.1421 | 1820259 | 0 |
| 33 | 5.99E-06 | 2265 | -59.3841 | -9.89E-07 | 222.7173 | 3.91E+10 | -2.0641 | 1820259 | 0 |
| 33.44 | 1.58E-06 | 1923 | -66.2668 | -7.06E-07 | 222.4654 | 3.91E+10 | -0.543 | 1820259 | 0 |
| 33.88 | -1.47E-06 | 1566 | -66.3663 | -4.70E-07 | 222.2023 | 3.91E+10 | 0.5053 | 1820259 | 0 |
| 34.32 | -3.39E-06 | 1223 | -61.9472 | -2.82E-07 | 221.9494 | 3.91E+10 | 1.1686 | 1820259 | 0 |
| 34.76 | -4.44E-06 | 911.9606 | -54.8198 | -1.38E-07 | 221.7205 | 3.91E+10 | 1.5312 | 1820259 | 0 |
| 35.2 | -4.84E-06 | 643.896 | -46.3697 | -3.25E-08 | 221.523 | 3.91E+10 | 1.6696 | 1820259 | 0 |
| 35.64 | -4.79E-06 | 422.3312 | -37.6069 | 3.95E-08 | 221.3597 | 3.91E+10 | 1.6497 | 1820259 | 0 |
| 36.08 | -4.43E-06 | 246.726 | -29.2235 | 8.47E-08 | 221.2303 | 3.91E+10 | 1.5259 | 1820259 | 0 |
| 36.52 | -3.89E-06 | 113.6419 | -21.6538 | 1.09E-07 | 221.1323 | 3.91E+10 | 1.3414 | 1820259 | 0 |
| 36.96 | -3.27E-06 | 17.9462 | -15.1319 | 1.18E-07 | 221.0618 | 3.91E+10 | 1.129 | 1820259 | 0 |
| 37.4 | -2.65E-06 | -46.2756 | -9.7431 | 1.16E-07 | 221.0826 | 3.91E+10 | 0.9122 | 1820259 | 0 |
| 37.84 | -2.05E-06 | -85.0633 | -5.469 | 1.07E-07 | 221.1112 | 3.91E+10 | 0.7068 | 1820259 | 0 |
| 38.28 | -1.51E-06 | -104.141 | -2.2243 | 9.43E-08 | 221.1253 | 3.91E+10 | 0.5223 | 1820259 | 0 |
| 38.72 | -1.05E-06 | -108.652 | 0.1137 | 8.00E-08 | 221.1286 | 3.91E+10 | 0.3633 | 1820259 | 0 |
| 39.16 | -6.71E-07 | -103.026 | 1.6832 | 6.57E-08 | 221.1244 | 3.91E+10 | 0.2312 | 1820259 | 0 |
| 39.6 | -3.61E-07 | -90.9473 | 2.6216 | 5.26E-08 | 221.1155 | 3.91E+10 | 0.1243 | 1820259 | 0 |
| 40.04 | -1.15E-07 | -75.3973 | 3.0548 | 4.13E-08 | 221.1041 | 3.91E+10 | 0.0398 | 1820259 | 0 |
| 40.48 | 7.59E-08 | -58.7324 | 3.0908 | 3.23E-08 | 221.0918 | 3.91E+10 | -0.02615 | 1820259 | 0 |
| 40.92 | 2.25E-07 | -42.7924 | 2.8167 | 2.54E-08 | 221.0801 | 3.91E+10 | -0.07767 | 1820259 | 0 |
| 41.36 | 3.44E-07 | -29.0146 | 2.2984 | 2.06E-08 | 221.0699 | 3.91E+10 | -0.1187 | 1820259 | 0 |
| 41.8 | 4.42E-07 | -18.5428 | 1.5825 | 1.73E-08 | 221.0622 | 3.91E+10 | -0.1525 | 1820259 | 0 |
| 42.24 | 5.27E-07 | -12.3217 | 1.0767 | 1.53E-08 | 221.0576 | 3.91E+10 | -0.03908 | 391296 | 0 |
| 42.68 | 6.04E-07 | -7.1893 | 0.8542 | 1.39E-08 | 221.0538 | 3.91E+10 | -0.0452 | 395372 | 0 |
| 43.12 | 6.75E-07 | -3.3165 | 0.6001 | 1.32E-08 | 221.051 | 3.91E+10 | -0.05104 | 399448 | 0 |
| 43.56 | 7.43E-07 | -0.8664 | 0.3154 | 1.30E-08 | 221.0492 | 3.91E+10 | -0.05681 | 403524 | 0 |
| 44 | 8.11E-07 | 0 | 0 | 1.29E-08 | 221.0485 | 3.91E+10 | -0.06264 | 203800 | 0 |

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 6:00

Pile-head deflection = 0.5 inches
Computed slope at pile head = 0 radians
Maximum bending moment = -3573167 inch-lbs
Maximum shear force = 49035 lbs
Depth of maximum bending moment = 0 feet below pile head
Depth of maximum shear force = 0 feet below pile head
Number of iterations = 17
Number of zero deflection points = 4

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Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 7

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Pile-head conditions are Displacem and Pile-head Rotation (Loading Type 5)
Displacem of pile head = 0.75 inches
Rotation of pile head = 0.00E+00 radians
Axial load on pile head = 100000 lbs

| Depth X | Deflect. y | Bending Moment | Shear Force | Slope S | Total Stress | Bending Stiffness | Soil p | Res. Es*h | Soil Lat. | Spr. Load | Distrib. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| feet | inches | in-lbs | lbs | radians | psi* | in-lb^2 | lb/inch | lb/inch | lb/inch | | |
| 0 | 0.75 | -4735151 | 61158 | 0 | 3710 | 3.91E+10 | -134.652 | 473.9756 | 0 | | |
| 0.44 | 0.7483 | -4414089 | 60395 | -6.18E-04 | 3473 | 3.91E+10 | -144.221 | 1018 | 0 | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0.88 | 0.7435 | -4096733 | 59608 | -0.00119 | 3240 | 3.91E+10 | -153.558 | 1091 | 0 |
| 1.32 | 0.7357 | -3783365 | 58774 | -0.00173 | 3009 | 3.91E+10 | -162.637 | 1167 | 0 |
| 1.76 | 0.7253 | -3474262 | 57892 | -0.00222 | 2781 | 3.91E+10 | -171.433 | 1248 | 0 |
| 2.2 | 0.7123 | -3169690 | 56964 | -0.00266 | 2557 | 3.91E+10 | -179.919 | 1334 | 0 |
| 2.64 | 0.6971 | -2869908 | 55993 | -0.00307 | 2336 | 3.91E+10 | -188.075 | 1424 | 0 |
| 3.08 | 0.6799 | -2575164 | 54979 | -0.00344 | 2119 | 3.91E+10 | -195.877 | 1521 | 0 |
| 3.52 | 0.6608 | -2285698 | 53925 | -0.00377 | 1905 | 3.91E+10 | -203.304 | 1624 | 0 |
| 3.96 | 0.6401 | -2001736 | 52833 | -0.00406 | 1696 | 3.91E+10 | -210.337 | 1735 | 0 |
| 4.4 | 0.618 | -1723495 | 51705 | -0.00431 | 1491 | 3.91E+10 | -216.956 | 1854 | 0 |
| 4.84 | 0.5946 | -1451180 | 50548 | -0.00452 | 1290 | 3.91E+10 | -221.379 | 1966 | 0 |
| 5.28 | 0.5702 | -1184933 | 49370 | -0.0047 | 1094 | 3.91E+10 | -224.891 | 2083 | 0 |
| 5.72 | 0.5449 | -924871 | 48174 | -0.00484 | 902.5196 | 3.91E+10 | -228.005 | 2209 | 0 |
| 6.16 | 0.519 | -671099 | 46427 | -0.00495 | 715.5335 | 3.91E+10 | -433.604 | 4411 | 0 |
| 6.6 | 0.4926 | -429368 | 44115 | -0.00503 | 537.4191 | 3.91E+10 | -442.47 | 4742 | 0 |
| 7.04 | 0.466 | -199942 | 41757 | -0.00507 | 368.3711 | 3.91E+10 | -450.551 | 5105 | 0 |
| 7.48 | 0.4391 | 16939 | 39359 | -0.00508 | 233.5294 | 3.91E+10 | -457.842 | 5505 | 0 |
| 7.92 | 0.4123 | 221054 | 36924 | -0.00507 | 383.9271 | 3.91E+10 | -464.333 | 5946 | 0 |
| 8.36 | 0.3856 | 412208 | 34458 | -0.00502 | 524.7751 | 3.91E+10 | -470.012 | 6435 | 0 |
| 8.8 | 0.3593 | 590230 | 31963 | -0.00495 | 655.9466 | 3.91E+10 | -474.864 | 6979 | 0 |
| 9.24 | 0.3333 | 754971 | 29445 | -0.00486 | 777.3327 | 3.91E+10 | -478.873 | 7586 | 0 |
| 9.68 | 0.3079 | 906308 | 26909 | -0.00475 | 888.8422 | 3.91E+10 | -482.02 | 8266 | 0 |
| 10.12 | 0.2831 | 1044143 | 24357 | -0.00462 | 990.4026 | 3.91E+10 | -484.283 | 9031 | 0 |
| 10.56 | 0.2591 | 1168402 | 21797 | -0.00447 | 1082 | 3.91E+10 | -485.642 | 9896 | 0 |
| 11 | 0.2359 | 1279039 | 19232 | -0.00431 | 1163 | 3.91E+10 | -486.073 | 10878 | 0 |
| 11.44 | 0.2137 | 1376033 | 16666 | -0.00413 | 1235 | 3.91E+10 | -485.549 | 11999 | 0 |
| 11.88 | 0.1924 | 1459394 | 14107 | -0.00393 | 1296 | 3.91E+10 | -484.042 | 13286 | 0 |
| 12.32 | 0.1721 | 1529155 | 11558 | -0.00373 | 1348 | 3.91E+10 | -481.522 | 14773 | 0 |
| 12.76 | 0.1529 | 1585384 | 9025 | -0.00352 | 1389 | 3.91E+10 | -477.955 | 16500 | 0 |
| 13.2 | 0.1349 | 1628175 | 6513 | -0.0033 | 1421 | 3.91E+10 | -473.303 | 18523 | 0 |
| 13.64 | 0.118 | 1657655 | 4030 | -0.00308 | 1442 | 3.91E+10 | -467.525 | 20912 | 0 |
| 14.08 | 0.1024 | 1673983 | 1579 | -0.00286 | 1454 | 3.91E+10 | -460.57 | 23758 | 0 |
| 14.52 | 0.08786 | 1677351 | -830.807 | -0.00263 | 1457 | 3.91E+10 | -452.382 | 27185 | 0 |
| 14.96 | 0.07457 | 1667988 | -3194 | -0.00241 | 1450 | 3.91E+10 | -442.892 | 31361 | 0 |
| 15.4 | 0.06246 | 1646160 | -5504 | -0.00218 | 1434 | 3.91E+10 | -432.016 | 36521 | 0 |
| 15.84 | 0.05153 | 1612169 | -7752 | -0.00196 | 1409 | 3.91E+10 | -419.646 | 43003 | 0 |
| 16.28 | 0.04174 | 1566365 | -9931 | -0.00175 | 1375 | 3.91E+10 | -405.642 | 51310 | 0 |
| 16.72 | 0.03308 | 1509140 | -12031 | -0.00154 | 1333 | 3.91E+10 | -389.809 | 62225 | 0 |
| 17.16 | 0.02549 | 1440941 | -14042 | -0.00134 | 1283 | 3.91E+10 | -371.866 | 77038 | 0 |
| 17.6 | 0.01892 | 1362272 | -15951 | -0.00115 | 1225 | 3.91E+10 | -351.375 | 98033 | 0 |
| 18.04 | 0.01333 | 1273709 | -17744 | -9.73E-04 | 1160 | 3.91E+10 | -327.604 | 129717 | 0 |
| 18.48 | 0.00865 | 1175923 | -19399 | -8.07E-04 | 1088 | 3.91E+10 | -299.156 | 182543 | 0 |
| 18.92 | 0.00481 | 1069713 | -20882 | -6.56E-04 | 1009 | 3.91E+10 | -262.811 | 288491 | 0 |
| 19.36 | 0.00173 | 956100 | -22123 | -5.19E-04 | 925.5301 | 3.91E+10 | -207.328 | 632779 | 0 |
| 19.8 | -6.68E-04 | 836639 | -22237 | -3.98E-04 | 837.5076 | 3.91E+10 | 164.2517 | 1298051 | 0 |
| 20.24 | -0.00247 | 721697 | -21189 | -2.92E-04 | 752.8151 | 3.91E+10 | 232.7814 | 497711 | 0 |
| 20.68 | -0.00376 | 613193 | -19881 | -2.02E-04 | 672.8664 | 3.91E+10 | 262.8046 | 369429 | 0 |
| 21.12 | -0.00461 | 511972 | -18445 | -1.26E-04 | 598.284 | 3.91E+10 | 280.9317 | 322087 | 0 |
| 21.56 | -0.00509 | 418546 | -16931 | -6.34E-05 | 529.4454 | 3.91E+10 | 292.497 | 303450 | 0 |
| 22 | -0.00527 | 333245 | -15368 | -1.26E-05 | 466.5931 | 3.91E+10 | 299.6055 | 299891 | 0 |
| 22.44 | -0.00522 | 256273 | -13784 | 2.72E-05 | 409.8777 | 3.91E+10 | 300.3146 | 303601 | 0 |
| 22.88 | -0.00499 | 187655 | -12208 | 5.72E-05 | 359.3178 | 3.91E+10 | 296.8862 | 314270 | 0 |
| 23.32 | -0.00462 | 127300 | -10655 | 7.84E-05 | 314.8466 | 3.91E+10 | 291.242 | 332907 | 0 |
| 23.76 | -0.00416 | 75055 | -9137 | 9.21E-05 | 276.3512 | 3.91E+10 | 283.7095 | 360126 | 0 |
| 24.2 | -0.00365 | 30714 | -7663 | 9.93E-05 | 243.6797 | 3.91E+10 | 274.5193 | 397491 | 0 |
| 24.64 | -0.00311 | -5975 | -6242 | 1.01E-04 | 225.4514 | 3.91E+10 | 263.8362 | 447707 | 0 |
| 25.08 | -0.00258 | -35309 | -4881 | 9.81E-05 | 247.0655 | 3.91E+10 | 251.7746 | 515101 | 0 |
| 25.52 | -0.00208 | -57622 | -3587 | 9.19E-05 | 263.5058 | 3.91E+10 | 238.4063 | 606571 | 0 |
| 25.96 | -0.00161 | -73284 | -2367 | 8.30E-05 | 275.0459 | 3.91E+10 | 223.7587 | 733455 | 0 |
| 26.4 | -0.0012 | -82702 | -1227 | 7.25E-05 | 281.9858 | 3.91E+10 | 207.8017 | 915386 | 0 |
| 26.84 | -8.45E-04 | -86322 | -176.142 | 6.11E-05 | 284.6528 | 3.91E+10 | 190.4109 | 1189199 | 0 |
| 27.28 | -5.54E-04 | -84627 | 778.6925 | 4.95E-05 | 283.4039 | 3.91E+10 | 171.2688 | 1632923 | 0 |
| 27.72 | -3.23E-04 | -78151 | 1524 | 3.85E-05 | 278.6324 | 3.91E+10 | 111.1894 | 1820259 | 0 |
| 28.16 | -1.47E-04 | -68570 | 1952 | 2.86E-05 | 271.5728 | 3.91E+10 | 50.6779 | 1820259 | 0 |
| 28.6 | -2.04E-05 | -57571 | 2104 | 2.01E-05 | 263.4686 | 3.91E+10 | 7.027 | 1820259 | 0 |
| 29.04 | 6.52E-05 | -46372 | 2063 | 1.31E-05 | 255.217 | 3.91E+10 | -22.4676 | 1820259 | 0 |
| 29.48 | 1.18E-04 | -35797 | 1897 | 7.52E-06 | 247.4245 | 3.91E+10 | -40.5598 | 1820259 | 0 |
| 29.92 | 1.45E-04 | -26349 | 1658 | 3.32E-06 | 240.4633 | 3.91E+10 | -49.85 | 1820259 | 0 |
| 30.36 | 1.53E-04 | -18289 | 1388 | 3.09E-07 | 234.5246 | 3.91E+10 | -52.6612 | 1820259 | 0 |
| 30.8 | 1.48E-04 | -11696 | 1114 | -1.72E-06 | 229.6668 | 3.91E+10 | -50.9752 | 1820259 | 0 |
| 31.24 | 1.35E-04 | -6524 | 856.8801 | -2.95E-06 | 225.8555 | 3.91E+10 | -46.4132 | 1820259 | 0 |
| 31.68 | 1.17E-04 | -2645 | 628.0972 | -3.57E-06 | 222.9972 | 3.91E+10 | -40.247 | 1820259 | 0 |
| 32.12 | 9.70E-05 | 112.6238 | 433.5885 | -3.74E-06 | 221.1315 | 3.91E+10 | -33.4305 | 1820259 | 0 |
| 32.56 | 7.73E-05 | 1938 | 274.9977 | -3.60E-06 | 222.4765 | 3.91E+10 | -26.6418 | 1820259 | 0 |
| 33 | 5.90E-05 | 3020 | 150.9936 | -3.26E-06 | 223.274 | 3.91E+10 | -20.3295 | 1820259 | 0 |
| 33.44 | 4.28E-05 | 3536 | 58.3575 | -2.82E-06 | 223.6539 | 3.91E+10 | -14.7599 | 1820259 | 0 |
| 33.88 | 2.92E-05 | 3640 | -7.1665 | -2.34E-06 | 223.7303 | 3.91E+10 | -10.0598 | 1820259 | 0 |
| 34.32 | 1.81E-05 | 3463 | -50.2364 | -1.86E-06 | 223.5999 | 3.91E+10 | -6.2546 | 1820259 | 0 |
| 34.76 | 9.57E-06 | 3111 | -75.4628 | -1.41E-06 | 223.3409 | 3.91E+10 | -3.3008 | 1820259 | 0 |
| 35.2 | 3.23E-06 | 2667 | -87.113 | -1.02E-06 | 223.0139 | 3.91E+10 | -1.1121 | 1820259 | 0 |
| 35.64 | -1.22E-06 | 2192 | -88.9379 | -6.94E-07 | 222.6639 | 3.91E+10 | 0.4208 | 1820259 | 0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 36.08 | -4.10E-06 | 1729 | -84.0923 | -4.29E-07 | 222.3224 | 3.91E+10 | 1.4147 | 1820259 | 0 |
| 36.52 | -5.75E-06 | 1305 | -75.1214 | -2.24E-07 | 222.0099 | 3.91E+10 | 1.9834 | 1820259 | 0 |
| 36.96 | -6.47E-06 | 935.7813 | -63.9944 | -7.30E-08 | 221.738 | 3.91E+10 | 2.2313 | 1820259 | 0 |
| 37.4 | -6.52E-06 | 628.999 | -52.1659 | 3.27E-08 | 221.512 | 3.91E+10 | 2.2492 | 1820259 | 0 |
| 37.84 | -6.13E-06 | 384.8753 | -40.6514 | 1.01E-07 | 221.3321 | 3.91E+10 | 2.1123 | 1820259 | 0 |
| 38.28 | -5.46E-06 | 199.613 | -30.1093 | 1.41E-07 | 221.1956 | 3.91E+10 | 1.8809 | 1820259 | 0 |
| 38.72 | -4.64E-06 | 66.7722 | -20.919 | 1.59E-07 | 221.0977 | 3.91E+10 | 1.6003 | 1820259 | 0 |
| 39.16 | -3.78E-06 | -21.4589 | -13.2533 | 1.62E-07 | 221.0643 | 3.91E+10 | 1.3034 | 1820259 | 0 |
| 39.6 | -2.93E-06 | -73.353 | -7.1416 | 1.55E-07 | 221.1026 | 3.91E+10 | 1.0117 | 1820259 | 0 |
| 40.04 | -2.14E-06 | -97.0383 | -2.5225 | 1.44E-07 | 221.12 | 3.91E+10 | 0.738 | 1820259 | 0 |
| 40.48 | -1.42E-06 | -100.142 | 0.7147 | 1.30E-07 | 221.1223 | 3.91E+10 | 0.4882 | 1820259 | 0 |
| 40.92 | -7.63E-07 | -89.6285 | 2.698 | 1.18E-07 | 221.1146 | 3.91E+10 | 0.263 | 1820259 | 0 |
| 41.36 | -1.74E-07 | -71.7753 | 3.5506 | 1.07E-07 | 221.1014 | 3.91E+10 | 0.05991 | 1820259 | 0 |
| 41.8 | 3.64E-07 | -52.2469 | 3.3772 | 9.84E-08 | 221.087 | 3.91E+10 | -0.1256 | 1820259 | 0 |
| 42.24 | 8.65E-07 | -36.2157 | 2.8765 | 9.24E-08 | 221.0752 | 3.91E+10 | -0.06411 | 391296 | 0 |
| 42.68 | 1.34E-06 | -21.969 | 2.4423 | 8.85E-08 | 221.0647 | 3.91E+10 | -0.1003 | 395372 | 0 |
| 43.12 | 1.80E-06 | -10.5181 | 1.8181 | 8.63E-08 | 221.0563 | 3.91E+10 | -0.1361 | 399448 | 0 |
| 43.56 | 2.25E-06 | -2.8612 | 1.0046 | 8.54E-08 | 221.0506 | 3.91E+10 | -0.172 | 403524 | 0 |
| 44 | 2.70E-06 | 0 | 0 | 8.52E-08 | 221.0485 | 3.91E+10 | -0.2085 | 203800 | 0 |

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 7:00

Pile-head deflection = 0.75 inches
Computed slope at pile head = 0 radians
Maximum bending moment = -4735151 inch-lbs
Maximum shear force = 61158 lbs
Depth of maximum bending moment = 0 feet below pile head
Depth of maximum shear force = 0 feet below pile head
Number of iterations = 22
Number of zero deflection points = 4

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Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 8

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Pile-head conditions are Displacem and Pile-head Rotation (Loading Type 5)
Displacem of pile head = 1 inches
Rotation of pile head = 0.00E+00 radians
Axial load on pile head = 100000 lbs

| Depth X feet | Deflect. y inches | Bending Moment in-lbs | Shear Force lbs | Slope S radians | Total Stress psi* | Bending Stiffness in-lb^2 | Soil p lb/inch | Res. Es*h lb/inch | Soil Lat. lb/inch | Spr. Load | Distrib. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | -5778391 | 71468 | 0 | 4479 | 3.91E+10 | -148.204 | 391.2583 | | 0 | |
| 0.44 | 0.9979 | -5403059 | 70628 | -7.55E-04 | 4202 | 3.91E+10 | -158.746 | 839.9077 | | 0 | |
| 0.88 | 0.992 | -5031767 | 69762 | -0.00146 | 3929 | 3.91E+10 | -169.054 | 899.7806 | | 0 | |
| 1.32 | 0.9825 | -4664829 | 68843 | -0.00211 | 3658 | 3.91E+10 | -179.101 | 962.4752 | | 0 | |
| 1.76 | 0.9697 | -4302551 | 67872 | -0.00272 | 3391 | 3.91E+10 | -188.86 | 1028 | | 0 | |
| 2.2 | 0.9538 | -3945232 | 66849 | -0.00328 | 3128 | 3.91E+10 | -198.306 | 1098 | | 0 | |
| 2.64 | 0.9351 | -3593159 | 65778 | -0.00379 | 2869 | 3.91E+10 | -207.416 | 1171 | | 0 | |
| 3.08 | 0.9138 | -3246613 | 64660 | -0.00425 | 2613 | 3.91E+10 | -216.167 | 1249 | | 0 | |
| 3.52 | 0.8902 | -2905862 | 63497 | -0.00466 | 2362 | 3.91E+10 | -224.536 | 1332 | | 0 | |
| 3.96 | 0.8645 | -2571163 | 62290 | -0.00503 | 2116 | 3.91E+10 | -232.504 | 1420 | | 0 | |
| 4.4 | 0.837 | -2242762 | 61043 | -0.00536 | 1874 | 3.91E+10 | -240.05 | 1514 | | 0 | |
| 4.84 | 0.808 | -1920894 | 59761 | -0.00564 | 1636 | 3.91E+10 | -245.203 | 1602 | | 0 | |
| 5.28 | 0.7775 | -1605724 | 58456 | -0.00588 | 1404 | 3.91E+10 | -249.381 | 1694 | | 0 | |
| 5.72 | 0.7459 | -1297393 | 57129 | -0.00607 | 1177 | 3.91E+10 | -253.153 | 1792 | | 0 | |
| 6.16 | 0.7133 | -996026 | 55221 | -0.00623 | 954.9488 | 3.91E+10 | -469.48 | 3475 | | 0 | |
| 6.6 | 0.6801 | -707677 | 52716 | -0.00634 | 742.4848 | 3.91E+10 | -479.612 | 3724 | | 0 | |
| 7.04 | 0.6463 | -432648 | 50159 | -0.00642 | 539.8356 | 3.91E+10 | -488.958 | 3994 | | 0 | |
| 7.48 | 0.6123 | -171219 | 47554 | -0.00646 | 347.2076 | 3.91E+10 | -497.513 | 4290 | | 0 | |
| 7.92 | 0.5781 | 76352 | 44907 | -0.00647 | 277.3067 | 3.91E+10 | -505.27 | 4615 | | 0 | |
| 8.36 | 0.544 | 309831 | 42221 | -0.00644 | 449.3409 | 3.91E+10 | -512.218 | 4972 | | 0 | |
| 8.8 | 0.51 | 529008 | 39500 | -0.00639 | 610.837 | 3.91E+10 | -518.344 | 5366 | | 0 | |
| 9.24 | 0.4765 | 733697 | 36749 | -0.0063 | 761.6577 | 3.91E+10 | -523.631 | 5802 | | 0 | |
| 9.68 | 0.4435 | 923736 | 33973 | -0.00619 | 901.6836 | 3.91E+10 | -528.062 | 6287 | | 0 | |
| 10.12 | 0.4112 | 1098987 | 31175 | -0.00605 | 1031 | 3.91E+10 | -531.619 | 6827 | | 0 | |
| 10.56 | 0.3796 | 1259340 | 28361 | -0.00589 | 1149 | 3.91E+10 | -534.281 | 7432 | | 0 | |
| 11 | 0.3489 | 1404707 | 25536 | -0.00571 | 1256 | 3.91E+10 | -536.026 | 8111 | | 0 | |
| 11.44 | 0.3193 | 1535031 | 22703 | -0.00551 | 1352 | 3.91E+10 | -536.83 | 8878 | | 0 | |
| 11.88 | 0.2907 | 1650279 | 19869 | -0.0053 | 1437 | 3.91E+10 | -536.669 | 9748 | | 0 | |
| 12.32 | 0.2633 | 1750449 | 17039 | -0.00507 | 1511 | 3.91E+10 | -535.514 | 10739 | | 0 | |
| 12.76 | 0.2371 | 1835564 | 14217 | -0.00483 | 1574 | 3.91E+10 | -533.337 | 11875 | | 0 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 13.2 | 0.2123 | 1905679 | 11410 | -0.00458 | 1625 | 3.91E+10 | -530.104 | 13183 | 0 |
| 13.64 | 0.1888 | 1960880 | 8622 | -0.00431 | 1666 | 3.91E+10 | -525.781 | 14702 | 0 |
| 14.08 | 0.1668 | 2001284 | 5860 | -0.00405 | 1696 | 3.91E+10 | -520.326 | 16475 | 0 |
| 14.52 | 0.1461 | 2027038 | 3131 | -0.00377 | 1715 | 3.91E+10 | -513.696 | 18565 | 0 |
| 14.96 | 0.1269 | 2038328 | 438.9569 | -0.0035 | 1723 | 3.91E+10 | -505.838 | 21047 | 0 |
| 15.4 | 0.1091 | 2035369 | -2208 | -0.00322 | 1721 | 3.91E+10 | -496.691 | 24028 | 0 |
| 15.84 | 0.09285 | 2018419 | -4802 | -0.00295 | 1708 | 3.91E+10 | -486.18 | 27648 | 0 |
| 16.28 | 0.07799 | 1987771 | -7338 | -0.00268 | 1686 | 3.91E+10 | -474.216 | 32106 | 0 |
| 16.72 | 0.06455 | 1943761 | -9806 | -0.00241 | 1653 | 3.91E+10 | -460.682 | 37685 | 0 |
| 17.16 | 0.05249 | 1886769 | -12198 | -0.00216 | 1611 | 3.91E+10 | -445.425 | 44806 | 0 |
| 17.6 | 0.04178 | 1817224 | -14505 | -0.00191 | 1560 | 3.91E+10 | -428.234 | 54119 | 0 |
| 18.04 | 0.03237 | 1735612 | -16714 | -0.00167 | 1500 | 3.91E+10 | -408.804 | 66689 | 0 |
| 18.48 | 0.02419 | 1642479 | -18814 | -0.00144 | 1431 | 3.91E+10 | -386.665 | 84396 | 0 |
| 18.92 | 0.01719 | 1538449 | -20788 | -0.00122 | 1355 | 3.91E+10 | -361.027 | 110915 | 0 |
| 19.36 | 0.01128 | 1424244 | -22614 | -0.00102 | 1270 | 3.91E+10 | -330.406 | 154667 | 0 |
| 19.8 | 0.00639 | 1300727 | -24255 | -8.38E-04 | 1179 | 3.91E+10 | -291.425 | 240869 | 0 |
| 20.24 | 0.00242 | 1168993 | -25639 | -6.72E-04 | 1082 | 3.91E+10 | -232.755 | 506810 | 0 |
| 20.68 | -7.05E-04 | 1030686 | -25800 | -5.23E-04 | 980.4875 | 3.91E+10 | 171.8525 | 1287605 | 0 |
| 21.12 | -0.0031 | 897097 | -24675 | -3.93E-04 | 882.0552 | 3.91E+10 | 254.2732 | 433205 | 0 |
| 21.56 | -0.00485 | 770533 | -23241 | -2.80E-04 | 788.799 | 3.91E+10 | 289.002 | 314384 | 0 |
| 22 | -0.00606 | 651970 | -21659 | -1.84E-04 | 701.4388 | 3.91E+10 | 310.1622 | 270297 | 0 |
| 22.44 | -0.0068 | 542008 | -19993 | -1.04E-04 | 620.4156 | 3.91E+10 | 320.8032 | 249142 | 0 |
| 22.88 | -0.00715 | 440951 | -18289 | -3.71E-05 | 545.9537 | 3.91E+10 | 324.9158 | 239868 | 0 |
| 23.32 | -0.00719 | 348920 | -16572 | 1.62E-05 | 478.1429 | 3.91E+10 | 325.3699 | 238904 | 0 |
| 23.76 | -0.00698 | 265935 | -14860 | 5.77E-05 | 416.9974 | 3.91E+10 | 322.9758 | 244279 | 0 |
| 24.2 | -0.00658 | 191936 | -13167 | 8.87E-05 | 362.4723 | 3.91E+10 | 318.2541 | 255325 | 0 |
| 24.64 | -0.00604 | 126795 | -11505 | 1.10E-04 | 314.4746 | 3.91E+10 | 311.5599 | 272142 | 0 |
| 25.08 | -0.00542 | 70331 | -9882 | 1.23E-04 | 272.8702 | 3.91E+10 | 303.1443 | 295435 | 0 |
| 25.52 | -0.00474 | 22313 | -8307 | 1.30E-04 | 237.4892 | 3.91E+10 | 293.1888 | 326547 | 0 |
| 25.96 | -0.00405 | -17533 | -6789 | 1.30E-04 | 233.9675 | 3.91E+10 | 281.8241 | 367638 | 0 |
| 26.4 | -0.00337 | -49521 | -5335 | 1.26E-04 | 257.5371 | 3.91E+10 | 269.1403 | 422058 | 0 |
| 26.84 | -0.00272 | -74002 | -3951 | 1.17E-04 | 275.5755 | 3.91E+10 | 255.1908 | 495055 | 0 |
| 27.28 | -0.00213 | -91364 | -2643 | 1.06E-04 | 288.3681 | 3.91E+10 | 239.9893 | 595107 | 0 |
| 27.72 | -0.0016 | -102028 | -1420 | 9.30E-05 | 296.226 | 3.91E+10 | 223.4975 | 736635 | 0 |
| 28.16 | -0.00115 | -106455 | -286.983 | 7.89E-05 | 299.4876 | 3.91E+10 | 205.5931 | 946044 | 0 |
| 28.6 | -7.69E-04 | -105142 | 746.7948 | 6.46E-05 | 298.5204 | 3.91E+10 | 185.9892 | 1277271 | 0 |
| 29.04 | -4.65E-04 | -98637 | 1661 | 5.08E-05 | 293.7271 | 3.91E+10 | 160.3893 | 1820259 | 0 |
| 29.48 | -2.32E-04 | -87653 | 2296 | 3.83E-05 | 285.634 | 3.91E+10 | 79.9763 | 1820259 | 0 |
| 29.92 | -6.13E-05 | -74434 | 2563 | 2.73E-05 | 275.8935 | 3.91E+10 | 21.1164 | 1820259 | 0 |
| 30.36 | 5.64E-05 | -60620 | 2567 | 1.82E-05 | 265.7153 | 3.91E+10 | -19.441 | 1820259 | 0 |
| 30.8 | 1.31E-04 | -47344 | 2397 | 1.09E-05 | 255.9332 | 3.91E+10 | -45.0925 | 1820259 | 0 |
| 31.24 | 1.71E-04 | -35322 | 2122 | 5.31E-06 | 247.0749 | 3.91E+10 | -59.1024 | 1820259 | 0 |
| 31.68 | 1.87E-04 | -24945 | 1796 | 1.24E-06 | 239.4289 | 3.91E+10 | -64.427 | 1820259 | 0 |
| 32.12 | 1.85E-04 | -16363 | 1458 | -1.55E-06 | 233.1049 | 3.91E+10 | -63.6178 | 1820259 | 0 |
| 32.56 | 1.71E-04 | -9552 | 1134 | -3.30E-06 | 228.0869 | 3.91E+10 | -58.7853 | 1820259 | 0 |
| 33 | 1.50E-04 | -4380 | 842.9361 | -4.24E-06 | 224.276 | 3.91E+10 | -51.6039 | 1820259 | 0 |
| 33.44 | 1.26E-04 | -646.404 | 592.27 | -4.58E-06 | 221.5248 | 3.91E+10 | -43.3454 | 1820259 | 0 |
| 33.88 | 1.01E-04 | 1879 | 385.6281 | -4.50E-06 | 222.4331 | 3.91E+10 | -34.928 | 1820259 | 0 |
| 34.32 | 7.82E-05 | 3431 | 222.2103 | -4.14E-06 | 223.5763 | 3.91E+10 | -26.9727 | 1820259 | 0 |
| 34.76 | 5.76E-05 | 4230 | 98.5697 | -3.62E-06 | 224.1653 | 3.91E+10 | -19.8609 | 1820259 | 0 |
| 35.2 | 4.00E-05 | 4475 | 9.7336 | -3.03E-06 | 224.3461 | 3.91E+10 | -13.7892 | 1820259 | 0 |
| 35.64 | 2.56E-05 | 4336 | -49.949 | -2.44E-06 | 224.2434 | 3.91E+10 | -8.8179 | 1820259 | 0 |
| 36.08 | 1.43E-05 | 3950 | -86.198 | -1.88E-06 | 223.9593 | 3.91E+10 | -4.9128 | 1820259 | 0 |
| 36.52 | 5.74E-06 | 3428 | -104.392 | -1.38E-06 | 223.5741 | 3.91E+10 | -1.979 | 1820259 | 0 |
| 36.96 | -3.25E-07 | 2849 | -109.322 | -9.56E-07 | 223.1481 | 3.91E+10 | 0.1119 | 1820259 | 0 |
| 37.4 | -4.36E-06 | 2274 | -105.061 | -6.10E-07 | 222.7242 | 3.91E+10 | 1.5022 | 1820259 | 0 |
| 37.84 | -6.77E-06 | 1741 | -94.9352 | -3.39E-07 | 222.3311 | 3.91E+10 | 2.3332 | 1820259 | 0 |
| 38.28 | -7.94E-06 | 1272 | -81.5519 | -1.35E-07 | 221.9858 | 3.91E+10 | 2.7362 | 1820259 | 0 |
| 38.72 | -8.20E-06 | 879.6461 | -66.8663 | 9.84E-09 | 221.6967 | 3.91E+10 | 2.8265 | 1820259 | 0 |
| 39.16 | -7.83E-06 | 565.9541 | -52.2753 | 1.07E-07 | 221.4655 | 3.91E+10 | 2.7004 | 1820259 | 0 |
| 39.6 | -7.06E-06 | 327.5051 | -38.7173 | 1.68E-07 | 221.2898 | 3.91E+10 | 2.4352 | 1820259 | 0 |
| 40.04 | -6.06E-06 | 156.9224 | -26.7722 | 2.01E-07 | 221.1642 | 3.91E+10 | 2.0895 | 1820259 | 0 |
| 40.48 | -4.95E-06 | 44.5791 | -16.7545 | 2.14E-07 | 221.0814 | 3.91E+10 | 1.7051 | 1820259 | 0 |
| 40.92 | -3.80E-06 | -20.2313 | -8.795 | 2.16E-07 | 221.0634 | 3.91E+10 | 1.3098 | 1820259 | 0 |
| 41.36 | -2.67E-06 | -48.5244 | -2.9096 | 2.11E-07 | 221.0843 | 3.91E+10 | 0.9195 | 1820259 | 0 |
| 41.8 | -1.57E-06 | -51.1797 | 0.9464 | 2.04E-07 | 221.0862 | 3.91E+10 | 0.5411 | 1820259 | 0 |
| 42.24 | -5.09E-07 | -38.7459 | 2.4745 | 1.98E-07 | 221.0771 | 3.91E+10 | 0.03769 | 391296 | 0 |
| 42.68 | 5.25E-07 | -25.2586 | 2.4702 | 1.94E-07 | 221.0671 | 3.91E+10 | -0.03931 | 395372 | 0 |
| 43.12 | 1.54E-06 | -12.8653 | 2.0588 | 1.91E-07 | 221.058 | 3.91E+10 | -0.1165 | 399448 | 0 |
| 43.56 | 2.55E-06 | -3.7199 | 1.2373 | 1.90E-07 | 221.0513 | 3.91E+10 | -0.1946 | 403524 | 0 |
| 44 | 3.55E-06 | 0 | 0 | 1.90E-07 | 221.0485 | 3.91E+10 | -0.2741 | 203800 | 0 |

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 8:00

Pile-head deflection = 1 inches
Computed slope at pile head = 0 radians
Maximum bending moment = -5778391 inch-lbs

Maximum shear force = 71468 lbs
Depth of maximum bending moment = 0 feet below pile head
Depth of maximum shear force = 0 feet below pile head
Number of iterations = 23
Number of zero deflection points = 4

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Summary of Pile-head Responses for Conventio Analyses

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Definitions of Pile-head Loading Conditions:

Load Type 1:00 Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2:00 Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3:00 Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4:00 Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5:00 Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

| Load Case No. | Load Type | Load Pile-head 1 | Axial Load | Pile-head 1 | Pile-head Loading | Max Deflection Load 2 | Shear Rotation | Max in lbs | Moment Pile inches | in radians | Pile lbs | in-lbs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | y, | in | 0.25 | M, | in-lb | 0 | 100000 | 0.25 | -0.00266 | 14767 | 873547 |
| 2 | y, | in | 0.5 | M, | in-lb | 0 | 100000 | 0.5 | -0.0048 | 21720 | 1418300 |
| 3 | y, | in | 0.75 | M, | in-lb | 0 | 100000 | 0.75 | -0.00679 | 27161 | 1879294 |
| 4 | y, | in | 1 | M, | in-lb | 0 | 100000 | 1 | -0.00867 | 31810 | 2294678 |
| 5 | y, | in | 0.25 | S, | rad | 0 | 100000 | 0.25 | 0 | 33478 | -2201452 |
| 6 | y, | in | 0.5 | S, | rad | 0 | 100000 | 0.5 | 0 | 49035 | -3573167 |
| 7 | y, | in | 0.75 | S, | rad | 0 | 100000 | 0.75 | 0 | 61158 | -4735151 |
| 8 | y, | in | 1 | S, | rad | 0 | 100000 | 1 | 0 | 71468 | -5778391 |

Maximum pile-head deflection = 1 inches
Maximum pile-head rotation = -0.00867 radians = -0.49692 deg.

The analysis ended normally.

# APPENDIX G

# Site Response Analysis by Dr. Robert Pyke

**Robert Pyke, Consulting Engineer**

October 17, 2024

Cristiano Melo, PE, GE
Geotechnical Group Manager
BSK Associates
399 Lindbergh Avenue,
Livermore, CA 94551

Re: Tri-Valley East Wing Hospital Addition
Pleasanton CA
Site-Specific Site Response Analysis

Dear Cristiano,

At your request, I have conducted site-specific nonlinear effective stress site response analyses in accordance with the provisions of ASCE 7-16 in order to both determine appropriate ground surface motions for use in design and to confirm whether liquefaction is an issue at this site.

The site is located in Pleasanton, CA with representative co-ordinates being latitude 37.6942 and longitude -121.8800. The site lies in an area of active seismicity and is close to the Calaveras fault.

You have conducted a site investigation in 2023 for the current project with one boring that was advanced to 55 ½ feet below the ground surface (bgs) and two seismic CPTs. The boring showed what is likely 3 ½ feet of fill underlain by lean clay to a depth of about 40 feet bgs and then a fat clay to about 42 feet bgs. These clays were then underlain by intervals of silty sand, poorly graded sand with silt, and poorly graded sand. One sample was obtained at the bottom of the silty sand interval using a 3-inch split barrel sampler and a raw blowcount of 46 was obtained over the last 12 inches. This converts approximately to a raw SPT blowcount of about 30. The CPTs met practical refusal within several inches of the top of the silty sand layer, indicating that this sand is very dense, although it is possible that the cone may have encountered gravel particles, as fine gravel was seen at greater depths in the boring.

Subsequently two MASW lines were run by Advanced Geological Services. Their interpreted shear wave velocity profiles are shown in Figure 1, along with the measured shear wave velocities from the two SCPTs. The interpreted and measured shear wave velocities are not exactly the same but are not inconsistent. The weighted average shear wave velocities over the top 100 feet from the MASW lines are 677 and 700 fps.

**1310 Alma Avenue, No. 201, Walnut Creek, CA 94596**
**Telephone 925.323.7338 E-mail bobpyke@attglobal.net**

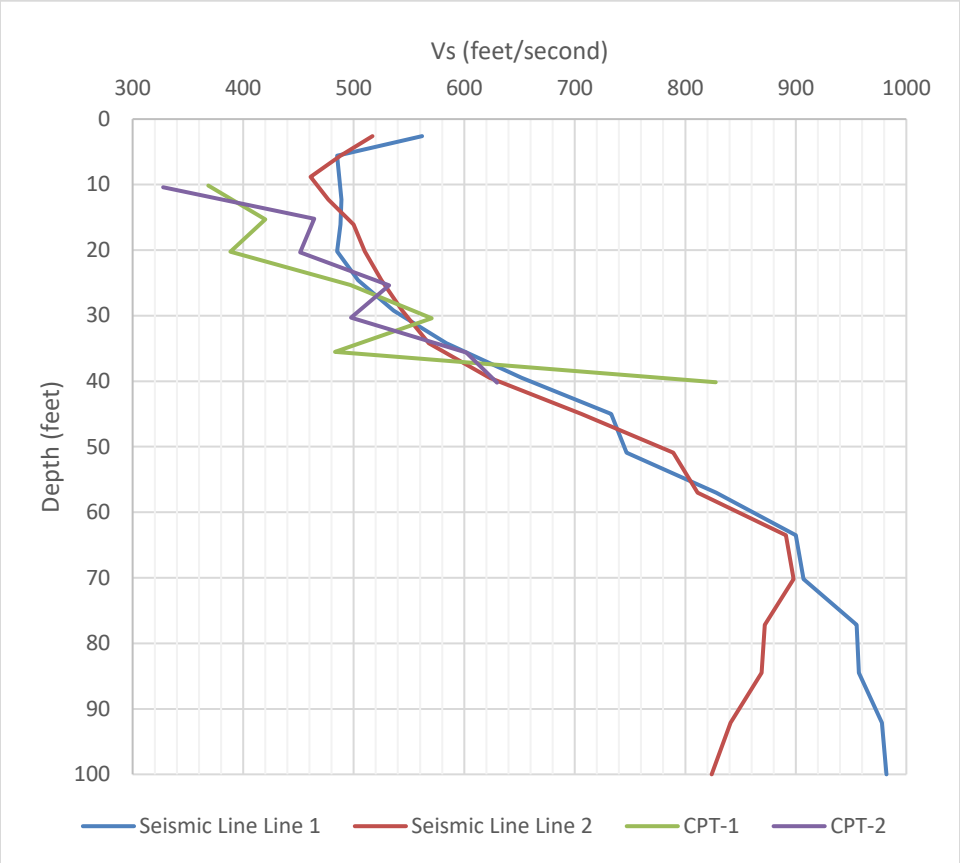



**Figure 1 – Measured Shear Wave Velocities**

These weighted average shear wave velocities place the site towards the lower end of Site Class D according to ASCE 7-16. The code seismic parameters for Site Class D at this location were obtained from the SEA/OSHPD website https://seismicmaps.org/ and are shown in Appendix A.

It is possible that this site would be considered to be susceptible to earthquake-induced liquefaction and classified as Site Class F if simplified analyses of liquefaction were conducted, but that class of analysis tend to be very conservative as explained in my technical note on the Limitations of Simplified Methods for Evaluating Earthquake-Induced Liquefaction and its Consequences, which is attached to this report.

However, although the depth and the age of the sandy deposits which underlie the clay cap at this site strongly suggest that any consequences of liquefaction would be negligible, at your request I have conducted bi-directional nonlinear effective stress site response analyses both to confirm this conclusion and to make a better estimate of the design ground motions at the surface that might be generated by a large earthquake on the nearby Calaveras fault. Because of the wide range of soil profiles that fall within Site Class D, there is significant uncertainty in the ground motion attenuation relationships

for this site class, and that large uncertainty tends to push up the median estimates of likely motions (see Pyke (2024)). For a site like this with a significant depth to "bedrock" and a relatively soft clay cap, it should be expected that the site-specific ground surface motions that are obtained in a careful analysis might fall below the standard code values for Site Class D.

Fortunately, relatively good data on the deeper subsurface conditions at this site are available from a technical memorandum dated June 07, 2021, prepared by eki environment & water for the Zone 7 Water Agency. This site lies relatively close to Cross Section B-B' shown in that memorandum. A plan showing the location of the cross sections and Cross Section B-B' are shown as plates at the end of this report. Consistent with your site investigation, the cross section shows about 40 feet of "overburden", which corresponds to the clay cap at this site, then about 30 feet of the "upper aquifer", which corresponds to the silty sand and sand with gravel. Below that the cross section shows some 70 feet of "aquitard", followed by the permeable Upper Tassajara to a depth of about 670 feet bgs, at which point the impermeable Lower Tassajara formation is reached. I have taken the Lower Tassajara formation to be "bedrock" and, in the absence of measurements of shear wave velocities at this depth, have assigned a shear wave velocity of 2400 fps, that is the Site Class B/C boundary to the base of my model of the site, consistent with the language of Section 11.4.3 of ASCE 7-16 which says that if site-specific velocity measurements are not made, the site coefficients should be taken as unity, that is the spectral acceleration values would correspond to the Site Class B/C boundary.

**Earthquake Input Motions**

In order to obtain site-specific input motions for this site, I compared the appropriate probabilistic and deterministic response spectra for the Site Class B/C boundary at this location. I obtained the 2475-year return period probabilistic spectrum using the USGS web site https://earthquake.usgs.gov/hazards/interactive/. Details of the results for this location are also reproduced in Appendix A. The deterministic spectrum was obtained using a magnitude 7.43 earthquake on the Calaveras fault at a distance of 4.4 km. The magnitude was obtained from the USGS Earthquake Scenario Map (BSSC, 2014), linking segments CN+CC+CS+CE on the Calaveras fault, and the distance was obtained from the Fault Activity Map of California. I applied equal weighting of four of the five ground motion prediction equations (GMPEs) (excluding that of Idriss) using the NGAWest2 spreadsheet which is downloadable from https://peer.berkeley.edu/peer-nga-west2-research-program-releases-excel-file-five-horizontal-ground-motion-prediction. Risk adjustment factors for the probabilistic spectrum were obtained from the SEA/OSHPD web site and the adjustment to "maximum direction" spectra was made using the factors suggested by Shahi and Baker (2014).

Three spreadsheets are attached to the report. One is the PEER spreadsheet, which shows all the values assumed in obtaining the median deterministic spectrum.
In the PEER spreadsheet a value of 8.9 km was specified for W because this is the depth of the fault given in M 7.4 Scenario Earthquake - Calaveras: CN+CC+CS+CE (usgs.gov) which I understand to be CGS's preferred source of data for characteristic earthquakes on nearby faults. This value for W gave very slightly higher values for the spectral accelerations than other possible choices, but in general, the values of the secondary input parameters in this spreadsheet make little difference to the computed spectral accelerations. A second spreadsheet shows the risk and rotation factors that were used to calculate the "maximum direction" probabilistic spectrum, and a third spreadsheet shows the construction of the "maximum direction" probabilistic spectrum and also shows the subsequent construction of the standard code spectrum from the code parameters and the recommended site-specific spectra constructed in accordance with Section 21.4 of ASCE 7-16.

The resulting probabilistic and deterministic response spectra are shown in Figure 2.

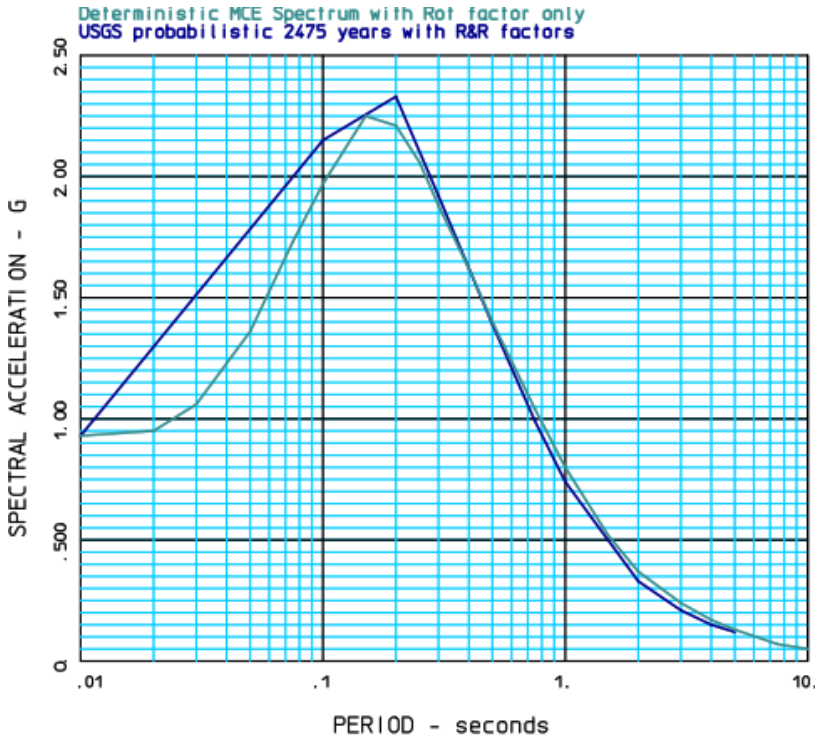



**Figure 2 – $MCE_R$ Ground Surface Response Spectra**

The Calaveras fault deterministic spectrum has slightly lower spectral accelerations than the probabilistic spectrum up to a period of 0.4 seconds and the two spectra are essentially equal at periods above that. I have taken the deterministic spectrum as the target for fitting the input motions.

ASCE 7-16 requires the use of a minimum of five input motions for site response analyses, and, while it is not clear whether this means five single components or five pairs of components, for good measure I have used both horizontal components of each of the five records as listed in Table 1. More complete details of the motions as recorded are shown in Appendix B. These motions are intended to represent an earthquake of up to magnitude 7.43 occurring on multiple segments of the Calaveras fault, which might show some forward directivity effects including larger velocity pulses. I have also included the Joshua Tree record which has a longer duration due to rearwards directivity effects.

**Table 1 – Selected Earthquake Records**

| Earthquake | Record Name | Station Name | Year | $M_w$ | R (km) | $V_{s30}$ (m/s) |
|---|---|---|---|---|---|---|
| | | | | | | |
| Imperial Valley | IV02 | El Centro 9 | 1940 | 6.95 | 6.09 | 213.4 |
| Imperial Valley | IVEC4 | El Centro 4 | 1979 | 6.53 | 7.05 | 208.9 |
| Landers | JOS | Joshua Tree | 1992 | 7.28 | 11.03 | 379.3 |
| Kobe | NIS | Nishi-Akashi | 1995 | 6.90 | 7.08 | 609.0 |
| Kocaeli | YAR | Yarimca | 1999 | 7.51 | 4.83 | 297.0 |
| | | | | | | |

I then modified the recorded motions so that they matched the Site Class B/C boundary deterministic MCE spectrum using the frequency domain program TINKER. The matches obtained to the target spectrum are shown in Figure 3. Plots of the individual time histories and spectra before and after matching are shown in Appendix C.

CGS staff have previously questioned both my use of seed acceleration histories recorded on soil sites and my use of a frequency domain procedure to match the seed records to the target spectrum and I responded in detail to both of these points in my letter to BSK Associates regarding the Murray Elementary School, dated March 26, 2024:

*Taking the second of these points first, the origin of the notion that an acceleration history fitted to a target response spectrum should look exactly like the recorded motion is not clear, but this principle is what led some structural engineers to prefer "scaling" records rather than "matching" or "fitting" them, until it was pointed out that the ASCE rules for scaling resulted in median response spectra that were as much as one standard deviation higher than the target spectrum! It may be that this preference for scaling resulted from the fact that frequency domain fitting tends to create more cycles of displacement as a result of the addition of longer period motions which are*

*generally lacking in the seed records, and this had an adverse effect on structural*

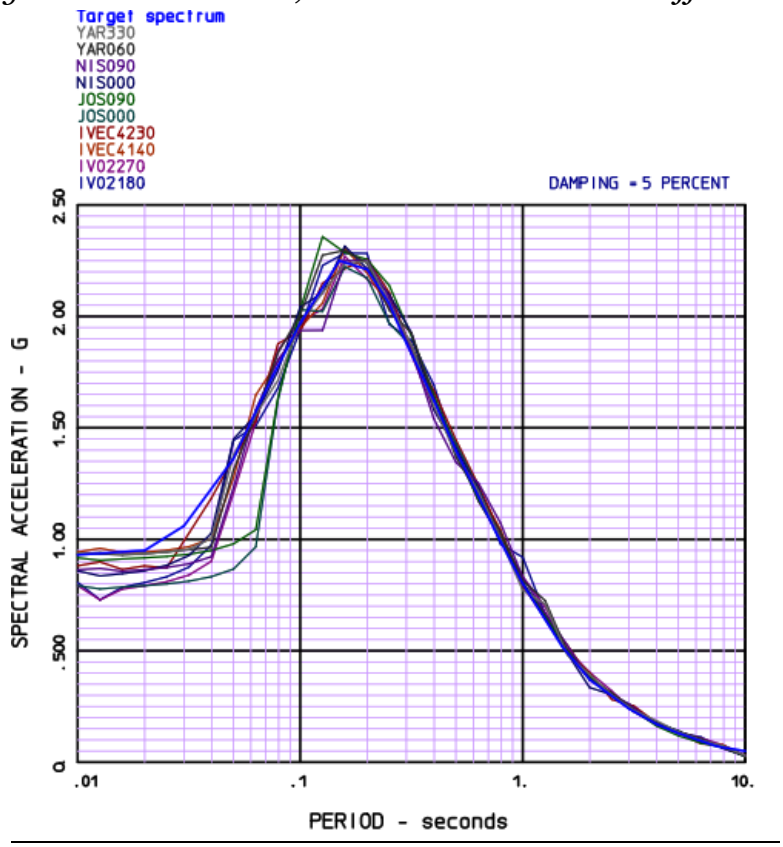



**Figure 3 – Fit to Target Response Spectrum**

*behavior when degradation was modeled! But unless you can find recorded motions that closely match the target spectrum, you have to add or subtract (and this normally means add) energy, particularly at longer periods. There is no reason that a record obtained at a different site, at a different distance for the causative fault, and with a somewhat different magnitude, should look exactly the same when it is modified to match a target spectrum developed using ground motion prediction equations. It would make more sense to argue that it should look different. Certainly, the fitted motion should still look like a real earthquake motion, but there is no good reason that it should look identical. But because of this weird belief that modified records should look little different from a record obtained on a different site, at a different distance from the causative fault, and likely from an earthquake with a different magnitude, it has become common to use a time domain fitting procedure that was originally developed for a different reason. I discussed this in my report to Miller Pacific Engineering Group re Wood Middle School dated September 15, 2023, that has recently been accepted by CGS:*

*California Geological Survey (CGS) staff have previously noted that there are some differences, particularly in the velocity and displacement histories between the recorded motions and the matched motions. This is the result of using a frequency domain spectral*

*matching technique which maintains the same phase relationship but alters, generally increasing, the Fourier amplitudes to achieve a match to the desired response spectrum amplitudes. This provides time histories that have response spectra which are, both in each case and on average, approximately at the level of the $MCE_R$ bedrock response spectrum over both the period range of significance to structural response (to use the language of the code) and the period range of significance to the site response, without the excessive conservatism that often results from simple arithmetic scaling of the selected input motions. Some structural engineers do not like this frequency domain spectral matching technique because it increases the number of cycles of displacement in the record, however, that kind of modification is entirely appropriate because the available recorded motions rarely have sufficient duration to represent magnitude 7 to 8 earthquakes. However, for engineering design purposes there is no merit in trying to maintain exactly the same appearance of the acceleration, velocity, or displacement histories of the recorded motions unless motions are available that have been recorded in earthquakes with the desired source mechanism, magnitude, and distance on soil conditions similar to the project site and with response spectra that closely match the target spectrum. The time domain spectral matching technique that is now widely used takes advantage of a limitation of response spectra which is that they are not a good indication of the energy content at various periods in an earthquake motion but rather just a locus of the maximum responses of a series of one degree of freedom oscillators. It is therefore possible to tweak the response spectrum simply by adding wavelets in order to obtain the desired peak response at given periods. This technique was originally developed in order to comply with an unreal requirement of the Nuclear Regulatory Commission that time histories simultaneously match response spectra for multiple values of structural damping when those response spectra had been constructed using arbitrary multipliers that Professors Newmark and Hall had come up with. The time domain spectral matching procedure was a brilliant way to get around that regulatory problem, but it has no particular merit and some significant shortcomings for engineering design purposes because it can achieve a good match to a target response spectrum without addition of the appropriate energy and number of cycles of loading to the available recorded motions especially for larger and closer design earthquakes.*

*Returning to the first point regarding my use of seed acceleration histories recorded on soil sites, my reason for doing this was that it is far easier to find records obtained on soil sites that are close to the causative fault in the magnitude range of interest, and these records not only tend to include near-field effects that may be desirable if the structural engineer is conducting time history analyses, but they also provide much closer fits to the target spectrum, so that less modification is required. However, in response to the CGS request and to demonstrate that it makes little difference to the computed ground surface response spectra, I have selected five pairs of horizontal motions recorded on sites with values of $V_{s30}$ in the order of 750 m/sec (2400 fps).*

*I note that it was not easy to find records that were recorded on sites near the Site Class B/C boundary at a short distance from the causative fault for low magnitude 7 earthquakes. Indeed, the only earthquake generated on a strike-slip fault that came close to fitting the bill is the Abbar record of the 1990 Manjil earthquake in Iran. In order to include two more strike-slip records, I had to increase the search radius to 50 km with the result that the records from the 1992 Landers and 2010 Darfield earthquakes have quite low amplitudes, although they otherwise have appropriate spectral shapes. While the seismic hazard at the Murray Elementary site is dominated by the Calaveras fault, the history of earthquakes in the Bay Area over the last 50 years or so indicates that there can be surprises caused by earthquakes on little known reverse fault earthquakes, and so I have also included two records from the 1989 Loma Pieta earthquake.*

The upshot of this additional work was that use of the alternate set of input acceleration histories made very little difference to the computed response spectra at the ground surface (because they were closely fitted to the same target spectrum), so that I have not repeated it here.

**Nonlinear Effective Stress Analyses**

The first formal analyses of site response were developed at the University of California, Berkeley, in the late nineteen sixties. These analyses involved conducting "equivalent linear" site response analyses, in which constant values of shear modulus and damping that were based on some fraction of the peak shear strain, were used throughout the whole record. However, in recent years there has been growing recognition that both equivalent linear analyses and simplified methods for evaluating the potential for liquefaction, and hence settlement and lateral spreading due to earthquakes, can be quite inaccurate. Pyke (2019 (a)) and Pyke and North (2019) describe an improved method for evaluating both site response and liquefaction and settlement which uses bi-directional, nonlinear effective stress site response analyses as embodied in the computer program TESS2. These improved analyses are consistent with an emerging consensus, see for example Ntritsos et al. (2018), Cubrinovski (2019), Hutabarat and Bray (2019), Kramer (2019), Olson et al. (2020) and Cubrinovski and Ntritsos (2023), that nonlinear effective stress site response analyses are necessary to understand case histories of liquefaction, let alone to make forward predictions. They also provide the most accurate method for conducting site-specific seismic hazard and/or site response analyses such as are generally required for Site Classes D, E and F under ASCE 7-16 and the 2022 CBC.

## Factors Impacting the Results of Site Response Analyses

While nonlinear effective stress analyses have the potential to accurately indicate the most likely ground surface motions, they require good data on the site and superior knowledge and experience of recorded ground motions, dynamic soil properties, and site response analyses. While the shear wave velocity profile of the soil is the key input parameter, the value chosen for the shear wave velocity of the underlying halfspace and the impedance ratio across the interface with that halfspace can also be significant. And, the degree of nonlinearity of the "modulus reduction curves" that are used as the backbone of most nonlinear soil models can be critically important. If the backbone curve is too nonlinear, excessive hysteretic damping will be generated and that wipes out shorter period motions. This is a characteristic of one widely used program, DEEPSOIL, which if the recommendations of the developers are followed, uses backbone curves which are far too nonlinear, with the result that the peak ground surface acceleration and shorter period responses are routinely underestimated. See Pyke (2021) and Pyke (2024). A good familiarity with recorded ground motions is necessary to judge whether the calculated results are credible or not.

## TESS2 Analyses and Results

I conducted the site response analyses for this site using TESS2. TESS2 employs the same explicit finite difference solution of the one-dimension wave propagation problem and the same HDCP soil model as were used in the earlier program TESS (Pyke, 1979, 1993, 2004). The features included in TESS2 are outlined and illustrated in Pyke (2019) and Crawford et al. (2019). TESS has been verified and validated in a number of studies including Kwok et al. (2007) and Stewart et al. (2008).

In older "equivalent linear" analyses of site response, it was necessary to specify the shear wave velocity, or the shear modulus at small strains, $G_{max}$, for each layer along with a "modulus reduction curve", and a modulus reduction curve of this kind can also be used as the "backbone" curve for constructing simple nonlinear models of shear stress – shear strain behavior. Pyke et al. (1993) constructed a consistent family of shear modulus reduction curves in terms of the reference strain, which is equal to $\tau_{max}$, the asymptotic value of the shear stress at large strains, divided by $G_{max}$, the shear modulus at small strains. The value of $\tau_{max}$ may be much greater than the conventional shear strength under monotonic loading as a result of both cyclic and rate of loading effects. For a plain hyperbola the reference strain is equal to the shear strain at which $G/G_{max}$ equals 0.5. Typical modulus reduction curves in terms of reference strain are shown in Figure 4. The modulus reduction curve for a reference strain of 0.1 percent closely matched the upper bound of the modulus reduction curves for sands given by Seed and Idriss (1971)

which is widely accepted as a good representation of the modulus reduction curve for

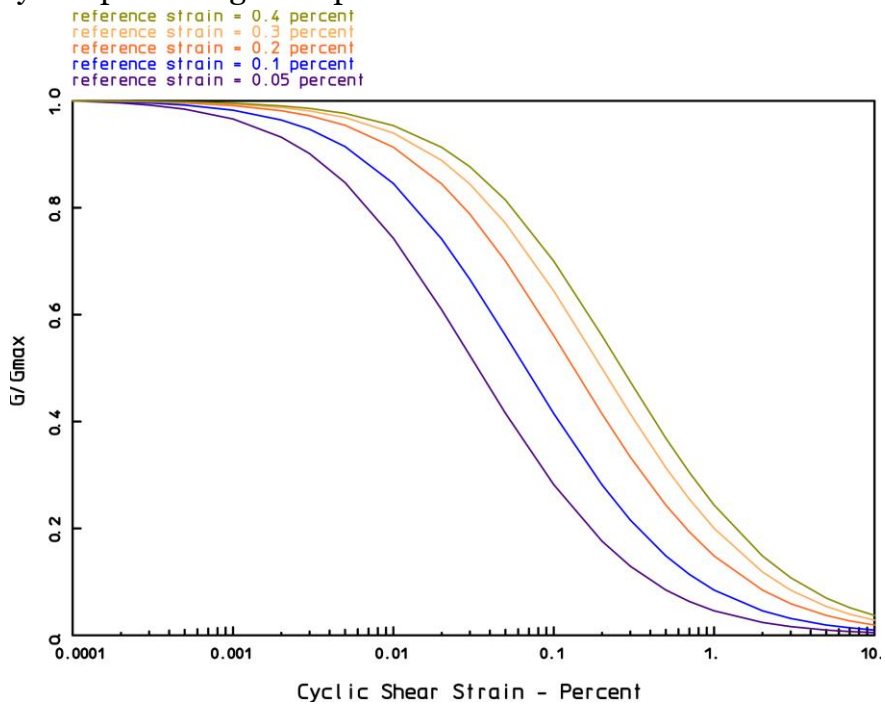



**Figure 4 – Modulus Reduction Curves as a Function of Reference Strain**

relatively young, clean sands. Clayey soils exhibit less nonlinearity than sands and have modulus reduction curves with larger reference strains. Young Bay Mud, a silty clay, based on extensive testing conducted for both the new East Bay portion of the San Francisco – Oakland Bay Bridge and the studies for a planned, but since abandoned, expansion of the San Francisco International Airport, has a reference strain of about 0.3 percent. For clean sands there is also a depth effect, as shown in the modulus reduction curves developed by Pyke et al. (1993) for use on nuclear power sites in Eastern North America which are shown in Figure 5. However, this depth effect, which results from $\tau_{max}$ increasing faster with depth than $G_{max}$, is offset by ageing and cementation and a minimal increase in the reference strain that might be expected in cemented materials. Freshly made laboratory samples of cemented materials in fact show much greater nonlinearity and smaller reference strains (see for instance Yang and Salvati (2010)). But since the deeper soils at this site have been repeatedly subject to strong earthquake ground motions, any increased nonlinearity will likely be small. Thus, the Upper Tassajara formation has been represented using a reference strain of 0.2 percent.

The new program, TESS2, runs two horizontal components of motion simultaneously and, if appropriate, adds the excess pore pressures generated by each component in accordance with the recommendation of Seed et al. (1978). Seismic settlements are computed as described by Pyke (2019a), using data from Pyke (1973) factored as necessary for the particular site conditions.

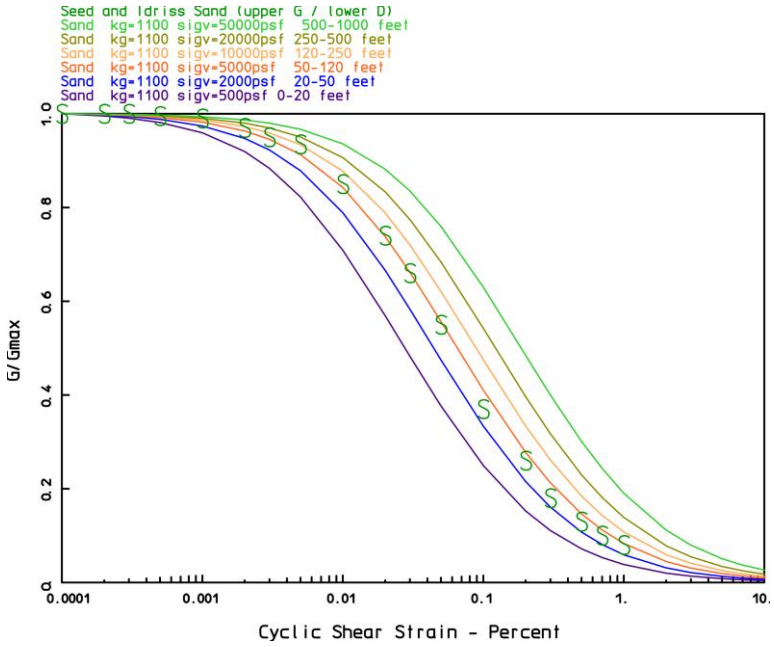



**Figure 5 – Modulus Reduction Curves as a Function of Depth**

I have made three runs with TESS2 using all five two-component input motions in order to study the sensitivity of the computed ground surface motions to the assumed depth to the Soil Class B/C boundary. These runs are labelled as follows:

tv670a - base case
tc670b - with more excess pore pressure development
tv670c - with lower shear wave velocities in the Upper Tassajara

The base case represents my best estimate of how to represent the site. The development of greater excess pore pressures in the Upper Aquifer might be expected to reduce the spectral accelerations at the periods of greatest interest. The assumption of lower shear wave velocities in the Lower Tassajara could work in either direction. The development of greater cyclic shear strains and hence damping will reduce the spectral accelerations at the periods of greatest interest but the greater impedance contrast at the base of the model reflects more of the down coming waves and tends to increase to resulting surface motions. But I should note that while the soils in this kind of alluvial deposit are generally highly stratified, they are also discontinuous horizontally. In this kind of profile there will be much more internal reflection of waves and higher damping than is observed in flat lying, horizontally continuous deposits which is what the 1D model used in TESS2 assumes. Thus, it can be stated with a high degree of confidence that the computed ground motions are likely conservative overall.

The details of the assumed input parameters and the results for these runs are shown in the printed outputs from TESS2 that are included in Appendix D. The two key input parameters controlling excess pore pressure development and the magnitude of earthquake-induced settlements in the Upper Aquifer are the cyclic stress ratio causing initial liquefaction in 10 cycles and the apparent relative density (ARD). For the base case, I have assumed a value of 0.8 for the cyclic stress ratio causing initial liquefaction in 10 cycles, based on Figure 6.4d of Boulanger and Idriss (2014), Stokoe (2023), the interpreted shear wave velocities which range from about 700 fps to 900 fps, and my own previous experience with nonlinear effective stress site response analyses. For Run tv670b. I reduced this value to 0.6. For the apparent relative density, I have assumed a value of 75 percent for the base case, and I reduced this to 70 percent in the silty sand layer for the other two cases. For all three cases, I applied a factor of 0.33 to the data on Monterey No. 0 sand from Pyke (1973) to account for these being natural soils that have presumably been shaken by many earthquakes in the past. The resulting computed settlements, which all occur in the sands of the Upper Aquifer, are quite small – about ½ to ¾ inch – but these numbers are likely conservative and in view of the non-liquefiable cap at this site, I would expect the maximum differential settlements to be negligibly small, even given a nearby magnitude 7.43 earthquake. Plots of the computed ground surface response spectra for the free field condition are shown in Figures 6-8. The spectrum of the Site Class B/C input motion and the standard code spectrum for Site Class D are also shown in Figures 6-8.

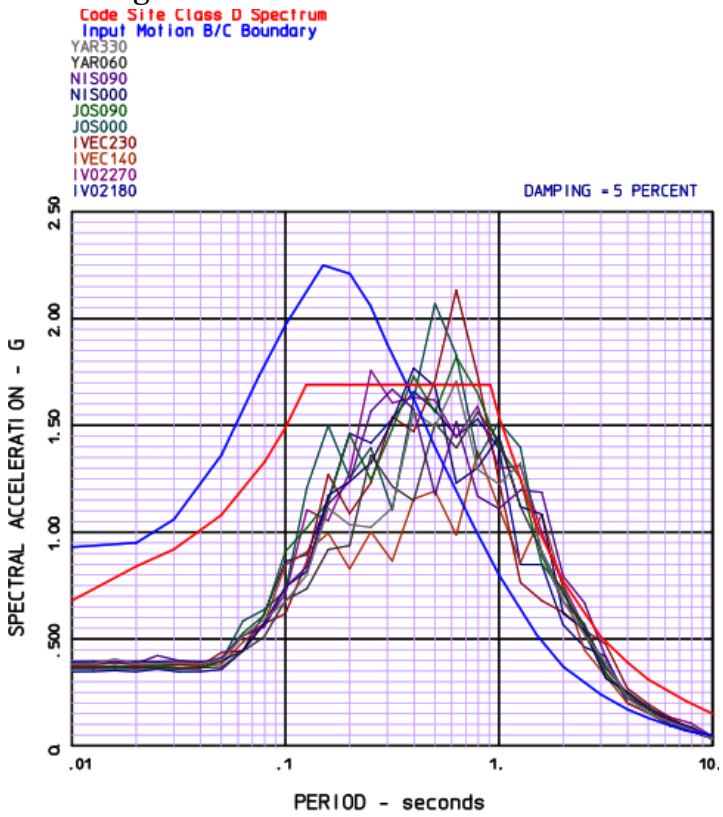



**Figure 6 – Ground Surface Response Spectra for Run tv670a**

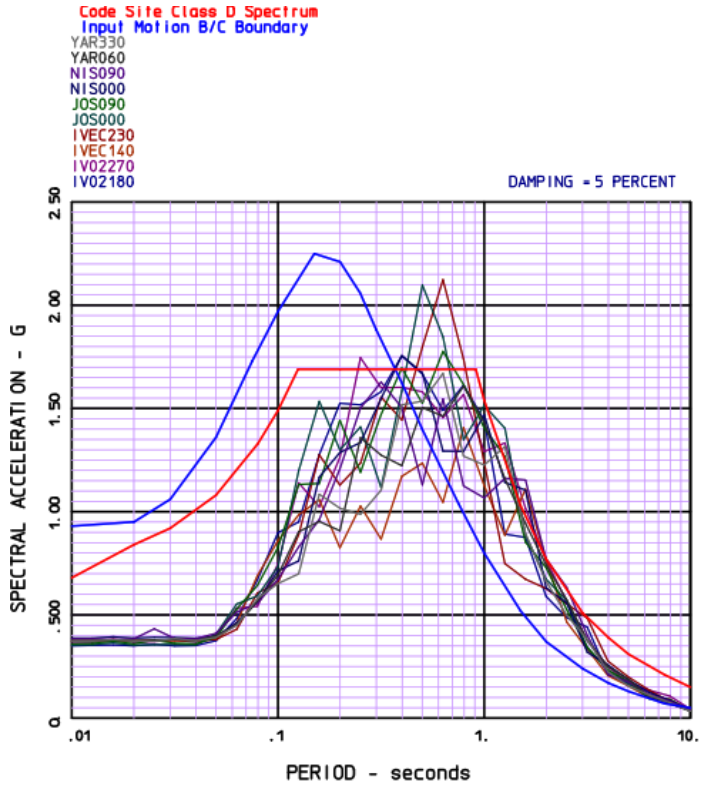



**Figure 7 – Ground Surface Response Spectra for Run tv670b**

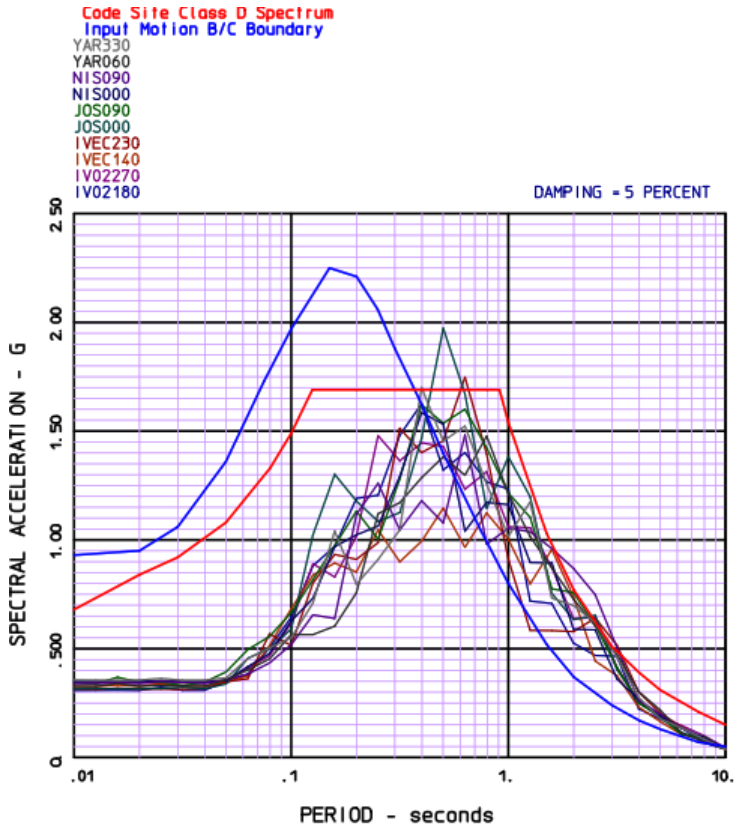



**Figure 8 – Ground Surface Response Spectra for Run tv670c**

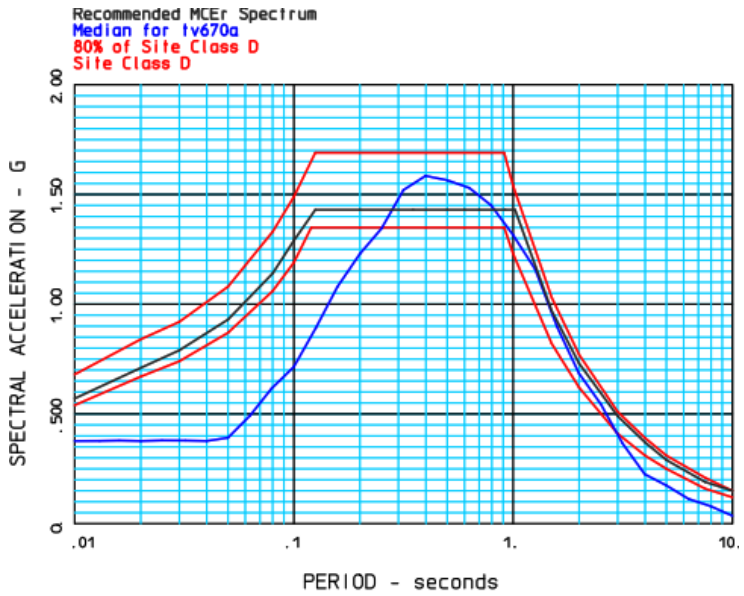



**Figure 9 – Recommended MCEr Spectrum**

Plots of the computed ground surface time histories for Run tv670a are attached as Appendix E. It might be noted that the ground surface motions show both more cycles and more uniform cycles than the original recorded motions. This occurs both because of the longer period energy that is added by the frequency domain matching procedure, and because the depth of the site damps out the shorter period motions which otherwise cause there to be more spikes in the records.

I note that CGS staff have previously asked that evidence be provided that the language of Section 21.1.3 of ASCE 7-16 is satisfied, and I have explained that since the individual input motions are closely fitted to the target spectrum and the spectrum of the computed surface motion is, by definition, equal to the spectrum of the input motion multiplied by the spectral amplification ratios at each period, the median of the computed surface motions must be closely equal to the target spectrum multiplied by the average of the spectral amplification ratios. The language in ASCE 7-16 is archaic and it would make more sense to just say that the recommended surface ground motion response spectrum cannot be less than the median of the computed individual ground motion response spectral values at each period.

There is little difference between the spectra shown in Figures 6 and 7 and these provide more conservative spectral accelerations over the period range of greatest interest, the fundamental period of vibration for the structure being approximately 0.75 seconds, than Figure 8. The median of the computed ground surface spectral accelerations for Run tv670a is shown in Figure 9 as a blue line, and the standard code spectrum for Site Class D, and 80 percent of that spectrum, are shown as red lines. I have constructed a recommended $MCE_R$ spectrum following the rules of Sections 21.3 and 21.4 of ASCE 7-16

and this is shown as a black line in Figure 9. The recommended DBE spectrum simply has spectral accelerations equal to two-thirds of the $MCE_R$ spectrum. Selected points defining the $MCE_R$ spectrum and the design spectrum are listed in Tables 2 and 3. The code parameters $S_{MS}$ and $S_{M1}$ are equal to 1.43 g and 1.46 g and the values for $S_{DS}$ and $S_{D1}$ are equal to 0.95 g and 0.97 g. The average peak ground acceleration obtained from Run tv670a is 0.37 g.

Sincerely,




Robert Pyke, PhD, GE

**Table 2 – Recommended $MCE_R$ Spectrum**

| PERIOD | Sa |
|---|---|
| seconds | g |
| 0.01 | 0.57 |
| 0.02 | 0.71 |
| 0.03 | 0.79 |
| 0.05 | 0.93 |
| 0.08 | 1.14 |
| 0.1 | 1.29 |
| 0.125 | 1.43 |
| 0.2 | 1.43 |
| 0.35 | 1.43 |
| 0.5 | 1.43 |
| 0.6 | 1.43 |
| 0.7 | 1.43 |
| 0.92 | 1.43 |
| 1.02 | 1.43 |
| 1.5 | 0.97 |
| 2 | 0.73 |
| 3 | 0.49 |
| 4 | 0.37 |
| 5 | 0.29 |
| 7.5 | 0.19 |
| 10 | 0.15 |

**Table 3 – Recommended Design Spectrum**

| PERIOD | Sa |
|---|---|
| seconds | g |
| 0.01 | 0.38 |
| 0.02 | 0.48 |
| 0.03 | 0.52 |
| 0.05 | 0.62 |
| 0.08 | 0.76 |
| 0.1 | 0.86 |
| 0.125 | 0.95 |
| 0.2 | 0.95 |
| 0.35 | 0.95 |
| 0.5 | 0.95 |
| 0.6 | 0.95 |
| 0.7 | 0.95 |
| 0.92 | 0.95 |
| 1.02 | 0.95 |
| 1.5 | 0.65 |
| 2 | 0.49 |
| 3 | 0.32 |
| 4 | 0.24 |
| 5 | 0.19 |
| 7.5 | 0.13 |
| 10 | 0.10 |

**Attachments:**

Plates from eki technical memorandum to Zone 7

Appendix A – Outputs from SEA/OSHPD and USGS

Appendix B – Details of input motions

Appendix C – Plots of time histories and response spectra for input motions

Appendix D – Printed output from TESS2 analyses

Appendix E – Plots of computed ground surface time histories

Appendix F – Excel spreadsheets

Expanded description of TESS2

Paper from 20ICSMGE - Pyke (2021)

Paper from 8ICEGE - Pyke (2024)

Technical Note re Limitations of Simplified Methods for Evaluating Earthquake-Induced Liquefaction and its Consequences

**References:**

Andrus, R.D., Hayati, H. and Mohanan, N.P., "Correcting Liquefaction Resistance for Aged Sands Using Measured to Estimated Velocity Ratio", Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Vol 135, No 6, pp 735-744, 2009

Andrus, D.R. and Stokoe, K.H., "Liquefaction Resistance of Soils from Shear-Wave Velocity," Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 126, No. 11, November, pp 1015-1025, 2000.

Andrus, R.D., Stokoe, K.H., and Juang, C.H., "Guide for Shear-Wave Based Liquefaction Potential Evaluation", Earthquake Spectra, Vol. 20, No. 2, May 2004

Arango, I., Lewis, M.R. and Kramer, C., "Updated Liquefaction Potential Analysis Eliminates Foundation Retrofitting at Two Critical Structures", Soil Dynamics and Earthquake Engineering, Vol 20, pp 17-25, 2000

Bartlett, S. F., and Youd, T. L., "Empirical prediction of liquefaction-induced lateral spread", Journal of Geotechnical Engineering, ASCE, Vol. 121, No. 4, 1995

Bray, J.D., "Evaluating the Effects of Liquefaction", (1049) Geo-Congress 2022: H. Bolton Seed Lecture: Jonathan Bray - YouTube

Bwambale, B., and Andrus, R.D., "State of the art in the assessment of aging effects on soil liquefaction", Soil Dynamics and Earthquake Engineering, 125, 2019

Boulanger, R.W. and Idriss, I.M., "CPT and SPT Based Liquefaction Triggering Procedures", Report No. UCD/CGM-14/01, UC Davis, April 2014

Boulanger, R.W., et al., "Evaluating Liquefaction and Lateral Spreading in Interbedded Sand, Silt and Clay Deposits Using the Cone Penetrometer", Geotechnical and Geophysical Site Characterization 5, Australian Geomechanics Society, Sydney, Australia, 2016

Boore, D.M., and Asten, M.W., "Comparisons of Shear-Wave Slowness in the Santa Clara Valley, California, Using Blind Interpretations of Data from Invasive and Noninvasive Methods",

Bulletin of the Seismological Society of America, Vol. 98, No.4., August 2008

Crawford, C., Tootle, J., Pyke, R. and Reimer, M., "Comparison of simplified and more refined analyses of seismic settlements", Proc. 7th International Conference on Earthquake Geotechnical Engineering, Rome, June 2019

Cubrinovski, M., Keynote Lecture 09, "Key aspects in the engineering assessment of soil liquefaction", Proc. 7th International Conference on Earthquake Geotechnical Engineering, Rome, June 2019

Cubrinovski, M., and Ntritsos, N. "8th Ishihara lecture: Holistic evaluation of liquefaction response", Soil Dynamics and Earthquake Engineering, Vol. 168, 2023

Dobry, R., and Abdoun, T., "An Investigation into Why Liquefaction Charts Work: A Necessary Step Toward Integrating the States of Art and Practice", 5th International Conference on Earthquake geotechnical Engineering, Santiago, Chile, January 2011.

Hayati, H. and Andrus R.D., "Updated Liquefaction Resistance Correction Factors for Aged Sands, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Vol 135, No 11, pp 16831692, 2009

Hayati, H., Andrus R.D., Gassman, S.L., Hasek, M., Camp, W.M., and Talwani, P., "Characterizing the Liquefaction Resistance of Aged Soils", Geotechnical Earthquake Engineering and Soil Dynamics IV Congress, ASCE GSP 181, 2008

Huang, Yin-Nang, Andrew S. Whittaker, and Nicolas Luco, "Maximum Spectral Demands in the Near-Fault Region", Earthquake Spectra, Volume 24, Issue 1, February 2008

Hutabarat, D., and Bray, J.D., "Effective stress analysis of liquefiable site in Christchurch to discern the characteristics of sediment ejecta", Proc. 7th International Conference on Earthquake Geotechnical Engineering, Rome, June 2019

Idriss, I.M. & Boulanger R.W., "Soil Liquefaction During Earthquakes", MNO-12, Earthquake Engineering Research Institute, 2008.

Idriss, I.M., Dobry, R., and Singh, R.D., "Nonlinear Behavior of Soft Clays", Journal of Geotechnical Engineering, ASCE, Vol.104, No.11, December 1978

Ishihara, K., "Liquefaction and flow failure during earthquakes", Geotechnique, Vol.43, No. 3, 1993

Ishihara, K., and Yoshimine, M., "Evaluation of Settlements in Sand Deposits Following Liquefaction During Earthquakes", Soils and Foundations, Vol.32, No.1, pp.173-188, March 1992

Ishihara, K., et al., "Post-liquefaction settlement analyses based on the volume change characteristics of undisturbed and reconstituted sands", Soils and Foundations, Vol. 56, No. 3, 2016

Jamiolkowski, M., et al., "Evaluation of Relative Density and Shear Strength of Sands from CPT and DMT", ASCE Special Geotechnical Publication 119, pp. 201-238, 2003

Kramer, S., Keynote Lecture 08, "The use of numerical analysis in the interpretation of liquefaction case histories", Proc. 7th International Conference on Earthquake Geotechnical Engineering, Rome, June 2019

Kwok, A.O., J.P. Stewart, Y.M.A. Hashash, N. Matasovic, R. Pyke, Z. Wang, and Z. Yang, "Use of exact solutions of wave propagation problems to guide implementation of nonlinear seismic ground response analysis procedures," *J. Geotech. & Geoenv. Engrg.*, ASCE, 133 (11), 2007
Leon, E., Gassman, S.L., and Talwani, P., "Accounting for Soil Aging when Assessing Liquefaction Potential", Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 132, No.3, pp 363-377, 2006

Lewis, M.R., et al., "Site Characterization Philosophy and Liquefaction Evaluation of Aged Sands", Geotechnical Earthquake Engineering and Soil Dynamics IV Congress, ASCE GSP 181, 2008

Mitchell, J.K., "Practical Problems from Surprising Soil Behavior - the Twentieth Terzaghi Lecture", Journal of Geotechnical Engineering, ASCE, Vol. 112, No. 3, pp. 255–289, 1986

Norfleet Consultants, "Engineering Geologic Site Characterization of the Greater Oakland – Alameda Area, Alameda County CA", CD ROM prepared for NEHRP, 1991

Ntritsos, N., et al., "Evaluation of Liquefaction Case Histories from the 2010-2011 Canterbury Earthquakes Using Advanced Effective Stress Analysis", Geotechnical Earthquake Engineering and Soil Dynamics V ASCE Geotechnical Special Publication 290, 2018

Ntritsos, N. and Cubrinovski, M., "A CPT-based effective stress analysis procedure for liquefaction assessment", Soil Dynamics and Earthquake Engineering, Vol. 131, 2020

Olson, S.M., et al. "Nonlinear Site Response Analysis with Pore-Water Pressure Generation for Liquefaction Triggering Evaluation", Journal of the Geotechnical and GeoEnvironmental Division, ASCE, Vo. 146, No. 2, 2020

Pampeyan, E.H., "Geologic Map of the Southern Part of the Redwood Point 7 ½' Quadrangle, San Mateo County, California, United States Geological Survey Open File Map, 1970

Pampeyan, E.H., "Geologic Map of the Palo Alto and Part of the Redwood Point 7 1/2' Quadrangles, San Mateo and Santa Clara Counties, California, United States Geological Survey, 1993

Pyke, R., "Settlement and Liquefaction of Sands Under Multi-Directional Loading," Ph.D. Thesis, University of California, Berkeley, 1973

Pyke, R., "Non-linear Soil Models for Irregular Cyclic Loadings," Journal of the Geotechnical Engineering Division, ASCE, Volume 105, No. GT6, June 1979

Pyke, R., et al., "Modeling of Dynamic Soil Properties", Appendix 7.A, Guidelines for Determining Design Basis Ground Motions, Report No. TR-102293, Electric Power Research Institute, November 1993

Pyke, R., "Practical Aspects of the Evaluation of Liquefaction Potential", Earthquake Geotechnical Engineering, Ishihara (ed.), Balkema, 1995

Pyke, R., Discussion of "Liquefaction Resistance of Soils: Summary Report From the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of liquefaction Resistance of Soils", Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 129, No.3, pp 283-284, 2003

Pyke, R., "Evolution of Soil Models Since the 1970s.", Opinion Paper, International Workshop on Uncertainties in Nonlinear Soil Properties and their Impact on Modeling Dynamic Soil Response, Sponsored by the National Science Foundation and PEER Lifelines Program PEER Headquarters, UC Berkeley, March 18-19, 2004.

Pyke, R., "Evaluating the Potential for Earthquake-Induced Liquefaction in Practice", 6th International Conference on Earthquake Geotechnical Engineering, Christchurch, New Zealand, November 2015

Pyke, R., "Improved analyses of earthquake-induced liquefaction and settlement", Proc 7th International Conference on Earthquake Geotechnical Engineering, Rome, June 2019

Pyke, R., "Improved Analysis of Potential Lateral Spreading Displacements in Earthquakes", Presented at the 2nd Ishihara Colloquium, San Diego State University, August 22-23, 2019(b) https://www.linkedin.com/pulse/improved-analysis-potential-lateral-spread-earthquakes-robert-pyke/

Pyke, R., "Limitations of Simplified Methods for Estimating Seismic Settlements ", 2020(a)

Pyke, R., "Limitations of Vs30 for characterizing sites for ground motion studies and guidance on the conduct of nonlinear site response analyses", 2020(b) https://www.linkedin.com/pulse/limitations-vs30-characterizing-sites-ground-motion-studies-pyke-1c/

Pyke, R., "Modeling of stress-strain relationships of soils from Ted Davis to current practice", Proceedings of the 20th International Conference on Soil Mechanics and Geotechnical

Engineering, Sydney, 2021

Pyke, R., “Lessons learned from the observed seismic settlement at the Jensen Filtration Plant in the San Fernando Earthquake”, ASCE Lifelines 21-22 Conference, Los Angeles, February 2022

Pyke, R., “The benefits of site-specific nonlinear site response analyses”, Proc. 8th International Conference on Earthquake Geotechnical Engineering, Osaka, 2024

Pyke, R., Knuppel, L.A, and Lee, K.L., "Evaluation of Liquefaction Potential at Los Angeles and Long Beach Harbors," Journal of the Geotechnical Engineering Division, ASCE, Volume 104, No. GT111, November 1978.

Pyke, R., and North, J., “Shortcomings of simplified analyses of earthquake-induced liquefaction and settlement”, Proc. 7th International Conference on Earthquake Geotechnical Engineering, Rome, June 2019

Robertson, P.K. and Shao, L., “Estimation of Seismic Compression in Dry Soils Using the CPT”, 5th Int. Conf. on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics. San Diego, 2010

Robertson, P.K., and Wride, C.E., “Evaluating cyclic liquefaction potential using the cone penetration tests”, Canadian Geotechnical Journal, Vol. 35, pp. 442-459, 1998

Schmertmann, J.H., "The Mechanical Ageing of Soils – the Twenty Fifth Terzaghi Lecture", Journal of Geotechnical Engineering, ASCE, Vol. 117, No. 9, 1991

Seed, H. Bolton, “Some Aspects of Sand Liquefaction Under Cyclic loading”, Proceedings of BOSS ’76, Trondheim, Norway, Vol. 1, pp. 374-391, 1976

Seed, H. Bolton, “Soil Liquefaction and Cyclic Mobility Evaluation for Level Ground During Earthquakes,” *Journal of the Geotechnical Engineering Division*, American Society of Civil Engineers, New York, NY, Vol. 105, No. GT2, pp. 201-255, 1979.

Seed, H.B., and Idriss, I.M., “Soil Moduli and Damping Factors for Dynamic Response Analyses”, Report No. EERC 70-10, December 1970

Seed, H. Bolton, Martin, P.P., Lysmer, J., "Pore Pressure Changes During Soil Liquefaction", ASCE, Vol.102, No.GT4, April 1976

Seed, H. Bolton, Pyke, R., and Martin, G.R., "Effect of Multi-directional Shaking on Pore Pressure Development in Sands," Journal of the Geotechnical Engineering Division, ASCE, volume 104, No. GT1, January 1978.

Semple, R., “Problems with Liquefaction Criteria and Their Application in Australia”, Australian Geomechanics, Vol. 48, No. 3, pp 15-48, September 2013

Shahi, S.K. and Baker, J.W., "NGA-West 2 Models for Ground Motion Directionality", Earthquake Spectra, Volume 30, No. 3, August 2014

Stewart, J.P., Kwok, A.O., Hashash, Y.M.A., Matasovic, N., Pyke, R., Wang, Z., and Yang, Z., "Benchmarking of nonlinear geotechnical ground response analysis procedures," *Report PEER 2008/04*, Pacific Earthquake Engineering Research Center, University of California, Berkeley, 2008

Stokoe, K.H., "UTexas Field and Laboratory Liquefaction Activities", Presentation delivered at the Dobry Symposium, Rensselaer Polytechnic Institute, Troy NY, May 2023

Yang, L., and Salvati, L.A., "Modeling the Dynamic Properties of Cemented Sand for Site Response Analysis", Proceedings of the 9th US National and 10th Canadian Conference on Earthquake Engineering, Paper No. 362, Toronto, 2010

Youd, T.L., Hansen C.M., and Bartlett, S.F., "Revised Multilinear Regression Equations for Prediction of lateral Spread Displacements", Journal of Geotechnical and GeoEnvironmental Engineering, ASCE, Vol. 128, No.128, December 2002

Youd, T.L., "Application of MLR Procedure for Prediction of Liquefaction-Induced Lateral Spread Displacement", Journal of the Geotechnical and GeoEnvironmental Division, ASCE, Vol. 144, No. 6, 2018

oOo

# Plates

**Taken from: Draft Geologic Cross Sections for Zone 7 2022 Alternative Groundwater Sustainability Plan**

**by eki environment & water, June 07, 2021**

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), OpenStreetMap contributors, and the GIS User Community

**LEGEND**

- Cross-Section Trace Location
- NorFleet '04 Fault Locations
- Streams
- Chain of Lakes
- Livermore Valley Groundwater Basin

**Surficial Geology**

- Qu Undivided surficial deposits
- Qoa Older alluvial deposits
- Qt Terrace deposits
- QTl Livermore gravels
- Tgvt Green Valley/Tassajara group
- Tc Cierbo Formation - white sandstone
- Tbr Briones Formation - sandstone and shell breccia
- Tn Neroly Formation - blue sandstone
- Ks Unnamed sandstone and shale
- Kss Unnamed sandstone
- Ku Unnamed shale
- Kc Unnamed conglomerate
- Kd Unit D - sandstone
- Kcu Upper Unit C - shale
- Kcm Middle Unit C - sandstone
- KJfe Eylar Mountain terrane - sandstone, siltstone, conglomerate and chert
- KJfm Melange terrane

Approximate Site Location

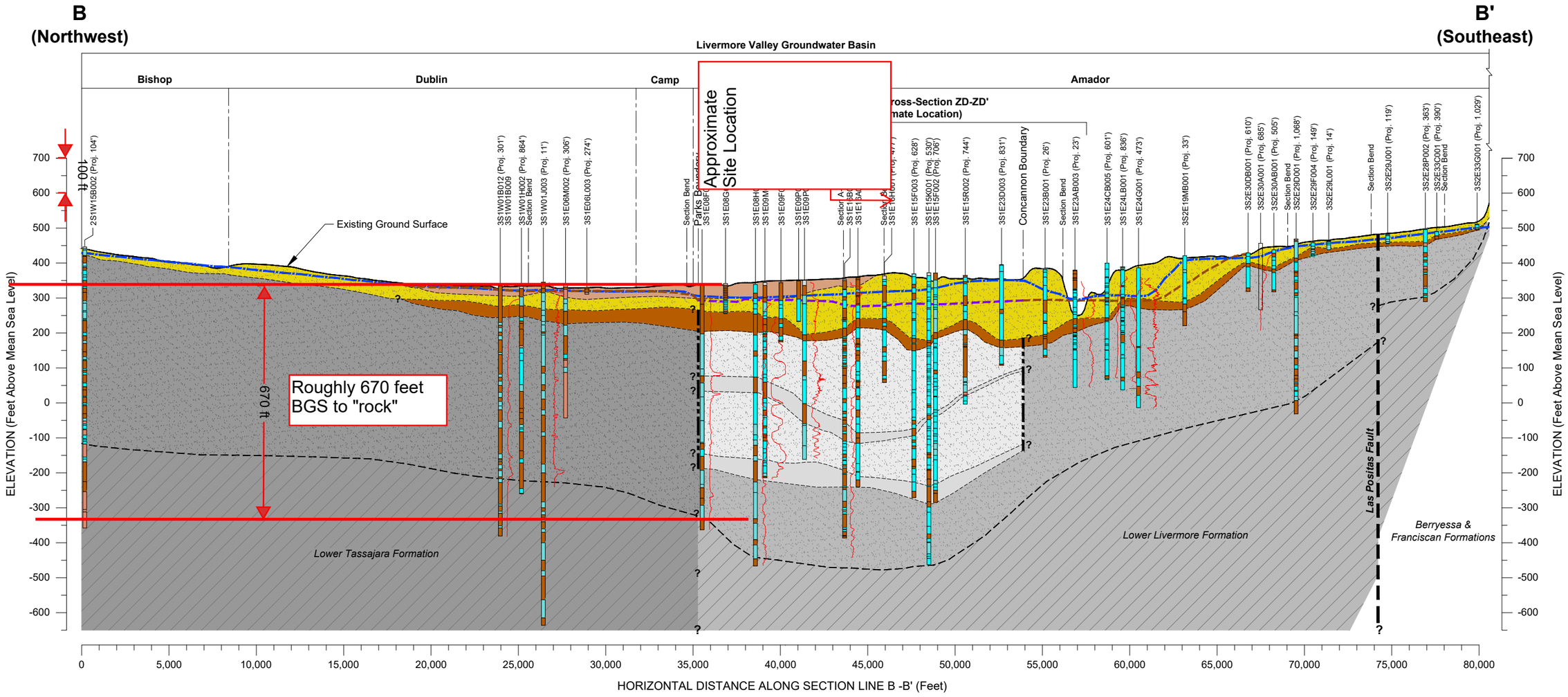
0 2.5 5 Miles

N W E S

DATE: June 2021

FILE: X:\2006\5.0\May2021\A06\Fig2_SurfGeoFaultsStreams.mxd

**Figure 2**
**Surficial Geology,**
**Major Faults and Streams**




## Cross-Section B - B'

Legend:

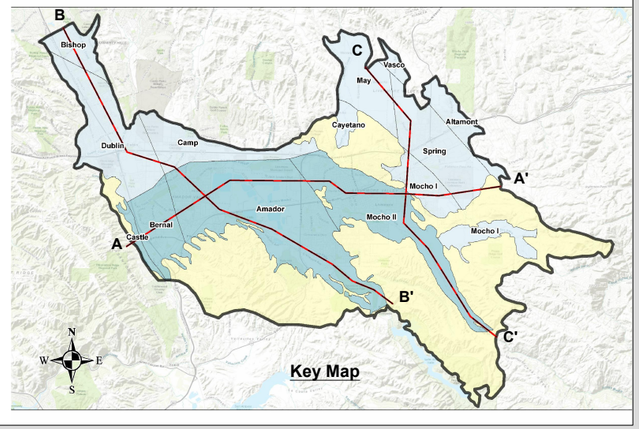
**Stratigraphy**
- Overburden
- Upper Aquifer
- Aquitard
- Lower Aquifer (Quaternary Gravels/Sands)
- Lower Aquifer (Quaternary Clays/Silts)
- Upper Livermore Formation
- Lower Livermore Formation
- Upper Tassajara Formation
- Lower Tassajara Formation
- Bottom of Groundwater Basin
- Static Water Level in Upper Aquifer (Fall 2019)
- Static Water Level in Lower Aquifer (Fall 2019)
- Static Water Level in Upper Livermore/Tassajara Formation (Fall 2019)

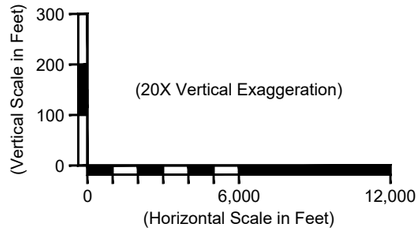
**Lithology**
- Topsoil/Fill
- Gravel
- Sand
- Silt
- Clay

**Geophysical**
- Long-Normal Resistivity

**Map Elements**
- A — A' Cross-Section Trace Location
- Livermore Valley Groundwater Basin

**Management Area**
- Fringe Management Area
- Main Basin Management Area
- Upland Management Area




**Geologic Cross-Section B - B'**

Zone 7 2022 Alternative GSP
Livermore, CA
June 2021
EKI C00065.00

**Figure 4a**

20210603,085738 G:\C00065.00\2021-06\Cross Section B-B.dwg Section B-B'

# Appendix A

## Outputs from SEA/OSHPD web site for Site Class D and from USGS Seismic Hazard Tool for Site Class B/C

USGS web services were down for some period of time and as a result this tool wasn't operational, resulting in *timeout* error.
USGS web services are now operational so this tool should work as expected.

# Tri-Valley Hospital

**Latitude, Longitude: 37.6942, -121.8800**




| | |
|---|---|
| **Date** | 10/2/2024, 3:47:45 PM |
| **Design Code Reference Document** | ASCE7-16 |
| **Risk Category** | II |
| **Site Class** | D - Stiff Soil |

| Type | Value | Description |
|---|---|---|
| $S_S$ | 1.687 | $MCE_R$ ground motion. (for 0.2 second period) |
| $S_1$ | 0.617 | $MCE_R$ ground motion. (for 1.0s period) |
| $S_{MS}$ | 1.687 | Site-modified spectral acceleration value |
| $S_{M1}$ | null -See Section 11.4.8 | Site-modified spectral acceleration value |
| $S_{DS}$ | 1.125 | Numeric seismic design value at 0.2 second SA |
| $S_{D1}$ | null -See Section 11.4.8 | Numeric seismic design value at 1.0 second SA |

| Type | Value | Description |
|---|---|---|
| SDC | null -See Section 11.4.8 | Seismic design category |
| $F_a$ | 1 | Site amplification factor at 0.2 second |
| $F_v$ | null -See Section 11.4.8 | Site amplification factor at 1.0 second |
| PGA | 0.703 | $MCE_G$ peak ground acceleration |
| $F_{PGA}$ | 1.1 | Site amplification factor at PGA |
| $PGA_M$ | 0.773 | Site modified peak ground acceleration |
| $T_L$ | 8 | Long-period transition period in seconds |
| SsRT | 2.093 | Probabilistic risk-targeted ground motion. (0.2 second) |
| SsUH | 2.237 | Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration |
| SsD | 1.687 | Factored deterministic acceleration value. (0.2 second) |
| S1RT | 0.765 | Probabilistic risk-targeted ground motion. (1.0 second) |
| S1UH | 0.829 | Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration. |
| S1D | 0.617 | Factored deterministic acceleration value. (1.0 second) |
| PGAd | 0.703 | Factored deterministic acceleration value. (Peak Ground Acceleration) |

| Type | Value | Description |
| --- | --- | --- |
| $PGA_{UH}$ | 0.847 | Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration |
| $C_{RS}$ | 0.936 | Mapped value of the risk coefficient at short periods |
| $C_{R1}$ | 0.922 | Mapped value of the risk coefficient at a period of 1 s |
| $C_V$ | 1.437 | Vertical coefficient |

DISCLAIMER

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U.S. Geological Survey - Earthquake Hazards Program

# Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new USGS Earthquake Hazard Toolbox for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

## Input

Edition

Dynamic: Conterminous U.S. 2014 (u…

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

37.6942

Time Horizon

Return period in years

2475

Longitude

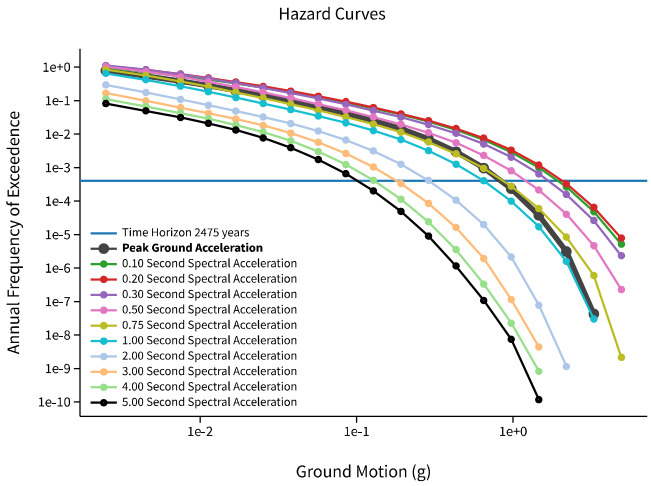
Decimal degrees, negative values for western longitudes

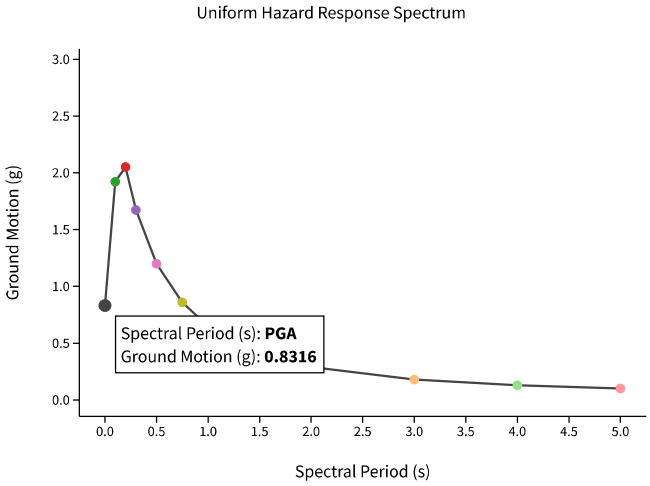
-121.88

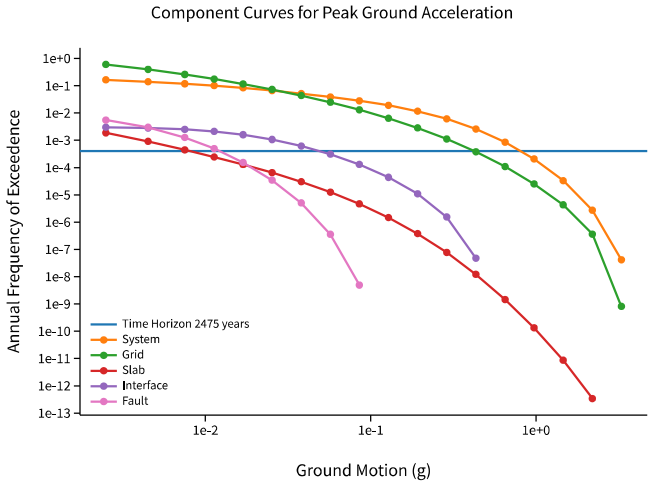
Site Class

760 m/s (B/C boundary)

## Hazard Curve



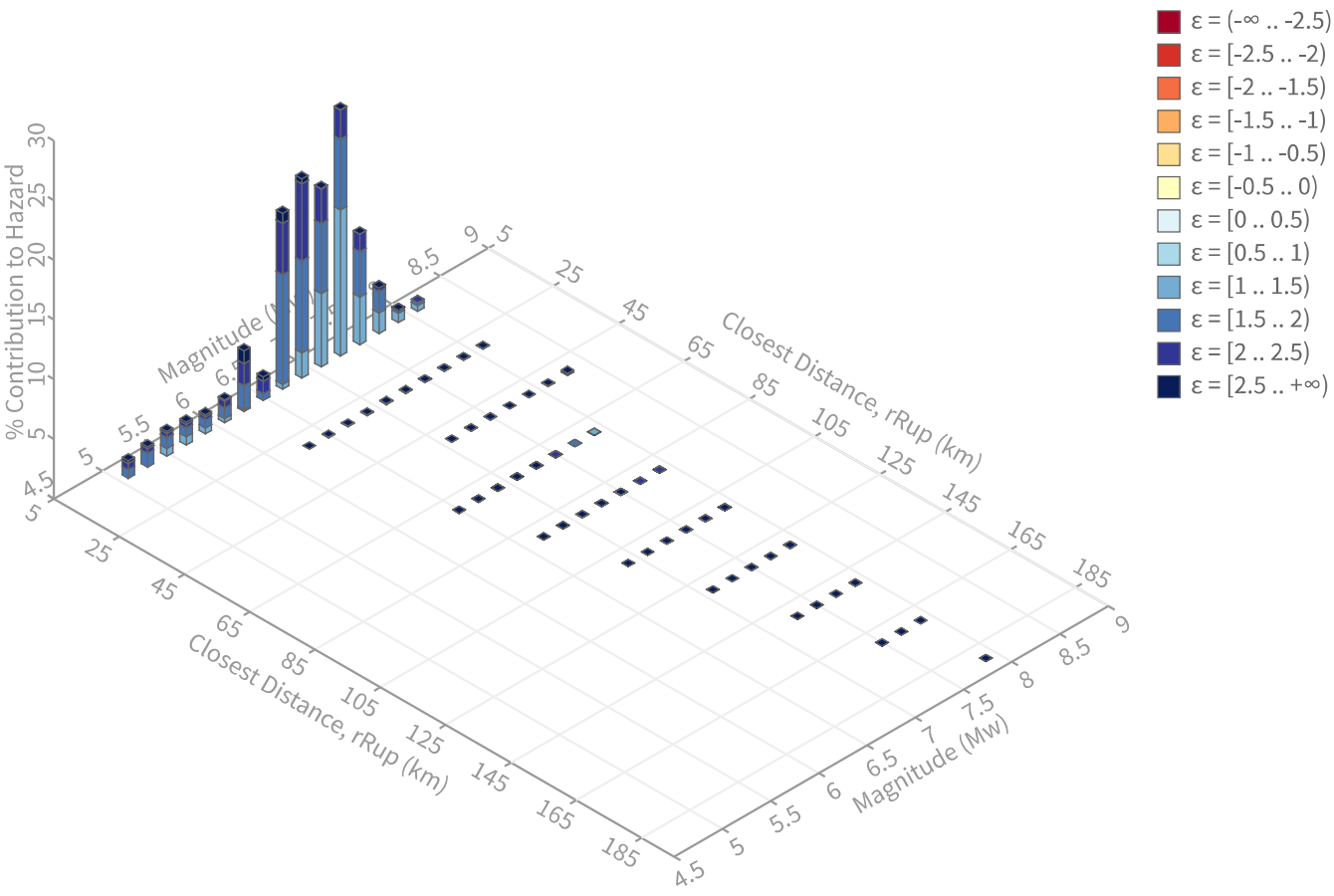




View Raw Data

## Deaggregation

Component

Total



# Summary statistics for, Deaggregation: Total

## Deaggregation targets

**Return period:** 2475 yrs
**Exceedance rate:** 0.0004040404 $yr^{-1}$
**PGA ground motion:** 0.83160304 g

## Recovered targets

**Return period:** 2936.6067 yrs
**Exceedance rate:** 0.00034052909 $yr^{-1}$

## Totals

**Binned:** 100 %
**Residual:** 0 %
**Trace:** 0.06 %

## Mean (over all sources)

**m:** 6.91
**r:** 10.36 km
**$\varepsilon_0$:** 1.77 σ

## Mode (largest m-r bin)

**m:** 7.29
**r:** 9.45 km
**$\varepsilon_0$:** 1.54 σ
**Contribution:** 20.6 %

## Mode (largest m-r-$\varepsilon_0$ bin)

**m:** 7.29
**r:** 8.37 km
**$\varepsilon_0$:** 1.39 σ
**Contribution:** 12.24 %

## Discretization

**r:** min = 0.0, max = 1000.0, Δ = 20.0 km
**m:** min = 4.4, max = 9.4, Δ = 0.2
**ε:** min = -3.0, max = 3.0, Δ = 0.5 σ

## Epsilon keys

**ε0:** [-∞ .. -2.5)
**ε1:** [-2.5 .. -2.0)
**ε2:** [-2.0 .. -1.5)
**ε3:** [-1.5 .. -1.0)
**ε4:** [-1.0 .. -0.5)
**ε5:** [-0.5 .. 0.0)
**ε6:** [0.0 .. 0.5)
**ε7:** [0.5 .. 1.0)
**ε8:** [1.0 .. 1.5)
**ε9:** [1.5 .. 2.0)
**ε10:** [2.0 .. 2.5)
**ε11:** [2.5 .. +∞]

## Deaggregation Contributors

| Source Set ↳ Source | Type | r | m | $\varepsilon_0$ | lon | lat | az | % |
|---|---|---|---|---|---|---|---|---|
| UC33brAvg_FM31 | System | | | | | | | 46.32 |
| Calaveras (No) [3] | | 8.30 | 7.12 | 1.49 | 121.935°W | 37.673°N | 244.43 | 21.41 |
| Hayward (So) [4] | | 15.00 | 7.11 | 2.19 | 122.008°W | 37.611°N | 230.57 | 9.37 |
| Mount Diablo Thrust South [1] | | 8.23 | 6.85 | 1.63 | 121.847°W | 37.760°N | 21.43 | 7.34 |
| Mount Diablo Thrust North CFM [0] | | 10.11 | 7.18 | 1.64 | 121.896°W | 37.782°N | 352.03 | 3.35 |
| UC33brAvg_FM32 | System | | | | | | | 43.19 |
| Calaveras (No) [3] | | 8.30 | 7.10 | 1.49 | 121.935°W | 37.673°N | 244.43 | 22.10 |
| Hayward (So) [4] | | 15.00 | 7.12 | 2.19 | 122.008°W | 37.611°N | 230.57 | 9.44 |
| Mount Diablo Thrust [0] | | 11.46 | 7.06 | 1.67 | 121.823°W | 37.742°N | 43.12 | 4.62 |
| Greenville (No) [4] | | 15.23 | 7.05 | 2.15 | 121.747°W | 37.769°N | 54.64 | 1.94 |
| UC33brAvg_FM31 (opt) | Grid | | | | | | | 5.25 |
| PointSourceFinite: -121.880, 37.708 | | 5.35 | 5.54 | 1.71 | 121.880°W | 37.708°N | 0.00 | 1.92 |
| PointSourceFinite: -121.880, 37.708 | | 5.35 | 5.54 | 1.71 | 121.880°W | 37.708°N | 0.00 | 1.92 |
| UC33brAvg_FM32 (opt) | Grid | | | | | | | 5.23 |
| PointSourceFinite: -121.880, 37.708 | | 5.35 | 5.54 | 1.71 | 121.880°W | 37.708°N | 0.00 | 1.94 |
| PointSourceFinite: -121.880, 37.708 | | 5.35 | 5.54 | 1.71 | 121.880°W | 37.708°N | 0.00 | 1.94 |

# Appendix B

## Details of Selected Records from PEER NGAWest2 Web Site

| Records selected for CEF | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Result ID | Record Sequence Number | Scale Factor | Tp-Pulse Period (sec) | 5-75% Duration (sec) | 5-95% Duration (sec) | Arias Intensity (m/sec) | Earthquake Name | Year | Station Name |
| 1 | 6 | 1 | - | 17.7 | 24.2 | 1.6 | "Imperial Valley-02" | 1940 | "El Centro Array #9" |
| 8 | 179 | 0.6281 | 4.788 | 3.4 | 10.3 | 1.4 | "Imperial Valley-06" | 1979 | "El Centro Array #4" |
| 27 | 864 | 0.8287 | - | 21.7 | 27.1 | 2.3 | "Landers" | 1992 | "Joshua Tree" |
| 37 | 1111 | 0.4576 | - | 4.5 | 11.2 | 3.4 | "Kobe_ Japan" | 1995 | "Nishi-Akashi" |
| 42 | 1176 | 0.8559 | 4.949 | 7 | 15.1 | 1.3 | "Kocaeli_ Turkey" | 1999 | "Yarimca" |

| Result ID | Magnitude | Mechanism | Rjb (km) | Rrup (km) | Vs30 (m/sec) | Lowest Useable Frequency (Hz) | Initial-search Scale Factor | Horizontal-1 Acc. Filename | Horizontal-2 Acc. Filename | Vertical Acc. Filename |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6.95 | strike slip | 6.09 | 6.09 | 213.44 | 0.25 | 1 | RSN6_IMPVALL.I_I-ELC180.AT2 | RSN6_IMPVALL.I_I-ELC270.AT2 | RSN6_IMPVALL.I_I-ELC-UP.AT2 |
| 8 | 6.53 | strike slip | 4.9 | 7.05 | 208.91 | 0.0625 | 0.6411 | RSN179_IMPVALL.H_H-E04140.AT2 | RSN179_IMPVALL.H_H-E04230.AT2 | RSN179_IMPVALL.H_H-E04-UP.AT2 |
| 27 | 7.28 | strike slip | 11.03 | 11.03 | 379.32 | 0.07 | 0.8459 | RSN864_LANDERS_JOS000.AT2 | RSN864_LANDERS_JOS090.AT2 | RSN864_LANDERS_JOS-UP.AT2 |
| 37 | 6.9 | strike slip | 7.08 | 7.08 | 609 | 0.125 | 0.4671 | RSN1111_KOBE_NIS000.AT2 | RSN1111_KOBE_NIS090.AT2 | RSN1111_KOBE_NIS-UP.AT2 |
| 42 | 7.51 | strike slip | 1.38 | 4.83 | 297 | 0.0875 | 0.8737 | RSN1176_KOCAELI_YPT060.AT2 | RSN1176_KOCAELI_YPT150.AT2 | RSN1176_KOCAELI_YPT-UP.AT2 |

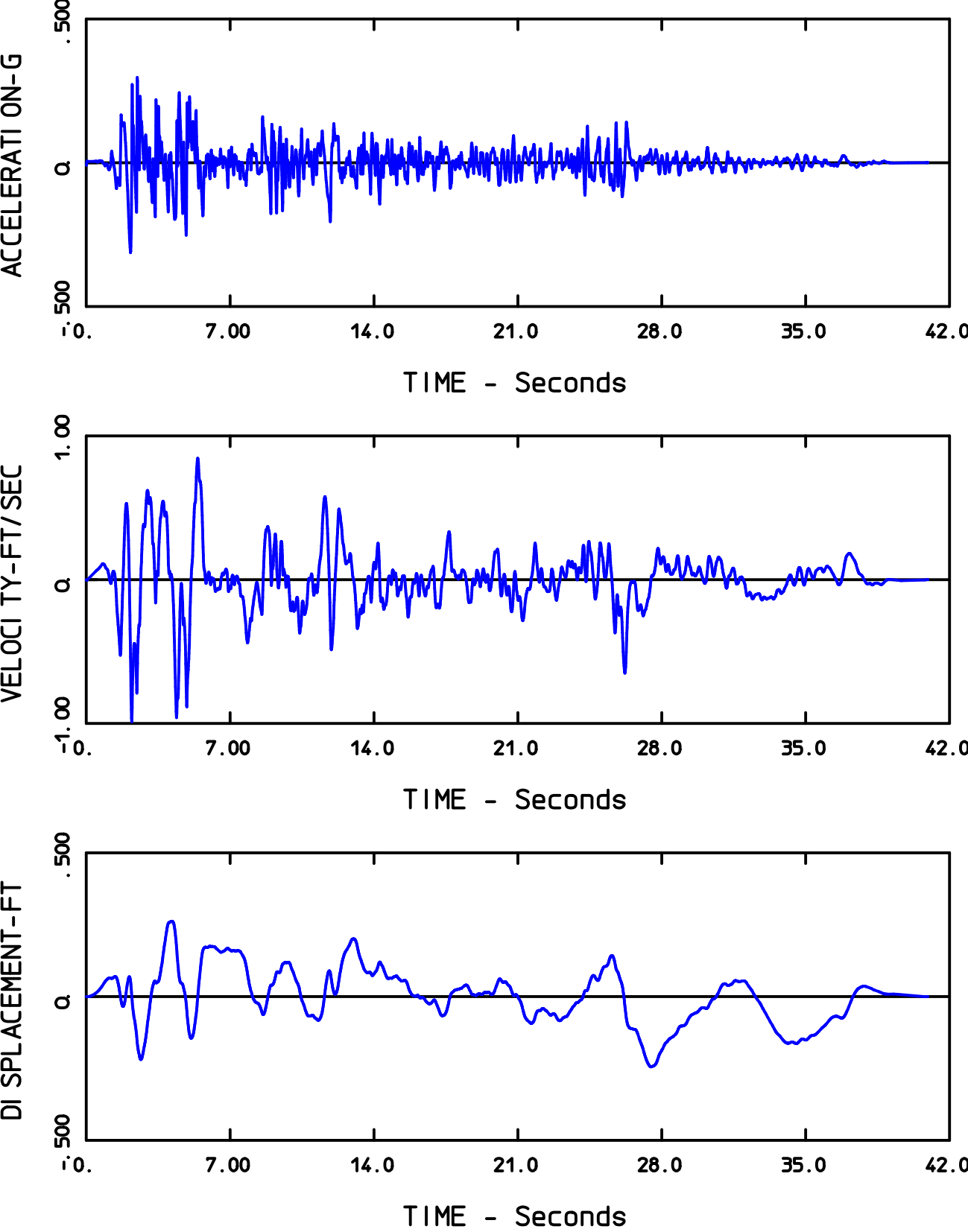
# Appendix C

## Input Motions Time History and Response Spectrum Plots

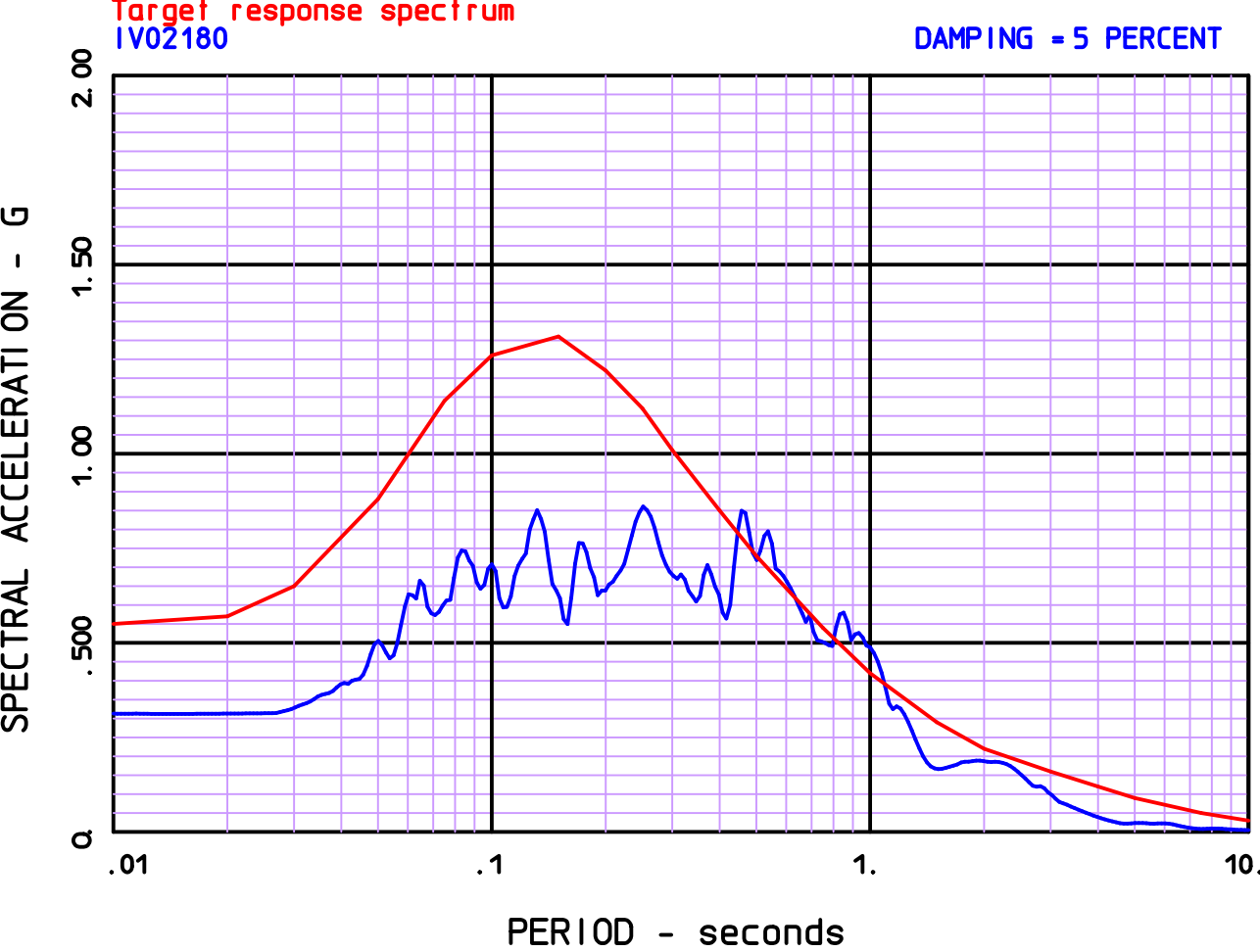
Two series of plots are included in this appendix:

1. Plots of the a, v and d histories of the selected records, as recorded. These are interspersed with plots of the 5 percent damped response spectra, as recorded.

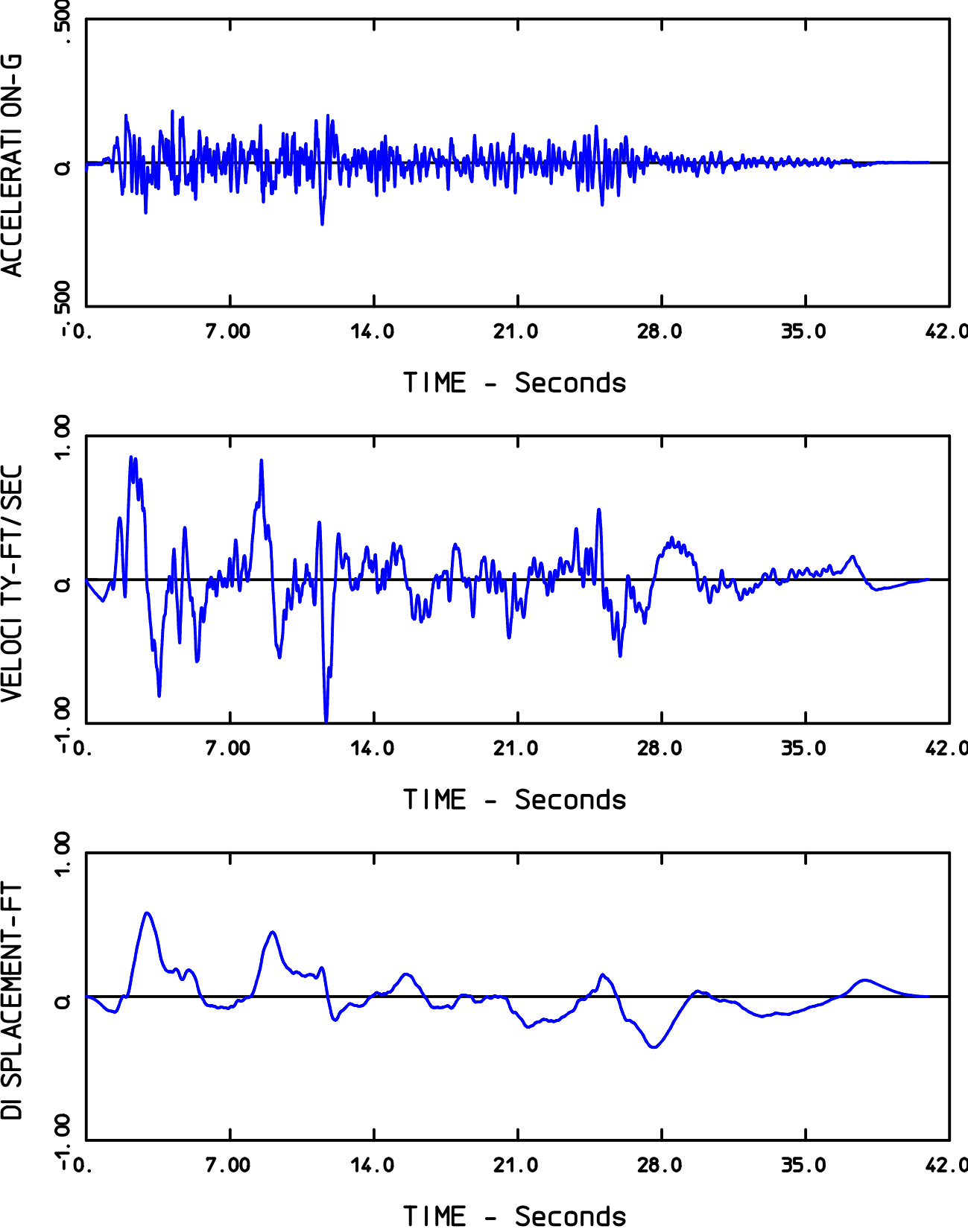
2. Plots of the a, v and d histories of the selected records, as matched to the Site Class B/C target spectrum. Again, these are interspersed with plots of the 5 percent damped response spectra, as modified.



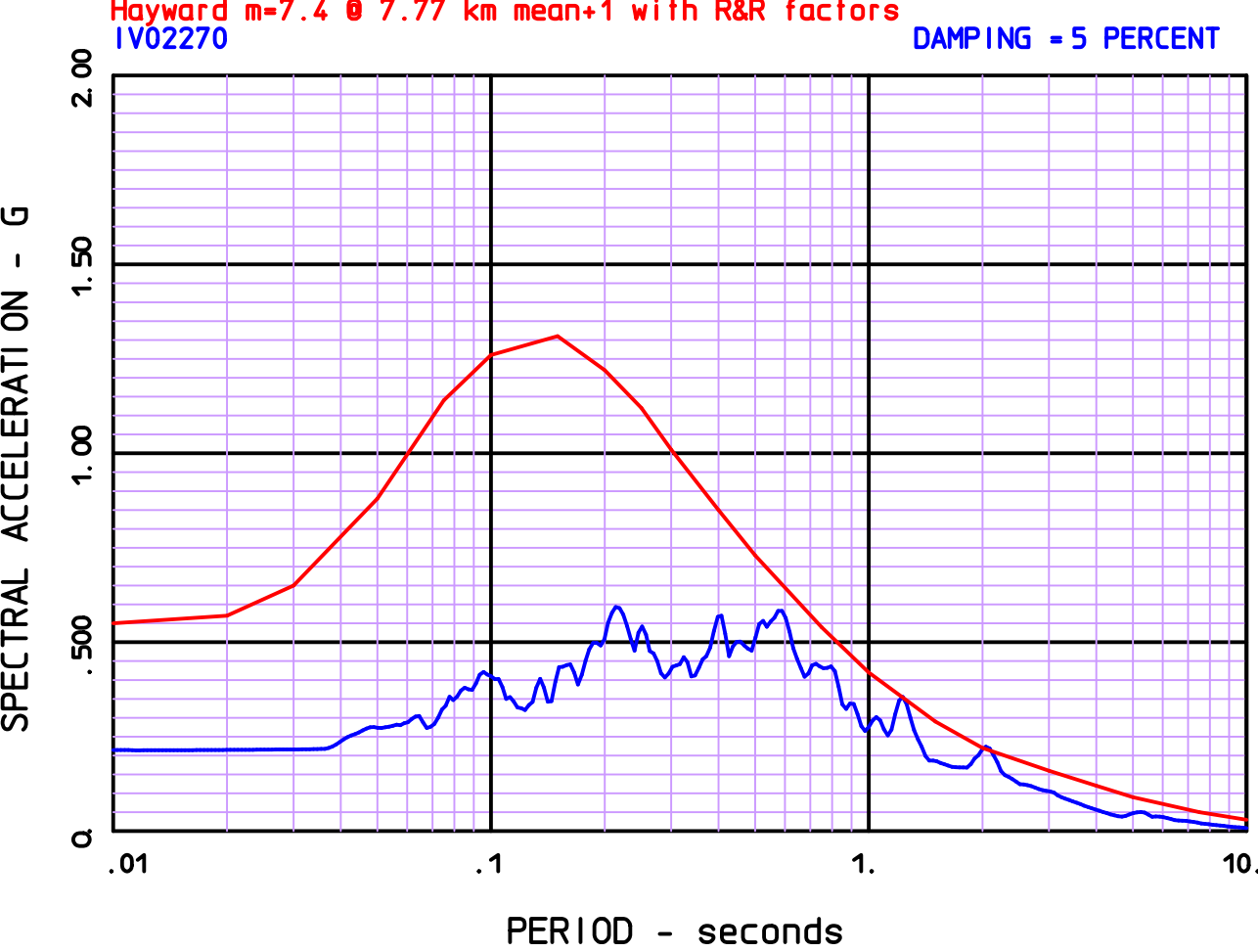

IV02180
As recorded



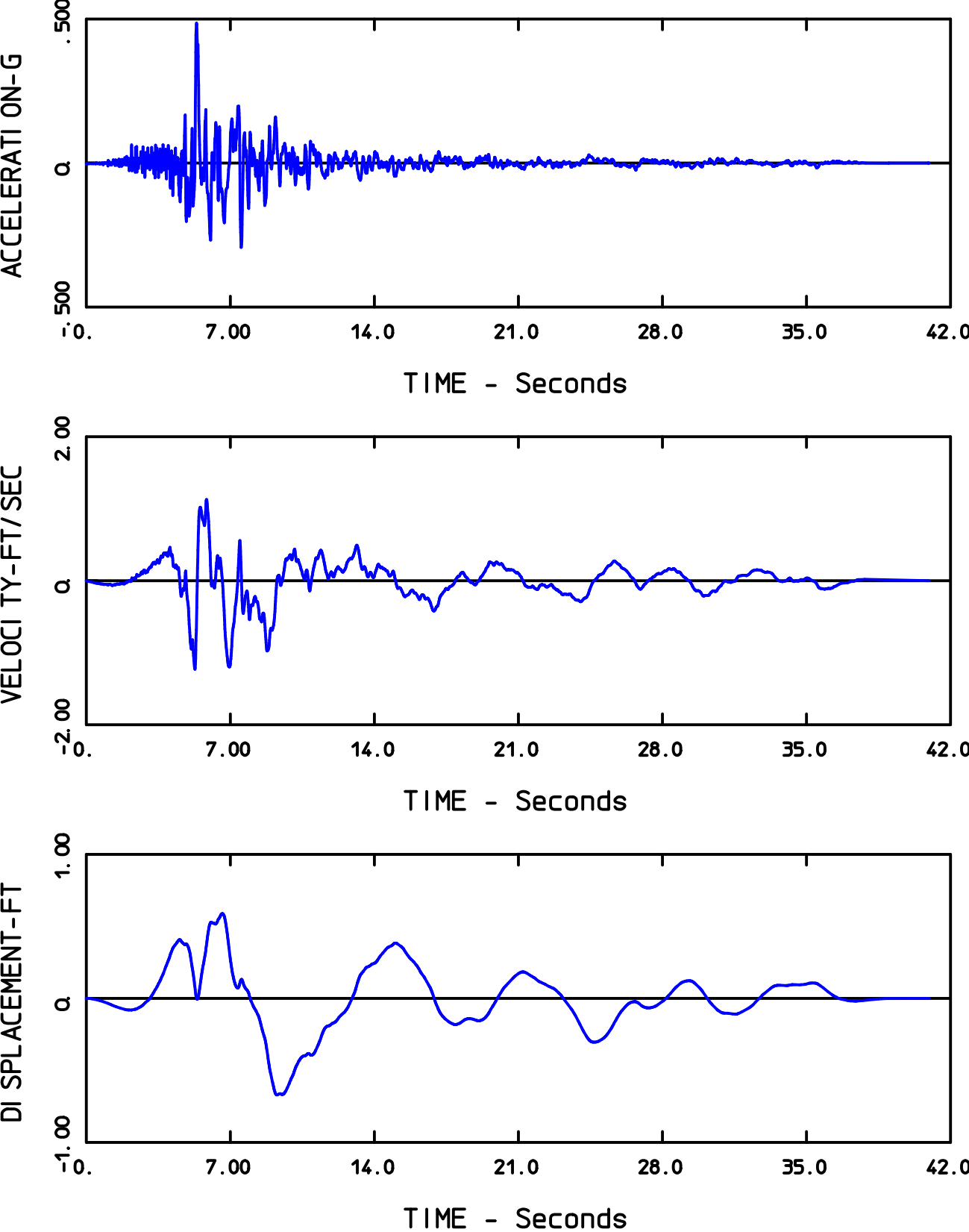

IV02180
As recorded



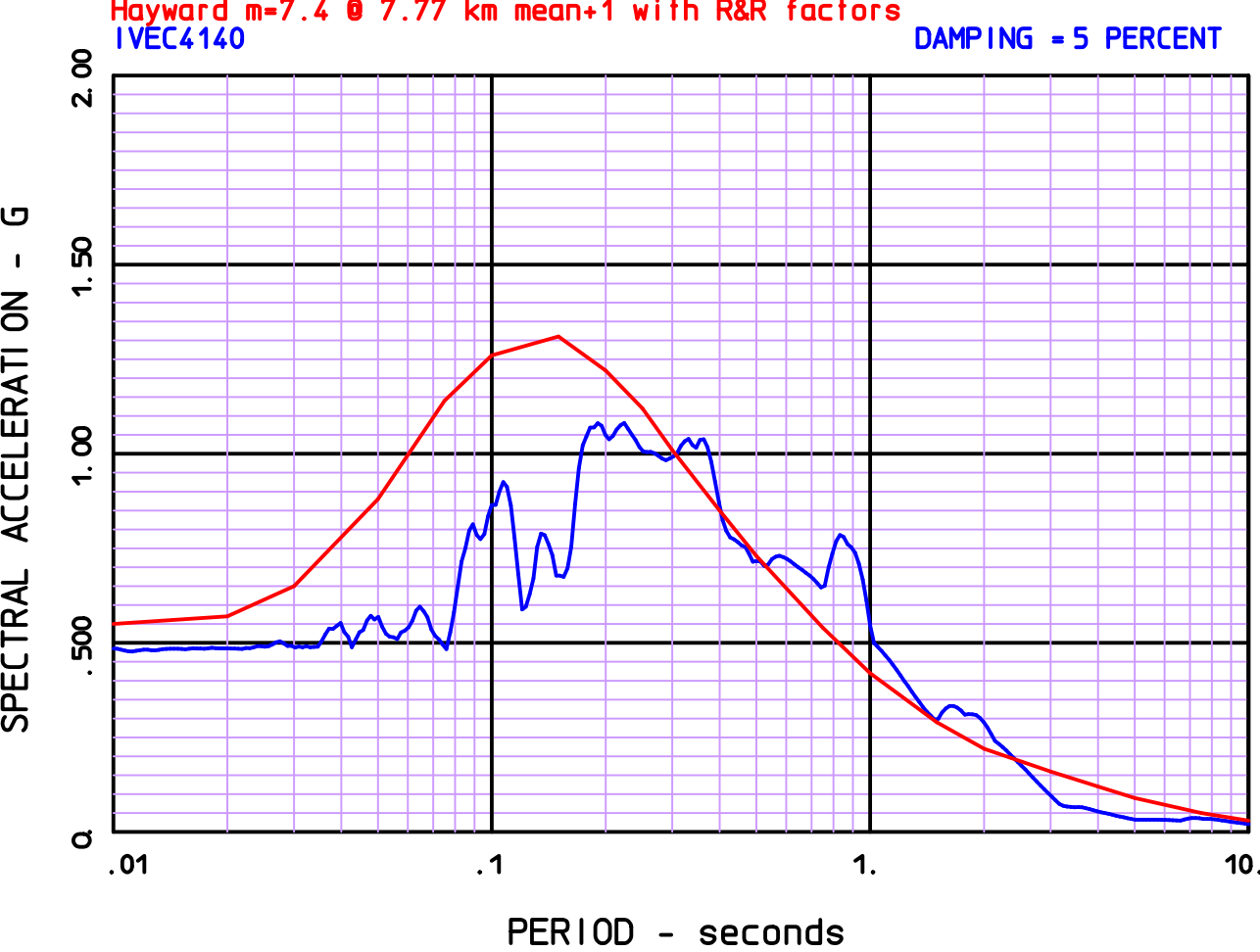

IV02270
As recorded



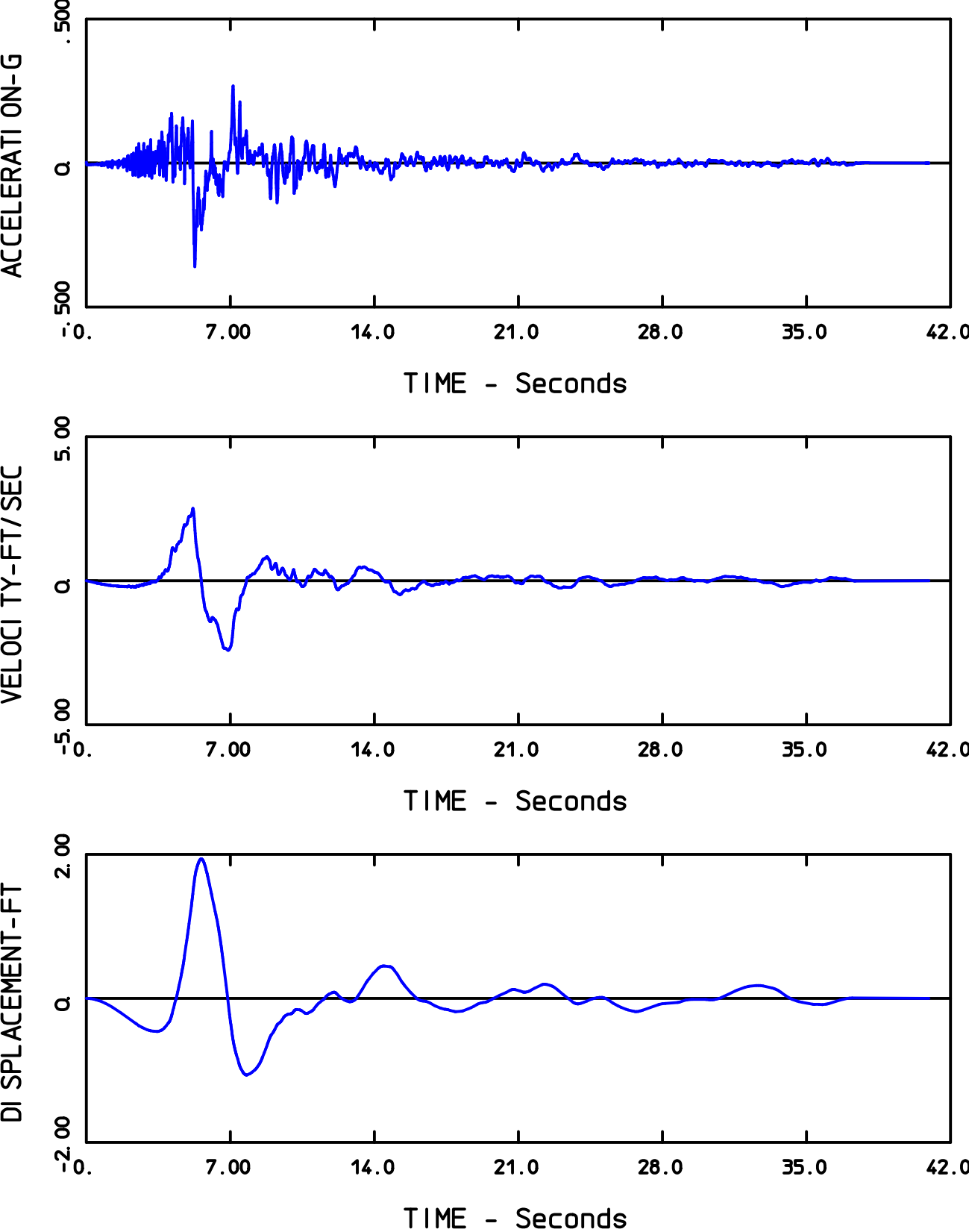

IV02270
As recorded



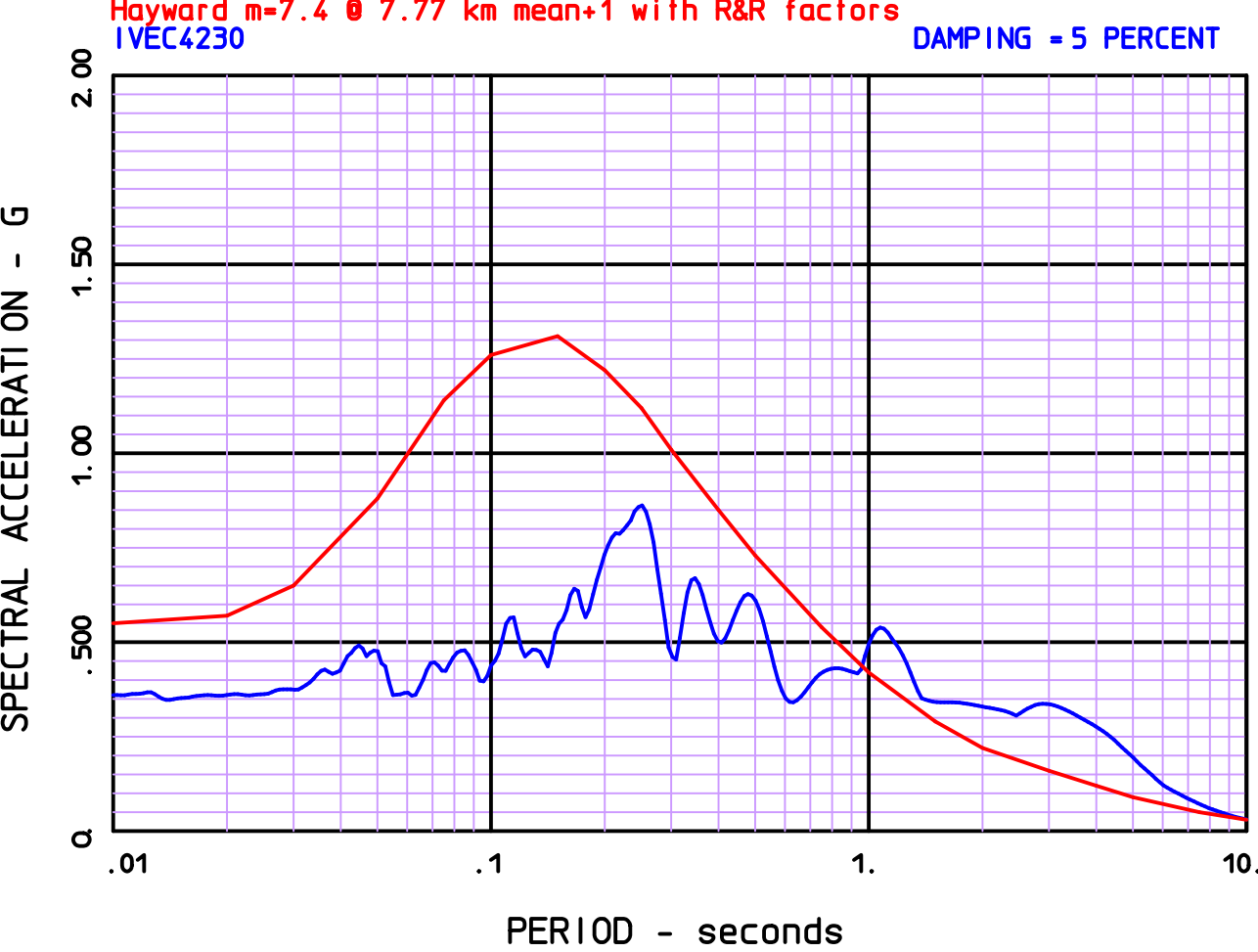

IVEC4140
As recorded



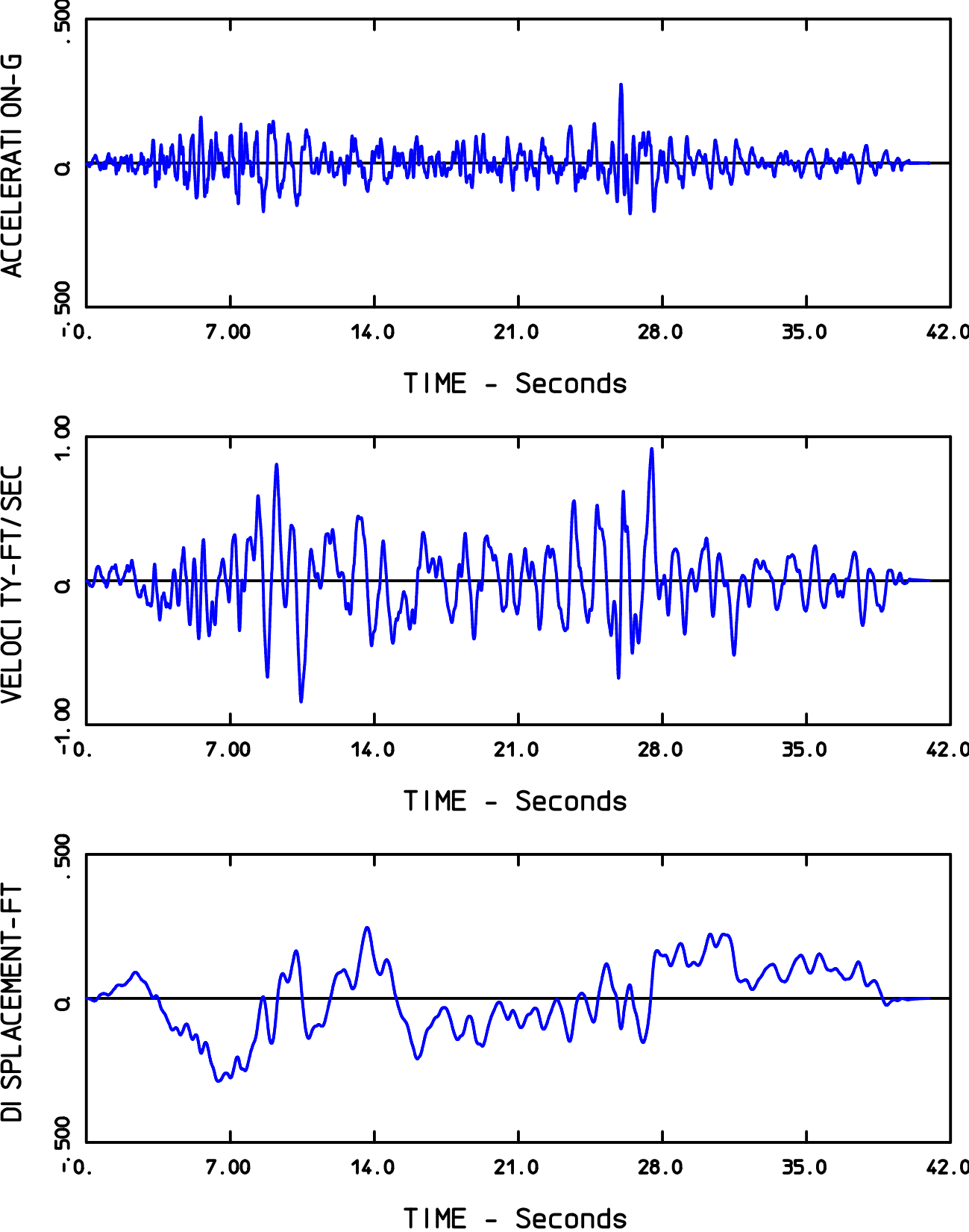

IVEC4140
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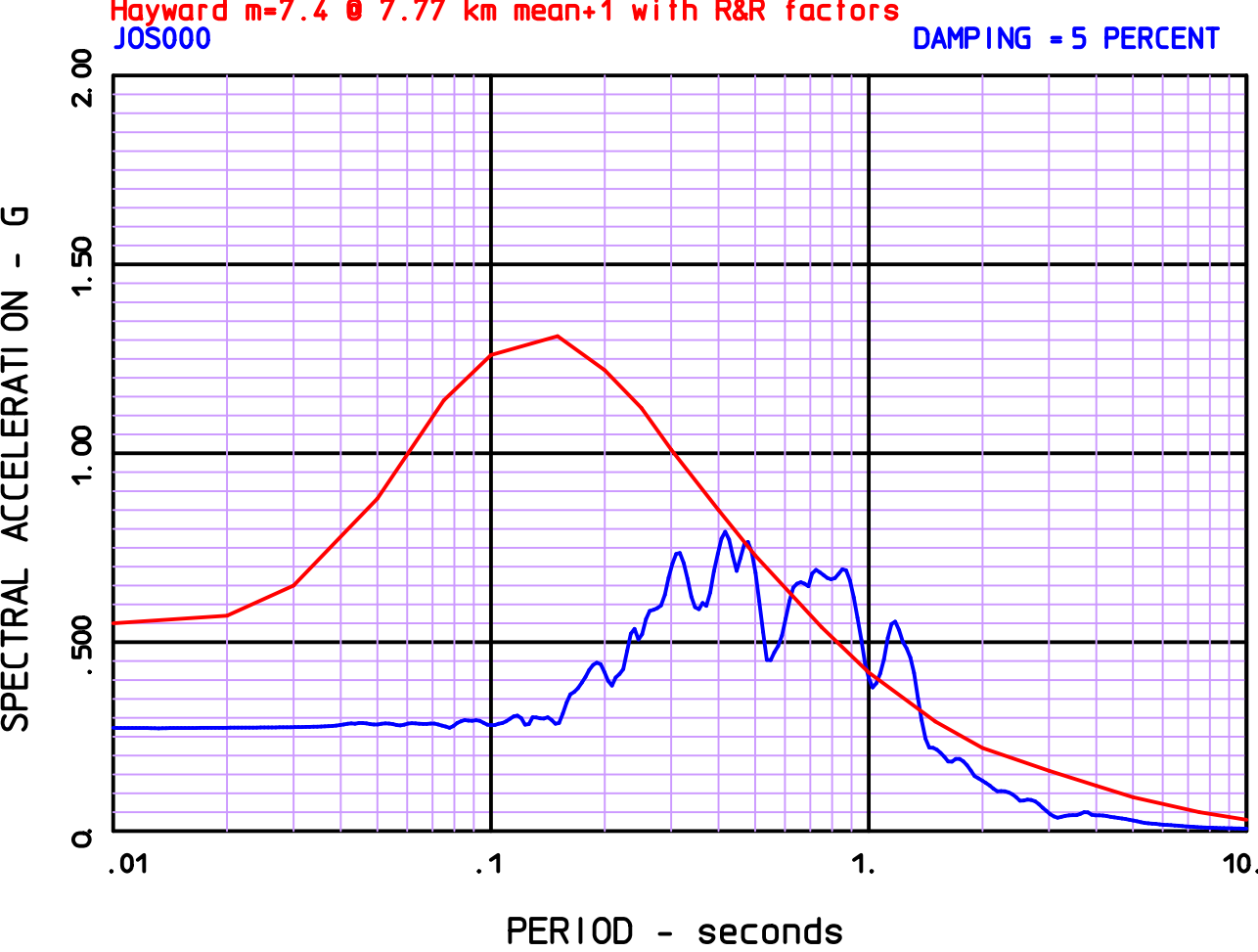

IVEC4230
As recorded



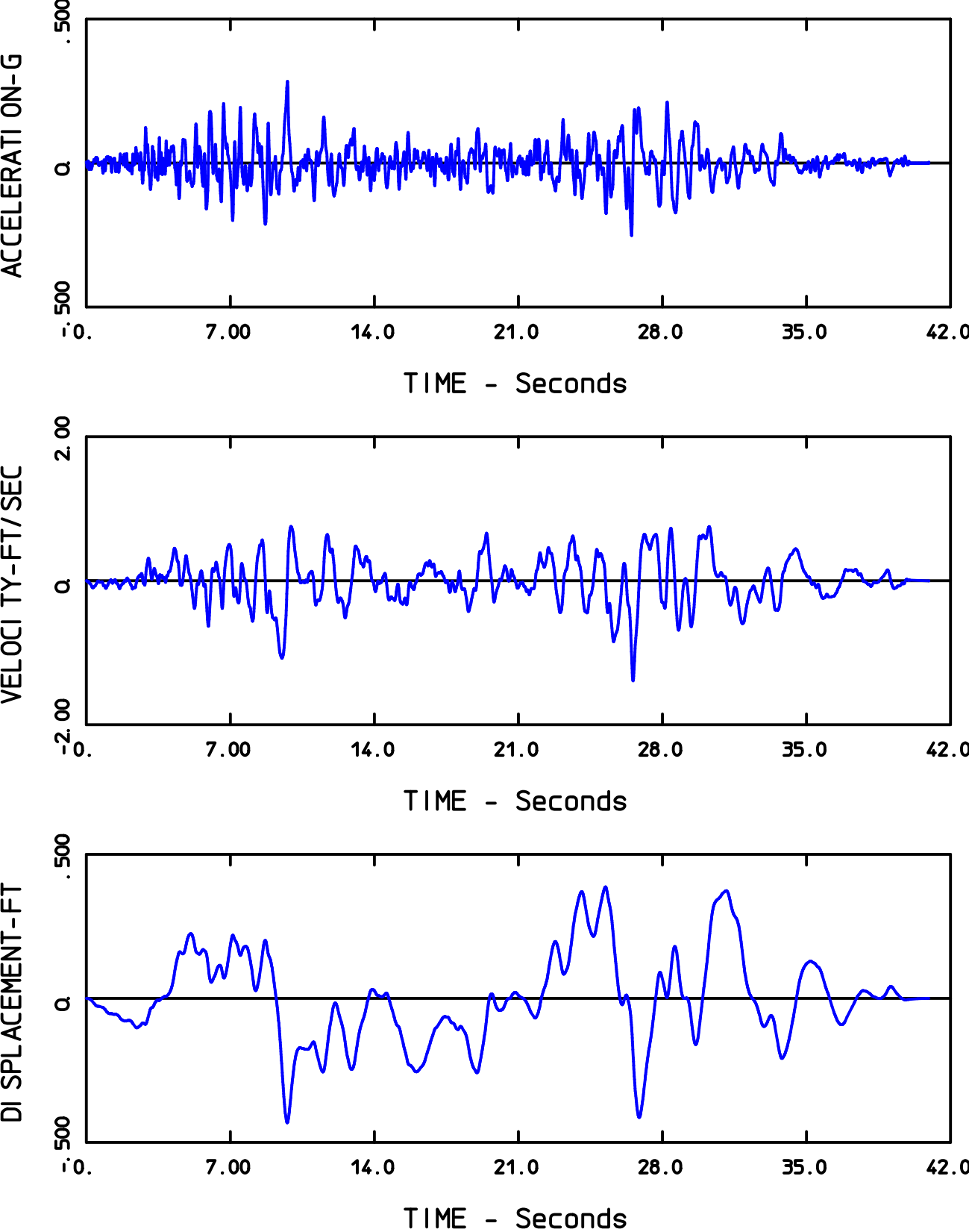

IVEC4230
As recorded



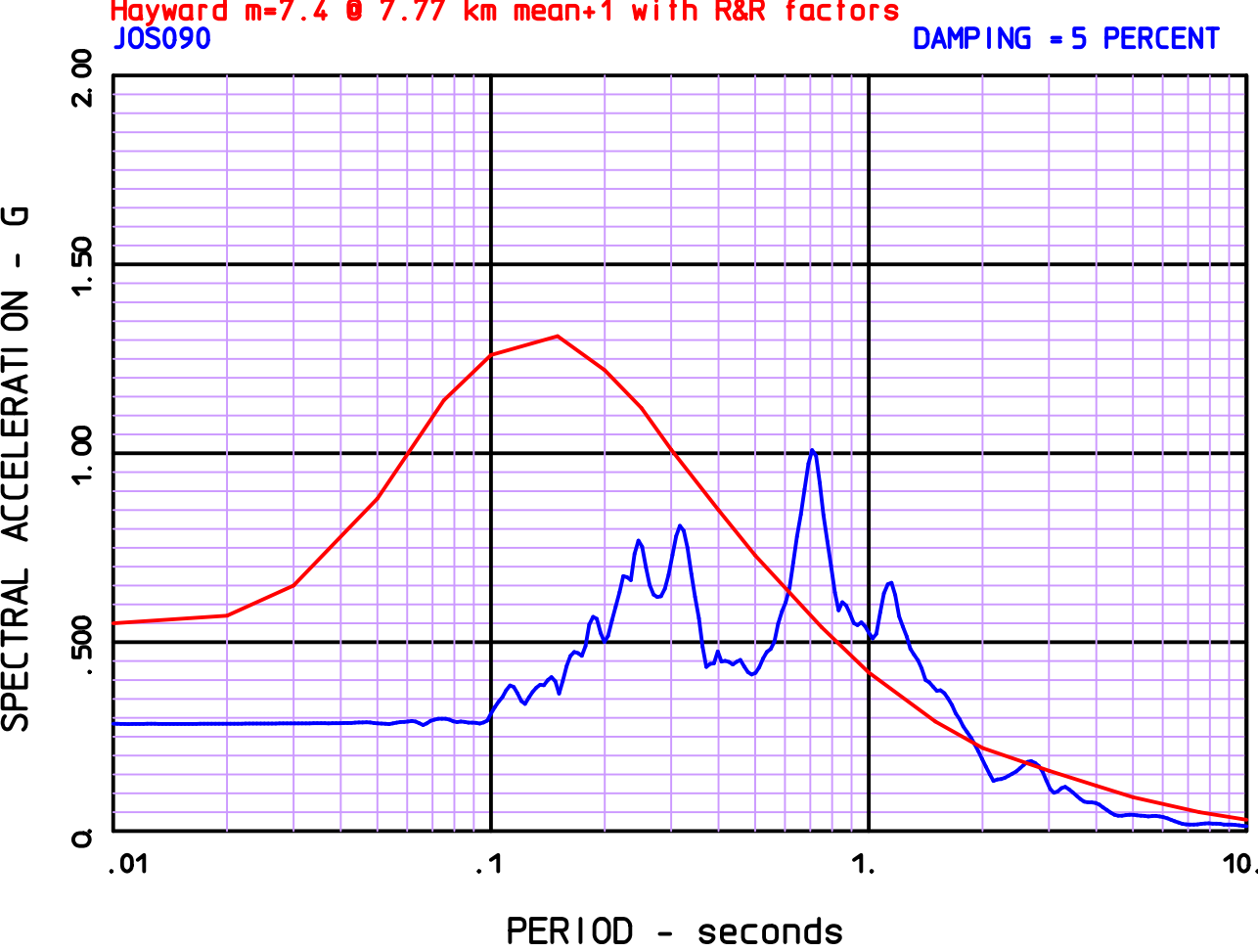

JOS000
As recorded



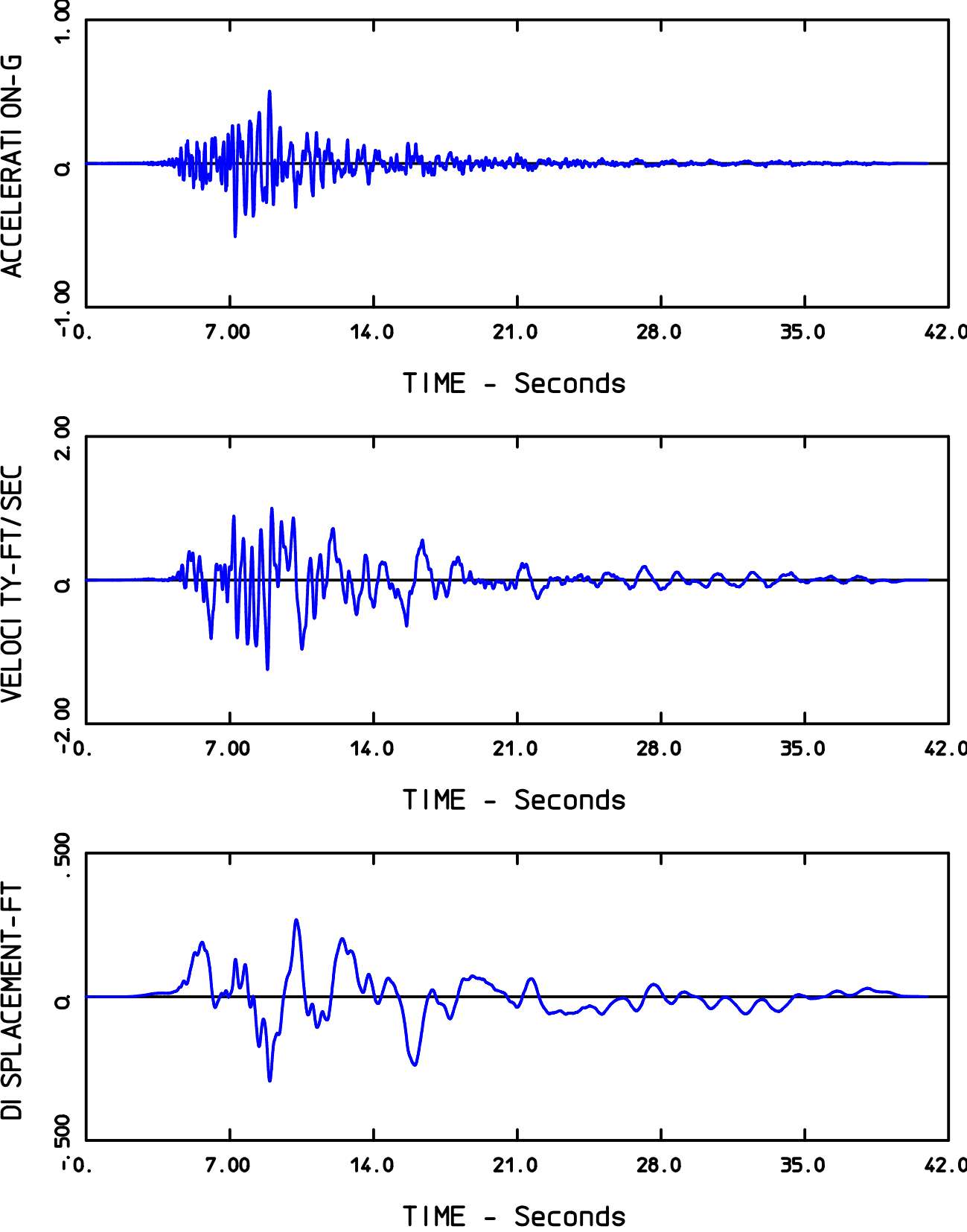

JOS000
As recorded



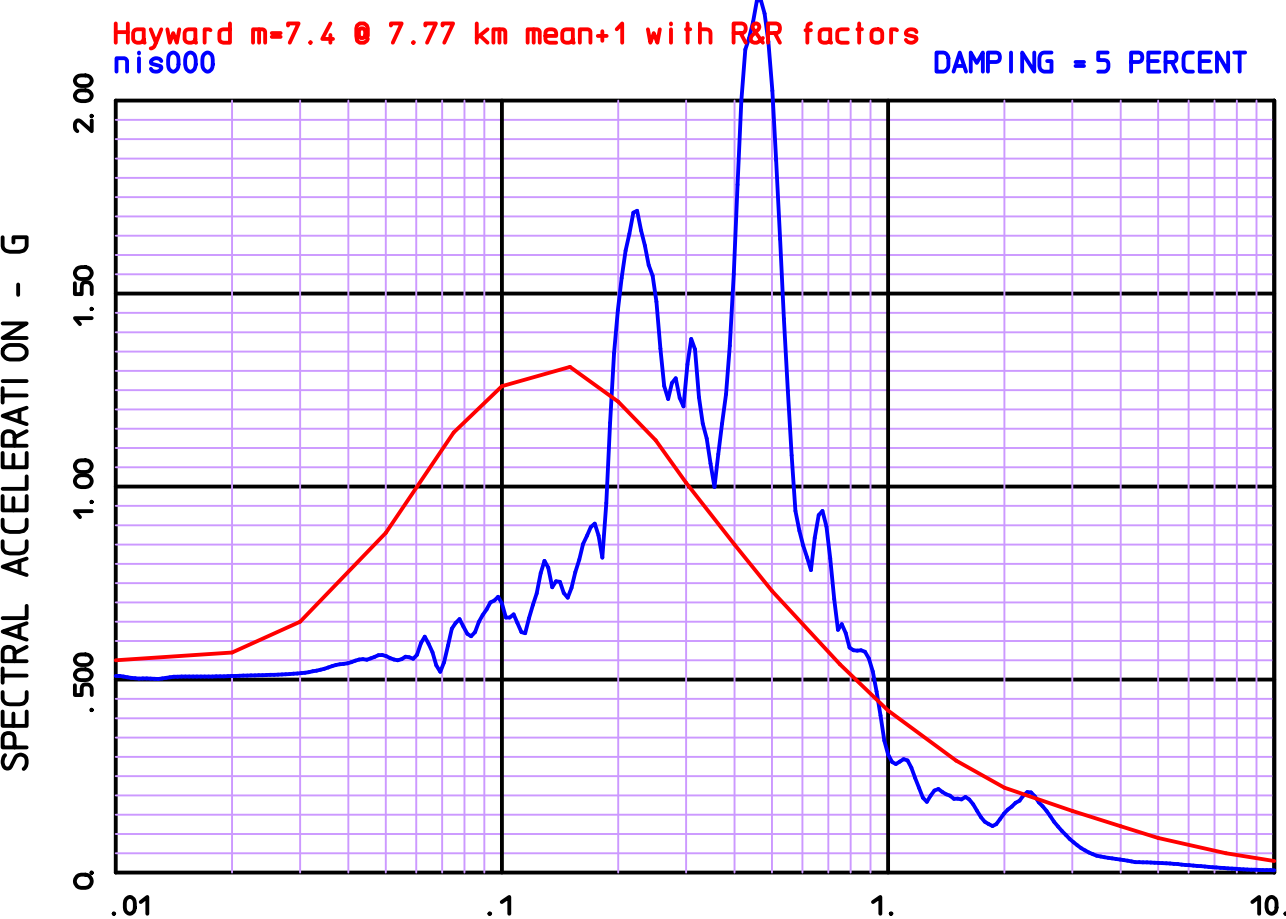

JOS090
As recorded



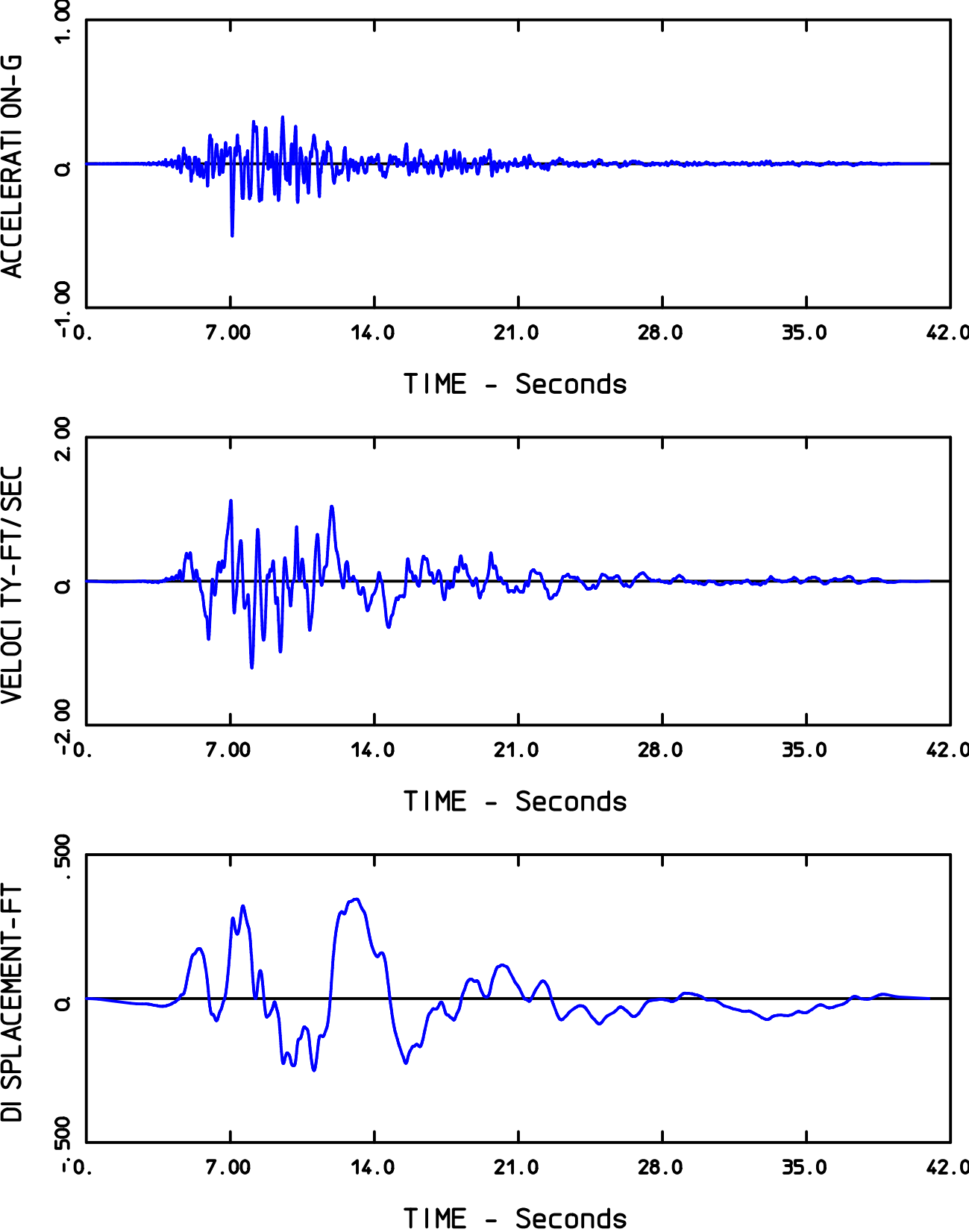

JOS090
As recorded



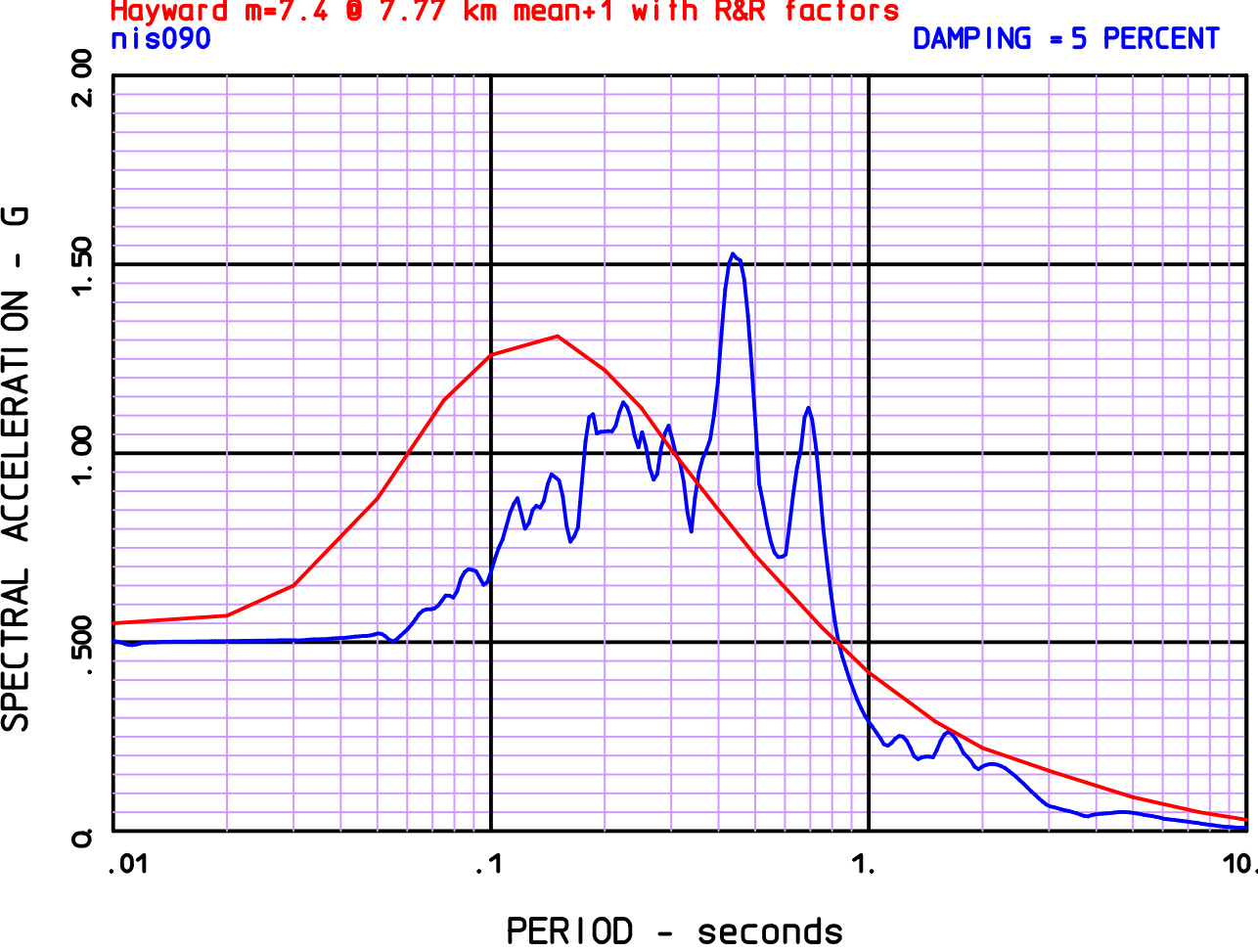

NIS000
As recorded



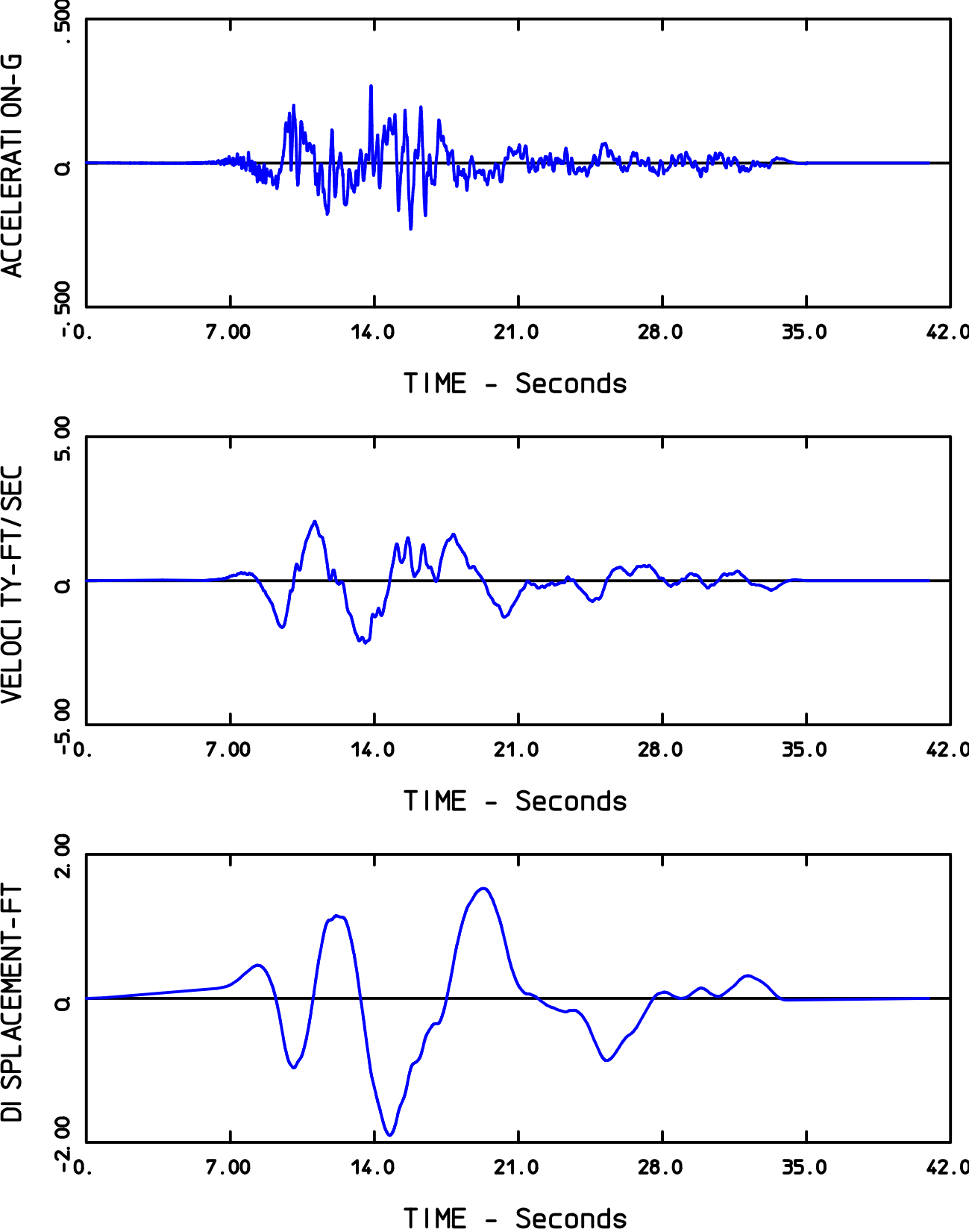

NIS000
As recorded



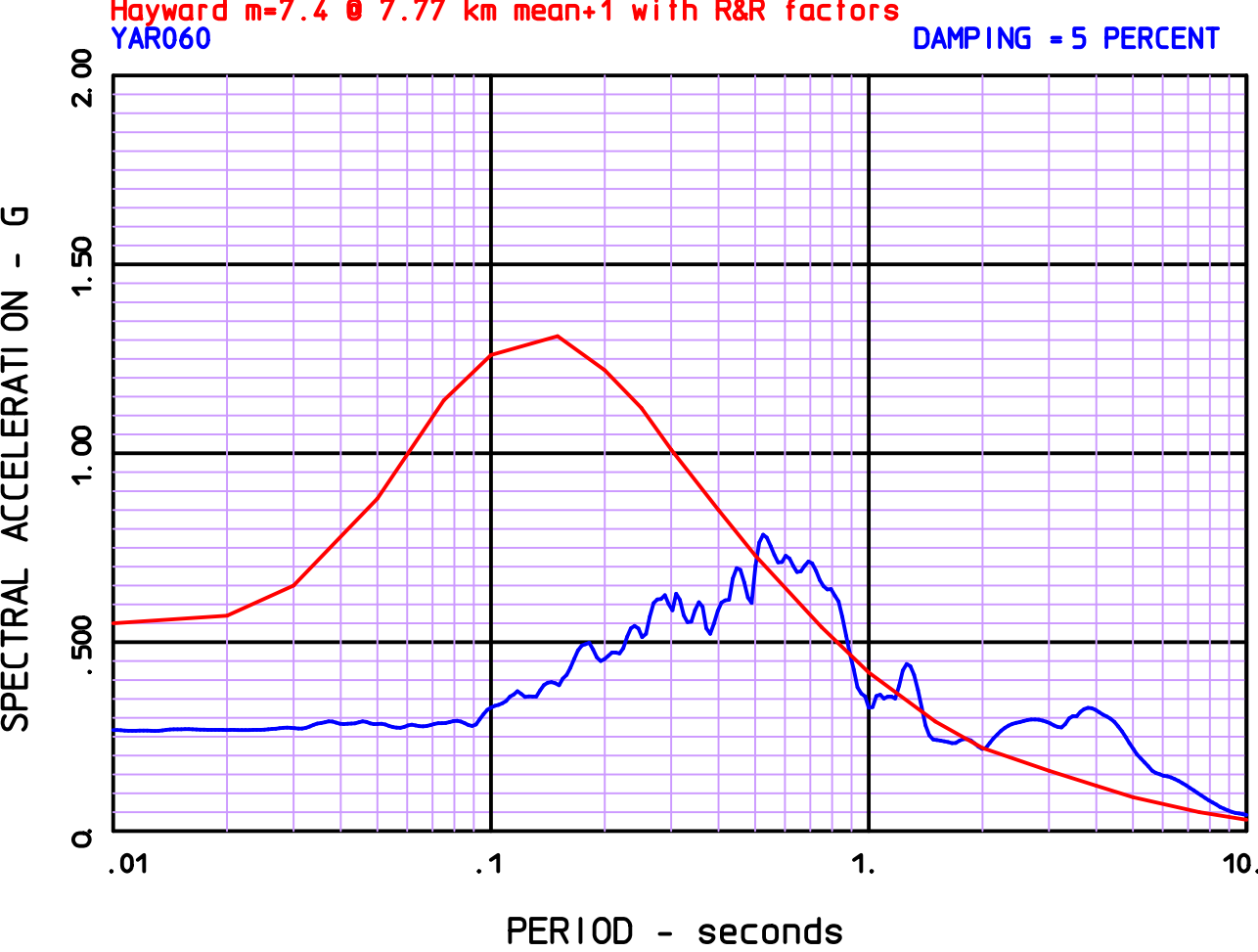

NIS090
As recorded



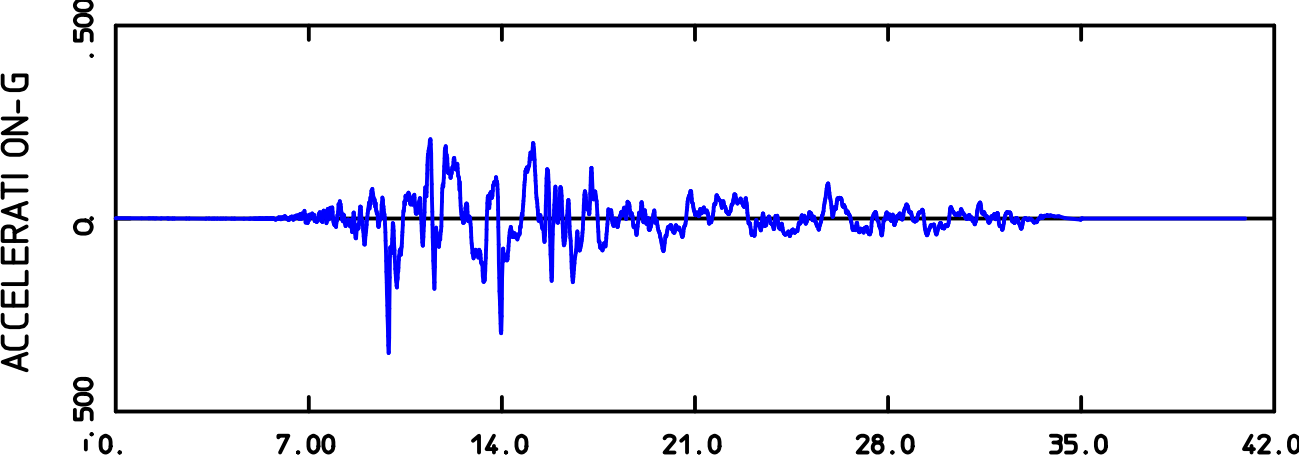

NIS090
As recorded

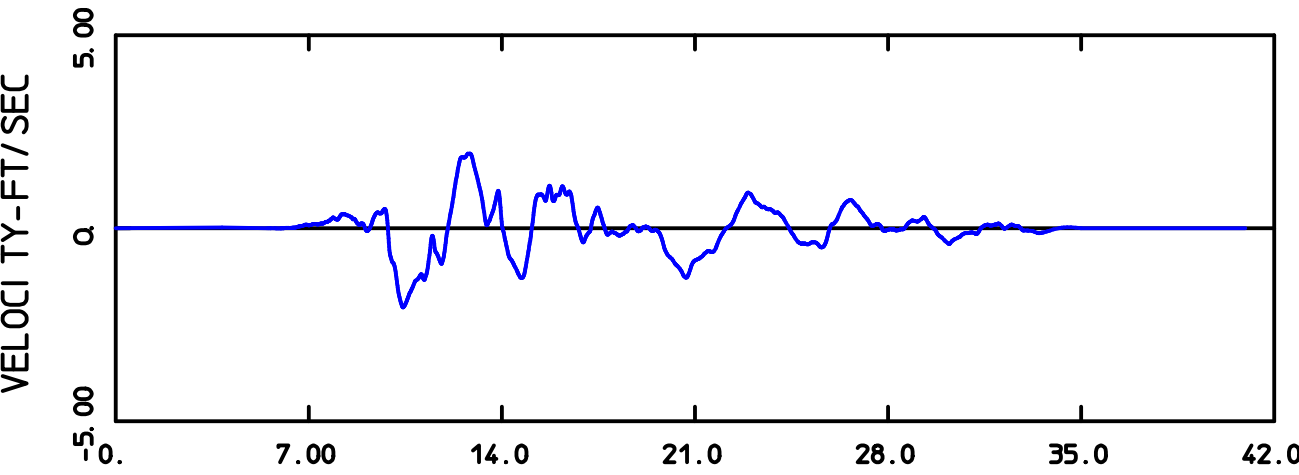


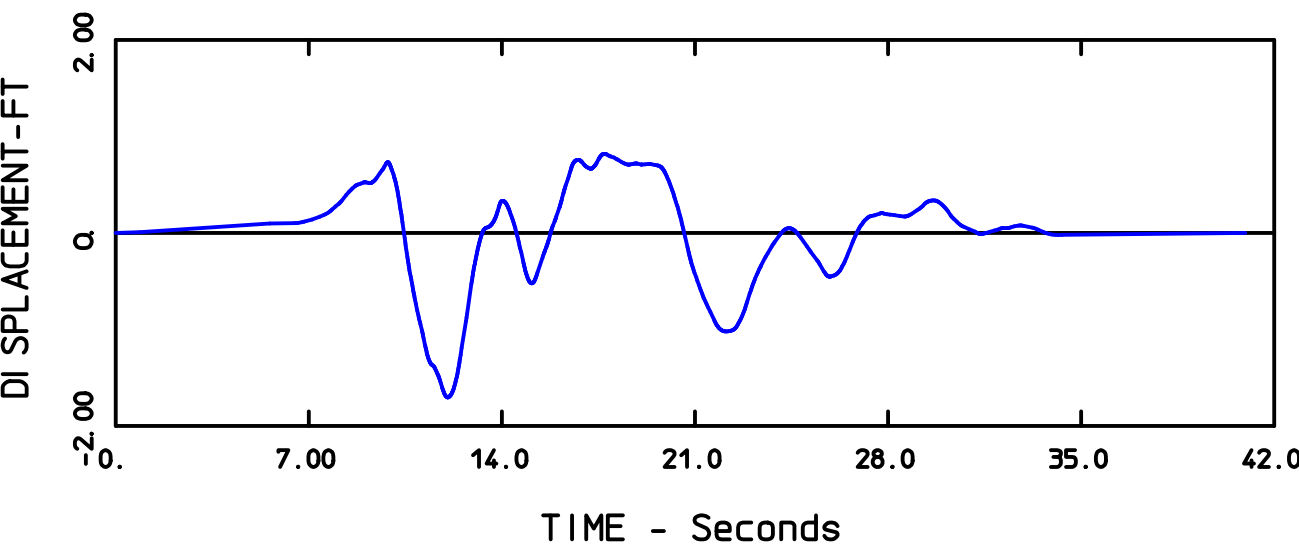

YAR060
As recorded



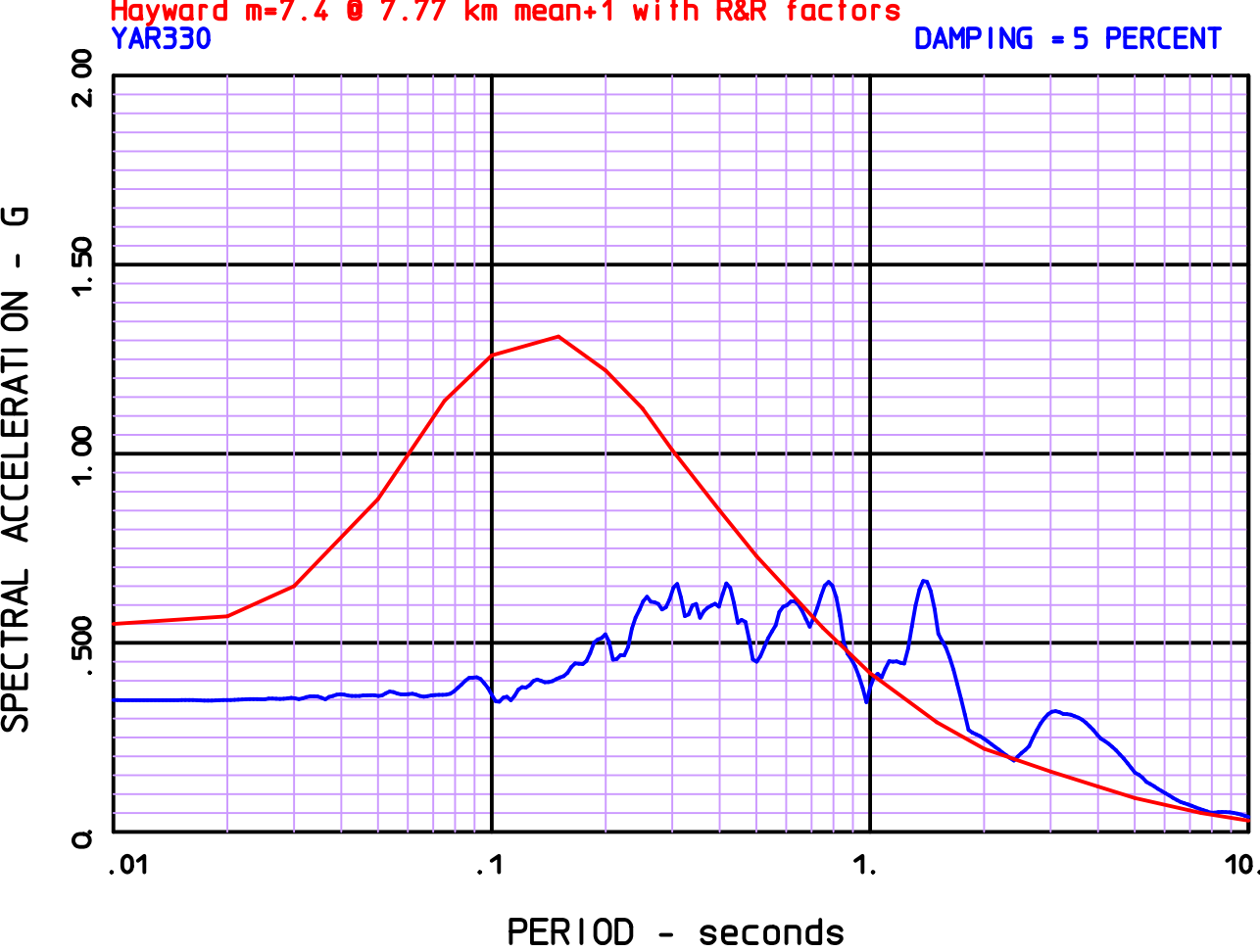

YAR060
As recorded



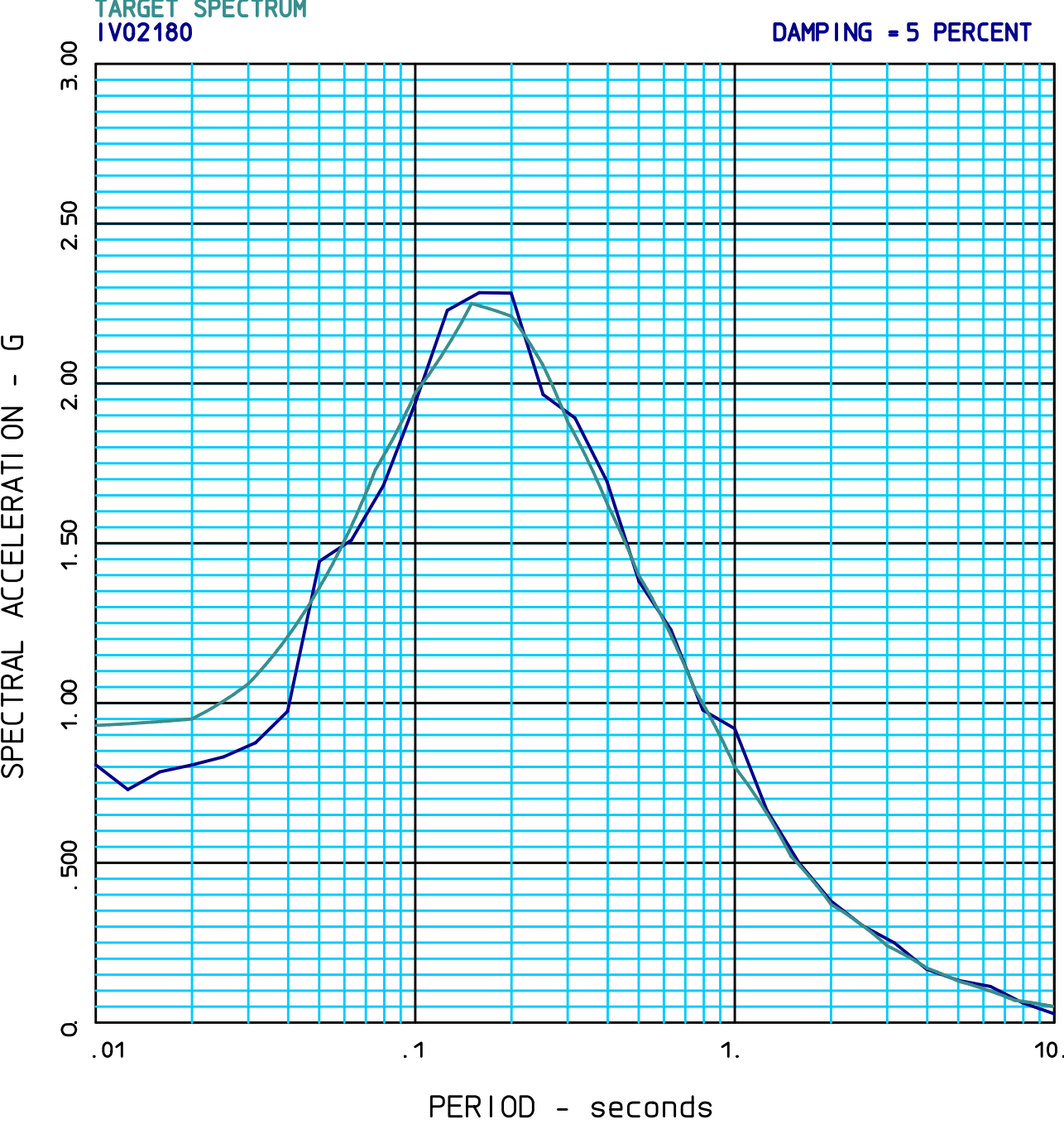



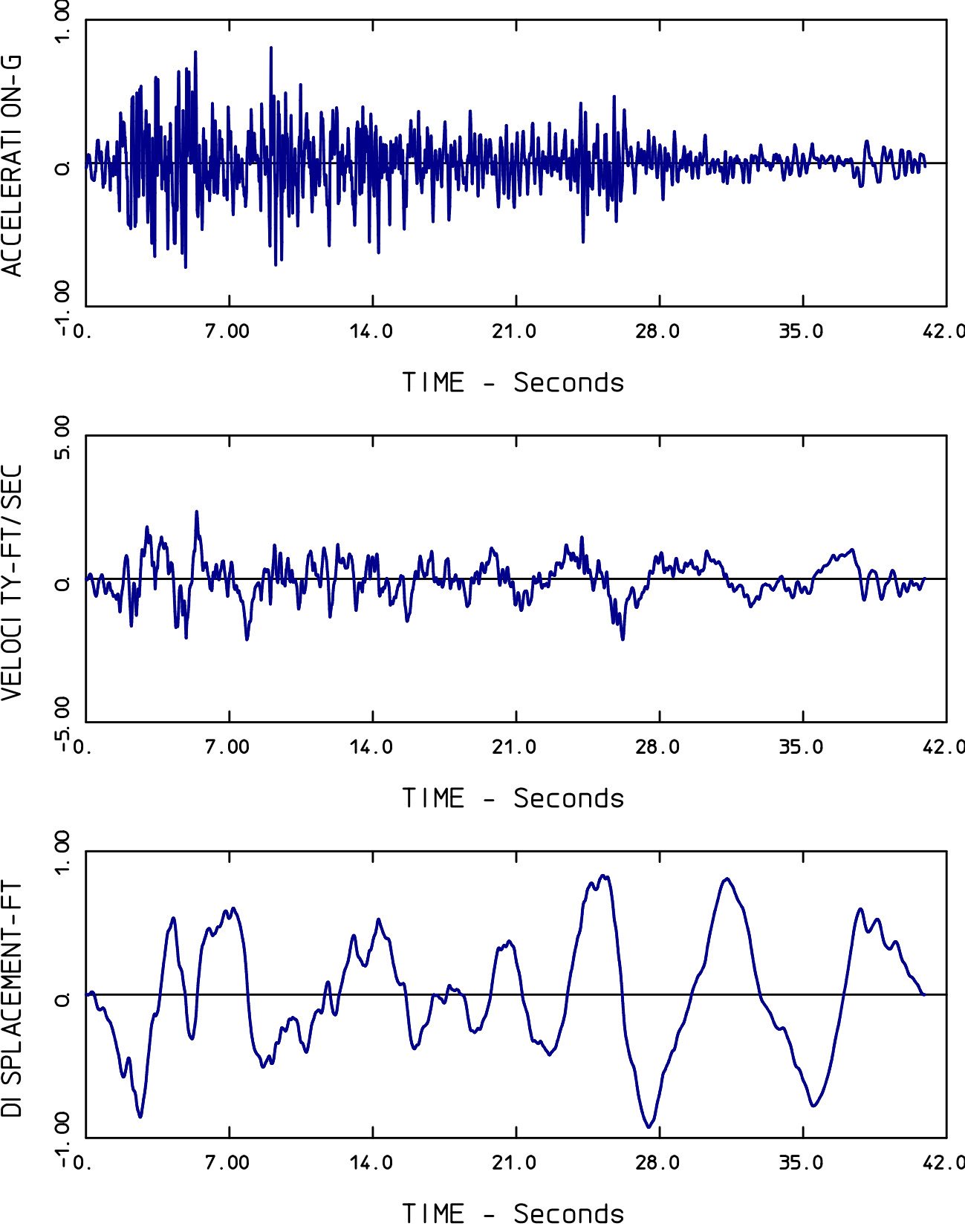

YAR330
As recorded



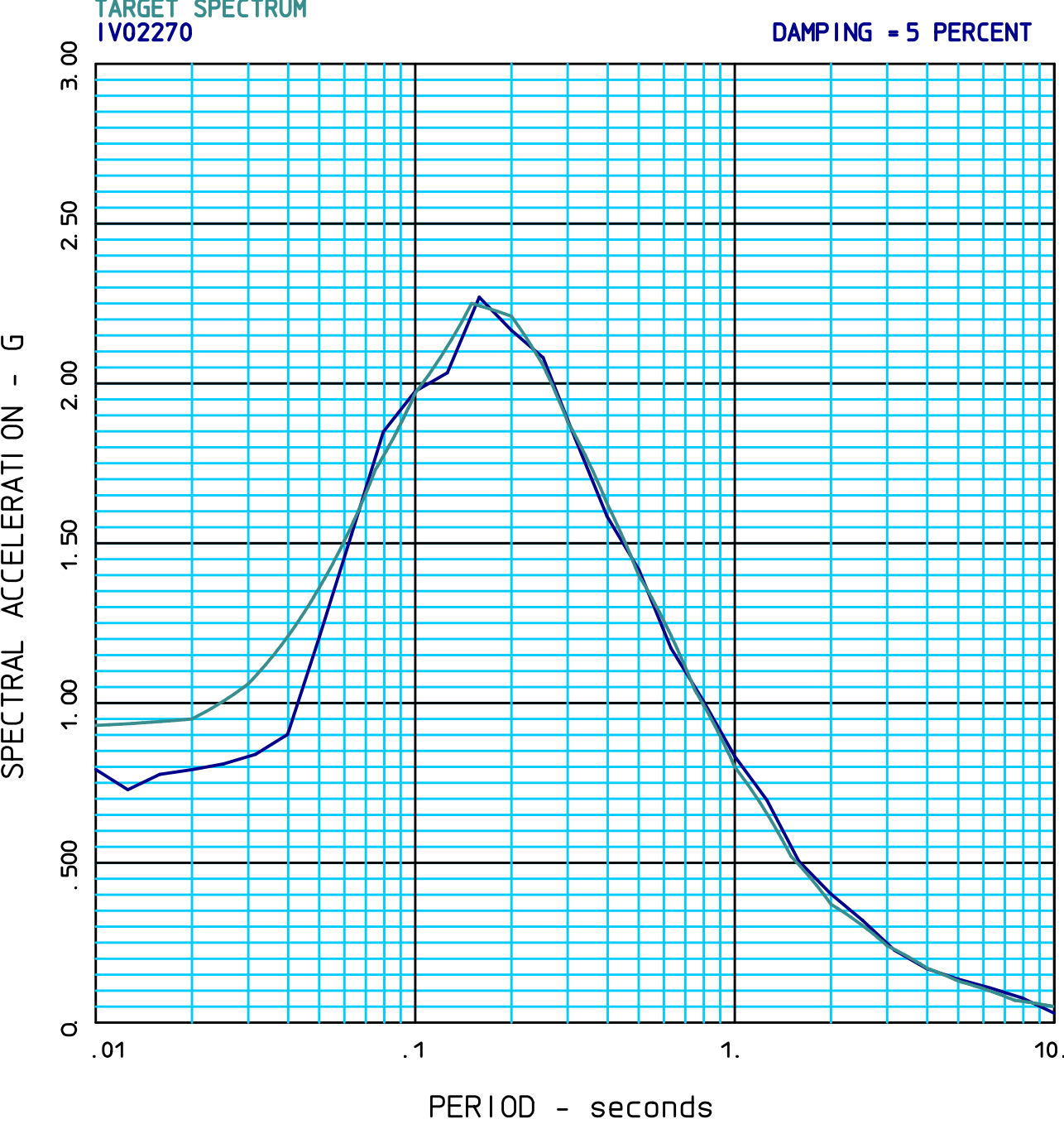

YAR330
As recorded



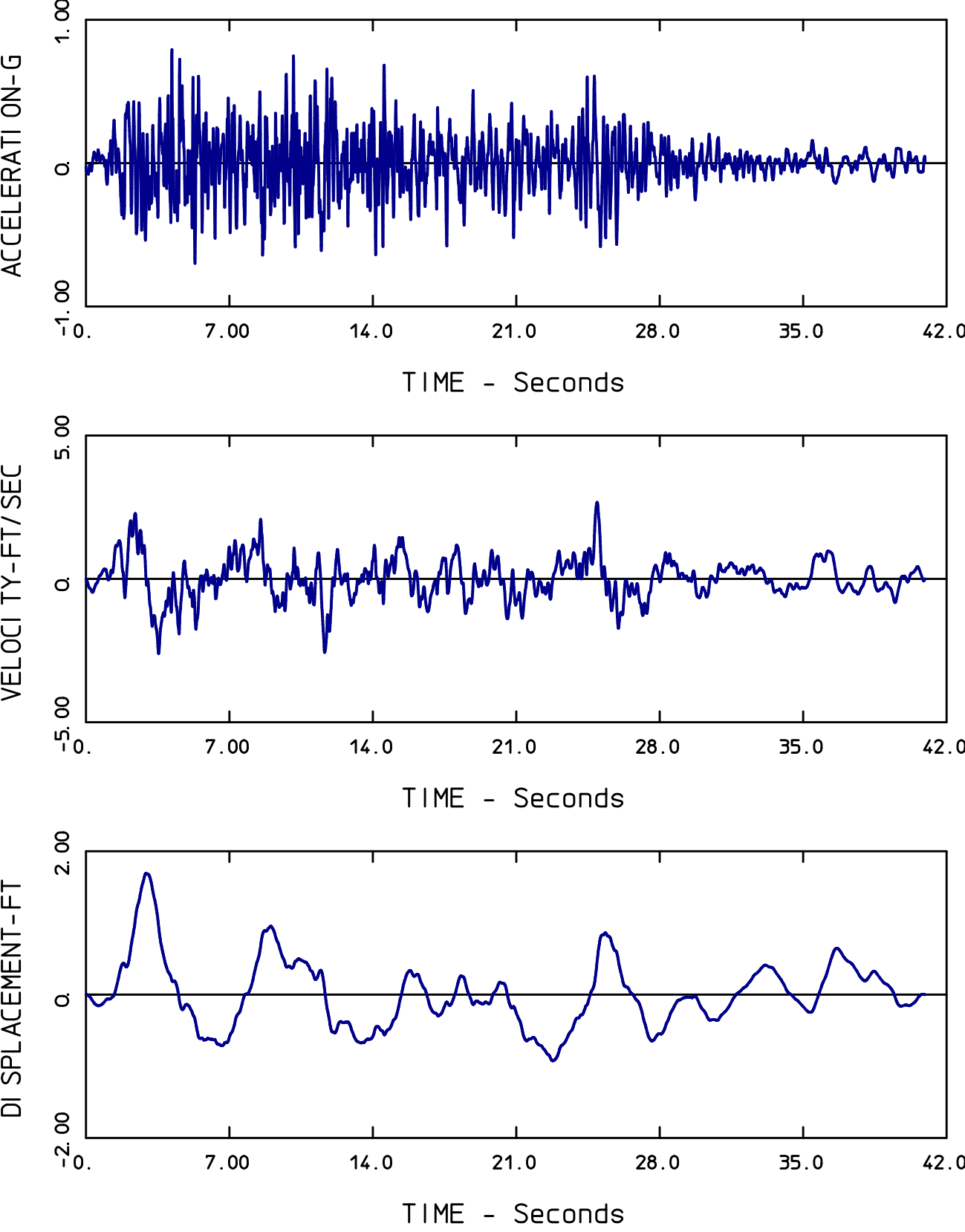

Tri Valley Hospital
IV02180 fitted to target spectrum



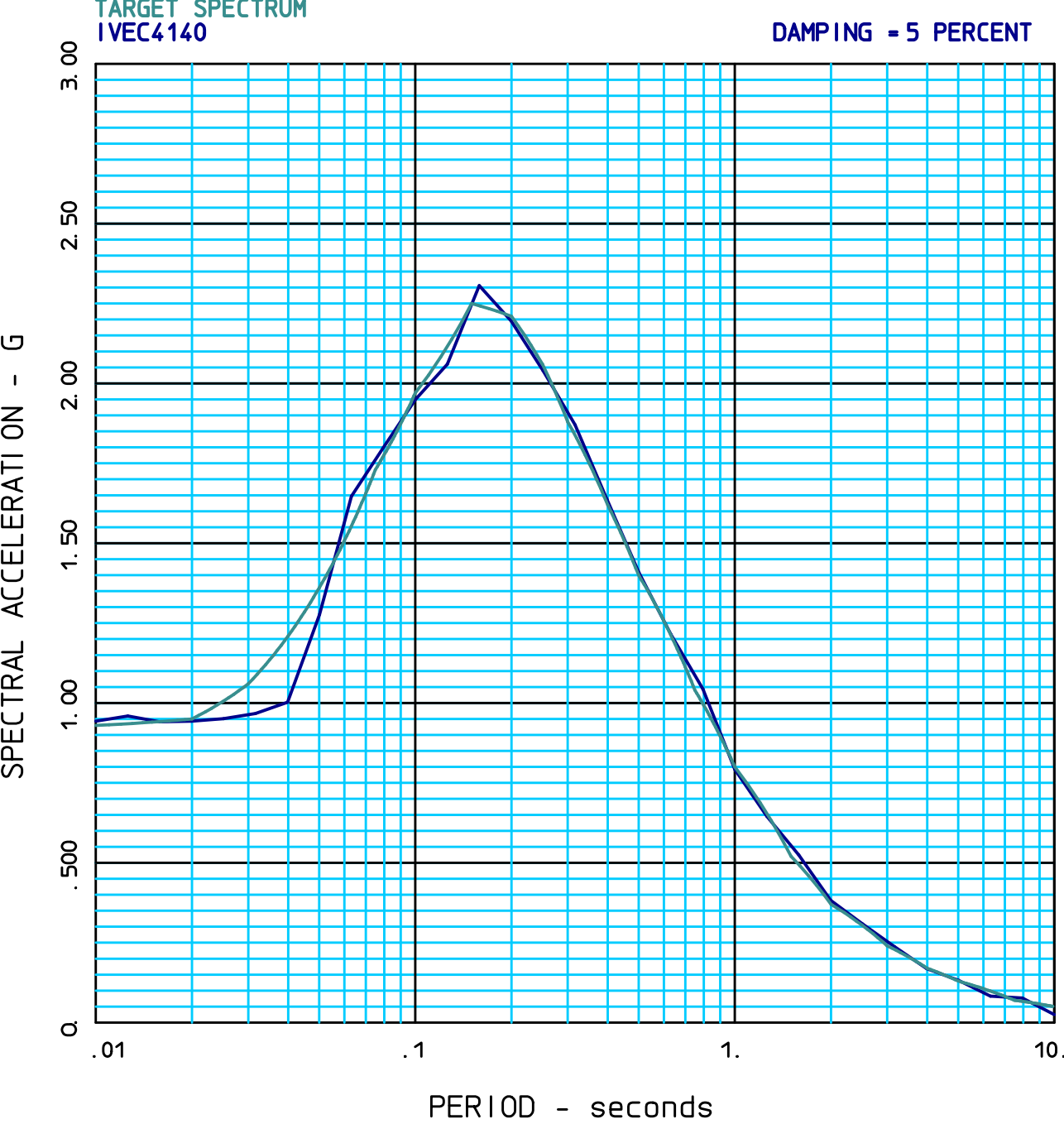

Tri Valley Hospital
IV02180 fitted to target spectrum



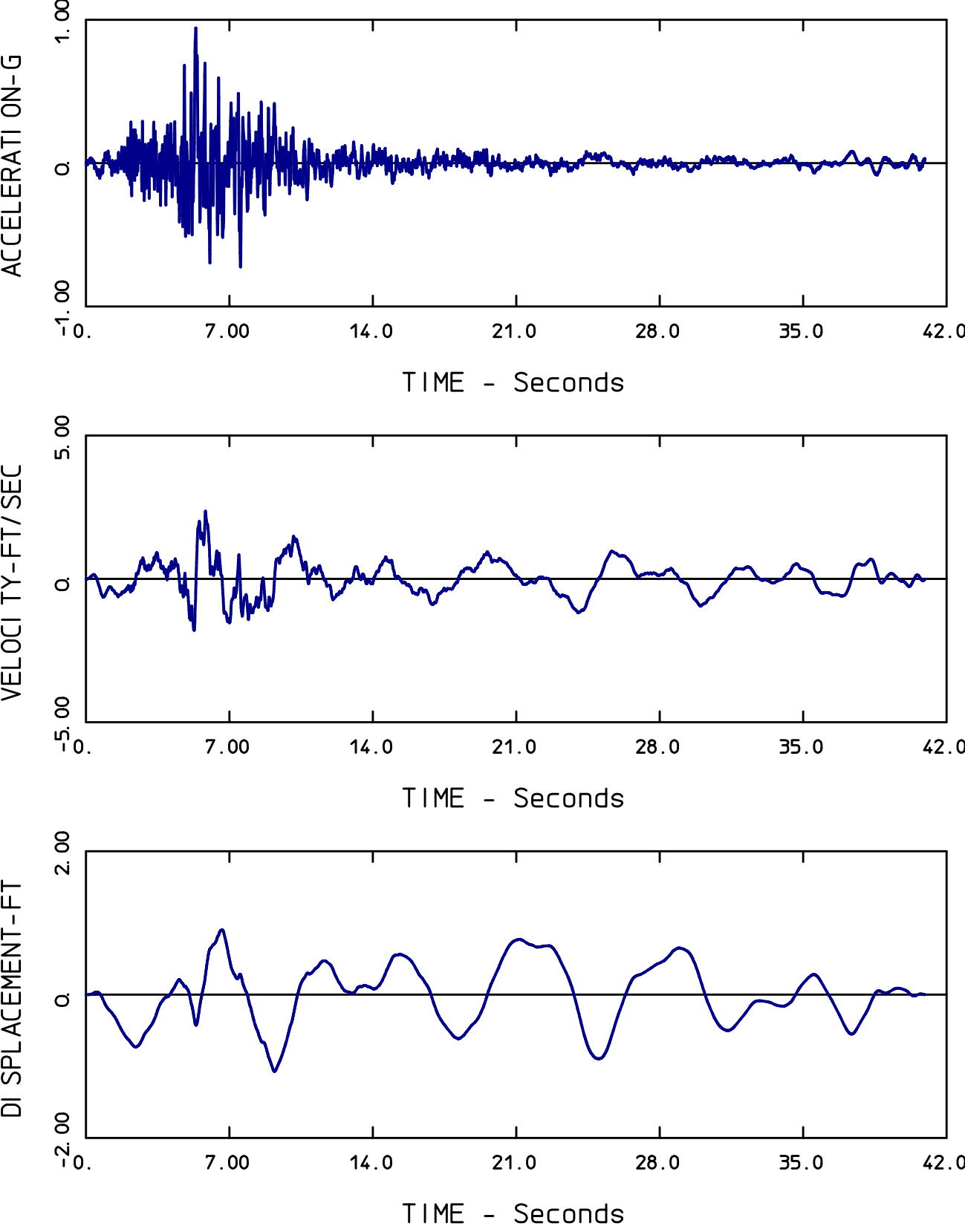

Tri Valley Hospital
IV02270 fitted to target spectrum



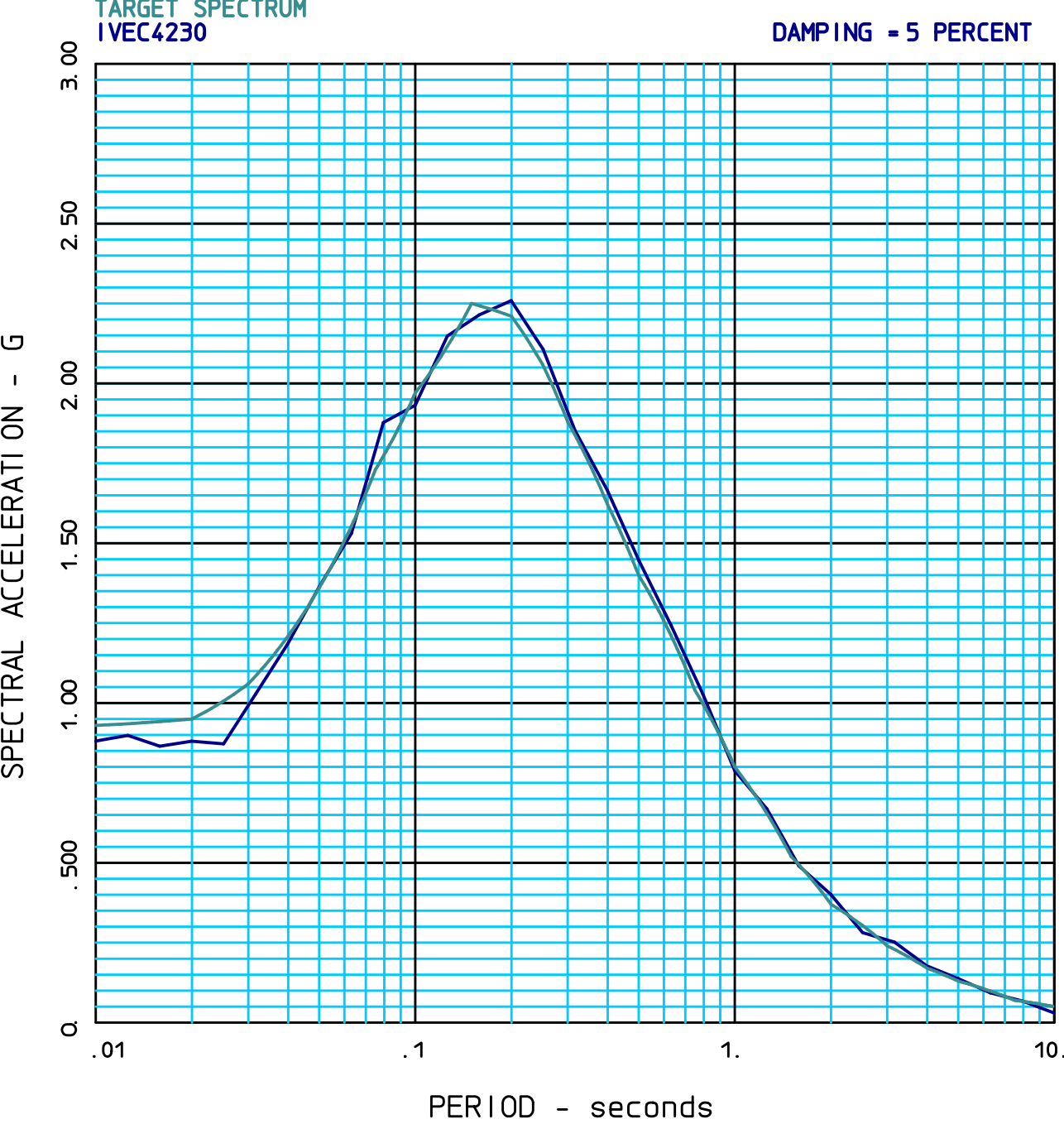

Tri Valley Hospital
IV02270 fitted to target spectrum



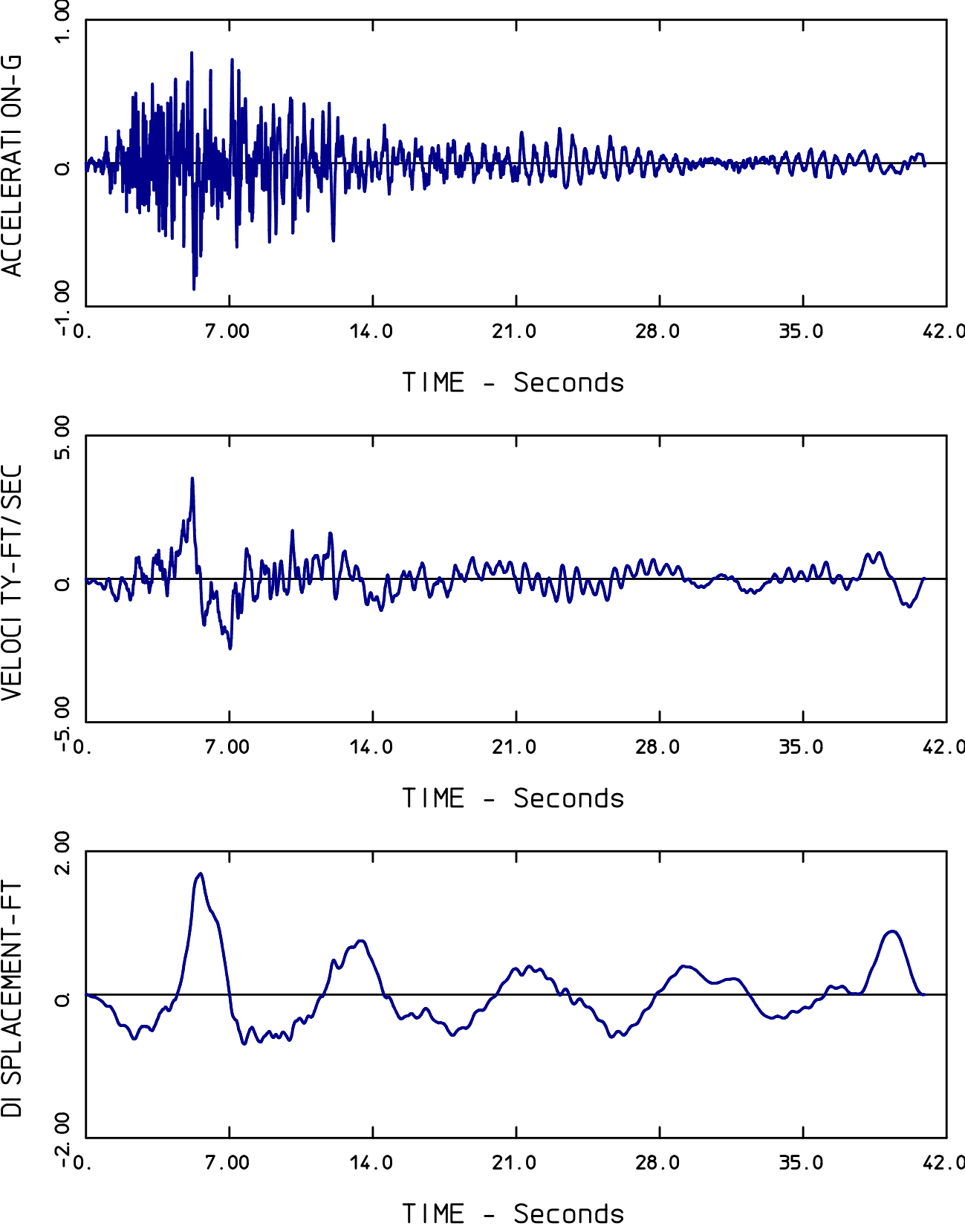

Tri Valley Hospital
IVEC4140 fitted to target spectrum



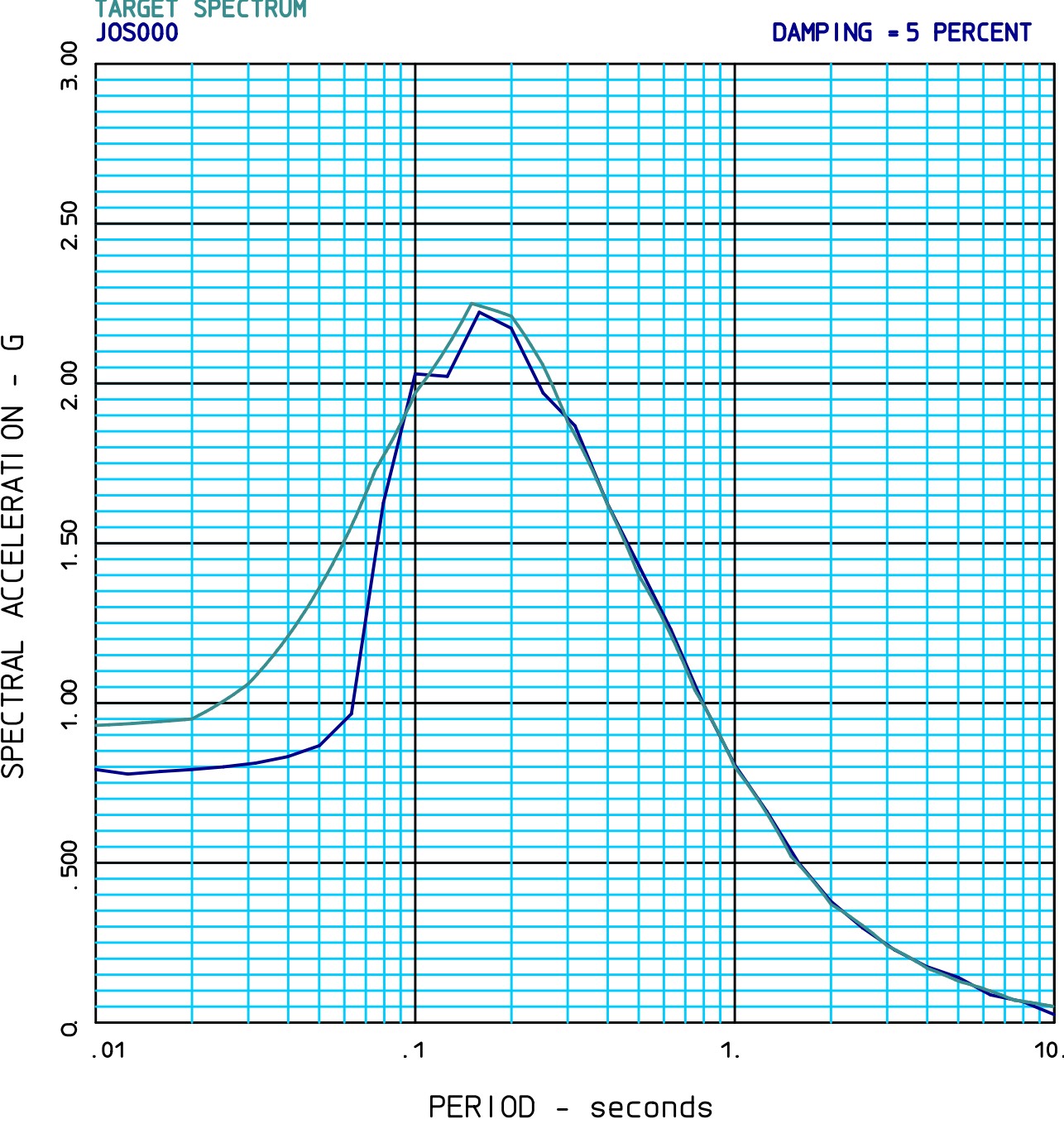

Tri Valley Hospital
IVEC4140 fitted to target spectrum



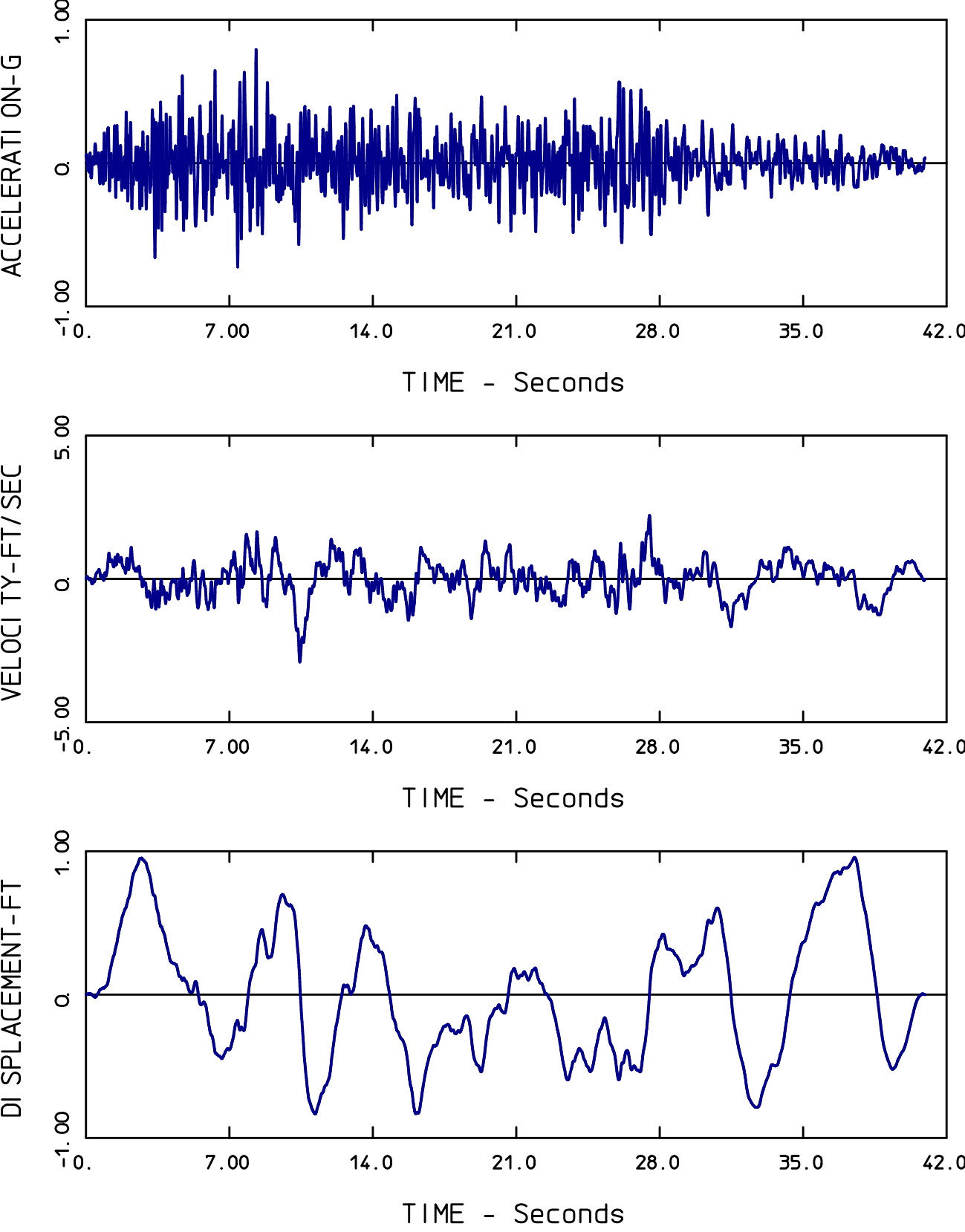

Tri Valley Hospital
IVEC4230 fitted to target spectrum



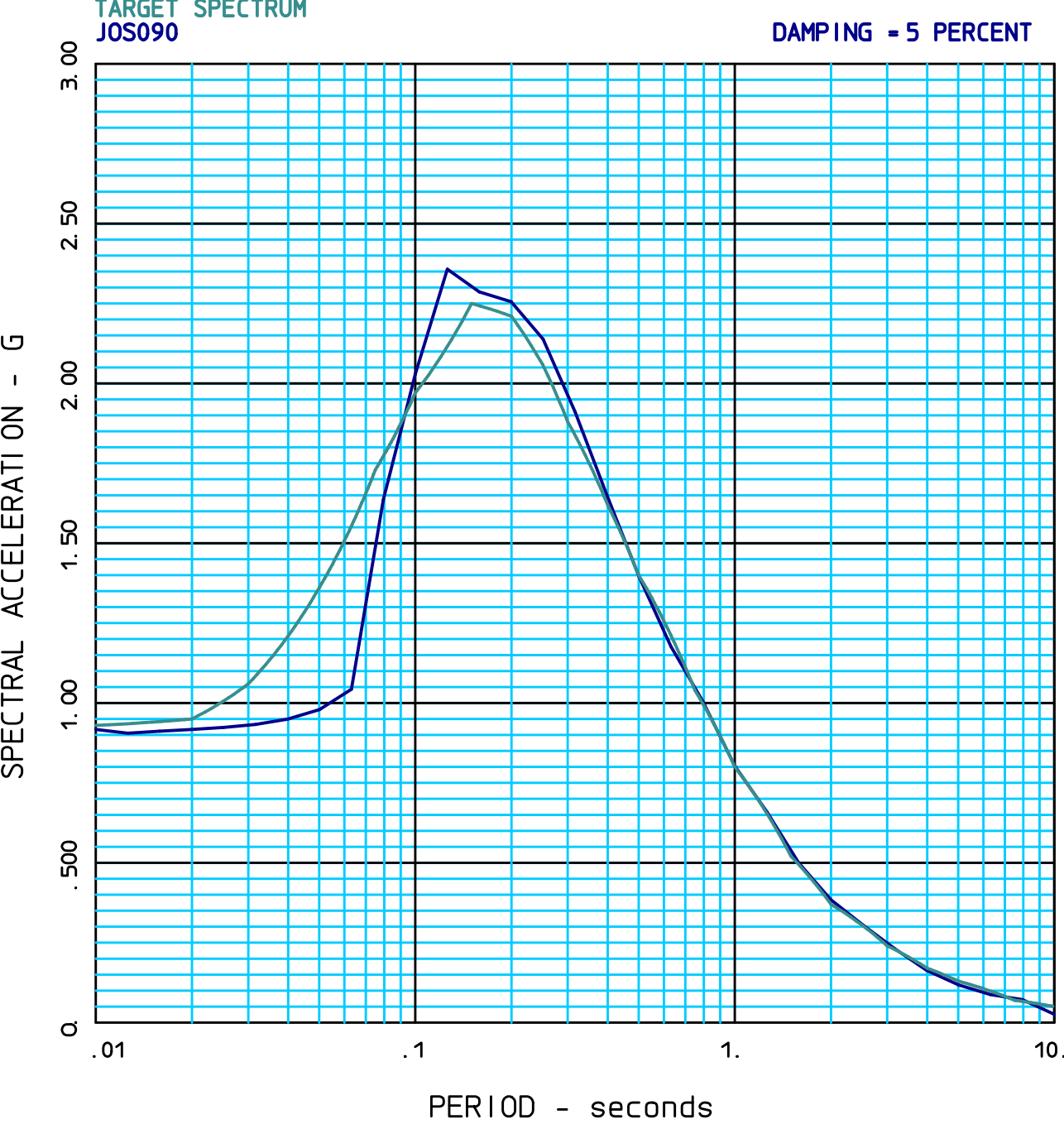

Tri Valley Hospital
IVEC4230 fitted to target spectrum



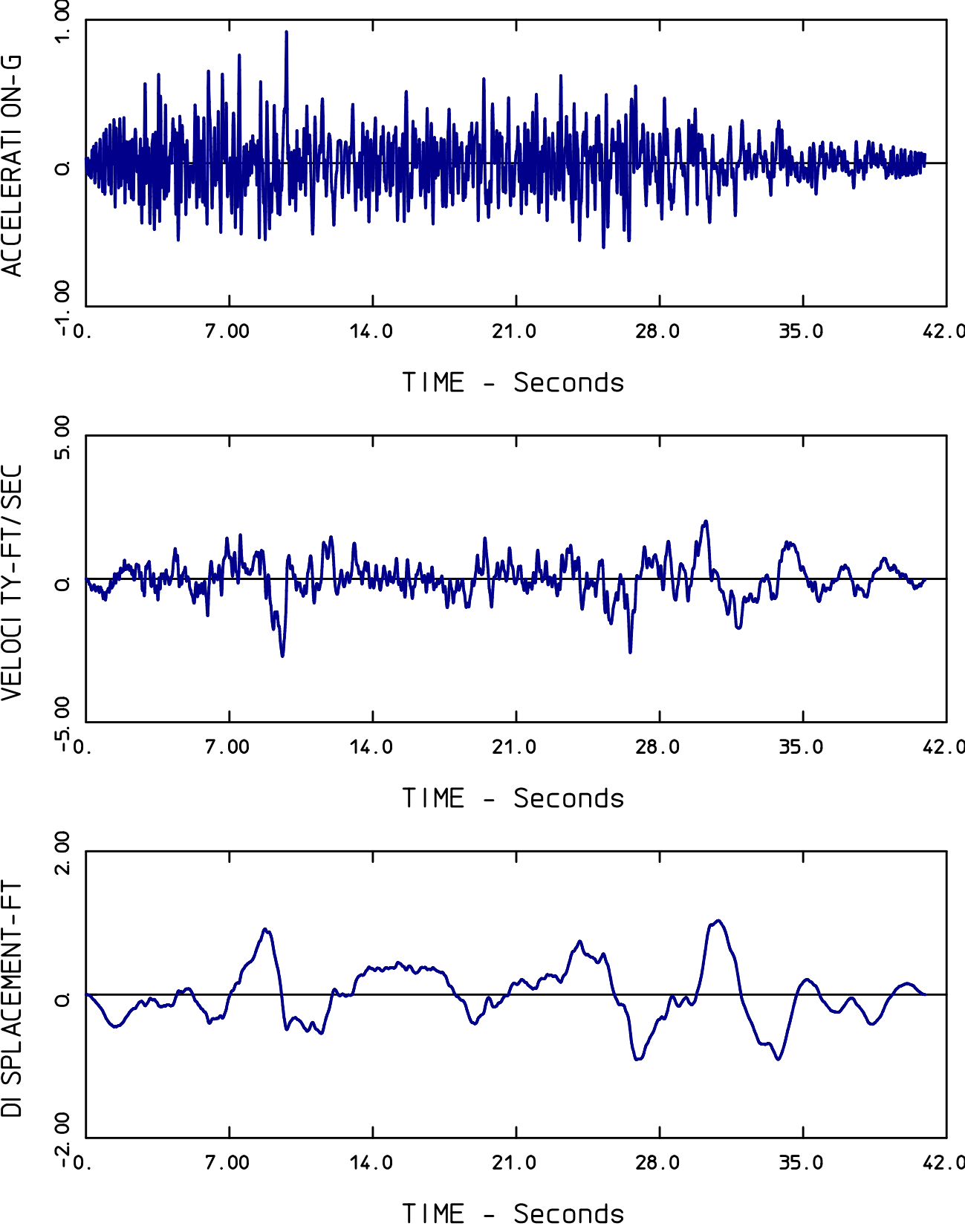

Tri Valley Hospital
JOS000 fitted to target spectrum



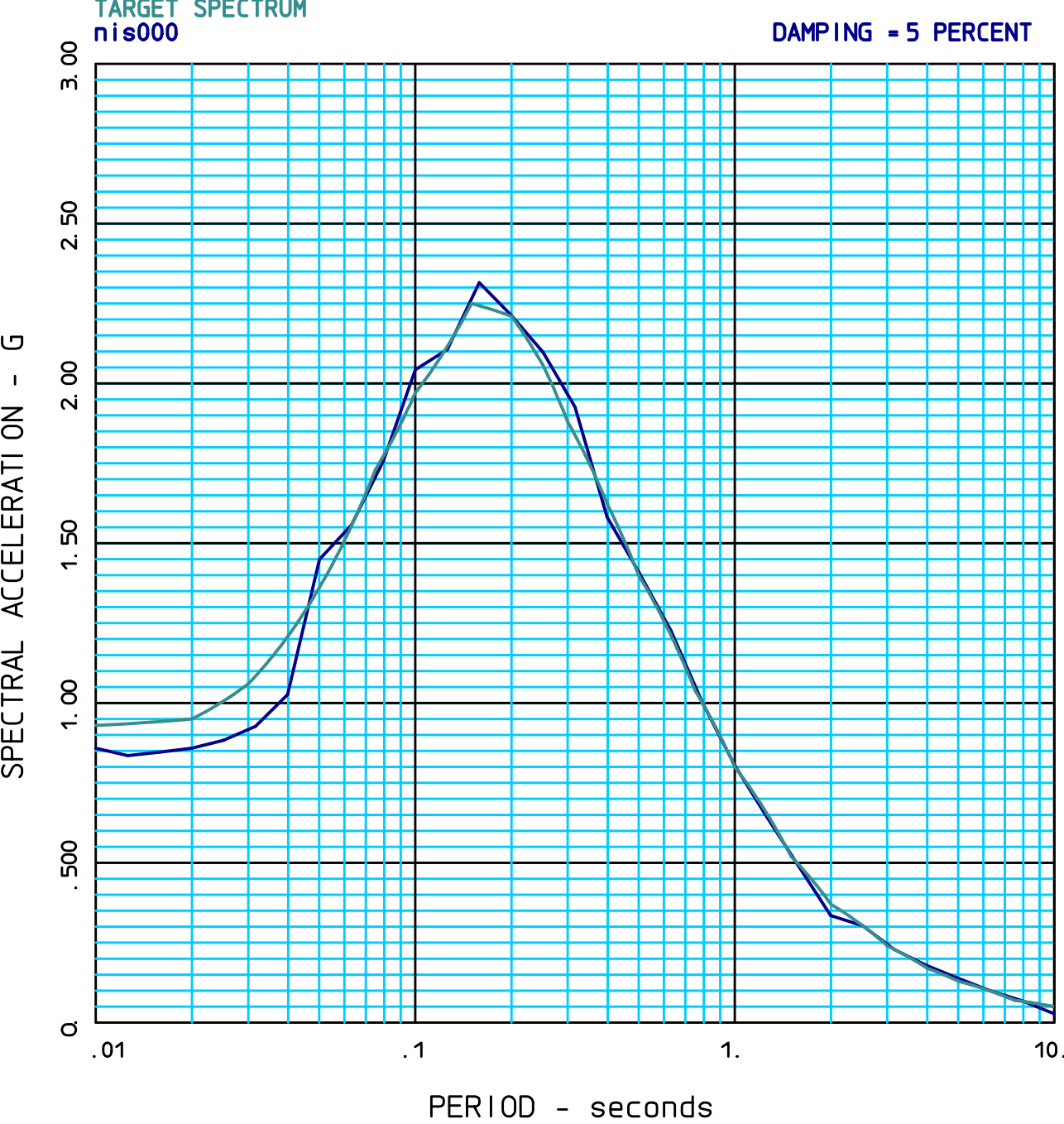

Tri Valley Hospital
JOS000 fitted to target spectrum



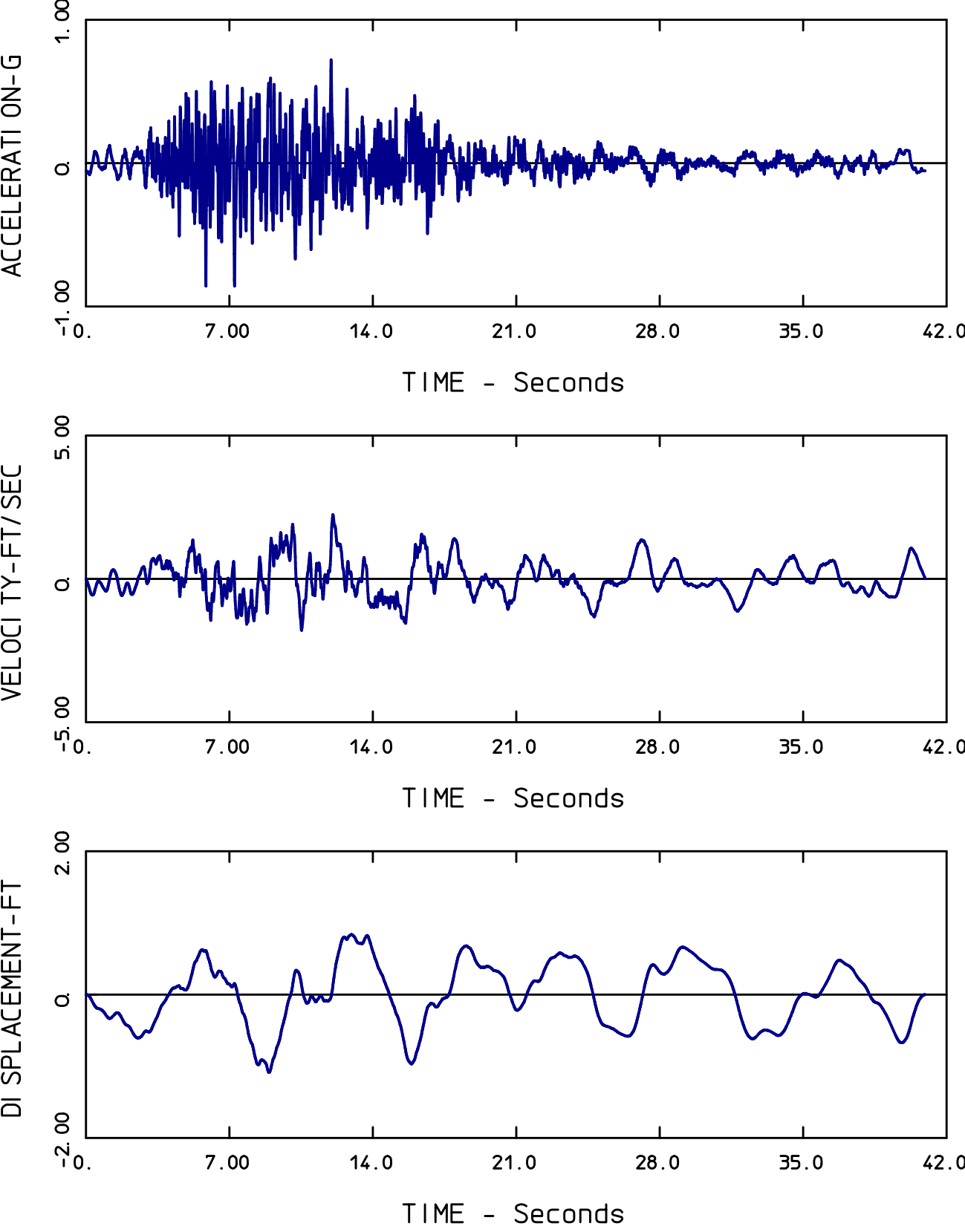

Tri Valley Hospital
JOS090 fitted to target spectrum



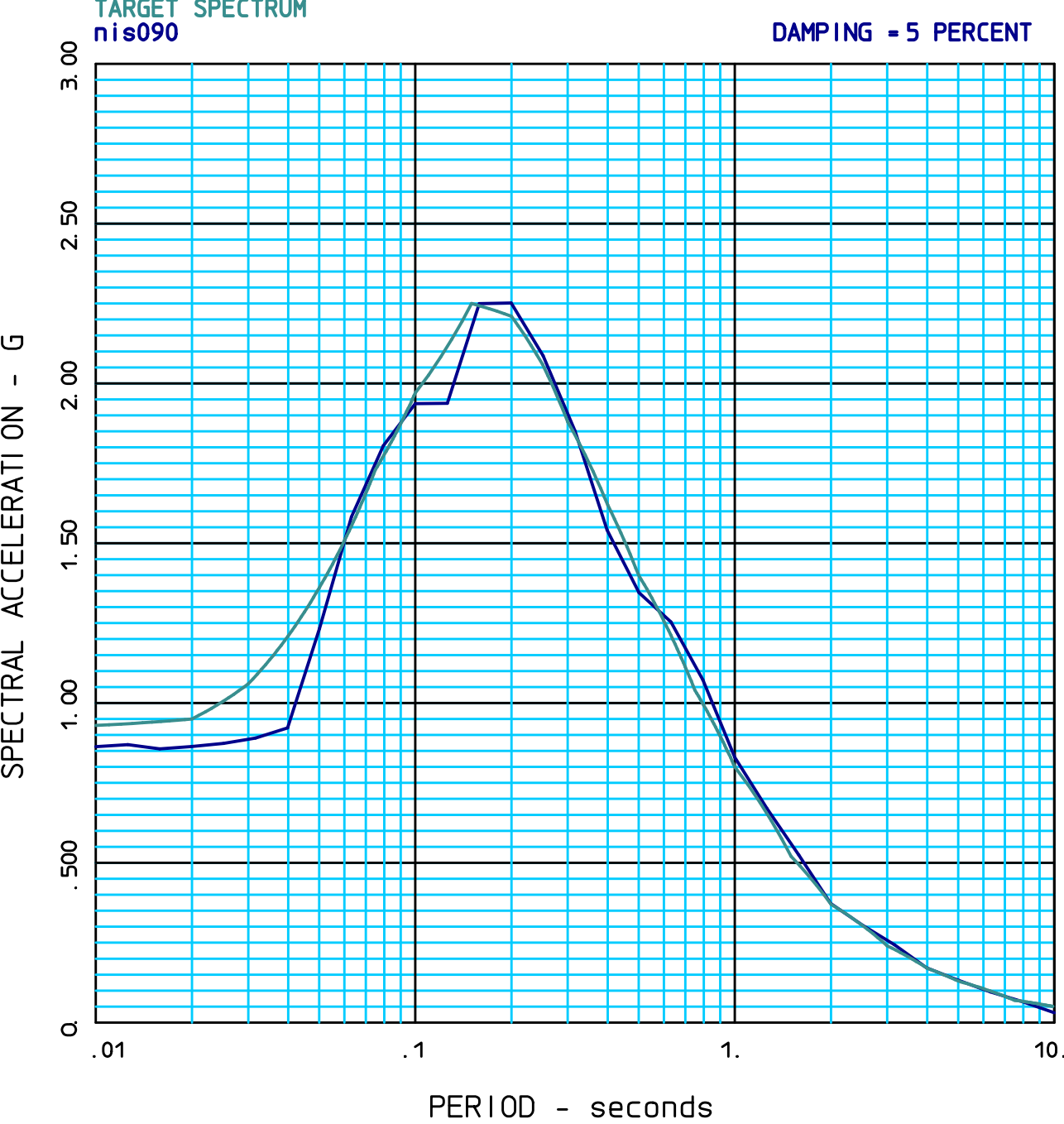

Tri Valley Hospital
JOS090 fitted to target spectrum



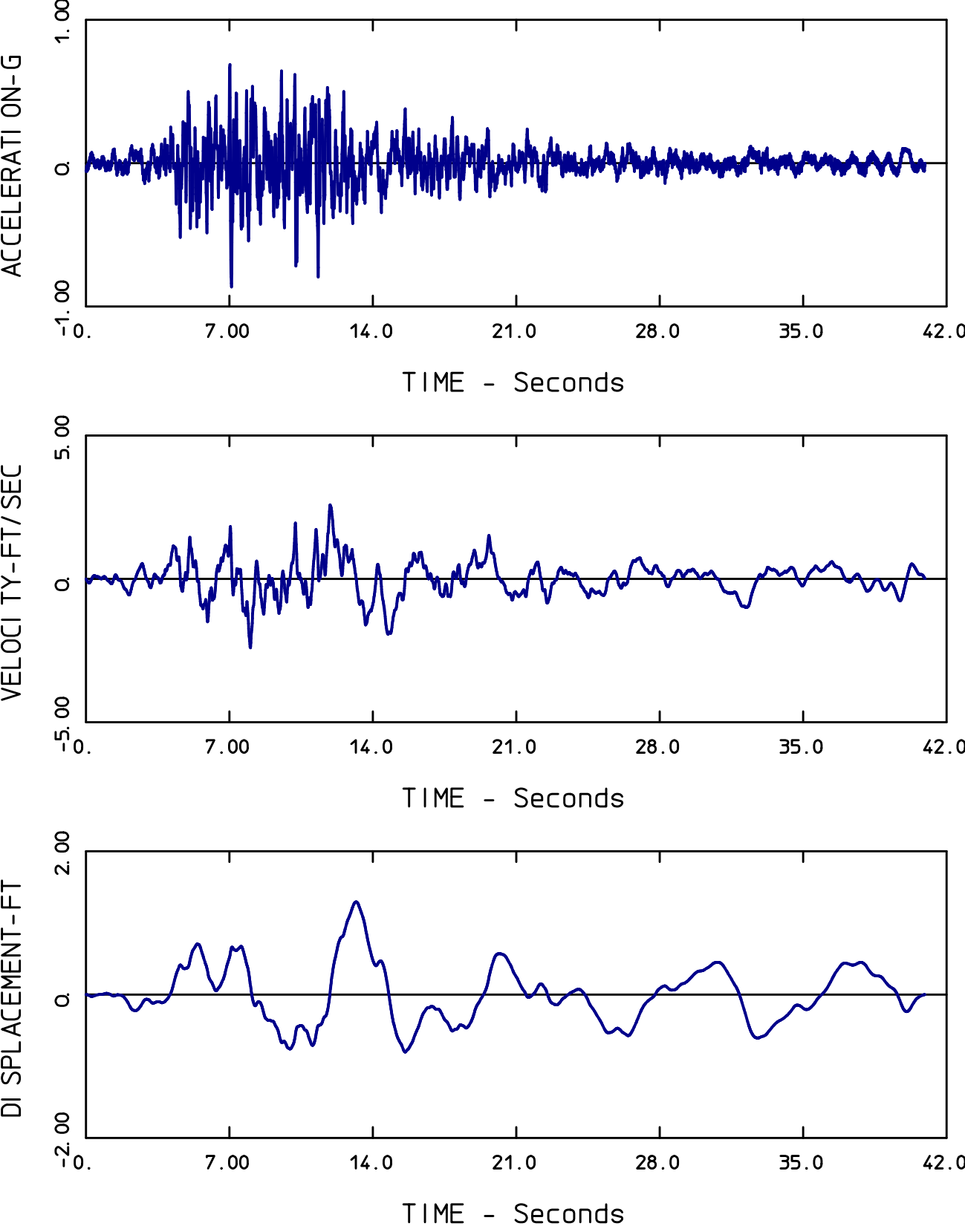

Tri Valley Hospital
NIS000 fitted to target spectrum



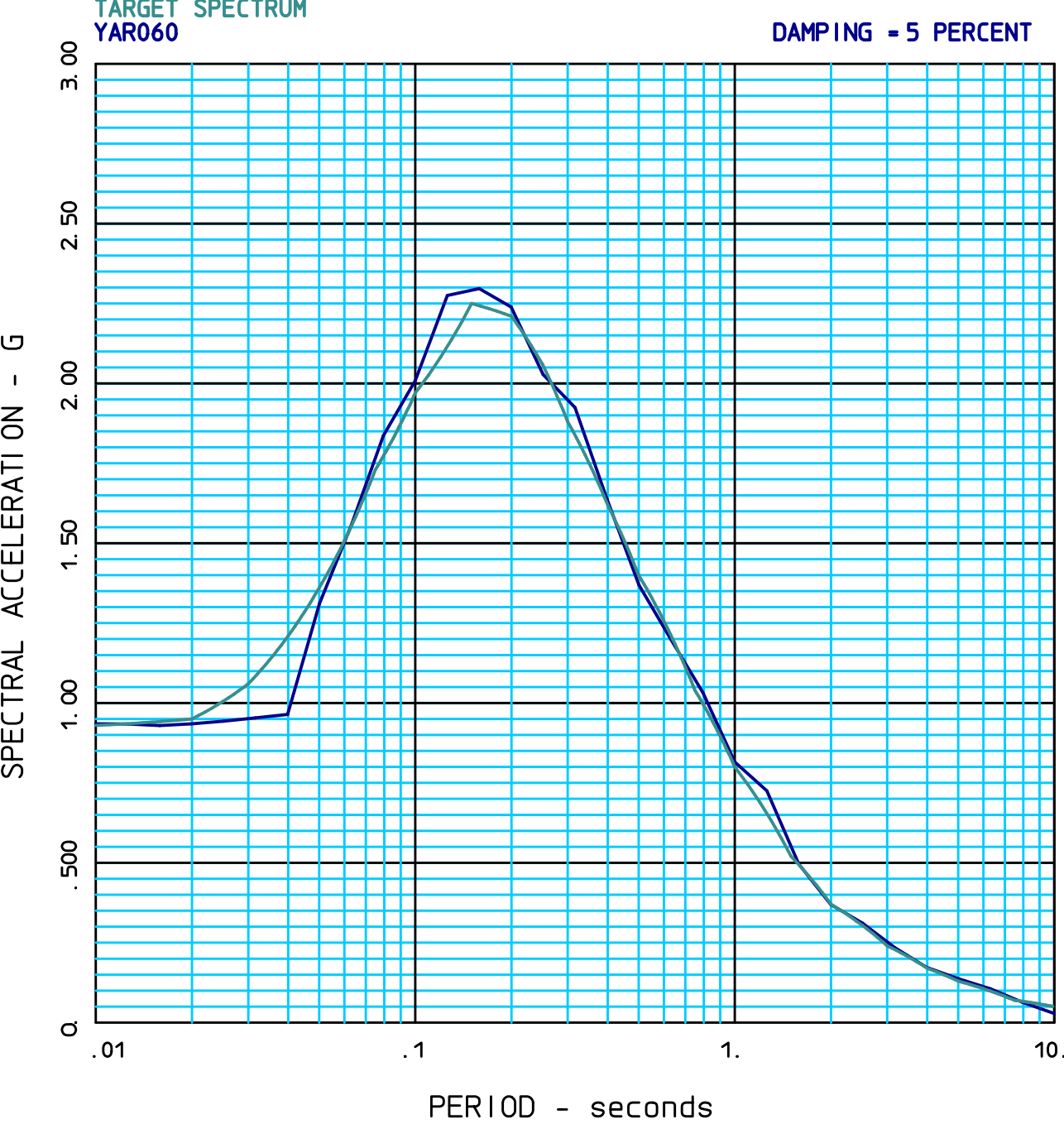

Tri Valley Hospital
NIS000 fitted to target spectrum



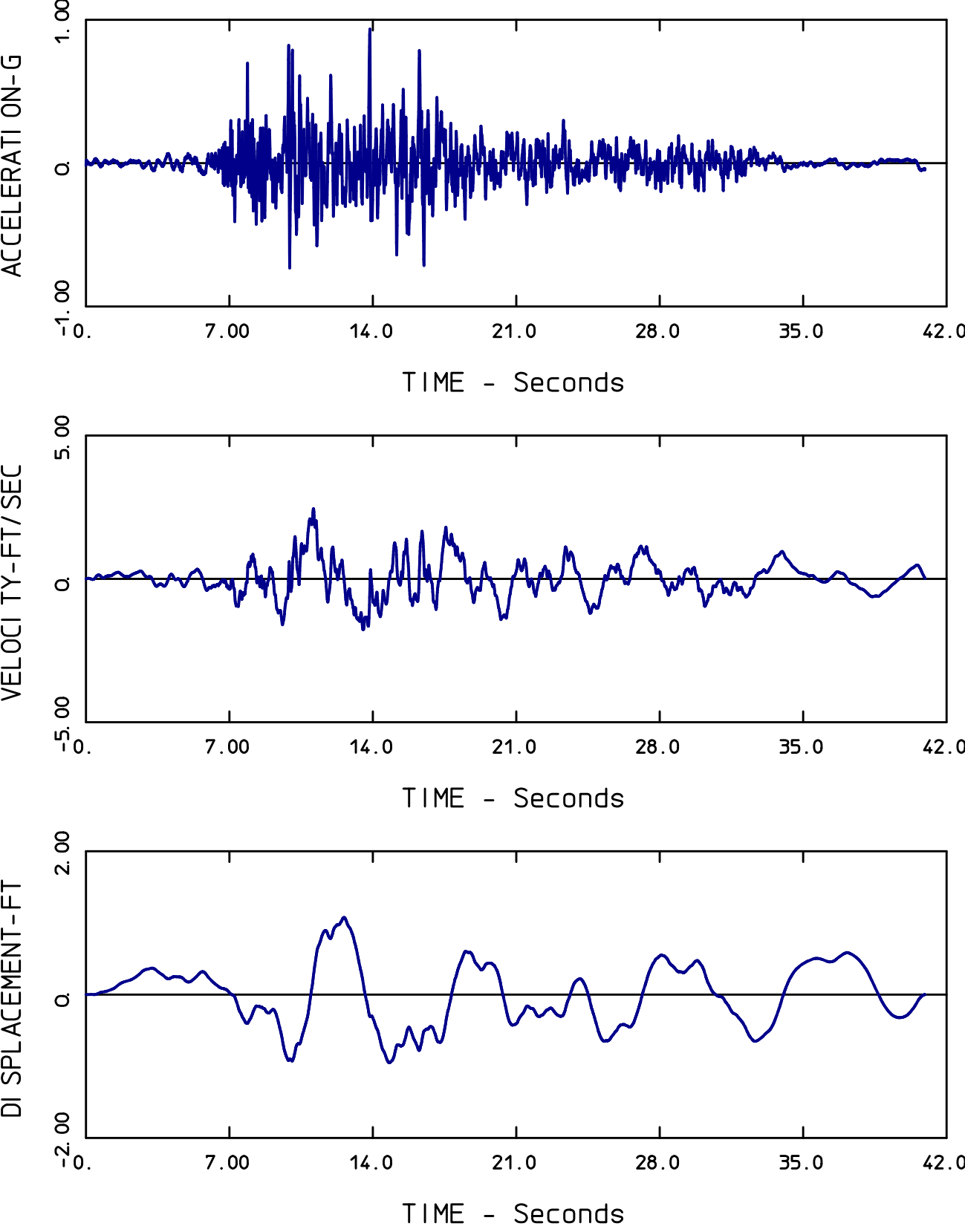

TRi Valley Hospital
NIS090 fitted to target spectrum



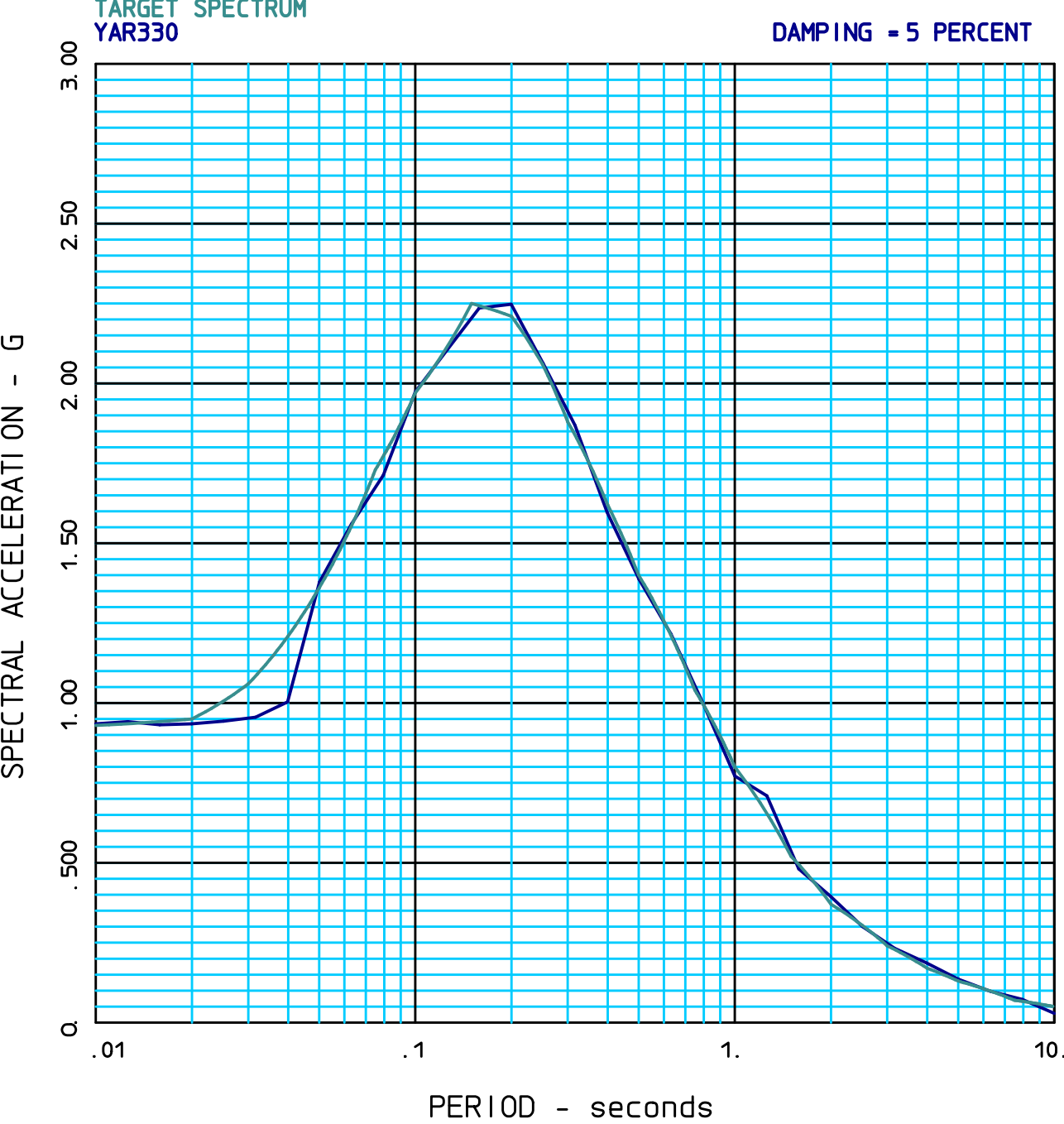

TRi Valley Hospital
NIS090 fitted to target spectrum



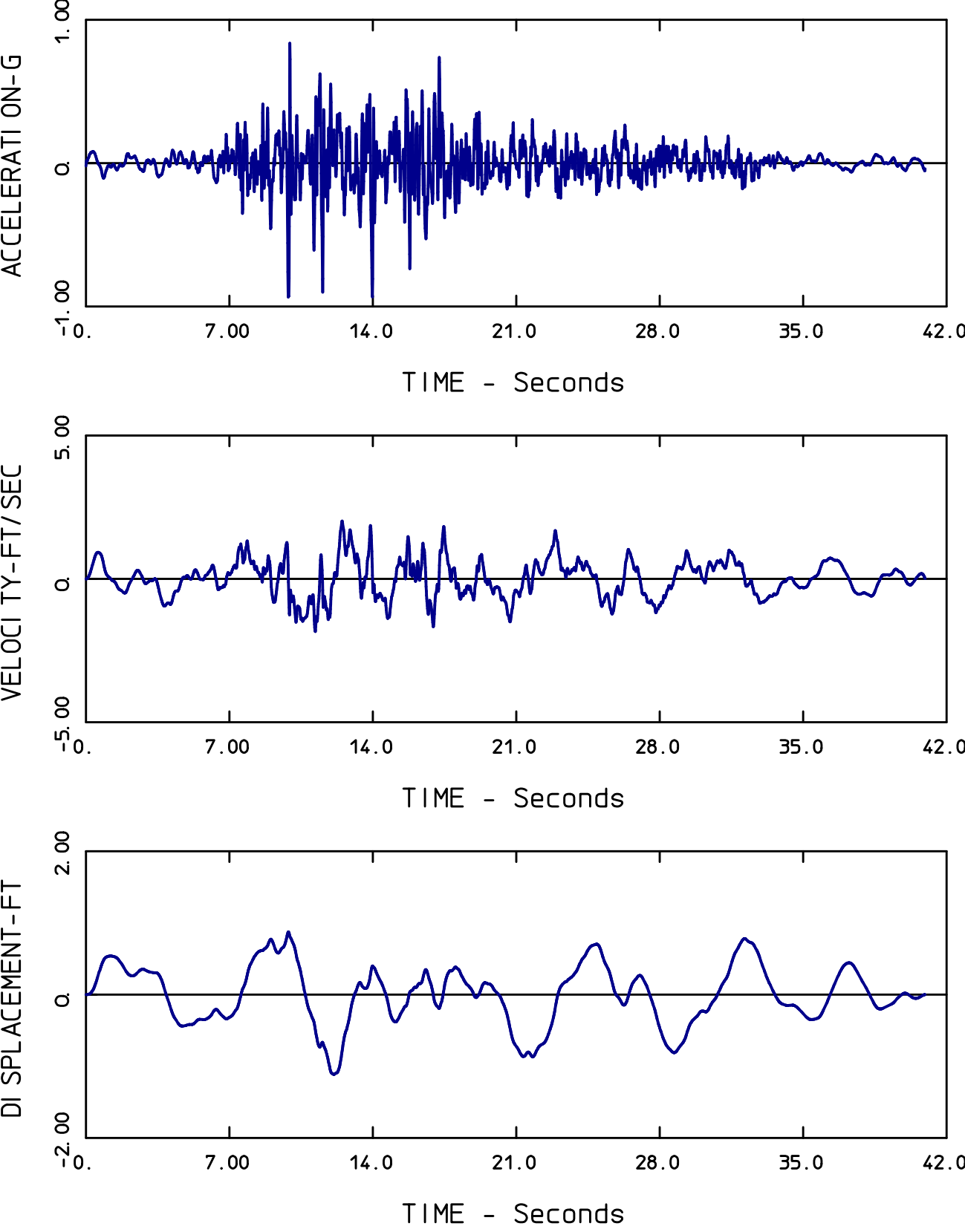

Tri Valley Hospital
YAR060 fitted to target spectrum




Tri Valley Hospital
YAR060 fitted to target spectrum




TRi Valley Hospital
YAR330 fitted to target spectrum




TRi Valley Hospital
YAR330 fitted to target spectrum

# Appendix D
# Printed Outputs
# Nonlinear Site Response Analyses

The following pages show the printed output from TESS2 for three runs showing the assumed input parameters and summaries of the results:

**tv670a** – base case
**tv670b** – with more epp development
**tv670c** – with lower Vs in Upper Tassajara

Each printed output is preceded by a table summarizing peak response values.

Definitions of key column headings are as follows:

In the INPUT data:

SIGV - vertical effective stress
VS - shear wave velocity
GMAX - shear modulus at low strains
TAUMAX - asymptote of stress-strain curve under rapid, cyclic loading
GAMREF – reference strain - ratio of TAUMAX to shear modulus at low strains

In the OUTPUT:

TMAX – is the peak shear stress during the loading
GAMMAX – is the peak cyclic shear strain
DELTA, DETAG and DETAU – are degradation indices generally used for clayey soils. Unity indicates no degradation.
UMAX – maximum excess pore pressure ratio at any time. Unity indicates initial liquefaction.
UFINAL – excess pore pressure ratio at the end of the specified input motion

# tv670a – base case

**********
MAXIMUM RESPONSE VALUES AT GROUND SURFACE
**********

| INPUT FILE | INPUT MOTION | INPUT AMAX | SLOPE | COMP | KDIS | AMAX | VMAX | DMAXR | DFINALR | RUMAX | SETTLEMENT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| tv670a | IV02180.txt | 0.81 | 0.00 | 1 | 0 | 0.34 | 3.06 | 1.39 | -1.14 | 0.07 | 0.05 |
| tv670a | iv02270.txt | 0.79 | 0.00 | 2 | 0 | 0.38 | 3.68 | 1.01 | 0.43 | 0.07 | 0.05 |
| tv670a | IVEC4140.txt | 0.94 | 0.00 | 1 | 0 | 0.37 | 2.88 | 1.57 | -1.32 | 0.05 | 0.04 |
| tv670a | IVEC4230.txt | 0.88 | 0.00 | 2 | 0 | 0.38 | 4.21 | 1.56 | 0.97 | 0.05 | 0.04 |
| tv670a | JOS000.txt | 0.79 | 0.00 | 1 | 0 | 0.36 | 3.67 | 1.07 | -0.20 | 0.06 | 0.05 |
| tv670a | JOS090.txt | 0.92 | 0.00 | 2 | 0 | 0.36 | 3.80 | 1.50 | -0.72 | 0.06 | 0.05 |
| tv670a | NIS000.txt | 0.86 | 0.00 | 1 | 0 | 0.39 | 2.79 | 0.69 | 0.30 | 0.04 | 0.04 |
| tv670a | NIS090.txt | 0.86 | 0.00 | 2 | 0 | 0.38 | 3.38 | 0.83 | -0.18 | 0.04 | 0.04 |
| tv670a | YAR060.txt | 0.94 | 0.00 | 1 | 0 | 0.36 | 2.94 | 1.20 | -0.92 | 0.05 | 0.04 |
| tv670a | YAR330.txt | 0.94 | 0.00 | 2 | 0 | 0.38 | 2.83 | 0.93 | -0.15 | 0.05 | 0.04 |

RUMAX IS MAX RU IN ANY LAYER; SETTLEMENT IS SETTLEMENT OF GROUND SURFACE IN FEET
DFINALR IS GROUND SURFACE FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN GSFRD IF SLOPE IS GREATER THAN ZERO

**********
**********

TESS2 - Version 3.00D
Copyright 2020 Robert Pyke
Built by rmp on 08/29/2020
Using Simply Fortran v. 2.4

**********
**********

INPUT/OUTPUT FILE NAME: **tv670a**

**********
Tri Valley Hospital
**********
670 feet deep profile - base case
**********

REDISTRIBUTION AND DISSIPATION OF PORE PRESSURES
IS NOT INCLUDED!

CALCULATION OF SETTLEMENTS IS TURNED ON

UNITS ARE KIPS, FEET AND SECONDS

**********
INPUT DATA
**********

MATERIAL PROPERTY PARAMETERS

| MTYPE | VT | ALPHA | GMRP | TSTR | FSTR |
|---|---|---|---|---|---|
| 1 | 0.02 | 1.00 | 0.00 | 0.00 | 0.00 |

| MTYPE | VT | ALPHA | GMRP | TSTR | FSTR |
|---|---|---|---|---|---|
| 2 | 0.02 | 1.00 | 0.00 | 0.00 | 0.00 |

| MTYPE | VT | ALPHA | GMRP | TSTR | FSTR |
|---|---|---|---|---|---|
| 3 | 0.02 | 1.00 | 0.00 | 0.00 | 0.00 |

| MTYPE | VT | ALPHA | GMRP | TSTR | FSTR |
|---|---|---|---|---|---|
| 4 | 0.02 | 1.00 | 0.00 | 0.00 | 0.00 |

PARAMETERS FOR SIMPLE DEGRADATION

| MTYPE | SS | RS | E | SG | RG | ST | RT |
|---|---|---|---|---|---|---|---|
| 2 | 0.12 | 0.65 | 1.50 | 0.12 | 0.65 | 0.12 | 0.65 |

PARAMETERS FOR PORE PRESSURE GENERATION CURVES

| LAYER NO. | MTYPE | TAUAV/SIGV | NL | E | F | G |
|---|---|---|---|---|---|---|
| 9 | 3 | 0.800 | 10 | 2.00 | 0.10 | 2.00 |
| 10 | 4 | 0.800 | 10 | 2.00 | 0.10 | 2.00 |
| 11 | 4 | 0.800 | 10 | 2.00 | 0.10 | 2.00 |

PARAMETERS FOR SETTLEMENT CALCULATIONS

| LAYER NO. | ARD | FACTOR |
|---|---|---|
| 9 | 75 | 0.33 |
| 10 | 75 | 0.33 |
| 11 | 75 | 0.33 |

PARAMETERS FOR HARDENING OF SHEAR MODULUS

| MAT.TYPE | KHARD | FHARD | FHARDS |
|---|---|---|---|
| 3 | 1 | 1.00 | 0.50 |
| 4 | 1 | 1.00 | 0.50 |

**********
THE TIMESTEP HAS BEEN REDUCED BY A FACTOR OF 2
IN ORDER TO MEET THE COURANT STABILITY CRITERION
ALTERNATELY YOU MAY INCREASE THE LAYER THICKNESS(ES)
**********

**********
LAYER DATA
**********

DEPTH TO WATER TABLE = 5.00
TRAVEL TIMES ARE RELATIVE TO A TIMESTEP OF 0.0050 SECONDS

| LAYER NO. | MTYPE | THICK | UNIT WT | OCR | KO | SIGV | VS | GMAX | TAUMAX | GAMREF | TTR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 4.00 | 0.120 | | | 0.24 | 500.00 | 931.68 | 1.863 | 0.200 | 0.625 |
| 2 | 1 | 6.00 | 0.110 | | | 0.83 | 400.00 | 546.58 | 1.366 | 0.250 | 0.333 |
| 3 | 1 | 5.00 | 0.112 | | | 1.09 | 425.00 | 628.26 | 1.257 | 0.200 | 0.425 |
| 4 | 1 | 5.00 | 0.114 | | | 1.35 | 450.00 | 716.93 | 1.434 | 0.200 | 0.450 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 1 | 5.00 | 0.116 | | | 1.61 | 475.00 | 812.81 | 1.626 | 0.200 | 0.475 |
| 6 | 1 | 5.00 | 0.118 | | | 1.88 | 500.00 | 916.15 | 1.832 | 0.200 | 0.500 |
| 7 | 1 | 5.00 | 0.119 | | | 2.16 | 525.00 | 1018.61 | 2.037 | 0.200 | 0.525 |
| 8 | 1 | 5.00 | 0.120 | | | 2.45 | 550.00 | 1127.33 | 2.255 | 0.200 | 0.550 |
| 9 | 3 | 10.00 | 0.125 | 1.00 | 0.60 | 2.91 | 700.00 | 1902.17 | 2.853 | 0.150 | 0.350 |
| 10 | 4 | 10.00 | 0.130 | 1.00 | 0.60 | 3.56 | 800.00 | 2583.85 | 3.101 | 0.120 | 0.400 |
| 11 | 4 | 10.00 | 0.130 | 1.00 | 0.80 | 4.23 | 850.00 | 2916.93 | 3.500 | 0.120 | 0.425 |
| 12 | 1 | 10.00 | 0.120 | | | 4.86 | 900.00 | 3018.63 | 6.037 | 0.200 | 0.450 |
| 13 | 1 | 10.00 | 0.120 | | | 5.44 | 910.00 | 3086.09 | 6.172 | 0.200 | 0.455 |
| 14 | 1 | 10.00 | 0.120 | | | 6.01 | 920.00 | 3154.29 | 6.309 | 0.200 | 0.460 |
| 15 | 1 | 10.00 | 0.120 | | | 6.59 | 930.00 | 3223.23 | 6.446 | 0.200 | 0.465 |
| 16 | 1 | 10.00 | 0.120 | | | 7.16 | 940.00 | 3292.92 | 6.586 | 0.200 | 0.470 |
| 17 | 1 | 10.00 | 0.120 | | | 7.74 | 950.00 | 3363.35 | 3.363 | 0.100 | 0.475 |
| 18 | 1 | 10.00 | 0.120 | | | 8.32 | 960.00 | 3434.53 | 6.869 | 0.200 | 0.480 |
| 19 | 1 | 20.00 | 0.130 | | | 9.28 | 1200.00 | 5813.66 | 11.627 | 0.200 | 0.300 |
| 20 | 1 | 20.00 | 0.130 | | | 10.63 | 1275.00 | 6563.08 | 13.126 | 0.200 | 0.319 |
| 21 | 1 | 20.00 | 0.130 | | | 11.98 | 1305.00 | 6875.57 | 13.751 | 0.200 | 0.326 |
| 22 | 1 | 20.00 | 0.130 | | | 13.34 | 1365.00 | 7522.34 | 15.045 | 0.200 | 0.341 |
| 23 | 1 | 20.00 | 0.130 | | | 14.69 | 1395.00 | 7856.62 | 15.713 | 0.200 | 0.349 |
| 24 | 1 | 20.00 | 0.130 | | | 16.04 | 1395.00 | 7856.62 | 15.713 | 0.200 | 0.349 |
| 25 | 1 | 20.00 | 0.130 | | | 17.39 | 1420.00 | 8140.75 | 16.281 | 0.200 | 0.355 |
| 26 | 1 | 20.00 | 0.130 | | | 18.74 | 1420.00 | 8140.75 | 16.281 | 0.200 | 0.355 |
| 27 | 1 | 20.00 | 0.130 | | | 20.10 | 1440.00 | 8371.68 | 16.743 | 0.200 | 0.360 |
| 28 | 1 | 20.00 | 0.130 | | | 21.45 | 1440.00 | 8371.68 | 16.743 | 0.200 | 0.360 |
| 29 | 1 | 20.00 | 0.130 | | | 22.80 | 1455.00 | 8547.00 | 17.094 | 0.200 | 0.364 |
| 30 | 1 | 20.00 | 0.130 | | | 24.15 | 1555.00 | 9762.21 | 19.524 | 0.200 | 0.389 |
| 31 | 1 | 20.00 | 0.130 | | | 25.50 | 1665.00 | 11192.21 | 22.384 | 0.200 | 0.416 |
| 32 | 1 | 20.00 | 0.130 | | | 26.86 | 1675.00 | 11327.06 | 22.654 | 0.200 | 0.419 |
| 33 | 1 | 20.00 | 0.130 | | | 28.21 | 1775.00 | 12719.91 | 25.440 | 0.200 | 0.444 |
| 34 | 1 | 20.00 | 0.130 | | | 29.56 | 1875.00 | 14193.52 | 28.387 | 0.200 | 0.469 |
| 35 | 1 | 20.00 | 0.130 | | | 30.91 | 1925.00 | 14960.60 | 29.921 | 0.200 | 0.481 |
| 36 | 1 | 20.00 | 0.130 | | | 32.26 | 1975.00 | 15747.87 | 31.496 | 0.200 | 0.494 |
| 37 | 1 | 25.00 | 0.130 | | | 33.78 | 2000.00 | 16149.07 | 32.298 | 0.200 | 0.400 |
| 38 | 1 | 25.00 | 0.130 | | | 35.47 | 2000.00 | 16149.07 | 32.298 | 0.200 | 0.400 |
| 39 | 1 | 25.00 | 0.130 | | | 37.16 | 2000.00 | 16149.07 | 32.298 | 0.200 | 0.400 |
| 40 | 1 | 25.00 | 0.130 | | | 38.85 | 2400.00 | 23254.66 | 46.509 | 0.200 | 0.480 |
| 41 | 1 | 25.00 | 0.130 | | | 40.54 | 2400.00 | 23254.66 | 46.509 | 0.200 | 0.480 |
| 42 | 1 | 25.00 | 0.130 | | | 42.23 | 2400.00 | 23254.66 | 46.509 | 0.200 | 0.480 |
| 43 | 1 | 20.00 | 0.130 | | | 43.76 | 2400.00 | 23254.66 | 46.509 | 0.200 | 0.600 |

**SHEAR WAVE VELOCITY IN BASE = 2400.**
**UNIT WEIGHT OF BASE = 0.135**

**********
**OUTPUT FOR IV02180**
**WITH A PEAK ACCELERATION OF 0.81 G**
**AND SLOPE = 0.00**
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.342 | 3.056 | 1.389 | 26.981 | -1.138 | 0.082 | 0.010 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.332 | 3.049 | 1.389 | 26.981 | -1.138 | 0.261 | 0.068 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.335 | 2.990 | 1.387 | 26.981 | -1.139 | 0.447 | 0.140 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.343 | 2.908 | 1.384 | 26.981 | -1.140 | 0.621 | 0.208 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.376 | 2.817 | 1.389 | 26.981 | -1.146 | 0.791 | 0.262 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.381 | 2.728 | 1.378 | 26.976 | -1.144 | 0.959 | 0.307 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.441 | 2.647 | 1.362 | 26.976 | -1.138 | 1.121 | 0.345 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.429 | 2.567 | 1.339 | 26.971 | -1.125 | 1.274 | 0.358 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.359 | 2.500 | 1.303 | 26.971 | -1.098 | 1.493 | 0.202 | 1.000 | 1.000 | 1.000 | 0.069 | 0.069 | 0.016 | 45.00 |
| 10 | 50.00 | 0.310 | 2.427 | 1.271 | 26.966 | -1.079 | 1.767 | 0.183 | 1.000 | 1.000 | 1.000 | 0.046 | 0.046 | 0.016 | 55.00 |
| 11 | 60.00 | 0.305 | 2.367 | 1.243 | 26.961 | -1.061 | 1.978 | 0.171 | 1.000 | 1.000 | 1.000 | 0.025 | 0.025 | 0.016 | 65.00 |
| 12 | 70.00 | 0.324 | 2.316 | 1.219 | 26.936 | -1.048 | 2.198 | 0.134 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.335 | 2.254 | 1.192 | 26.926 | -1.032 | 2.454 | 0.158 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.402 | 2.202 | 1.164 | 26.911 | -1.012 | 2.594 | 0.175 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.429 | 2.178 | 1.132 | 26.901 | -0.988 | 2.822 | 0.187 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.402 | 2.207 | 1.097 | 26.881 | -0.960 | 3.028 | 0.196 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.411 | 2.228 | 1.067 | 26.871 | -0.936 | 3.265 | 1.231 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.507 | 2.257 | 0.727 | 5.688 | -0.480 | 3.602 | 0.188 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.405 | 2.255 | 0.710 | 5.683 | -0.452 | 4.183 | 0.099 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.352 | 2.235 | 0.696 | 5.678 | -0.440 | 4.880 | 0.104 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.307 | 2.185 | 0.681 | 5.673 | -0.441 | 5.428 | 0.124 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.345 | 2.100 | 0.659 | 5.663 | -0.436 | 5.937 | 0.124 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.371 | 2.033 | 0.644 | 5.658 | -0.430 | 6.458 | 0.117 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.409 | 1.971 | 0.636 | 5.653 | -0.430 | 6.898 | 0.157 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.422 | 1.930 | 0.612 | 5.648 | -0.414 | 7.250 | 0.166 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.456 | 1.892 | 0.583 | 5.638 | -0.390 | 7.432 | 0.183 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.445 | 1.833 | 0.546 | 5.633 | -0.359 | 7.503 | 0.190 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.448 | 1.782 | 0.509 | 5.623 | -0.329 | 7.872 | 0.208 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.486 | 1.738 | 0.469 | 5.613 | -0.309 | 8.308 | 0.223 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.531 | 1.678 | 0.424 | 5.593 | -0.285 | 8.813 | 0.185 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.503 | 1.670 | 0.389 | 5.578 | -0.263 | 9.316 | 0.153 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.480 | 1.649 | 0.353 | 5.568 | -0.237 | 9.728 | 0.158 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.512 | 1.636 | 0.315 | 5.543 | -0.203 | 10.036 | 0.135 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.489 | 1.614 | 0.282 | 5.523 | -0.176 | 10.347 | 0.123 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.459 | 1.582 | 0.253 | 5.508 | -0.153 | 10.676 | 0.120 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.457 | 1.553 | 0.225 | 5.493 | -0.135 | 10.944 | 0.117 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.440 | 1.510 | 0.197 | 5.483 | -0.112 | 11.166 | 0.120 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.448 | 1.460 | 0.160 | 5.468 | -0.078 | 11.370 | 0.123 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.472 | 1.441 | 0.124 | 5.448 | -0.056 | 11.512 | 0.127 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.472 | 1.423 | 0.082 | 5.428 | -0.024 | 11.544 | 0.073 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.441 | 1.418 | 0.059 | 5.423 | -0.014 | 11.997 | 0.078 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 42 | 625.00 | 0.441 | 1.397 | 0.036 | 5.413 | -0.004 | 12.268 | 0.070 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.423 | 1.380 | 0.016 | 5.408 | -0.003 | 12.457 | 0.071 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.495 | 1.362 | 0.857 | | | | | | | | GROUND SURFACE SETTLEMENT | | 0.048 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

**********
OUTPUT FOR IV02270
WITH A PEAK ACCELERATION OF 0.79 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.383 | 3.676 | 1.013 | 26.036 | 0.429 | 0.092 | 0.011 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.367 | 3.672 | 1.013 | 26.036 | 0.429 | 0.290 | 0.075 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.368 | 3.627 | 1.012 | 26.041 | 0.429 | 0.502 | 0.172 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.378 | 3.555 | 1.015 | 26.046 | 0.432 | 0.699 | 0.253 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.375 | 3.476 | 1.010 | 26.046 | 0.429 | 0.891 | 0.328 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.399 | 3.405 | 0.992 | 26.051 | 0.415 | 1.067 | 0.386 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.379 | 3.362 | 0.977 | 26.056 | 0.402 | 1.239 | 0.450 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.349 | 3.323 | 0.964 | 26.061 | 0.402 | 1.399 | 0.479 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.337 | 3.286 | 0.958 | 26.061 | 0.407 | 1.622 | 0.278 | 1.000 | 1.000 | 1.000 | 0.069 | 0.069 | 0.016 | 45.00 |
| 10 | 50.00 | 0.342 | 3.256 | 0.933 | 26.066 | 0.394 | 1.893 | 0.254 | 1.000 | 1.000 | 1.000 | 0.046 | 0.046 | 0.016 | 55.00 |
| 11 | 60.00 | 0.350 | 3.231 | 0.906 | 26.066 | 0.384 | 2.096 | 0.244 | 1.000 | 1.000 | 1.000 | 0.025 | 0.025 | 0.016 | 65.00 |
| 12 | 70.00 | 0.351 | 3.191 | 0.896 | 26.066 | 0.387 | 2.255 | 0.155 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.345 | 3.126 | 0.895 | 26.071 | 0.395 | 2.459 | 0.176 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.369 | 3.067 | 0.892 | 26.066 | 0.403 | 2.739 | 0.191 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.398 | 3.001 | 0.887 | 26.071 | 0.420 | 2.999 | 0.208 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.428 | 2.945 | 0.862 | 26.066 | 0.419 | 3.238 | 0.220 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.493 | 2.900 | 0.835 | 26.071 | 0.415 | 3.339 | 1.749 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.529 | 2.861 | 0.580 | 3.538 | 0.116 | 3.809 | 0.239 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.425 | 2.790 | 0.561 | 3.538 | 0.106 | 4.209 | 0.111 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.372 | 2.703 | 0.539 | 3.543 | 0.085 | 4.925 | 0.115 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.370 | 2.601 | 0.518 | 3.543 | 0.089 | 5.531 | 0.125 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.346 | 2.508 | 0.495 | 3.558 | 0.101 | 5.986 | 0.127 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.353 | 2.438 | 0.474 | 3.563 | 0.102 | 6.517 | 0.128 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.367 | 2.337 | 0.450 | 3.573 | 0.094 | 7.014 | 0.156 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.356 | 2.214 | 0.417 | 3.578 | 0.087 | 7.698 | 0.143 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.374 | 2.147 | 0.392 | 3.583 | 0.082 | 8.143 | 0.154 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.405 | 2.110 | 0.372 | 3.583 | 0.074 | 8.605 | 0.171 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28 | 320.00 | 0.463 | 2.082 | 0.335 | 3.588 | 0.048 | 9.013 | 0.184 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.517 | 2.062 | 0.314 | 4.388 | -0.002 | 9.427 | 0.163 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.545 | 1.942 | 0.277 | 4.378 | -0.004 | 9.506 | 0.161 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.518 | 1.930 | 0.256 | 4.368 | -0.016 | 9.599 | 0.116 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.606 | 1.948 | 0.235 | 25.026 | -0.019 | 10.040 | 0.120 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.506 | 1.932 | 0.211 | 4.838 | -0.017 | 10.437 | 0.114 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.513 | 1.922 | 0.194 | 4.833 | -0.012 | 11.029 | 0.104 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.496 | 1.902 | 0.175 | 4.828 | -0.009 | 11.708 | 0.101 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.508 | 1.871 | 0.155 | 4.828 | -0.003 | 11.770 | 0.101 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.411 | 1.865 | 0.138 | 4.823 | -0.000 | 12.278 | 0.100 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.435 | 1.858 | 0.115 | 4.823 | -0.000 | 12.779 | 0.105 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.389 | 1.862 | 0.087 | 3.573 | 0.009 | 13.313 | 0.096 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.446 | 1.868 | 0.066 | 3.563 | -0.002 | 13.685 | 0.076 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.416 | 1.867 | 0.049 | 4.808 | -0.000 | 14.019 | 0.073 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.375 | 1.851 | 0.033 | 24.961 | -0.004 | 14.334 | 0.076 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.385 | 1.834 | 0.015 | 4.778 | 0.000 | 14.703 | 0.078 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.395 | 1.818 | 1.424 | | | | | | GROUND SURFACE SETTLEMENT | | | | 0.048 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 1

FOR SECOND COMPONENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 2

**********
NEXT INPUT MOTION
**********

**********
THE TIMESTEP HAS BEEN REDUCED BY A FACTOR OF 2
IN ORDER TO MEET THE COURANT STABILITY CRITERION
ALTERNATELY YOU MAY INCREASE THE LAYER THICKNESS(ES)
**********

**********
OUTPUT FOR IVEC4140
WITH A PEAK ACCELERATION OF 0.94 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.374 | 2.879 | 1.573 | 9.853 | -1.322 | 0.090 | 0.010 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.371 | 2.876 | 1.573 | 9.858 | -1.322 | 0.295 | 0.069 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.374 | 2.854 | 1.571 | 9.853 | -1.321 | 0.495 | 0.142 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.377 | 2.819 | 1.568 | 9.853 | -1.319 | 0.683 | 0.202 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.377 | 2.774 | 1.569 | 9.853 | -1.326 | 0.872 | 0.244 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.397 | 2.720 | 1.576 | 9.853 | -1.339 | 1.056 | 0.388 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.324 | 2.659 | 1.560 | 9.848 | -1.328 | 1.225 | 0.376 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.329 | 2.587 | 1.542 | 9.838 | -1.315 | 1.382 | 0.435 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.365 | 2.505 | 1.521 | 9.823 | -1.298 | 1.653 | 0.183 | 1.000 | 1.000 | 1.000 | 0.048 | 0.048 | 0.014 | 45.00 |
| 10 | 50.00 | 0.331 | 2.412 | 1.501 | 9.818 | -1.285 | 1.936 | 0.198 | 1.000 | 1.000 | 1.000 | 0.031 | 0.031 | 0.013 | 55.00 |
| 11 | 60.00 | 0.325 | 2.329 | 1.483 | 9.818 | -1.274 | 2.148 | 0.199 | 1.000 | 1.000 | 1.000 | 0.020 | 0.020 | 0.013 | 65.00 |
| 12 | 70.00 | 0.377 | 2.248 | 1.462 | 9.818 | -1.261 | 2.386 | 0.150 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.417 | 2.166 | 1.443 | 9.818 | -1.248 | 2.631 | 0.172 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.400 | 2.078 | 1.422 | 9.818 | -1.233 | 2.798 | 0.189 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.378 | 1.981 | 1.401 | 9.823 | -1.221 | 3.043 | 0.201 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.545 | 1.897 | 1.377 | 9.828 | -1.204 | 3.265 | 0.222 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.422 | 1.816 | 1.350 | 9.838 | -1.187 | 3.320 | 3.428 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.541 | 2.167 | 0.819 | 5.953 | -0.500 | 3.674 | 0.260 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.466 | 2.149 | 0.791 | 5.948 | -0.476 | 4.239 | 0.128 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.411 | 2.096 | 0.762 | 5.948 | -0.459 | 4.910 | 0.133 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.297 | 2.020 | 0.733 | 5.943 | -0.441 | 5.571 | 0.146 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.309 | 1.924 | 0.698 | 5.948 | -0.416 | 6.081 | 0.143 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.377 | 1.820 | 0.663 | 5.953 | -0.389 | 6.430 | 0.152 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.390 | 1.831 | 0.627 | 5.968 | -0.354 | 6.723 | 0.162 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.371 | 1.820 | 0.590 | 5.973 | -0.310 | 7.028 | 0.169 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.408 | 1.769 | 0.548 | 5.973 | -0.265 | 7.412 | 0.191 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.432 | 1.714 | 0.505 | 5.978 | -0.230 | 7.658 | 0.183 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.427 | 1.623 | 0.460 | 5.968 | -0.191 | 7.998 | 0.199 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.435 | 1.510 | 0.412 | 5.968 | -0.163 | 8.403 | 0.210 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.454 | 1.464 | 0.360 | 5.963 | -0.131 | 8.766 | 0.171 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.416 | 1.456 | 0.321 | 5.953 | -0.113 | 9.085 | 0.141 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.413 | 1.432 | 0.286 | 5.948 | -0.094 | 9.429 | 0.148 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.393 | 1.408 | 0.253 | 5.943 | -0.080 | 9.809 | 0.131 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.431 | 1.384 | 0.221 | 5.933 | -0.065 | 10.046 | 0.114 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.428 | 1.353 | 0.196 | 5.923 | -0.058 | 10.149 | 0.108 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.449 | 1.326 | 0.171 | 5.913 | -0.053 | 10.284 | 0.102 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.431 | 1.299 | 0.148 | 5.903 | -0.048 | 10.443 | 0.098 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.452 | 1.302 | 0.120 | 5.888 | -0.039 | 10.423 | 0.101 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.485 | 1.295 | 0.093 | 5.873 | -0.031 | 10.362 | 0.100 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.506 | 1.290 | 0.068 | 5.858 | -0.025 | 10.453 | 0.059 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.515 | 1.300 | 0.052 | 5.853 | -0.019 | 10.339 | 0.060 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.507 | 1.296 | 0.033 | 5.848 | -0.006 | 10.463 | 0.061 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.518 | 1.306 | 0.015 | 5.848 | -0.004 | 10.448 | 0.059 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.511 | 1.330 | 0.909 | | | | | | GROUND SURFACE SETTLEMENT | | | | 0.041 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO

DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

**********
OUTPUT FOR IVEC4230
WITH A PEAK ACCELERATION OF 0.88 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.381 | 4.210 | 1.563 | 6.278 | 0.973 | 0.092 | 0.010 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.371 | 4.197 | 1.563 | 6.278 | 0.973 | 0.296 | 0.072 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.373 | 4.063 | 1.562 | 6.283 | 0.975 | 0.499 | 0.164 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.386 | 3.937 | 1.561 | 6.278 | 0.987 | 0.692 | 0.248 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.375 | 3.828 | 1.557 | 6.278 | 1.002 | 0.880 | 0.322 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.414 | 3.734 | 1.544 | 6.283 | 1.012 | 1.065 | 0.367 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.465 | 3.673 | 1.529 | 6.283 | 1.018 | 1.244 | 0.442 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.445 | 3.592 | 1.512 | 6.288 | 1.025 | 1.461 | 0.474 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.397 | 3.535 | 1.492 | 6.288 | 1.026 | 1.656 | 0.247 | 1.000 | 1.000 | 1.000 | 0.048 | 0.048 | 0.014 | 45.00 |
| 10 | 50.00 | 0.314 | 3.452 | 1.465 | 6.283 | 1.014 | 1.934 | 0.236 | 1.000 | 1.000 | 1.000 | 0.031 | 0.031 | 0.013 | 55.00 |
| 11 | 60.00 | 0.315 | 3.408 | 1.446 | 6.283 | 1.005 | 2.186 | 0.239 | 1.000 | 1.000 | 1.000 | 0.020 | 0.020 | 0.013 | 65.00 |
| 12 | 70.00 | 0.324 | 3.368 | 1.420 | 6.283 | 0.988 | 2.388 | 0.165 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.373 | 3.333 | 1.404 | 6.283 | 0.978 | 2.603 | 0.187 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.407 | 3.305 | 1.387 | 6.278 | 0.963 | 2.884 | 0.202 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.405 | 3.290 | 1.369 | 6.283 | 0.959 | 3.013 | 0.220 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.555 | 3.294 | 1.347 | 6.278 | 0.952 | 3.258 | 0.220 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.405 | 3.295 | 1.326 | 6.278 | 0.949 | 3.327 | 3.265 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.382 | 3.369 | 0.944 | 6.078 | 0.376 | 3.754 | 0.300 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.354 | 3.333 | 0.920 | 6.073 | 0.356 | 4.375 | 0.137 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.306 | 3.250 | 0.896 | 6.068 | 0.347 | 5.101 | 0.143 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.293 | 3.157 | 0.870 | 6.063 | 0.331 | 5.671 | 0.160 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.290 | 3.086 | 0.841 | 6.053 | 0.315 | 6.169 | 0.162 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.297 | 3.031 | 0.810 | 6.043 | 0.300 | 6.726 | 0.174 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.347 | 2.986 | 0.772 | 6.028 | 0.280 | 7.245 | 0.207 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.391 | 2.938 | 0.725 | 6.008 | 0.260 | 7.722 | 0.213 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.385 | 2.922 | 0.678 | 5.983 | 0.242 | 8.188 | 0.241 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.444 | 2.884 | 0.625 | 5.963 | 0.211 | 8.543 | 0.265 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.387 | 2.823 | 0.563 | 5.938 | 0.174 | 8.871 | 0.284 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.423 | 2.768 | 0.492 | 5.913 | 0.132 | 9.206 | 0.288 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.383 | 2.752 | 0.419 | 5.883 | 0.083 | 9.494 | 0.236 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.337 | 2.704 | 0.357 | 5.858 | 0.044 | 9.885 | 0.190 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.329 | 2.669 | 0.307 | 5.838 | 0.012 | 10.277 | 0.195 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 33 | 420.00 | 0.353 | 2.657 | 0.259 | 5.823 | -0.012 | 10.570 | 0.116 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.368 | 2.641 | 0.233 | 5.813 | -0.016 | 10.845 | 0.105 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.385 | 2.619 | 0.212 | 5.808 | -0.016 | 11.148 | 0.099 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.410 | 2.572 | 0.189 | 5.803 | -0.017 | 11.426 | 0.095 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.413 | 2.541 | 0.169 | 5.803 | -0.018 | 11.778 | 0.096 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.437 | 2.513 | 0.142 | 5.798 | -0.017 | 12.229 | 0.103 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.462 | 2.440 | 0.113 | 5.793 | -0.014 | 12.608 | 0.111 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.450 | 2.376 | 0.082 | 5.788 | -0.011 | 12.834 | 0.066 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.439 | 2.342 | 0.062 | 5.783 | -0.010 | 13.201 | 0.075 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.430 | 2.313 | 0.041 | 5.768 | -0.009 | 13.687 | 0.073 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.440 | 2.234 | 0.018 | 5.788 | -0.005 | 13.466 | 0.079 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.446 | 2.224 | 1.250 | | | | | | | GROUND SURFACE SETTLEMENT | | | 0.041 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 3

FOR SECOND COMPONENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 4

**********
NEXT INPUT MOTION
**********

**********
THE TIMESTEP HAS BEEN REDUCED BY A FACTOR OF 2
IN ORDER TO MEET THE COURANT STABILITY CRITERION
ALTERNATELY YOU MAY INCREASE THE LAYER THICKNESS(ES)
**********

**********
OUTPUT FOR JOS000
WITH A PEAK ACCELERATION OF 0.79 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.357 | 3.672 | 1.071 | 16.728 | -0.201 | 0.086 | 0.010 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 4.00 | 0.343 | 3.668 | 1.071 | 16.728 | -0.201 | 0.275 | 0.070 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.337 | 3.610 | 1.065 | 16.728 | -0.197 | 0.473 | 0.158 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.344 | 3.551 | 1.060 | 16.728 | -0.189 | 0.653 | 0.219 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.343 | 3.487 | 1.060 | 16.733 | -0.185 | 0.826 | 0.259 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.340 | 3.419 | 1.063 | 16.733 | -0.190 | 0.992 | 0.289 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.438 | 3.347 | 1.074 | 16.733 | -0.214 | 1.177 | 0.314 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.462 | 3.270 | 1.085 | 16.733 | -0.252 | 1.318 | 0.321 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.382 | 3.200 | 1.090 | 16.733 | -0.295 | 1.530 | 0.184 | 1.000 | 1.000 | 1.000 | 0.058 | 0.058 | 0.017 | 45.00 |
| 10 | 50.00 | 0.344 | 3.133 | 1.074 | 16.733 | -0.324 | 1.839 | 0.155 | 1.000 | 1.000 | 1.000 | 0.037 | 0.037 | 0.016 | 55.00 |
| 11 | 60.00 | 0.314 | 3.092 | 1.071 | 27.606 | -0.350 | 2.078 | 0.148 | 1.000 | 1.000 | 1.000 | 0.024 | 0.024 | 0.016 | 65.00 |
| 12 | 70.00 | 0.328 | 3.036 | 1.079 | 27.606 | -0.382 | 2.329 | 0.132 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.358 | 2.984 | 1.068 | 27.606 | -0.389 | 2.492 | 0.150 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.410 | 2.916 | 1.067 | 27.616 | -0.406 | 2.661 | 0.178 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.367 | 2.841 | 1.054 | 27.621 | -0.416 | 2.907 | 0.205 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.377 | 2.751 | 1.035 | 27.621 | -0.424 | 3.043 | 0.221 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.384 | 2.653 | 1.016 | 27.621 | -0.436 | 3.195 | 1.673 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.527 | 2.955 | 0.644 | 27.621 | -0.188 | 3.587 | 0.251 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.381 | 2.869 | 0.626 | 27.621 | -0.193 | 4.124 | 0.110 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.348 | 2.727 | 0.609 | 27.616 | -0.197 | 4.634 | 0.100 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.295 | 2.624 | 0.595 | 27.606 | -0.200 | 5.102 | 0.106 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.312 | 2.546 | 0.590 | 27.591 | -0.213 | 5.566 | 0.098 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.324 | 2.480 | 0.581 | 27.586 | -0.220 | 6.002 | 0.102 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.339 | 2.427 | 0.570 | 27.586 | -0.226 | 6.425 | 0.141 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.375 | 2.356 | 0.547 | 27.581 | -0.221 | 6.804 | 0.154 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.369 | 2.291 | 0.512 | 27.576 | -0.203 | 7.249 | 0.170 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.377 | 2.240 | 0.460 | 27.576 | -0.177 | 7.749 | 0.181 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.461 | 2.226 | 0.412 | 27.576 | -0.152 | 8.411 | 0.193 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.443 | 2.132 | 0.345 | 27.576 | -0.114 | 8.590 | 0.209 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.416 | 2.092 | 0.287 | 27.576 | -0.079 | 8.919 | 0.170 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.415 | 2.033 | 0.242 | 27.571 | -0.050 | 9.350 | 0.116 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.380 | 1.993 | 0.216 | 27.561 | -0.039 | 9.809 | 0.122 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.387 | 1.950 | 0.190 | 10.498 | -0.026 | 10.362 | 0.112 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.383 | 1.890 | 0.173 | 10.493 | -0.012 | 10.630 | 0.095 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.416 | 1.828 | 0.160 | 10.488 | -0.001 | 10.922 | 0.086 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.466 | 1.802 | 0.146 | 10.483 | -0.001 | 11.511 | 0.091 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.376 | 1.755 | 0.126 | 10.478 | -0.010 | 11.730 | 0.084 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.392 | 1.713 | 0.106 | 10.473 | -0.008 | 12.242 | 0.089 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.447 | 1.665 | 0.083 | 10.463 | -0.009 | 12.709 | 0.095 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.469 | 1.668 | 0.059 | 10.453 | -0.000 | 12.833 | 0.058 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.420 | 1.669 | 0.044 | 10.453 | -0.001 | 13.183 | 0.062 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.401 | 1.647 | 0.030 | 10.448 | 0.001 | 13.907 | 0.068 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.387 | 1.584 | 0.014 | 10.448 | 0.002 | 13.680 | 0.072 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.409 | 1.578 | 0.925 | | | | | | GROUND SURFACE SETTLEMENT | | | | 0.048 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

**********

OUTPUT FOR JOS090
WITH A PEAK ACCELERATION OF 0.92 G
AND SLOPE = 0.00

**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.363 | 3.800 | 1.496 | 12.118 | -0.720 | 0.087 | 0.010 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.351 | 3.788 | 1.496 | 12.118 | -0.720 | 0.279 | 0.074 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.374 | 3.709 | 1.494 | 12.118 | -0.720 | 0.486 | 0.154 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.364 | 3.598 | 1.494 | 12.118 | -0.734 | 0.673 | 0.216 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.346 | 3.483 | 1.473 | 12.113 | -0.723 | 0.852 | 0.286 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.357 | 3.368 | 1.441 | 12.113 | -0.692 | 1.028 | 0.344 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.383 | 3.266 | 1.401 | 12.108 | -0.650 | 1.185 | 0.377 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.385 | 3.185 | 1.360 | 12.103 | -0.621 | 1.300 | 0.360 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.334 | 3.152 | 1.319 | 12.098 | -0.590 | 1.523 | 0.203 | 1.000 | 1.000 | 1.000 | 0.058 | 0.058 | 0.017 | 45.00 |
| 10 | 50.00 | 0.342 | 3.121 | 1.288 | 12.093 | -0.587 | 1.822 | 0.183 | 1.000 | 1.000 | 1.000 | 0.037 | 0.037 | 0.016 | 55.00 |
| 11 | 60.00 | 0.349 | 3.096 | 1.247 | 12.088 | -0.553 | 2.097 | 0.193 | 1.000 | 1.000 | 1.000 | 0.024 | 0.024 | 0.016 | 65.00 |
| 12 | 70.00 | 0.362 | 3.072 | 1.206 | 12.083 | -0.525 | 2.335 | 0.146 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.393 | 3.042 | 1.182 | 12.078 | -0.511 | 2.546 | 0.163 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.420 | 3.024 | 1.157 | 12.073 | -0.500 | 2.742 | 0.178 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.404 | 3.020 | 1.131 | 12.073 | -0.491 | 2.909 | 0.197 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.412 | 2.989 | 1.103 | 30.350 | -0.487 | 3.150 | 0.221 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.381 | 2.971 | 1.068 | 30.350 | -0.477 | 3.252 | 2.109 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.484 | 2.943 | 0.818 | 10.318 | -0.157 | 3.488 | 0.242 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.414 | 2.915 | 0.786 | 10.308 | -0.137 | 4.093 | 0.120 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.414 | 2.881 | 0.761 | 10.298 | -0.141 | 4.867 | 0.128 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.332 | 2.824 | 0.734 | 10.283 | -0.144 | 5.515 | 0.143 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.331 | 2.764 | 0.706 | 10.268 | -0.150 | 6.028 | 0.153 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.343 | 2.690 | 0.674 | 10.258 | -0.162 | 6.431 | 0.159 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.387 | 2.620 | 0.638 | 10.248 | -0.160 | 6.710 | 0.178 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.365 | 2.517 | 0.596 | 10.233 | -0.160 | 6.947 | 0.175 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.377 | 2.431 | 0.554 | 10.223 | -0.163 | 7.099 | 0.191 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.370 | 2.354 | 0.504 | 10.213 | -0.164 | 7.306 | 0.189 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.357 | 2.284 | 0.452 | 10.208 | -0.148 | 7.238 | 0.194 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.365 | 2.216 | 0.397 | 10.123 | -0.124 | 7.344 | 0.190 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.370 | 2.154 | 0.341 | 10.098 | -0.106 | 7.518 | 0.153 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.371 | 2.099 | 0.300 | 10.078 | -0.096 | 7.523 | 0.122 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.441 | 2.076 | 0.266 | 10.063 | -0.086 | 7.806 | 0.112 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.427 | 2.071 | 0.233 | 10.038 | -0.079 | 7.982 | 0.098 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.391 | 2.030 | 0.206 | 10.008 | -0.072 | 8.339 | 0.084 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.384 | 1.975 | 0.185 | 9.988 | -0.063 | 8.992 | 0.082 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.413 | 1.920 | 0.165 | 19.532 | -0.054 | 9.100 | 0.075 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.397 | 1.897 | 0.148 | 19.522 | -0.049 | 9.417 | 0.080 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 38 | 525.00 | 0.411 | 1.901 | 0.117 | 19.512 | -0.028 | 10.060 | 0.082 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.457 | 1.890 | 0.094 | 19.502 | -0.021 | 10.767 | 0.090 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.485 | 1.868 | 0.065 | 19.492 | -0.017 | 10.936 | 0.060 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.474 | 1.840 | 0.050 | 19.487 | -0.013 | 11.466 | 0.060 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.449 | 1.805 | 0.031 | 19.477 | -0.008 | 11.707 | 0.065 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.476 | 1.768 | 0.013 | 9.918 | -0.002 | 11.795 | 0.065 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.488 | 1.761 | 0.886 | | | | | | | GROUND SURFACE SETTLEMENT | | | 0.048 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 5

FOR SECOND COMPONENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 6

**********
NEXT INPUT MOTION
**********

**********
THE TIMESTEP HAS BEEN REDUCED BY A FACTOR OF 2
IN ORDER TO MEET THE COURANT STABILITY CRITERION
ALTERNATELY YOU MAY INCREASE THE LAYER THICKNESS(ES)
**********

**********
OUTPUT FOR NIS000
WITH A PEAK ACCELERATION OF 0.86 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.389 | 2.789 | 0.687 | 16.518 | 0.297 | 0.093 | 0.011 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.379 | 2.784 | 0.687 | 16.518 | 0.297 | 0.301 | 0.076 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.383 | 2.736 | 0.689 | 16.518 | 0.293 | 0.518 | 0.180 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.369 | 2.661 | 0.686 | 16.518 | 0.297 | 0.719 | 0.257 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.402 | 2.555 | 0.689 | 16.518 | 0.290 | 0.919 | 0.347 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.359 | 2.446 | 0.692 | 16.518 | 0.286 | 1.113 | 0.405 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 30.00 | 0.363 | 2.348 | 0.698 | 16.518 | 0.280 | 1.297 | 0.424 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.384 | 2.250 | 0.694 | 16.518 | 0.279 | 1.461 | 0.416 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.303 | 2.219 | 0.695 | 16.518 | 0.267 | 1.688 | 0.210 | 1.000 | 1.000 | 1.000 | 0.041 | 0.041 | 0.014 | 45.00 |
| 10 | 50.00 | 0.274 | 2.175 | 0.677 | 16.518 | 0.259 | 1.967 | 0.191 | 1.000 | 1.000 | 1.000 | 0.026 | 0.026 | 0.013 | 55.00 |
| 11 | 60.00 | 0.315 | 2.129 | 0.664 | 16.518 | 0.251 | 2.191 | 0.181 | 1.000 | 1.000 | 1.000 | 0.016 | 0.016 | 0.013 | 65.00 |
| 12 | 70.00 | 0.320 | 2.106 | 0.648 | 16.518 | 0.243 | 2.371 | 0.134 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.370 | 2.090 | 0.635 | 16.523 | 0.235 | 2.529 | 0.146 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.379 | 2.062 | 0.622 | 16.523 | 0.228 | 2.756 | 0.159 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.370 | 2.020 | 0.606 | 16.523 | 0.217 | 2.853 | 0.175 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.367 | 1.967 | 0.582 | 16.523 | 0.216 | 3.022 | 0.184 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.393 | 1.906 | 0.561 | 16.523 | 0.207 | 3.150 | 1.199 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.493 | 2.038 | 0.567 | 16.418 | 0.071 | 3.419 | 0.197 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.405 | 1.968 | 0.546 | 16.413 | 0.056 | 3.915 | 0.098 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.401 | 1.892 | 0.529 | 16.413 | 0.039 | 4.499 | 0.098 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.335 | 1.825 | 0.504 | 16.413 | 0.029 | 5.015 | 0.110 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.324 | 1.735 | 0.489 | 16.428 | 0.013 | 5.558 | 0.114 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.341 | 1.689 | 0.467 | 16.433 | 0.006 | 6.129 | 0.126 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.322 | 1.677 | 0.438 | 16.438 | -0.002 | 6.660 | 0.148 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.363 | 1.664 | 0.400 | 16.433 | 0.010 | 7.151 | 0.159 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.353 | 1.647 | 0.363 | 16.443 | 0.013 | 7.567 | 0.166 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.356 | 1.674 | 0.331 | 16.498 | 0.011 | 7.846 | 0.170 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.344 | 1.737 | 0.297 | 12.188 | 0.008 | 8.110 | 0.176 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.408 | 1.780 | 0.277 | 12.173 | -0.006 | 8.450 | 0.175 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.361 | 1.799 | 0.255 | 12.163 | -0.013 | 8.769 | 0.155 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.374 | 1.791 | 0.232 | 12.148 | -0.021 | 8.951 | 0.120 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.421 | 1.759 | 0.212 | 12.138 | -0.033 | 9.266 | 0.115 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.490 | 1.731 | 0.188 | 12.123 | -0.038 | 9.576 | 0.106 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.522 | 1.692 | 0.164 | 12.118 | -0.031 | 9.866 | 0.095 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.588 | 1.668 | 0.145 | 12.108 | -0.026 | 10.210 | 0.093 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.410 | 1.647 | 0.126 | 12.098 | -0.015 | 10.460 | 0.089 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.447 | 1.622 | 0.114 | 10.558 | -0.018 | 10.796 | 0.089 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.400 | 1.602 | 0.098 | 10.558 | -0.006 | 11.163 | 0.087 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.447 | 1.571 | 0.076 | 10.553 | -0.005 | 11.631 | 0.098 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.445 | 1.543 | 0.059 | 10.543 | 0.000 | 11.980 | 0.062 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.451 | 1.518 | 0.044 | 10.528 | -0.003 | 12.328 | 0.061 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.471 | 1.470 | 0.030 | 10.523 | -0.003 | 12.487 | 0.066 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.463 | 1.431 | 0.014 | 10.523 | 0.001 | 13.312 | 0.071 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.478 | 1.414 | 0.966 | | | | | | | GROUND SURFACE SETTLEMENT | | | 0.039 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

**********
OUTPUT FOR NIS090
WITH A PEAK ACCELERATION OF 0.86 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.381 | 3.384 | 0.831 | 8.138 | -0.177 | 0.092 | 0.011 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.376 | 3.376 | 0.831 | 8.138 | -0.177 | 0.289 | 0.069 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.379 | 3.289 | 0.827 | 8.133 | -0.178 | 0.497 | 0.163 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.441 | 3.167 | 0.819 | 8.128 | -0.178 | 0.704 | 0.210 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.358 | 3.049 | 0.809 | 8.118 | -0.182 | 0.861 | 0.239 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.387 | 2.934 | 0.807 | 8.113 | -0.176 | 1.039 | 0.263 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.359 | 2.833 | 0.805 | 8.103 | -0.171 | 1.215 | 0.284 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.424 | 2.802 | 0.797 | 8.088 | -0.162 | 1.364 | 0.287 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.325 | 2.806 | 0.791 | 8.078 | -0.157 | 1.546 | 0.166 | 1.000 | 1.000 | 1.000 | 0.041 | 0.041 | 0.014 | 45.00 |
| 10 | 50.00 | 0.343 | 2.801 | 0.782 | 8.068 | -0.158 | 1.828 | 0.151 | 1.000 | 1.000 | 1.000 | 0.026 | 0.026 | 0.013 | 55.00 |
| 11 | 60.00 | 0.310 | 2.776 | 0.776 | 8.063 | -0.156 | 2.036 | 0.164 | 1.000 | 1.000 | 1.000 | 0.016 | 0.016 | 0.013 | 65.00 |
| 12 | 70.00 | 0.304 | 2.736 | 0.772 | 8.058 | -0.145 | 2.205 | 0.137 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.330 | 2.666 | 0.770 | 8.058 | -0.142 | 2.370 | 0.157 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.334 | 2.583 | 0.764 | 8.053 | -0.139 | 2.533 | 0.176 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.386 | 2.492 | 0.755 | 8.053 | -0.131 | 2.694 | 0.187 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.410 | 2.399 | 0.744 | 8.053 | -0.129 | 2.862 | 0.192 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.352 | 2.343 | 0.723 | 8.048 | -0.131 | 3.020 | 0.858 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.464 | 2.529 | 0.601 | 12.088 | -0.248 | 3.164 | 0.188 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.454 | 2.467 | 0.597 | 12.083 | -0.249 | 3.509 | 0.097 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.386 | 2.387 | 0.602 | 12.083 | -0.266 | 3.919 | 0.104 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.273 | 2.318 | 0.589 | 12.083 | -0.269 | 4.281 | 0.113 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.280 | 2.270 | 0.573 | 12.078 | -0.259 | 4.687 | 0.107 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.299 | 2.226 | 0.553 | 12.073 | -0.255 | 5.082 | 0.104 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.328 | 2.205 | 0.531 | 12.068 | -0.237 | 5.565 | 0.116 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.318 | 2.130 | 0.504 | 12.063 | -0.215 | 5.901 | 0.123 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.327 | 2.053 | 0.475 | 12.058 | -0.192 | 6.451 | 0.137 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.345 | 1.961 | 0.456 | 12.053 | -0.186 | 6.902 | 0.134 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.380 | 1.918 | 0.427 | 12.048 | -0.170 | 7.159 | 0.153 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.423 | 1.898 | 0.392 | 12.043 | -0.151 | 7.376 | 0.158 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.469 | 1.859 | 0.350 | 12.043 | -0.128 | 7.674 | 0.118 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.373 | 1.830 | 0.322 | 12.033 | -0.122 | 8.060 | 0.103 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.351 | 1.786 | 0.287 | 12.028 | -0.102 | 8.524 | 0.110 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.372 | 1.739 | 0.248 | 12.018 | -0.087 | 8.939 | 0.095 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.379 | 1.711 | 0.217 | 12.013 | -0.065 | 9.339 | 0.091 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.375 | 1.656 | 0.186 | 12.008 | -0.058 | 9.785 | 0.091 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.395 | 1.594 | 0.162 | 12.003 | -0.054 | 10.324 | 0.089 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.387 | 1.613 | 0.139 | 8.053 | -0.043 | 10.538 | 0.086 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.381 | 1.627 | 0.118 | 8.048 | -0.030 | 10.792 | 0.094 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.455 | 1.629 | 0.094 | 8.048 | -0.018 | 11.186 | 0.096 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.421 | 1.633 | 0.067 | 8.043 | -0.014 | 11.560 | 0.064 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.433 | 1.627 | 0.051 | 8.038 | -0.009 | 11.925 | 0.065 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.429 | 1.617 | 0.035 | 8.033 | -0.006 | 12.154 | 0.066 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 43 | 650.00 | 0.444 | 1.616 | 0.015 | 8.028 | -0.002 | 12.325 | 0.070 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.424 | 1.605 | 1.154 | | | | | | | GROUND SURFACE SETTLEMENT | | | 0.039 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 7

FOR SECOND COMPONENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 8

**********
NEXT INPUT MOTION
**********

**********
THE TIMESTEP HAS BEEN REDUCED BY A FACTOR OF 2
IN ORDER TO MEET THE COURANT STABILITY CRITERION
ALTERNATELY YOU MAY INCREASE THE LAYER THICKNESS(ES)
**********

**********
OUTPUT FOR YAR060
WITH A PEAK ACCELERATION OF 0.94 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.360 | 2.940 | 1.196 | 27.241 | -0.923 | 0.086 | 0.010 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.358 | 2.937 | 1.196 | 27.241 | -0.923 | 0.286 | 0.071 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.359 | 2.921 | 1.192 | 27.241 | -0.922 | 0.486 | 0.169 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.337 | 2.922 | 1.182 | 27.241 | -0.913 | 0.673 | 0.246 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.325 | 2.912 | 1.174 | 27.246 | -0.907 | 0.858 | 0.316 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.343 | 2.887 | 1.164 | 27.246 | -0.901 | 1.034 | 0.363 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.322 | 2.826 | 1.157 | 27.246 | -0.896 | 1.211 | 0.405 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.342 | 2.753 | 1.147 | 27.251 | -0.891 | 1.377 | 0.426 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.316 | 2.683 | 1.145 | 27.251 | -0.894 | 1.614 | 0.227 | 1.000 | 1.000 | 1.000 | 0.047 | 0.047 | 0.015 | 45.00 |
| 10 | 50.00 | 0.314 | 2.609 | 1.147 | 27.251 | -0.902 | 1.857 | 0.207 | 1.000 | 1.000 | 1.000 | 0.026 | 0.026 | 0.014 | 55.00 |
| 11 | 60.00 | 0.311 | 2.543 | 1.148 | 27.251 | -0.907 | 2.033 | 0.183 | 1.000 | 1.000 | 1.000 | 0.013 | 0.013 | 0.013 | 65.00 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | 70.00 | 0.321 | 2.474 | 1.155 | 27.251 | -0.915 | 2.160 | 0.145 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.337 | 2.406 | 1.155 | 27.251 | -0.919 | 2.349 | 0.160 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.342 | 2.368 | 1.144 | 27.246 | -0.911 | 2.610 | 0.170 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.374 | 2.371 | 1.126 | 27.246 | -0.895 | 2.709 | 0.191 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.434 | 2.363 | 1.096 | 27.246 | -0.869 | 2.876 | 0.204 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.354 | 2.348 | 1.065 | 27.241 | -0.841 | 3.032 | 1.080 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.524 | 2.332 | 0.757 | 27.236 | -0.528 | 3.458 | 0.215 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.463 | 2.294 | 0.721 | 27.231 | -0.501 | 3.792 | 0.100 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.369 | 2.248 | 0.696 | 25.686 | -0.482 | 4.600 | 0.106 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.334 | 2.210 | 0.660 | 25.671 | -0.450 | 5.364 | 0.117 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.374 | 2.170 | 0.622 | 25.666 | -0.421 | 5.947 | 0.117 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.340 | 2.149 | 0.584 | 25.686 | -0.391 | 6.404 | 0.123 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.357 | 2.146 | 0.552 | 25.686 | -0.363 | 6.692 | 0.133 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.400 | 2.127 | 0.513 | 25.686 | -0.331 | 6.630 | 0.124 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.441 | 2.113 | 0.469 | 25.671 | -0.295 | 6.980 | 0.127 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.466 | 2.113 | 0.420 | 25.686 | -0.252 | 7.372 | 0.125 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.498 | 2.111 | 0.379 | 25.681 | -0.219 | 7.640 | 0.138 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.516 | 2.108 | 0.323 | 25.671 | -0.169 | 7.747 | 0.135 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.530 | 2.102 | 0.272 | 25.666 | -0.127 | 7.813 | 0.120 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.462 | 2.094 | 0.227 | 25.661 | -0.093 | 7.880 | 0.096 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.490 | 2.064 | 0.200 | 25.656 | -0.074 | 8.122 | 0.096 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.399 | 2.047 | 0.179 | 25.656 | -0.066 | 8.434 | 0.086 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.402 | 2.029 | 0.145 | 25.651 | -0.044 | 8.744 | 0.079 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.444 | 2.009 | 0.130 | 25.666 | -0.036 | 9.022 | 0.077 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.414 | 2.000 | 0.108 | 25.651 | -0.026 | 9.265 | 0.077 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.417 | 1.969 | 0.095 | 11.848 | -0.015 | 9.501 | 0.077 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.446 | 1.963 | 0.081 | 11.838 | -0.006 | 9.672 | 0.078 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.427 | 1.946 | 0.065 | 11.828 | -0.002 | 9.755 | 0.079 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.475 | 1.921 | 0.050 | 11.818 | 0.001 | 9.843 | 0.051 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.473 | 1.878 | 0.038 | 11.813 | 0.002 | 10.067 | 0.050 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.452 | 1.829 | 0.026 | 11.813 | 0.002 | 10.321 | 0.054 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.470 | 1.757 | 0.013 | 11.808 | -0.002 | 10.497 | 0.055 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.467 | 1.719 | 1.067 | | | | | | GROUND SURFACE SETTLEMENT | | | | 0.043 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

**********
OUTPUT FOR YAR330
WITH A PEAK ACCELERATION OF 0.94 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.380 | 2.835 | 0.926 | 10.658 | -0.154 | 0.091 | 0.010 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.367 | 2.826 | 0.926 | 10.658 | -0.153 | 0.294 | 0.078 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.372 | 2.776 | 0.919 | 10.658 | -0.156 | 0.505 | 0.165 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.352 | 2.682 | 0.906 | 10.658 | -0.170 | 0.702 | 0.244 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.338 | 2.589 | 0.887 | 10.663 | -0.188 | 0.895 | 0.319 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.347 | 2.495 | 0.861 | 10.668 | -0.215 | 1.083 | 0.366 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.374 | 2.394 | 0.831 | 10.678 | -0.249 | 1.261 | 0.410 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.418 | 2.309 | 0.799 | 10.683 | -0.290 | 1.414 | 0.429 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.362 | 2.242 | 0.805 | 17.868 | -0.333 | 1.624 | 0.230 | 1.000 | 1.000 | 1.000 | 0.047 | 0.047 | 0.015 | 45.00 |
| 10 | 50.00 | 0.322 | 2.145 | 0.833 | 19.457 | -0.374 | 1.850 | 0.187 | 1.000 | 1.000 | 1.000 | 0.026 | 0.026 | 0.014 | 55.00 |
| 11 | 60.00 | 0.354 | 2.078 | 0.851 | 19.452 | -0.394 | 2.033 | 0.189 | 1.000 | 1.000 | 1.000 | 0.013 | 0.013 | 0.013 | 65.00 |
| 12 | 70.00 | 0.304 | 2.012 | 0.863 | 19.447 | -0.414 | 2.263 | 0.145 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.326 | 1.993 | 0.865 | 19.442 | -0.420 | 2.418 | 0.171 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.401 | 1.987 | 0.856 | 19.437 | -0.416 | 2.664 | 0.190 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.375 | 1.985 | 0.856 | 19.432 | -0.426 | 2.944 | 0.211 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.345 | 1.978 | 0.844 | 19.427 | -0.421 | 3.090 | 0.230 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.321 | 1.949 | 0.831 | 19.422 | -0.414 | 3.144 | 1.740 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.659 | 1.930 | 0.590 | 17.688 | -0.165 | 3.261 | 0.241 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.570 | 1.911 | 0.546 | 17.678 | -0.145 | 3.779 | 0.111 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.487 | 1.881 | 0.515 | 17.668 | -0.134 | 4.362 | 0.118 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.354 | 1.813 | 0.482 | 17.653 | -0.117 | 5.037 | 0.131 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.349 | 1.752 | 0.452 | 17.638 | -0.105 | 5.441 | 0.133 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.357 | 1.671 | 0.422 | 17.613 | -0.091 | 5.963 | 0.108 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.349 | 1.603 | 0.402 | 17.598 | -0.092 | 6.278 | 0.118 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.372 | 1.598 | 0.383 | 17.583 | -0.095 | 6.475 | 0.119 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.389 | 1.613 | 0.358 | 17.573 | -0.104 | 6.670 | 0.163 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.434 | 1.626 | 0.323 | 17.558 | -0.082 | 6.810 | 0.156 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.428 | 1.657 | 0.288 | 17.543 | -0.075 | 7.023 | 0.166 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.439 | 1.702 | 0.240 | 17.533 | -0.037 | 7.376 | 0.121 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.456 | 1.717 | 0.203 | 17.533 | -0.034 | 7.667 | 0.105 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.460 | 1.727 | 0.184 | 13.568 | -0.030 | 7.937 | 0.096 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.477 | 1.728 | 0.169 | 13.558 | -0.025 | 8.210 | 0.095 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.466 | 1.715 | 0.156 | 13.543 | -0.013 | 8.422 | 0.085 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.440 | 1.683 | 0.142 | 13.523 | -0.007 | 8.642 | 0.079 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.454 | 1.674 | 0.125 | 13.513 | -0.003 | 8.761 | 0.073 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.453 | 1.650 | 0.113 | 13.508 | -0.005 | 8.869 | 0.073 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.478 | 1.638 | 0.099 | 12.528 | -0.001 | 9.056 | 0.072 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.502 | 1.606 | 0.084 | 12.528 | -0.001 | 9.334 | 0.073 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.494 | 1.581 | 0.066 | 12.528 | 0.001 | 9.720 | 0.078 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.535 | 1.549 | 0.049 | 16.723 | 0.002 | 10.009 | 0.051 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.534 | 1.538 | 0.037 | 12.523 | 0.001 | 10.237 | 0.054 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.535 | 1.516 | 0.025 | 12.518 | -0.002 | 10.627 | 0.056 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.528 | 1.466 | 0.013 | 12.523 | -0.005 | 10.592 | 0.058 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.516 | 1.476 | 1.000 | | | | | | GROUND SURFACE SETTLEMENT | | | | 0.043 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

```
HISTORY OF ACCELERATION AT TOP OF LAYER  1 IS SAVED IN OUTPUT FILE NUMBER  9

FOR SECOND COMPONENT

HISTORY OF ACCELERATION AT TOP OF LAYER  1 IS SAVED IN OUTPUT FILE NUMBER 10


************************************
NORMAL TERMINATION FOR THIS INPUT FILE
************************************
```

# tv670b – more epp development

**********
MAXIMUM RESPONSE VALUES AT GROUND SURFACE
**********

| INPUT FILE | INPUT MOTION | INPUT AMAX | SLOPE | COMP | KDIS | AMAX | VMAX | DMAXR | DFINALR | RUMAX | SETTLEMENT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| tv670b | IV02180.txt | 0.81 | 0.00 | 1 | 0 | 0.35 | 3.01 | 1.35 | -1.10 | 0.49 | 0.06 |
| tv670b | iv02270.txt | 0.79 | 0.00 | 2 | 0 | 0.37 | 3.74 | 1.00 | 0.32 | 0.49 | 0.06 |
| tv670b | IVEC4140.txt | 0.94 | 0.00 | 1 | 0 | 0.37 | 3.00 | 1.60 | -1.39 | 0.34 | 0.05 |
| tv670b | IVEC4230.txt | 0.88 | 0.00 | 2 | 0 | 0.37 | 4.23 | 1.59 | 1.06 | 0.34 | 0.05 |
| tv670b | JOS000.txt | 0.79 | 0.00 | 1 | 0 | 0.35 | 3.67 | 1.13 | -0.30 | 0.47 | 0.06 |
| tv670b | JOS090.txt | 0.92 | 0.00 | 2 | 0 | 0.36 | 3.75 | 1.52 | -0.82 | 0.47 | 0.06 |
| tv670b | NIS000.txt | 0.86 | 0.00 | 1 | 0 | 0.39 | 2.83 | 0.77 | 0.18 | 0.33 | 0.05 |
| tv670b | NIS090.txt | 0.86 | 0.00 | 2 | 0 | 0.38 | 3.36 | 0.83 | -0.16 | 0.33 | 0.05 |
| tv670b | YAR060.txt | 0.94 | 0.00 | 1 | 0 | 0.38 | 2.91 | 1.20 | -0.90 | 0.35 | 0.05 |
| tv670b | YAR330.txt | 0.94 | 0.00 | 2 | 0 | 0.37 | 2.84 | 0.88 | -0.25 | 0.35 | 0.05 |

RUMAX IS MAX RU IN ANY LAYER; SETTLEMENT IS SETTLEMENT OF GROUND SURFACE IN FEET
DFINALR IS GROUND SURFACE FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN GSFRD IF SLOPE IS GREATER THAN ZERO

**********
**********

TESS2 - Version 3.00D
Copyright 2020 Robert Pyke
Built by rmp on 08/29/2020
Using Simply Fortran v. 2.4

**********
**********

INPUT/OUTPUT FILE NAME: **tv670b**

**********
Tri Valley Hospital
**********
670 feet deep profile - more epp
**********

REDISTRIBUTION AND DISSIPATION OF PORE PRESSURES
IS NOT INCLUDED!

CALCULATION OF SETTLEMENTS IS TURNED ON

UNITS ARE KIPS, FEET AND SECONDS

**********
INPUT DATA
**********

MATERIAL PROPERTY PARAMETERS

| MTYPE | VT | ALPHA | GMRP | TSTR | FSTR |
|---|---|---|---|---|---|
| 1 | 0.02 | 1.00 | 0.00 | 0.00 | 0.00 |

| MTYPE | VT | ALPHA | GMRP | TSTR | FSTR |
|---|---|---|---|---|---|
| 2 | 0.02 | 1.00 | 0.00 | 0.00 | 0.00 |

| MTYPE | VT | ALPHA | GMRP | TSTR | FSTR |
|---|---|---|---|---|---|
| 3 | 0.02 | 1.00 | 0.00 | 0.00 | 0.00 |

| MTYPE | VT | ALPHA | GMRP | TSTR | FSTR |
|---|---|---|---|---|---|
| 4 | 0.02 | 1.00 | 0.00 | 0.00 | 0.00 |

PARAMETERS FOR SIMPLE DEGRADATION

| MTYPE | SS | RS | E | SG | RG | ST | RT |
|---|---|---|---|---|---|---|---|
| 2 | 0.12 | 0.65 | 1.50 | 0.12 | 0.65 | 0.12 | 0.65 |

PARAMETERS FOR PORE PRESSURE GENERATION CURVES

| LAYER NO. | MTYPE | TAUAV/SIGV | NL | E | F | G |
|---|---|---|---|---|---|---|
| 9 | 3 | 0.600 | 10 | 2.00 | 0.10 | 2.00 |
| 10 | 4 | 0.600 | 10 | 2.00 | 0.10 | 2.00 |
| 11 | 4 | 0.600 | 10 | 2.00 | 0.10 | 2.00 |

PARAMETERS FOR SETTLEMENT CALCULATIONS

| LAYER NO. | ARD | FACTOR |
|---|---|---|
| 9 | 70 | 0.33 |
| 10 | 78 | 0.33 |
| 11 | 75 | 0.33 |

PARAMETERS FOR HARDENING OF SHEAR MODULUS

| MAT.TYPE | KHARD | FHARD | FHARDS |
|---|---|---|---|
| 3 | 1 | 1.00 | 0.50 |
| 4 | 1 | 1.00 | 0.50 |

**********
THE TIMESTEP HAS BEEN REDUCED BY A FACTOR OF 2
IN ORDER TO MEET THE COURANT STABILITY CRITERION
ALTERNATELY YOU MAY INCREASE THE LAYER THICKNESS(ES)
**********

**********
LAYER DATA
**********

DEPTH TO WATER TABLE = 5.00
TRAVEL TIMES ARE RELATIVE TO A TIMESTEP OF 0.0050 SECONDS

| LAYER NO. | MTYPE | THICK | UNIT WT | OCR | KO | SIGV | VS | GMAX | TAUMAX | GAMREF | TTR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 4.00 | 0.120 | | | 0.24 | 500.00 | 931.68 | 1.863 | 0.200 | 0.625 |
| 2 | 1 | 6.00 | 0.110 | | | 0.83 | 400.00 | 546.58 | 1.366 | 0.250 | 0.333 |
| 3 | 1 | 5.00 | 0.112 | | | 1.09 | 425.00 | 628.26 | 1.257 | 0.200 | 0.425 |
| 4 | 1 | 5.00 | 0.114 | | | 1.35 | 450.00 | 716.93 | 1.434 | 0.200 | 0.450 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 1 | 5.00 | 0.116 | | | 1.61 | 475.00 | 812.81 | 1.626 | 0.200 | 0.475 |
| 6 | 1 | 5.00 | 0.118 | | | 1.88 | 500.00 | 916.15 | 1.832 | 0.200 | 0.500 |
| 7 | 1 | 5.00 | 0.119 | | | 2.16 | 525.00 | 1018.61 | 2.037 | 0.200 | 0.525 |
| 8 | 1 | 5.00 | 0.120 | | | 2.45 | 550.00 | 1127.33 | 2.255 | 0.200 | 0.550 |
| 9 | 3 | 10.00 | 0.125 | 1.00 | 0.60 | 2.91 | 700.00 | 1902.17 | 2.853 | 0.150 | 0.350 |
| 10 | 4 | 10.00 | 0.130 | 1.00 | 0.80 | 3.56 | 800.00 | 2583.85 | 3.101 | 0.120 | 0.400 |
| 11 | 4 | 10.00 | 0.130 | 1.00 | 0.60 | 4.23 | 850.00 | 2916.93 | 3.500 | 0.120 | 0.425 |
| 12 | 1 | 10.00 | 0.120 | | | 4.86 | 900.00 | 3018.63 | 6.037 | 0.200 | 0.450 |
| 13 | 1 | 10.00 | 0.120 | | | 5.44 | 910.00 | 3086.09 | 6.172 | 0.200 | 0.455 |
| 14 | 1 | 10.00 | 0.120 | | | 6.01 | 920.00 | 3154.29 | 6.309 | 0.200 | 0.460 |
| 15 | 1 | 10.00 | 0.120 | | | 6.59 | 930.00 | 3223.23 | 6.446 | 0.200 | 0.465 |
| 16 | 1 | 10.00 | 0.120 | | | 7.16 | 940.00 | 3292.92 | 6.586 | 0.200 | 0.470 |
| 17 | 1 | 10.00 | 0.120 | | | 7.74 | 950.00 | 3363.35 | 3.363 | 0.100 | 0.475 |
| 18 | 1 | 10.00 | 0.120 | | | 8.32 | 960.00 | 3434.53 | 6.869 | 0.200 | 0.480 |
| 19 | 1 | 20.00 | 0.130 | | | 9.28 | 1200.00 | 5813.66 | 11.627 | 0.200 | 0.300 |
| 20 | 1 | 20.00 | 0.130 | | | 10.63 | 1275.00 | 6563.08 | 13.126 | 0.200 | 0.319 |
| 21 | 1 | 20.00 | 0.130 | | | 11.98 | 1305.00 | 6875.57 | 13.751 | 0.200 | 0.326 |
| 22 | 1 | 20.00 | 0.130 | | | 13.34 | 1365.00 | 7522.34 | 15.045 | 0.200 | 0.341 |
| 23 | 1 | 20.00 | 0.130 | | | 14.69 | 1395.00 | 7856.62 | 15.713 | 0.200 | 0.349 |
| 24 | 1 | 20.00 | 0.130 | | | 16.04 | 1395.00 | 7856.62 | 15.713 | 0.200 | 0.349 |
| 25 | 1 | 20.00 | 0.130 | | | 17.39 | 1420.00 | 8140.75 | 16.281 | 0.200 | 0.355 |
| 26 | 1 | 20.00 | 0.130 | | | 18.74 | 1420.00 | 8140.75 | 16.281 | 0.200 | 0.355 |
| 27 | 1 | 20.00 | 0.130 | | | 20.10 | 1440.00 | 8371.68 | 16.743 | 0.200 | 0.360 |
| 28 | 1 | 20.00 | 0.130 | | | 21.45 | 1440.00 | 8371.68 | 16.743 | 0.200 | 0.360 |
| 29 | 1 | 20.00 | 0.130 | | | 22.80 | 1455.00 | 8547.00 | 17.094 | 0.200 | 0.364 |
| 30 | 1 | 20.00 | 0.130 | | | 24.15 | 1555.00 | 9762.21 | 19.524 | 0.200 | 0.389 |
| 31 | 1 | 20.00 | 0.130 | | | 25.50 | 1665.00 | 11192.21 | 22.384 | 0.200 | 0.416 |
| 32 | 1 | 20.00 | 0.130 | | | 26.86 | 1675.00 | 11327.06 | 22.654 | 0.200 | 0.419 |
| 33 | 1 | 20.00 | 0.130 | | | 28.21 | 1775.00 | 12719.91 | 25.440 | 0.200 | 0.444 |
| 34 | 1 | 20.00 | 0.130 | | | 29.56 | 1875.00 | 14193.52 | 28.387 | 0.200 | 0.469 |
| 35 | 1 | 20.00 | 0.130 | | | 30.91 | 1925.00 | 14960.60 | 29.921 | 0.200 | 0.481 |
| 36 | 1 | 20.00 | 0.130 | | | 32.26 | 1975.00 | 15747.87 | 31.496 | 0.200 | 0.494 |
| 37 | 1 | 25.00 | 0.130 | | | 33.78 | 2000.00 | 16149.07 | 32.298 | 0.200 | 0.400 |
| 38 | 1 | 25.00 | 0.130 | | | 35.47 | 2000.00 | 16149.07 | 32.298 | 0.200 | 0.400 |
| 39 | 1 | 25.00 | 0.130 | | | 37.16 | 2000.00 | 16149.07 | 32.298 | 0.200 | 0.400 |
| 40 | 1 | 25.00 | 0.130 | | | 38.85 | 2400.00 | 23254.66 | 46.509 | 0.200 | 0.480 |
| 41 | 1 | 25.00 | 0.130 | | | 40.54 | 2400.00 | 23254.66 | 46.509 | 0.200 | 0.480 |
| 42 | 1 | 25.00 | 0.130 | | | 42.23 | 2400.00 | 23254.66 | 46.509 | 0.200 | 0.480 |
| 43 | 1 | 20.00 | 0.130 | | | 43.76 | 2400.00 | 23254.66 | 46.509 | 0.200 | 0.600 |

**SHEAR WAVE VELOCITY IN BASE = 2400.**
**UNIT WEIGHT OF BASE = 0.135**

**********
**OUTPUT FOR IV02180**
**WITH A PEAK ACCELERATION OF 0.81 G**
**AND SLOPE = 0.00**
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.350 | 3.012 | 1.354 | 26.996 | -1.097 | 0.084 | 0.010 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.330 | 3.010 | 1.353 | 26.996 | -1.097 | 0.265 | 0.070 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.328 | 2.960 | 1.351 | 26.996 | -1.097 | 0.450 | 0.141 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.355 | 2.889 | 1.347 | 26.996 | -1.097 | 0.616 | 0.201 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.361 | 2.805 | 1.346 | 26.996 | -1.105 | 0.788 | 0.261 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.379 | 2.715 | 1.343 | 26.991 | -1.110 | 0.955 | 0.284 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.398 | 2.634 | 1.323 | 26.991 | -1.098 | 1.104 | 0.326 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.442 | 2.563 | 1.305 | 26.991 | -1.090 | 1.265 | 0.331 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.332 | 2.492 | 1.272 | 26.986 | -1.066 | 1.471 | 0.290 | 1.000 | 1.000 | 1.000 | 0.494 | 0.494 | 0.027 | 45.00 |
| 10 | 50.00 | 0.334 | 2.409 | 1.228 | 26.976 | -1.036 | 1.739 | 0.227 | 1.000 | 1.000 | 1.000 | 0.376 | 0.376 | 0.017 | 55.00 |
| 11 | 60.00 | 0.334 | 2.346 | 1.204 | 26.941 | -1.027 | 2.011 | 0.192 | 1.000 | 1.000 | 1.000 | 0.274 | 0.274 | 0.017 | 65.00 |
| 12 | 70.00 | 0.345 | 2.305 | 1.175 | 26.906 | -1.005 | 2.271 | 0.149 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.378 | 2.249 | 1.150 | 26.896 | -0.988 | 2.479 | 0.167 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.344 | 2.196 | 1.126 | 26.886 | -0.973 | 2.654 | 0.180 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.384 | 2.204 | 1.095 | 26.881 | -0.949 | 2.834 | 0.196 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.368 | 2.216 | 1.067 | 26.871 | -0.930 | 3.017 | 0.203 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.405 | 2.241 | 1.042 | 8.938 | -0.911 | 3.257 | 1.210 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.512 | 2.259 | 0.758 | 8.938 | -0.565 | 3.576 | 0.196 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.382 | 2.252 | 0.739 | 8.938 | -0.539 | 4.170 | 0.097 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.345 | 2.221 | 0.727 | 8.928 | -0.528 | 4.864 | 0.106 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.298 | 2.169 | 0.715 | 8.928 | -0.521 | 5.428 | 0.123 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.336 | 2.102 | 0.701 | 8.928 | -0.516 | 5.904 | 0.124 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.374 | 2.026 | 0.675 | 8.923 | -0.495 | 6.405 | 0.135 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.405 | 1.969 | 0.651 | 8.918 | -0.482 | 6.859 | 0.155 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.422 | 1.922 | 0.629 | 5.648 | -0.464 | 7.226 | 0.162 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.433 | 1.867 | 0.602 | 5.643 | -0.446 | 7.401 | 0.180 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.452 | 1.822 | 0.565 | 5.633 | -0.412 | 7.471 | 0.188 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.507 | 1.813 | 0.522 | 5.623 | -0.383 | 7.852 | 0.209 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.423 | 1.756 | 0.478 | 5.613 | -0.343 | 8.310 | 0.223 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.531 | 1.715 | 0.431 | 5.593 | -0.318 | 8.816 | 0.183 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.507 | 1.666 | 0.392 | 5.578 | -0.289 | 9.305 | 0.151 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.486 | 1.652 | 0.360 | 5.568 | -0.259 | 9.706 | 0.158 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.487 | 1.638 | 0.319 | 5.548 | -0.221 | 10.019 | 0.140 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.476 | 1.614 | 0.285 | 5.523 | -0.190 | 10.349 | 0.123 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.466 | 1.596 | 0.256 | 5.508 | -0.167 | 10.639 | 0.120 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.462 | 1.549 | 0.227 | 5.493 | -0.141 | 10.830 | 0.120 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.450 | 1.510 | 0.199 | 5.483 | -0.125 | 11.150 | 0.118 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.491 | 1.455 | 0.162 | 5.468 | -0.091 | 11.307 | 0.122 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.469 | 1.429 | 0.124 | 5.448 | -0.060 | 11.443 | 0.123 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.470 | 1.405 | 0.087 | 5.433 | -0.034 | 11.522 | 0.074 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.440 | 1.405 | 0.063 | 5.423 | -0.023 | 11.952 | 0.081 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 42 | 625.00 | 0.446 | 1.404 | 0.038 | 5.413 | -0.010 | 12.177 | 0.068 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.425 | 1.406 | 0.019 | 5.408 | -0.005 | 12.360 | 0.070 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.430 | 1.377 | 0.859 | | | | | | | | GROUND SURFACE SETTLEMENT | | 0.061 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

**********
OUTPUT FOR IV02270
WITH A PEAK ACCELERATION OF 0.79 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.369 | 3.737 | 1.003 | 26.046 | 0.322 | 0.088 | 0.010 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.357 | 3.733 | 1.002 | 26.046 | 0.322 | 0.279 | 0.070 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.357 | 3.683 | 1.002 | 26.046 | 0.326 | 0.479 | 0.156 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.354 | 3.620 | 1.008 | 26.051 | 0.334 | 0.647 | 0.227 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.369 | 3.539 | 0.993 | 26.051 | 0.320 | 0.828 | 0.296 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.357 | 3.460 | 0.975 | 26.056 | 0.309 | 1.008 | 0.361 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.373 | 3.413 | 0.953 | 26.056 | 0.299 | 1.183 | 0.394 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.431 | 3.374 | 0.947 | 26.061 | 0.310 | 1.349 | 0.448 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.354 | 3.344 | 0.938 | 26.066 | 0.315 | 1.587 | 0.542 | 1.000 | 1.000 | 1.000 | 0.494 | 0.494 | 0.027 | 45.00 |
| 10 | 50.00 | 0.329 | 3.308 | 0.893 | 26.071 | 0.302 | 1.839 | 0.396 | 1.000 | 1.000 | 1.000 | 0.376 | 0.376 | 0.017 | 55.00 |
| 11 | 60.00 | 0.335 | 3.274 | 0.849 | 26.076 | 0.294 | 2.031 | 0.338 | 1.000 | 1.000 | 1.000 | 0.274 | 0.274 | 0.017 | 65.00 |
| 12 | 70.00 | 0.344 | 3.225 | 0.811 | 26.076 | 0.290 | 2.322 | 0.155 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.368 | 3.162 | 0.804 | 26.081 | 0.300 | 2.507 | 0.165 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.392 | 3.101 | 0.796 | 26.081 | 0.307 | 2.748 | 0.187 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.394 | 3.054 | 0.781 | 26.076 | 0.313 | 3.011 | 0.195 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.378 | 2.982 | 0.761 | 26.081 | 0.318 | 3.286 | 0.219 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.393 | 2.925 | 0.736 | 26.081 | 0.321 | 3.351 | 1.639 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.514 | 2.863 | 0.568 | 3.468 | 0.043 | 3.718 | 0.231 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.437 | 2.808 | 0.549 | 3.468 | 0.014 | 4.392 | 0.113 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.374 | 2.748 | 0.528 | 3.468 | 0.012 | 4.987 | 0.109 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.382 | 2.646 | 0.506 | 4.438 | 0.014 | 5.773 | 0.128 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.376 | 2.544 | 0.483 | 4.443 | 0.026 | 6.293 | 0.129 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.394 | 2.446 | 0.458 | 4.438 | 0.036 | 6.672 | 0.146 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.380 | 2.336 | 0.447 | 4.433 | 0.024 | 7.164 | 0.161 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.405 | 2.223 | 0.434 | 4.428 | -0.003 | 8.055 | 0.146 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.403 | 2.167 | 0.414 | 4.418 | -0.006 | 8.292 | 0.152 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.391 | 2.153 | 0.383 | 4.408 | -0.009 | 8.762 | 0.152 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28 | 320.00 | 0.442 | 2.166 | 0.356 | 4.398 | -0.024 | 9.161 | 0.160 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.517 | 2.095 | 0.324 | 4.388 | -0.035 | 9.510 | 0.162 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.550 | 2.006 | 0.292 | 4.378 | -0.045 | 9.788 | 0.138 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.528 | 1.948 | 0.266 | 25.026 | -0.046 | 9.962 | 0.120 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.505 | 1.940 | 0.256 | 25.021 | -0.056 | 10.125 | 0.122 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.489 | 1.914 | 0.232 | 25.016 | -0.052 | 10.424 | 0.112 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.505 | 1.900 | 0.206 | 25.011 | -0.043 | 10.816 | 0.102 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.534 | 1.885 | 0.184 | 25.006 | -0.040 | 11.593 | 0.100 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.494 | 1.895 | 0.166 | 25.001 | -0.041 | 11.957 | 0.104 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.481 | 1.860 | 0.147 | 24.991 | -0.038 | 12.483 | 0.098 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.415 | 1.854 | 0.125 | 24.981 | -0.038 | 12.999 | 0.107 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.411 | 1.859 | 0.097 | 24.971 | -0.032 | 13.320 | 0.105 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.443 | 1.852 | 0.070 | 24.956 | -0.021 | 14.374 | 0.076 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.444 | 1.845 | 0.053 | 4.813 | -0.019 | 14.290 | 0.070 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.395 | 1.842 | 0.034 | 4.818 | -0.007 | 14.498 | 0.075 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.440 | 1.845 | 0.018 | 24.931 | -0.007 | 14.835 | 0.073 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.381 | 1.844 | 1.423 | | | | | | GROUND SURFACE SETTLEMENT | | | | 0.061 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 1

FOR SECOND COMPONENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 2

**********
NEXT INPUT MOTION
**********

**********
THE TIMESTEP HAS BEEN REDUCED BY A FACTOR OF 2
IN ORDER TO MEET THE COURANT STABILITY CRITERION
ALTERNATELY YOU MAY INCREASE THE LAYER THICKNESS(ES)
**********

**********
OUTPUT FOR IVEC4140
WITH A PEAK ACCELERATION OF 0.94 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.375 | 3.003 | 1.605 | 9.868 | -1.391 | 0.090 | 0.010 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.379 | 3.000 | 1.605 | 9.868 | -1.391 | 0.293 | 0.067 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.371 | 2.970 | 1.602 | 9.868 | -1.390 | 0.494 | 0.140 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.431 | 2.922 | 1.599 | 9.868 | -1.390 | 0.708 | 0.191 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.460 | 2.861 | 1.596 | 9.863 | -1.390 | 0.902 | 0.232 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.428 | 2.794 | 1.604 | 9.863 | -1.402 | 1.057 | 0.383 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.374 | 2.718 | 1.583 | 9.853 | -1.385 | 1.230 | 0.419 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.365 | 2.638 | 1.562 | 9.848 | -1.369 | 1.386 | 0.451 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.327 | 2.558 | 1.541 | 9.838 | -1.351 | 1.605 | 0.214 | 1.000 | 1.000 | 1.000 | 0.337 | 0.337 | 0.022 | 45.00 |
| 10 | 50.00 | 0.294 | 2.455 | 1.524 | 9.823 | -1.342 | 1.877 | 0.223 | 1.000 | 1.000 | 1.000 | 0.256 | 0.256 | 0.014 | 55.00 |
| 11 | 60.00 | 0.323 | 2.367 | 1.500 | 9.818 | -1.324 | 2.160 | 0.209 | 1.000 | 1.000 | 1.000 | 0.190 | 0.190 | 0.015 | 65.00 |
| 12 | 70.00 | 0.365 | 2.279 | 1.473 | 9.813 | -1.301 | 2.381 | 0.147 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.347 | 2.194 | 1.454 | 9.813 | -1.289 | 2.659 | 0.170 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.408 | 2.104 | 1.433 | 9.813 | -1.272 | 2.945 | 0.192 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.439 | 2.010 | 1.413 | 9.813 | -1.258 | 3.101 | 0.199 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.400 | 1.918 | 1.391 | 9.813 | -1.242 | 3.223 | 0.223 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.439 | 1.842 | 1.363 | 9.823 | -1.221 | 3.337 | 3.411 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.577 | 2.241 | 0.817 | 5.953 | -0.542 | 3.764 | 0.252 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.462 | 2.214 | 0.790 | 5.948 | -0.511 | 4.283 | 0.122 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.407 | 2.109 | 0.763 | 5.943 | -0.486 | 4.923 | 0.132 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.332 | 2.036 | 0.732 | 5.943 | -0.469 | 5.571 | 0.147 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.332 | 1.943 | 0.696 | 5.943 | -0.438 | 6.067 | 0.152 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.369 | 1.846 | 0.661 | 5.953 | -0.409 | 6.437 | 0.152 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.358 | 1.841 | 0.624 | 5.963 | -0.375 | 6.741 | 0.168 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.451 | 1.805 | 0.584 | 5.978 | -0.333 | 7.021 | 0.170 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.434 | 1.750 | 0.543 | 5.978 | -0.286 | 7.234 | 0.181 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.389 | 1.679 | 0.501 | 5.968 | -0.249 | 7.836 | 0.194 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.397 | 1.611 | 0.454 | 5.963 | -0.211 | 8.137 | 0.195 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.418 | 1.515 | 0.412 | 5.968 | -0.176 | 8.515 | 0.205 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.414 | 1.453 | 0.365 | 5.958 | -0.151 | 8.905 | 0.170 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.416 | 1.438 | 0.326 | 5.953 | -0.121 | 9.156 | 0.149 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.392 | 1.418 | 0.291 | 5.943 | -0.093 | 9.490 | 0.146 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.396 | 1.393 | 0.258 | 5.938 | -0.078 | 9.731 | 0.130 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.384 | 1.364 | 0.227 | 5.928 | -0.065 | 10.006 | 0.117 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.428 | 1.337 | 0.200 | 5.923 | -0.055 | 10.264 | 0.107 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.421 | 1.310 | 0.177 | 5.913 | -0.052 | 10.504 | 0.098 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.461 | 1.301 | 0.155 | 5.898 | -0.041 | 10.536 | 0.105 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.475 | 1.305 | 0.127 | 5.888 | -0.029 | 10.649 | 0.099 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.490 | 1.305 | 0.099 | 5.878 | -0.022 | 10.483 | 0.100 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.488 | 1.298 | 0.069 | 5.863 | -0.013 | 10.340 | 0.061 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.507 | 1.296 | 0.053 | 5.853 | -0.012 | 10.504 | 0.064 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.483 | 1.306 | 0.034 | 5.843 | -0.008 | 10.337 | 0.061 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.496 | 1.320 | 0.016 | 5.838 | -0.002 | 10.350 | 0.063 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.498 | 1.323 | 0.910 | | | | | | GROUND SURFACE SETTLEMENT | | | | 0.051 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO

DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

**********
OUTPUT FOR IVEC4230
WITH A PEAK ACCELERATION OF 0.88 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.374 | 4.231 | 1.589 | 6.318 | 1.063 | 0.090 | 0.011 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.359 | 4.215 | 1.589 | 6.318 | 1.063 | 0.284 | 0.075 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.374 | 4.078 | 1.588 | 6.318 | 1.065 | 0.492 | 0.166 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.355 | 3.953 | 1.586 | 6.318 | 1.077 | 0.683 | 0.245 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.338 | 3.829 | 1.583 | 6.303 | 1.094 | 0.872 | 0.316 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.438 | 3.738 | 1.571 | 6.308 | 1.099 | 1.063 | 0.390 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.411 | 3.652 | 1.555 | 6.298 | 1.105 | 1.231 | 0.399 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.457 | 3.611 | 1.549 | 14.043 | 1.112 | 1.395 | 0.459 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.375 | 3.547 | 1.534 | 14.043 | 1.110 | 1.636 | 0.265 | 1.000 | 1.000 | 1.000 | 0.337 | 0.337 | 0.022 | 45.00 |
| 10 | 50.00 | 0.319 | 3.468 | 1.517 | 14.043 | 1.098 | 1.944 | 0.255 | 1.000 | 1.000 | 1.000 | 0.256 | 0.256 | 0.014 | 55.00 |
| 11 | 60.00 | 0.330 | 3.411 | 1.480 | 14.038 | 1.072 | 2.177 | 0.249 | 1.000 | 1.000 | 1.000 | 0.190 | 0.190 | 0.015 | 65.00 |
| 12 | 70.00 | 0.355 | 3.373 | 1.450 | 6.293 | 1.049 | 2.422 | 0.165 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.425 | 3.347 | 1.438 | 6.288 | 1.042 | 2.584 | 0.187 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.437 | 3.323 | 1.418 | 6.288 | 1.029 | 2.857 | 0.203 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.400 | 3.305 | 1.400 | 6.298 | 1.020 | 2.921 | 0.221 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.419 | 3.305 | 1.378 | 6.293 | 1.016 | 3.207 | 0.238 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.407 | 3.298 | 1.355 | 13.993 | 1.009 | 3.296 | 3.338 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.381 | 3.405 | 0.954 | 6.078 | 0.400 | 3.718 | 0.293 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.344 | 3.360 | 0.924 | 6.073 | 0.378 | 4.340 | 0.134 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.308 | 3.270 | 0.897 | 6.068 | 0.357 | 5.071 | 0.147 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.306 | 3.176 | 0.870 | 6.063 | 0.338 | 5.656 | 0.162 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.291 | 3.107 | 0.838 | 6.058 | 0.318 | 6.176 | 0.162 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.295 | 3.055 | 0.804 | 6.048 | 0.301 | 6.694 | 0.179 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.307 | 3.014 | 0.766 | 6.028 | 0.277 | 7.224 | 0.208 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.382 | 2.977 | 0.717 | 6.008 | 0.251 | 7.719 | 0.215 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.428 | 2.942 | 0.667 | 5.983 | 0.224 | 8.121 | 0.251 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.392 | 2.889 | 0.616 | 5.963 | 0.201 | 8.478 | 0.254 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.375 | 2.833 | 0.556 | 5.938 | 0.173 | 8.819 | 0.279 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.417 | 2.801 | 0.490 | 5.913 | 0.134 | 9.131 | 0.296 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.374 | 2.739 | 0.416 | 5.888 | 0.087 | 9.426 | 0.230 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.334 | 2.720 | 0.356 | 5.858 | 0.050 | 9.833 | 0.188 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.326 | 2.690 | 0.308 | 5.843 | 0.022 | 10.225 | 0.194 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 33 | 420.00 | 0.333 | 2.667 | 0.258 | 5.823 | -0.011 | 10.844 | 0.113 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.376 | 2.654 | 0.233 | 5.813 | -0.018 | 10.756 | 0.103 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.385 | 2.638 | 0.211 | 5.808 | -0.022 | 11.022 | 0.098 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.377 | 2.582 | 0.189 | 5.808 | -0.024 | 11.283 | 0.097 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.422 | 2.541 | 0.167 | 5.803 | -0.023 | 11.629 | 0.097 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.403 | 2.504 | 0.140 | 5.803 | -0.021 | 12.060 | 0.095 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.450 | 2.446 | 0.113 | 5.793 | -0.020 | 12.425 | 0.107 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.474 | 2.382 | 0.079 | 5.788 | -0.017 | 13.128 | 0.066 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.402 | 2.335 | 0.059 | 5.788 | -0.013 | 12.832 | 0.072 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.460 | 2.271 | 0.036 | 5.793 | -0.013 | 13.127 | 0.066 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.452 | 2.262 | 0.018 | 5.788 | -0.006 | 13.344 | 0.081 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.446 | 2.207 | 1.251 | | | | | | | GROUND SURFACE SETTLEMENT | | | 0.051 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 3

FOR SECOND COMPONENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 4

**********
NEXT INPUT MOTION
**********

**********
THE TIMESTEP HAS BEEN REDUCED BY A FACTOR OF 2
IN ORDER TO MEET THE COURANT STABILITY CRITERION
ALTERNATELY YOU MAY INCREASE THE LAYER THICKNESS(ES)
**********

**********
OUTPUT FOR JOS000
WITH A PEAK ACCELERATION OF 0.79 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.354 | 3.671 | 1.127 | 27.651 | -0.298 | 0.085 | 0.010 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 4.00 | 0.364 | 3.667 | 1.127 | 27.651 | -0.297 | 0.280 | 0.071 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.334 | 3.621 | 1.121 | 27.651 | -0.293 | 0.468 | 0.139 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.351 | 3.562 | 1.113 | 27.646 | -0.288 | 0.647 | 0.192 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.343 | 3.483 | 1.107 | 27.646 | -0.282 | 0.806 | 0.237 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.398 | 3.415 | 1.114 | 16.738 | -0.291 | 0.962 | 0.266 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.369 | 3.346 | 1.125 | 16.738 | -0.314 | 1.111 | 0.300 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.389 | 3.266 | 1.142 | 27.631 | -0.343 | 1.254 | 0.297 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.357 | 3.191 | 1.170 | 27.626 | -0.386 | 1.481 | 0.254 | 1.000 | 1.000 | 1.000 | 0.472 | 0.472 | 0.027 | 45.00 |
| 10 | 50.00 | 0.314 | 3.125 | 1.190 | 27.616 | -0.448 | 1.764 | 0.245 | 1.000 | 1.000 | 1.000 | 0.373 | 0.373 | 0.017 | 55.00 |
| 11 | 60.00 | 0.372 | 3.075 | 1.167 | 27.606 | -0.463 | 1.996 | 0.210 | 1.000 | 1.000 | 1.000 | 0.290 | 0.290 | 0.018 | 65.00 |
| 12 | 70.00 | 0.360 | 3.016 | 1.148 | 27.606 | -0.481 | 2.269 | 0.134 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.392 | 2.957 | 1.138 | 27.606 | -0.486 | 2.510 | 0.155 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.343 | 2.890 | 1.126 | 27.616 | -0.499 | 2.669 | 0.175 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.387 | 2.814 | 1.116 | 27.621 | -0.513 | 2.824 | 0.197 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.362 | 2.729 | 1.103 | 27.621 | -0.529 | 3.076 | 0.220 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.373 | 2.636 | 1.074 | 27.621 | -0.531 | 3.183 | 1.655 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.539 | 2.857 | 0.710 | 27.621 | -0.266 | 3.506 | 0.222 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.367 | 2.781 | 0.686 | 27.621 | -0.265 | 3.982 | 0.108 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.350 | 2.656 | 0.672 | 27.611 | -0.273 | 4.476 | 0.101 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.315 | 2.566 | 0.652 | 27.606 | -0.270 | 4.905 | 0.109 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.300 | 2.493 | 0.649 | 27.596 | -0.279 | 5.366 | 0.098 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.310 | 2.432 | 0.633 | 27.586 | -0.278 | 5.838 | 0.122 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.347 | 2.392 | 0.612 | 27.581 | -0.274 | 6.259 | 0.137 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.352 | 2.313 | 0.583 | 27.581 | -0.268 | 6.663 | 0.157 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.381 | 2.246 | 0.533 | 27.576 | -0.240 | 7.074 | 0.173 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.399 | 2.187 | 0.481 | 27.576 | -0.211 | 7.351 | 0.176 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.420 | 2.157 | 0.432 | 27.571 | -0.188 | 7.770 | 0.192 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.417 | 2.151 | 0.376 | 27.571 | -0.152 | 8.404 | 0.200 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.440 | 2.076 | 0.310 | 27.571 | -0.108 | 8.866 | 0.158 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.400 | 2.012 | 0.265 | 27.571 | -0.081 | 9.415 | 0.112 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.399 | 1.950 | 0.226 | 27.561 | -0.058 | 9.807 | 0.109 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.430 | 1.916 | 0.205 | 27.561 | -0.053 | 10.280 | 0.098 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.431 | 1.827 | 0.179 | 27.556 | -0.046 | 10.645 | 0.090 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.439 | 1.788 | 0.162 | 27.551 | -0.042 | 11.083 | 0.097 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.368 | 1.756 | 0.138 | 10.488 | -0.031 | 11.432 | 0.089 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.392 | 1.744 | 0.124 | 10.478 | -0.022 | 11.833 | 0.086 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.392 | 1.701 | 0.104 | 10.473 | -0.020 | 12.163 | 0.089 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.404 | 1.684 | 0.082 | 10.468 | -0.015 | 12.499 | 0.092 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.426 | 1.672 | 0.062 | 10.458 | -0.003 | 12.796 | 0.064 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.408 | 1.660 | 0.045 | 10.453 | -0.003 | 13.115 | 0.068 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.412 | 1.657 | 0.029 | 10.448 | -0.001 | 13.659 | 0.067 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.394 | 1.605 | 0.013 | 27.506 | -0.002 | 13.426 | 0.067 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.400 | 1.604 | 0.925 | | | | | | GROUND SURFACE SETTLEMENT | | | | 0.062 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

**********

OUTPUT FOR JOS090
WITH A PEAK ACCELERATION OF 0.92 G
AND SLOPE = 0.00

**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.360 | 3.753 | 1.520 | 30.345 | -0.822 | 0.086 | 0.010 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.347 | 3.746 | 1.520 | 30.350 | -0.822 | 0.274 | 0.072 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.360 | 3.678 | 1.523 | 30.345 | -0.825 | 0.467 | 0.151 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.384 | 3.577 | 1.525 | 30.345 | -0.827 | 0.652 | 0.210 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.424 | 3.465 | 1.513 | 30.345 | -0.814 | 0.831 | 0.258 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.425 | 3.360 | 1.488 | 30.345 | -0.787 | 1.003 | 0.316 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.454 | 3.272 | 1.454 | 30.340 | -0.749 | 1.178 | 0.351 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.456 | 3.195 | 1.420 | 30.340 | -0.715 | 1.291 | 0.372 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.334 | 3.139 | 1.392 | 30.340 | -0.685 | 1.548 | 0.346 | 1.000 | 1.000 | 1.000 | 0.472 | 0.472 | 0.027 | 45.00 |
| 10 | 50.00 | 0.327 | 3.103 | 1.356 | 30.345 | -0.654 | 1.916 | 0.349 | 1.000 | 1.000 | 1.000 | 0.373 | 0.373 | 0.017 | 55.00 |
| 11 | 60.00 | 0.344 | 3.088 | 1.326 | 30.350 | -0.629 | 2.188 | 0.310 | 1.000 | 1.000 | 1.000 | 0.290 | 0.290 | 0.018 | 65.00 |
| 12 | 70.00 | 0.331 | 3.070 | 1.286 | 30.350 | -0.602 | 2.387 | 0.152 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.356 | 3.065 | 1.267 | 30.350 | -0.594 | 2.592 | 0.171 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.388 | 3.043 | 1.244 | 30.350 | -0.592 | 2.783 | 0.184 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.408 | 3.015 | 1.220 | 30.350 | -0.584 | 3.051 | 0.193 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.404 | 3.002 | 1.181 | 30.345 | -0.568 | 3.142 | 0.208 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.368 | 2.994 | 1.141 | 30.345 | -0.553 | 3.253 | 2.125 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.538 | 2.960 | 0.828 | 10.318 | -0.168 | 3.514 | 0.233 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.450 | 2.934 | 0.799 | 10.308 | -0.155 | 4.139 | 0.119 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.435 | 2.870 | 0.768 | 10.298 | -0.146 | 4.926 | 0.132 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.345 | 2.818 | 0.742 | 10.283 | -0.158 | 5.581 | 0.148 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.311 | 2.754 | 0.712 | 10.268 | -0.160 | 6.102 | 0.152 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.402 | 2.683 | 0.680 | 10.258 | -0.167 | 6.511 | 0.156 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.395 | 2.613 | 0.647 | 10.243 | -0.163 | 6.813 | 0.175 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.382 | 2.523 | 0.603 | 10.233 | -0.153 | 7.037 | 0.182 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.363 | 2.446 | 0.558 | 10.223 | -0.154 | 7.234 | 0.195 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.368 | 2.361 | 0.509 | 10.223 | -0.155 | 7.503 | 0.197 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.360 | 2.291 | 0.459 | 10.208 | -0.139 | 7.663 | 0.203 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.350 | 2.215 | 0.399 | 10.198 | -0.120 | 7.687 | 0.193 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.338 | 2.162 | 0.344 | 10.098 | -0.100 | 7.426 | 0.149 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.363 | 2.114 | 0.301 | 10.083 | -0.085 | 7.518 | 0.122 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.425 | 2.109 | 0.266 | 10.063 | -0.079 | 7.714 | 0.124 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.414 | 2.050 | 0.228 | 10.028 | -0.065 | 8.006 | 0.102 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.425 | 2.012 | 0.203 | 19.547 | -0.059 | 8.513 | 0.082 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.423 | 1.993 | 0.182 | 19.537 | -0.055 | 8.907 | 0.079 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.506 | 1.916 | 0.159 | 9.973 | -0.046 | 9.153 | 0.080 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.487 | 1.883 | 0.138 | 9.963 | -0.043 | 9.590 | 0.083 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 38 | 525.00 | 0.426 | 1.883 | 0.112 | 9.953 | -0.036 | 9.891 | 0.081 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.453 | 1.874 | 0.091 | 19.502 | -0.038 | 10.610 | 0.086 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.489 | 1.865 | 0.063 | 19.492 | -0.021 | 10.879 | 0.058 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.470 | 1.834 | 0.046 | 19.487 | -0.015 | 11.483 | 0.058 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.479 | 1.802 | 0.030 | 9.918 | -0.010 | 11.633 | 0.064 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.463 | 1.779 | 0.014 | 19.477 | -0.002 | 12.111 | 0.068 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.469 | 1.779 | 0.888 | | | | | | | GROUND SURFACE SETTLEMENT | | | 0.062 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 5

FOR SECOND COMPONENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 6

**********
NEXT INPUT MOTION
**********

**********
THE TIMESTEP HAS BEEN REDUCED BY A FACTOR OF 2
IN ORDER TO MEET THE COURANT STABILITY CRITERION
ALTERNATELY YOU MAY INCREASE THE LAYER THICKNESS(ES)
**********

**********
OUTPUT FOR NIS000
WITH A PEAK ACCELERATION OF 0.86 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.388 | 2.832 | 0.774 | 16.518 | 0.178 | 0.093 | 0.010 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.380 | 2.825 | 0.774 | 16.518 | 0.177 | 0.295 | 0.079 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.372 | 2.745 | 0.774 | 16.518 | 0.177 | 0.508 | 0.167 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.390 | 2.650 | 0.775 | 16.518 | 0.174 | 0.707 | 0.251 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.371 | 2.539 | 0.775 | 16.518 | 0.173 | 0.904 | 0.339 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.379 | 2.435 | 0.778 | 16.518 | 0.171 | 1.095 | 0.395 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 30.00 | 0.357 | 2.330 | 0.786 | 16.518 | 0.159 | 1.279 | 0.409 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.403 | 2.243 | 0.783 | 16.518 | 0.154 | 1.447 | 0.390 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.327 | 2.180 | 0.770 | 16.523 | 0.149 | 1.678 | 0.230 | 1.000 | 1.000 | 1.000 | 0.329 | 0.329 | 0.022 | 45.00 |
| 10 | 50.00 | 0.294 | 2.117 | 0.747 | 16.518 | 0.143 | 1.951 | 0.188 | 1.000 | 1.000 | 1.000 | 0.252 | 0.252 | 0.013 | 55.00 |
| 11 | 60.00 | 0.296 | 2.104 | 0.728 | 16.523 | 0.145 | 2.168 | 0.195 | 1.000 | 1.000 | 1.000 | 0.203 | 0.203 | 0.014 | 65.00 |
| 12 | 70.00 | 0.320 | 2.086 | 0.708 | 16.523 | 0.139 | 2.342 | 0.134 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.361 | 2.064 | 0.696 | 16.528 | 0.131 | 2.598 | 0.150 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.402 | 2.035 | 0.686 | 16.523 | 0.123 | 2.683 | 0.158 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.378 | 2.000 | 0.672 | 16.523 | 0.115 | 2.839 | 0.174 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.388 | 1.955 | 0.653 | 16.528 | 0.114 | 3.006 | 0.174 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.384 | 1.906 | 0.639 | 16.528 | 0.101 | 3.131 | 1.112 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.504 | 2.024 | 0.595 | 16.423 | 0.037 | 3.394 | 0.192 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.400 | 1.976 | 0.579 | 16.428 | 0.014 | 3.868 | 0.094 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.367 | 1.895 | 0.553 | 16.428 | 0.003 | 4.417 | 0.099 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.338 | 1.827 | 0.537 | 16.423 | -0.009 | 4.898 | 0.108 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.321 | 1.752 | 0.525 | 16.428 | -0.023 | 5.385 | 0.110 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.312 | 1.678 | 0.497 | 16.433 | -0.022 | 5.923 | 0.123 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.337 | 1.665 | 0.458 | 16.438 | -0.013 | 6.449 | 0.140 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.360 | 1.651 | 0.419 | 16.438 | -0.003 | 6.975 | 0.151 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.346 | 1.648 | 0.380 | 16.443 | 0.002 | 7.362 | 0.164 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.343 | 1.689 | 0.344 | 16.508 | 0.006 | 7.700 | 0.166 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.352 | 1.745 | 0.306 | 16.508 | 0.022 | 7.942 | 0.173 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.431 | 1.793 | 0.277 | 16.498 | 0.003 | 8.240 | 0.177 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.359 | 1.811 | 0.245 | 12.163 | -0.003 | 8.584 | 0.150 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.367 | 1.798 | 0.218 | 12.148 | 0.001 | 8.844 | 0.127 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.379 | 1.765 | 0.201 | 12.138 | -0.014 | 9.093 | 0.132 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.376 | 1.738 | 0.184 | 12.128 | -0.014 | 9.318 | 0.116 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.357 | 1.699 | 0.170 | 12.113 | -0.022 | 9.543 | 0.090 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.367 | 1.660 | 0.148 | 12.108 | -0.019 | 9.788 | 0.087 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.386 | 1.635 | 0.127 | 12.098 | -0.003 | 10.041 | 0.088 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.396 | 1.623 | 0.114 | 10.563 | 0.002 | 10.330 | 0.084 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.420 | 1.596 | 0.099 | 10.558 | 0.003 | 10.701 | 0.091 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.411 | 1.564 | 0.080 | 10.553 | 0.005 | 11.079 | 0.109 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.435 | 1.534 | 0.056 | 10.538 | -0.000 | 11.456 | 0.064 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.438 | 1.508 | 0.041 | 10.533 | 0.001 | 11.864 | 0.060 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.446 | 1.465 | 0.027 | 10.533 | 0.001 | 12.283 | 0.063 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.453 | 1.432 | 0.012 | 12.048 | 0.001 | 12.787 | 0.067 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.439 | 1.412 | 0.963 | | | | | | GROUND SURFACE SETTLEMENT | | | | 0.049 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

**********
OUTPUT FOR NIS090
WITH A PEAK ACCELERATION OF 0.86 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.384 | 3.356 | 0.832 | 8.133 | -0.163 | 0.092 | 0.011 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.373 | 3.353 | 0.831 | 8.133 | -0.164 | 0.286 | 0.074 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.369 | 3.250 | 0.828 | 8.128 | -0.163 | 0.487 | 0.155 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.361 | 3.146 | 0.820 | 8.123 | -0.162 | 0.671 | 0.206 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.375 | 3.034 | 0.808 | 8.113 | -0.168 | 0.857 | 0.241 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.369 | 2.931 | 0.802 | 8.108 | -0.158 | 1.037 | 0.261 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.382 | 2.833 | 0.801 | 8.098 | -0.145 | 1.216 | 0.278 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.422 | 2.815 | 0.793 | 8.088 | -0.139 | 1.366 | 0.290 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.375 | 2.817 | 0.786 | 8.078 | -0.140 | 1.540 | 0.224 | 1.000 | 1.000 | 1.000 | 0.329 | 0.329 | 0.022 | 45.00 |
| 10 | 50.00 | 0.316 | 2.806 | 0.784 | 8.068 | -0.133 | 1.797 | 0.194 | 1.000 | 1.000 | 1.000 | 0.252 | 0.252 | 0.013 | 55.00 |
| 11 | 60.00 | 0.308 | 2.789 | 0.785 | 8.063 | -0.115 | 2.045 | 0.183 | 1.000 | 1.000 | 1.000 | 0.203 | 0.203 | 0.014 | 65.00 |
| 12 | 70.00 | 0.301 | 2.741 | 0.784 | 8.058 | -0.100 | 2.215 | 0.141 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.319 | 2.680 | 0.785 | 8.058 | -0.094 | 2.387 | 0.156 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.301 | 2.591 | 0.778 | 8.053 | -0.093 | 2.569 | 0.174 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.370 | 2.501 | 0.766 | 8.053 | -0.092 | 2.707 | 0.186 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.375 | 2.418 | 0.752 | 8.053 | -0.090 | 2.894 | 0.189 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.351 | 2.345 | 0.726 | 8.048 | -0.100 | 3.040 | 0.815 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.563 | 2.541 | 0.591 | 12.093 | -0.229 | 3.200 | 0.205 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.481 | 2.476 | 0.591 | 12.088 | -0.234 | 3.543 | 0.104 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.397 | 2.401 | 0.584 | 12.088 | -0.238 | 3.909 | 0.104 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.305 | 2.330 | 0.572 | 12.083 | -0.236 | 4.350 | 0.108 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.307 | 2.282 | 0.558 | 12.083 | -0.235 | 4.875 | 0.107 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.326 | 2.249 | 0.541 | 12.078 | -0.230 | 5.243 | 0.108 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.306 | 2.203 | 0.511 | 12.073 | -0.209 | 5.706 | 0.119 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.339 | 2.135 | 0.481 | 12.068 | -0.184 | 5.869 | 0.121 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.365 | 2.048 | 0.453 | 12.063 | -0.172 | 6.453 | 0.137 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.368 | 1.950 | 0.422 | 12.053 | -0.150 | 6.805 | 0.138 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.432 | 1.893 | 0.394 | 12.048 | -0.150 | 7.120 | 0.147 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.413 | 1.856 | 0.361 | 12.043 | -0.135 | 7.306 | 0.152 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.463 | 1.826 | 0.330 | 12.038 | -0.128 | 7.526 | 0.118 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.381 | 1.814 | 0.299 | 12.033 | -0.114 | 7.946 | 0.100 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.347 | 1.777 | 0.261 | 12.023 | -0.088 | 8.477 | 0.108 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.355 | 1.738 | 0.228 | 12.018 | -0.069 | 8.952 | 0.102 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.397 | 1.711 | 0.202 | 12.013 | -0.063 | 9.375 | 0.088 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.427 | 1.645 | 0.178 | 8.063 | -0.056 | 9.695 | 0.086 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.379 | 1.609 | 0.162 | 8.058 | -0.042 | 10.109 | 0.089 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.435 | 1.614 | 0.143 | 8.053 | -0.036 | 10.707 | 0.088 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.393 | 1.631 | 0.119 | 8.048 | -0.020 | 10.806 | 0.096 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.380 | 1.633 | 0.093 | 8.048 | -0.012 | 11.203 | 0.095 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.415 | 1.637 | 0.068 | 8.043 | -0.004 | 11.720 | 0.063 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.420 | 1.636 | 0.050 | 8.038 | -0.008 | 12.010 | 0.063 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.406 | 1.626 | 0.033 | 8.033 | -0.008 | 12.081 | 0.065 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 43 | 650.00 | 0.434 | 1.617 | 0.016 | 8.028 | -0.006 | 12.320 | 0.069 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.419 | 1.615 | 1.153 | | | | | | | GROUND SURFACE SETTLEMENT | | | 0.049 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 7

FOR SECOND COMPONENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 8

**********
NEXT INPUT MOTION
**********

**********
THE TIMESTEP HAS BEEN REDUCED BY A FACTOR OF 2
IN ORDER TO MEET THE COURANT STABILITY CRITERION
ALTERNATELY YOU MAY INCREASE THE LAYER THICKNESS(ES)
**********

**********
OUTPUT FOR YAR060
WITH A PEAK ACCELERATION OF 0.94 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.375 | 2.910 | 1.201 | 27.241 | -0.902 | 0.090 | 0.010 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.364 | 2.907 | 1.201 | 27.241 | -0.902 | 0.282 | 0.072 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.342 | 2.884 | 1.196 | 27.241 | -0.899 | 0.487 | 0.156 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.335 | 2.888 | 1.185 | 27.246 | -0.891 | 0.663 | 0.233 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.318 | 2.889 | 1.173 | 27.246 | -0.881 | 0.844 | 0.292 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.312 | 2.865 | 1.163 | 27.246 | -0.875 | 1.011 | 0.343 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.317 | 2.809 | 1.154 | 27.246 | -0.871 | 1.185 | 0.387 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.382 | 2.735 | 1.146 | 27.251 | -0.868 | 1.353 | 0.401 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.335 | 2.664 | 1.144 | 27.251 | -0.872 | 1.599 | 0.312 | 1.000 | 1.000 | 1.000 | 0.349 | 0.349 | 0.021 | 45.00 |
| 10 | 50.00 | 0.322 | 2.587 | 1.125 | 27.251 | -0.863 | 1.828 | 0.255 | 1.000 | 1.000 | 1.000 | 0.255 | 0.255 | 0.015 | 55.00 |
| 11 | 60.00 | 0.303 | 2.519 | 1.106 | 27.251 | -0.850 | 1.985 | 0.220 | 1.000 | 1.000 | 1.000 | 0.185 | 0.185 | 0.016 | 65.00 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | 70.00 | 0.347 | 2.453 | 1.093 | 27.251 | -0.842 | 2.130 | 0.139 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.409 | 2.387 | 1.090 | 27.246 | -0.842 | 2.321 | 0.153 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.392 | 2.353 | 1.083 | 27.246 | -0.840 | 2.488 | 0.166 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.407 | 2.352 | 1.059 | 27.246 | -0.821 | 2.710 | 0.174 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.389 | 2.349 | 1.031 | 27.241 | -0.794 | 2.935 | 0.194 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.352 | 2.341 | 0.995 | 27.241 | -0.762 | 3.010 | 1.069 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.519 | 2.322 | 0.766 | 25.701 | -0.527 | 3.382 | 0.197 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.458 | 2.279 | 0.733 | 25.696 | -0.494 | 3.783 | 0.099 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.380 | 2.232 | 0.706 | 25.681 | -0.474 | 4.582 | 0.105 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.323 | 2.188 | 0.668 | 25.681 | -0.441 | 5.341 | 0.112 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.419 | 2.181 | 0.637 | 25.676 | -0.419 | 5.947 | 0.116 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.315 | 2.167 | 0.608 | 25.681 | -0.400 | 6.397 | 0.118 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.336 | 2.141 | 0.577 | 25.676 | -0.376 | 6.716 | 0.128 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.361 | 2.128 | 0.545 | 25.676 | -0.356 | 6.755 | 0.128 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.396 | 2.122 | 0.503 | 25.676 | -0.318 | 6.978 | 0.131 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.440 | 2.115 | 0.451 | 25.686 | -0.273 | 7.313 | 0.132 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.541 | 2.113 | 0.403 | 25.681 | -0.236 | 7.569 | 0.133 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.479 | 2.112 | 0.346 | 25.676 | -0.185 | 7.707 | 0.139 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.456 | 2.114 | 0.296 | 25.671 | -0.143 | 7.790 | 0.114 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.449 | 2.108 | 0.250 | 25.676 | -0.105 | 7.882 | 0.099 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.496 | 2.089 | 0.225 | 25.661 | -0.088 | 8.439 | 0.098 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.430 | 2.070 | 0.196 | 25.676 | -0.071 | 8.553 | 0.088 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.428 | 2.025 | 0.176 | 25.681 | -0.064 | 8.770 | 0.079 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.425 | 2.026 | 0.152 | 25.671 | -0.049 | 9.040 | 0.077 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.478 | 1.989 | 0.130 | 25.661 | -0.036 | 9.241 | 0.076 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.402 | 1.979 | 0.116 | 25.661 | -0.035 | 9.394 | 0.075 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.436 | 1.949 | 0.092 | 25.651 | -0.023 | 9.587 | 0.078 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.424 | 1.932 | 0.070 | 25.646 | -0.015 | 9.767 | 0.074 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.476 | 1.894 | 0.047 | 21.417 | -0.008 | 9.993 | 0.048 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.468 | 1.847 | 0.038 | 21.412 | -0.010 | 10.153 | 0.052 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.447 | 1.799 | 0.028 | 21.412 | -0.009 | 10.243 | 0.053 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.521 | 1.736 | 0.011 | 15.058 | -0.001 | 10.511 | 0.054 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.471 | 1.726 | 1.066 | | | | | | GROUND SURFACE SETTLEMENT | | | | 0.052 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

**********
OUTPUT FOR YAR330
WITH A PEAK ACCELERATION OF 0.94 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.374 | 2.844 | 0.877 | 10.643 | -0.249 | 0.090 | 0.010 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.364 | 2.838 | 0.876 | 10.643 | -0.249 | 0.288 | 0.073 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.389 | 2.770 | 0.869 | 10.643 | -0.251 | 0.505 | 0.156 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.358 | 2.680 | 0.857 | 10.643 | -0.262 | 0.698 | 0.230 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.338 | 2.582 | 0.838 | 10.648 | -0.276 | 0.887 | 0.292 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.332 | 2.488 | 0.816 | 10.653 | -0.302 | 1.070 | 0.345 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.362 | 2.398 | 0.834 | 17.873 | -0.333 | 1.242 | 0.378 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.396 | 2.314 | 0.855 | 17.878 | -0.366 | 1.400 | 0.409 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.319 | 2.243 | 0.874 | 17.878 | -0.395 | 1.600 | 0.334 | 1.000 | 1.000 | 1.000 | 0.349 | 0.349 | 0.021 | 45.00 |
| 10 | 50.00 | 0.309 | 2.144 | 0.890 | 17.873 | -0.424 | 1.805 | 0.241 | 1.000 | 1.000 | 1.000 | 0.255 | 0.255 | 0.015 | 55.00 |
| 11 | 60.00 | 0.307 | 2.065 | 0.903 | 19.457 | -0.449 | 2.062 | 0.253 | 1.000 | 1.000 | 1.000 | 0.185 | 0.185 | 0.016 | 65.00 |
| 12 | 70.00 | 0.334 | 2.039 | 0.891 | 19.447 | -0.450 | 2.203 | 0.150 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.376 | 2.026 | 0.891 | 19.442 | -0.453 | 2.450 | 0.176 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.322 | 2.016 | 0.884 | 19.437 | -0.450 | 2.640 | 0.191 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.353 | 2.004 | 0.877 | 19.432 | -0.452 | 2.806 | 0.215 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.467 | 1.998 | 0.857 | 19.427 | -0.440 | 3.010 | 0.225 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.391 | 1.977 | 0.842 | 19.422 | -0.437 | 3.127 | 1.693 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.587 | 1.962 | 0.551 | 17.683 | -0.113 | 3.249 | 0.235 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.577 | 1.920 | 0.517 | 17.673 | -0.101 | 3.659 | 0.106 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.497 | 1.884 | 0.483 | 17.663 | -0.078 | 4.243 | 0.111 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.324 | 1.823 | 0.446 | 17.653 | -0.060 | 4.828 | 0.126 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.338 | 1.758 | 0.412 | 17.638 | -0.046 | 5.466 | 0.101 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.374 | 1.683 | 0.394 | 17.628 | -0.048 | 5.973 | 0.110 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.371 | 1.613 | 0.373 | 17.613 | -0.051 | 6.314 | 0.119 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.413 | 1.585 | 0.355 | 17.598 | -0.057 | 6.548 | 0.120 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.410 | 1.605 | 0.330 | 17.588 | -0.058 | 6.700 | 0.167 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.430 | 1.617 | 0.295 | 17.568 | -0.044 | 6.771 | 0.162 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.435 | 1.651 | 0.263 | 17.553 | -0.027 | 7.086 | 0.167 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.454 | 1.684 | 0.234 | 13.588 | -0.002 | 7.413 | 0.136 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.470 | 1.703 | 0.213 | 13.578 | 0.010 | 7.747 | 0.106 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.465 | 1.716 | 0.198 | 13.568 | 0.018 | 8.039 | 0.095 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.479 | 1.718 | 0.179 | 13.558 | 0.010 | 8.254 | 0.095 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.458 | 1.713 | 0.163 | 13.543 | 0.014 | 8.421 | 0.079 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.455 | 1.701 | 0.146 | 13.528 | 0.006 | 8.598 | 0.077 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.441 | 1.670 | 0.131 | 13.513 | 0.005 | 8.800 | 0.072 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.446 | 1.645 | 0.116 | 13.508 | 0.002 | 8.877 | 0.074 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.465 | 1.629 | 0.100 | 13.503 | -0.003 | 9.015 | 0.069 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.483 | 1.605 | 0.084 | 13.493 | -0.006 | 9.352 | 0.073 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.495 | 1.580 | 0.069 | 16.733 | -0.003 | 9.775 | 0.076 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.529 | 1.570 | 0.052 | 16.723 | 0.001 | 10.072 | 0.050 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.503 | 1.558 | 0.042 | 16.718 | 0.007 | 10.276 | 0.053 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.501 | 1.529 | 0.028 | 16.713 | 0.008 | 10.438 | 0.056 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.526 | 1.480 | 0.012 | 12.523 | -0.000 | 10.562 | 0.056 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.538 | 1.476 | 0.999 | | | | | | GROUND SURFACE SETTLEMENT | | | | 0.052 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

```
HISTORY OF ACCELERATION AT TOP OF LAYER  1 IS SAVED IN OUTPUT FILE NUMBER  9

FOR SECOND COMPONENT

HISTORY OF ACCELERATION AT TOP OF LAYER  1 IS SAVED IN OUTPUT FILE NUMBER 10


************************************
NORMAL TERMINATION FOR THIS INPUT FILE
************************************
```

# tv670c.dat – lower Vs in UT

**********
MAXIMUM RESPONSE VALUES AT GROUND SURFACE
**********

| INPUT FILE | INPUT MOTION | INPUT AMAX | SLOPE | COMP | KDIS | AMAX | VMAX | DMAXR | DFINALR | RUMAX | SETTLEMENT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| tv670c | IV02180.txt | 0.81 | 0.00 | 1 | 0 | 0.31 | 2.95 | 1.47 | -1.19 | 0.03 | 0.04 |
| tv670c | iv02270.txt | 0.79 | 0.00 | 2 | 0 | 0.34 | 3.83 | 1.22 | 0.44 | 0.03 | 0.04 |
| tv670c | IVEC4140.txt | 0.94 | 0.00 | 1 | 0 | 0.33 | 2.75 | 1.49 | -1.05 | 0.02 | 0.03 |
| tv670c | IVEC4230.txt | 0.88 | 0.00 | 2 | 0 | 0.32 | 4.12 | 1.82 | 0.84 | 0.02 | 0.03 |
| tv670c | JOS000.txt | 0.79 | 0.00 | 1 | 0 | 0.32 | 3.52 | 1.05 | -0.15 | 0.02 | 0.04 |
| tv670c | JOS090.txt | 0.92 | 0.00 | 2 | 0 | 0.35 | 3.83 | 1.66 | -0.69 | 0.02 | 0.04 |
| tv670c | NIS000.txt | 0.86 | 0.00 | 1 | 0 | 0.35 | 2.88 | 0.88 | 0.07 | 0.02 | 0.04 |
| tv670c | NIS090.txt | 0.86 | 0.00 | 2 | 0 | 0.34 | 3.39 | 1.07 | -0.51 | 0.02 | 0.04 |
| tv670c | YAR060.txt | 0.94 | 0.00 | 1 | 0 | 0.33 | 3.15 | 1.14 | -0.67 | 0.02 | 0.04 |
| tv670c | YAR330.txt | 0.94 | 0.00 | 2 | 0 | 0.36 | 3.02 | 1.08 | -0.53 | 0.02 | 0.04 |

RUMAX IS MAX RU IN ANY LAYER; SETTLEMENT IS SETTLEMENT OF GROUND SURFACE IN FEET
DFINALR IS GROUND SURFACE FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN GSFRD IF SLOPE IS GREATER THAN ZERO

```
************************************************
 ************************************************

  TESS2 - Version 3.00D
  Copyright 2020 Robert Pyke
  Built by rmp on 08/29/2020
  Using Simply Fortran v. 2.4

 ************************************************
 ************************************************

 INPUT/OUTPUT FILE NAME: tv670c


 ***************************************
 Tri Valley Hospital
 ***************************************
 670 feet deep profile - lower Vs in UT
 ***************************************


 REDISTRIBUTION AND DISSIPATION OF PORE PRESSURES
 IS NOT INCLUDED!


 CALCULATION OF SETTLEMENTS IS TURNED ON


 UNITS ARE KIPS, FEET AND SECONDS


 **********
 INPUT DATA
 **********

 MATERIAL PROPERTY PARAMETERS

  MTYPE        VT     ALPHA      GMRP      TSTR      FSTR
    1        0.02      1.00      0.00      0.00      0.00

  MTYPE        VT     ALPHA      GMRP      TSTR      FSTR
    2        0.02      1.00      0.00      0.00      0.00

  MTYPE        VT     ALPHA      GMRP      TSTR      FSTR
    3        0.02      1.00      0.00      0.00      0.00

  MTYPE        VT     ALPHA      GMRP      TSTR      FSTR
    4        0.02      1.00      0.00      0.00      0.00
```

PARAMETERS FOR SIMPLE DEGRADATION

| MTYPE | SS | RS | E | SG | RG | ST | RT |
|---|---|---|---|---|---|---|---|
| 2 | 0.12 | 0.65 | 1.50 | 0.12 | 0.65 | 0.12 | 0.65 |

PARAMETERS FOR PORE PRESSURE GENERATION CURVES

| LAYER NO. | MTYPE | TAUAV/SIGV | NL | E | F | G |
|---|---|---|---|---|---|---|
| 9 | 3 | 0.800 | 10 | 2.00 | 0.10 | 2.00 |
| 10 | 4 | 0.800 | 10 | 2.00 | 0.10 | 2.00 |
| 11 | 4 | 0.800 | 10 | 2.00 | 0.10 | 2.00 |

PARAMETERS FOR SETTLEMENT CALCULATIONS

| LAYER NO. | ARD | FACTOR |
|---|---|---|
| 9 | 70 | 0.33 |
| 10 | 75 | 0.33 |
| 11 | 75 | 0.33 |

PARAMETERS FOR HARDENING OF SHEAR MODULUS

| MAT.TYPE | KHARD | FHARD | FHARDS |
|---|---|---|---|
| 3 | 1 | 1.00 | 0.50 |
| 4 | 1 | 1.00 | 0.50 |

**********
THE TIMESTEP HAS BEEN REDUCED BY A FACTOR OF 2
IN ORDER TO MEET THE COURANT STABILITY CRITERION
ALTERNATELY YOU MAY INCREASE THE LAYER THICKNESS(ES)
**********

**********
LAYER DATA
**********

DEPTH TO WATER TABLE = 5.00
TRAVEL TIMES ARE RELATIVE TO A TIMESTEP OF 0.0050 SECONDS

| LAYER NO. | MTYPE | THICK | UNIT WT | OCR | KO | SIGV | VS | GMAX | TAUMAX | GAMREF | TTR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 4.00 | 0.120 | | | 0.24 | 500.00 | 931.68 | 1.863 | 0.200 | 0.625 |
| 2 | 1 | 6.00 | 0.110 | | | 0.83 | 400.00 | 546.58 | 1.366 | 0.250 | 0.333 |
| 3 | 1 | 5.00 | 0.112 | | | 1.09 | 425.00 | 628.26 | 1.257 | 0.200 | 0.425 |
| 4 | 1 | 5.00 | 0.114 | | | 1.35 | 450.00 | 716.93 | 1.434 | 0.200 | 0.450 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 1 | 5.00 | 0.116 | | | 1.61 | 475.00 | 812.81 | 1.626 | 0.200 | 0.475 |
| 6 | 1 | 5.00 | 0.118 | | | 1.88 | 500.00 | 916.15 | 1.832 | 0.200 | 0.500 |
| 7 | 1 | 5.00 | 0.119 | | | 2.16 | 525.00 | 1018.61 | 2.037 | 0.200 | 0.525 |
| 8 | 1 | 5.00 | 0.120 | | | 2.45 | 550.00 | 1127.33 | 2.255 | 0.200 | 0.550 |
| 9 | 3 | 10.00 | 0.125 | 1.00 | 0.60 | 2.91 | 700.00 | 1902.17 | 2.853 | 0.150 | 0.350 |
| 10 | 4 | 10.00 | 0.130 | 1.00 | 0.60 | 3.56 | 800.00 | 2583.85 | 3.101 | 0.120 | 0.400 |
| 11 | 4 | 10.00 | 0.130 | 1.00 | 0.80 | 4.23 | 850.00 | 2916.93 | 3.500 | 0.120 | 0.425 |
| 12 | 1 | 10.00 | 0.120 | | | 4.86 | 900.00 | 3018.63 | 6.037 | 0.200 | 0.450 |
| 13 | 1 | 10.00 | 0.120 | | | 5.44 | 910.00 | 3086.09 | 6.172 | 0.200 | 0.455 |
| 14 | 1 | 10.00 | 0.120 | | | 6.01 | 920.00 | 3154.29 | 6.309 | 0.200 | 0.460 |
| 15 | 1 | 10.00 | 0.120 | | | 6.59 | 930.00 | 3223.23 | 6.446 | 0.200 | 0.465 |
| 16 | 1 | 10.00 | 0.120 | | | 7.16 | 940.00 | 3292.92 | 6.586 | 0.200 | 0.470 |
| 17 | 1 | 10.00 | 0.120 | | | 7.74 | 950.00 | 3363.35 | 3.363 | 0.100 | 0.475 |
| 18 | 1 | 10.00 | 0.120 | | | 8.32 | 960.00 | 3434.53 | 6.869 | 0.200 | 0.480 |
| 19 | 1 | 20.00 | 0.130 | | | 9.28 | 1000.00 | 4037.27 | 8.075 | 0.200 | 0.250 |
| 20 | 1 | 20.00 | 0.130 | | | 10.63 | 1050.00 | 4451.09 | 8.902 | 0.200 | 0.262 |
| 21 | 1 | 20.00 | 0.130 | | | 11.98 | 1100.00 | 4885.09 | 9.770 | 0.200 | 0.275 |
| 22 | 1 | 20.00 | 0.130 | | | 13.34 | 1140.00 | 5246.83 | 10.494 | 0.200 | 0.285 |
| 23 | 1 | 20.00 | 0.130 | | | 14.69 | 1180.00 | 5621.49 | 11.243 | 0.200 | 0.295 |
| 24 | 1 | 20.00 | 0.130 | | | 16.04 | 1220.00 | 6009.07 | 12.018 | 0.200 | 0.305 |
| 25 | 1 | 20.00 | 0.130 | | | 17.39 | 1260.00 | 6409.57 | 12.819 | 0.200 | 0.315 |
| 26 | 1 | 20.00 | 0.130 | | | 18.74 | 1300.00 | 6822.98 | 13.646 | 0.200 | 0.325 |
| 27 | 1 | 20.00 | 0.130 | | | 20.10 | 1330.00 | 7141.52 | 14.283 | 0.200 | 0.332 |
| 28 | 1 | 20.00 | 0.130 | | | 21.45 | 1360.00 | 7467.33 | 14.935 | 0.200 | 0.340 |
| 29 | 1 | 20.00 | 0.130 | | | 22.80 | 1390.00 | 7800.40 | 15.601 | 0.200 | 0.347 |
| 30 | 1 | 20.00 | 0.130 | | | 24.15 | 1420.00 | 8140.75 | 16.281 | 0.200 | 0.355 |
| 31 | 1 | 20.00 | 0.130 | | | 25.50 | 1450.00 | 8488.35 | 16.977 | 0.200 | 0.362 |
| 32 | 1 | 20.00 | 0.130 | | | 26.86 | 1470.00 | 8724.13 | 17.448 | 0.200 | 0.368 |
| 33 | 1 | 20.00 | 0.130 | | | 28.21 | 1490.00 | 8963.14 | 17.926 | 0.200 | 0.373 |
| 34 | 1 | 20.00 | 0.130 | | | 29.56 | 1510.00 | 9205.37 | 18.411 | 0.200 | 0.377 |
| 35 | 1 | 20.00 | 0.130 | | | 30.91 | 1530.00 | 9450.84 | 18.902 | 0.200 | 0.382 |
| 36 | 1 | 20.00 | 0.130 | | | 32.26 | 1550.00 | 9699.53 | 19.399 | 0.200 | 0.387 |
| 37 | 1 | 25.00 | 0.130 | | | 33.78 | 1565.00 | 9888.18 | 19.776 | 0.200 | 0.313 |
| 38 | 1 | 25.00 | 0.130 | | | 35.47 | 1580.00 | 10078.63 | 20.157 | 0.200 | 0.316 |
| 39 | 1 | 25.00 | 0.130 | | | 37.16 | 1595.00 | 10270.91 | 20.542 | 0.200 | 0.319 |
| 40 | 1 | 25.00 | 0.130 | | | 38.85 | 1610.00 | 10465.00 | 20.930 | 0.200 | 0.322 |
| 41 | 1 | 25.00 | 0.130 | | | 40.54 | 1620.00 | 10595.40 | 21.191 | 0.200 | 0.324 |
| 42 | 1 | 25.00 | 0.130 | | | 42.23 | 1630.00 | 10726.62 | 21.453 | 0.200 | 0.326 |
| 43 | 1 | 20.00 | 0.130 | | | 43.76 | 1640.00 | 10858.63 | 21.717 | 0.200 | 0.410 |

**SHEAR WAVE VELOCITY IN BASE = 2400.**
**UNIT WEIGHT OF BASE = 0.135**

**********
**OUTPUT FOR IV02180**
**WITH A PEAK ACCELERATION OF 0.81 G**
**AND SLOPE = 0.00**
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.308 | 2.949 | 1.470 | 8.963 | -1.192 | 0.074 | 0.010 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.298 | 2.944 | 1.470 | 8.963 | -1.191 | 0.242 | 0.058 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.299 | 2.891 | 1.467 | 8.968 | -1.190 | 0.409 | 0.121 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.309 | 2.827 | 1.465 | 8.968 | -1.193 | 0.555 | 0.167 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.328 | 2.760 | 1.461 | 8.968 | -1.195 | 0.700 | 0.199 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.314 | 2.674 | 1.455 | 8.968 | -1.189 | 0.849 | 0.218 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.343 | 2.606 | 1.453 | 8.963 | -1.186 | 0.989 | 0.253 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.349 | 2.535 | 1.452 | 8.963 | -1.182 | 1.121 | 0.267 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.284 | 2.469 | 1.446 | 8.963 | -1.166 | 1.297 | 0.145 | 1.000 | 1.000 | 1.000 | 0.027 | 0.027 | 0.016 | 45.00 |
| 10 | 50.00 | 0.294 | 2.400 | 1.436 | 8.968 | -1.156 | 1.556 | 0.134 | 1.000 | 1.000 | 1.000 | 0.016 | 0.016 | 0.013 | 55.00 |
| 11 | 60.00 | 0.312 | 2.347 | 1.432 | 8.968 | -1.151 | 1.819 | 0.134 | 1.000 | 1.000 | 1.000 | 0.010 | 0.010 | 0.013 | 65.00 |
| 12 | 70.00 | 0.333 | 2.295 | 1.426 | 8.968 | -1.141 | 2.015 | 0.119 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.336 | 2.238 | 1.414 | 8.968 | -1.131 | 2.247 | 0.140 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.342 | 2.186 | 1.405 | 8.968 | -1.117 | 2.423 | 0.151 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.373 | 2.136 | 1.393 | 8.968 | -1.105 | 2.669 | 0.170 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.392 | 2.153 | 1.383 | 8.973 | -1.092 | 2.873 | 0.178 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.384 | 2.173 | 1.367 | 8.973 | -1.067 | 3.003 | 1.049 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.416 | 2.196 | 1.183 | 8.978 | -0.853 | 3.244 | 0.209 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.332 | 2.202 | 1.164 | 8.978 | -0.828 | 3.700 | 0.173 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.322 | 2.193 | 1.115 | 8.978 | -0.781 | 4.286 | 0.177 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.309 | 2.140 | 1.070 | 8.973 | -0.736 | 4.816 | 0.179 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.319 | 2.073 | 1.025 | 8.973 | -0.693 | 5.345 | 0.191 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.328 | 2.012 | 0.978 | 8.968 | -0.659 | 5.893 | 0.191 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.340 | 1.943 | 0.937 | 8.963 | -0.636 | 6.375 | 0.185 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.335 | 1.875 | 0.908 | 8.963 | -0.624 | 6.712 | 0.186 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.334 | 1.803 | 0.870 | 8.958 | -0.602 | 6.898 | 0.181 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.359 | 1.731 | 0.831 | 8.958 | -0.579 | 7.039 | 0.184 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.389 | 1.673 | 0.791 | 8.953 | -0.559 | 7.168 | 0.175 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.439 | 1.644 | 0.768 | 9.283 | -0.550 | 7.306 | 0.166 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.401 | 1.633 | 0.734 | 9.273 | -0.531 | 7.426 | 0.161 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.342 | 1.614 | 0.694 | 9.273 | -0.497 | 7.513 | 0.173 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.357 | 1.583 | 0.657 | 9.273 | -0.465 | 7.677 | 0.170 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.370 | 1.550 | 0.614 | 9.268 | -0.429 | 7.869 | 0.165 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.396 | 1.518 | 0.569 | 9.268 | -0.397 | 8.040 | 0.176 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.428 | 1.516 | 0.523 | 9.268 | -0.359 | 8.209 | 0.172 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.364 | 1.483 | 0.478 | 9.268 | -0.328 | 8.424 | 0.165 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.343 | 1.474 | 0.425 | 9.263 | -0.288 | 8.686 | 0.165 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.378 | 1.467 | 0.368 | 9.258 | -0.248 | 9.041 | 0.165 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.387 | 1.454 | 0.308 | 9.253 | -0.206 | 9.597 | 0.158 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.399 | 1.469 | 0.246 | 9.248 | -0.158 | 9.761 | 0.155 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.476 | 1.476 | 0.179 | 9.243 | -0.115 | 10.161 | 0.153 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 42 | 625.00 | 0.477 | 1.501 | 0.114 | 9.233 | -0.068 | 10.472 | 0.160 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.513 | 1.509 | 0.050 | 9.218 | -0.023 | 10.519 | 0.156 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.555 | 1.549 | 0.862 | | | | | | | | GROUND SURFACE SETTLEMENT | | 0.042 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

**********
OUTPUT FOR IV02270
WITH A PEAK ACCELERATION OF 0.79 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.343 | 3.832 | 1.225 | 26.196 | 0.435 | 0.082 | 0.010 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.329 | 3.830 | 1.225 | 26.196 | 0.435 | 0.263 | 0.066 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.336 | 3.810 | 1.227 | 26.196 | 0.440 | 0.457 | 0.141 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.344 | 3.766 | 1.227 | 26.196 | 0.446 | 0.633 | 0.202 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.323 | 3.709 | 1.221 | 26.191 | 0.445 | 0.809 | 0.262 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.347 | 3.654 | 1.219 | 26.191 | 0.449 | 0.976 | 0.317 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.362 | 3.586 | 1.233 | 26.191 | 0.476 | 1.133 | 0.342 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.447 | 3.509 | 1.235 | 26.181 | 0.489 | 1.290 | 0.361 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.331 | 3.439 | 1.238 | 26.176 | 0.504 | 1.504 | 0.203 | 1.000 | 1.000 | 1.000 | 0.027 | 0.027 | 0.016 | 45.00 |
| 10 | 50.00 | 0.324 | 3.366 | 1.235 | 26.176 | 0.515 | 1.779 | 0.199 | 1.000 | 1.000 | 1.000 | 0.016 | 0.016 | 0.013 | 55.00 |
| 11 | 60.00 | 0.313 | 3.297 | 1.217 | 26.171 | 0.505 | 2.022 | 0.188 | 1.000 | 1.000 | 1.000 | 0.010 | 0.010 | 0.013 | 65.00 |
| 12 | 70.00 | 0.359 | 3.232 | 1.203 | 26.171 | 0.506 | 2.243 | 0.142 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.352 | 3.163 | 1.198 | 26.171 | 0.513 | 2.364 | 0.150 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.368 | 3.086 | 1.186 | 26.171 | 0.513 | 2.615 | 0.163 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.420 | 3.007 | 1.170 | 26.171 | 0.515 | 2.816 | 0.181 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.484 | 2.924 | 1.157 | 26.171 | 0.523 | 3.112 | 0.197 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.414 | 2.841 | 1.143 | 26.166 | 0.531 | 3.199 | 1.198 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.365 | 2.760 | 0.920 | 3.623 | 0.270 | 3.565 | 0.242 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.342 | 2.698 | 0.914 | 3.623 | 0.288 | 3.841 | 0.203 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.340 | 2.550 | 0.898 | 3.623 | 0.302 | 4.408 | 0.204 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.344 | 2.454 | 0.878 | 3.623 | 0.292 | 4.991 | 0.203 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.349 | 2.372 | 0.828 | 3.623 | 0.240 | 5.511 | 0.201 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.391 | 2.284 | 0.776 | 3.628 | 0.215 | 5.953 | 0.218 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.419 | 2.208 | 0.716 | 3.623 | 0.156 | 6.365 | 0.210 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.425 | 2.138 | 0.665 | 3.623 | 0.123 | 6.800 | 0.181 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.411 | 2.074 | 0.623 | 3.628 | 0.094 | 7.210 | 0.191 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.434 | 2.019 | 0.582 | 3.628 | 0.059 | 7.536 | 0.188 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28 | 320.00 | 0.403 | 2.024 | 0.541 | 3.623 | 0.047 | 7.936 | 0.180 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.375 | 1.978 | 0.502 | 3.628 | 0.054 | 8.575 | 0.187 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.371 | 1.927 | 0.462 | 3.623 | 0.068 | 8.931 | 0.177 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.408 | 1.917 | 0.429 | 4.948 | 0.075 | 9.328 | 0.177 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.353 | 1.888 | 0.410 | 4.943 | 0.067 | 9.963 | 0.174 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.348 | 1.888 | 0.386 | 4.933 | 0.062 | 9.943 | 0.159 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.354 | 1.871 | 0.352 | 4.928 | 0.071 | 10.170 | 0.154 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.386 | 1.886 | 0.319 | 4.913 | 0.085 | 10.427 | 0.156 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.406 | 1.922 | 0.286 | 4.903 | 0.089 | 10.672 | 0.162 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.378 | 1.948 | 0.258 | 4.893 | 0.082 | 10.922 | 0.163 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.474 | 1.975 | 0.217 | 3.603 | 0.083 | 11.209 | 0.149 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.469 | 1.976 | 0.182 | 4.863 | 0.062 | 11.489 | 0.158 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.451 | 1.973 | 0.155 | 26.026 | 0.073 | 11.830 | 0.162 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.490 | 1.968 | 0.128 | 26.021 | 0.063 | 12.084 | 0.162 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.454 | 1.968 | 0.075 | 26.011 | 0.033 | 12.206 | 0.152 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.451 | 1.972 | 0.032 | 3.558 | 0.012 | 12.341 | 0.150 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.461 | 1.974 | 1.397 | | | | | | | GROUND SURFACE SETTLEMENT | | | 0.042 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 1

FOR SECOND COMPONENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 2

**********
NEXT INPUT MOTION
**********

**********
THE TIMESTEP HAS BEEN REDUCED BY A FACTOR OF 2
IN ORDER TO MEET THE COURANT STABILITY CRITERION
ALTERNATELY YOU MAY INCREASE THE LAYER THICKNESS(ES)
**********

**********
OUTPUT FOR IVEC4140
WITH A PEAK ACCELERATION OF 0.94 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.327 | 2.753 | 1.489 | 9.948 | -1.051 | 0.078 | 0.009 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.321 | 2.747 | 1.489 | 9.948 | -1.051 | 0.249 | 0.057 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.320 | 2.674 | 1.488 | 9.943 | -1.051 | 0.426 | 0.111 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.335 | 2.574 | 1.486 | 9.948 | -1.053 | 0.591 | 0.147 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.336 | 2.469 | 1.492 | 9.948 | -1.062 | 0.756 | 0.246 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.355 | 2.400 | 1.494 | 9.943 | -1.066 | 0.920 | 0.270 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.423 | 2.342 | 1.484 | 9.943 | -1.060 | 1.109 | 0.300 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.413 | 2.279 | 1.470 | 9.943 | -1.048 | 1.247 | 0.277 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.346 | 2.214 | 1.455 | 9.938 | -1.038 | 1.411 | 0.141 | 1.000 | 1.000 | 1.000 | 0.015 | 0.015 | 0.012 | 45.00 |
| 10 | 50.00 | 0.286 | 2.135 | 1.443 | 9.938 | -1.033 | 1.689 | 0.129 | 1.000 | 1.000 | 1.000 | 0.010 | 0.010 | 0.011 | 55.00 |
| 11 | 60.00 | 0.305 | 2.066 | 1.426 | 9.938 | -1.021 | 1.956 | 0.145 | 1.000 | 1.000 | 1.000 | 0.007 | 0.007 | 0.011 | 65.00 |
| 12 | 70.00 | 0.331 | 1.999 | 1.411 | 9.938 | -1.014 | 2.204 | 0.133 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.344 | 1.927 | 1.397 | 9.938 | -1.008 | 2.407 | 0.147 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.447 | 1.849 | 1.382 | 9.933 | -0.999 | 2.687 | 0.172 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.342 | 1.773 | 1.361 | 9.938 | -0.984 | 2.963 | 0.187 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.382 | 1.724 | 1.340 | 9.938 | -0.968 | 3.134 | 0.210 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.374 | 1.706 | 1.315 | 9.943 | -0.950 | 3.278 | 2.717 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.375 | 1.979 | 1.045 | 6.053 | -0.437 | 3.606 | 0.242 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.328 | 1.968 | 1.022 | 6.048 | -0.411 | 4.023 | 0.214 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.296 | 1.905 | 0.980 | 6.043 | -0.367 | 4.582 | 0.224 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.342 | 1.815 | 0.934 | 6.038 | -0.319 | 5.057 | 0.230 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.316 | 1.711 | 0.885 | 6.028 | -0.269 | 5.451 | 0.249 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.334 | 1.678 | 0.836 | 6.018 | -0.210 | 5.936 | 0.246 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.325 | 1.664 | 0.785 | 6.013 | -0.154 | 6.271 | 0.218 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.290 | 1.649 | 0.736 | 6.013 | -0.115 | 6.721 | 0.209 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.369 | 1.631 | 0.691 | 6.008 | -0.083 | 7.089 | 0.201 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.390 | 1.623 | 0.648 | 6.008 | -0.060 | 7.338 | 0.201 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.391 | 1.610 | 0.607 | 6.008 | -0.046 | 7.524 | 0.201 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.380 | 1.592 | 0.562 | 6.003 | -0.037 | 7.615 | 0.192 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.404 | 1.559 | 0.517 | 5.998 | -0.012 | 7.692 | 0.186 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.405 | 1.521 | 0.475 | 5.993 | -0.002 | 7.809 | 0.176 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.387 | 1.482 | 0.436 | 5.983 | 0.014 | 7.894 | 0.165 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.362 | 1.483 | 0.401 | 5.978 | 0.018 | 8.015 | 0.156 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.363 | 1.463 | 0.364 | 5.968 | 0.031 | 8.100 | 0.157 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.386 | 1.444 | 0.327 | 5.958 | 0.040 | 8.214 | 0.145 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.422 | 1.404 | 0.296 | 5.953 | 0.044 | 8.359 | 0.140 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.489 | 1.388 | 0.263 | 5.948 | 0.045 | 8.587 | 0.143 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.426 | 1.347 | 0.223 | 5.923 | 0.044 | 8.547 | 0.143 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.423 | 1.317 | 0.179 | 5.903 | 0.036 | 8.596 | 0.135 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.435 | 1.363 | 0.142 | 5.888 | 0.028 | 8.586 | 0.136 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.496 | 1.388 | 0.106 | 5.878 | 0.009 | 8.636 | 0.128 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.531 | 1.443 | 0.067 | 5.858 | 0.010 | 8.514 | 0.125 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.568 | 1.522 | 0.031 | 5.843 | 0.002 | 8.358 | 0.132 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.646 | 1.530 | 0.907 | | | | | | GROUND SURFACE SETTLEMENT | | | | 0.034 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO

DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

**********
OUTPUT FOR IVEC4230
WITH A PEAK ACCELERATION OF 0.88 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.315 | 4.117 | 1.820 | 6.478 | 0.842 | 0.076 | 0.009 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.309 | 4.105 | 1.820 | 6.478 | 0.842 | 0.249 | 0.060 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.309 | 4.016 | 1.817 | 6.478 | 0.843 | 0.422 | 0.128 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.338 | 3.918 | 1.811 | 6.473 | 0.845 | 0.578 | 0.170 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.355 | 3.833 | 1.805 | 6.473 | 0.853 | 0.739 | 0.216 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.346 | 3.753 | 1.801 | 6.473 | 0.865 | 0.899 | 0.258 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.406 | 3.681 | 1.794 | 6.473 | 0.875 | 1.060 | 0.294 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.376 | 3.599 | 1.783 | 6.468 | 0.881 | 1.227 | 0.318 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.333 | 3.525 | 1.769 | 6.468 | 0.888 | 1.409 | 0.167 | 1.000 | 1.000 | 1.000 | 0.015 | 0.015 | 0.012 | 45.00 |
| 10 | 50.00 | 0.278 | 3.427 | 1.756 | 6.468 | 0.893 | 1.688 | 0.165 | 1.000 | 1.000 | 1.000 | 0.010 | 0.010 | 0.011 | 55.00 |
| 11 | 60.00 | 0.289 | 3.349 | 1.747 | 6.463 | 0.886 | 1.933 | 0.178 | 1.000 | 1.000 | 1.000 | 0.007 | 0.007 | 0.011 | 65.00 |
| 12 | 70.00 | 0.378 | 3.311 | 1.734 | 6.463 | 0.874 | 2.168 | 0.141 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.360 | 3.276 | 1.720 | 6.468 | 0.867 | 2.362 | 0.161 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.390 | 3.253 | 1.706 | 6.463 | 0.854 | 2.625 | 0.178 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.407 | 3.232 | 1.685 | 6.463 | 0.834 | 2.866 | 0.195 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.457 | 3.217 | 1.667 | 6.463 | 0.817 | 3.157 | 0.217 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.392 | 3.206 | 1.638 | 6.473 | 0.794 | 3.161 | 1.677 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.313 | 3.208 | 1.390 | 6.348 | 0.488 | 3.461 | 0.242 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.280 | 3.190 | 1.362 | 6.343 | 0.465 | 3.937 | 0.234 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.283 | 3.112 | 1.309 | 6.333 | 0.436 | 4.505 | 0.236 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.289 | 3.046 | 1.252 | 6.318 | 0.400 | 4.952 | 0.241 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.294 | 2.985 | 1.193 | 6.283 | 0.358 | 5.342 | 0.241 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.263 | 2.942 | 1.135 | 6.268 | 0.324 | 5.739 | 0.243 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.279 | 2.908 | 1.075 | 6.253 | 0.294 | 6.129 | 0.245 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.286 | 2.853 | 1.022 | 6.728 | 0.270 | 6.461 | 0.231 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.279 | 2.824 | 0.973 | 6.728 | 0.243 | 6.743 | 0.239 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.278 | 2.767 | 0.923 | 6.723 | 0.222 | 6.948 | 0.230 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.288 | 2.701 | 0.868 | 6.093 | 0.197 | 7.377 | 0.217 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.300 | 2.669 | 0.820 | 6.083 | 0.169 | 7.776 | 0.216 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.321 | 2.599 | 0.764 | 6.073 | 0.139 | 8.062 | 0.217 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.299 | 2.554 | 0.707 | 6.063 | 0.107 | 8.232 | 0.208 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.318 | 2.535 | 0.649 | 6.048 | 0.080 | 8.314 | 0.200 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 33 | 420.00 | 0.366 | 2.531 | 0.594 | 6.028 | 0.055 | 8.442 | 0.207 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.340 | 2.512 | 0.540 | 6.693 | 0.031 | 8.723 | 0.207 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.364 | 2.489 | 0.484 | 6.698 | 0.012 | 8.953 | 0.211 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.332 | 2.447 | 0.434 | 6.693 | 0.001 | 9.509 | 0.201 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.335 | 2.424 | 0.385 | 6.703 | -0.011 | 9.395 | 0.194 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.350 | 2.391 | 0.322 | 6.698 | -0.026 | 9.660 | 0.198 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.385 | 2.339 | 0.256 | 6.693 | -0.048 | 10.025 | 0.203 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.419 | 2.356 | 0.192 | 6.683 | -0.049 | 10.272 | 0.200 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.424 | 2.390 | 0.125 | 6.678 | -0.058 | 10.564 | 0.201 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.442 | 2.414 | 0.072 | 7.873 | -0.055 | 10.862 | 0.166 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.527 | 2.426 | 0.034 | 6.608 | -0.021 | 11.183 | 0.155 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.574 | 2.399 | 1.209 | | | | | | | GROUND SURFACE SETTLEMENT | | | 0.034 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 3

FOR SECOND COMPONENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 4

**********
NEXT INPUT MOTION
**********

**********
THE TIMESTEP HAS BEEN REDUCED BY A FACTOR OF 2
IN ORDER TO MEET THE COURANT STABILITY CRITERION
ALTERNATELY YOU MAY INCREASE THE LAYER THICKNESS(ES)
**********

**********
OUTPUT FOR JOS000
WITH A PEAK ACCELERATION OF 0.79 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.316 | 3.520 | 1.053 | 11.808 | -0.153 | 0.076 | 0.010 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 4.00 | 0.316 | 3.521 | 1.053 | 11.808 | -0.153 | 0.243 | 0.059 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.318 | 3.475 | 1.052 | 11.808 | -0.151 | 0.422 | 0.120 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.346 | 3.427 | 1.049 | 11.808 | -0.145 | 0.586 | 0.172 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.353 | 3.377 | 1.048 | 11.813 | -0.139 | 0.744 | 0.215 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.360 | 3.326 | 1.046 | 11.813 | -0.133 | 0.896 | 0.228 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.340 | 3.274 | 1.046 | 11.813 | -0.143 | 1.046 | 0.254 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.384 | 3.226 | 1.053 | 11.813 | -0.163 | 1.186 | 0.258 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.329 | 3.177 | 1.064 | 11.813 | -0.191 | 1.386 | 0.138 | 1.000 | 1.000 | 1.000 | 0.020 | 0.020 | 0.017 | 45.00 |
| 10 | 50.00 | 0.299 | 3.120 | 1.064 | 11.813 | -0.203 | 1.606 | 0.119 | 1.000 | 1.000 | 1.000 | 0.012 | 0.012 | 0.014 | 55.00 |
| 11 | 60.00 | 0.303 | 3.071 | 1.063 | 11.813 | -0.234 | 1.830 | 0.122 | 1.000 | 1.000 | 1.000 | 0.007 | 0.007 | 0.014 | 65.00 |
| 12 | 70.00 | 0.294 | 3.020 | 1.052 | 11.813 | -0.253 | 2.073 | 0.117 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.302 | 2.968 | 1.041 | 11.813 | -0.259 | 2.241 | 0.135 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.320 | 2.909 | 1.024 | 11.813 | -0.264 | 2.468 | 0.153 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.380 | 2.841 | 1.005 | 11.818 | -0.272 | 2.683 | 0.170 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.358 | 2.766 | 0.984 | 27.606 | -0.277 | 2.889 | 0.180 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.355 | 2.684 | 0.966 | 27.601 | -0.279 | 3.099 | 0.748 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.336 | 2.550 | 0.878 | 27.591 | -0.267 | 3.302 | 0.200 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.322 | 2.472 | 0.870 | 27.586 | -0.282 | 3.485 | 0.164 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.280 | 2.373 | 0.830 | 27.591 | -0.275 | 3.881 | 0.177 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.294 | 2.308 | 0.789 | 27.601 | -0.271 | 4.246 | 0.165 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.291 | 2.273 | 0.778 | 27.606 | -0.285 | 4.553 | 0.187 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.269 | 2.224 | 0.731 | 27.606 | -0.254 | 4.827 | 0.182 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.310 | 2.152 | 0.688 | 27.601 | -0.232 | 5.155 | 0.185 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.342 | 2.097 | 0.648 | 10.648 | -0.201 | 5.457 | 0.177 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.367 | 2.059 | 0.622 | 10.638 | -0.174 | 5.805 | 0.176 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.391 | 2.039 | 0.596 | 10.633 | -0.156 | 6.140 | 0.185 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.398 | 2.005 | 0.567 | 10.633 | -0.135 | 6.496 | 0.181 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.401 | 1.968 | 0.530 | 10.628 | -0.118 | 6.844 | 0.177 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.414 | 1.930 | 0.501 | 10.623 | -0.088 | 7.208 | 0.176 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.399 | 1.879 | 0.466 | 10.618 | -0.068 | 7.709 | 0.160 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.422 | 1.881 | 0.432 | 10.613 | -0.066 | 8.210 | 0.164 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.407 | 1.809 | 0.401 | 10.588 | -0.057 | 8.654 | 0.165 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.421 | 1.759 | 0.370 | 10.568 | -0.036 | 9.027 | 0.162 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.396 | 1.769 | 0.343 | 10.548 | -0.015 | 9.347 | 0.169 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.399 | 1.792 | 0.313 | 10.528 | -0.009 | 9.496 | 0.161 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.391 | 1.803 | 0.280 | 10.518 | 0.007 | 9.740 | 0.148 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.392 | 1.818 | 0.237 | 10.503 | 0.001 | 9.937 | 0.152 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.376 | 1.833 | 0.193 | 10.488 | 0.005 | 10.050 | 0.135 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.403 | 1.816 | 0.151 | 10.478 | 0.002 | 10.468 | 0.132 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.420 | 1.783 | 0.113 | 10.473 | 0.001 | 10.795 | 0.138 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.441 | 1.767 | 0.074 | 10.463 | 0.009 | 10.976 | 0.133 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.480 | 1.796 | 0.033 | 10.448 | 0.002 | 11.033 | 0.139 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.512 | 1.805 | 0.921 | | | | | | GROUND SURFACE SETTLEMENT | | | | 0.045 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

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OUTPUT FOR JOS090
WITH A PEAK ACCELERATION OF 0.92 G
AND SLOPE = 0.00

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**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.346 | 3.832 | 1.658 | 30.375 | -0.689 | 0.083 | 0.009 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.322 | 3.828 | 1.658 | 30.375 | -0.689 | 0.258 | 0.063 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.334 | 3.788 | 1.660 | 30.380 | -0.694 | 0.439 | 0.125 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.341 | 3.721 | 1.663 | 30.380 | -0.697 | 0.609 | 0.177 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.312 | 3.637 | 1.669 | 30.380 | -0.705 | 0.780 | 0.216 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.335 | 3.546 | 1.668 | 30.380 | -0.706 | 0.938 | 0.258 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.364 | 3.459 | 1.663 | 30.380 | -0.702 | 1.096 | 0.275 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.349 | 3.383 | 1.648 | 30.380 | -0.689 | 1.227 | 0.266 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.320 | 3.315 | 1.638 | 30.385 | -0.679 | 1.379 | 0.145 | 1.000 | 1.000 | 1.000 | 0.020 | 0.020 | 0.017 | 45.00 |
| 10 | 50.00 | 0.303 | 3.246 | 1.623 | 30.385 | -0.672 | 1.547 | 0.134 | 1.000 | 1.000 | 1.000 | 0.012 | 0.012 | 0.014 | 55.00 |
| 11 | 60.00 | 0.316 | 3.200 | 1.610 | 30.385 | -0.666 | 1.806 | 0.142 | 1.000 | 1.000 | 1.000 | 0.007 | 0.007 | 0.014 | 65.00 |
| 12 | 70.00 | 0.329 | 3.163 | 1.589 | 30.385 | -0.651 | 2.085 | 0.120 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.381 | 3.127 | 1.575 | 30.380 | -0.651 | 2.365 | 0.139 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.443 | 3.095 | 1.545 | 30.385 | -0.634 | 2.579 | 0.159 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.397 | 3.070 | 1.528 | 30.385 | -0.632 | 2.762 | 0.179 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.357 | 3.053 | 1.494 | 30.380 | -0.618 | 2.969 | 0.194 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.367 | 3.024 | 1.460 | 30.380 | -0.606 | 3.183 | 1.585 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.409 | 3.005 | 1.090 | 30.365 | -0.328 | 3.375 | 0.232 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.364 | 2.975 | 1.053 | 30.360 | -0.316 | 3.803 | 0.209 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.321 | 2.912 | 0.983 | 30.350 | -0.283 | 4.309 | 0.213 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.318 | 2.830 | 0.946 | 30.345 | -0.284 | 4.683 | 0.210 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.315 | 2.748 | 0.902 | 30.340 | -0.273 | 4.948 | 0.214 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.318 | 2.677 | 0.848 | 30.340 | -0.258 | 5.100 | 0.204 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.322 | 2.594 | 0.801 | 30.335 | -0.267 | 5.285 | 0.201 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.318 | 2.503 | 0.754 | 30.330 | -0.261 | 5.560 | 0.182 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.305 | 2.416 | 0.709 | 30.320 | -0.262 | 5.768 | 0.179 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.310 | 2.320 | 0.666 | 30.315 | -0.272 | 6.111 | 0.170 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.290 | 2.228 | 0.624 | 30.305 | -0.270 | 6.491 | 0.165 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.287 | 2.136 | 0.570 | 30.295 | -0.261 | 6.841 | 0.174 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.303 | 2.067 | 0.524 | 30.285 | -0.259 | 7.200 | 0.149 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.314 | 2.016 | 0.475 | 30.280 | -0.230 | 7.540 | 0.143 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.304 | 1.977 | 0.439 | 30.275 | -0.214 | 7.850 | 0.134 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.332 | 1.983 | 0.398 | 30.275 | -0.195 | 8.170 | 0.136 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.330 | 2.000 | 0.356 | 30.280 | -0.175 | 8.490 | 0.135 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.375 | 1.998 | 0.315 | 30.270 | -0.147 | 8.725 | 0.140 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.323 | 1.988 | 0.274 | 30.270 | -0.126 | 8.952 | 0.140 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.344 | 1.973 | 0.237 | 30.280 | -0.101 | 9.230 | 0.136 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 38 | 525.00 | 0.397 | 1.952 | 0.188 | 9.643 | -0.069 | 9.483 | 0.141 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.378 | 1.935 | 0.159 | 9.643 | -0.043 | 9.764 | 0.131 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.403 | 1.910 | 0.131 | 9.633 | -0.019 | 10.039 | 0.142 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.433 | 1.889 | 0.099 | 9.628 | -0.000 | 10.257 | 0.144 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.488 | 1.874 | 0.065 | 31.355 | 0.012 | 10.413 | 0.152 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.538 | 1.853 | 0.036 | 31.360 | 0.009 | 10.401 | 0.147 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.611 | 1.829 | 0.840 | | | | | | | GROUND SURFACE SETTLEMENT | | | 0.045 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 5

FOR SECOND COMPONENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 6

**********
NEXT INPUT MOTION
**********

**********
THE TIMESTEP HAS BEEN REDUCED BY A FACTOR OF 2
IN ORDER TO MEET THE COURANT STABILITY CRITERION
ALTERNATELY YOU MAY INCREASE THE LAYER THICKNESS(ES)
**********

**********
OUTPUT FOR NIS000
WITH A PEAK ACCELERATION OF 0.86 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.350 | 2.877 | 0.885 | 9.703 | 0.068 | 0.084 | 0.009 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.339 | 2.873 | 0.884 | 9.703 | 0.068 | 0.274 | 0.061 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.349 | 2.818 | 0.880 | 9.703 | 0.068 | 0.463 | 0.141 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.366 | 2.737 | 0.876 | 16.613 | 0.065 | 0.645 | 0.206 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.354 | 2.654 | 0.883 | 16.618 | 0.051 | 0.823 | 0.259 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.328 | 2.568 | 0.888 | 16.608 | 0.039 | 1.001 | 0.314 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 30.00 | 0.403 | 2.490 | 0.889 | 16.608 | 0.028 | 1.173 | 0.336 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.344 | 2.418 | 0.887 | 16.608 | 0.016 | 1.323 | 0.325 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.390 | 2.360 | 0.876 | 16.608 | 0.014 | 1.576 | 0.166 | 1.000 | 1.000 | 1.000 | 0.018 | 0.018 | 0.013 | 45.00 |
| 10 | 50.00 | 0.278 | 2.328 | 0.857 | 16.608 | 0.018 | 1.799 | 0.146 | 1.000 | 1.000 | 1.000 | 0.011 | 0.011 | 0.011 | 55.00 |
| 11 | 60.00 | 0.345 | 2.303 | 0.841 | 16.608 | 0.019 | 2.030 | 0.140 | 1.000 | 1.000 | 1.000 | 0.006 | 0.006 | 0.011 | 65.00 |
| 12 | 70.00 | 0.309 | 2.278 | 0.816 | 16.603 | 0.031 | 2.216 | 0.116 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.392 | 2.236 | 0.803 | 16.608 | 0.032 | 2.401 | 0.132 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.334 | 2.189 | 0.788 | 16.603 | 0.033 | 2.556 | 0.138 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.360 | 2.138 | 0.765 | 16.603 | 0.039 | 2.829 | 0.151 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.328 | 2.081 | 0.746 | 16.603 | 0.041 | 2.991 | 0.164 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.378 | 2.022 | 0.719 | 16.603 | 0.048 | 3.087 | 0.798 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.360 | 2.028 | 0.658 | 9.423 | 0.042 | 3.323 | 0.185 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.342 | 1.969 | 0.649 | 9.413 | 0.044 | 3.663 | 0.156 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.283 | 1.855 | 0.635 | 9.393 | 0.038 | 4.108 | 0.155 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.320 | 1.829 | 0.603 | 9.383 | 0.050 | 4.412 | 0.157 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.324 | 1.845 | 0.577 | 9.378 | 0.050 | 4.619 | 0.156 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.388 | 1.846 | 0.545 | 9.353 | 0.072 | 5.012 | 0.155 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.377 | 1.823 | 0.515 | 9.343 | 0.090 | 5.319 | 0.153 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.365 | 1.806 | 0.491 | 9.328 | 0.091 | 5.621 | 0.153 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.326 | 1.814 | 0.468 | 9.323 | 0.088 | 5.915 | 0.149 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.334 | 1.825 | 0.443 | 9.313 | 0.093 | 6.182 | 0.139 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.360 | 1.861 | 0.430 | 10.748 | 0.098 | 6.469 | 0.148 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.407 | 1.864 | 0.413 | 10.743 | 0.105 | 6.795 | 0.139 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.443 | 1.843 | 0.401 | 10.733 | 0.121 | 7.108 | 0.153 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.484 | 1.821 | 0.383 | 10.723 | 0.121 | 7.413 | 0.153 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.556 | 1.799 | 0.362 | 10.713 | 0.123 | 7.703 | 0.158 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.506 | 1.774 | 0.335 | 10.708 | 0.114 | 7.982 | 0.161 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.421 | 1.751 | 0.312 | 10.693 | 0.116 | 8.253 | 0.165 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.432 | 1.718 | 0.288 | 10.663 | 0.105 | 8.501 | 0.163 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.432 | 1.684 | 0.266 | 10.643 | 0.100 | 8.659 | 0.168 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.422 | 1.643 | 0.245 | 10.633 | 0.092 | 8.789 | 0.169 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.455 | 1.595 | 0.215 | 10.618 | 0.083 | 8.957 | 0.172 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.457 | 1.538 | 0.176 | 10.603 | 0.059 | 9.183 | 0.175 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.454 | 1.506 | 0.145 | 10.593 | 0.056 | 9.535 | 0.176 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.465 | 1.483 | 0.106 | 10.578 | 0.029 | 9.858 | 0.168 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.472 | 1.467 | 0.063 | 10.563 | -0.001 | 10.219 | 0.168 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.499 | 1.468 | 0.036 | 12.068 | -0.013 | 10.328 | 0.142 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.557 | 1.461 | 0.916 | | | | | | | GROUND SURFACE SETTLEMENT | | | 0.035 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

**********
OUTPUT FOR NIS090
WITH A PEAK ACCELERATION OF 0.86 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.341 | 3.392 | 1.068 | 16.158 | -0.511 | 0.082 | 0.009 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.328 | 3.387 | 1.067 | 16.158 | -0.511 | 0.255 | 0.059 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.332 | 3.338 | 1.064 | 16.153 | -0.511 | 0.451 | 0.104 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.333 | 3.281 | 1.061 | 16.148 | -0.512 | 0.612 | 0.144 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.329 | 3.220 | 1.056 | 16.138 | -0.509 | 0.770 | 0.170 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.356 | 3.147 | 1.048 | 16.128 | -0.503 | 0.933 | 0.192 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.346 | 3.072 | 1.045 | 16.113 | -0.500 | 1.097 | 0.203 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.373 | 3.008 | 1.044 | 16.098 | -0.499 | 1.211 | 0.217 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.334 | 2.959 | 1.041 | 16.088 | -0.495 | 1.409 | 0.123 | 1.000 | 1.000 | 1.000 | 0.018 | 0.018 | 0.013 | 45.00 |
| 10 | 50.00 | 0.304 | 2.919 | 1.036 | 16.078 | -0.491 | 1.684 | 0.120 | 1.000 | 1.000 | 1.000 | 0.011 | 0.011 | 0.011 | 55.00 |
| 11 | 60.00 | 0.327 | 2.887 | 1.033 | 16.078 | -0.486 | 1.956 | 0.124 | 1.000 | 1.000 | 1.000 | 0.006 | 0.006 | 0.011 | 65.00 |
| 12 | 70.00 | 0.317 | 2.847 | 1.024 | 16.078 | -0.485 | 2.141 | 0.112 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.335 | 2.793 | 1.016 | 16.073 | -0.485 | 2.293 | 0.130 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.405 | 2.727 | 1.012 | 16.073 | -0.489 | 2.476 | 0.145 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.329 | 2.643 | 1.010 | 16.068 | -0.497 | 2.659 | 0.162 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.359 | 2.549 | 1.009 | 16.068 | -0.503 | 2.899 | 0.170 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.314 | 2.456 | 1.004 | 16.063 | -0.507 | 3.125 | 0.661 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.411 | 2.347 | 0.981 | 16.058 | -0.499 | 3.314 | 0.177 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.370 | 2.282 | 0.959 | 16.058 | -0.487 | 3.637 | 0.163 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.303 | 2.166 | 0.930 | 16.053 | -0.465 | 4.058 | 0.161 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.268 | 2.086 | 0.884 | 16.053 | -0.427 | 4.413 | 0.153 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.258 | 2.053 | 0.870 | 16.058 | -0.433 | 4.766 | 0.146 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.290 | 2.053 | 0.842 | 16.058 | -0.421 | 5.128 | 0.149 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.269 | 2.016 | 0.806 | 16.058 | -0.408 | 5.540 | 0.147 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.313 | 1.994 | 0.759 | 16.063 | -0.383 | 5.936 | 0.158 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.357 | 1.911 | 0.729 | 16.063 | -0.370 | 6.306 | 0.145 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.358 | 1.850 | 0.686 | 16.063 | -0.339 | 6.956 | 0.142 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.410 | 1.801 | 0.644 | 16.063 | -0.310 | 7.276 | 0.155 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.368 | 1.759 | 0.598 | 12.103 | -0.278 | 7.801 | 0.155 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.344 | 1.715 | 0.564 | 12.098 | -0.250 | 8.283 | 0.157 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.347 | 1.681 | 0.525 | 12.093 | -0.227 | 8.841 | 0.160 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.342 | 1.715 | 0.487 | 12.088 | -0.199 | 9.166 | 0.166 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.384 | 1.743 | 0.444 | 12.083 | -0.170 | 9.506 | 0.171 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.411 | 1.766 | 0.406 | 12.073 | -0.151 | 9.958 | 0.171 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.414 | 1.786 | 0.363 | 12.058 | -0.128 | 10.270 | 0.170 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.383 | 1.795 | 0.321 | 12.048 | -0.106 | 10.517 | 0.167 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.346 | 1.792 | 0.280 | 12.038 | -0.087 | 10.784 | 0.159 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.388 | 1.789 | 0.239 | 8.078 | -0.068 | 11.030 | 0.162 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.466 | 1.772 | 0.202 | 8.068 | -0.051 | 11.222 | 0.180 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.442 | 1.760 | 0.155 | 11.993 | -0.048 | 11.439 | 0.162 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.434 | 1.755 | 0.118 | 8.053 | -0.034 | 11.579 | 0.166 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.447 | 1.749 | 0.077 | 8.043 | -0.026 | 11.740 | 0.165 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 43 | 650.00 | 0.504 | 1.746 | 0.036 | 8.038 | -0.015 | 11.975 | 0.170 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.571 | 1.754 | 1.090 | | | | | | | GROUND SURFACE SETTLEMENT | | | 0.035 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 7

FOR SECOND COMPONENT

HISTORY OF ACCELERATION AT TOP OF LAYER 1 IS SAVED IN OUTPUT FILE NUMBER 8

**********
NEXT INPUT MOTION
**********

**********
THE TIMESTEP HAS BEEN REDUCED BY A FACTOR OF 2
IN ORDER TO MEET THE COURANT STABILITY CRITERION
ALTERNATELY YOU MAY INCREASE THE LAYER THICKNESS(ES)
**********

**********
OUTPUT FOR YAR060
WITH A PEAK ACCELERATION OF 0.94 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.328 | 3.150 | 1.145 | 21.492 | -0.671 | 0.079 | 0.009 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.321 | 3.148 | 1.144 | 21.492 | -0.670 | 0.247 | 0.065 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.311 | 3.139 | 1.141 | 21.492 | -0.669 | 0.425 | 0.133 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.334 | 3.136 | 1.131 | 21.492 | -0.661 | 0.590 | 0.188 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.328 | 3.130 | 1.119 | 21.492 | -0.651 | 0.758 | 0.244 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.306 | 3.120 | 1.109 | 21.492 | -0.642 | 0.914 | 0.279 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.300 | 3.100 | 1.091 | 21.492 | -0.629 | 1.079 | 0.315 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.334 | 3.065 | 1.075 | 21.492 | -0.614 | 1.222 | 0.316 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.300 | 3.020 | 1.061 | 21.492 | -0.602 | 1.446 | 0.173 | 1.000 | 1.000 | 1.000 | 0.019 | 0.019 | 0.014 | 45.00 |
| 10 | 50.00 | 0.273 | 2.964 | 1.059 | 21.492 | -0.604 | 1.712 | 0.155 | 1.000 | 1.000 | 1.000 | 0.010 | 0.010 | 0.012 | 55.00 |
| 11 | 60.00 | 0.298 | 2.908 | 1.051 | 21.497 | -0.604 | 1.927 | 0.159 | 1.000 | 1.000 | 1.000 | 0.006 | 0.006 | 0.012 | 65.00 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | 70.00 | 0.331 | 2.852 | 1.046 | 21.497 | -0.606 | 2.089 | 0.122 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.306 | 2.791 | 1.039 | 21.497 | -0.605 | 2.250 | 0.132 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.327 | 2.729 | 1.034 | 21.497 | -0.604 | 2.379 | 0.135 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.351 | 2.697 | 1.019 | 21.497 | -0.599 | 2.590 | 0.161 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.350 | 2.675 | 1.005 | 25.951 | -0.591 | 2.802 | 0.172 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.348 | 2.669 | 0.975 | 21.497 | -0.560 | 2.905 | 0.782 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.501 | 2.643 | 0.805 | 21.497 | -0.376 | 3.123 | 0.204 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.372 | 2.622 | 0.770 | 21.497 | -0.350 | 3.626 | 0.186 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.279 | 2.561 | 0.726 | 21.497 | -0.325 | 4.179 | 0.209 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.287 | 2.490 | 0.656 | 21.497 | -0.262 | 4.532 | 0.199 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.315 | 2.430 | 0.595 | 21.497 | -0.203 | 4.854 | 0.198 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.311 | 2.360 | 0.540 | 21.492 | -0.161 | 5.179 | 0.193 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.315 | 2.327 | 0.518 | 21.492 | -0.145 | 5.478 | 0.192 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.313 | 2.302 | 0.491 | 21.492 | -0.133 | 5.801 | 0.185 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.288 | 2.295 | 0.455 | 21.497 | -0.107 | 6.063 | 0.177 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.317 | 2.273 | 0.430 | 21.507 | -0.093 | 6.357 | 0.177 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.311 | 2.252 | 0.417 | 21.502 | -0.088 | 6.613 | 0.176 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.349 | 2.207 | 0.398 | 21.502 | -0.079 | 6.810 | 0.177 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.339 | 2.169 | 0.378 | 21.502 | -0.077 | 6.922 | 0.163 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.348 | 2.134 | 0.360 | 21.502 | -0.082 | 7.009 | 0.120 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.354 | 2.085 | 0.342 | 25.811 | -0.085 | 7.199 | 0.118 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.360 | 2.039 | 0.320 | 25.811 | -0.085 | 7.396 | 0.120 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.390 | 1.982 | 0.291 | 25.801 | -0.074 | 7.582 | 0.122 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.401 | 1.931 | 0.267 | 25.801 | -0.076 | 7.720 | 0.117 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.406 | 1.909 | 0.244 | 25.801 | -0.070 | 7.880 | 0.120 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.408 | 1.885 | 0.220 | 25.776 | -0.067 | 8.117 | 0.118 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.465 | 1.803 | 0.189 | 25.796 | -0.060 | 8.325 | 0.121 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.496 | 1.728 | 0.159 | 25.756 | -0.050 | 8.463 | 0.110 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.528 | 1.702 | 0.111 | 10.958 | -0.026 | 8.676 | 0.120 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.557 | 1.641 | 0.084 | 10.953 | -0.018 | 8.642 | 0.124 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.584 | 1.616 | 0.060 | 17.588 | -0.022 | 8.901 | 0.123 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.603 | 1.590 | 0.034 | 17.578 | -0.008 | 9.027 | 0.127 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.577 | 1.590 | 1.062 | | | | | | GROUND SURFACE SETTLEMENT | | | | 0.038 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

**********
OUTPUT FOR YAR330
WITH A PEAK ACCELERATION OF 0.94 G
AND SLOPE = 0.00
**********

**********
MAXIMUM RESPONSE VALUES AT TOP OF OR IN EACH LAYER
**********

| LAYER NO. | DEPTH TO TOP | AMAX | VMAX | DMAXR | TIME | DFINALR | TAUMAX | CYCLIC GAMMAX | FINAL DELTA | FINAL DETAG | FINAL DETAU | UMAX | UFINAL | SETTLE | DEPTH TO MIDLAYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.356 | 3.016 | 1.077 | 26.766 | -0.532 | 0.085 | 0.010 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 2.00 |
| 2 | 4.00 | 0.340 | 3.009 | 1.077 | 26.766 | -0.531 | 0.268 | 0.064 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 7.00 |
| 3 | 10.00 | 0.355 | 2.934 | 1.081 | 26.756 | -0.536 | 0.453 | 0.140 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 12.50 |
| 4 | 15.00 | 0.346 | 2.849 | 1.086 | 26.746 | -0.543 | 0.627 | 0.203 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 17.50 |
| 5 | 20.00 | 0.327 | 2.746 | 1.097 | 26.741 | -0.555 | 0.808 | 0.253 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 22.50 |
| 6 | 25.00 | 0.344 | 2.640 | 1.112 | 26.731 | -0.572 | 0.972 | 0.301 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 27.50 |
| 7 | 30.00 | 0.324 | 2.548 | 1.132 | 26.726 | -0.592 | 1.145 | 0.334 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 32.50 |
| 8 | 35.00 | 0.326 | 2.453 | 1.155 | 26.721 | -0.618 | 1.294 | 0.352 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 37.50 |
| 9 | 40.00 | 0.315 | 2.376 | 1.177 | 26.711 | -0.642 | 1.519 | 0.186 | 1.000 | 1.000 | 1.000 | 0.019 | 0.019 | 0.014 | 45.00 |
| 10 | 50.00 | 0.279 | 2.299 | 1.195 | 26.711 | -0.664 | 1.787 | 0.166 | 1.000 | 1.000 | 1.000 | 0.010 | 0.010 | 0.012 | 55.00 |
| 11 | 60.00 | 0.312 | 2.232 | 1.212 | 26.711 | -0.683 | 2.027 | 0.154 | 1.000 | 1.000 | 1.000 | 0.006 | 0.006 | 0.012 | 65.00 |
| 12 | 70.00 | 0.316 | 2.196 | 1.225 | 26.711 | -0.702 | 2.173 | 0.124 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 75.00 |
| 13 | 80.00 | 0.360 | 2.205 | 1.223 | 26.706 | -0.704 | 2.326 | 0.137 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 85.00 |
| 14 | 90.00 | 0.373 | 2.199 | 1.221 | 26.706 | -0.710 | 2.480 | 0.159 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 95.00 |
| 15 | 100.00 | 0.316 | 2.187 | 1.212 | 26.706 | -0.706 | 2.634 | 0.181 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 105.00 |
| 16 | 110.00 | 0.324 | 2.180 | 1.201 | 26.706 | -0.700 | 2.764 | 0.196 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 115.00 |
| 17 | 120.00 | 0.343 | 2.162 | 1.178 | 26.706 | -0.682 | 2.949 | 0.988 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 125.00 |
| 18 | 130.00 | 0.493 | 2.143 | 1.030 | 26.706 | -0.551 | 3.153 | 0.216 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 135.00 |
| 19 | 140.00 | 0.391 | 2.117 | 1.002 | 26.701 | -0.533 | 3.517 | 0.193 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 150.00 |
| 20 | 160.00 | 0.362 | 2.028 | 0.973 | 26.701 | -0.518 | 3.968 | 0.180 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 170.00 |
| 21 | 180.00 | 0.368 | 1.977 | 0.920 | 26.696 | -0.484 | 4.414 | 0.183 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 190.00 |
| 22 | 200.00 | 0.368 | 1.888 | 0.867 | 26.691 | -0.449 | 4.832 | 0.176 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 210.00 |
| 23 | 220.00 | 0.387 | 1.844 | 0.821 | 26.686 | -0.423 | 5.203 | 0.173 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 230.00 |
| 24 | 240.00 | 0.381 | 1.829 | 0.787 | 26.681 | -0.420 | 5.478 | 0.156 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 250.00 |
| 25 | 260.00 | 0.382 | 1.830 | 0.732 | 26.676 | -0.390 | 5.709 | 0.148 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 270.00 |
| 26 | 280.00 | 0.389 | 1.827 | 0.693 | 26.666 | -0.383 | 5.897 | 0.137 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 290.00 |
| 27 | 300.00 | 0.398 | 1.818 | 0.657 | 26.656 | -0.368 | 6.050 | 0.139 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 310.00 |
| 28 | 320.00 | 0.403 | 1.811 | 0.611 | 26.646 | -0.345 | 6.199 | 0.139 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 330.00 |
| 29 | 340.00 | 0.389 | 1.787 | 0.569 | 26.636 | -0.331 | 6.474 | 0.143 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 350.00 |
| 30 | 360.00 | 0.388 | 1.774 | 0.541 | 26.621 | -0.326 | 6.544 | 0.137 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 370.00 |
| 31 | 380.00 | 0.408 | 1.759 | 0.504 | 26.611 | -0.306 | 6.703 | 0.136 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 390.00 |
| 32 | 400.00 | 0.425 | 1.742 | 0.474 | 26.596 | -0.287 | 6.947 | 0.136 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 410.00 |
| 33 | 420.00 | 0.441 | 1.714 | 0.432 | 26.586 | -0.268 | 7.247 | 0.112 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 430.00 |
| 34 | 440.00 | 0.442 | 1.692 | 0.389 | 26.576 | -0.239 | 7.568 | 0.115 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 450.00 |
| 35 | 460.00 | 0.410 | 1.668 | 0.343 | 26.571 | -0.208 | 7.895 | 0.113 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 470.00 |
| 36 | 480.00 | 0.438 | 1.643 | 0.309 | 29.351 | -0.186 | 8.249 | 0.113 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 490.00 |
| 37 | 500.00 | 0.410 | 1.616 | 0.281 | 29.346 | -0.167 | 8.452 | 0.110 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 512.50 |
| 38 | 525.00 | 0.458 | 1.569 | 0.222 | 29.341 | -0.121 | 8.656 | 0.117 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 537.50 |
| 39 | 550.00 | 0.484 | 1.569 | 0.172 | 12.543 | -0.079 | 8.959 | 0.120 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 562.50 |
| 40 | 575.00 | 0.541 | 1.602 | 0.131 | 12.538 | -0.038 | 9.187 | 0.116 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 587.50 |
| 41 | 600.00 | 0.576 | 1.648 | 0.100 | 12.533 | -0.030 | 9.436 | 0.122 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 612.50 |
| 42 | 625.00 | 0.612 | 1.697 | 0.070 | 16.973 | -0.016 | 9.613 | 0.121 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 637.50 |
| 43 | 650.00 | 0.642 | 1.709 | 0.028 | 12.518 | -0.010 | 9.812 | 0.124 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 660.00 |
| BASE | 670.00 | 0.638 | 1.709 | 0.976 | | | | | | GROUND SURFACE SETTLEMENT | | | | 0.038 | |

DFINALR IS FINAL RELATIVE DISPLACEMENT WHEN SLOPE IS ZERO AND INCREASE IN FRD IF SLOPE IS GREATER IS GREATER THAN ZERO
DMAX FOR BASE IS ABSOLUTE DISPACEMENT, OTHERS ARE RELATIVE DISPLACEMENT

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HISTORY OF ACCELERATION AT TOP OF LAYER  1 IS SAVED IN OUTPUT FILE NUMBER  9

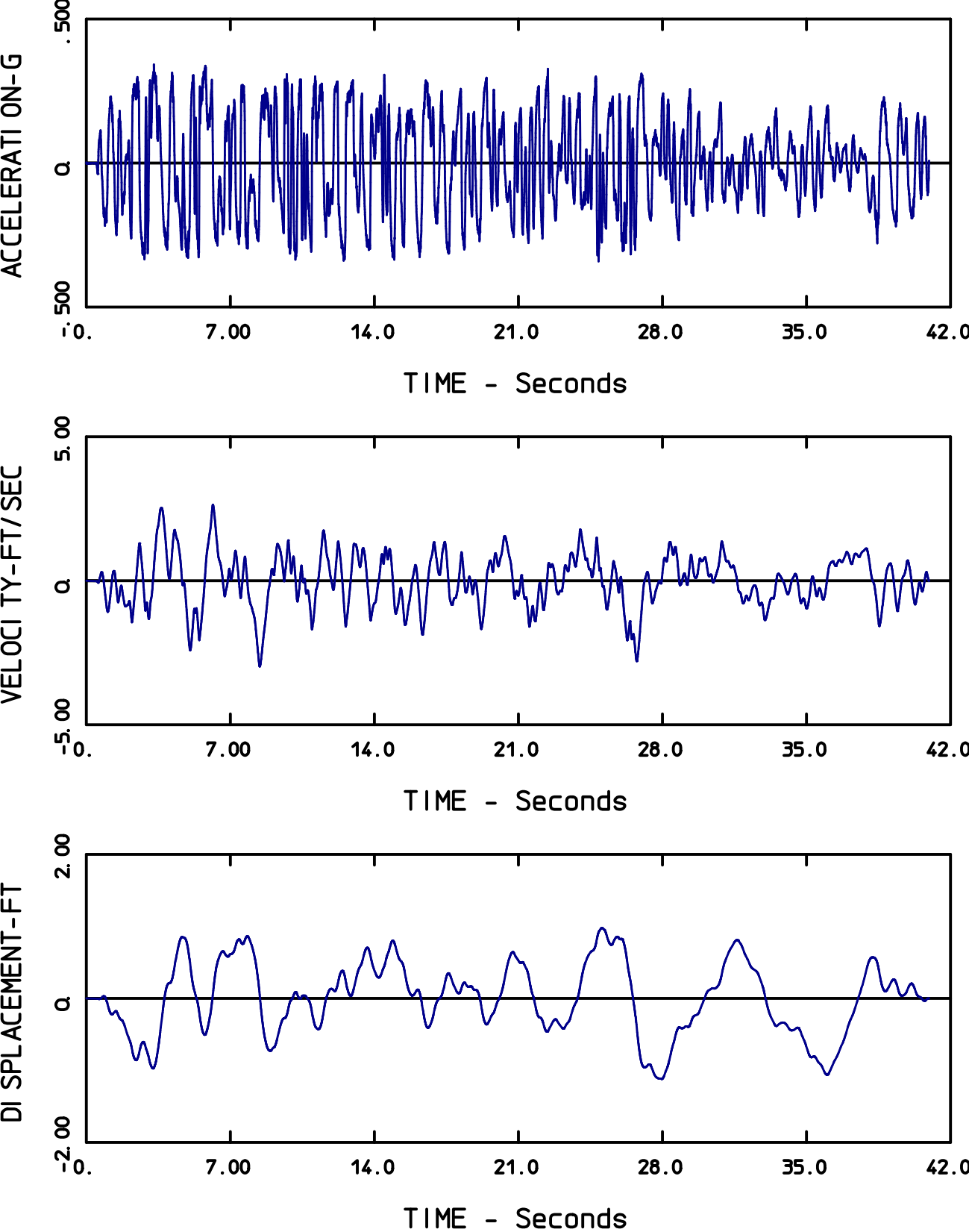
FOR SECOND COMPONENT

HISTORY OF ACCELERATION AT TOP OF LAYER  1 IS SAVED IN OUTPUT FILE NUMBER 10

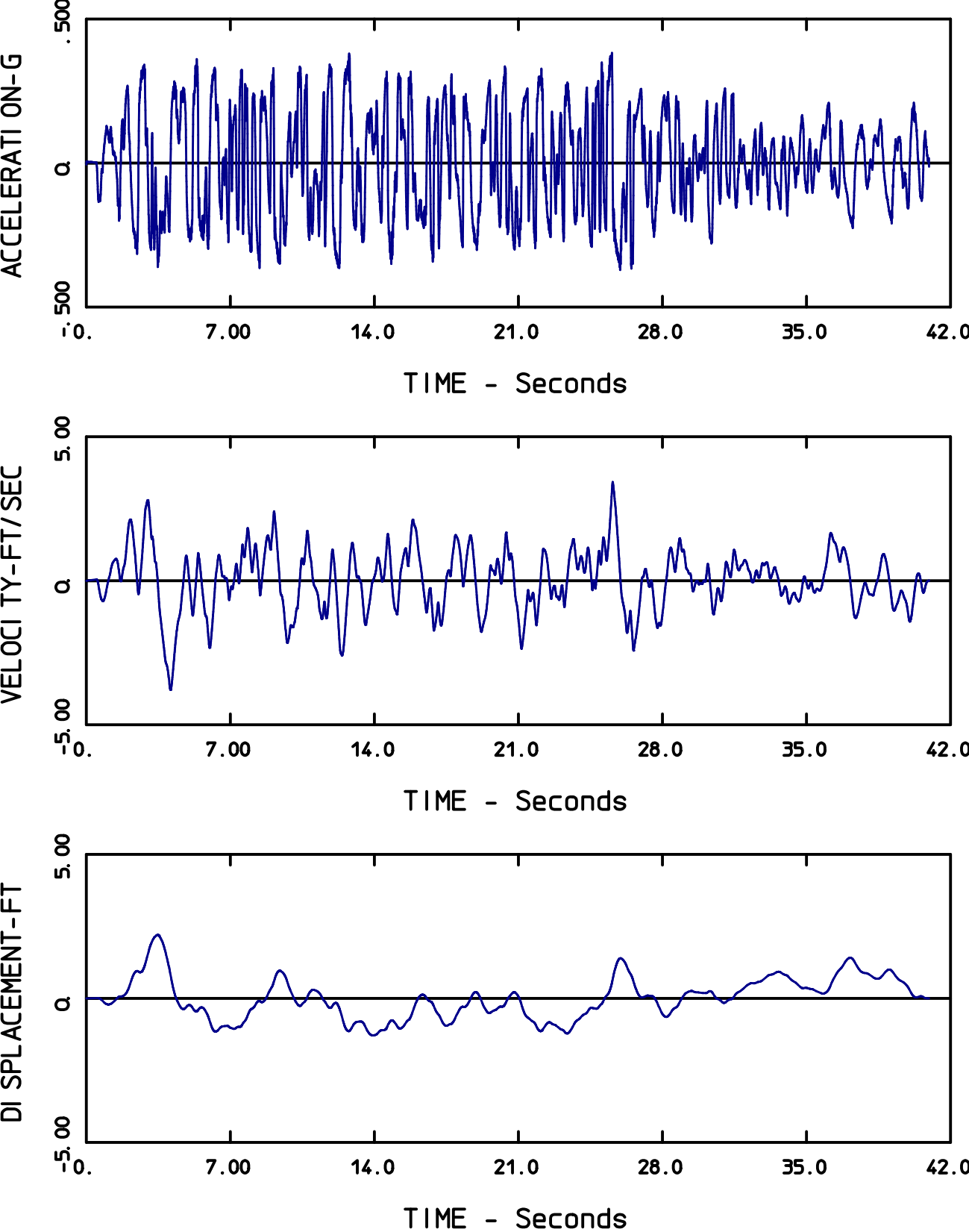

************************************
NORMAL TERMINATION FOR THIS INPUT FILE
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```

# Appendix E

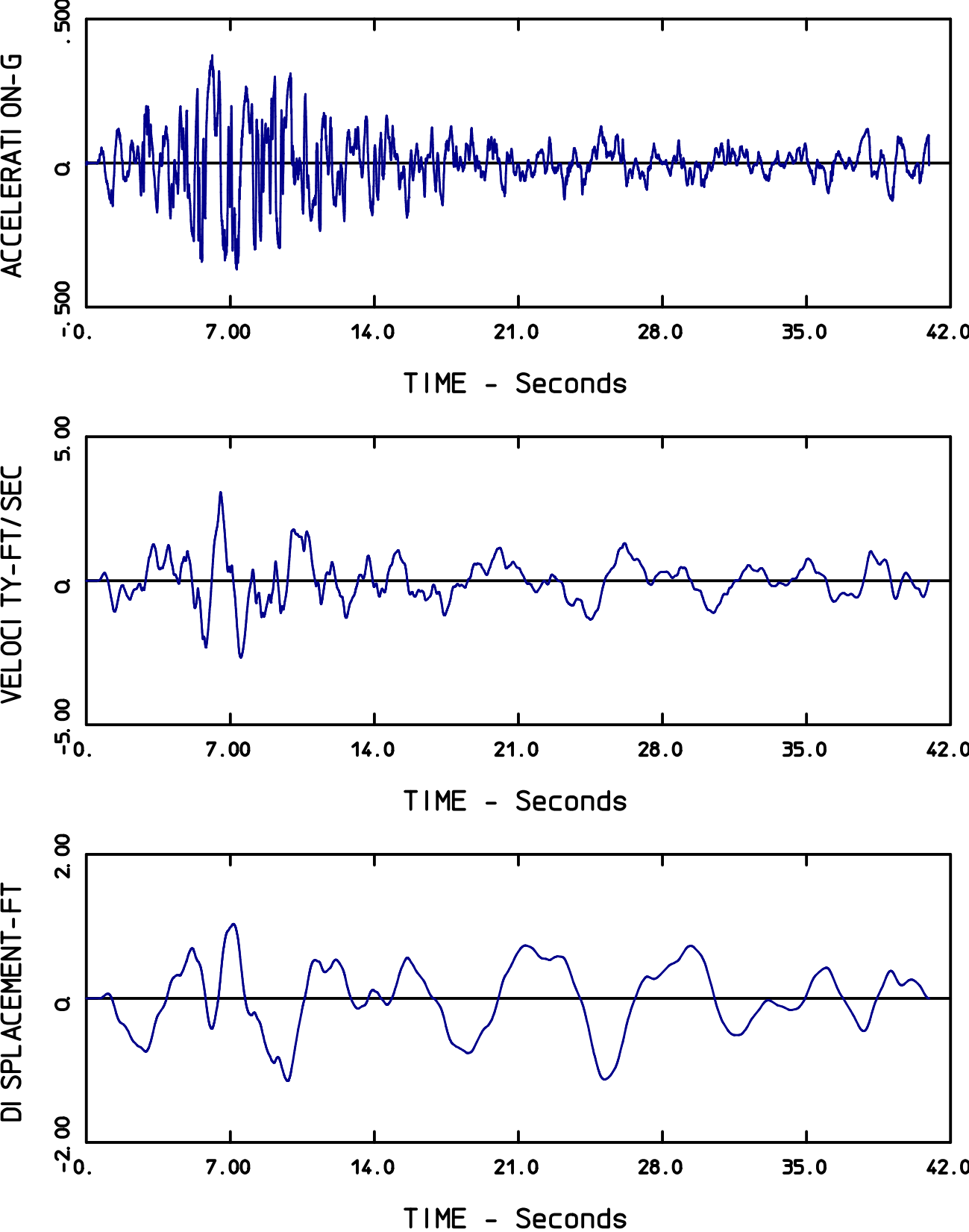
# Ground Surface Time History Plots



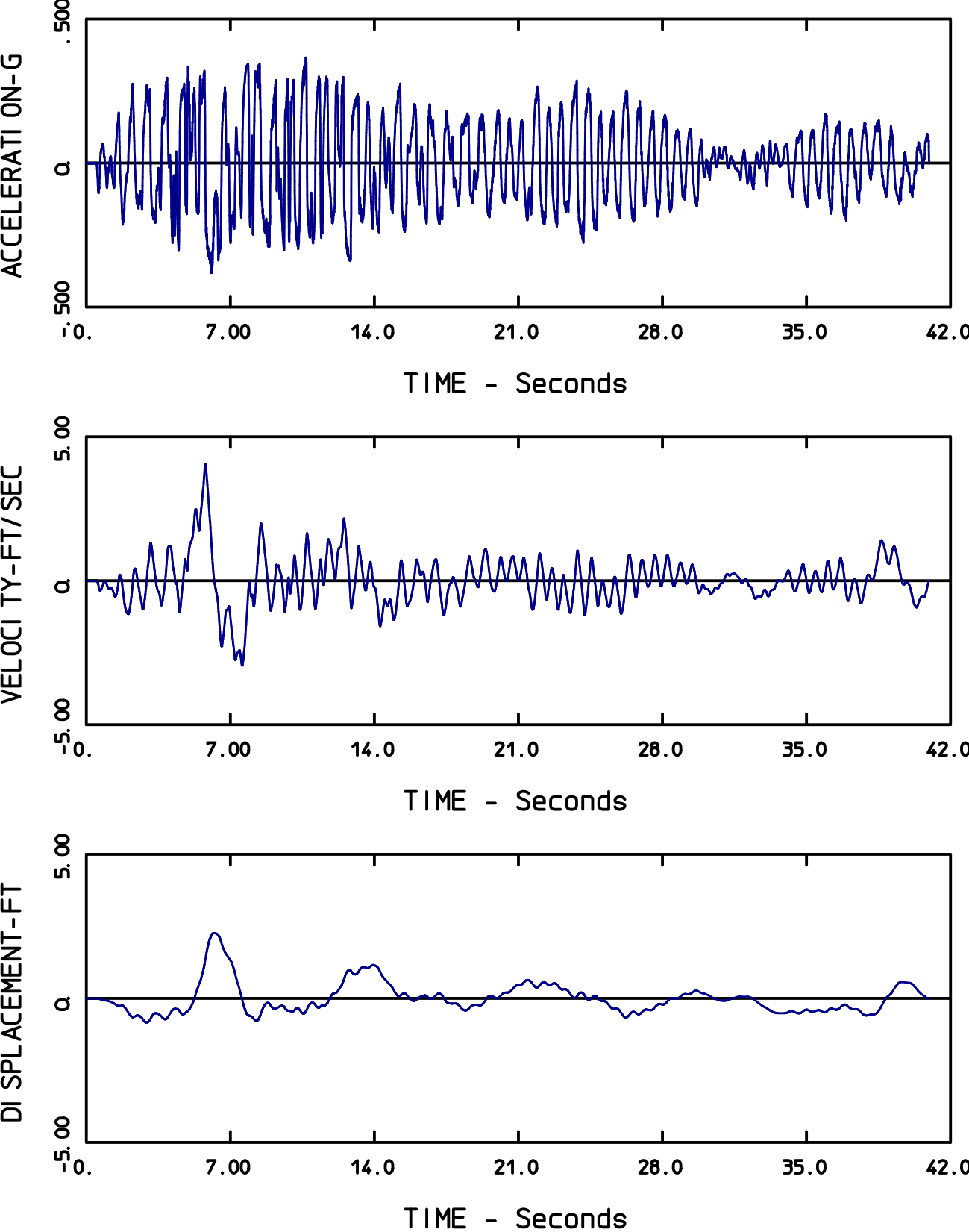

IV02180
Ground Surface Motion for tv670a



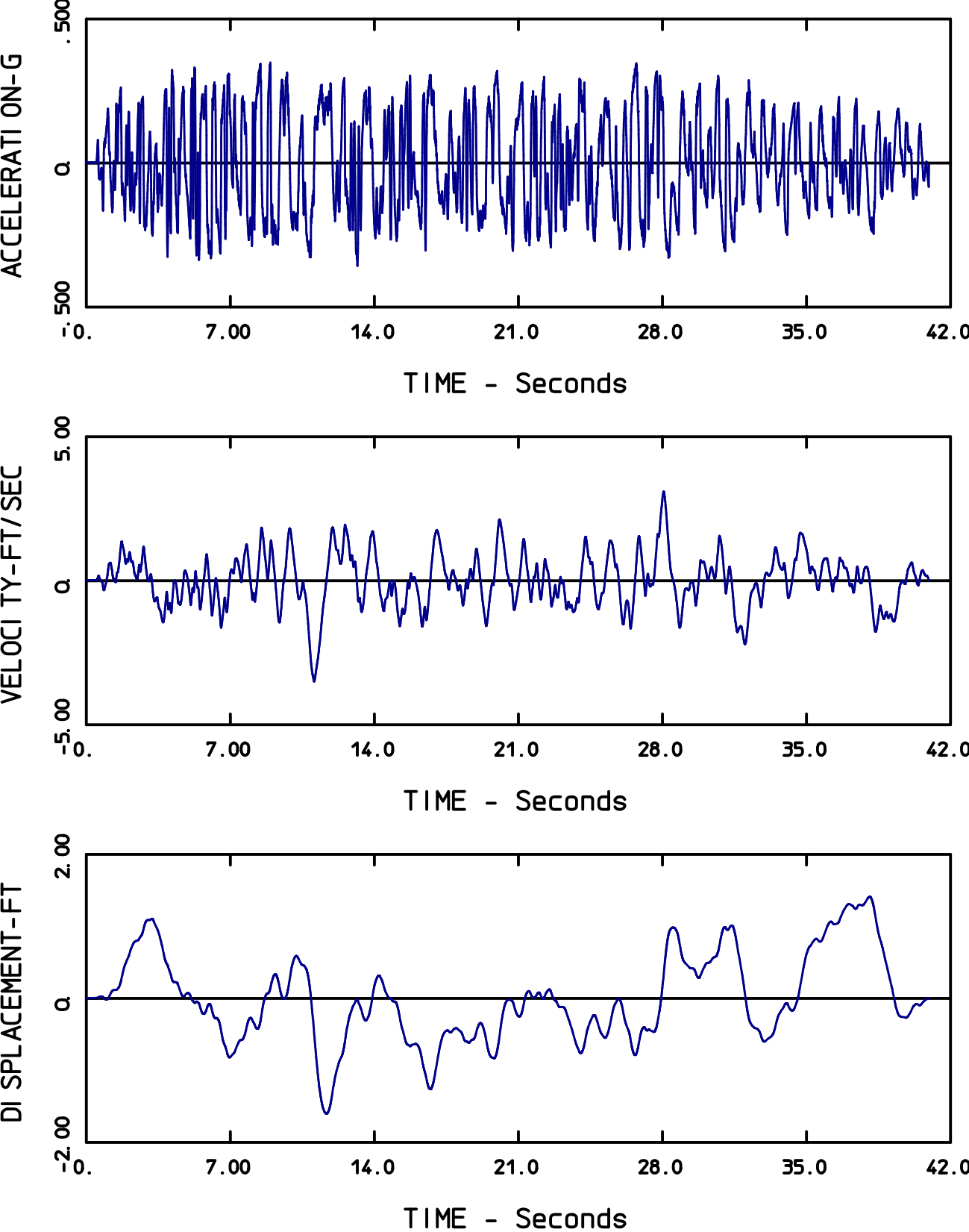

IV02270
Ground Surface Motion for tv670a



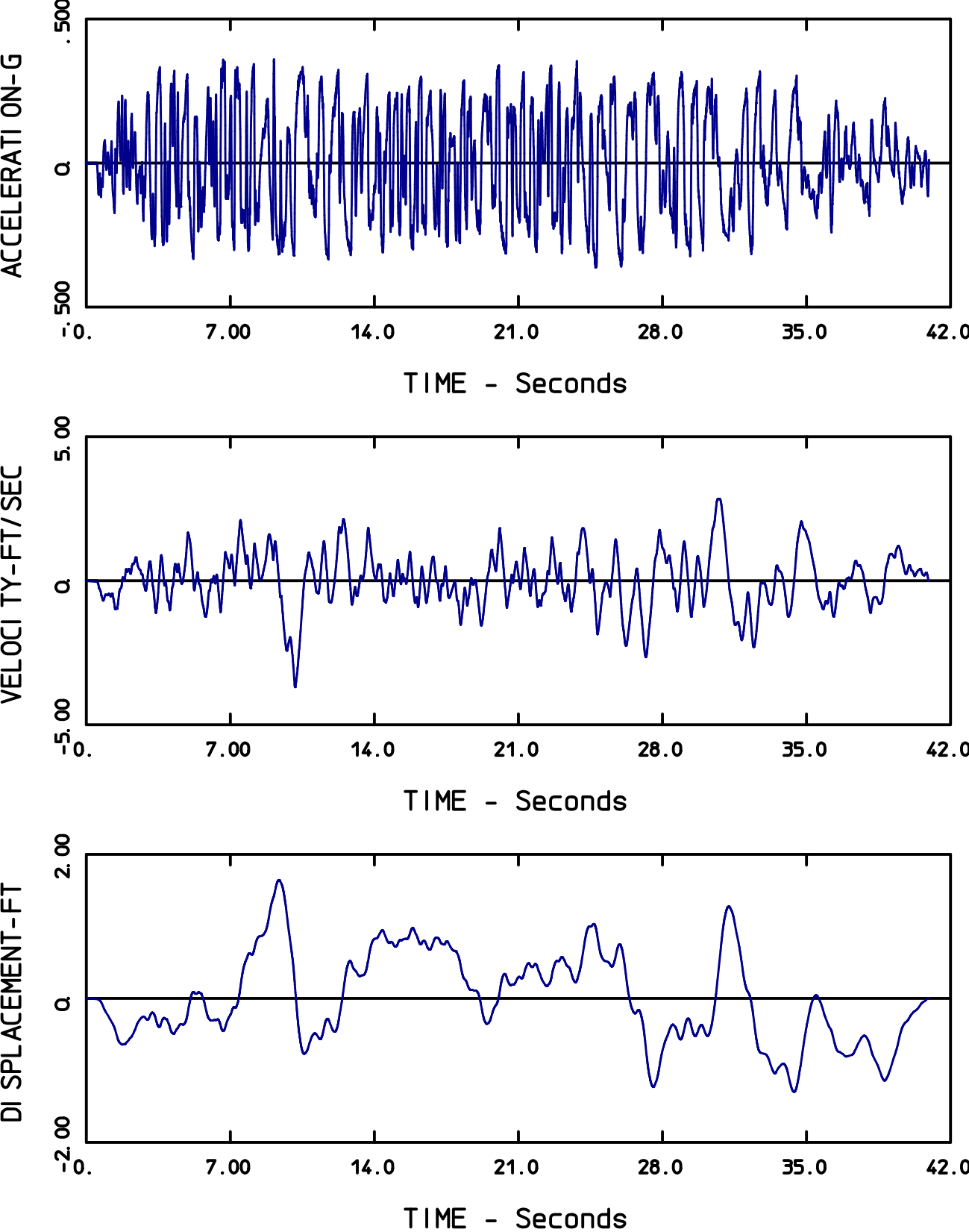

IVEC414gs
Ground Surface Motion for tv670a



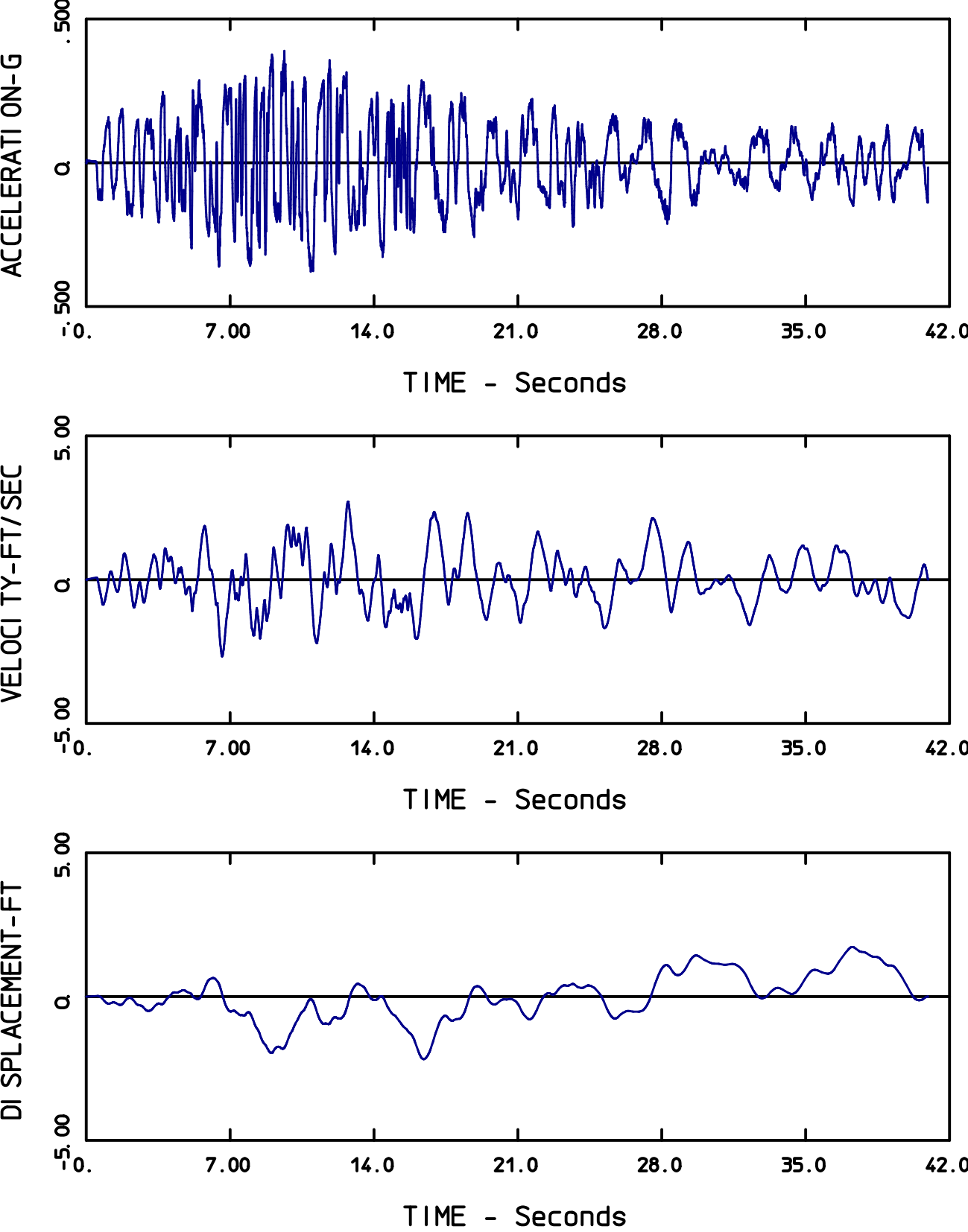

IVEC423gs
Ground Surface Motion for tv670a



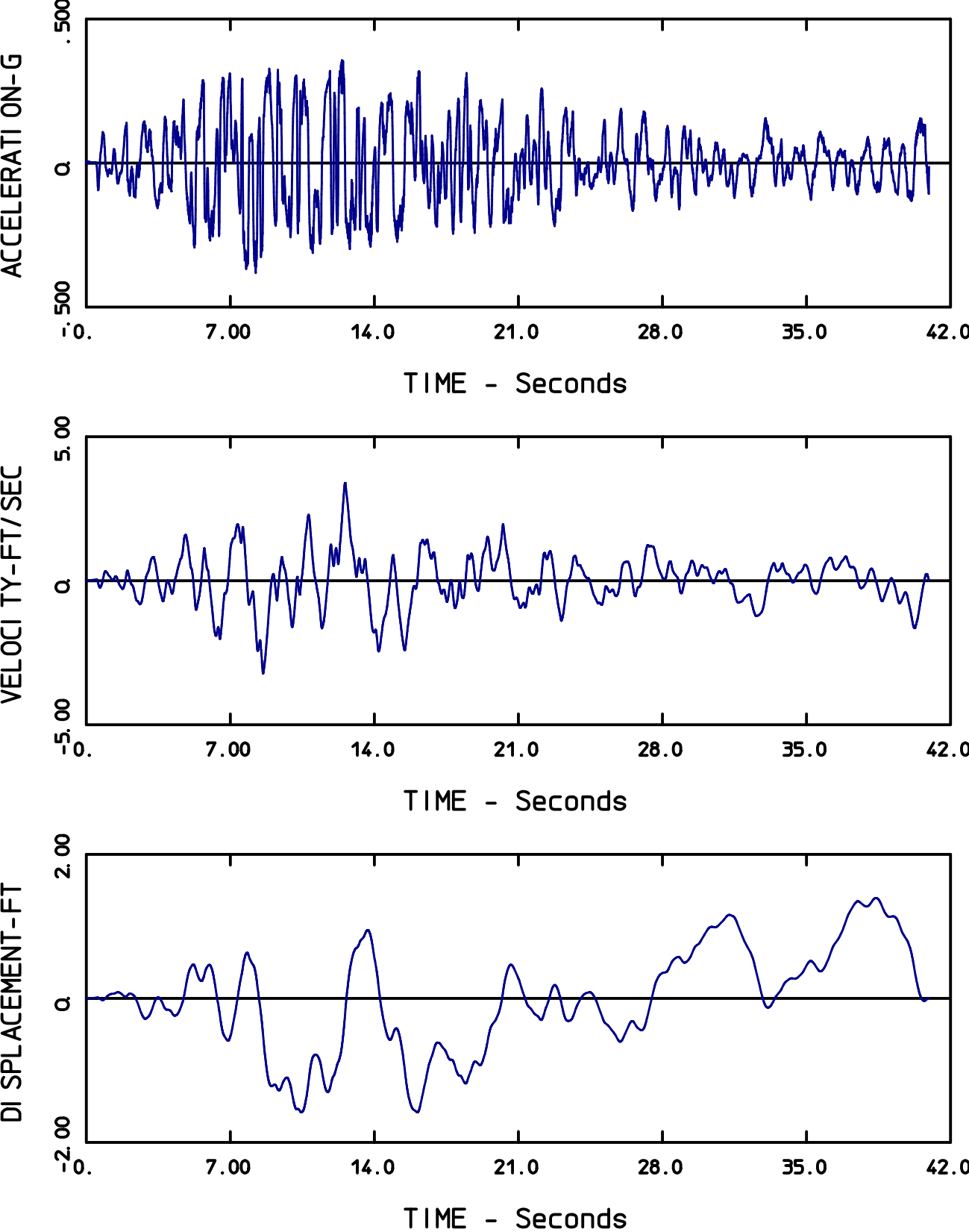

JOS000gs
Ground Surface Motion for tv670a



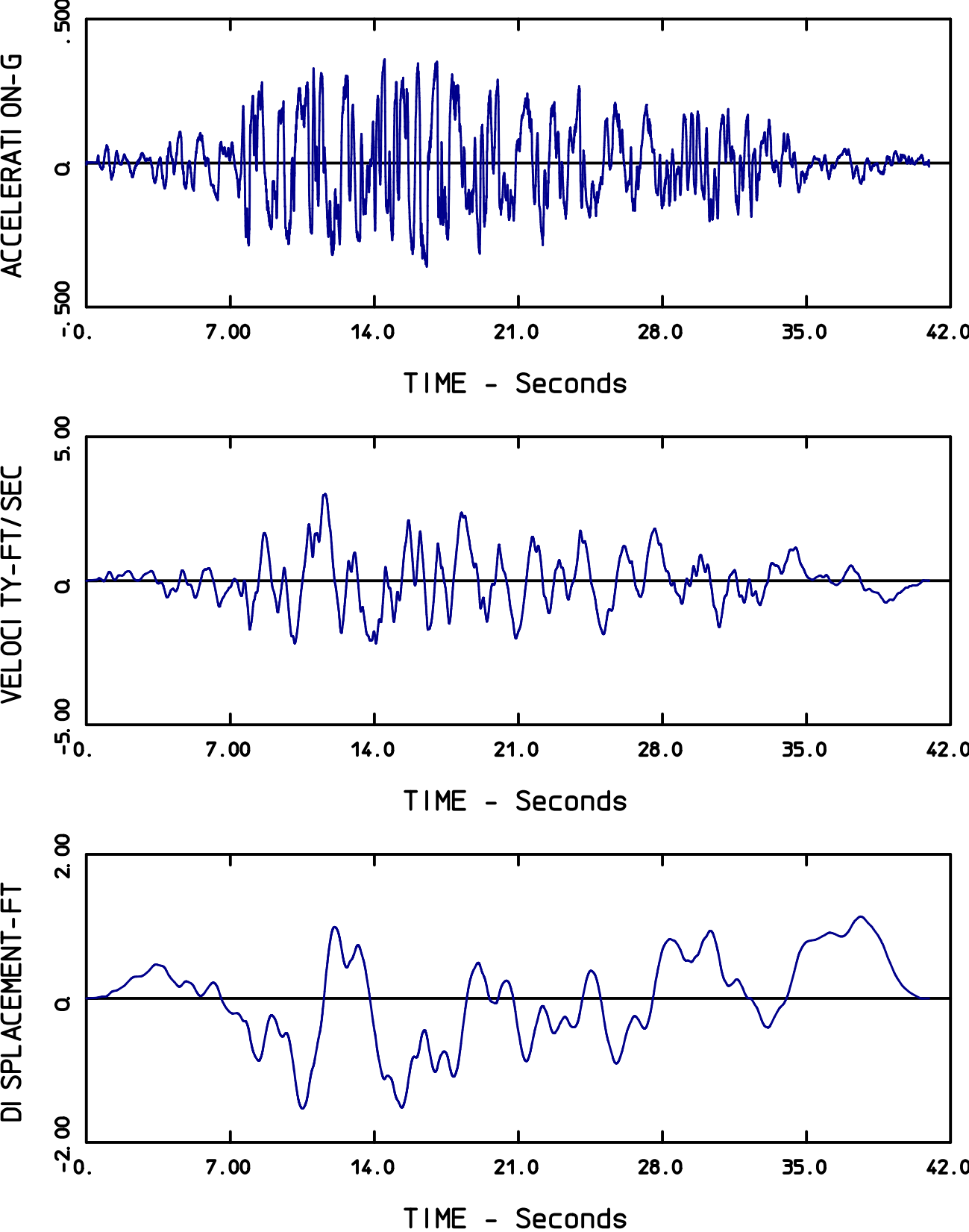

JOS090gs
Ground Surface Motion for tv670a



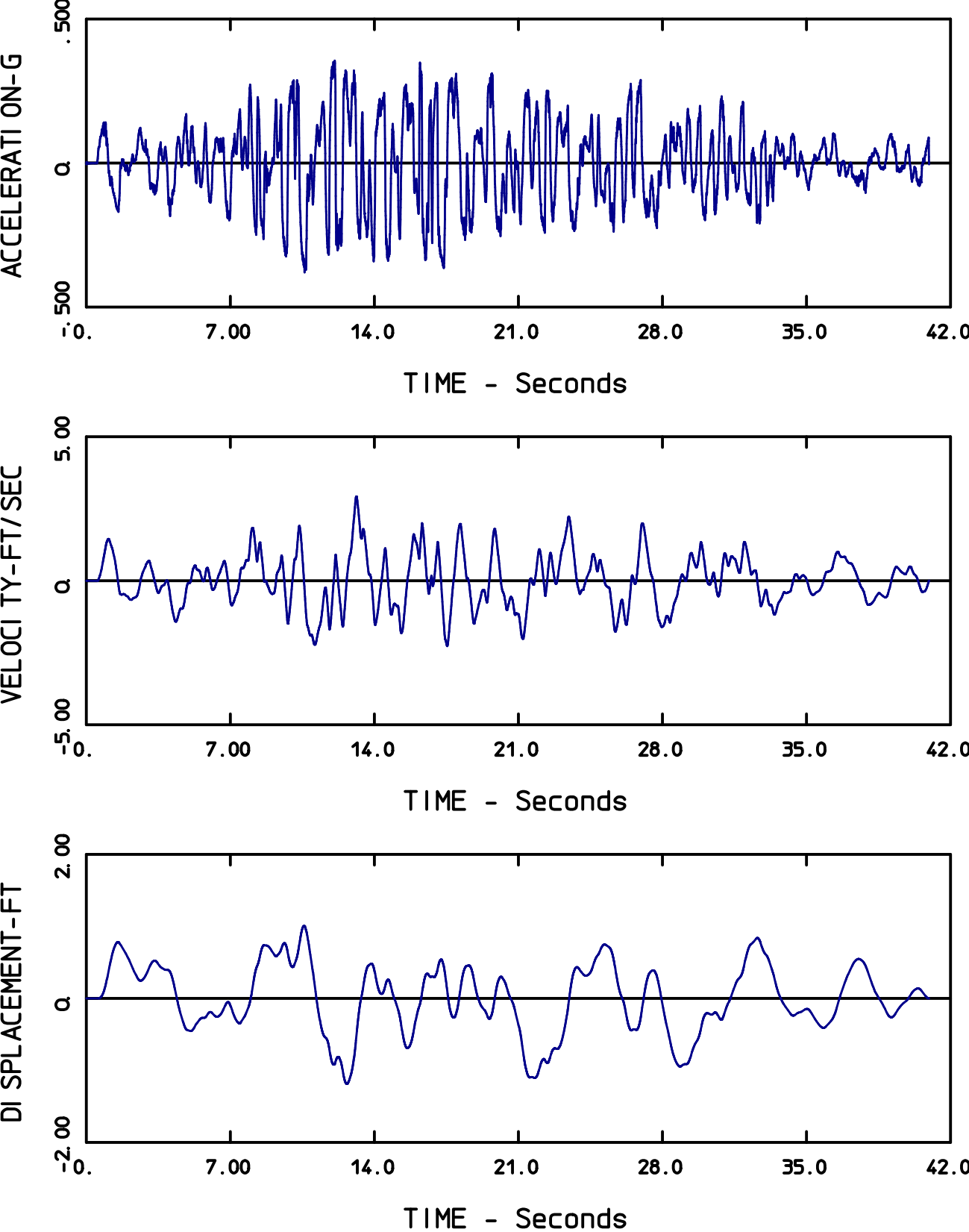

NIS000gs
Ground Surface Motion for tv670a




NIS090gs
Ground Surface Motion for tv670a




YAR060gs
Ground Surface Motion for tv670a




YAR330gs
Ground Surface Motion for tv670a

# Appendix F

## Excel Spreadsheets

**PEER NGAWest 2 Ground Motions**

**Excel Worksheet for Probabilistic Spectrum**

**Excel Worksheet for Deterministic Spectrum +**
**Code Site Class D Spectrum +**
**Recommended MCEr and Design Spectra**

# PACIFIC EARTHQUAKE ENGINEERING RESEARCH CENTER

## WEIGHTED AVERAGE of 2014 NGA WEST-2 GMPEs

**Last updated: 04 14 15**

*by Emel Seyhan, PhD, PEER & UCLA -- email: emel.seyhan@gmail.com, peer_center@berkeley.edu*

*This excel file will be updated as necessary on the PEER website to fix any typos or other errors. Please check the website frequently for new versions at: http://peer.berkeley.edu/ngawest2/databases/*

| Legend | Pre-defined option | Main input variable | Calculated variable | Input var. flag | Internal variable |
|---|---|---|---|---|---|

| | | |
|---|---|---|
| GMPE averaging | Geometric | *Weighted average of the natural logarithm of the spectral values* |

| GMPEs | ASK14 | BSSA14 | CB14 | CY14 | I14 |
|---|---|---|---|---|---|
| Weight | 0.25 | 0.25 | 0.25 | 0.25 | 0 |

| | |
|---|---|
| # of std. dev. | 1 |
| Damping ratio (%) | 5 |

*Modification factors are calculated in Sheet DSF*

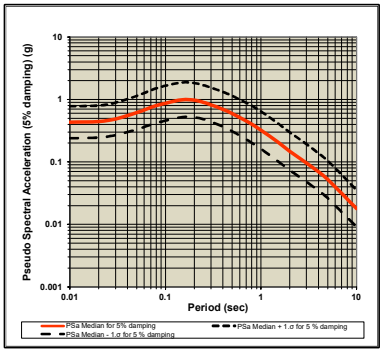
***ASK14*** Abrahamson & Silva & Kamai 2014 NGA West-2 Model
***BSSA14*** Boore & Stewart & Seyhan & Atkinson 2014 NGA West-2 Model
***CB14*** Campbell & Bozorgnia 2014 NGA West-2 Model
***CY14*** Chiou & Youngs 2014 NGA West-2 Model
***I14*** Idriss 2014 NGA West-2 Model

## RotD50 Horizontal Component of PGA, PGV and *IMs*

**Input variables** | **Errors and warnings**

| | | Baseline: 5% Damping | | | | User defined: 5% Damping | | | |
|---|---|---|---|---|---|---|---|---|---|
| GMP | T (s) | PSa Median for 5% damping | PSa Median + 1.σ for 5% damping | PSa Median - 1.σ for 5% damping | $S_d$ Median for 5% damping | PSa Median for 5% damping | PSa Median + 1.σ for 5 % damping | PSa Median - 1.σ for 5 % damping | Sd Median for 5 % damping |
| | 0.01 | 0.43179 | 0.77732 | 0.23986 | 0.00107 | 0.43179 | 0.77732 | 0.23986 | 0.00107 |
| | 0.02 | 0.44314 | 0.79946 | 0.24563 | 0.00440 | 0.44314 | 0.79946 | 0.24563 | 0.00440 |
| | 0.03 | 0.48951 | 0.89201 | 0.26863 | 0.01094 | 0.48902 | 0.89112 | 0.26836 | 0.01093 |
| | 0.05 | 0.61449 | 1.14037 | 0.33112 | 0.03814 | 0.61449 | 1.14037 | 0.33112 | 0.03814 |
| | 0.075 | 0.76945 | 1.45454 | 0.40704 | 0.10744 | 0.77099 | 1.45745 | 0.40785 | 0.10766 |
| | 0.1 | 0.86818 | 1.65091 | 0.45656 | 0.21551 | 0.87079 | 1.65587 | 0.45793 | 0.21616 |
| | 0.15 | 0.98833 | 1.87038 | 0.52225 | 0.55202 | 0.99031 | 1.87412 | 0.52329 | 0.55312 |
| | 0.2 | 0.97177 | 1.82496 | 0.51746 | 0.96492 | 0.97372 | 1.82861 | 0.51849 | 0.96685 |
| | 0.25 | 0.90002 | 1.68074 | 0.48195 | 1.39636 | 0.90362 | 1.68746 | 0.48388 | 1.40194 |
| | 0.3 | 0.82120 | 1.54205 | 0.43732 | 1.83468 | 0.82203 | 1.54360 | 0.43776 | 1.83651 |
| | 0.4 | 0.69536 | 1.31640 | 0.36731 | 2.76184 | 0.69675 | 1.31903 | 0.36805 | 2.76736 |
| | 0.5 | 0.59470 | 1.14095 | 0.30998 | 3.69068 | 0.59530 | 1.14209 | 0.31029 | 3.69437 |
| | 0.75 | 0.42538 | 0.83911 | 0.21565 | 5.93975 | 0.42538 | 0.83911 | 0.21565 | 5.93975 |
| | 1 | 0.32343 | 0.64569 | 0.16201 | 8.02881 | 0.32311 | 0.64504 | 0.16185 | 8.02078 |
| | 1.5 | 0.20717 | 0.41630 | 0.10310 | 11.57124 | 0.20717 | 0.41630 | 0.10310 | 11.57124 |
| | 2 | 0.14862 | 0.29892 | 0.07389 | 14.75678 | 0.14832 | 0.29832 | 0.07374 | 14.72727 |
| | 3 | 0.09618 | 0.19321 | 0.04788 | 21.48823 | 0.09609 | 0.19301 | 0.04783 | 21.46674 |
| | 4 | 0.06921 | 0.13758 | 0.03482 | 27.48933 | 0.06914 | 0.13744 | 0.03478 | 27.46184 |
| | 5 | 0.05261 | 0.10479 | 0.02641 | 32.65066 | 0.05245 | 0.10448 | 0.02633 | 32.55271 |
| | 7.5 | 0.02826 | 0.05614 | 0.01423 | 39.46623 | 0.02821 | 0.05603 | 0.01420 | 39.38730 |
| | 10 | 0.01802 | 0.03546 | 0.00916 | 44.73621 | 0.01795 | 0.03532 | 0.00912 | 44.55726 |
| PGA (g) | 0 | 0.42974 | 0.77301 | 0.23891 | 0.00107 | 0.42974 | 0.77301 | 0.23891 | 0.00107 |
| PGV (cm/s) | -1 | 44.32966 | 80.81373 | 24.31664 | 0.11004 | NA | NA | NA | NA |

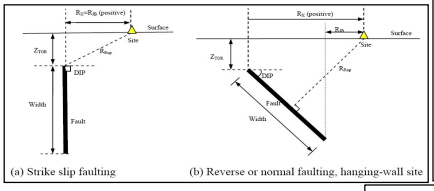
PSa (g), $S_d$ (cm)



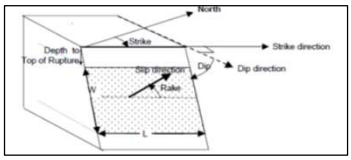

| | |
|---|---|
| $M_w$ | |
| 7.43 | |
| $R_{RUP}$ (km) | |
| 4.4 | |
| $R_{JB}$ (km) | |
| 4.4 | |
| $R_X$ (km) | |
| 4.4 | |
| Ry0 (km) | *If unknown use 999* |
| 0 | |
| $V_{S30}$ (m/sec) | |
| 750 | |
| U (BSSA13) | *1: Unspecified fault mech.* |
| 0 | |
| $F_{RV}$ | *1: reverse fault* |
| 0 | |
| $F_{NM}$ | *1: normal fault* |
| 0 | |
| $F_{HW}$ | *1: hanging wall side* |
| 0 | |
| Dip (deg) | |
| 90 | |
| $Z_{TOR}$ (km) | *If unknown use 999* |
| 0 | |
| $Z_{HYP}$ (km) | *If unknown use 999* |
| 999 | |
| $Z_{1.0}$ (km) | *If unknown use 999* |
| 999 | |
| $Z_{2.5}$ (km) | *If unknown use 999* |
| 999 | |
| W (km) | *If unknown use 999* |
| 8.9 | |
| Vs30Flag | |
| measured | *Choose options for $V_{S30}$ from the list* |
| $F_{AS}$ | |
| no | *Aftershock effect is not applicable.* |
| Region | |
| California | *Choose region from the list* |

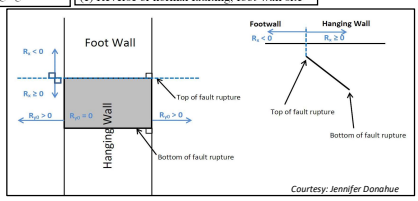
**Calculated Variables/Flags**

| | |
|---|---|
| ΔDPP | *Always 0 for median calcs.* |
| 0 | |
| PGA , (g) | |
| 0.394 | |
| $Z_{BOT}$ (km) (CB14) | *Enter for default W calcs* |
| 15 | |
| SS | |
| 1 | *auto calculated* |
| $V_{s30Flag}$ | |
| 1 | *measured* |
| $F_{AS}$ | |
| 0 | *Aftershock effect is not applicable.* |
| Region | |
| 0 | *California* |
| Option for Sa value | |
| 1 | *Weighted average of the natural logarithm of the spectral values* |




(a) Strike slip faulting (b) Reverse or normal faulting, hanging-wall site (c) Reverse or normal faulting, foot-wall site




**Definition of Parameters**

***Damping ratio*** = Viscous damping ratio (%) See Sanaz et al. (2012) PEER Report
***PSA*** = Pseudo-absolute acceleration response spectrum (g)
***PGA*** = Peak ground acceleration (g)
***PGV*** = Peak ground velocity (cm/s)
$S_d$ = Relative displacement response spectrum (cm)
$M_w$ = Moment magnitude
$R_{RUP}$ = Closest distance to coseismic rupture (km), used in ASK13, CB13 and CY13. See Figures a, b and c for illustation
$R_{JB}$ = Closest distance to surface projection of coseismic rupture (km). See Figures a, b and c for illustation
$R_X$ = Horizontal distance from top of rupture measured perpendicular to fault strike (km). See Figures a, b and c for illustation
$R_{y0}$ = The horizontal distance off the end of the rupture measured parallel to strike (km)
$V_{S30}$ = The average shear-wave velocity (m/s) over a subsurface depth of 30 m
***U*** = Unspecified-mechanism factor: 1 for unspecified; 0 otherwise
$F_{RV}$ = Reverse-faulting factor: 0 for strike slip, normal, normal-oblique; 1 for reverse, reverse-oblique and thrust
$F_{NM}$ = Normal-faulting factor: 0 for strike slip, reverse, reverse-oblique, thrust and normal-oblique; 1 for normal
$F_{HW}$ = Hanging-wall factor: 1 for site on down-dip side of top of rupture; 0 otherwise
***Dip*** = Average dip of rupture plane (degrees)
$Z_{TOR}$ = Depth to top of coseismic rupture (km)
$Z_{HYP}$ = Hypocentral depth from the earthquake
$Z_{1.0}$ = Depth to Vs=1 km/sec
$Z_{2.5}$ = Depth to Vs=2.5 km/sec
***W*** = Fault rupture width (km)
$V_{s30flag}$ = 1 for measured, 0 for inferred Vs30
$F_{AS}$ = 0 for mainshock; 1 for aftershock
***Region*** = Specific regions considered in the models, Click on Region to see codes
***ΔDPP*** = Directivity term, direct point parameter; uses 0 for median predictions
***PGA , (g)*** = Peak ground acceleration on rock (g), this specific cell is updated in the cell for BSSA14 and CB14, for others it is taken account for in the macros
$Z_{BOT}$ (km) = The depth to the bottom of the seismogenic crust
$Z_{BOR}$ (km) = The depth to the bottom of the rupture plane
***SS*** = 1 for strike slip, automatically updated in the cell

**Input variables with defaults (If entered 999 as input):**

*Red colored value: The value is used in the code when input is unknown*

| DEFAULTS | USER defined | ASK14 | BSSA14 | CB14 | CY14 | I14 |
|---|---|---|---|---|---|---|
| W (km) | 8.90 | | | 15.000 | | |
| $Z_{1.0}$ (km) | 999.000 | 0.052 | | | 0.044 | |
| $\delta Z_{1.0}$ (km) | 0.000 | | 0.000 | | | |
| $Z_{2.5}$ ($V_{S30}$=1100)(km) | 999.000 | | | 0.398 | | |
| $Z_{2.5}$ ($V_{S30}$)(km) | 999.000 | | | 0.616 | | |
| $Z_{TOR}$ (km) | 999.00 | | | 10.227 | | |
| $Z_{TOR}$ (km) | 0.00 | | | 0.000 | 0.000 | |
| $Z_{BOR}$ (km) | - | | | 15.000 | | |


## ACKNOWLEDGEMENTS

Nick Gregor, Bechtel
Silvia Mazzoni, Consultant
Sanaz Rezaeian, USGS

*All NGA West-2 participants are acknowledged for their constructive comments and feedback.*

Tri Valley Hospital

USGS probabilistic results for 2475 years and Site Class BC

| Period | Sa | Risk Factor | S&B Factor | SaRot100 | MCEr spectrum | |
|---|---|---|---|---|---|---|
| pga | 0.83 | 0.94 | 1.19 | 0.93 | 0.01 | 0.93 |
| 0.1 | 1.92 | 0.94 | 1.19 | 2.15 | 0.1 | 2.15 |
| 0.2 | 2.05 | 0.94 | 1.21 | 2.33 | 0.2 | 2.33 |
| 0.3 | 1.67 | 0.94 | 1.22 | 1.92 | 0.3 | 1.92 |
| 0.5 | 1.2 | 0.94 | 1.23 | 1.39 | 0.5 | 1.39 |
| 0.75 | 0.86 | 0.93 | 1.24 | 0.99 | 0.75 | 0.99 |
| 1 | 0.65 | 0.92 | 1.24 | 0.74 | 1 | 0.74 |
| 2 | 0.29 | 0.92 | 1.24 | 0.33 | 2 | 0.33 |
| 3 | 0.18 | 0.92 | 1.25 | 0.21 | 3 | 0.21 |
| 4 | 0.13 | 0.92 | 1.26 | 0.15 | 4 | 0.15 |
| 5 | 0.1 | 0.92 | 1.26 | 0.12 | 5 | 0.12 |

Tri Valley Hospital

Deterministic m=7.43 at 4.4 km - Site Class BC

| | | | | | Deterministic MCE Spectrum | | Code Spectra for Site Class D | | | | Site-specific spectrum | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Period | Sa | Risk Factor | S&B Factor | SaRot100 | | | Code MCE | | 80% of Code Spectrum | | MCEr | | Design | |
| 0.01 | 0.78 | 1 | 1.19 | 0.93 | 0.01 | 0.93 | 0.01 | 0.68 | 0.01 | 0.54 | 0.01 | 0.57 | 0.01 | 0.38 |
| 0.02 | 0.80 | 1 | 1.19 | 0.95 | 0.02 | 0.95 | 0.02 | 0.84 | 0.02 | 0.67 | 0.02 | 0.71 | 0.02 | 0.48 |
| 0.03 | 0.89 | 1 | 1.19 | 1.06 | 0.03 | 1.06 | 0.03 | 0.92 | 0.03 | 0.74 | 0.03 | 0.79 | 0.03 | 0.52 |
| 0.05 | 1.14 | 1 | 1.19 | 1.36 | 0.05 | 1.36 | 0.05 | 1.08 | 0.05 | 0.87 | 0.05 | 0.93 | 0.05 | 0.62 |
| 0.075 | 1.46 | 1 | 1.19 | 1.73 | 0.075 | 1.73 | 0.08 | 1.33 | 0.08 | 1.06 | 0.08 | 1.14 | 0.08 | 0.76 |
| 0.1 | 1.66 | 1 | 1.19 | 1.97 | 0.1 | 1.97 | 0.1 | 1.49 | 0.1 | 1.19 | 0.1 | 1.29 | 0.1 | 0.86 |
| 0.15 | 1.87 | 1 | 1.2 | 2.25 | 0.15 | 2.25 | 0.125 | 1.69 | 0.12 | 1.35 | 0.125 | 1.43 | 0.125 | 0.95 |
| 0.2 | 1.83 | 1 | 1.21 | 2.21 | 0.2 | 2.21 | 0.2 | 1.69 | 0.2 | 1.35 | 0.2 | 1.43 | 0.2 | 0.95 |
| 0.25 | 1.69 | 1 | 1.22 | 2.06 | 0.25 | 2.06 | 0.4 | 1.69 | 0.4 | 1.35 | 0.35 | 1.43 | 0.35 | 0.95 |
| 0.3 | 1.54 | 1 | 1.22 | 1.88 | 0.3 | 1.88 | 0.6 | 1.69 | 0.6 | 1.35 | 0.5 | 1.43 | 0.5 | 0.95 |
| 0.4 | 1.32 | 1 | 1.23 | 1.62 | 0.4 | 1.62 | 0.8 | 1.69 | 0.8 | 1.35 | 0.6 | 1.43 | 0.6 | 0.95 |
| 0.5 | 1.14 | 1 | 1.23 | 1.40 | 0.5 | 1.40 | 0.9 | 1.69 | 0.9 | 1.35 | 0.7 | 1.43 | 0.7 | 0.95 |
| 0.75 | 0.84 | 1 | 1.24 | 1.04 | 0.75 | 1.04 | 0.91 | 1.69 | 0.91 | 1.35 | 0.92 | 1.43 | 0.92 | 0.95 |
| 1 | 0.65 | 1 | 1.24 | 0.80 | 1 | 0.80 | 1 | 1.54 | 1 | 1.23 | 1.02 | 1.43 | 1.02 | 0.95 |
| 1.5 | 0.42 | 1 | 1.24 | 0.52 | 1.5 | 0.52 | 1.5 | 1.03 | 1.5 | 0.82 | 1.5 | 0.97 | 1.5 | 0.65 |
| 2 | 0.30 | 1 | 1.24 | 0.37 | 2 | 0.37 | 2 | 0.77 | 2 | 0.62 | 2 | 0.73 | 2 | 0.49 |
| 3 | 0.19 | 1 | 1.25 | 0.24 | 3 | 0.24 | 3 | 0.51 | 3 | 0.41 | 3 | 0.49 | 3 | 0.32 |
| 4 | 0.14 | 1 | 1.26 | 0.17 | 4 | 0.17 | 4 | 0.39 | 4 | 0.31 | 4 | 0.37 | 4 | 0.24 |
| 5 | 0.10 | 1 | 1.26 | 0.13 | 5 | 0.13 | 5 | 0.31 | 5 | 0.25 | 5 | 0.29 | 5 | 0.19 |
| 7.5 | 0.06 | 1 | 1.28 | 0.07 | 7.5 | 0.07 | 7.5 | 0.21 | 7.5 | 0.16 | 7.5 | 0.19 | 7.5 | 0.13 |
| 10 | 0.04 | 1 | 1.29 | 0.05 | 10 | 0.05 | 10 | 0.15 | 10 | 0.12 | 10 | 0.15 | 10 | 0.10 |

# EXPANDED DESCRIPTION OF TESS2 – AUGUST 2021

## THE FOLLOWING IS THE DESCRIPTION INCLUDED IN PYKE (2019)

SITE RESPONSE ANALYSIS FRAMEWORK

TESS2 is a nonlinear site response analysis program that assumes ground surface motions result from vertically propagating shear waves. The program accepts two orthogonal horizontal input acceleration histories and simultaneously computes the response in the directions of these two components. The computed peak ground motion parameters and the cyclic shear stresses and strains vary in each of these directions, but the excess pore pressures and the settlements must be common to both directions. Thus, at each timestep in the calculation the program computes the response in each direction, and then, if there is a zero-crossing of the shear stress, the program computes the increments in excess pore pressure and settlement in each layer in each direction, and then adds them together.

### *3.1 Solution Technique and Modelling of Nonlinear Behavior*

TESS2 employs an explicit finite difference solution of the one-dimension wave propagation problem. Its predecessor program TESS, which uses the same solution technique, has been verified and validated in a number of studies including Kwok et al. (2007) and Stewart et al. (2008). In conventional "equivalent linear" analyses of site response it is necessary to specify the shear wave velocity, or the shear modulus at small strains, $G_{max}$, for each layer along with a "modulus reduction curve", and a modulus curve of this kind can also be used as the "backbone" curve for constructing simple nonlinear models of shear stress / shear strain behavior – see Pyke (1979, 2004). Pyke et al. (1993) constructed a consistent family of modulus reduction curves in terms of the reference strain. These curve are the default option in TESS2, and while other, more refined curves can be specified, especially in problems which involve generation of excess pore pressures, attempts at refinement are generally not worth the efforts because the backbone curve changes as a function of the excess pore pressure and this change dominates the response. Likewise, while multi-directional shaking and the number of cycles, or accumulated settlement, can impact the shear modulus of dry sand - see Pyke (1973), Vucetic and Mortezaie (2015) - these effects are dominated by softening as a result of excess pore pressure development.

### *3.2 Calculation of Excess Pore Pressures*

Excess pore pressures in TESS2 are computed using the procedure suggested by Seed, Martin and Lysmer (1976) and the user only needs to specify the value of $CSR_{10}$, the cyclic stress ratio causing liquefaction in 10 cycles. Whenever there is a zero crossing of the shear stress in either direction, the increment in excess pore pressure is added for the relevant layer. Again, more sophisticated approaches, such as that of Martin et al. (1975) could be used, but the Seed, Martin and Lysmer approach is both simple and satisfactory. An explicit finite difference solution of the diffusion equation is used to redistribute and dissipate the excess pore pressures at each timestep, and it turns out that this is just as, or even more, important, than modeling the increases in excess pore pressure in a totally undrained system.

### *3.3 Calculation of Settlements*

Based on the work of Pyke (1973) and Seed et al. (1978), the same calculation is used to compute the settlement of a dry or non-saturated sand layer and the settlement of a saturated sand layer. Although in saturated layers settlement is delayed and is only seen when excess pore pressures dissipate, in TESS2 the

settlements are added immediately to the cumulative settlement. For fully saturated sands, this calculation is suspended when initial liquefaction is achieved and the accumulated latent settlement jumps to the values obtained from Ishihara and Yoshimine (1992) or similar, perhaps site-specific, studies. Data from Pyke (1973) and Ishihara and Yoshimine (1992) is built into TESS2 so all that the user needs to specify to compute settlements is the apparent relative density.

### *3.4 Additional default values*

Additional default values or relationships are built into the program. These include the relationship between normalized SPT blowcounts and relative density as a function of soil type suggested by Cubrinovski and Ishihara (1999); relationships between $CSR_{10}$ and soil type, apparent relative density and age; typical values for hydraulic conductivity as a function of soil type; and typical values for the reference strain as a function of soil type. Thus, the user only has to specify the soil type, the shear wave velocity, the unit weight, and the penetration resistance or apparent relative density for each layer in the analytical model.

## ADDITIONAL COMMENTS

As noted above "The program accepts two orthogonal horizontal input acceleration histories and simultaneously computes the response in the directions of these two components. The computed peak ground motion parameters and the cyclic shear stresses and strains vary in each of these directions, but the excess pore pressures and the settlements must be common to both directions. Thus, at each timestep in the calculation the program computes the response in each direction, and then, if there is a zero-crossing of the shear stress, the program computes the increments in excess pore pressure and settlement in each layer in each direction, and then adds them together."

The calculation of the site response in each horizontal direction is exactly the same as in the earlier 1D version of TESS and uses a well-known explicit finite difference solution which is identical to that used in the program FLAC. In the comparisons of nonlinear site response programs reported by Kwok et al. (2007) and Stewart et al. (2008), TESS was one of the only two programs that perfectly matched a known elastic solution. The other programs were at least mildly upset by either the deliberate inclusion of viscous damping or the damping generated by the solution scheme.

The solutions of the response to each component of motion are run simultaneously and if there is no excess pore pressure development or settlement the results that are obtained are identical to those that would be obtained if they were run completely separately. So, the possible effects of multi-directional shaking on the stress-strain relationships are ignored. However, if the development of excess pore pressures and/or the calculation of settlements is specified then at each timestep a check is made for each layer as to whether there has been a crossing of the zero shear stress line. If it has, that marks the completion of a half cycle of loading and that triggers the calculation of any increment in excess pore pressure and settlement or latent settlement for that layer. If there is an increase in the settlement or latent settlement that in turn increases the low-strain shear modulus if the hardening option has been specified.

As noted above the increment in excess pore pressure is computed using the procedure suggested by Seed, Martin and Lysmer (1976). Their standard curves are built into the program but the user can specify alternate curves if they wish. The standard curves are presented in terms of equivalent uniform cycles of loading, so the program computes the number of equivalent uniform cycles from the actual irregular shear stress history.

At each timestep, if the excess pore pressures have changed in any layer and re-distribution and dissipation of excess pore pressure has been specified, an explicit finite difference solution of the diffusion equation is activated and the adjusted excess pore pressures are used to compute the low strain shear modulus at the

beginning of the next timestep if pressure dependent moduli have been specified. Default values of the hydraulic conductivities are built into the program for twelve soil types and if the user choses to just specify the soil type the values used by the program are printed in the output file. Alternately the user may specify the hydraulic conductivity for each layer.

As also noted above, the same calculation is used to compute the settlement of a dry or non-saturated sand layer and the settlement of a saturated sand layer, although in saturated layers the settlement is actually delayed and is only seen when excess pore pressures dissipate. In TESS2 the settlements are added immediately to the cumulative settlement. For fully saturated sands, this calculation is suspended when initial liquefaction is achieved and the accumulated latent settlement jumps to the values obtained from Ishihara and Yoshimine (1992) or similar, perhaps site-specific, studies.

The details of the procedures used to compute settlements short of complete liquefaction and also the hardening of sands is described in Pyke (2021) as follows: "Following the suggestion of Geoffrey Martin, as published in Martin et al. (1975), the data on settlement was reduced as shown in Figure 3 in which the settlement per cycle is shown as a function of the cyclic shear strain and the accumulated settlement. The accumulated settlement turns out to serve as a very good measure of the effects of the strain history to that point. It was also found that when the data was reduced in this way, the settlement per cycle was largely independent of confining pressure, confirming that behavior under cyclic loading is more fundamentally controlled by the cyclic shear strain, rather than the cyclic shear stress or stress ratio."

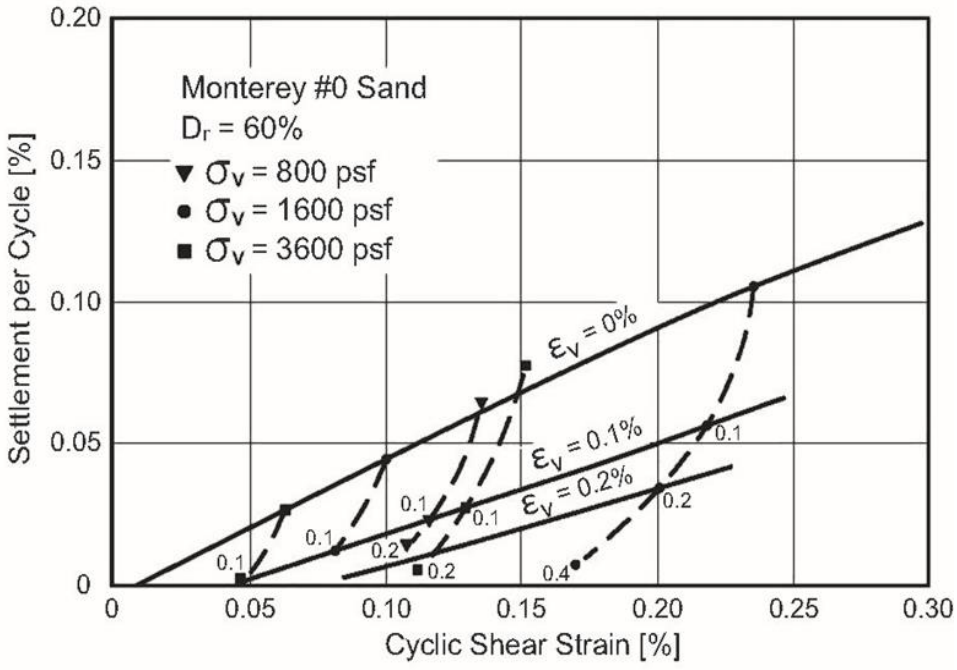



**Figure 3. Settlement per Cycle for Monterey #0 Sand.**

Thus, after each half cycle of loading the increment of settlement or latent settlement is computed as a function of both the amplitude of that half cycle and the accumulated settlement to date. The relevant data for three different relative densities of Monterey No. 0 sand is built into the program and the program interpolates to obtain intermediate values. The user specifies a factor to reduce the Monterey No. 0 values for natural soils as appropriate. Alternately the user can specify data of the kind shown in Figure 3 if site

specific tests have been conducted. Again, only half the computed values are added because this calculation is performed every half cycle.
For saturated sands, if the excess pore pressure ratio reaches 100 percent in any layer, the calculated settlement jumps as a default to the percentage settlement at large strains suggested by Ishihara and Yoshimine (1995) or to similar, perhaps site-specific, values. The Ishihara and Yoshimine (1995) values for lower shear strains and their correlation with the factor of safety against liquefaction are not used, The Ishihara and Yoshimine (1995) values were obtained from cyclic triaxial tests and are likely conservative. Slightly lower values can be obtained by substituting the values for "undisturbed" sands reported by Ishihara et al. (2016).

For hardening of sands, as explained in Pyke (2021), "the data on the secant shear modulus can also be reduced in a similar fashion, as shown in Figure 4. The increase in the secant shear modulus for this dry sand is quite marked, and Pyke (1973) suggests that it still generally applies when there is multi-directional shaking. As pointed out by Vucetic and Mortezaie (2015), this effect can also be seen in undrained cyclic tests on saturated sands although in that case it is quickly overwhelmed by the decrease in stiffness that accompanies the development of excess pore pressures."

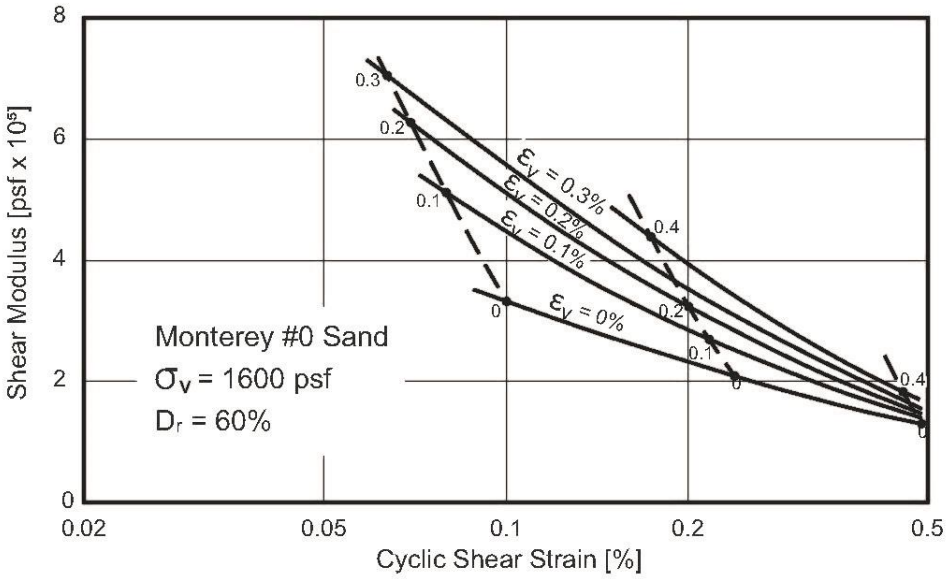



**Figure 4. – Hardening of Monterey #0 Sand.**

If settlements are being computed, the percentage increase in the shear modulus is obtained from data of this kind and is applied on the next timestep. Again values for Monterey No. 0 sand are provided as a default but the user can specify their own values.

# Modeling of stress-strain relationships of soils from Ted Davis to current practice

## Modélisation des relations contrainte-deformation des sols de Ted Davis à la pratique actuelle

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ABSTRACT: This paper summarizes the history of the treatment of stress-strain relationships in geotechnical engineering over the 60-year period from the early 1960's to present day. Key developments in this treatment from the initial separation into elastic and plastic analyses, through the use of hyperbolic stress-strain relationships for static analyses and equivalent linear analyses for earthquake engineering analyses, to more fully addressing cyclic loadings, nonlinearity and three-dimensional geometry are noted. It is concluded that current practice is uneven, with an inadequate emphasis on behavior in unloading and reloading, a persistent failure to distinguish between behavior under slow monotonic loadings and fast cyclic loadings, and the lack of study of the transition from cyclic loading to failure in a particular direction. The complexity of full three-dimensional soil models used in more advanced analyses has the effect of making soil models like religion – everyone believes in their own but is reluctant to accept anyone-else's. It is also concluded that the observation made by the faculty at the University of California, Berkeley, in 1970, that our analytical capabilities were getting ahead of our capacity to evaluate soil properties by use of field and/or laboratory tests, is even more true today.

RÉSUMÉ : Cet article resume les etapes importantes dans l'histoire de l'analyse des relation contraintes-deformations sur une periode s'etendant du debut des annees 1960 a nos jours. Au cours de cette etude, des developpements cles ont ete constates, comprenant la separation entre analyse en domaine plastique et elastique, et passant par l'utilisation d'une relation contrainte-deformation de type hyperbolique pour les analyses statique et de type lineaire pour les analyses d'ingenierie sismique, afin de traiter de facon plus convenable les charges cycliques, l'analyse non-lineaire et la geometrie tridimentionnelle. Il peut etre conclu que les methodes actuelles sont contrastees, incluant une insistance inadéquate sur le comportement au déchargement et au rechargement, un echec constant a distinguer un comportement sous charge monotone lente et charge cyclique rapide, et le manque d'etude approfondie au sujet des transitions entre charge cyclique et rupture selon une direction (un plan) particuliere. La complexite des modeles de sols en trois dimension utilises lors d'analyses plus avancees a pour effet de les faire passer pour l'equivalent d'une religion – chacun croit en son propre modele et n'est pas dispose a accepter celui d'une autre personne. Il peut egalement etre conclu que le constat fait en 1970 a l'Universite de Californie, Berkeley, suggerant que nos capacities d'analyses devancaient nos competences a evaluer les proprietes des sols in-situ et/ou en laboratoire, est d'autant plus vrai aujourd'hui.

KEYWORDS: soils, stress-strain, nonlinear, cyclic, three-dimensional

## 1 INTRODUCTION.

The author was initially taught soil mechanics by the late Professor E.H. (Ted) Davis at the University of Sydney in 1962 and 1963. Then, after working for 5 years, principally on investigations, design, and construction of Corin Dam, outside Canberra, Australia, he attended graduate school at the University of California, Berkeley (Cal), from 1969 to 1973.

During the period from 1963 to 1969 civil engineering had gone from use of slide rules to use of electronic computers and the programs in structural and geotechnical engineering at Cal were among the leaders in developing modern methods of analysis made possible by the use of computers. Within geotechnical engineering these analyses fell into two general categories: "static", or monotonically loaded analyses of slopes, embankments and excavations, and "dynamic", or cyclically loaded analyses of site response and also the response of slopes, embankments and excavations during earthquakes. Because the speed and capacity of computers was still limited at that time, simplified methods of representing soil properties were used in both static and dynamic analyses for both one and two-dimensional geometries.

Subsequently, as computers became faster and were able to access much larger memories, a variety of more complete soil models have been developed for use in analyses of two and three-dimensional geometries, but there is still no widely accepted 3D soil model. It has been said that soil models are like religion: everyone believes in their own but is skeptical of anyone-else's.

Since 1973 the author has been involved in a wide variety of applications of these methods of analysis and has developed his own simplified nonlinear soil model for use in earthquake site response, liquefaction, seismic settlement and lateral spreading analyses. This paper briefly describes the history of developing soil models for use in geotechnical and soil-structure interaction analyses. It is noted that soil behavior is interesting and complex, which makes this a challenging task. However, many geotechnical engineers have failed to grasp the importance of reversals and have failed to distinguish between behavior under slow monotonic loadings and fast cyclic loadings. The over-use of linearization of soil properties to accommodate structural engineers who do not wish to include representation of the actual nonlinear behavior in their models is also a continuing problem.

## 2 TED DAVIS.

Ted Davis was a brilliant man who developed the concept of using elastic theory at low strains and plasticity theory at larger strains into a workable approach for practicing engineers. John Christian once told the author of his admiration for Ted, who while on sabbatical leave at MIT when walking across the campus and an interesting problem came up in discussion, would reach into his briefcase and say "oh, I have a solution for that". I am sure that Ted understood that soils were complex because of the care that he would take in repeatedly say "assuming that we have a linear, homogeneous, isotropic material" before detailing an elegant elastic solution. As I recall, Ted taught us that elastic solutions could safely be used up to about 50 percent of the ultimate load, which is sufficient for many practical purposes where one aims to have a factor of safety of two or more. In this range it is possible to select an appropriate average modulus somewhere between the maximum modulus and half that value

depending on the nature of the loading. When failure was approached, Ted switched to using plasticity theory. After struggling though Hill's "Mathematical Theory of Plasticity", developed for metals, I was not convinced at the time, and remain unconvinced to this day, that any soil particle has ever read the Mathematical Theory of Plasticity. But at the time this approach was a good starting point. In conjunction with Harry Poulos, Ted developed and published many useful solutions for elastic behavior and in conjunction with John Booker, innovative solutions to plasticity problems. In fact, the Davis-Poulos-Booker approach remains applicable for many problems today provided the engineer shows good judgement in choosing the required soil properties. Indeed, one of the attractions of this approach is that it is clear that there are some assumptions, and thus approximations, involved, so that the engineer might be less inclined to believe that the calculated answer is precisely correct. There continue to be assumptions and approximations involved in more complete and complex models of soil behavior, but they may not be so obvious.

## 3. WHY SOILS ARE INTERESTING.

Soils are not in fact linear, homogeneous, isotropic materials. "Plastic" behavior starts at very small strains; they are layered and lensed; and they show inherent and stress-induced anisotropy. The stress-strain relationships of soils are strongly impacted by reversals in loading, and by stress and strain history, and by ageing. Cohesive soils act quite differently when they are over-consolidated, and cohesionless soils can change their properties dramatically with confining pressure - so much so that they might be thought of as not a single material but a family of materials with a transition from contractive to dilative behavior as a function of both strain and pressure for a soil with a given density. Evaluation of soil properties is further compounded by differences between field and laboratory behavior. Laboratory measurements of soil properties are almost always impacted by both changes in the soil fabric, because of either sample disturbance or reconstitution of test specimens, and the deformation boundary conditions of the particular test apparatus. A partial answer to this problem is to rely more on field tests to measure soil properties at low strains, but reliance on field tests, and in particular penetration tests of any kind, for the evaluation of properties at large strains is problematic. All these factors should be kept in mind when constructing or using more advanced soil models, but that appears to happen rarely if at all. Ideally a paragraph like this and a warning that the purpose of analysis is to gain insight into the problem at hand, rather than to obtain precise numerical results, should be included as a preface to every geotechnical consulting report.

## 4. SIMPLE SOIL MODELS FOR STATIC ANALYSES.

Following the development of the finite element method as a practical tool for structural analysis in the late 1960's it was quickly adopted for use in geotechnical analyses. Some of the earliest work used linear elastic stress-strain relationships, capped by the shear strength of the material, usually determined by the Mohr-Coulomb failure criterion. This bilinear elastic-plastic model of soil behavior has come to be known at the Mohr-Coulomb model, which is not a particularly good name but seems to have stuck. However, this model ignored the ability of the then new computerized analyses to follow the transition from elastic to plastic and bridge the two components of the Davis-Poulos-Booker approach. To address that problem Mike Duncan and his students at Cal developed a hyperbolic stress-strain relationship, generally referred to as the Duncan and Chang model, in which the stress-strain relationship was a hyperbola fitted between the elastic modulus at small strains and the ultimate static strength. This remains a powerful approach for many problems today. However, even though this model provides good results throughout much of the loading, it breaks down near or at the point of failure because soils really do exhibit plastic behavior at that point with the strain increments being more or less in the direction of the stress, rather than the stress increment. Thus, current consulting practice has generally shifted to using more modern finite element or finite difference programs using more sophisticated three-dimensional "plasticity" models. However, frequently the old Mohr-Coulomb model, the simplest of all possible plasticity models, is used, which appears to the author to defeat the purpose of spending time and money on an advanced analysis. The defenders of such analyses like to claim that they can get the correct answer in back-calculations of observed behavior, but that is true only if they happen to choose the correct input parameters. There is usually some combination of input parameters that can match key elements of the observed behavior, but that should not give any confidence that the model can be used for forward projections.

Another problem with this class of model is that reversing loads are not always addressed. This is relatively easy to do using, for instance, the Cundall-Pyke hypothesis described below. However, in at least some analyses when the load reverses the stress-strain point simply moves backwards down the same stress-strain curve, which is quite wrong.

## 5. EQUIVALENT LINEAR DYNAMIC SOIL PROPERTIES.

At the same time as the Duncan and Chang approach to modeling soil behavior for static analyses was being developed, Harry Seed and Ed Idriss developed the concept of using "equivalent linear" properties for use in iterative linear analyses of earthquake engineering problems. This was done partly to accommodate the methods of analysis being used at that time which required linear elastic properties and partly to avoid the complexities of modeling the actual nonlinear behavior.

Such equivalent linear "properties" consist of three elements: the maximum shear modulus, that is the shear modulus at low strains; a modulus reduction curve that plots the ratio of "average" secant shear modulus, typically taken as the secant shear modulus on the 5$^{th}$ cycle of a strain-controlled laboratory test, and the maximum shear modulus, as a function of cyclic shear strain; and the damping ratio, also plotted as a function of cyclic shear strain. The damping ratio is an odd quantity obtained partly by equivalencing the area of a real stress-strain loop to the area of an ellipse described by an equivalent visco-elastic model. These approximations, which neglected the effects of any excess pore pressure development and any hardening effects and the fact that the cyclic strains were constantly changing, were consistent with using iterative linear analyses using properties based on the "average" cyclic shear strain in each layer or element to conduct analyses of nonlinear systems. Figure 1 below, which shows the stress-strain history for a typical layer in a site response analysis using one of the motions from the 1995 Kobe earthquake as the input, suggests that determining an appropriate average cyclic shear strain is in fact quite a challenge. Equivalent linear analyses served a useful function at that time but, as an example, in earthquake site response analyses, one of their main applications, they exaggerate the response at the equivalent natural period and overdamp or filter out the response at other periods. They did allow deconvolution of ground surface motions, but the resulting input motions were not realistic. A typical defense of the use of such approximate analyses is that it is not possible to deconvolve the ground surface motions using a nonlinear analysis, but the author has developed an iterative procedure to do that which converges very quickly on realistic looking base motions. Equivalent linear analyses are stable and reliable because of the inherent overdamping of higher frequencies, but they provide reliably incorrect answers.

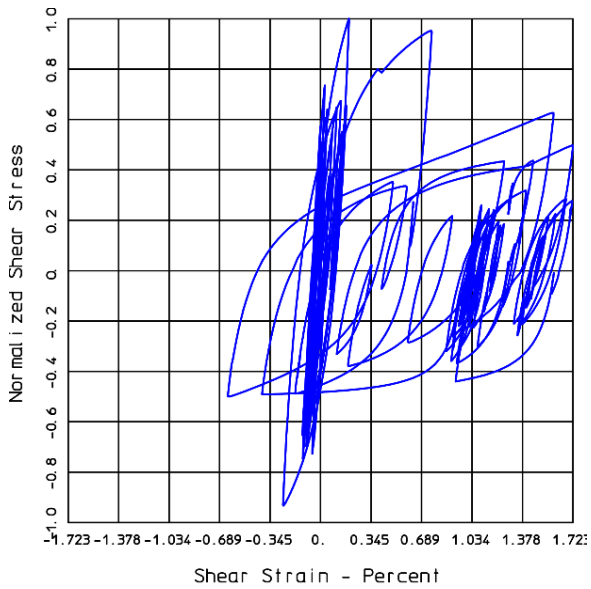



Figure 1. Shear stress – shear strain history for a sandy silt layer in a site response analysis using the NIS000 record of the Kobe earthquake.

## 6. SIMPLE NONLINEAR DYNAMIC SOIL MODELS.

Simple models of the shear stress – shear strain behavior under cyclic loading can be constructed using the same shear modulus reduction curve that is used in equivalent linear analyses as a "backbone curve". The backbone curve could just be defined by a table of values but is commonly specified to be a hyperbola or a modified hyperbola whose initial slope equals the shear modulus at small strains. The asymptotic limit on the shear stress is often taken to be equal to some vaguely defined shear strength, but, as discussed below, is better thought of as just an asymptote.

Rules are then needed for how this backbone curve translates to unloading and reloading curves under cyclic loading. Initially, and to this day, this is commonly done using the Masing hypothesis, even though Masing's original paper was written in German and few geotechnical engineers have ever read it. The Masing hypothesis was based on the behavior of an assembly of springs and sliders, now commonly called an Iwan model. This kind of model simply doubles the scale of the backbone curve on the first unloading and then maintains that shape on subsequent loadings and unloadings. The Iwan model has been used with some success for modeling, for instance, joint behavior in structural analyses, but it has a big limitation for use in geotechnical analyses and the fact that it complies with the Masing Hypothesis should not be taken as anything other than a circular argument. Masing himself tested his hypothesis on brass cylinders and concluded that it did not work very well.

A clue to the limitations of the Masing hypothesis is provided by the fact that in an application such as that shown in Figure 1, additional rules are needed to make it work – if the shear stress on reloading or unloading crosses the previous loading or unloading curve, it has to follow the previous curve; if the shear stress on reloading or unloading exceeds the asymptotic shear stress, the material suddenly becomes plastic and maintains that shear stress. But the big limitation of the Masing hypothesis for geotechnical studies is that if there is an initial shear stress at the start of a cyclic loading, it is well documented that even with a uniform symmetrical cyclic loading, the test specimen will accumulate permanent displacements in the direction of the initial shear stress. However, even a model that follows the extended Masing rules does not do that – it simply cycles around and around without developing permanent deformations.

This problem led the author to conclude that a better rule was that the scale of the backbone curve should be changed by a factor equal to the normalized distance from the reversal point to the asymptotic stress in the direction that the load was now heading. Thus, if the reversal point was close to the asymptotic shear stress, either positive or negative, the factor would be close to two, and if it was at zero shear stress, the factor would be one. Peter Cundall had reached the same conclusion independently and so when the author published this idea (Pyke 1979) he named it the Cundall-Pyke hypothesis. This basic rule eliminates the need for any additional rules since a model based on it never actually reaches the asymptotic shear strength let alone exceeds it. And, critically, permanent deformations are developed when even a symmetrical cyclic load is applied on top of an initial shear stress.

As noted already, the backbone curve is commonly specified to be a hyperbola or a modified hyperbola whose initial slope equals the shear modulus at small strains and whose asymptotic shear stress is variously defined. Stress strain curves for soils are not exactly hyperbolic and so various workers have suggested fitting parameters in order to make modified hyperbolas that provide a better match to laboratory data. The earliest of these to gain prominence was that of Hardin and Drnevich which used two fitting parameters, a and b. The author used these in his first soil model using the Cundall-Pyke hypothesis which was thus called the HDCP soil model. However, the parameter b led to potentially unstable results and the Hardin and Drnevich a parameter had the wrong signs which meant that sands were more linear than a plain hyperbola and clays were more nonlinear, when the opposite is really true. Darendeli (2000) later suggested a modified hyberbola with a single parameter, also called a, that provides more stable and accurate results. However, it is likely a mistake to try to closely match any particular set of laboratory tests results exactly since those results are impacted by the boundary conditions of the particular test apparatus and do not necessarily accurately represent field conditions. Added to which, the fabric of the tests specimens is likely to be different whether due to sample disturbance or remolding. In fact, many laboratory tests are carried out using washed and screened sands or pure clays, which are rarely if ever found in natural deposits. So, the general trends observed in laboratory tests should be respected, but not necessarily in every detail.

Pyke et al. (1993) constructed families of modulus reduction curves for both sands and clays using the HDCP model with plain hyperbolas and using the "reference strain", calculated as the shear strength or asymptotic shear stress divided by the shear modulus at low strains, that is the maximum shear modulus, to characterize the individual curves. Alternately, for a plain hyperbola, the reference strain is the cyclic shear strain at a shear modulus equal to half the maximum shear modulus. A typical reference strain for a clean sand at low confining pressures is 0.1 percent and for a clayey silt like San Francisco Bay Mud it is 0.3 percent.

Pyke et al. (1993) also provided companion curves for the damping ratio that is used in equivalent linear analyses. The values shown in that report are 50 percent of the hysteretic damping generated by the HDCP model using plain hyperbolas, because a plain hyperbola without introducing features such as the development of pore pressures and dilation at larger shear strains, which make the stress strain loops more S-shaped, leads to hysteresis loops that are too fat. The reduction by 50 percent provided values that were not inconsistent with hysteretic damping values measured in constant strain laboratory tests and generally was found to give acceptable results in equivalent linear analyses.

Curves of damping ratio vs cyclic shear strain are not required as an input to nonlinear analyses because the appropriate hysteretic damping is generated automatically. This is illustrated in Figure 1. This example includes some excess pore pressure

development and modest dilation at larger shear strains but the larger loops are relatively fat. However, it can be seen that when driven by an irregular cyclic loading the closed loops are smaller and less numerous that might be expected under an equivalent uniform loading. The overall pattern of behavior is in fact quite different from a laboratory test conducted with either constant cyclic shear stresses or strains. The permanent strains in this example are due simply to the irregularity of the input motion but model will develop permanent strains if there is an initial shear stress.

The original example of the Cundall-Pyke hypothesis in Pyke (1979) showed the development of permanent shear strains under even a symmetrical cyclic load when it was added to an initial shear stress but generated permanents strain too quickly. This was because the stiffening of the shear modulus, or "hardening", that results from cyclic loading was not included. Data from the author's thesis (Pyke 1973) shows both that the settlement per cycle for a given cyclic shear strain decreases with an increasing number of cycles and that the secant shear modulus increased with an increasing number of cycles. Following the suggestion of Geoffrey Martin, the author uses the accumulated volume change, or the latent volume change in the case of a saturated sand, as a measure of the strain history up to that point. These changes in the stiffness as well as the rate of settlement as a function of the previous cyclic loading are quite significant and are illustrated in Pyke (2021a).

The 1979 example also showed sharp corners on the stress strain loops, which is generally not correct. Acting on a suggestion by Mladen Vucetic, Pyke (2004) introduced rate of strain effects which generate the low strain damping which is seen in laboratory tests and helps damp out high frequency noise in analyses. This is very much preferable to arbitrarily introducing artificial viscous damping to control high frequency noise.

A further example of the effect on soil fabric of cyclic loading is provided in Figure 2 which is taken from Dahl et al. (2014).

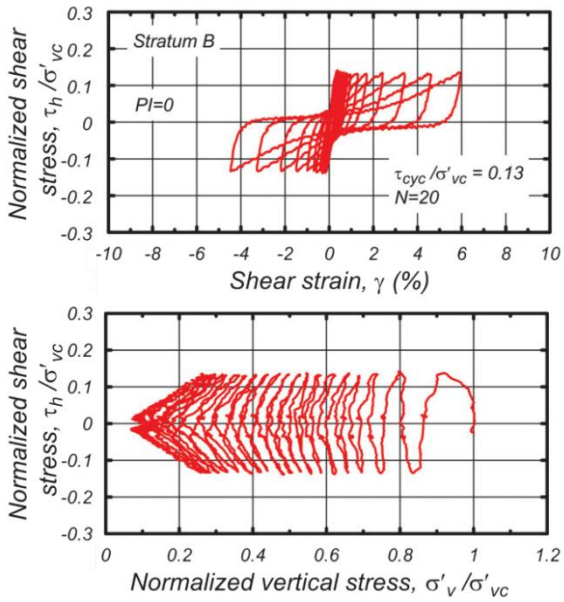



Figure 2. Results from constant height stress-controlled cyclic simple shear test on a sandy silt. From Dahl et al. (2014).

It may be seen in Figure 2, that the shear strain at which dilation kicks in increases with the number of cycles as excess pore pressures increase and the specimen is pushed out further, first in one direction and then the other. The Dahl et al. paper also serves as a great example of the issues involved in sampling and testing real soils. And it includes data on the effect of initial shear stresses in generating permanent deformations, as shown in

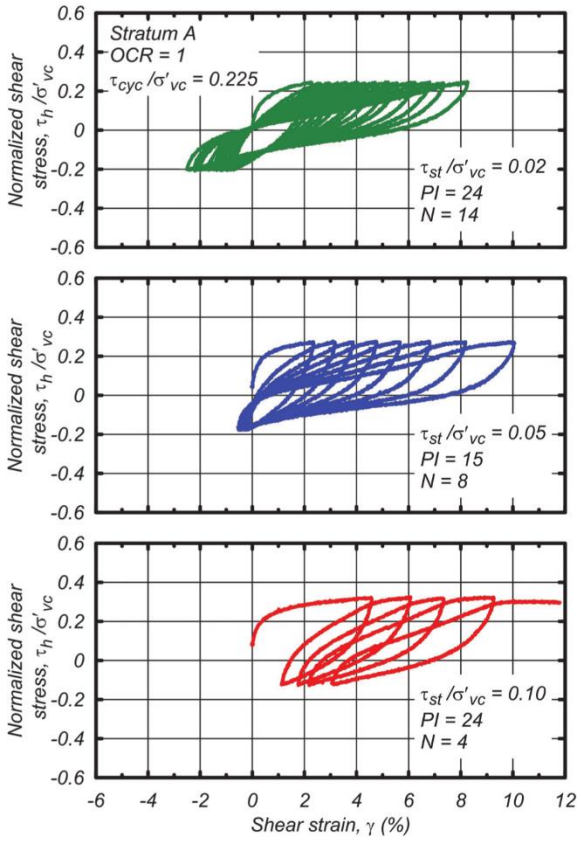



Figure 3. Results from stress-controlled cyclic simple shear tests with initial shear stresses on a clayey silt. From Dahl et al. (2014).

Figure 3. That data was used to calibrate the HDCP soil model for use in analyses of potential lateral spreading for a major land development project.

The phenomenon illustrated in Figure 2, the impact of cyclic loading on the tendency for dilation of a granular soil, is one of the two principal reasons why the "static" shear strength, that is the strength under a monotonic loading, should not be used as the asymptotic shear stress in a nonlinear soil model. The other is rate of loading effects. For example, based on data developed for San Francisco Bay Mud on several large projects in which the author has been involved, the apparent shear strength implied by the projection of shear stress-shear strain curves to large strains can be as much as three times the conventional static shear strength. The consequence of constructing a nonlinear soil model using the conventional static shear strength is that the model becomes more nonlinear and has much larger damping. Soil models or computer programs that limit the asymptotic shear strength to the conventional static shear strength produce results which are clearly overdamped and not consistent with recorded motions. The author's practice is to not specify an asymptotic shear stress when running site response analyses but to specify the reference strain and to accept whatever asymptotic shear strength is implied by the maximum shear modulus and the reference strain.

Constructing a nonlinear soil model which generates appropriate hysteretic damping is not a straightforward task and it cannot be accomplished by detailed matching of the results of a particular element test in the laboratory. Rather it requires checking the results obtained in analyses with observed data in the field as has been done by Afshari and Stewart (2019). The soil model then accommodates not only any differences between the soil behavior under field conditions and in the laboratory but also accounts for elements of the wave propagation in the field that might arise from various inhomogeneities that are not modeled in the analysis.

## 7. EFFECTS OF MULTI-DIRECTIONAL LOADING

Although most laboratory tests are conducted using uni-directional loadings, most dynamic problems in the field, and especially earthquake loadings, involve multi-directional loadings. The effects of multi-directional shaking on sands have been described by Pyke (1973), Seed, Pyke and Martin (1978), and Pyke (2021a). These effects are most dramatic on the pore settlements of dry sands, and hence the development of excess pressures in fully saturated sands. The principal finding of these studies was that the settlements of dry sand caused by horizontal shaking with two orthogonal components were approximately equal to the sum of the settlements caused by horizontal shaking with each component acting alone. The effect on shear modulus is complicated and deserves further study. The shear modulus initially appears to be lowered by multi-directional shaking, but, at least for dry sands, settlements then progress more quickly so that the shear modulus increases more quickly than for uni-directional loading and may end up being higher. The effects of vertical shaking are often ignored because in a fully saturated soil they should make no difference to the effective vertical stresses, but they should be considered in non-saturated or dry soils. When vertical shaking is superimposed on multi-directional horizontal shaking, the settlements are increased but the shear modulus is increased on some cycles and reduced on other cycles. So, early in the loading the shear modulus remains about the same as for horizontal shaking, but hardening will occur at a faster rate.

These multi-directional loading and hardening effects are ignored by most soil models. Most analyses of earthquake site response are carried out for a column of soil driven by a single horizontal component so that multi-directional shaking could not be addressed in any case. A few use 3D brick elements and are driven by two horizontal motions and perhaps a vertical motion so that it is possible to address multi-directional loading and hardening effects, but only if the soil model includes them.

The author's own 1D site response program, TESS2, does not include vertical excitation but runs analyses for two horizontal components simultaneously. However, the user can take the vertical motion into account when specifying the parameters for computing settlements or latent settlements. This method of analysis implies that the shear modulus in one direction is independent of shaking in another direction. As noted above, this is not precisely correct, but when the strain history and hardening effects are taken into account, it may not be such a bad approximation. The settlements or excess pore pressures and latent settlements which are computed separately for the response to the two horizontal components and then are added together, both to obtain the total accumulated settlement or latent settlement and to adjust the shear modulus when this is specified to be a function of the effective confining pressure. This approach is not as elegant as using 3D elements and a 3D soil model which captures all the necessary features of soil behavior, but it has the advantage of both being relatively simple and forcing the user to think about the input assumptions, and maybe even about the limitations of the approach. Because the HDCP soil model in TESS2 generates permanent displacements, TESS2 can be used for analyses of lateral spreading in addition to analyses of site response, liquefaction, and seismic settlement (Pyke 2019).

## 8. MORE COMPLETE AND COMPLEX SOIL MODELS

More complete and complex soil models are needed to conduct 2D and 3D nonlinear analyses, especially under complex cyclic loadings. But all geotechnical analyses involve approximations and there is no guarantee that more complex and complete soil models are any more accurate than simplified ones. There is also no guarantee that users in practice will recognize that to justify the time and expense of conducting 2D or 3D nonlinear analyses, whether static or dynamic, there should be sufficient field and laboratory investigations to establish the 3D geometry of the soil deposits or constructed works and to identify inhomogeneities including finer layering, lenses, and anisotropy. Many such analyses appear to the author to be conducted solely to produce multi-colored pictures in reports which might look impressive to laypeople but lack adequate backup and explanation. For instance, example shear-stress shear strain plots should be shown, not to prove that they match laboratory test data exactly, but to show that they are consistent with laboratory test data and common sense.

2D and 3D soil models require a second elastic modulus, usually a constrained or bulk modulus, but surprisingly little attention is paid to the second modulus unless the instantaneous Poisson's ratio exceeds 0.5 and the solution scheme blows up. That limitation is a problem since real soils can dilate quite strongly especially under low confining pressures. A more complex and complete soil model should also include hardening and rate of loading effects as discussed above with reference to simple models. The common complaint that 3D soils models are too complex or have too many parameters may have some merit, but unless they properly model complex soil behavior soil models are of limited value. The trick is to do that at the same time as making them easily understood and managed by users.

A review of the various available models is beyond the scope of this paper, but an important test is whether they can develop permanent strains in response to initial shear stresses. "Failure seeking" models like PM4Silt developed at the University of California, Davis, can do this and Boulanger (2019) provides a good example of the intelligent use of advanced soil models.

But the most common model seen by the author in practice is the so-called Mohr-Coulomb model, which, as noted above, is simply a linear elastic / perfectly plastic model. It is usually not clear how this model unloads and reloads and rarely, if ever, is any effort made to calibrate its ability to develop permanent deformations or to establish what damping it generates under cyclic loading. In at least some earthquake engineering applications the shear modulus is chosen as a function of the "average" shear stress so that the analysis is just an equivalent linear analysis with a cutoff at high stresses. It is true that the Mohr-Coulomb model does develop permanent deformations in approximately the right direction under earthquake loads but that is simply because elements that have large initial shear stresses reach failure and go plastic before other elements do. The calculated displacements should be taken with a good dose of salt.

## 9. ONGOING COMPLEX SOIL BEHAVIOR ISSUES.

Some more complex soil behavior issues such as strain history and hardening effects under cyclic loading, and multi-directional shaking, have been discussed above, but there are further issues which have not been adequately researched to allow confident modeling of them in complex soil models.

Laboratory tests are normally run with monotonic loadings to failure or with uniform cycles of stress or strain, not with a combination of these two types of loading or with irregular cyclic loadings. Some years ago, in connection with the design of an offshore platform, the author conducted what became know as the "tickle test" in which a small cyclic loading was superimposed on the monotonic loading to failure in a triaxial apparatus of a dense silt. Perhaps not surprisingly, the tendency to dilate under the monotonic loading was entirely suppressed. It is possible that this mechanism might, for instance, play a role in the triggering of flow slides in tailings dams by micro-earthquakes or mine blasts, although the conventional wisdom is that the high frequency waves generated by those sources do not

create significant strains in a large structure. What is perhaps more likely is something else that is not captured in traditional modeling. Namely, that if seepage and piping have created a locally unstable soil structure which has dimensions in the order of say a meter or less, then that structure will be impacted by higher frequency motions which might trigger a local collapse and initiate a progressive failure (Pyke 2021b). This is a particular case of an inhomogeneity governing the behavior of what can otherwise be modelled as a continuum and illustrates the danger of leaving critical details out of an analysis. More generally, the transition from behavior under cyclic loading to failure in a particular direction has been the subject of little if any study, although the Material Point Method (MPM) appears to offer promise as a framework for such analyses.

Another question is whether behavior in cyclic tests or in the field under irregular loadings is the same as in tests with uniform cyclic stresses or strains. As shown for instance in the paper by Dahl et al. referenced above, in a stress-controlled laboratory test with a constant applied cyclic stress, the strain at which strong dilation kicks in is moved out as a result of the cyclic loading causing pronounced S-shaped shear stress – shear strain loops. This no doubt corresponds to a change in the soil fabric caused by the repeated loading. But does the same thing happen under irregular and multi-directional loadings? Modelers go to great efforts to match this kind of behavior as seen in laboratory tests, but does it occur in the field? This issue also links to the question of the asymptotic shear stress not being equal to static shear strength as noted above, another question that deserves further study. While there is compelling evidence that in sub-failure situations the asymptotic shear stress should be much greater than static shear strength, does that also hold true as failure in a particular direction is approached?

Also, to assume that on average the shear modulus and its variation with strain are the same as under uniform loading in a single direction might be an adequate approximation for some purposes but the limits of its applicability are not clear. The author regrets not studying this issue in more detail at the time of conducting research for his PhD.

Finally, there is a pressing need for geotechnical engineers to educate structural engineers as to the significance of some aspects of soil behavior to soil-structure interaction problems. As one example, although geotechnical engineers have specified nonlinear p-y curves for use in soil-pile interaction analyses for many years, computer programs for the analysis of piles commonly make no provision for the proper behavior in unloading and reloading and thus it is not possible to compute meaningful deflections in response to staged or repeated loadings. A second example is the use of a single set of elastic springs to represent the foundation compliance even for high-rise buildings. This still occurs in cities like San Francisco and Seattle even when the geotechnical engineer may have conducted elaborate studies using nonlinear analyses to determine the foundation input motions. As the capacity of computers continues to grow it should be possible to conduct long-overdue studies of the effects of more accurate modeling of foundation compliance for this and other soil-structure interaction problems.

## 10. CONCLUSIONS.

The Davis-Poulos-Booker approach to modeling soil behavior using different approaches for low strain behavior and at failure remains valid today. Progress towards constructing a single model of soil behavior that is valid at both small strains and at failure, for both “static” and “dynamic” loadings, is best described as uneven. For many problems, a somewhat simplified approach such as the use of Duncan and Chang hyperbolas with the addition of proper rules for unloading and reloading is adequate for static analyses, and the use of models like the HDCP model for 1D earthquake site response analyses is adequate for dynamic analyses, and more complete and complex models are not required.

Soil behavior is interesting but complex. Soil models should not be required to exactly match the results of a particular laboratory test because any one laboratory test is unlikely to precisely represent field conditions, but soil models should capture the essential elements of soil behavior.

Where use of more complete and complex models is justified, such as in some 2D and 3D analyses, users need to become much more familiar with the assumptions they are making and spell out in their reports both the main assumptions and the sensitivity of the results to these assumptions. They should never report just the result of a single analysis. Ideally, they should show that the model is consistent with relevant laboratory element tests, but it is not necessary to match them perfectly. And, in the author’s opinion, the Mohr-Coulomb model is not appropriate for use in more advanced analyses.

There is a pressing need for more emphasis on basic studies of soil behavior. When the author was a student at Cal in the early 1970’s the faculty were saying that our analytical capability had outstripped our ability to determine soil properties in the field and the laboratory, and that is even more true today.

Particular issues that require more attention are the modeling of unloading and reloading; the modeling of strain history and hardening effects: rate of loading effects; the effect of irregular and multi-directional loadings; and the interaction between monotonic and cyclic loadings.

Even with an improved focus on soil properties, geotechnical engineering will remain very much an art as well as a science, and experience and good judgment will continue to be essential to good practice.

## 11. REFERENCES.


Afshari K. and Stewart J.P. 2019. Insights from California Vertical Arrays on the Effectiveness of Ground Response Analysis with Alternate Damping Models, BSSA, 109(4), 1250-1264.

Boulanger R.W. 2019. Nonlinear dynamic analysis of Austrian Dam in the 1989 Loma Prieta earthquake. *J. Geotech. GeoEnviron. Eng*., ASCE, 145(11).

Dahl K.R., DeJong J.T., Boulanger R.W., Pyke R., Wahl D. 2014. Characterization of an alluvial silt and clay deposit for monotonic, cyclic, and post-cyclic behavior. *Can. Geotech. J.* 51, 432-440.

Darendeli M.B. 2001. Development of a New Family of Normalized Modulus Reduction and Material Damping Curves. PhD thesis, University of Texas, Austin.

Pyke R.M. 1973. Settlement and Liquefaction of Sands Under Multi Directional Loading, PhD Thesis, University of California, Berkeley.

Pyke R. 1979. Non-linear Soil Models for Irregular Cyclic Loadings. *J. Geotech. Eng. Div.* ASCE, 105(GT6),

Pyke R., et al. 1993. Modeling of Dynamic Soil Properties, Appendix 7.A, Guidelines for Determining Design Basis Ground Motions. Report No. TR-102293, Electric Power Research Institute, Palo Alto.

Pyke R. 2004. Evolution of Soil Models Since the 1970s. *Int. Workshop on Uncertainties in Nonlinear Soil Properties and their Impact on Modeling Dynamic Soil Response,* National Science Foundation and PEER Lifelines Program, Berkeley.

Pyke R. 2019. Improved analyses of earthquake-induced liquefaction and settlement, *Proc. 7th Int. Conf. on Earthquake Geotech. Eng.*, Rome.

Pyke R. 2021a. Lessons learned from the observed seismic settlement at the Jensen Filtration Plant in the San Fernando earthquake. Submitted to ASCE Lifelines 21-22, UCLA.

Pyke R. 2021b. New technical findings resulting from recent failures of tailings dams in Brazil and Australia. Invited lecture, National Congress of Dams, COPEGP, Lima.

Seed H.B., Pyke R., and Martin G.R. 1978) Effect of Multi-Directional Shaking on Pore Pressure Development in Sands," *J. Geotech. Eng*., ASCE, 104(1).

# The benefits of site-specific nonlinear site response analyses

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## ABSTRACT

Current building codes in the United States provide for five standard ground surface response spectra for seismic design purposes as a function of a site classification based on the weighted average shear wave velocity over the top 30 m of the profile, $V_{s30}$, and mapped spectral accelerations at period of 0.2 and 1.0 seconds. These mapped spectral accelerations were obtained using standard ground motion prediction equations and the average shear wave velocity and standard deviation for each site class. The current building codes allow for both the conduct of site-specific seismic hazard analyses and the conduct of site-specific response analyses, but the resulting ground surface response spectra must not fall below 80 percent of the standard response spectra. This paper describes several site conditions which are typical of those sites where it is advantageous to conduct nonlinear site response analyses and argues that there are conditions under which the lower limit is not applicable.

**Keywords:** building codes, ground surface response spectra, site-specific, site response analyses, nonlinear

## 1 INTRODUCTION

Current building codes in the United States, which are based on ASCE/SEI Standard 7-16, provide for five standard ground surface response spectra for seismic design purposes as a function of a site classification based on the weighted average shear wave velocity over the top 100 feet, or 30 m, of the profile, $V_{s30}$, and mapped spectral accelerations at period of 0.2 and 1.0 seconds. These mapped spectral accelerations were obtained using standard ground motion prediction equations and the average shear wave velocity and standard deviation for each site class. These codes do require site response analyses for softer soil sites and where there are "soils vulnerable to potential failure or collapse under seismic loading, such as liquefiable soils …" More generally, these codes allow for both the conduct of site-specific seismic hazard analyses and the conduct of site-specific response analyses, but the resulting ground surface response spectra must not fall below 80 percent of the standard response spectra.

Because of the variability of the sites that fall within each site class, the standard deviation based on data recorded in similar tectonic regions worldwide is quite large, and the seismic hazard analysis results for the ground surface motions, whether governed by probabilistic or deterministic criteria, tend to be conservative. This is particularly marked for site class D. A site that has a $V_{s30}$ close to 1200 ft/sec, the upper limit of the site class, is quite different from a site that has a $V_{s30}$ close to the lower bound of 600 ft/sec.

These issues will be reduced, but not eliminated, when state and local building codes are updated in accordance with ASCE/SEI 7-22 in 2025, when the number of site classes will be increased from five to eight.

This paper describes several sites in the Greater San Francisco Bay Area which are typical of those sites where it is advantageous to conduct nonlinear site response analyses and argues that there are conditions under which the lower limit is not applicable. The advantages of conducting nonlinear effective-stress site response analyses, even when these are not strictly required by the building codes, are also noted.

## 2 OTHER ISSUES WITH SITE CLASSES

One of the issues with regard to this kind of site classification is whether the average stiffness of the upper 30 m of the profile alone is sufficient to characterize the site. European codes also include the depth to "bedrock" as a factor and the depth to a significant impedance contrast certainly might be of some relevance. The author has previously explored whether or not the low-strain equivalent site period of the column above a significant impedance contrast is useful, but concluded that it did not capture large-strain site response any better than $V_{s30}$ (Pyke, 2020). However, deeper soil sites must tend to create the possibility of larger cyclic shear strains, which leads to higher material damping, and a tendency to shift the peak

ground surface response to longer periods. But these effects will be site specific and they are difficult to nail down in the language of a building code.

Sites with shallow bedrock, or a particularly soft surficial layer less than 30 m deep, also constitute a problem. One solution might be to simply include language that says that if "bedrock" is found at a depth of less than 30 m, the weighted average shear wave velocity to that depth should be used to define the Site Class. Likewise, if a softer surficial layer with a thickness greater than some minimum value is underlain by a much stiffer soil layer with an impedance contrast exceeding a specified amount, the Site Class should be based on the weighted average shear wave velocity of the surficial layer.

In the meantime, sites with either deep or shallow bedrock call for site-specific site response analyses.

## 3 EXAMPLES

### 3.1 Santa Rosa Site

This site has approximately 60 m of alluvium over volcanic bedrock. However, the upper 10 m are more recent alluvial deposits which are much softer, as may be seen in Figure 1, which shows the measured shear wave velocities as a function of depth. The site is located very close to the Rogers Creek – Healdsburg fault so the input motions are relatively high.

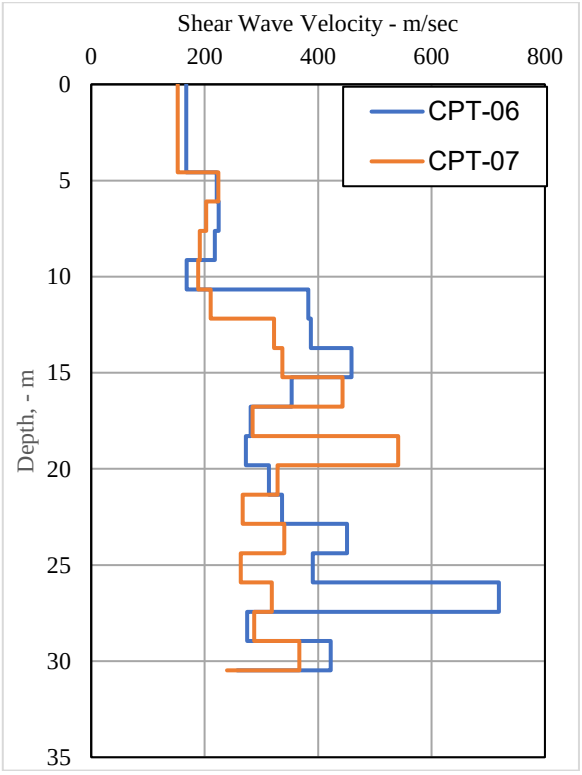



Fig. 1. Measured shear wave velocities at Santa Rosa site.

Site-specific site response analyses were conducted using the author's computer program TESS2.

TESS2 employs the same explicit finite difference solution of the one-dimension wave propagation problem and the same HDCP soil model as were used in the earlier program TESS. TESS has been verified and validated in a number of studies including Stewart et al. (2008). A more detailed description of TESS2 is included in Pyke (2019). TESS2 runs two horizontal components of motion simultaneously so that the development of excess pore pressures in saturated materials and the settlement caused by cyclic loading of non-saturated materials can be tracked more accurately. The bi-directional analysis makes little difference in site response analyses of clayey sites, but it can be very significant when there are through-going cohesionless soil layers. TESS2 uses the HDCP soil model, which is a one-dimensional "failure seeking" model as suggested by Pyke (1979). The default backbone curve of the nonlinear shear stress - shear strain relationships is based on the modulus reduction curves suggested by Pyke et al. (1993), although any curves can be used. Low strain damping is included by adding rate effects, as originally suggested by Mladen Vucetic. There is no added viscous damping or damping generated by the solution scheme.

The results for the Santa Rosa site are summarized in Figure 2, which shows the median 5 percent damped ground surface response spectra for the maximum credible earthquake (MCE), computed using five two-component input motions, relative to 80 percent of the standard code response spectrum for Site Class D (red line). The computed median response spectrum generally falls below the red line and the response spectrum constructed following the rules in the code, which specify a flat top with a spectral acceleration equal to 90 percent of the computed peak spectral acceleration, is shown as a blue line.

The key thing here is that the soft top of the profile generates large cyclic shear strains, in the order of 0.5 percent or more at the bottom of this soft material, which in turn generates significant material damping and thus reduces the ground surface motions.

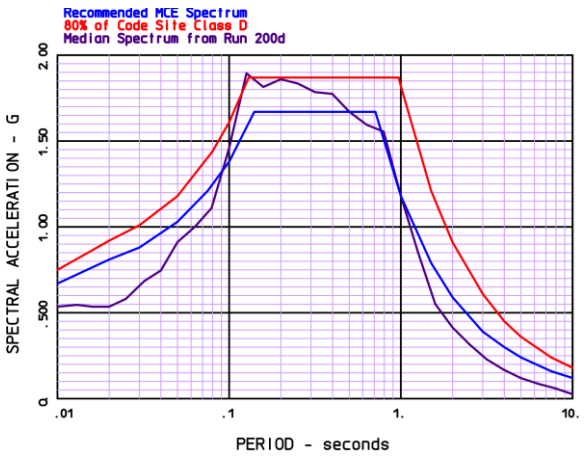



Fig. 2. Ground surface response spectra at Santa Rosa site.

Thus, although the depth to "bedrock" is not particularly great, the soft top and the notable impedance contrast at the base of the soft layer dominate the site response. This site serves as a good example of one of the points made in Section 2 above.

### 3.2 Fremont Site

This example is based on several sites in Fremont and North San Jose, which are very close to the South Hayward fault and also have a great depth of alluvial soils overlying Franciscan formation bedrock. Measured shear wave velocities that are typical of these sites are shown in Figure 3. The measured shear wave velocities only go down to 30 m, but regional data compiled by the US Geological Survey allows the profile to be extended down to the Franciscan formation at a depth of about 364 m.

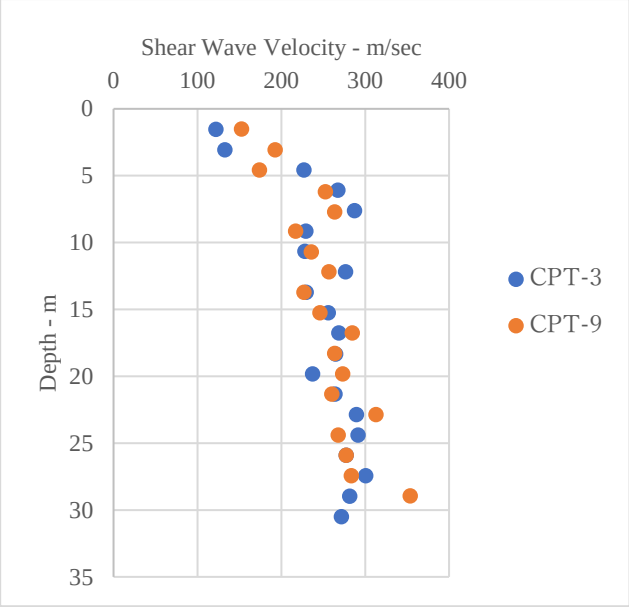



Fig. 3. Measured shear wave velocities at Fremont site.

While there is a softer layer of more recent sediments than extends from the ground surface to a depth of about 10 m, the shear wave velocities in this layer gradually increase so that they match the velocities of the older alluvium and there is no sharp impedance contrast, as in the previous example. Thus, the peak cyclic shear strains are generally in the range of 0.1 to 0.2 percent, which is much lower than in the previous example, but because of the depth to bedrock the equivalent linear site period is rather longer than the period of the peak spectral accelerations of the input motions. Both as a result of material damping and this mismatch in periods, the computed ground surface motions turns out to be less than 80 percent of the standard code response spectrum, as shown in Figure 4.

Erring a little on the conservative side because of the uncertainty about the deeper profile at this site, one might suggest that using an MCE response spectrum with a flat top at 1.5 g would be appropriate, and that this would maintain the level of risk that the building code is aiming for. The modulus reduction curves that were used in these analyses followed the recommendations of Pyke et al. (1993) and were not the source of excessive damping in the analyses, although that can sometimes be the cause of lower computed ground surface motions. This point is discussed further in the following section.

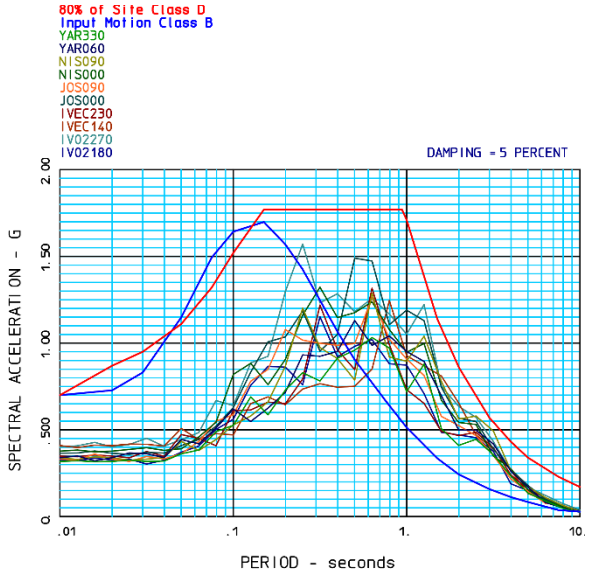



Fig. 4. Ground surface response spectra at Fremont site.

### 3.3 San Leandro Site

This site is a little further from the North Hayward fault than the previous example is from the South Hayward fault and the depth to Franciscan formation bedrock is estimated to be about 273 m, based on a local compilation of data. The average of the shear wave velocities measured to a depth of 30 m is shown in Figure 5. Again, there is no sharp impedance contract within the top 30 m.

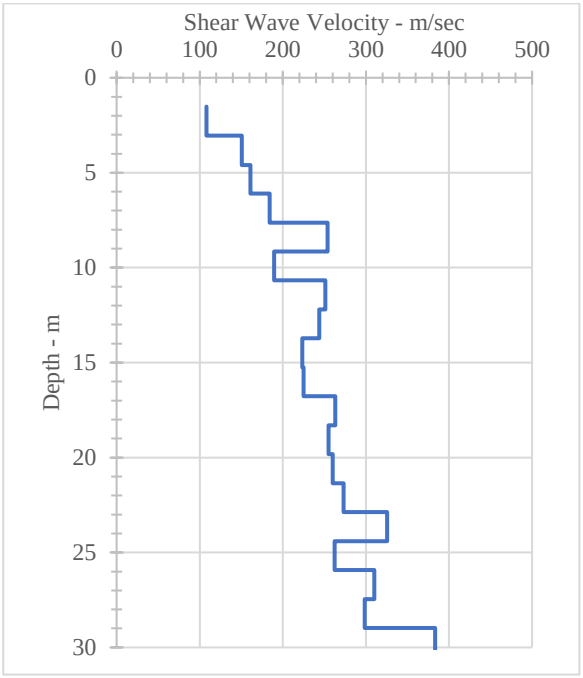



Fig. 5. Measured shear wave velocities at San Leandro site.

The calculations for this site also assumed a deep profile that was stiffer than the Fremont site based on data acquired closer to this site. Because of these three factors, namely the greater distance from the fault, the shallower soil profile and the stiffer soil profile, the equivalent linear site period is closer to the period of the peak spectral accelerations of the input motions and the computed ground surface response spectra that are shown in Figure 6 are similar to 80 percent of the standard code response spectrum.

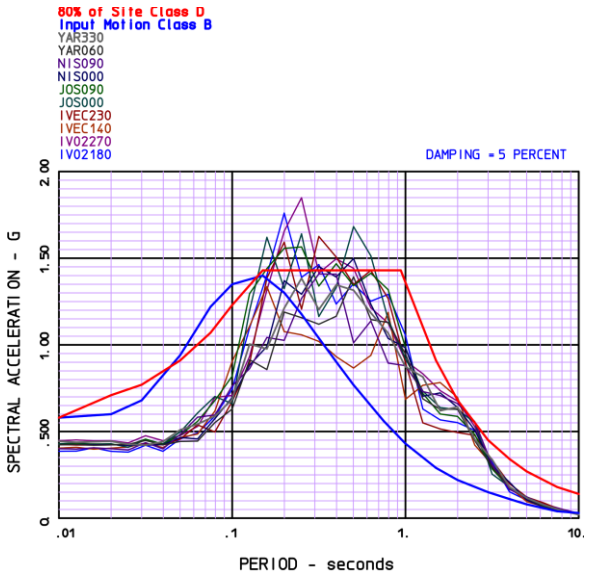



Fig. 6. Ground surface response spectra at San Leandro site.

The San Leandro site generally consists of lean clays which are not susceptible to liquefaction, but one boring and CPT pair revealed an approximately 3 m-thick interval between about 2 m and 5 m bgs which is described in the boring log as well graded sand with silt and gravel. Additional CPTs were conducted to delineate the extent of this interval and it was found to be limited. Note that, as discussed further below under the heading Other Advantages, if a lens or a fragment of a tortuous backfilled channel develops excess pore pressures as a result of earthquake shaking, it becomes a "soft inclusion" and will not develop large cyclic shear strains because the motion will be controlled by the surrounding lean clays. However, to show what the effect of a through-going liquefiable layer on the ground surface motions might be, and to study the effect of different interpretations based on SPT and CPT data, runs were made to explore these issues.

The results for a run using the interpretation of the cyclic stress ratio causing liquefaction based on the SPT data, which just triggered liquefaction, are shown in Figure 7. It may be seen that the peak spectral acceleration shifts to a longer period and the spectral accelerations are generally lower than for the case without the sand layer, but the difference is not that great. This is because when the excess pore pressures only

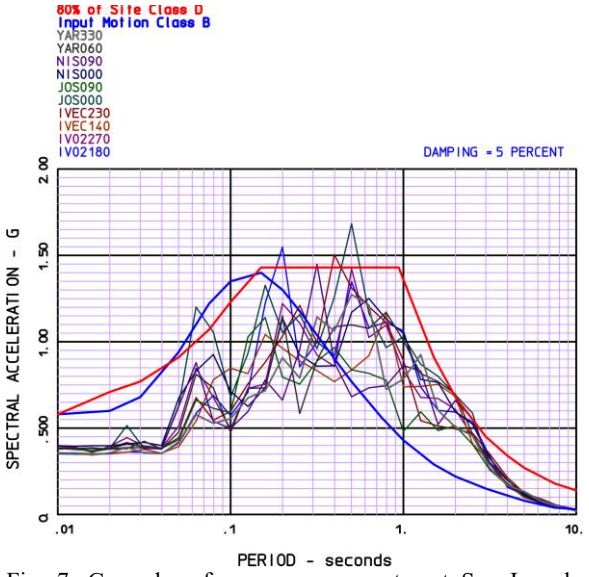



Fig. 7. Ground surface response spectra at San Leandro site assuming liquefiable shallow sand layer.

develop slowly and reach 100 percent during some portion of the cycle of loading towards the end of the record, the peak spectral accelerations are recorded earlier in the record when the potentially liquefiable layer is still stiffer. But if liquefaction were triggered earlier in the record, the spectral accelerations might be more dramatically reduced. That would clearly be indicative of potential issues with the site and the building's support, but the current code states that the design response spectrum should be not less than 80 percent of the standard code response spectrum for Site Class E, for which the flat top extends much further to the right. The use of the Site Class E response spectrum as the standard for potentially liquefiable sites is very questionable. Analyses of the site response for sites that are potentially liquefiable do involve more uncertainties than do analyses of non-liquefiable sites, but it would still make more sense to allow use of the results of site-specific site response analyses, provided they were reviewed by appropriately qualified and experienced geotechnical engineers.

### 3.4 Burlingame Site

This site has just 100 m of alluvium overlying Franciscan formation bedrock. There is only a thin layer of young Bay Mud underlying man-made fill at the top of the profile and no pronounced Old Bay Clay layer. In other words, it is a perfect Site Class D site. One-dimensional site response analyses using TESS2, using input motions fitted to a Site Class B response spectrum gave ground surface motions that were very compatible with the standard Site Class D response spectrum for this location between periods of 0.2 and 0.8 seconds.

However, as an alternative to supporting a planned 11-story office building on auger-cast piles, as is customary in this area, the owner proposed supporting it on a grid of deep soil mixed (DSM) walls with a typical

spacing of 10 m and a depth of about 17 m. The ground improvement subcontractor provided an estimate of the average shear wave velocities and unit weights for this grid and new site response analyses were conducted using these properties, treating the underside of the building's mat foundation as a free surface, as appears to be allowed by Section 19.2.3 (2) of ASCE 7-16. This is equivalent to assuming that upcoming shear waves are reflected by the bottom of the mat in the same way that they are at a free surface. This procedure also neglects any effect that the free-field motions have on the motion of the block of soil under the building and the DSM grid, and neglects both inertial and kinematic soil-structure interaction. However, modeling the increased stiffness of the DSM grid in the analysis lowered the spectral accelerations between periods of 0.2 and 0.8 seconds to about 80 percent of the standard response spectrum for Site Class D at this location. This reduction appeared to result from both the stiffer top of the profile and the fact that there is a slightly softer layer from 24 to 30 m bgs, and the cyclic shear strains and hence material damping in that layer increased significantly.

When the top of the profile was made both stiffer and more massive by adding the mass of the building to the top "soil" layer, the spectral accelerations up to a period of about 2 seconds were further reduced. These results are very dependent on the assumption of vertically propagating shear waves and the presence of the slightly softer layer in the profile, which acts as a filter for the shorter period motions, and otherwise involves significant approximations, but they do provide some indication of the likely effects of the added stiffness and mass on the ground motions at the base of the building, which are not otherwise accounted for in standard building design or codes.

## 4 CAUTIONS

In addition to generally requiring better field and laboratory investigations and more care, there are two related issues that make nonlinear analyses complicated and raise the possibility of erroneous results. The first of these issues is simply that modeling the degradation of the stiffness and the degeneration of shear stress – shear strain loops is necessarily somewhat complicated, and it is often difficult to follow what is actually happening in some soil models. This is particularly important when there is an intersection with the second issue which is the modeling of damping. Nonlinear site response analyses can be upset by two different problems related to material damping. One of these is that the solution scheme, or deliberately added viscous damping, might overdamp higher frequencies. The other, even more significant problem is that some programs or soil models adjust the modulus reduction curves, which form the backbone of the soil model, in order to match the conventional static shear strength. This is wrong because the asymptotic shear stress, or strength under cyclic loading, can be much higher than the static shear strength. Using the static value of the shear strength leads to excessive damping. Well documented studies, such as Pyke et al. (1993), suggest that the asymptotic shear strength for the backbone curve can be somewhat, or even much higher than that conventional static shear strength, because of both rate-of-loading and hardening effects. For a uniform cyclic loading in the analysis, using plain hyperbolas, this will produce greater damping than is seen in laboratory tests conducted with uniform loadings, but in reality, the shear stress - shear strain loops in nonlinear analyses rarely close and there are other energy losses in real soil profiles, and the use of backbone curves with higher asymptotic shear strengths and plain hyperbolic shapes yields good results in comparisons with recorded motions from vertical arrays. The significant effort involved in matching the loops and the damping to laboratory test data is not justified or required because of the difference between the laboratory and field conditions. See Pyke (2004) and Pyke (2021). However, the author has seen a number of examples of site response analyses of soft clay sites in the San Francisco Bay Area where erroneous matching of the backbone curves to the conventional static shear strengths leads to excessive damping and very low ground surface motions. That may be one of the reasons that the code-writing committees have applied the 80 percent of the standard code response spectrum limit in the past, but that is not necessary if there are review procedures in place to ensure good practice.

## 5 OTHER ADVANTAGES

Even without the possibility of triggering liquefaction, which places the site in Site Class F and requires a site response analysis, better estimates of surface ground motions can be made using nonlinear site response analyses. This is obviously true for soft clay sites, but it is also true where there is any possibility of the development of excess pore pressures, settlements, and lateral spreading. See Pyke (2023) for a discussion of the limitations of various simplified methods of analysis, which are often used in practice, but should at best only be used in screening analyses. Nonlinear effective-stress analyses explicitly model not only the development of excess pore pressures but also the redistribution and dissipation of excess pore pressures. Indeed, there is a growing consensus that the occurrence of liquefaction can only be understood by conducting nonlinear effective-stress analyses. See for example Ntritsos et al. (2018), Cubrinovski (2019), Hutabarat and Bray (2019), Kramer (2019) and Olson et al. (2020).

Moreover, analyses based on a single boring or CPT may include what are logged as "layers" but are in fact lenses or portions of a sinuous backfilled channel. Such lenses or segments of a channel cannot respond to

earthquake ground motions independently as is assumed in simplified analyses or even in standard one-dimensional site response analyses. If such "layers" do tend to develop excess pore pressures, they become "soft inclusions" and the shear strains and hence the shear stresses are controlled by the response of the surrounding materials (again, see Pyke (1995, 2003, 2015)). This mechanism can now be simulated in TESS2, by applying the displacement histories generated by running the site response calculation representing the site as a whole to a column that includes the potentially liquefiable "layer". The level of effort involved is not justified for all projects as knowledge of the depositional environment and common-sense should be sufficient on most projects, but where regulators require a "calculation", it is now possible to easily provide a meaningful calculation without having to conduct a two or three dimensional analysis.

## 6 CONCLUSIONS

Because of the wide variability of sites that fall into the existing Site Class D under US building codes, it is likely that some of these sites will legitimately show ground surface motions that are less than 80 percent, or more than 120 percent, of the standard code response spectrum. As noted above, this issue will be reduced, but not eliminated, when state and local building codes are updated in accordance with ASCE/SEI 7-22 in 2025. There is no easy solution for those sites that fall at the upper end of overall site stiffness in any site class. These site in effect get a break relative to average or softer sites, but responsible engineers and owners might want to conduct site-specific site response analyses if they want to maintain the level of risk that the building code is aiming for. But if the site is a particularly soft or deep site and the computed ground surface motions are less than 80 percent of the standard code response spectrum, owners are being penalized by the enforcement of the no less than 80 percent of the code response spectrum rule, and the building code objective of designing for a uniform risk for all sites across the country is being disrupted. Strict enforcement of the 80% rule penalizes new development in jurisdictions that include a number of such sites. As it happens, the detailed language of ASCE/SEI 7-22 omits this lower limit for site-specific site response analyses and only applies it to site-specific seismic hazard analyses. While this may have resulted from an editing issue, there is a strong argument for not re-instating this limit and rather beefing up the requirement for more focused review of the results of site response analyses by appropriately qualified professionals. In the meantime, there is also a strong argument that Building Officials should waive the existing lower limit when that is suggested by well-documented analyses that have been appropriately reviewed.

## REFERENCES


1) ASCE/SEI (2016): Standard 7-16, Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
2) Cubrinovski, M. (2019): Key aspects in the engineering assessment of soil liquefaction, *Proc. 7th International Conference on Earthquake Geotechnical Engineering*, Rome.
3) Hutabarat, D., and Bray, J.D. (2019): Effective stress analysis of liquefiable site in Christchurch to discern the characteristics of sediment ejecta, *Proc. 7th International Conference on Earthquake Geotechnical Engineering*, Rome.
4) Kramer, S. (2019): The use of numerical analysis in the interpretation of liquefaction case histories, *Proc. 7th International Conference on Earthquake Geotechnical Engineering*, Rome.
5) Ntritsos, N., et al. (2018): Evaluation of Liquefaction Case Histories from the 2010-2011 Canterbury Earthquakes Using Advanced Effective Stress Analysis, *Geotechnical Earthquake Engineering and Soil Dynamics V, ASCE Geotechnical Special Publication 290*.
6) Olson, S.M., et al. (2020): Nonlinear Site Response Analysis with Pore-Water Pressure Generation for Liquefaction Triggering Evaluation, *Journal of the Geotechnical and GeoEnvironmental Division, ASCE*, Vo. 146, No. 2.
7) Pyke, R. (1979): Non-linear Soil Models for Irregular Cyclic Loadings, *Journal of the Geotechnical Engineering Division, ASCE*, Vol. 105, No. GT6.
8) Pyke, R., et al. (1993): Modeling of Dynamic Soil Properties, Appendix 7.A, Guidelines for Determining Design Basis Ground Motions, *Report No. TR-102293,* Electric Power Research Institute, Palo Alto.
9) Pyke, R. (1995): Practical Aspects of the Evaluation of Liquefaction Potential, *Earthquake Geotechnical Engineering, Ishihara (ed.)*, Balkema.
10) Pyke, R. (2003): Discussion of Liquefaction Resistance of Soils: Summary Report From the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of liquefaction Resistance of Soils, *Journal of Geotechnical and Geo-environmental Engineering, ASCE*, Vol. 129, No.3.
11) Pyke R. (2004): Evolution of Soil Models Since the 1970s. *Int. Workshop on Uncertainties in Nonlinear Soil Properties and their Impact on Modeling Dynamic Soil Response, NSF and PEER Lifelines Program*, Berkeley.
12) Pyke, R. (2015): Evaluating the potential for earthquake-induced liquefaction in practice, *Proc. 6th International Conference on Earthquake Geotechnical Engineering*, Christchurch, New Zealand.
13) Pyke, R., (2019): Improved analyses of earthquake-induced liquefaction and settlement, *Proc. 7th International Conference on Earthquake Geotechnical Engineering*, Rome.
14) Pyke, R. (2020): Limitations of Vs30 for Characterizing Sites for Ground Motion Studies, *(21) Limitations of Vs30 for characterizing sites for ground motion studies and guidance on the conduct of nonlinear site response analyses | LinkedIn*.
15) Pyke, R. (2021): Modeling of stress-strain relationships of soils from Ted Davis to current practice, *Proceedings of the 20th International Conference on Soil Mechanics and Geotechnical Engineering*, Sydney.
16) Pyke, R. (2023): Limitations of Simplified Analyses of Liquefaction, Settlement and Lateral Spreading, *(21) Limitations of Simplified Analyses ... | LinkedIn*.
17) Stewart, J.P., Kwok, A.O., Hashash, Y.M.A., Matasovic, N., Pyke, R., Wang, Z., and Yang, Z. (2008): Benchmarking of nonlinear geotechnical ground response analysis procedures, *Report PEER 2008/04*, Pacific Earthquake Engineering Research Center, University of California, Berkeley.

# Further Updated Limitations of Simplified Methods for Evaluating Earthquake-Induced Liquefaction and its Consequences

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This note originated as a two-page document that summarized the main limitations of simplified methods for evaluating earthquake-induced liquefaction and its consequences. These consequences include loss of bearing capacity, uplift of structures embedded below the water table, settlement that occurs when excess pore pressures are dissipated, and lateral spreading. Most of these limitations also apply to simplified methods for estimating earthquake-induced settlements of dry or moist sands. Some of the same limitations also apply to simplified methods for estimating earthquake-induced displacement of slopes, but those methods also involve other issues which were not covered in my original note and are not addressed here. The original note also assumed that the reader was familiar with the methods that were being discussed and focused mostly on their limitations. The previous update of this article described some of the history of development of these simplified methods in order both to place some context around their current use and to note the significant approximations that are involved, but individual methods were still not described in every detail. This further update adds some more detail about individual methods and adds sub-headings in the hope of making the lengthier document more readable.

## The Origin of Simplified Methods

The basis of the original "simplified procedure for evaluating soil liquefaction potential" described by Seed and Idriss (1971) was that the average cyclic shear stress on a horizontal plane, $\tau_{av}$, could be obtained as a function of the peak ground surface acceleration by the following equation:

$$\tau_{av} = 0.65 \cdot a_{max}/g \cdot \sigma_v \cdot r_d$$

where $a_{max}$ is the peak ground surface acceleration, g is the acceleration due to gravity, $\sigma_v$ is the total vertical stress at the depth in question, and $r_d$ is an empirical factor that accounts for the fact that the soil column above the depth in question is not rigid. The average, that is uniform, cyclic shear stress for a number of cycles of loading, taken to be a function of the earthquake magnitude, can then be compared to the uniform cyclic shear stress that causes "initial liquefaction", or 100 percent excess pore pressure, in the same number of cycles. This combination of the uniform cyclic shear stress and number of cycles that triggers initial liquefaction was originally obtained from cyclic triaxial tests and were subsequently "corrected" to simple shear conditions.

The original simplified procedure was a brilliant way of making it possible for engineers to better understand and to make preliminary evaluations of the potential for liquefaction at a time when there were only a few people who could run even equivalent linear one-dimensional site response analyses. However, times change, and fifty years later, there are many more geotechnical

engineers with graduate education who are capable of running nonlinear effective stress site response analyses in order to obtain better estimates of the cyclic shear stresses and strains in critical layers. In addition, the importance of the depositional history and soil fabric to the behavior of real soils under cyclic loading is now better understood and there should be more emphasis on taking this into account.

In any case the original simplified procedure caught on and evolved into a variety of more complex but still simplified procedures that are available today. One of the first steps was that both sides of the above equation were divided by the initial vertical effective stress, $\sigma_v'$, at the depth in question and the value $\tau_{av} / \sigma_v'$ became known as the cyclic stress ratio (CSR). Likewise, the cyclic shear stress causing initial liquefaction, or a prescribed single or double amplitude cyclic shear strain, was "normalized" by dividing it by the vertical effective stress and became referred to as the cyclic resistance ratio (CRR). However, because the cyclic shear stress causing initial liquefaction does not vary linearly with the initial vertical effective stress, this was an imperfect normalization and an overburden correction factor, $K_\sigma$, later had to be added in order to address this issue.

Then, rather than basing the cyclic stress ratio causing liquefaction in a given number of cycles on laboratory test data, practice shifted to using correlations between the observation of the occurrence, or non-occurrence, of liquefaction in various earthquakes and Standard Penetration Test (SPT) blowcounts and Cone Penetration Test (CPT) tip resistances. These correlations were normally developed for magnitude 7.5 earthquakes, so that then a magnitude scaling factor was introduced to provide for other magnitudes. Variations of the depth reduction curve that were magnitude dependent were also developed. Thus, the simplified procedure for "triggering" of liquefaction, that is reaching 100 percent excess pore pressure, became based on a series of charts like this:

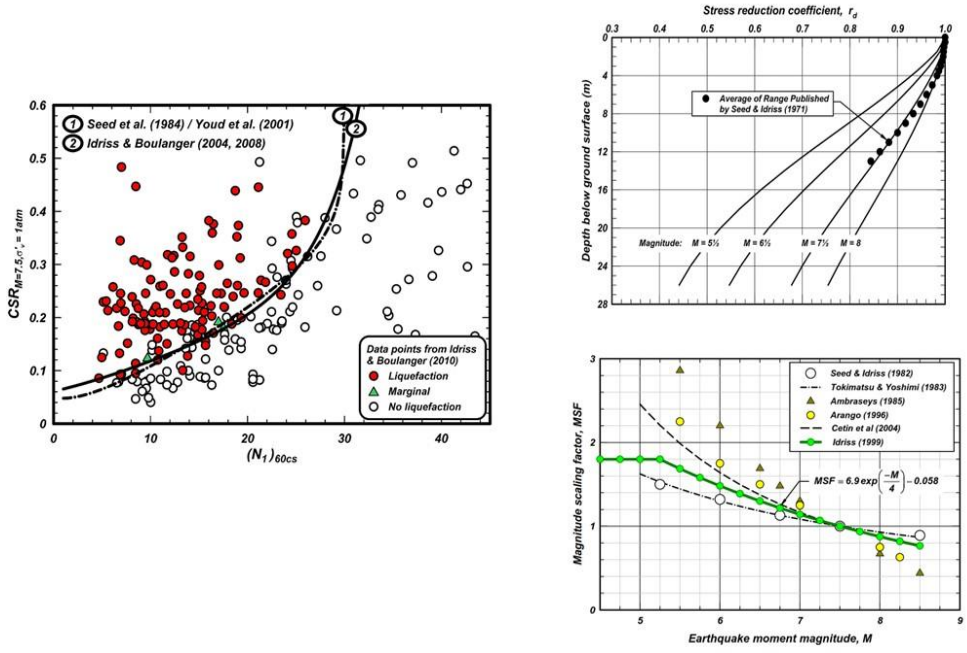



**Figure 1 – Simplified Method for Evaluating Triggering of Liquefaction**

Unfortunately, as one of my colleagues has put it, academics then spent about two decades shifting these curves around the page rather than focusing on the overall limitations of the procedure.

Extensions of the procedure developed for "triggering" liquefaction were also developed for evaluating settlement of both saturated and non-saturated sands and for predicting the magnitude of possible lateral spreading. These extensions, as well as the interpretation of SPT and CPT data, generally involve a number of correlations which are both very approximate and poorly understood. Most, if not all, of these correlations are based on laboratory tests, including calibration chamber tests, conducted on washed and screened clean sands that have not been subjected to pre-straining or overconsolidation, what Professor Michele Jamiolkowski referred to as "baby" sands. The behavior of real soils may be different. Thus, the simplified procedures gradually became more complicated, so that few, if any, practicing engineers fully understand each step in the various procedures, the limits of applicability of that step and whether the site in question fits within the limits of the overall applicability of the method. The current procedures have ended up being both over-simplified and too complicated to understand!

I am not sure how or why it became common practice to rely so much on simplified methods of analysis, especially for evaluating the consequences of liquefaction such as settlement and lateral spreading, but likely the paper by Youd et al. (2001), which reported the conclusions of two academic / industry workshops, and the subsequent paper by Seed et al. (2003) and monograph by Idriss and Boulanger (2008), all of which focused more on the triggering of initial liquefaction, had at least something to do with it. I wrote a critical discussion of the Youd et al. paper and my discussion and the authors' closure, which largely agreed with my comments, were published as Pyke (2003). However, I suspect that most graduate students and practicing geotechnical engineers have read the original Youd et al. paper and not my discussion! Readers of this note might like to read my discussion and the authors' closure, but the six points that I made at that time are still valid and are covered in the following text. However, practicing geotechnical engineers should not have to read my previous writings or this note to understand that the simplified methods are not very accurate. It is just wrong if you calculate 30 feet of lateral spreading of a levee built on a sandy, but relatively dense, foundation, or if you calculate 10-15 inches of settlement for a profile that lacks horizontally continuous sand or silty sand layers, and that kind of profile has never been known to exhibit any consequences of liquefaction. If that happens you should seek a better method of evaluation if the project has any importance at all.

## The Critical First Step

The first step in any evaluation of liquefaction and its consequences should in fact be answering the question "is there any evidence of earthquake-induced liquefaction and settlement or lateral spreading of similar soils in a similar tectonic environment?" - see for instance Pyke (1995, 2003, 2015) and Semple (2013). While there are rare instances of liquefaction being reported in Pleistocene-age sands, the vast majority of well-documented case histories have occurred in geologically recent cohesionless soils and man-made fills, particularly hydraulically placed fills. A significant early contribution on the susceptibility of various types of sedimentary deposits to liquefaction was made by Youd and Perkins (1978) and excellent recent contributions on this subject are provided by Kayen (2024) and Abayo et al. (2023).

**Do You Always Need to Show a Calculation?**

The widespread use of simplified methods of analysis has been driven in part by the belief that "one has to show a calculation." However, that belief does not promote better geotechnical engineering practice, and often leads to the opposite, which is worse practice. The policy of having to show a calculation promotes the use of computer programs which the user may not understand and can lead to blind acceptance of the output of computer programs, rather than checking the results of calculations against common sense and experience. A good screening analysis, for example, should emphasize common sense and experience rather than calculations. It did not require any analyses to conclude that the Marina District in San Francisco was susceptible to liquefaction prior to the 1989 Loma Prieta earthquake, or that the areas with recent alluvium and a high water table along the Avon River in Christchurch NZ were susceptible to liquefaction prior to the 2010-11 Christchurch earthquakes.

**Common Sense Rules**

But, if you have to do a quick simplified analysis, here are some common sense rules that should be applied:

1. All soil layers that have "clayey" descriptors should be tested as necessary to confirm that description and should be excluded. (The question of the effect of silty and clayey fines on liquefaction is discussed in more detail below.)

2. Soils that are older than several thousand years or are known to be over-consolidated should be excluded. See for instance Arango et al. (2000).

3. Sand and silty sand layers with measured shear wave velocities exceeding about 720 fps should also be excluded, see Andrus et al. (2009). However, gravelly soils which contain sufficient sand to be susceptible to liquefaction may have shear wave velocities up to about 1050 fps, see Rollins et al. (2022). Broadly speaking, gravels with less than about 30 percent sand are not susceptible to liquefaction because, unless they are confined by impermeable layers, any excess pore pressures that tend to develop will dissipate too quickly, but gravels that contain more than 30 percent sand or are otherwise confined should not be excluded unless the shear wave velocity exceeds 1050 fps. If measured shear wave velocities are not available, layers that would be otherwise characterized as "dense" or "very dense" should be excluded. Layers that are characterized as "dense" may still be susceptible to excess pore pressure development under strong shaking, but few if any adverse consequences of liquefaction have been observed when the normalized clean sand SPT blowcount exceeds 15. See for instance Ishihara (1993) and Youd et al. (2002).

4. Finally, a clayey or otherwise non-liquefiable crust overlying a potentially liquefiable layer will limit any adverse consequences of liquefaction. See for instance Ishihara (1985) and Youd and Garris (1995). While lateral spreads triggered by liquefaction of layers under a crust as thick as 10 m are not totally unknown, they are limited to very large earthquakes such as have occurred off the coasts of Alaska, Chile and Japan.

**General Limitations**

More specifically the following eight factors limit the accuracy of simplified methods of analysis and tend to make the results very conservative:

1. The "cyclic stress ratio" computed working down from the peak ground surface acceleration assuming no liquefaction is invariably much greater than that computed using a nonlinear effective stress site response analysis which takes into account the specific layering and properties of the site. Pyke (2019) and Crawford et al. (2019) show examples of the comparison of the cyclic stress ratios computed using the simplified and more accurate methods and found that the cyclic stress ratio computed using site response analyses can be as low as one half that computed using the simplified method. This reduction also results from the fact that triggering liquefaction in any one layer reduces the amplitudes of the ground motion above that layer.

2. Duration varies with the type of source and the distance as well as with magnitude. Site specific ground motions have to be much more accurate than using averages of worldwide data. See item 7 below for additional advantages of using site-specific input motions.

3. The correction of penetration resistance measured using either the SPT or the CPT for fines content is generally inadequate. Fines, and especially clayey fines, can dramatically reduce the penetration resistance while improving the resistance to developing excess pore pressures under cyclic loadings. If simplified analyses suggest that there are significant consequences of liquefaction, it is desirable to take samples and run hydrometer tests in order to obtain the full particle size distribution. Measurement of the PI is not unimportant but viewing the full particle size distribution is even more informative. Because the interpretation of soil type from CPTs is not foolproof, it is good practice to always conduct at least several CPT / boring pairs at the outset of an investigation whenever liquefaction is a possibility. The CPTs should be advanced first, and then SPT blowcounts can be targeted in the upper portion of any sufficiently thick sandy layers. Regardless of whether the weighted average shear wave velocity is required in order to determine the site class according to the building code, measurement of the shear wave velocities in seismic CPTs is always valuable because the shear wave velocity also serves as a good index test.

4. The correction of penetration resistance measured using either the SPT or the CPT for "transition", "thin layer", "multiple thin layer", and "underlying soft layer" effects is also generally inadequate. Recent work by Boulanger and DeJong (2018) and Yost et al. (2021) provides some guidance on these effects, but they are rarely accounted for in practice.

5. Penetration resistance also does not fully reflect the effect of ageing, including cementation, pre-straining, and over-consolidation on improving the soil response to cyclic loading.

6. There is growing evidence that the cyclic stress ratios that trigger liquefaction in a given number of cycles that are obtained as a function of the penetration resistance from the

standard charts that are used in simplified methods may be overly conservative - see for instance Stokoe (2023). Stokoe's team conducted relatively well-controlled studies of silty sands following the earthquakes in Christchurch NZ. By comparison, the soil profiles and properties in the case histories on which the standard curves are based are not so well documented.

7. There is also a growing consensus that the occurrence of liquefaction can only be understood by conducting nonlinear effective-stress site response analyses in which excess pore pressure development, redistribution and dissipation are tracked. See Ntritsos et al. (2018), Cubrinovski (2019), Hutabarat and Bray (2019), Kramer (2019), Olson et al. (2020) and Cubrinovski and Ntritsos (2023). It further turns out that such analyses are needed to determine which intervals in the deposit are most susceptible to liquefaction and to properly understand the case histories on which the simplified, empirical methods are based.

8. Nonlinear effective-stress site response analyses also use site-specific acceleration histories as input so that the overall duration and the number of cycles of loading are much better represented than they are in simplified analyses. And, because settlement and excess pore pressure development are a function of the prior loading up to the current point in time, these quantities can be calculated much more accurately using site-specific acceleration histories as input, rather than assuming a number of cycles of a uniform loading. Just as equivalent linear site response analyses were a brilliant idea at the time, so was the concept of a number of uniform cycles being equivalent to an irregular loading, but that was more than fifty years ago!

   While nonlinear effective-stress site response analyses are usually considered to be more difficult to perform than simplified methods of analysis, and may require more detailed field and laboratory studies, they are actually easier to understand and they can provide the engineer with more insight into both liquefaction issues and design ground motions.

9. Analyses based on a single boring or CPT may include what are logged as "layers" but are in fact lenses or portions of a sinuous backfilled channel. Such lenses or segments of a channel cannot respond to earthquake ground motions independently as is assumed in simplified analyses or even in standard one-dimensional site response analyses. If such "layers" do tend to develop excess pore pressures, they become "soft inclusions" and the shear strains and hence the shear stresses are controlled by the response of the surrounding materials (again, see Pyke (1995)).

The lens / sinuous channel issue can now be simulated in my own site response analysis program, TESS2, by applying the displacement histories generated by running the site response calculation representing the general site conditions to a column that includes the potentially liquefiable "layer." This level of effort is not justified for all projects as knowledge of the depositional environment and common sense should be sufficient on most projects, but where regulators require a "calculation", it is possible to provide a meaningful calculation without running two or three-dimensional response analyses.

**Particular Limitations**

It is not possible in a relatively short note to spell out all the particular limitations of individual simplified methods of analysis, but there are many of them and it is not easy for practicing engineers to be fully cognizant of them or to evaluate their impact on any given project. It is important that practicing engineers understand that not everything that is published in a journal is correct for every situation, and that simplified analyses of some sites may never be accurate enough to be useful. Some of the more important limitations are discussed below.

*Settlement*

Simplified methods for estimating settlements caused by earthquake loadings are particularly bad. Neither Harry Seed nor I thought that settlements of non-saturated sands was a major problem, but I nonetheless completed my Ph.D. thesis on this subject for other reasons, including achieving a better general understanding of the behavior of sands under cyclic loadings, as explained in Pyke (2022).

The conservatism of simplified methods for evaluating settlements of non-saturated sands results from the use of inappropriate laboratory test results, as well as the limitations associated with working down from the peak ground surface acceleration. Tokimatsu and Seed (1987) used data from Silver and Seed (1971), who had used a particularly angular sand which might be expected to settle much more than natural soils. Tokimatsu and Seed also recommended doubling the computed settlements of non-saturated sands based on Pyke et al. (1975). But that is a conservative interpretation of the Pyke et al. paper and doubling the computed settlements when they are already conservative is unnecessary. More accurate estimation of earthquake-induced excess pore pressures and settlements requires use of bi-directional nonlinear effective stress site response analyses in which two horizontal input motions are applied simultaneously and the increments in excess pore pressures and latent or immediate settlements are then calculated each half cycle for the motions in each of the two horizontal directions and added to the total.

The computer program CLiq includes a procedure for estimating settlements of dry, that is non-saturated sands, due to Robertson and Shao (2010). This is a legitimate, although very approximate procedure, which is based on Pradel (1998), which in turn is based on Tokimatsu and Seed (1987), thus the results are likely quite conservative.

There is no hard limit on the total amount of settlement that can occur, but it can be seen from data presented in Pyke (2020) and Pyke (2022) that additional settlements will be small once the accumulated settlement reaches a value on the order of 0.5 percent of the layer thickness under uni-directional loading. Since the settlements caused by each component of motion are additive, once the accumulated settlement reaches about 0.5 percent of the layer thickness, additional settlements caused by motion in either direction will also be small. In other words, accounting for the second component of motion increases the rate at which settlements or latent settlement accumulate but does not have much effect on the maximum settlement.

For sands below the water table, the problem is more complicated because, as noted for instance by Macedo and Bray (2018), there are three possible contributors to ground surface or building

settlements: the settlement that occurs when excess pore pressures are dissipated during or after the earthquake; the settlement that occurs as a result of material being ejected by excess pore pressures; and the settlement under or adjacent to buildings and other structures that results from rocking of the building adding to the cyclic shear stresses and strains in the soil.

For the first of these mechanisms, that is free-field settlement that occurs when excess pore pressures are dissipated during or after the earthquake, excessive conservatism again results partly from the use of conservative laboratory data. Tokimatsu and Seed (1987) used old data from Lee and Albaisa (1974), obtained from cyclic triaxial tests, which are inappropriate for this purpose. Ishihara and Yoshimine (1992) used a variety of laboratory tests, but as noted subsequently by Ishihara et al. (2016), they tested only freshly placed washed sands instead of naturally occurring soils. But simplified analyses of the settlement of saturated sands are even more conservative because they are both conservative with respect to reaching the point of initial liquefaction in a particular layer, and conservative regarding the depth of sand that reaches the point of initial liquefaction. Both these factors lead to larger settlements on reconsolidation. A nonlinear effective stress site response analysis will generally indicate both slower development of excess pore pressures and a much more limited depth of liquefaction. See Crawford et al (2019) and Pyke (2020) for examples of this issue.

The method of Ishihara and Yoshimine (1992) is also conservative for other another reason. Based on earlier studies by Ishihara's students, Ishihara and Yoshimine (1992) developed a relationship between volumetric strain on reconsolidation and the maximum amplitude of the shear strain as a function of relative density on the basis of various stress-controlled cyclic tests with uniform cycles of loading. They then settled on a definition of the "factor of safety" against liquefaction defined as 5 percent double amplitude axial strain in 20 cycles, and, following a complicated process which I doubt any practitioners have ever read, constructed relationships between this factor of safety and the maximum amplitude of the shear strain as a function of relative density. They then concluded that "if the factor of safety is known by means of the conventional method of liquefaction analysis, it will be possible to circumvent the determination of the maximum shear strain and to directly estimate the amount of post-liquefaction volumetric strain." They cite references from that time on how to evaluate the conventional factor of safety against liquefaction, but who knows how this is implemented in current spreadsheets and computer programs and whether it is consistent with how the settlement data was processed. Moreover, fundamentally the concept of a factor of safety against liquefaction makes no sense. The value of the expected excess pore pressures as a percentage of the initial vertical effective stress (the excess pore pressure ratio) makes sense and might be of some value, but the processes of settlement on reconsolidation after liquefaction or lateral spreading do not lend themselves to a single value of the factor of safety. Back when laboratory tests were generally conducted using stress-controlled cyclic tests with uniform cycles and irregular shear stress histories were converted to an equivalent number of uniform cycles, it was understandable that Ishihara and Yoshimine (1992) developed this procedure, but Pyke (1973), Pyke et al. (1975) and Pyke (2022) describe a much better way of computing the accumulation of latent settlement for irregular cyclic loadings. These procedures compute latent settlements every half cycle as a function of the peak strain in that half cycle and the accumulated latent settlement to that point. The accumulated settlement is used as a measure of the extent of previous cyclic loading as suggested by Martin et al. (1975) and Seed et al. (1978).

As a simple example of the limitations of the Ishihara and Yoshimine (1992) procedure, let me summarize part of a recent analysis conducted for a site in San Jose, California, focusing on a deep sand layer which is about 20 feet thick. This sand layer showed tip resistances ranging from 200 to 600 tsf, which convert to interpreted normalized SPT blow counts in order of 25 to 50 and had measured shear wave velocities in the order of 1200 to 1300 fps. But even though "transitions" were excluded and an $I_c$ cutoff of 2.05 was applied, the computed "factors of safety", while they are above 2.0 in some parts of this layer, drop to as little as 0.25 in other parts of the layer, so that volumetric strains in the order of 2 percent and settlement on reconsolidation of 2 inches were computed. While it would be possible to just ignore this result because of the depth of the layer, the high measured shear wave velocities, and also the facts that in this case there is a 20-foot-deep clay cap and no history of liquefaction at similar sites, the computed factors of safety make no sense, and the engineer should reject the analysis on that basis alone.

Further examples of the excessive conservatism of the Ishihara and Yoshimine (1992) procedure are illustrated in the papers by Pyke (2019) and Crawford et al. (2019) in which settlements of saturated sands computed using Ishihara and Yoshimine (1992) are directly compared with those computed using a bi-directional, nonlinear, effective stress site response analysis, as described in Pyke (2019) and Pyke (2022). In these two examples, computed settlements of 10 and 16 inches using Ishihara and Yoshimine (1992) were reduced to what are still believed to be conservative estimates of 1 to 2 and 2 to 3 inches, that is by a factor of 5 or more! Similar reductions have also been achieved in several dozen unpublished consulting studies.

The method of Zhang et al. (2002), which uses CPT data, basically relies on Ishihara and Yoshimine (1992) and is conservative for the same reasons, but it does have the advantage of offering a correction for fines due to Robertson and Wride (1998), which is one of the better corrections for fines content.

Cetin et al. (2009) recommended a "correction" for the settlement of saturated sands on reconsolidation which is unconservative. While this work was well-intentioned, the basis for the authors' "linear weighting scheme" is not well supported and should not be used. If the computed settlements are thought to be excessive, there are better ways to get a more accurate estimate.

There is an even more shocking misunderstanding in the unconservative direction. I have recently seen some engineers, presumably trying to offset the conservatism of simplified methods of analysis, argue that sands which are dilative under static loadings, as indicated by either laboratory tests or CPT-based correlations, do not exhibit any consequences of earthquake-induced liquefaction. This is simply not correct. It is true that such sands are likely not susceptible to "static liquefaction" and the generation of flow slides, but it was clearly established by the original studies by Seed and Lee, and many subsequent studies and field observations, that under cyclic loading otherwise dilative sands could develop excess pore pressures and at least reach the point of initial liquefaction, or 100% excess pore pressure development. However, as noted above, the consequences of this excess pore pressure development diminish with increasing density, and other factors such as ageing and pre-straining. Ishihara (1993) suggested that clean sands are dilative above a normalized SPT blowcount of about 9 and do not exhibit significant consequences of liquefaction above a

normalized SPT blowcount of about 15, at which point sands at normal confining pressures are strongly dilative. Development of any significant excess pore pressures is unlikely for sands with normalized SPT blowcounts above 30. But simply assuming that clean sands which are dilative under static loadings are not susceptible to earthquake-induced liquefaction and its consequences is unconservative!

Prediction of the exact amount of settlement that may results from the second and third mechanisms described by Macedo and Bray (2018), namely, the settlement that occurs as a result of material being ejected by excess pore pressures and the settlement under or adjacent to buildings and other structures that results from rocking of the building adding to the cyclic shear stresses and strains in the soil, is quite difficult. There is no question that these mechanisms are real, but these problems are best avoided by not using shallow foundations on sites that are highly susceptible to liquefaction.

*Lateral Spreading*

The relationships for lateral spreading developed by Les Youd and his colleagues - Bartlett and Youd (1995) and Youd et al. (2002) are the best of the simplified methods if applied with respect for the geology of the site as illustrated in Youd (2018). Youd (2018) also discusses checks that should be applied to each layer in the soil profile which includes the exclusion of sand layers under 1 m in thickness and those having a normalized clean sand SPT blowcount of greater than 15. The importance of ruling out sites with significant fines is also noted. See Youd et al. (2009) for three case histories involving sites where lateral spreading might have been anticipated but where significant deformations did not in fact develop.

The large scatter in the empirical data, which is not unexpected given the dependence of lateral spreading on the character of the ground motions and the inherent variability of ground motions and other factors, suggests that more advanced analyses, such as that described by Pyke (2019b) which use site-specific input motions, may be justified on more critical or high value projects.

The method of Zhang et al. (2004) makes no sense at all as it relies on an inappropriate correlation between cyclic strains in tests conducted without initial shear stresses and permanent strains developed in the field where there are initial shear stresses, which is what causes permanent deformations. These are two quite different mechanisms, and the method of Zhang et al. (2004) should not be used.

*Summary comment*

It is for all these reasons that Dr. Peter Robertson, the technical advisor to the developer of the program CLiq, has suggested to me that such tools should be used primarily for screening and should not be used to obtain the final answer on “high value” projects.

**A Good Example**

A good example of the limitations of simplified analyses of liquefaction and its effects is provided by Jon Bray in his 2022 Seed Lecture. Much of that lecture is based on studies conducted in

Christchurch, New Zealand, following the 2010 and 2011 earthquakes. Most of those studies were conducted along the Avon River whose floodplain is underlain by quite recent alluvial deposits. Those studies did not add a great deal of practical value to existing knowledge because most of these alluvial deposits were clear examples of soils that would be susceptible to liquefaction in even moderate earthquakes. However, there were some sites that showed no surface manifestations of liquefaction, and in particular no ejecta. The sites that did show surface effects of liquefaction, which are shown in red in Figure 2, were found to contain thick deposits of clean sands that had a typical value of $I_c$, the soil behavior index obtained from cone penetration tests, of consistently less than 1.8. The sites that did not show surface effects of liquefaction, shown in blue, may have contained some cleaner sand layers but were generally finer grained and typically had $I_c$ values greater than 1.8.

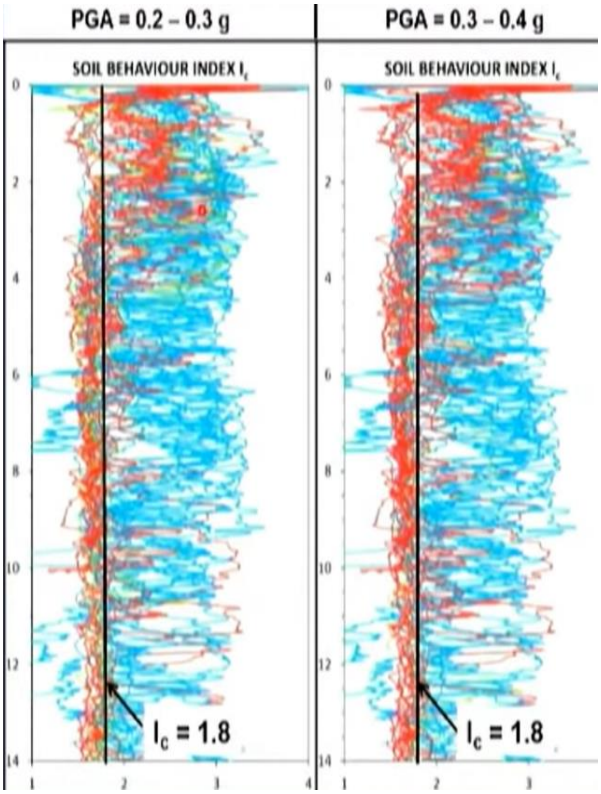



**Figure 2 – From Bray (2022)**

As Professor Bray correctly says in his lecture, it all goes back to geology. The sites that generally had $I_c$ values greater than 1.8 had been deposited in back-water swamps. While these soils were often characterized as silty sands, they in fact tended to have clean sand layers separated by silt or even clay layers. For some years I have advised clients that they should not rely on simplified analyses if the values of $I_c$ generally exceed 2.05, the generally accepted upper limit for clean sands (see Pyke and North (2019)), rather than the value of 2.6, which is the conventional point of separation of sandy and clayey soils. This does not necessarily mean that there is no problem at sites that include silty soils that have $I_c$ values greater than 1.8 or 2.05, but it does mean that you should not automatically accept the results of simplified analyses and that more detailed site investigations or more advanced analyses are called for on high-value or critical projects. Further support for Bray's limiting value of $I_c$ of 1.8 for classic liquefaction with surface effects was

provided by Robertson and Wride (1998) who found that the need to correct penetration resistances to "clean sand" values started at an $I_c$ value of 1.7, and by the case history described by Boulanger et al. (2016), so that applying even a limit on $I_c$ of 2.05 in simplified analyses may be too conservative.

### Further Support for Using a Lower $I_c$ Cutoff

Figure 3 shows a typical pattern of SPT blowcounts interpreted from the results of CPTs in the San Francisco Bay Area where the Bayshore deposits typically result from overlapping alluvial fans with occasional creek and levee deposits cutting through them. This results in lenses or pockets of cleaner sands within layers of more silty and clayey materials that are not continuous over a wide area. Such deposits have not exhibited historic liquefaction, but simplified methods often predict liquefaction and significant seismic settlements. The figure shows that below an $I_c$ value of about 1.8 the interpreted SPT blowcounts are between about 15 and 30. These materials, which are cleaner sands, may develop some excess pore pressures under cyclic loading but are most unlikely to produce consequences of engineering significance because, as noted previously, engineering consequences are unlikely above a normalized clean sand blowcount of 15.

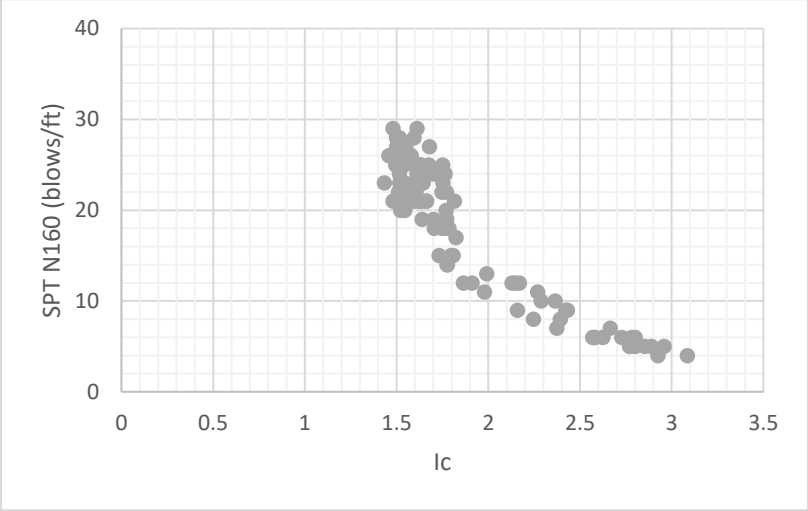



**Figure 3 – Sensitivity of SPT Blowcounts to $I_c$**

For $I_c$ values greater than about 1.8, the interpreted SPT blowcounts fall off as a function of the $I_c$ value, but this reflects increasing fines content and lower penetration resistance rather than increased susceptibility to adverse performance under cyclic loadings.

### Additional Factors to Consider

Additional factors that should be considered, even in screening analyses, include greater emphasis on the method of deposition, and the significance of complete saturation. The method of deposition is critical for both natural and man-made deposits. As illustrated in Pyke (1973) and in basic texts on sedimentary geology, a denser rain of particles leads to looser packing and lower densities. Conversely a less dense rain of particles leads to tighter packing. Some of the effects of

this are reflected in penetration resistance, but not all of the effects. The impact of the method of deposition can be seen for instance in the difference in the behavior of older hydraulic fills, which were largely dumped, or otherwise deposited with a dense rain of particles, compared with newer hydraulically placed fills in which the placement is more distributed and there is some compactive effort applied by spreading and grading operations using heavy equipment once the fill is above water - see Pyke et al. (1978) for an example.

Also, it should not be assumed that sands below the current water table are "fully saturated". In the laboratory it takes quite high back pressures to obtain a B factor approaching unity. This can easily be checked in the field by measuring the compression wave velocity – see Stokoe (2023) for an example. And see Banister et al. (1976) for an example where simplified analyses had predicted liquefaction in a large-scale field experiment, but liquefaction did not occur. This was attributed in part at least to seasonal fluctuations in the water table and the need for longer-term saturation, ideally with some flow of water, to obtain complete saturation.

### Criteria for Eliminating Soils with Silty and Clayey Fines

It should be noted that the academic criteria for delineating soils that are susceptible to liquefaction are likely very conservative. These criteria define soils that might develop significant excess pore pressures under the worst conditions, such as those under buildings constructed on shallow foundations on loose sands or silts with a high water table, where rocking of the building can add to the cyclic shear stresses and strains in the soil. Although the criteria of Bray and Sancio (2006) are widely cited and used, there are important points made in their conclusions which should be emphasized: "Moreover, some soils with PI < 12 may not be susceptible to liquefaction.

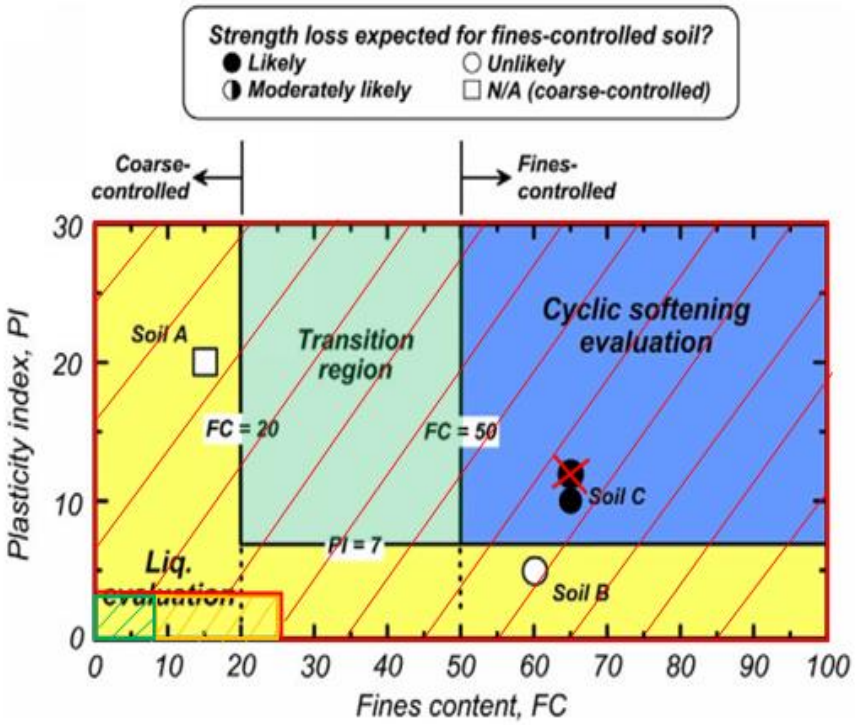



**Figure 4 – From Gingery (2021)**

Other factors such as soil minerology, void ratio, overconsolidation ratio, age, etc. are also contributing factors to liquefaction susceptibility", and "the proposed criteria should be applied with engineering judgment."

Figure 4 was sent to me by Jim Gingery of Keller North America in response to a question that I asked during a presentation to CalGeo. Jim's accompanying text said: "*There is a domain of soil types that are liquefiable but not densifiable. This is generally non-plastic to low-plasticity silty sands and sandy silts. I tried to illustrate this in the figure above from Armstrong and Malvick (2016) by overlaying zones of compactable (green hatch - small rectangle in bottom left-hand corner), marginal (orange hatch – longer rectangle in bottom left-hand corner) and not compactible (red hatch). The figure's proportions make it look like the domain for compactible and marginally compactible liquefiable soils is small, but there are plenty of such soils.*"

Jim's statement that there are soils that are liquefiable but not densifiable, is likely correct in a general sense, but it might be more correct to say that such soils can still develop some excess-pore pressures and show "cyclic mobility", but they are unlikely to exhibit significant consequences of this behavior unless, for instance, they are under buildings with shallow foundations, or are adjacent to large diameter piles or piers, which apply additional cyclic shear stresses and strains to the underlying or adjacent soils. Case histories which show larger earthquake-induced settlements usually involve lateral spreading or pumping under buildings with shallow foundations that have been built on loose saturated sands and silts. Analysis of these case histories is of legitimate academic interest but the most important lesson for practicing engineers is to spend the money on a deep foundation!

**Methods of Analysis**

There are basically four kinds of geotechnical analysis:

1. One that does not involve any calculations but relies on common sense and experience. Experience includes both the engineer's personal experience and the collected experience of the profession including observations of behavior in past earthquakes.

2. "Back of the envelope" calculations, that is a simple calculation that gives the engineer a sense of the expected behavior.

3. Simplified analyses, which might involve more calculations and require a spreadsheet or a computer program.

4. More complete analyses which include more detailed modeling of the geometry and all the relevant variables. These can be 1, 2 or 3D models.

In many cases I believe that Option 1 is all that is necessary, although a simple "back of the envelope" calculation such as the Youd et al. procedure for estimating lateral spreads, or my suggestion that settlement of non-saturated sands will not exceed about 0.5 percent of the layer

height, may help quantify the potential problem. The late Professor Bob Whitman was of the opinion that beyond Options 1 and 2, there was no point in running a simplified analysis and that you should try to model the problem as accurately as possible in a more complete analysis. I concur with that but note that a more complete analysis will still involve a number of approximations, so one should not assume that the numerical answer will be precisely correct. However, the engineer should obtain a much better understanding of the problem and obtain answers that are "in the ballpark" if adequate field and laboratory data are available.

**Concluding Remarks**

When I was a graduate student in the early nineteen-seventies it was possible to read essentially all the relevant published papers on any topic of interest, but that is impossible for practicing engineers today. Further, the published papers are largely written by academics who have to publish or perish. And both research funding and publication processes tend to favor new findings and problems, rather than consolidation of existing knowledge and focusing on practical engineering solutions. For example, the big lesson from the Niigata and Kocaeli earthquakes is not so much the details of the liquefaction processes that were involved, but that it is not a good idea to construct apartment blocks with shallow foundations on loose sands or silts, especially when there is a high water table! But in this note I have tried to pull together some important findings that come out of both research papers and observations of performance in earthquakes over a period of 50 years.

These can be broadly summarized as follows:

- It's the geology stupid!

  Or, more specifically, the method of deposition and the resulting soil fabric. And don't forget to ask: "is there any evidence of earthquake-induced liquefaction and settlement or lateral spreading of similar soils in a similar tectonic environment?

- It is not wise to completely rely on automated processes involving spreadsheets or computer programs in geotechnical engineering. The variability in the depositional history and current geometry of soil deposits necessarily calls for some judgment to be exercised by the responsible engineer who should always ask, "does this answer make any sense?"

- The simplified methods for evaluating liquefaction, settlement and lateral spreading are at best screening tools. Ideally, no responsible engineer should rely on any of the simplified methods for evaluating liquefaction and its consequences unless they have some familiarity with each step in the procedure, the limits of applicability of that step and whether the site in question fits within the limits of the overall applicability of the method. And reviewers should not automatically either accept or reject the results of simplified analyses on projects of any importance.

- More detailed site investigations and more advanced analyses may be called for on high-value or critical projects. Even for simplified analyses it is good practice to initially conduct seismic CPTs and, if there are any potentially liquefiable layers, to follow-up with companion borings in which SPTs are targeted towards the top of those layers and full grain size curves are obtained.

## References


Abayo, N.I., et al., "Fluvial geomorphic factors affecting liquefaction-induced lateral spreading", Earthquake Spectra, Vol. 39, No.4, 2023

Andrus, R.D., Hayati, H. and Mohanan, N.P., "Correcting Liquefaction Resistance for Aged Sands Using Measured to Estimated Velocity Ratio", Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 135, No. 6, pp 735-744, 2009

Andrus, R.D., Stokoe, K.H., and Juang, C.H., "Guide for Shear-Wave Based Liquefaction Potential Evaluation", Earthquake Spectra, Vol. 20, No. 2, May 2004

Arango, I., Lewis, M.R. and Kramer, C., "Updated Liquefaction Potential Analysis Eliminates Foundation Retrofitting at Two Critical Structures", Soil Dynamics and Earthquake Engineering, Vol 20, pp 17-25, 2000

Armstrong, R.J., and Malvick, E.J., "Practical Considerations in the Use of Liquefaction Susceptibility Criteria", Earthquake Spectra, Vol. 32, No. 3, August 2016

Banister, J.R., Pyke, R., Ellet, D.M., and Winters, L., "In-situ Pore Pressure Measurements at Rio Blanco," Journal of the Geotechnical Engineering Division, ASCE, Volume 102, No. GT10, October 1976

Bartlett, S. F., and Youd, T. L., "Empirical prediction of liquefaction-induced lateral spread", Journal of Geotechnical Engineering, ASCE, Vol. 121, No. 4, 1995

Bwambale, B., and Andrus, R.D., "State of the art in the assessment of aging effects on soil liquefaction", Soil Dynamics and Earthquake Engineering, 125, 2019

Boulanger, R.W., and DeJong, J.T., "Inverse Filtering Procedure to Correct Cone Penetration Data for Thin Layer and Transition Effects" in Cone Penetration Testing 2018, CRC Press, 2018

Boulanger, R.W., et al., "Evaluating Liquefaction and Lateral Spreading in Interbedded Sand, Silt and Clay Deposits Using the Cone Penetrometer", Geotechnical and Geophysical Site Characterization 5, Australian Geomechanics Society, Sydney, Australia, 2016

Bray, J.D., "Evaluating the Effects of Liquefaction", (1049) Geo-Congress 2022: H. Bolton Seed Lecture: Jonathan Bray - YouTube

Bray, J.D., and Sancio, R.B., "Assessment of the Liquefaction Susceptibility of Fine-Grained Soils", Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 132, No. 9, September 2006

Cetin, K.O., et al., "Probabilistic model for assessment of cyclically-induced reconsolidation (volumetric) strains, Journal of the Geotechnical and GeoEnvironmental Division, ASCE, Vol. 135, No. 3, 2009

Crawford, C., Tootle, J., Pyke, R. and Reimer, M., "Comparison of simplified and more refined analyses of seismic settlements", Proc. 7th International Conference on Earthquake Geotechnical Engineering, Rome, June 2019

Cubrinovski, M., Keynote Lecture 09, "Key aspects in the engineering assessment of soil liquefaction", Proc. 7th International Conference on Earthquake Geotechnical Engineering, Rome, June 2019

Gingery, J., "Design Elements of Ground Improvement for Liquefaction Mitigation", Presentation to CalGeo, July 29, 2021

Idriss, I.M., and Boulanger, R.W., "Soil Liquefaction During Earthquakes", Monograph MNO-12, Earthquake Engineering Research Institute, 2008

Ishihara, K., "Liquefaction and flow failure during earthquakes", Geotechnique, Vol.43, No. 3, 1993

Ishihara, K., "Stability of Natural Deposits During Earthquakes", Proceedings of the 11th International Conference on Soil Mechanics and Foundation Engineering, San Francisco, Vol. 1, pp 321-376, 1985

Ishihara, K., and Yoshimine, M., "Evaluation of Settlements in Sand Deposits Following Liquefaction During Earthquakes", Soils and Foundations, Vol.32, No.1, pp.173-188, March 1992

Ishihara, K., et al., "Post-liquefaction settlement analyses based on the volume change characteristics of undisturbed and reconstituted sands", Soils and Foundations, Vol. 56, No. 3, 2016

Kayen, R., "Geology is the key: Understanding the liquefaction susceptibility of Niigata City soil", Proceedings of the 8th International Conference on Earthquake Geotechnical Engineering, Osaka, 2024

Hutabarat, D., and Bray, J.D., "Effective stress analysis of liquefiable site in Christchurch to discern the characteristics of sediment ejecta", Proc. 7th International Conference on Earthquake Geotechnical Engineering, Rome, June 2019

Kramer, S., Keynote Lecture 08, "The use of numerical analysis in the interpretation of liquefaction case histories", Proc. 7th International Conference on Earthquake Geotechnical Engineering, Rome, June 2019

Lee, K.L., and Albaisa, A., "Earthquake-induced settlements in saturated sands", Journal of the Soil Mechanics and Foundations Division, ASCE, Vol. 100, No. 4, 1974

Macedo, J., and Bray, J.D., "Key Trends in Liquefaction-Induced Building Settlement", Journal of the Geotechnical and GeoEnvironmental Division, ASCE, Vo. 144, No. 11, 2018

Martin, G.R., Seed, H.B., and Finn, W.D.L., "Fundamentals of Liquefaction under Cyclic Loading", Journal of the Geotechnical Engineering Division, ASCE, Volume 101, No. GT5, May 1975

Ntritsos, N., et al., "Evaluation of Liquefaction Case Histories from the 2010-2011 Canterbury Earthquakes Using Advanced Effective Stress Analysis", Geotechnical Earthquake Engineering and Soil Dynamics V ASCE Geotechnical Special Publication 290, 2018

Olson, S.M., et al. "Nonlinear Site Response Analysis with Pore-Water Pressure Generation for Liquefaction Triggering Evaluation", Journal of the Geotechnical and GeoEnvironmental Division, ASCE, Vo. 146, No. 2, 2020

Pradel, D., "Procedure to Evaluate Earthquake-induced Settlements in Dry Sandy Soils", Journal of Geotechnical Engineering, ASCE, Vol. 124, No. 4, 1998

Pyke, R., "Settlement and Liquefaction of Sands Under Multi-Directional Loading," Ph.D. Thesis, University of California, Berkeley, 1973

Pyke, R., "Practical Aspects of the Evaluation of Liquefaction Potential", Earthquake Geotechnical Engineering, Ishihara (ed.), Balkema, 1995

Pyke, R., Discussion of "Liquefaction Resistance of Soils: Summary Report From the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of liquefaction Resistance of Soils", Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 129, No.3, March 2003

Pyke, R., "Evaluating the Potential for Earthquake-Induced Liquefaction in Practice", 6th International Conference on Earthquake Geotechnical Engineering, Christchurch, New Zealand, November 2015

Pyke, R., "Improved analyses of earthquake-induced liquefaction and settlement", Proc. 7th International Conference on Earthquake Geotechnical Engineering, Rome, 2019 (a)

Pyke, R., "Improved Analysis of Potential Lateral Spreading Displacements in Earthquakes", Presented at the 2nd Ishihara Colloquium, San Diego State University, August 22-23, 2019(b)
https://www.linkedin.com/pulse/improved-analysis-potential-lateral-spread-earthquakes-robert-pyke/

Pyke, R., “Limitations of Simplified Methods for Estimating Seismic Settlements”, 2020 https://www.linkedin.com/pulse/limitations-simplified-methods-estimating-seismic-settlements-pyke/

Pyke, R., “Lessons learned from the observed seismic settlement at the Jensen Filtration Plant in the San Fernando Earthquake”, ASCE Lifelines 21-22 Conference, Los Angeles, February 2022

Pyke, R., “The benefits of site-specific nonlinear site response analyses”, Proc. 8th International Conference on Earthquake Geotechnical Engineering, Osaka, 2024

Pyke, R., Knuppel, L.A, and Lee, K.L., "Evaluation of Liquefaction Potential at Los Angeles and Long Beach Harbors," Journal of the Geotechnical Engineering Division, ASCE, Volume 104, No. GT11, November 1978

Pyke, R., and North, J., “Shortcomings of simplified analyses of earthquake-induced liquefaction and settlement”, Proc. 7th Int. Conference on Earthquake Geotechnical Engineering, Rome, June 2019

Pyke, R., Seed, H.B. and Chan, C.K., “Settlement of sands under multi-directional shaking”, Journal of Geotechnical Engineering, ASCE, Vol. 101, No. 4, 1975

Robertson, P.K., and Shao, L., “Estimation of seismic compression in dry soils using the CPT”, Proc. Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics, San Diego, 2010

Robertson, P.K., and Wride, C.E., “Evaluating cyclic liquefaction potential using the cone penetration tests”, Canadian Geotechnical Journal, Vol. 35, pp. 442-459, 1998

Rollins, K.M., et al., “A New Vs-Based Liquefaction-Triggering Procedure for Gravelly Soils”, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Volume 148, No. GT6, June 2022

Seed, H.B., and Idriss, I.M., “Simplified Procedure for Evaluating Soil Liquefaction Potential,” Journal of the Soil Mechanics and Foundations Division, ASCE, Vol.97, No. SM9, September 1971

Seed, H.B., Pyke, R., and Martin, G.R., "Effect of Multi-Directional Shaking on Pore Pressure Development in Sands," Journal of the Geotechnical Engineering Division, ASCE, Volume 104, No. GT1, January 1978

Seed, R.B., et al., “Recent Advances in Soil Liquefaction Engineering: a Unified and Consistent Framework”, 26th Annual ASCE Los Angeles Geotechnical Spring Seminar, Long Beach, 2003

Silver, M.L. and Seed, H.B., “Volume changes in sands during cyclic loading”, Journal of the Soil Mechanics and Foundations Division, ASCE, Vol. 97, No. 9, 1971

Semple, R., “Problems with Liquefaction Criteria and Their Application in Australia”, Australian Geomechanics, Vol. 48, No. 3, pp 15-48, September 2013

Stokoe, K.H., “UTexas Field and Laboratory Liquefaction Activities”, Presentation to the Dobry Symposium, Rensselaer Polytechnic Institute, Troy NY, May 2023

Tokimatsu, K., and Seed, H.B., “Evaluation of Settlements in Sands Due to Earthquake Shaking”, Journal of Geotechnical Engineering, ASCE, Vol.113, No. 8, August 1987

Yost, K.M., et al., “Assessment of the Efficacies of Correction Procedures for Multiple Thin Layer Effects on Cone Penetration Tests”, Soil Dynamics and Earthquake Engineering, Vol. 144, 2021

Youd, T.L., et al., “Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils”, Journal of Geotechnical and GeoEnvironmental Engineering, ASCE, Vol. 127, No. 10, October 2001

Youd, T.L., et al., “Zero-Displacement Lateral Spreads, 1999 Kocaeli, Turkey, Earthquake”, Journal of Geotechnical and GeoEnvironmental Engineering, ASCE, Vol. 135, No. 1, January 2009

Youd, T.L., and Garris, C.G., “Liquefaction-Induced Ground-Surface Disruption”, ASCE Journal of Geotechnical Engineering, Vol. 121, No. 11, 1995

Youd, T.L., Hansen C.M., and Bartlett, S.F., "Revised Multilinear Regression Equations for Prediction of lateral Spread Displacements", Journal of Geotechnical and GeoEnvironmental Engineering, ASCE, Vol. 128, No.128, December 2002

Youd, T.L., and Perkins, D.M., "Mapping Liquefaction-Induced ground Failure Potential", Journal of the geotechnical Engineering Division, ASCE, Vol. 104, No. GT4, April 1978.

Youd, T.L., "Application of MLR Procedure for Prediction of Liquefaction-Induced Lateral Spread Displacement", Journal of the Geotechnical and GeoEnvironmental Division, ASCE, Vo. 144, No. 6, 2018

Zhang, G., Robertson, P.K., and Brachman, R.W.I., "Estimating liquefaction-induced ground settlements from CPT for level ground", Canadian Geotechnical Journal, Vol. 39, pp. 1168-1180, 2002

Zhang, G., Robertson, P.K., and Brachman, R.W.I., "Estimating Liquefaction-Induced Lateral Displacements Using the Standard Penetration Test or Cone Penetration Test", Journal of Geotechnical and GeoEnvironmental Engineering, ASCE, Vol. 130, No. 8, August 2004.

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# APPENDIX H

# Liquefaction Analysis Results for Seismic Lines

**399 Lindbergh Ave**
Livermore, CA 94551

Seismic line SL-1

# $V_s$ BASED LIQUEFACTION ANALYSIS REPORT

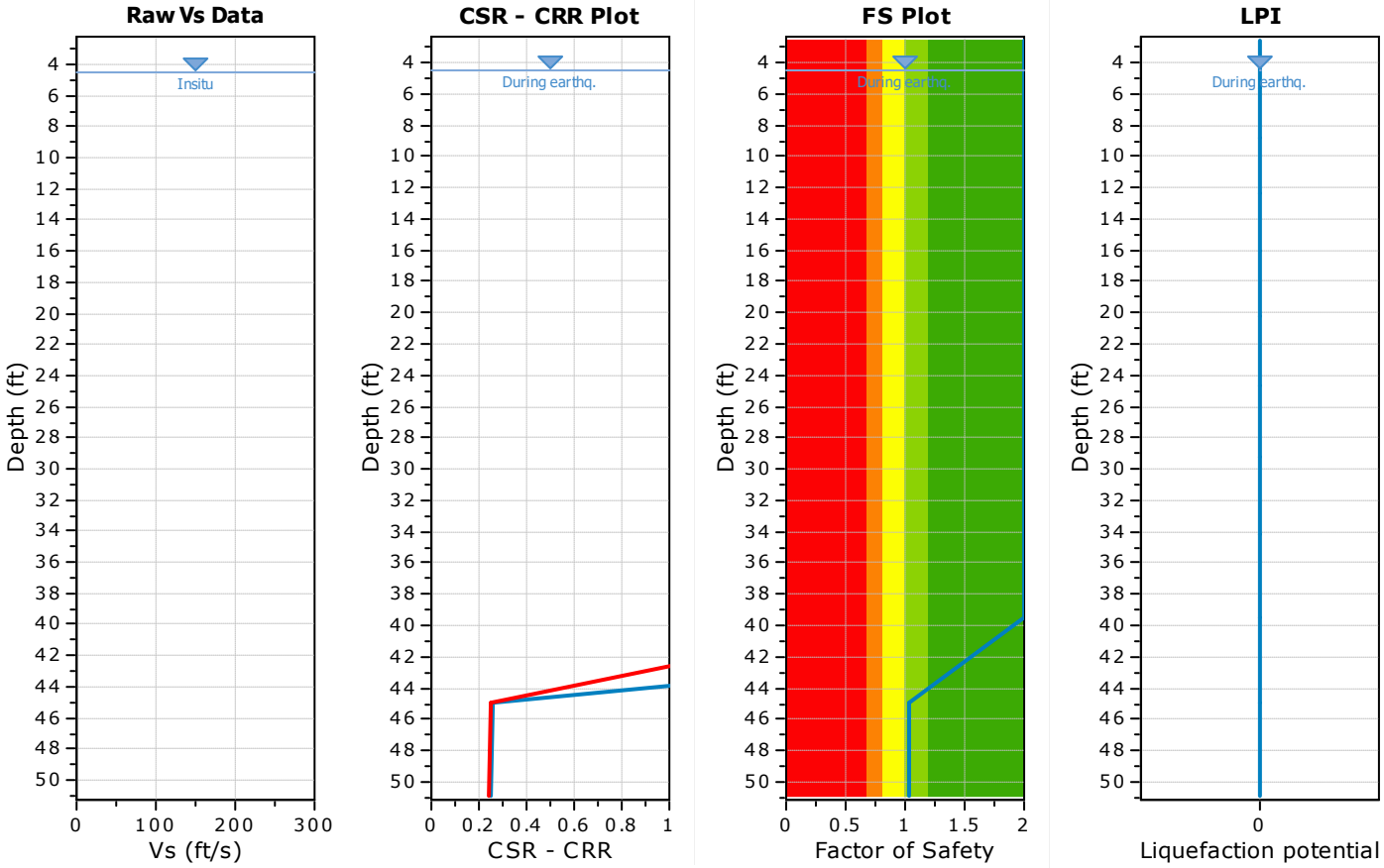
**Project title : Tri-Valley Hospital Expansion**

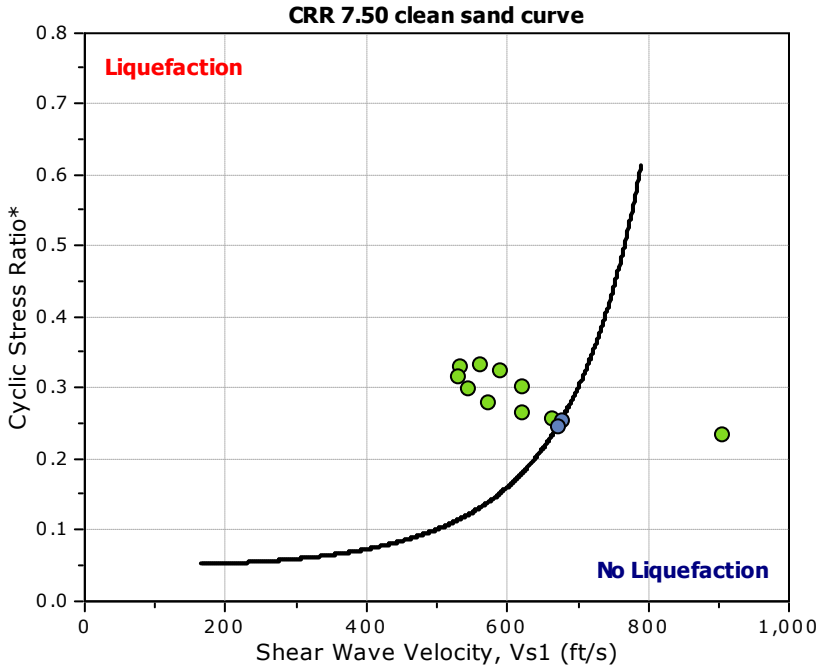
**$V_s$ Name: MASW Line 1**

**Location :**

**:: Input parameters and analysis properties ::**

| | |
|---|---|
| Analysis method: | Kayen et al. 2013 |
| G.W.T. (in-situ): | 4.50 ft |
| G.W.T. (earthq.): | 4.50 ft |
| Earthquake magnitude $M_w$: | 7.43 |
| Peak ground acceleration: | 0.37 g |
| Eq. external load: | 0.00 tsf |



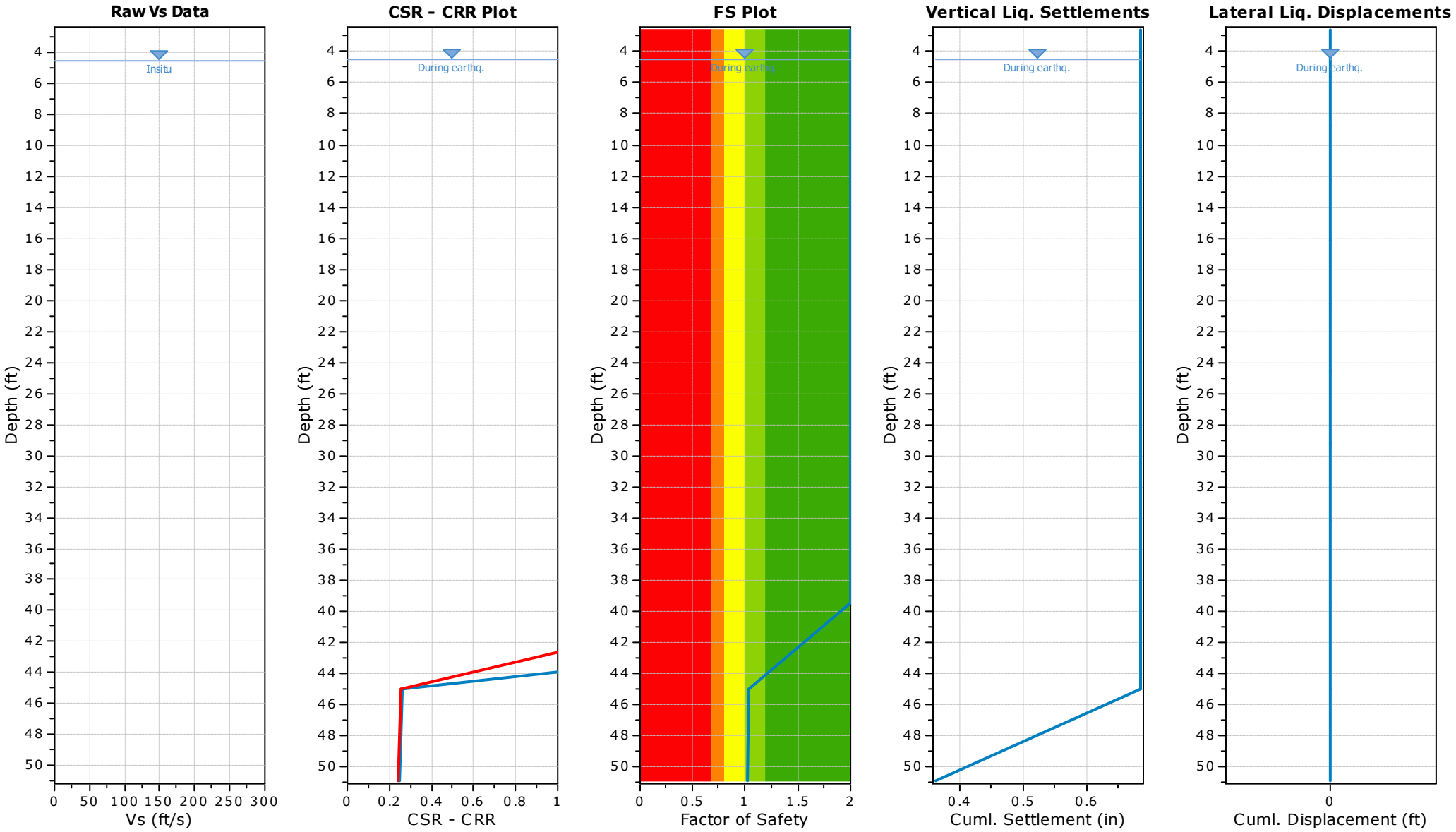

**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LPI color scheme**

- Very high risk
- High risk
- Low risk

## :: Overall Liquefaction Assessment Analysis Plots ::



**:: Field input data ::**

| Test Depth (ft) | $V_s$ Field Value (ft/s) | Fines Content (%) | Unit Weight (pcf) | Infl. Thickness (ft) | Can Liquefy |
|---|---|---|---|---|---|
| 2.60 | 562.00 | 0.00 | 120.00 | 2.60 | No |
| 5.60 | 485.00 | 0.00 | 120.00 | 3.00 | No |
| 8.80 | 487.00 | 0.00 | 120.00 | 3.20 | No |
| 12.30 | 489.00 | 0.00 | 120.00 | 3.50 | No |
| 16.10 | 488.00 | 0.00 | 120.00 | 3.80 | No |
| 20.20 | 485.00 | 0.00 | 120.00 | 4.10 | No |
| 24.60 | 504.00 | 0.00 | 120.00 | 4.40 | No |
| 29.20 | 536.00 | 0.00 | 120.00 | 4.60 | No |
| 34.20 | 584.00 | 0.00 | 120.00 | 5.00 | No |
| 39.50 | 652.00 | 0.00 | 120.00 | 5.30 | No |
| 45.00 | 733.00 | 10.00 | 120.00 | 5.50 | Yes |
| 50.90 | 747.00 | 10.00 | 120.00 | 5.90 | Yes |

**Abbreviations**

Depth: Depth at which test was performed (ft)
Vs Field Value: Measured shear waves velocity (ft/s)
Fines Content: Fines content at test depth (%)
Unit Weight: Unit weight at test depth (pcf)
Infl. Thickness: Thickness of the soil layer to be considered in settlements analysis (ft)
Can Liquefy: User defined switch for excluding/including test depth from the analysis procedure

**:: Cyclic Resistance Ratio (CRR) calculation data ::**

| Depth (ft) | $V_s$ Field Value (ft/s) | Unit Weight (pcf) | $\sigma_v$ (tsf) | $u_o$ (tsf) | $\sigma'_{vo}$ (tsf) | Norm. Factor | $V_{s1}$ (ft/s) | $CRR_{7.5}$ |
|---|---|---|---|---|---|---|---|---|
| 2.60 | 562.00 | 120.00 | 0.16 | 0.00 | 0.16 | 1.61 | 906.96 | 4.000 |
| 5.60 | 485.00 | 120.00 | 0.34 | 0.03 | 0.30 | 1.37 | 663.72 | 4.000 |
| 8.80 | 487.00 | 120.00 | 0.53 | 0.13 | 0.39 | 1.28 | 623.49 | 4.000 |
| 12.30 | 489.00 | 120.00 | 0.74 | 0.24 | 0.49 | 1.21 | 591.38 | 4.000 |
| 16.10 | 488.00 | 120.00 | 0.97 | 0.36 | 0.60 | 1.15 | 561.41 | 4.000 |
| 20.20 | 485.00 | 120.00 | 1.21 | 0.49 | 0.72 | 1.10 | 533.60 | 4.000 |
| 24.60 | 504.00 | 120.00 | 1.48 | 0.63 | 0.85 | 1.06 | 532.54 | 4.000 |
| 29.20 | 536.00 | 120.00 | 1.75 | 0.77 | 0.98 | 1.02 | 546.19 | 4.000 |
| 34.20 | 584.00 | 120.00 | 2.05 | 0.93 | 1.13 | 0.98 | 575.07 | 4.000 |
| 39.50 | 652.00 | 120.00 | 2.37 | 1.09 | 1.28 | 0.95 | 621.94 | 4.000 |
| 45.00 | 733.00 | 120.00 | 2.70 | 1.26 | 1.44 | 0.93 | 679.07 | 0.261 |
| 50.90 | 747.00 | 120.00 | 3.05 | 1.45 | 1.61 | 0.90 | 672.97 | 0.251 |

**Abbreviations**

$\sigma_v$: Total stress during SPT test (tsf)
$u_o$: Water pore pressure during SPT test (tsf)
$\sigma'_{vo}$: Effective overburden pressure during SPT test (tsf)
Norm. Factor: overburden-stress correction factor
$V_{S1}$: Overburden-stress corrected shear wave velocity
$CRR_{7.5}$: Cyclic resistance ratio for M=7.5

**:: Cyclic Stress Ratio calculation (CSR fully adjusted and normalized) ::**

| Depth (ft) | Unit Weight (pcf) | $\sigma_{v,eq}$ (tsf) | $u_{o,eq}$ (tsf) | $\sigma'_{vo,eq}$ (tsf) | $r_d$ | $\alpha$ | CSR | MSF | $CSR_{eq,M=7.5}$ | $K_{sigma}$ | $CSR^*$ | FS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.60 | 120.00 | 0.16 | 0.00 | 0.16 | 0.99 | 1.00 | 0.238 | 1.02 | 0.234 | 1.00 | 0.234 | 2.000 | ● |
| 5.60 | 120.00 | 0.34 | 0.03 | 0.30 | 0.97 | 1.00 | 0.261 | 1.02 | 0.256 | 1.00 | 0.256 | 2.000 | ● |

**:: Cyclic Stress Ratio calculation (CSR fully adjusted and normalized) ::**

| Depth (ft) | Unit Weight (pcf) | $\sigma_{v,eq}$ (tsf) | $u_{o,eq}$ (tsf) | $\sigma'_{vo,eq}$ (tsf) | $r_d$ | $\alpha$ | CSR | MSF | $CSR_{eq,M=7.5}$ | $K_{sigma}$ | $CSR^*$ | FS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8.80 | 120.00 | 0.53 | 0.13 | 0.39 | 0.95 | 1.00 | 0.306 | 1.02 | 0.301 | 1.00 | 0.301 | 2.000 | ● |
| 12.30 | 120.00 | 0.74 | 0.24 | 0.49 | 0.92 | 1.00 | 0.330 | 1.02 | 0.325 | 1.00 | 0.325 | 2.000 | ● |
| 16.10 | 120.00 | 0.97 | 0.36 | 0.60 | 0.88 | 1.00 | 0.338 | 1.02 | 0.333 | 1.00 | 0.333 | 2.000 | ● |
| 20.20 | 120.00 | 1.21 | 0.49 | 0.72 | 0.83 | 1.00 | 0.335 | 1.02 | 0.329 | 1.00 | 0.329 | 2.000 | ● |
| 24.60 | 120.00 | 1.48 | 0.63 | 0.85 | 0.77 | 1.00 | 0.322 | 1.02 | 0.317 | 1.00 | 0.317 | 2.000 | ● |
| 29.20 | 120.00 | 1.75 | 0.77 | 0.98 | 0.71 | 1.00 | 0.304 | 1.02 | 0.299 | 1.00 | 0.299 | 2.000 | ● |
| 34.20 | 120.00 | 2.05 | 0.93 | 1.13 | 0.65 | 1.00 | 0.285 | 1.02 | 0.280 | 1.00 | 0.280 | 2.000 | ● |
| 39.50 | 120.00 | 2.37 | 1.09 | 1.28 | 0.60 | 1.00 | 0.268 | 1.02 | 0.264 | 1.00 | 0.264 | 2.000 | ● |
| 45.00 | 120.00 | 2.70 | 1.26 | 1.44 | 0.57 | 1.00 | 0.256 | 1.02 | 0.252 | 1.00 | 0.252 | 1.037 | ● |
| 50.90 | 120.00 | 3.05 | 1.45 | 1.61 | 0.54 | 1.00 | 0.249 | 1.02 | 0.245 | 1.00 | 0.245 | 1.026 | ● |

**Abbreviations**

$\sigma_{v,eq}$: Total overburden pressure at test point, during earthquake (tsf)
$u_{o,eq}$: Water pressure at test point, during earthquake (tsf)
$\sigma'_{vo,eq}$: Effective overburden pressure, during earthquake (tsf)
$r_d$: Nonlinear shear mass factor
$\alpha$: Improvement factor due to stone columns
CSR : Cyclic Stress Ratio
MSF : Magnitude Scaling Factor
$CSR_{eq,M=7.5}$: CSR adjusted for M=7.5
$K_{sigma}$: Effective overburden stress factor
$CSR^*$: CSR fully adjusted (user FS applied)***
FS: Calculated factor of safety against soil liquefaction

*** User FS: 1.00

**:: Liquefaction potential according to Iwasaki ::**

| Depth (ft) | FS | F | wz | Thickness (ft) | $I_L$ |
|---|---|---|---|---|---|
| 2.60 | 2.000 | 0.00 | 9.60 | 3.00 | 0.00 |
| 5.60 | 2.000 | 0.00 | 9.15 | 3.00 | 0.00 |
| 8.80 | 2.000 | 0.00 | 8.66 | 3.20 | 0.00 |
| 12.30 | 2.000 | 0.00 | 8.13 | 3.50 | 0.00 |
| 16.10 | 2.000 | 0.00 | 7.55 | 3.80 | 0.00 |
| 20.20 | 2.000 | 0.00 | 6.92 | 4.10 | 0.00 |
| 24.60 | 2.000 | 0.00 | 6.25 | 4.40 | 0.00 |
| 29.20 | 2.000 | 0.00 | 5.55 | 4.60 | 0.00 |
| 34.20 | 2.000 | 0.00 | 4.79 | 5.00 | 0.00 |
| 39.50 | 2.000 | 0.00 | 3.98 | 5.30 | 0.00 |
| 45.00 | 1.037 | 0.00 | 3.14 | 5.50 | 0.00 |
| 50.90 | 1.026 | 0.00 | 2.24 | 5.90 | 0.00 |

**Overall potential $I_L$ : 0.00**

$I_L$ = 0.00 - No liquefaction
$I_L$ between 0.00 and 5 - Liquefaction not probable
$I_L$ between 5 and 15 - Liquefaction probable
$I_L$ > 15 - Liquefaction certain

**:: Vertical settlements estimation for dry sands ::**

| Depth (ft) | $V_{s1,cs}$ (ft/s) | $(N_1)_{60,cs}$ | $\tau_{av}$ | p | $G_{max}$ (tsf) | $\alpha$ | b | $\gamma$ | $\varepsilon_{15}$ | $N_c$ | $\varepsilon_{Nc}$ (%) | $\Delta h$ (ft) | $\Delta S$ (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.60 | 906.96 | 50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.60 | 0.000 |

**:: Vertical settlements estimation for dry sands ::**

| Depth (ft) | $V_{s1,cs}$ (ft/s) | $(N_1)_{60,cs}$ | $\tau_{av}$ | p | $G_{max}$ (tsf) | a | b | γ | $\varepsilon_{15}$ | $N_c$ | $\varepsilon_{Nc}$ (%) | Δh (ft) | ΔS (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**Cumulative settlemetns: 0.000**

**Abbreviations**

$V_{s1,cs}$: Normalized shear wave velocity clean sand equivalent
$(N_1)_{60,cs}$: Estimated normalized corrected clean sand SPT
$\tau_{av}$: Average cyclic shear stress
p: Average stress
$G_{max}$: Maximum shear modulus (tsf)
a, b: Shear strain formula variables
γ: Average shear strain
$\varepsilon_{15}$: Volumetric strain after 15 cycles
$N_c$: Number of cycles
$\varepsilon_{Nc}$: Volumetric strain for number of cycles $N_c$ (%)
Δh: Thickness of soil layer (in)
ΔS: Settlement of soil layer (in)

**:: Vertical settlements estimation for saturated sands ::**

| Depth (ft) | $V_{s1,cs}$ (ft/s) | $q_{t1N,cs}$ | $e_v$ weight factor | $e_v$ (%) | Δh (ft) | s (in) |
|---|---|---|---|---|---|---|
| 5.60 | 663.72 | 160.44 | 1.00 | 0.00 | 3.00 | 0.000 |
| 8.80 | 623.49 | 122.39 | 1.00 | 0.00 | 3.20 | 0.000 |
| 12.30 | 591.38 | 97.35 | 1.00 | 0.00 | 3.50 | 0.000 |
| 16.10 | 561.41 | 77.72 | 1.00 | 0.00 | 3.80 | 0.000 |
| 20.20 | 533.60 | 62.38 | 1.00 | 0.00 | 4.10 | 0.000 |
| 24.60 | 532.54 | 61.85 | 1.00 | 0.00 | 4.40 | 0.000 |
| 29.20 | 546.19 | 69.00 | 1.00 | 0.00 | 4.60 | 0.000 |
| 34.20 | 575.07 | 86.25 | 1.00 | 0.00 | 5.00 | 0.000 |
| 39.50 | 621.94 | 121.08 | 1.00 | 0.00 | 5.30 | 0.000 |
| 45.00 | 688.31 | 187.80 | 1.00 | 0.49 | 5.50 | 0.324 |
| 50.90 | 681.82 | 180.25 | 1.00 | 0.51 | 5.90 | 0.362 |

**Cumulative settlements: 0.686**

**Abbreviations**

$V_{s1,cs}$: Normalized shear wave velocity clean sand equivalent
$q_{t1N,cs}$: Estimated normalized corrected clean sand cone resitance
$e_v$: Post liquefaction volumetric strain (%)
Δh: Thickness of soil layer to be considered (ft)
s: Estimated settlement (in)

**:: Lateral displacements estimation for saturated sands ::**

| Depth (ft) | $V_{s1,cs}$ (ft/s) | $(N_1)_{60,cs}$ | $D_r$ (%) | $\gamma_{max}$ (%) | $d_z$ (ft) | LDI | LD (ft) |
|---|---|---|---|---|---|---|---|
| 2.60 | 906.96 | 50 | 100.00 | 0.00 | 2.60 | 0.000 | 0.00 |
| 5.60 | 663.72 | 27 | 72.75 | 0.00 | 3.00 | 0.000 | 0.00 |
| 8.80 | 623.49 | 21 | 64.16 | 0.00 | 3.20 | 0.000 | 0.00 |
| 12.30 | 591.38 | 17 | 57.72 | 0.00 | 3.50 | 0.000 | 0.00 |
| 16.10 | 561.41 | 14 | 52.38 | 0.00 | 3.80 | 0.000 | 0.00 |
| 20.20 | 533.60 | 11 | 46.43 | 0.00 | 4.10 | 0.000 | 0.00 |
| 24.60 | 532.54 | 11 | 46.43 | 0.00 | 4.40 | 0.000 | 0.00 |
| 29.20 | 546.19 | 13 | 50.48 | 0.00 | 4.60 | 0.000 | 0.00 |
| 34.20 | 575.07 | 15 | 54.22 | 0.00 | 5.00 | 0.000 | 0.00 |

**:: Lateral displacements estimation for saturated sands ::**

| Depth (ft) | $V_{s1,cs}$ (ft/s) | $(N_1)_{60,cs}$ | $D_r$ (%) | $\gamma_{max}$ (%) | $d_z$ (ft) | LDI | LD (ft) |
|---|---|---|---|---|---|---|---|
| 39.50 | 621.94 | 21 | 64.16 | 0.00 | 5.30 | 0.000 | 0.00 |
| 45.00 | 688.31 | 31 | 77.95 | 2.99 | 5.50 | 0.000 | 0.00 |
| 50.90 | 681.82 | 30 | 76.68 | 3.05 | 5.90 | 0.000 | 0.00 |

**Cumulative lateral displacements: 0.00**

**Abbreviations**

$V_{s1,cs}$: Normalized shear wave velocity clean sand equivalent
$(N_1)_{60,cs}$: Estimated normalized corrected clean sand SPT
$D_r$: Relative density (%)
$\gamma_{max}$: Maximum amplitude of cyclic shear strain (%)
$d_z$: Soil layer thickness (ft)
LDI: Lateral displacement index (ft)
LD: Actual estimated displacement (ft)

**399 Lindbergh Ave**
Livermore, CA 94551

Seismic line SL-2

## $V_s$ BASED LIQUEFACTION ANALYSIS REPORT

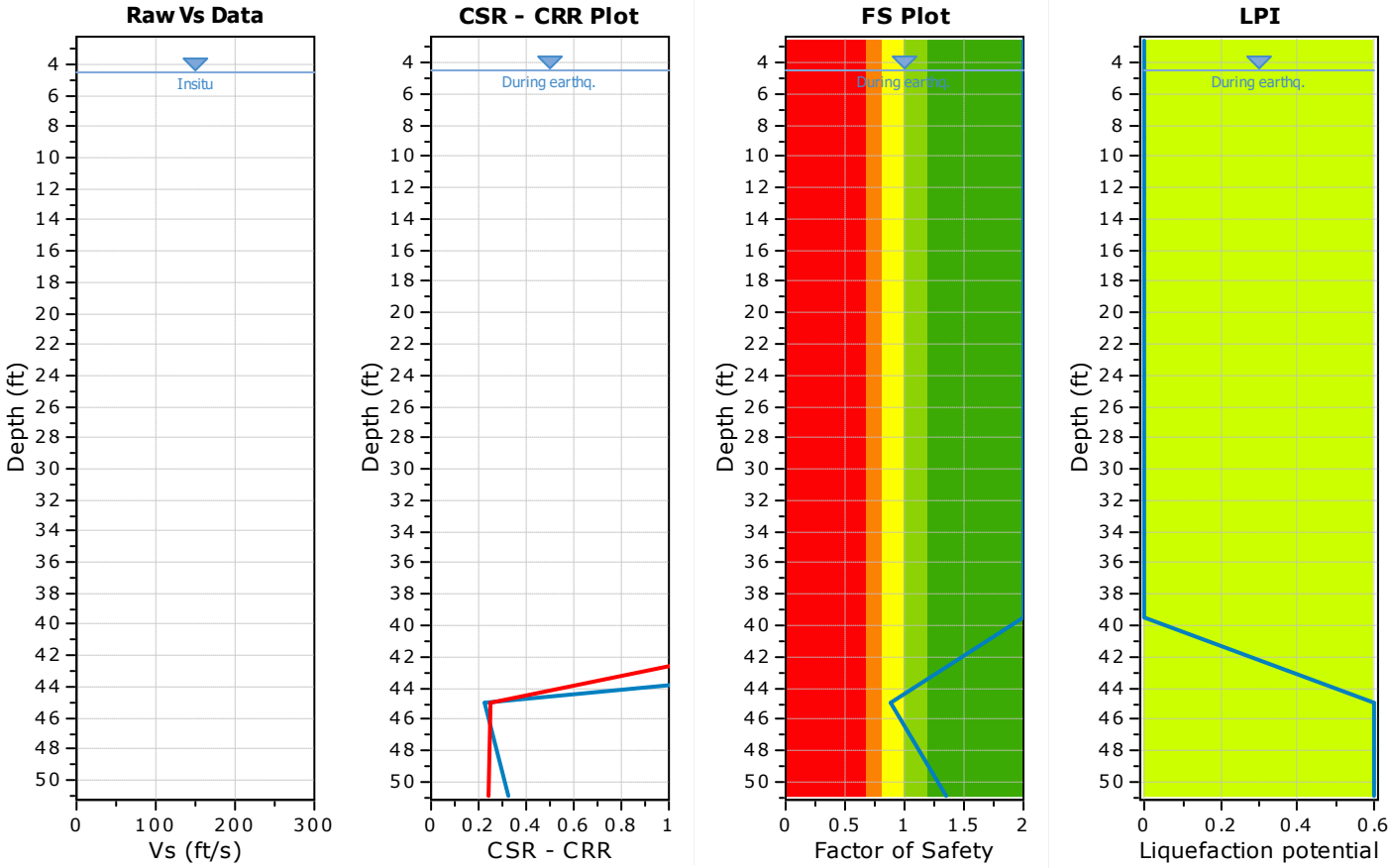
**Project title : Tri-Valley Hospital Expansion**

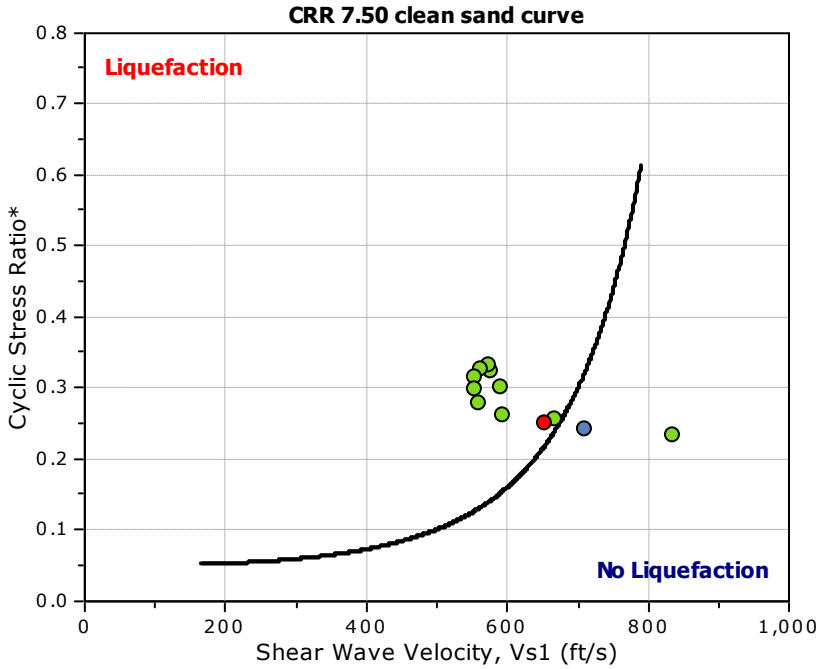
**$V_s$ Name: MASW Line 2**

**Location :**

**:: Input parameters and analysis properties ::**

| | |
|---|---|
| Analysis method: | Kayen et al. 2013 |
| G.W.T. (in-situ): | 4.50 ft |
| G.W.T. (earthq.): | 4.50 ft |
| Earthquake magnitude $M_w$: | 7.43 |
| Peak ground acceleration: | 0.37 g |
| Eq. external load: | 0.00 tsf |



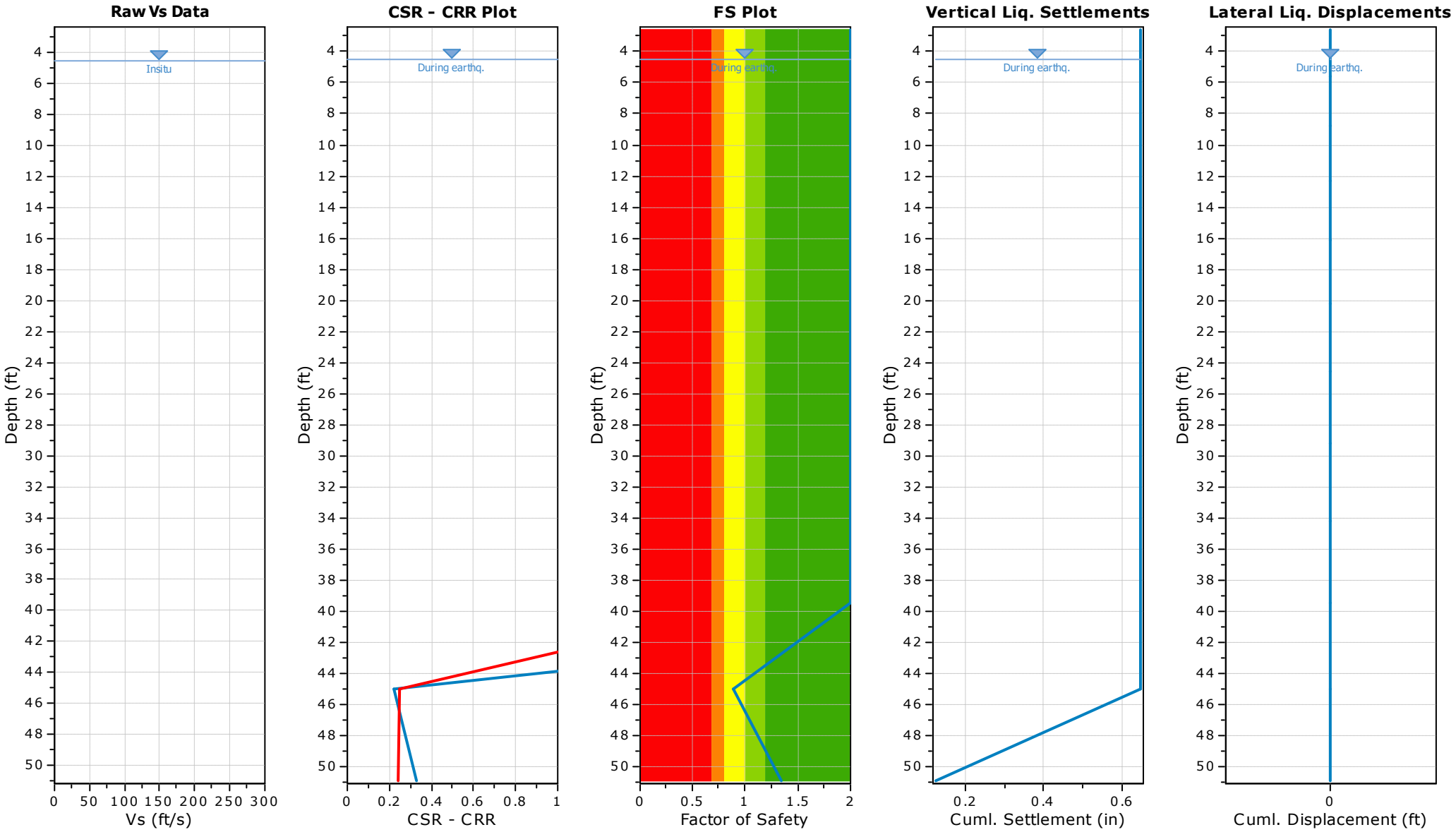

**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LPI color scheme**

- Very high risk
- High risk
- Low risk

## :: Overall Liquefaction Assessment Analysis Plots ::



**:: Field input data ::**

| Test Depth (ft) | $V_s$ Field Value (ft/s) | Fines Content (%) | Unit Weight (pcf) | Infl. Thickness (ft) | Can Liquefy |
|---|---|---|---|---|---|
| 2.60 | 517.00 | 0.00 | 120.00 | 2.60 | No |
| 5.60 | 488.00 | 0.00 | 120.00 | 3.00 | No |
| 8.80 | 461.00 | 0.00 | 120.00 | 3.20 | No |
| 12.30 | 477.00 | 0.00 | 120.00 | 3.50 | No |
| 16.10 | 500.00 | 0.00 | 120.00 | 3.80 | No |
| 20.20 | 510.00 | 0.00 | 120.00 | 4.10 | No |
| 24.60 | 525.00 | 0.00 | 120.00 | 4.40 | No |
| 29.20 | 544.00 | 0.00 | 120.00 | 4.60 | No |
| 34.20 | 568.00 | 0.00 | 120.00 | 5.00 | No |
| 39.50 | 623.00 | 0.00 | 120.00 | 5.30 | No |
| 45.00 | 706.00 | 10.00 | 120.00 | 5.50 | Yes |
| 50.90 | 789.00 | 10.00 | 120.00 | 5.90 | Yes |

**Abbreviations**

Depth: Depth at which test was performed (ft)
Vs Field Value: Measured shear waves velocity (ft/s)
Fines Content: Fines content at test depth (%)
Unit Weight: Unit weight at test depth (pcf)
Infl. Thickness: Thickness of the soil layer to be considered in settlements analysis (ft)
Can Liquefy: User defined switch for excluding/including test depth from the analysis procedure

**:: Cyclic Resistance Ratio (CRR) calculation data ::**

| Depth (ft) | $V_s$ Field Value (ft/s) | Unit Weight (pcf) | $\sigma_v$ (tsf) | $u_o$ (tsf) | $\sigma'_{vo}$ (tsf) | Norm. Factor | $V_{s1}$ (ft/s) | $CRR_{7.5}$ |
|---|---|---|---|---|---|---|---|---|
| 2.60 | 517.00 | 120.00 | 0.16 | 0.00 | 0.16 | 1.61 | 834.34 | 4.000 |
| 5.60 | 488.00 | 120.00 | 0.34 | 0.03 | 0.30 | 1.37 | 667.83 | 4.000 |
| 8.80 | 461.00 | 120.00 | 0.53 | 0.13 | 0.39 | 1.28 | 590.21 | 4.000 |
| 12.30 | 477.00 | 120.00 | 0.74 | 0.24 | 0.49 | 1.21 | 576.87 | 4.000 |
| 16.10 | 500.00 | 120.00 | 0.97 | 0.36 | 0.60 | 1.15 | 575.21 | 4.000 |
| 20.20 | 510.00 | 120.00 | 1.21 | 0.49 | 0.72 | 1.10 | 561.11 | 4.000 |
| 24.60 | 525.00 | 120.00 | 1.48 | 0.63 | 0.85 | 1.06 | 554.73 | 4.000 |
| 29.20 | 544.00 | 120.00 | 1.75 | 0.77 | 0.98 | 1.02 | 554.34 | 4.000 |
| 34.20 | 568.00 | 120.00 | 2.05 | 0.93 | 1.13 | 0.98 | 559.32 | 4.000 |
| 39.50 | 623.00 | 120.00 | 2.37 | 1.09 | 1.28 | 0.95 | 594.28 | 4.000 |
| 45.00 | 706.00 | 120.00 | 2.70 | 1.26 | 1.44 | 0.93 | 654.06 | 0.222 |
| 50.90 | 789.00 | 120.00 | 3.05 | 1.45 | 1.61 | 0.90 | 710.81 | 0.327 |

**Abbreviations**

$\sigma_v$: Total stress during SPT test (tsf)
$u_o$: Water pore pressure during SPT test (tsf)
$\sigma'_{vo}$: Effective overburden pressure during SPT test (tsf)
Norm. Factor: overburden-stress correction factor
$V_{S1}$: Overburden-stress corrected shear wave velocity
$CRR_{7.5}$: Cyclic resistance ratio for M=7.5

**:: Cyclic Stress Ratio calculation (CSR fully adjusted and normalized) ::**

| Depth (ft) | Unit Weight (pcf) | $\sigma_{v,eq}$ (tsf) | $u_{o,eq}$ (tsf) | $\sigma'_{vo,eq}$ (tsf) | $r_d$ | $\alpha$ | CSR | MSF | $CSR_{eq,M=7.5}$ | $K_{sigma}$ | $CSR^*$ | FS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.60 | 120.00 | 0.16 | 0.00 | 0.16 | 0.99 | 1.00 | 0.238 | 1.02 | 0.234 | 1.00 | 0.234 | 2.000 | ● |
| 5.60 | 120.00 | 0.34 | 0.03 | 0.30 | 0.97 | 1.00 | 0.260 | 1.02 | 0.256 | 1.00 | 0.256 | 2.000 | ● |

**:: Cyclic Stress Ratio calculation (CSR fully adjusted and normalized) ::**

| Depth (ft) | Unit Weight (pcf) | $\sigma_{v,eq}$ (tsf) | $u_{o,eq}$ (tsf) | $\sigma'_{vo,eq}$ (tsf) | $r_d$ | $\alpha$ | CSR | MSF | $CSR_{eq,M=7.5}$ | $K_{sigma}$ | $CSR^*$ | FS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8.80 | 120.00 | 0.53 | 0.13 | 0.39 | 0.95 | 1.00 | 0.306 | 1.02 | 0.301 | 1.00 | 0.301 | 2.000 | ● |
| 12.30 | 120.00 | 0.74 | 0.24 | 0.49 | 0.92 | 1.00 | 0.329 | 1.02 | 0.324 | 1.00 | 0.324 | 2.000 | ● |
| 16.10 | 120.00 | 0.97 | 0.36 | 0.60 | 0.88 | 1.00 | 0.337 | 1.02 | 0.332 | 1.00 | 0.332 | 2.000 | ● |
| 20.20 | 120.00 | 1.21 | 0.49 | 0.72 | 0.83 | 1.00 | 0.333 | 1.02 | 0.328 | 1.00 | 0.328 | 2.000 | ● |
| 24.60 | 120.00 | 1.48 | 0.63 | 0.85 | 0.77 | 1.00 | 0.320 | 1.02 | 0.315 | 1.00 | 0.315 | 2.000 | ● |
| 29.20 | 120.00 | 1.75 | 0.77 | 0.98 | 0.70 | 1.00 | 0.302 | 1.02 | 0.297 | 1.00 | 0.297 | 2.000 | ● |
| 34.20 | 120.00 | 2.05 | 0.93 | 1.13 | 0.65 | 1.00 | 0.283 | 1.02 | 0.278 | 1.00 | 0.278 | 2.000 | ● |
| 39.50 | 120.00 | 2.37 | 1.09 | 1.28 | 0.60 | 1.00 | 0.267 | 1.02 | 0.262 | 1.00 | 0.262 | 2.000 | ● |
| 45.00 | 120.00 | 2.70 | 1.26 | 1.44 | 0.56 | 1.00 | 0.255 | 1.02 | 0.251 | 1.00 | 0.251 | 0.886 | ● |
| 50.90 | 120.00 | 3.05 | 1.45 | 1.61 | 0.54 | 1.00 | 0.247 | 1.02 | 0.243 | 1.00 | 0.243 | 1.343 | ● |

**Abbreviations**

$\sigma_{v,eq}$: Total overburden pressure at test point, during earthquake (tsf)
$u_{o,eq}$: Water pressure at test point, during earthquake (tsf)
$\sigma'_{vo,eq}$: Effective overburden pressure, during earthquake (tsf)
$r_d$: Nonlinear shear mass factor
$\alpha$: Improvement factor due to stone columns
CSR : Cyclic Stress Ratio
MSF : Magnitude Scaling Factor
$CSR_{eq,M=7.5}$: CSR adjusted for M=7.5
$K_{sigma}$: Effective overburden stress factor
$CSR^*$: CSR fully adjusted (user FS applied)***
FS: Calculated factor of safety against soil liquefaction

*** User FS: 1.00

**:: Liquefaction potential according to Iwasaki ::**

| Depth (ft) | FS | F | wz | Thickness (ft) | $I_L$ |
|---|---|---|---|---|---|
| 2.60 | 2.000 | 0.00 | 9.60 | 3.00 | 0.00 |
| 5.60 | 2.000 | 0.00 | 9.15 | 3.00 | 0.00 |
| 8.80 | 2.000 | 0.00 | 8.66 | 3.20 | 0.00 |
| 12.30 | 2.000 | 0.00 | 8.13 | 3.50 | 0.00 |
| 16.10 | 2.000 | 0.00 | 7.55 | 3.80 | 0.00 |
| 20.20 | 2.000 | 0.00 | 6.92 | 4.10 | 0.00 |
| 24.60 | 2.000 | 0.00 | 6.25 | 4.40 | 0.00 |
| 29.20 | 2.000 | 0.00 | 5.55 | 4.60 | 0.00 |
| 34.20 | 2.000 | 0.00 | 4.79 | 5.00 | 0.00 |
| 39.50 | 2.000 | 0.00 | 3.98 | 5.30 | 0.00 |
| 45.00 | 0.886 | 0.11 | 3.14 | 5.50 | 0.60 |
| 50.90 | 1.343 | 0.00 | 2.24 | 5.90 | 0.00 |

**Overall potential $I_L$ : 0.60**

$I_L$ = 0.00 - No liquefaction
$I_L$ between 0.00 and 5 - Liquefaction not probable
$I_L$ between 5 and 15 - Liquefaction probable
$I_L$ > 15 - Liquefaction certain

**:: Vertical settlements estimation for dry sands ::**

| Depth (ft) | $V_{s1,cs}$ (ft/s) | $(N_1)_{60,cs}$ | $\tau_{av}$ | p | $G_{max}$ (tsf) | $\alpha$ | b | $\gamma$ | $\varepsilon_{15}$ | $N_c$ | $\varepsilon_{Nc}$ (%) | $\Delta h$ (ft) | $\Delta S$ (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.60 | 834.34 | 50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.60 | 0.000 |

**:: Vertical settlements estimation for dry sands ::**

| Depth (ft) | $V_{s1,cs}$ (ft/s) | $(N_1)_{60,cs}$ | $\tau_{av}$ | p | $G_{max}$ (tsf) | a | b | γ | $\varepsilon_{15}$ | $N_c$ | $\varepsilon_{Nc}$ (%) | Δh (ft) | ΔS (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**Cumulative settlemetns: 0.000**

**Abbreviations**

$V_{s1,cs}$: Normalized shear wave velocity clean sand equivalent
$(N_1)_{60,cs}$: Estimated normalized corrected clean sand SPT
$\tau_{av}$: Average cyclic shear stress
p: Average stress
$G_{max}$: Maximum shear modulus (tsf)
a, b: Shear strain formula variables
γ: Average shear strain
$\varepsilon_{15}$: Volumetric strain after 15 cycles
$N_c$: Number of cycles
$\varepsilon_{Nc}$: Volumetric strain for number of cycles $N_c$ (%)
Δh: Thickness of soil layer (in)
ΔS: Settlement of soil layer (in)

**:: Vertical settlements estimation for saturated sands ::**

| Depth (ft) | $V_{s1,cs}$ (ft/s) | $q_{t1N,cs}$ | $e_v$ weight factor | $e_v$ (%) | Δh (ft) | s (in) |
|---|---|---|---|---|---|---|
| 5.60 | 667.83 | 164.78 | 1.00 | 0.00 | 3.00 | 0.000 |
| 8.80 | 590.21 | 96.52 | 1.00 | 0.00 | 3.20 | 0.000 |
| 12.30 | 576.87 | 87.43 | 1.00 | 0.00 | 3.50 | 0.000 |
| 16.10 | 575.21 | 86.34 | 1.00 | 0.00 | 3.80 | 0.000 |
| 20.20 | 561.11 | 77.54 | 1.00 | 0.00 | 4.10 | 0.000 |
| 24.60 | 554.73 | 73.80 | 1.00 | 0.00 | 4.40 | 0.000 |
| 29.20 | 554.34 | 73.58 | 1.00 | 0.00 | 4.60 | 0.000 |
| 34.20 | 559.32 | 76.48 | 1.00 | 0.00 | 5.00 | 0.000 |
| 39.50 | 594.28 | 99.43 | 1.00 | 0.00 | 5.30 | 0.000 |
| 45.00 | 661.82 | 158.46 | 1.00 | 0.79 | 5.50 | 0.524 |
| 50.90 | 722.26 | 231.32 | 1.00 | 0.18 | 5.90 | 0.125 |

**Cumulative settlements: 0.649**

**Abbreviations**

$V_{s1,cs}$: Normalized shear wave velocity clean sand equivalent
$q_{t1N,cs}$: Estimated normalized corrected clean sand cone resitance
$e_v$: Post liquefaction volumetric strain (%)
Δh: Thickness of soil layer to be considered (ft)
s: Estimated settlement (in)

**:: Lateral displacements estimation for saturated sands ::**

| Depth (ft) | $V_{s1,cs}$ (ft/s) | $(N_1)_{60,cs}$ | $D_r$ (%) | $\gamma_{max}$ (%) | $d_z$ (ft) | LDI | LD (ft) |
|---|---|---|---|---|---|---|---|
| 2.60 | 834.34 | 50 | 100.00 | 0.00 | 2.60 | 0.000 | 0.00 |
| 5.60 | 667.83 | 28 | 74.08 | 0.00 | 3.00 | 0.000 | 0.00 |
| 8.80 | 590.21 | 17 | 57.72 | 0.00 | 3.20 | 0.000 | 0.00 |
| 12.30 | 576.87 | 16 | 56.00 | 0.00 | 3.50 | 0.000 | 0.00 |
| 16.10 | 575.21 | 15 | 54.22 | 0.00 | 3.80 | 0.000 | 0.00 |
| 20.20 | 561.11 | 14 | 52.38 | 0.00 | 4.10 | 0.000 | 0.00 |
| 24.60 | 554.73 | 13 | 50.48 | 0.00 | 4.40 | 0.000 | 0.00 |
| 29.20 | 554.34 | 13 | 50.48 | 0.00 | 4.60 | 0.000 | 0.00 |
| 34.20 | 559.32 | 14 | 52.38 | 0.00 | 5.00 | 0.000 | 0.00 |

**:: Lateral displacements estimation for saturated sands ::**

| Depth (ft) | $V_{s1,cs}$ (ft/s) | $(N_1)_{60,cs}$ | $D_r$ (%) | $\gamma_{max}$ (%) | $d_z$ (ft) | LDI | LD (ft) |
|---|---|---|---|---|---|---|---|
| 39.50 | 594.28 | 18 | 59.40 | 0.00 | 5.30 | 0.000 | 0.00 |
| 45.00 | 661.82 | 27 | 72.75 | 4.54 | 5.50 | 0.000 | 0.00 |
| 50.90 | 722.26 | 38 | 86.30 | 1.92 | 5.90 | 0.000 | 0.00 |

**Cumulative lateral displacements: 0.00**

**Abbreviations**

$V_{s1,cs}$: Normalized shear wave velocity clean sand equivalent
$(N_1)_{60,cs}$: Estimated normalized corrected clean sand SPT
$D_r$: Relative density (%)
$\gamma_{max}$: Maximum amplitude of cyclic shear strain (%)
$d_z$: Soil layer thickness (ft)
LDI: Lateral displacement index (ft)
LD: Actual estimated displacement (ft)

## References


- Ronald D. Andrus, Hossein Hayati, Nisha P. Mohanan, 2009. Correcting Liquefaction Resistance for Aged Sands Using Measured to Estimated Velocity Ratio, Journal of Geotechnical and Geoenvironmental Engineering, Vol. 135, No. 6, June 1

- Boulanger, R.W. and Idriss, I. M., 2014. CPT AND SPT BASED LIQUEFACTION TRIGGERING PROCEDURES. DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING COLLEGE OF ENGINEERING UNIVERSITY OF CALIFORNIA AT DAVIS

- Dipl.-Ing. Heinz J. Priebe, Vibro Replacement to Prevent Earthquake Induced Liquefaction, Proceedings of the Geotechnique-Colloquium at Darmstadt, Germany, on March 19th, 1998 (also published in Ground Engineering, September 1998), Technical paper 12-57E

- Robertson, P.K. and Cabal, K.L., 2007, Guide to Cone Penetration Testing for Geotechnical Engineering. Available at no cost at http://www.geologismiki.gr/

- Youd, T.L., Idriss, I.M., Andrus, R.D., Arango, I., Castro, G., Christian, J.T., Dobry, R., Finn, W.D.L., Harder, L.F., Hynes, M.E., Ishihara, K., Koester, J., Liao, S., Marcuson III, W.F., Martin, G.R., Mitchell, J.K., Moriwaki, Y., Power, M.S., Robertson, P.K., Seed, R., and Stokoe, K.H., Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshop on Evaluation of Liquefaction Resistance of Soils, ASCE, Journal of Geotechnical & Geoenvironmental Engineering, Vol. 127, October, pp 817-833

- Zhang, G., Robertson. P.K., Brachman, R., 2002, Estimating Liquefaction Induced Ground Settlements from the CPT, Canadian Geotechnical Journal, 39: pp 1168-1180

- Zhang, G., Robertson. P.K., Brachman, R., 2004, Estimating Liquefaction Induced Lateral Displacements using the SPT and CPT, ASCE, Journal of Geotechnical & Geoenvironmental Engineering, Vol. 130, No. 8, 861-871

- Pradel, D., 1998, Procedure to Evaluate Earthquake-Induced Settlements in Dry Sandy Soils, ASCE, Journal of Geotechnical & Geoenvironmental Engineering, Vol. 124, No. 4, 364-368

- R. Kayen, R. E. S. Moss, E. M. Thompson, R. B. Seed, K. O. Cetin, A. Der Kiureghian, Y. Tanaka, K. Tokimatsu, 2013. Shear-Wave Velocity–Based Probabilistic and Deterministic Assessment of Seismic Soil Liquefaction Potential, Journal of Geotechnical and Geoenvironmental Engineering, Vol. 139, No. 3, March 1

# APPENDIX I

# Important Information About This Geotechnical-Engineering Report

# Important Information about This

# Geotechnical-Engineering Report

**Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.**

**While you cannot eliminate all such risks, you can manage them. The following information is provided to help.**

**The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.**

## Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

## Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

*Do not rely on this report* if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

## Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

## You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

*responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

## Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

## This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

## This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

## Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

## Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

## Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

## Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
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# TECHNICAL MEMORANDUM

**Date:** August 21st, 2024 **BKF Job Number: 20221230**

**Deliver To:** **City of Pleasanton: Community Development Department Planning Division**

**From:** **Brandon Mettler, PE**

**Subject:** **Sewer Demand Study**

---

Stanford Health Care Tri-Valley is proposing an East Wing Hospital Addition that will add 62,000 SF of floor area at their campus located at 5555 West Las Positas Blvd. We anticipate this expansion will generate a new sewer load of 18,418 Total Gallons/Day (12.79 GPM). This load estimate was provided by Gayner Engineers (Project MEP). Please see attached for proposed building location and new sewer lines.

The campus is currently served by three 6" sewer services to the City System. One is located along Owens Drive and connects into the existing 15" VCP Main. The other two services are located upstream along Andrews Drive connect into the existing 15" VCP Main there. Please see attached for highlighted City Utility Map C2D1.

The project is proposing a new 6" sewer service location upstream of these existing services on Andrews Drive. The new service will re-rout portions of the campus that was being served by the service connection on Owens Drive and has been blocked by the new building expansion. The Owens Drive service would then serve the new building expansion and the load generated above.

Also attached is an excerpt from the City of Pleasanton's Sewer Capacity Evaluation Report provided by Michael Stella (PE, Senior Civil Engineer City of Pleasanton) via email on 6/25/2024. There are currently no system surcharges downstream of our sewer points of service. The surcharged pipe along Old Santa Rita Road is not a proposed point of connection for the East Wing Hospital Addition.

REV.
APRIL 2007
LYNX TECHNOLOGIES

# CITY OF PLEASANTON
# SEWER/STORM DRAIN SYSTEM FACILITIES

Existing SHCVC Campus Sewer POCs.

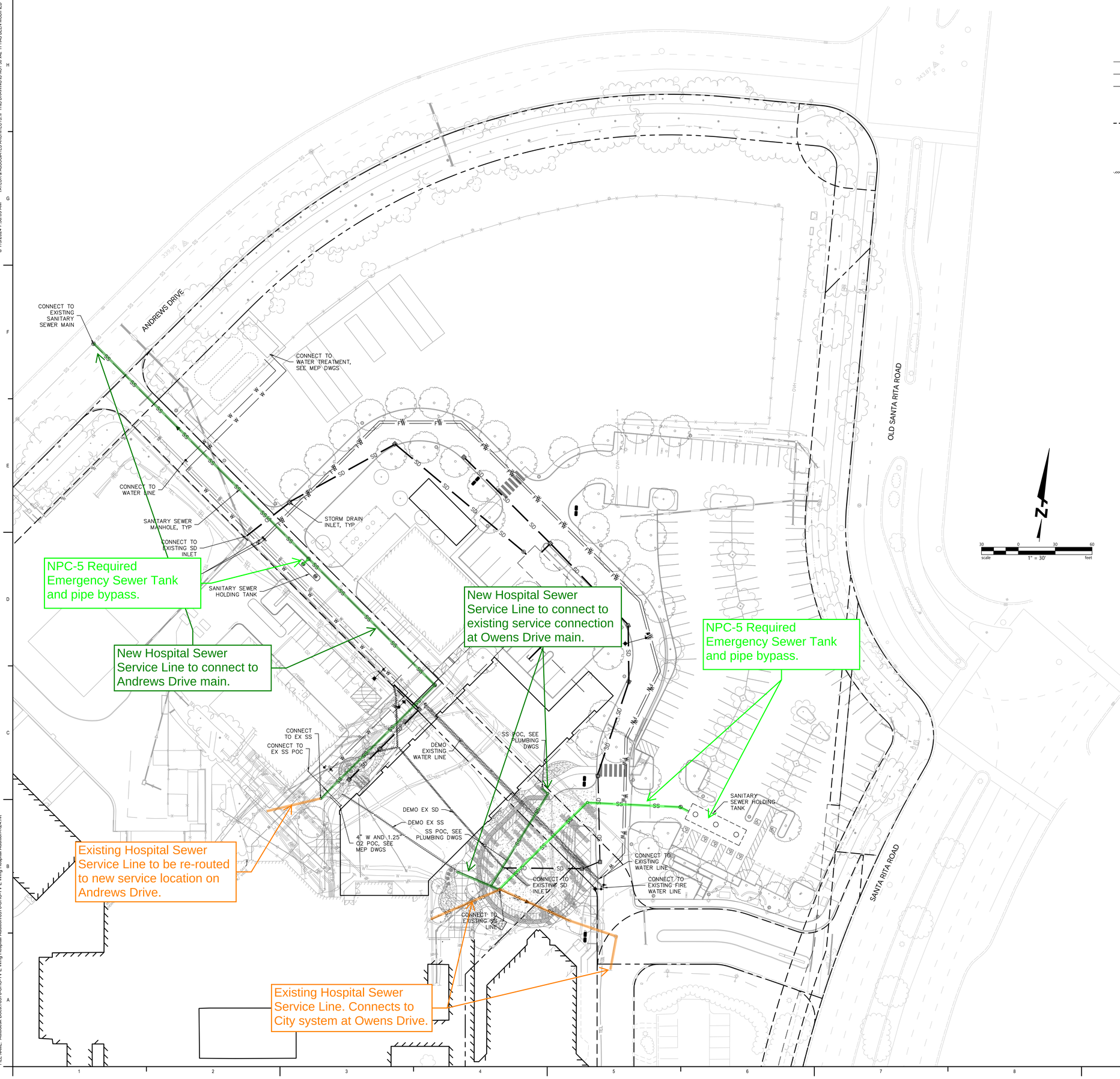
GRAPHIC SCALE 0 50 100 150 FEET

| | | |
|---|---|---|
| C2A4 | C2B3 | C2B4 |
| C2C2 | C2D1 | C2D2 |
| C2C4 | C2D3 | C2D4 |

**C2D1**

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FILE NAME: Autodesk Docs://6370-SHC-TV E Wing Hospital Addition/6370-SHC-TV E Wing Hospital Addition-R24.rvt

TAYLOR design

DESIGN PROFESSIONAL STAMP

CONSULTANT

BKF ENGINEERS
980 9TH STREET
SUITE 2300
SACRAMENTO, CA 95814
(916) 556-5800
www.bkf.com

AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
|---|---|---|

PROJECT INFORMATION

**STANFORD HEALTHCARE TRI-VALLEY**
**East Wing Hospital Addition**

| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - VALLEYCARE |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 20225514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

# UTILITY PLAN

SHEET NUMBER

# C4.0

PACKAGE ISSUANCE: DESIGN REVIEW SUBMITTAL

# Figure 6-3: Wet Weather Capacity Results

Pleasanton Capacity Evaluation Report

SHCVC Campus

Surcharge caused by future development. Capacity project 3.

EALS Pump Station

Surcharge caused by future development. Capacity project 4.

Backup surcharge at lift stations 6 and 8. No capacity projects are required because there is no surcharge within 3ft of a manhole rim.

Surcharge within 3ft of the Manhole rim. Capacity Project 2.

Modeled Overflow at MHs SC6B2M409, SC6D2M200, and SC6D2M300. Capacity Project 1.

## Legend

Gravity Main Surcharge State

- No Surcharge (d/D < 1)
- Backup Surcharge (d/D = 1)
- Throttle Surcharge (d/D = 1)
- City Force Main
- Private Force Main
- Modeled Overflow

0 0.25 0.5 1 Miles

California State Parks, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS, Esri, NASA, NGA, USGS, FEMA, Bureau of Land Management, Esri, HERE, Garmin, INCREMENT P, NGA, USGS

Woodard & Curran

THE CITY OF PLEASANTON

Map Created: May 2024

# TECHNICAL MEMORANDUM

**Date:** August 21st, 2024 **BKF Job Number: 20221230**

**Deliver To:** **City of Pleasanton: Community Development Department Planning Division**

**From:** **Brandon Mettler, PE**

**Subject:** **Water Demand Study**

---

Stanford Health Care Tri-Valley is proposing an East Wing Hospital Addition that will add 62,000 SF of floor area at their campus located at 5555 West Las Positas Blvd. We anticipate this expansion will generate a new water demand of 27,284 Total Gallons/Day (18.95 GPM). This load estimate was provided by Gayner Engineers (Project MEP). Please see attached for proposed building location and water line relocations.

The campus is currently served by two 10" water services to the City System. Both services are located along Andrews Drive connect into the existing 12" ACP Main there. Please see attached for highlighted City Utility Map C2D2.

The project is not proposing a new water service location and will utilize these existing services on Andrews Drive. The building expansion will utilize the current 8" on-site service to the main hospital (See attached as-built plans). The Medical Office Building Service and a fire line will be re-routed around the building expansion (see proposed utility layout).

Also attached is an excerpt from the City of Pleasanton's Water Distribution Capacity Master Plan provided by Michael Stella (PE, Senior Civil Engineer City of Pleasanton) via email on 7/8/2024 along with the following feedback: "*This morning I took a quick look at the City's Water Distribution System Capacity Master Plan to see whether the hospital expansion will trigger a need for water network upgrades. The report (excerpt attached) reveals two areas of concern, both related to fire flow. To the immediate north of the hospital on Old Santa Rita Road, a Priority A project titled "FF-121" was recommended in the master plan. We will need to evaluate this specific issue further once the hospital expansion plans become more refined. To the southwest, an existing fire hydrant serving the hospital campus was found to have an undersized lateral pipe. This appears to be a minor issue but we will also evaluate it further*".

Existing SHCVC Campus Water POCs.

ANDREWS DR

OLD SANTA RITA RD

SANTA RITA RD

PICKENS LN

CHURCHILL CT

NEWMAN PL

FAIRLANDS DR

FIRE STATION NO. 3 3200

POSITAS BLVD

WEST LAS

ACCESS MH

BRINE LINE

12" ACP

10" DIP

12" DIP

24" DIP

12" CIP

14" ACP

8" ACP

6502

4807

3336

4821

REV.
JAN 2012
LYNX TECHNOLOGIES

CITY OF PLEASANTON
WATER SYSTEM FACILITIES

GRAPHIC SCALE
0 50 100 150
FEET

| | | |
|---|---|---|
| C2B3 | C2B4 | D2A3 |
| C2D1 | C2D2 | D2C1 |
| C2D3 | C2D4 | D2C3 |

C2D2

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Caution: If this sheet is not 30" x 42", it is a reduced print. Scale accordingly.

## CATCH BASIN SCHEDULE

| C.B. NUMBER | TYPE | C.B. NUMBER | TYPE |
|---|---|---|---|
| 1 | Standard Field Inlet | 17 | Standard Drop Inlet |
| 2 | Standard Field Inlet | 18 | Standard Field Inlet |
| 3 | Standard Field Inlet | 19 | Manhole with Grate |
| 4 | Standard Field Inlet | 20 | Standard Drop Inlet |
| 5 | Manhole with Grate | 21 | Standard Field Inlet |
| 6 | Standard Field Inlet | 22 | Christy V-9 with Grate |
| 7 | Standard Field Inlet | 23 | Christy V-9 with Grate |
| 8 | Christy V-9 with Grate | 24 | Christy V-9 with Grate |
| 9 | Standard Field Inlet | 25 | Christy V-9 with Grate |
| 10 | Christy V-9 with Grate | 26 | Standard Field Inlet |
| 11 | Standard Drop Inlet | 27 | Christy V-9 with Grate |
| 12 | Standard Drop Inlet | 28 | Christy V-9 with Grate |
| 13 | Standard Drop Inlet | 29 | Standard Field Inlet |
| 14 | Standard Field Inlet | 30 | Standard Field Inlet |
| 15 | Standard Field Inlet | 31 | Christy V-9 with Grate |
| 16 | Standard Drop Inlet | 32 | Standard Drop Inlet |
| | | 33 | Standard Field Inlet |

NOTE: FOR PAVEMENT SECTION, SEE SHEET C6.

SCALE: 1"=20'

SEE SHEET C4 (FOR CONTINUATION)

GRADING PLAN

UNAUTHORIZED CHANGES & USES
CAUTION: The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.


**Rocklin Baran & Balbona Inc**
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**Dillingham Construction**
Commercial Construction Division
Pleasanton, California

Drawn
Checked
Consultant

**NOLTE and ASSOCIATES**
Engineers/Planners/Surveyors
☐ SACRAMENTO (916) 446-0500 ☐ SAN DIEGO (619) 291-1886 ☐ SAN JOSE (408) 287-4200 ☐ WALNUT CREEK (415) 934-0300

Agencies Approvals

REGISTERED ARCHITECT DENIS PURCELL C13720 STATE OF CALIFORNIA


| Date | No. | Description |
|---|---|---|
| 7/10/91 | 6 | BULLETIN #3- TRASH COMPACTOR |
| 9-25-90 | 4 | BULLETIN #1 |
| 7.16.90 | 3 | ADDENDUM NO.3 |
| 5/21/90 | | CITY BACK CHECK |
| FEB 12 1990 | | CITY SUBMITTAL |
| FEB 1 1990 | | |

Issue Record

Project
**ValleyCare Medical Center**
**ACUTE CARE HOSPITAL**
**SITE IMPROVEMENTS**
West Las Positas Boulevard
Pleasanton, California

Sheet Description
**GRADING PLAN**

Project No. 8818809
Date
Sheet No. **C5**

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NPC-5 Required Emergency Water Tanks and pipe routing.

Re-Routed Medical Office Building and new Fire Service Loop.

Existing Hospital and CUP Service to remain.

CONNECT TO EXISTING SANITARY SEWER MAIN

ANDREWS DRIVE

CONNECT TO WATER TREATMENT, SEE MEP DWGS

CONNECT TO WATER LINE

SANITARY SEWER MANHOLE, TYP

CONNECT TO EXISTING SD INLET

CONNECT TO EXISTING WATER LINE

SANITARY SEWER HOLDING TANK

STORM DRAIN INLET, TYP

CONNECT TO EX SS

CONNECT TO EX SS POC

DEMO EXISTING WATER LINE

SS POC, SEE PLUMBING DWGS

DEMO EX SD

DEMO EX SS

SS POC, SEE PLUMBING DWGS

4" W AND 1.25" O2 POC, SEE MEP DWGS

CONNECT TO EXISTING SD INLET

CONNECT TO EXISTING SS LINE

CONNECT TO EXISTING WATER LINE

CONNECT TO EXISTING FIRE WATER LINE

SANITARY SEWER HOLDING TANK

OLD SANTA RITA ROAD

SANTA RITA ROAD

UTILITY LEGEND

- SD — STORM DRAIN LINE
- SS — SANITARY SEWER LINE
- W — WATER LINE
- STORM DRAIN INLET
- STORM DRAIN MANHOLE
- STORM DRAIN TRENCH DRAIN
- SANITARY SEWER MAN HOLE
- SANITARY SEWER CLEANOUT
- WATER VALVE
- DEMOLISH EXISTING UTILITY

N

30 0 30 60
scale 1" = 30' feet

PACKAGE ISSUANCE: DESIGN REVIEW SUBMITTAL

FILE NAME: Autodesk Docs://6370-SHC-TV E Wing Hospital Addition/6370-SHC-TV E Wing Hospital Addition-R24.rvt

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AGENCY APPROVAL

REVISION SCHEDULE

| NO. | REVISION NAME | DATE: |
|---|---|---|

PROJECT INFORMATION

**STANFORD HEALTHCARE TRI-VALLEY**
**East Wing Hospital Addition**

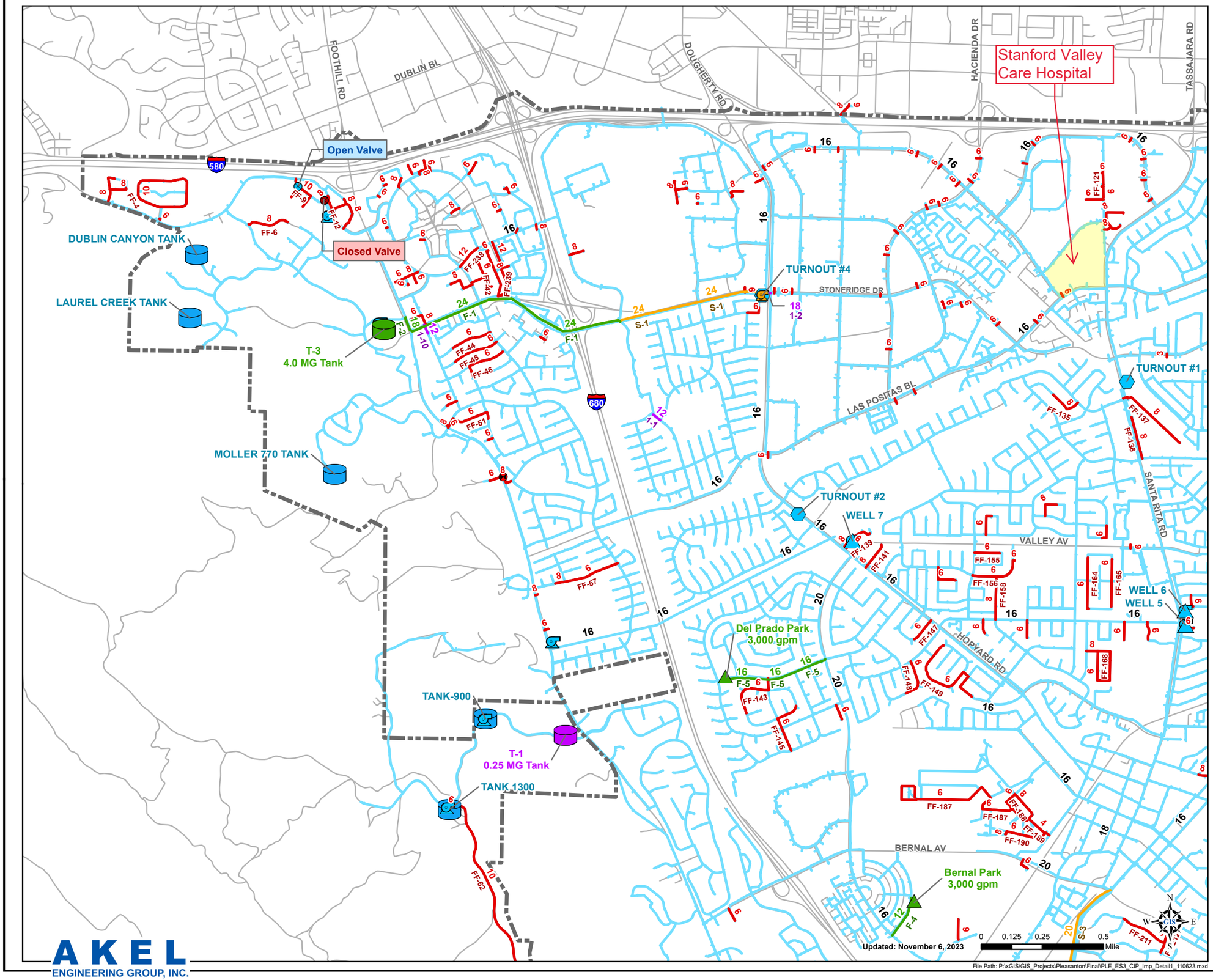
| | |
|---|---|
| FACILITY NAME: | STANFORD HEALTH CARE - VALLEYCARE |
| FACILITY ADDRESS: | 5555 WEST LAS POSITAS BLVD PLEASANTON, CA 94588 |
| OWNER PROJECT NUMBER: | 2022514 |
| AUTHORITY HAVING JURISDICTION: | CITY OF PLEASANTON |
| AGENCY FACILITY NUMBER: | 16632 |
| AGENCY BUILDING NUMBER: | TBD |
| AGENCY PROJECT NUMBER: | TBD |
| ARCHITECT PROJECT NO: | 6370.101 |

SHEET TITLE — ISSUE DATE: 08/23/2024

## UTILITY PLAN

SHEET NUMBER

# C4.0




## Legend

**Existing System Improvements**
- Tanks
- Pipes

**Near-Term System Improvements**
- Tanks
- Pump Stations
- Pipes

**Future System Improvements**
- Tanks
- Wells
- Pipes

**Fire Flow Improvements**
- Proposed PRV
- Pipes

**Existing System**
- Tanks
- Pump Stations
- Turnouts
- Wells
- Open Valve
- Closed Valve
- Pipes
- City Limits

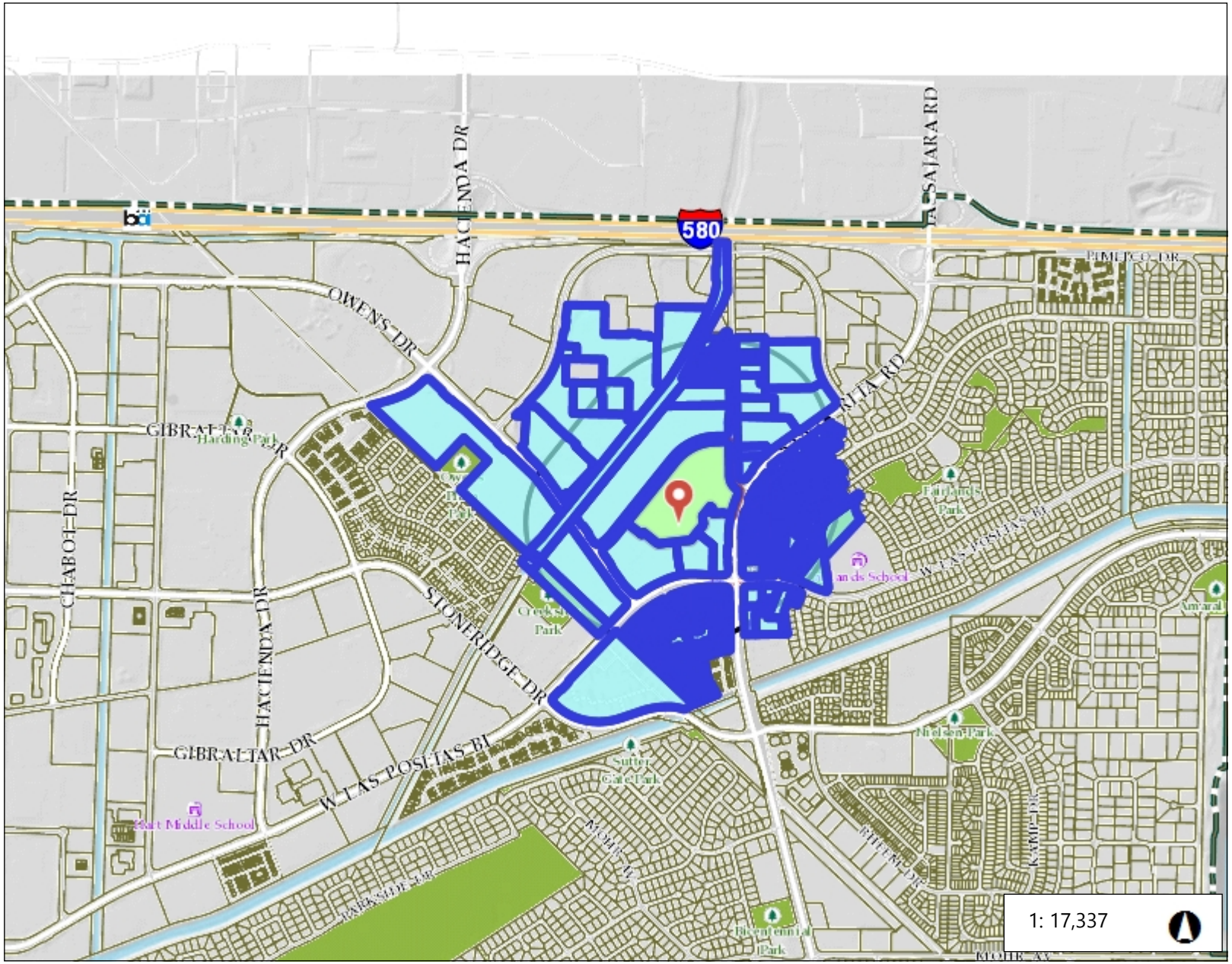
# ES.3
# Capital Improvements
# Detail 1
Water Distribution System
Capacity Master Plan

THE CITY OF PLEASANTON

AKEL ENGINEERING GROUP, INC.

# 5555 W. LAS POSITAS BOULEVARD

EXHIBIT C




Legend

- Fire Station
- School
- Park
- Parcels

Notes

Notes

2,889.5 0 1,444.75 2,889.5 Feet

NAD_1983_2011_StatePlane_California_III_FIPS_0403_Ft_US

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# Planning Commission Agenda Report

May 28, 2025
Item 6

**SUBJECT:** **P25-0192**

**APPLICANT/ PROPERTY OWNER:** City of Pleasanton/Multiple

**PURPOSE:** Application to amend Chapters 18.08, 18.20, 18.40, 18.48, 18.84, 18.88, 18.92, and Table 18.44.080 of the Pleasanton Municipal Code (PMC) to: (1) modify the definition of Light Industrial; (2) establish the definition of an Innovation-Based Business (IBB); (3) modify Table 18.44.080 to permit or conditionally permit IBB uses in the I-P, I-G, O, PUD-C-O, PUD-I, PUD-I/C-O, and PUD-MU Districts, and the following Districts of the Hacienda PUD Area: OGPD, OPD, OMPD, CDP, IPD, MOIPD, MCOIRPD, and MCOIPD; (4) modify the Design Review requirements for (a) industrial tenants leasing space in a previously reviewed and approved building; and (b) industrial tenants that are permitted by right within an industrial zone; and (5) modify specific and related development standards for IBB uses

**LOCATION:** City-wide

**GENERAL PLAN:** General and Limited Industrial, Business Park, and Mixed Use

**ZONING:** I-P (Industrial Park), O (Office), PUD-C-O (Planned Unit Development-Commercial-Office), PUD-I/C-O (Planned Unit Development-Industrial/Commercial-Office), and PUD-MU (Planned Unit Development-Mixed Use) Districts, and the following Hacienda PUD Area Districts: OGPD, OPD, OMPD, CDP, IPD, MOIPD, MCOIRPD, and MCOIPD

**EXHIBITS:**

A. Draft Resolution recommending the City Council find the proposed text amendments are exempt under the California Environmental Quality Act under Guidelines Section 15061(b)(3) and approve amendments to Chapters 18.08, 18.20, 18.40, 18.48, 18.84, 18.88, 18.92, and Table 18.44.080 of the Pleasanton Municipal Code (PMC) to: (1) modify the definition of Light Industrial; (2) establish the definition of an Innovation-Based Business (IBB); (3) modify Table 18.44.080 to permit or conditionally permit IBB uses in the I-P, I-G, O, PUD-C-O, PUD-I, PUD-I/C-O, and PUD-MU Districts, and the following Districts of the Hacienda PUD Area: OGPD,

OPD, OMPD, CDP, IPD, MOIPD, MCOIRPD, and MCOIPD; (4) modify the Design Review requirements for (a) industrial tenants leasing space in a previously reviewed and approved building; and (b) industrial tenants that are permitted by right within an industrial zone; and (5) modify specific and related development standards for IBB uses

B. DRAFT Proposed Zoning Text Amendments

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**STAFF RECOMMENDATION**

Staff recommends the Planning Commission:

1. Adopt a resolution recommending the City Council find the proposed text amendments to the Zoning Code are exempt from the California Environmental Quality Act under Guidelines Section 15061(b)3 (common sense exemption) and approve Case No. P25-0192. The draft text amendments as set forth in Exhibit B.

**EXECUTIVE SUMMARY**

The subject application proposes to amend various chapters of the Pleasanton Municipal Code with respect to "Innovation-Based Businesses" (IBB), by defining them as a distinct use category, and providing tailored zoning requirements that will facilitate these high-value, relatively low-impact industrial uses in appropriate locations. The proposed amendments have been developed to advance Priority 5.0 of the City's *Economic Development Strategic Plan*, which directs the City to identify zoning modifications that would help attract the Life Sciences/ Biotechnology sector and other target industries to Pleasanton.

Specifically, amendments are proposed to Chapters 18.08, 18.20, 18.40, 18.48, 18.84, 18.88, 18.92, and Table 18.44.080 of the Pleasanton Municipal Code (PMC) to: (1) modify the definition of Light Industrial; (2) establish the definition of an Innovation-Based Business (IBB); (3) modify Table 18.44.080 to permit or conditionally permit IBB uses in the I-P, I-G, O, PUD-C-O, PUD-I, PUD-I/C-O, and PUD-MU Districts, and the following Districts of the Hacienda PUD Area: OGPD, OPD, OMPD, CDP, IPD, MOIPD, MCOIRPD, and MCOIPD; (4) modify the Design Review requirements for (a) industrial tenants leasing space in a previously reviewed and approved building; and (b) industrial tenants that are permitted by right within an industrial zone; and (5) modify specific and related development standards for IBB uses. The Planning Commission is being asked to review the proposed amendments to the PMC and forward a positive recommendation to the City Council for consideration and decision.

**BACKGROUND**

Pleasanton's industrial sector plays a key role in creating quality jobs and economic vitality. In recent years, Pleasanton's office and retail sectors have both gone through a period of contraction and uncertainty. But meanwhile, several new light industrial sectors, collectively known as "Innovation-Based Business" or IBB, have emerged that offer new economic opportunities for Pleasanton.

While Life Sciences and Biotechnology are sectors that are most often thought of under IBB, it can also include other industries such as Robotics, Advanced Manufacturing, Food Tech and similar uses. Collectively, these sectors are identified as IBB. These uses are already allowed

in the City's Zoning Code, but currently, they are included in the Light Industry definition, which can cause confusion and inefficiency. Unlike either Light Industry or Heavy Industry uses, IBBs are characterized by several features:

- Buildings often have exterior architecture that is similar to, or compatible with, office buildings.
- The interior is designed to be highly flexible to accommodate a range of uses over time, including office, lab, testing, or small-scale manufacturing.
- All operations take place indoors.
- The nature of the operations does not tend to generate noise, odor, vibrations, or other potential nuisances that extend to adjacent properties.
- Although controlled substances may be used on site, IBB uses do not have the same level of safety or hazardous materials concerns of Heavy Industrial uses.
- Occupancy levels are typically much lower for IBB than for office uses, at about one employee per 300 to 400 square feet, compared to one per 250 square feet for office.

Pleasanton is well-positioned to attract new IBB, with a solid and diverse industrial base with approximately 5.2 million square feet of current inventory. But unfortunately, the City's zoning code is somewhat outdated, and as a result, may create unnecessary barriers to IBB that may impede this type of new investment in Pleasanton.

Many of the IBBs noted above have specific facility requirements and typically need to build out their new space/facilities within a very tight schedule, because of the nature of their investment/capital funding and business models. Thus, cities that can offer them expedited review, certainty, and accommodation during the approval process are much more attractive locations for investment. Conversely, IBBs avoid locating where the zoning requirements could cause unnecessary delays, uncertainty, or impose unreasonable requirements that create barriers to investment.

In 2023, the City Council – as part of their adoption of the updated *Economic Development Strategic Plan* (EDSP) – approved a major initiative to attract the Life Sciences/Biotechnology sector and modernize the City's Zoning and permit process to reduce regulatory barriers for those businesses. This initiative appears as Initiative 5.1 within the EDSP.

## DISCUSSION

Assessment of existing City Zoning

Planning Division and Economic Development Division staff collectively worked with an expert consultant in the Life Sciences industry – the Alex Greenwood Group – to assess the current zoning and develop recommended PMC amendments to allow the City's zoning to better accommodate the unique site requirements for Biotechnology and other target industries. The analysis included the following:

- Assessment of current industrial zoning to identify opportunities to improve clarity, certainty, and efficiency for the review of new Biotechnology and other IBB.
- Compare the City's existing zoning site requirements to the current market realities and common site requirements for various high-value industrial sectors and identify places where the City's zoning may pose unintended bureaucratic obstacles.
- Feedback and insights from key Pleasanton business and community leaders.

- Compare Pleasanton's zoning regulations to other cities that have been successful in attracting Biotechnology and other IBB.

This analysis led to several key findings about Pleasanton's industrial zoning:

1. The existing use definitions do not include (or make allowance for) the more modern, innovation-based industrial uses leading industrial growth in the Bay Area.
2. Some of the existing industrial zones require a discretionary, conditional use permit for types of low-impact industrial uses that ideally should be permitted outright.
3. Some of the industrial zones have unnecessary restrictions on complementary uses that could be beneficial to co-locate with innovation-based industrial uses, such as hotels.
4. Pleasanton's extensive use of Planned Unit Developments (PUDs) can obscure the actual zoning requirements and make it difficult for prospective businesses to quickly identify and assess appropriately zoned sites.
5. Pleasanton lacks a clear, transparent, interactive GIS service hosted on its website, where prospective businesses can efficiently research the zoning requirements of various parcels within the City.
6. Development standards (e.g., height limit, setbacks, parking, etc.) need to be updated in several places to reflect market realities and current industry site requirements, while at the same time providing reasonable parameters on new development.
7. There are several areas in the existing Zoning Code where the Design Review process is triggered unnecessarily.
8. All of the issues listed above create inefficiencies that can add months of time to the entitlement and permit approval process.

Pleasanton is well-positioned to compete regionally for IBB due to its quality of life, highly skilled and educated workforce, and emerging cluster of firms within and supportive of the IBB sector, but zoning must be clear and facilitate new investment to build and maintain competitive momentum. Unlike more traditional industrial or office uses, Life Science businesses often face accelerated timelines from the time they secure a new round of funding to the time they are required to open a new lab facility. As a result, these businesses favor zoning processes that are rapid, "over-the-counter" whenever possible, and flexible to meet specific industry site requirements. IBB prefers locations with updated, streamlined zoning to avoid delays and uncertainty. To stay competitive, Pleasanton's zoning should be updated to reflect the industry needs of this emerging sector.

<u>Comparison to Other Cities</u>
As part of the analysis mentioned above, Pleasanton's industrial zoning was compared to several Bay Area cities that have recently modernized and streamlined their Industrial Zoning. Several cities were identified as having developed particularly successful best practices in Industrial Zoning supportive of IBBs and used as a starting point for considering revisions to the PMC. They include Fremont, Hayward, Berkeley, San Leandro, South San Francisco, Concord, and Oakley.

Review of the specific zoning and regulatory strategies adopted by these cities helped to provide insights into how Pleasanton's zoning can be modified to make it more competitive in

attracting Biotechnology and other IBBs with specific recommendations tied to Pleasanton's local conditions and community expectations.

Recommended PMC Amendments

Based on the analysis detailed above, several recommendations were developed for updating and improving the City's Industrial Zoning. These recommendations have been incorporated into the proposed Resolution (see Exhibit A), and proposed zoning text amendments (see Exhibit B) are described below:

1. **Adjust the definition of "Light Industrial" (18.08.263); and establish a new industrial use definition: "Innovation-Based Business" (Proposed 18.08.264)**

   In addition to "Heavy Industrial" and "Light Industrial", the City would establish a new, third definition of industrial use: "Innovation-Based Business" (IBB). The IBB definition would distinguish this subset of industrial uses characterized by:

   - Use of advanced technology;
   - Smaller scale production and/or focus on research & development;
   - Operations entirely indoor; and
   - Industrial processes may involve significant use of mechanical and/or scientific equipment but do not generate any excessive off-site impacts.

   Examples of IBB uses include: Research & Development (R&D), pilot production, or small-to-medium scale production facilities focused on scientific research and the design, development, and testing of electrical, electronic, magnetic, optical, pharmaceutical, chemical, and biotechnology components and products. IBB uses may include the handling of some hazardous materials, but regulated to minimize the risk of off-site impacts.

   To accommodate the new IBB definition and promote clarity, the City would also make minor adjustments to the definition of "Light Industrial." Currently, the definition of Light Industrial includes a broad range of uses, including uses that would fall into the new IBB definition. The proposed new definition of Light Industrial would remove reference to IBB uses (such as research and development, or limited intensity manufacturing and assembly) since those uses would now be covered under the IBB definition. On the other hand, the proposed new definition would continue to include – and clearly call out – a range of typical Light Industrial uses, such as:

   - Warehousing, storage, wholesaling, logistics, and distribution uses.
   - Printing, contractors, and business services not generally patronized by the general public.
   - Food processing, recycling, laundry plants, light assembly, and other industrial operations with minimal risk of external impacts.
   - Outdoor storage and construction yard space.
   - Artist or artisan workspace that involves the production of an applied art or craft strictly using hand tools or small mechanical equipment.

This approach would create a clear division between IBB uses and Light Industrial uses, allowing more efficient and consistent review of industrial projects.

**2. Adjust the restrictions on various industrial and industrial-supporting uses within the O, I-P and I-G zones (see Table 18.44.080)**

IBB uses – from Biotechnology to Advanced Manufacturing – seek to attract a highly sought-after scientific, engineering, and technical workforce. For this reason, the trend has been for IBB uses to locate in buildings that offer many of the same amenities and architectural features as premium ("Class A") office buildings. For the same reason, IBB uses are also being integrated into mixed-use districts where workers can access services and amenities. Examples include Mission Bay (San Francisco) and Kendall Square (Cambridge, MA).

The proposed Zoning updates would acknowledge this trend and allow IBB uses to locate in a range of appropriately zoned districts. In addition, the Zoning updates would allow more flexibility to co-locate hotels, higher education facilities, and/or personal service uses in the same area, to provide a more amenity-rich work environment. The Zoning updates would include the following specific provisions:

- The new IBB use would be a permitted use in the following zones:
  - I-P, I-G, PUD-C-O, PUD-I, PUD-I/C-O, and PUD-MU Districts; and
  - The following Districts within Hacienda PUD Area: OGPD, OPD, OMPD, CDP, IPD, MOIPD, MCOIRPD, and MCOIPD.
- IBBs would be subject to a Minor Conditional Use Permit (MCUP) in the Office (O) District.
- Personal Service uses would be conditionally permitted in the I-P District with a Minor Conditional Use Permit (MCUP).
- Hotels would be permitted in the O and I-P Districts.

The Hacienda PUD Area Districts referenced above generally correspond or refer back to one of the "straight" zoning Districts in the PMC regarding permitted and conditionally permitted uses. In the event of a conflict between the PMC and the Hacienda PUD Area, the PUD remains the governing/controlling document.

It is also important to note that while the IBB framework is intended to be compatible with existing PUD entitlements, implementation of the IBB framework may occasionally require minor amendments to the Hacienda and/or other applicable PUDs. Any such amendments would be considered on a case-by-case basis to ensure alignment with the intent and goals of both the IBB and the PUD.

**3. Amend Chapter 18.20 - Design Review to modify the Design Review requirements for (a) industrial tenants leasing space in a previously reviewed and approved building; and (b) industrial tenants that are permitted by right within an industrial zone**

Currently, *all* industrial uses involving virtually any exterior improvements must go through the City's design review process. This is a cumbersome requirement that may negatively impact the City's ability to attract IBB investment:

- ***At odds with zoning intent for otherwise permitted uses:*** If the City has already determined a use should be permitted by-right, then the zoning approval should be "ministerial", and any related approvals be able to be processed in a streamlined

manner as possible. By requiring the applicant to go through an extensive and discretionary Design Review when the underlying use is otherwise permitted, it undermines the original intent of some uses being allowed to be approved easily and automatically. The existing design review requirements are broad and extensive for commercial uses, requiring design review for even very minor or inconsequential exterior changes.

- ***Adding cost, time, and uncertainty to the Applicant's process:*** By making an otherwise permitted use subject to Design Review, the applicant will incur additional costs and be required to wait several additional months to go through Design Review. In addition, the process becomes discretionary, which adds uncertainty for the applicant. For example, the applicant may not have a clear idea of what type of architectural design will be acceptable to the City, and they may need to redesign their exterior to pass Design Review – thus adding further time and expense. All these factors create an obstacle that can deter businesses from locating in Pleasanton.

While both of these factors are important to address, it is recognized that the design review process can help ensure projects are well designed, functional and address site-specific adjacencies; therefore, design review will remain appropriate in some situations (for example, construction of a brand-new building or a substantial addition or modification to an existing building.) However, the level of such review (administrative vs. Planning Commission level), and circumstances under which it is required, should be carefully considered, so as to avoid creating unnecessary burdens for new, desired business investment.

Accordingly, the proposed Resolution (Exhibit A) would modify PMC Section 18.20 so all permitted uses that would occupy new construction or require significant additions or other more substantial modifications to existing buildings and sites for permitted IBB uses in the Industrial Zoning districts would be subject to design review, generally at the Zoning Administrator level, unless referred to the Planning Commission as allowed for by Chapter 18.20. Staff notes that the PMC includes key performance standards and development standards, as well as various regulations around aspects such as parking, loading, landscaping, and circulation, with which all IBB projects would be required to comply.

**4. Adjustment to development standards for IBB uses and zones where IBB is permitted or conditionally permitted**

These changes aim to strike a balance between flexibility and accountability. Some standards have been made more permissive to allow for practical implementation, while others have been refined to provide greater specificity and assurance that any potential project impacts will be effectively mitigated.

- ***Building Height:*** IBB uses tend to require large floor-to-floor heights to accommodate special heating, ventilation and air conditioning (HVAC) systems, chemical lines, and other requirements. For some advanced manufacturing uses, the floor-to-floor heights may exceed 25 feet due to equipment and HVAC requirements. In addition, many IBB uses (notably Biotechnology) require multi-story buildings to accommodate the tech and scientific workforce who must work collaboratively on projects. Examples of some typical multi-story biotechnology projects in other Bay Area communities include: Genentech (five stories), Merck (nine stories), Chiron (six stories), and Verily Life

Sciences (five to seven stories). To accommodate the typical business and operational requirements, IBB uses are proposed to be allowed to utilize the following height limits:

- Maximum height of 85 feet 5 inches for IBB uses located within 1 mile of BART. This will facilitate the attraction of a biotechnology facility with up to five stories in the vicinity of major transit. (Staff notes that, while somewhat higher than many existing office buildings in Hacienda and within the vicinity of BART, this scale is consistent with height maximums allowed in Hacienda today (up to 85 feet 5 inches), and with recently approved buildings such as Workday.)
- Maximum height of 55 feet for IBB uses more than 1 mile from BART. This will accommodate up to three-story IBB buildings for Advanced Manufacturing, Food Tech, Biotechnology, or other similar uses.
- An additional 15 feet of building height allowed for the screening of all roof-mounted building systems, antennae, and any other non-architectural roof features.

Staff notes that, while taller than building heights generally allowed in the Industrial zoning districts (40 feet), the 85-foot-5-inch provision would be limited to a 1-mile radius from BART, which includes Hacienda (where this height limit is allowed for many properties today); and near Stoneridge Mall, which has a 65-foot height limit today, and examples of buildings in this height range include 10x Genomics and Workday. For the broader area (more than 1 mile from BART), 55 feet versus 40 feet represents an approximately one-story height difference, a relatively modest increase. Staff further notes that other development standards, specific to IBB uses, require additional articulation for buildings over 40 feet, and the design review process as described above, for new construction, will help ensure taller buildings remain compatible with surrounding development, especially when adjacent/in close proximity to existing residential and other sensitive receptor uses.

- ***Service Equipment:*** Equipment required for building services, such as transformers, emergency generators, gas meters, and similar components, would be required to be carefully located to minimize visual impact from public open spaces and primary pedestrian and vehicular routes. Screening by means of structured elements or effective use of landscape materials to the extent feasible when equipment exceeds 3 feet in height.
- ***Emissions & Other Impacts:*** Section 18.48.060 currently prohibits any business with emissions dangerous to human or animal health. This section would be replaced with a general requirement that any industrial business with potentially dangerous emissions must be regulated in compliance with all applicable Federal, State, and Bay Area Air Quality Management District (BAAQMD) regulations. Criteria regarding odor, vibration, noise, and other similar potential negative impacts are already addressed in Chapter 18.48 - Industrial Districts of the PMC and will not be changed.

<u>Other Implementing Actions to Support IBB Uses</u>

Staff notes the proposed Zoning updates mentioned above will remove major regulatory barriers and facilitate the attraction of IBB uses to Pleasanton. However, the scale of IBB development would continue to be severely limited by the General Plan's existing FAR limits, which set a maximum FAR of 0.5 in Industrial Districts. Revision to the General Plan to modify the FAR limit is a more substantial policy discussion, and staff is proposing a two-step process for improving the regulatory process: the first step would be the Zoning updates discussed and proposed in this report; and the second step would be a General Plan Amendment to examine

the FAR density requirements for industrial uses. Unlike the proposed Zoning update, a General Plan Amendment will be a longer process and, depending on the nature of the changes, may involve CEQA analysis. This could be pursued during the next 12-24 months.

Similarly, these amendments reflect a relatively modest adjustment to the PMC. Staff believes there is a substantial need to update and revise other key sections of the PMC, particularly the Design Review chapter, to better align it with economic development goals, make the process more clear and effective for applicants, staff and decision-makers, and reduce the administrative burden of processing relatively minor design changes.

General Plan Consistency

The support and development of IBBs are consistent with the goals and policies of the General Plan, which encourages sustainable economic growth, diversification of the local economy, and the advancement of technology and education. The proposed revisions are also consistent with the General Plan's General and Limited Industrial Land Use category, which is implemented by the I-P and I-G zoning districts, and which allows a broad range of industrial uses, of which IBB is a subcategory. The amendments would also be consistent with the intent of the Retail/Highway/Service Commercial Business and Professional Office Land Use and Business Park designations, since IBB is a low-impact commercial use with characteristics in keeping with the range of permitted and conditionally permitted uses in this district. By fostering an environment conducive to innovation, such as providing flexible zoning, streamlined development review processes, and objective design standards, the City would be more attractive to, and be able to retain, high-value industries and businesses. This would not only create high-paying jobs but also contribute to environmental stewardship through the development of clean technologies and resource-efficient practices. Encouraging innovation aligns with long-term goals for economic resilience, competitiveness, and quality of life.

Staff concludes the proposed text amendments would also be consistent with the General Plan Land Use Policies and Programs listed below:

*Sustainability*

Program 2.2: Encourage the reuse of vacant and underutilized parcels and buildings within existing urban areas.

Program 2.4: Require higher residential and commercial densities in the proximity of transportation corridors and hubs, where feasible.

Program 2.5: Assure that new major commercial, office, and institutional centers are adequately served by transit and by pedestrian and bicycle facilities.

*Overall Community Development*

Goal 2: Achieve and maintain a complete well-rounded community of desirable neighborhoods, a strong employment base, and a variety of community facilities.

Policy 4: Allow development consistent with the General Plan Land Use Map.

*Industrial, Commercial and Office*

Policy 13: Ensure that neighborhood, community, and regional commercial centers provide goods and services needed by residents and businesses of Pleasanton and its market area.
Program 13.1: Zone sufficient land for neighborhood, community, and regional commercial uses to support Pleasanton's increasing business activity.
Policy 15: Encourage industrial, commercial, and office development which is compatible with environmental constraints in Pleasanton.

*Economic and Fiscal Element*

Goal 2: Sustain the community's quality of life with a vigorous and diverse economy.
Policy 1: Enhance Pleasanton's diversified economic base through an aggressive business retention and expansion program.
Goal 4: Maintain a diverse and stable revenue system.
Program 8.1: Promote a varied mix of land uses to ensure a broad revenue base through proactive land use planning and zoning.
Program 8.2: Continue to investigate and utilize potential new revenue sources, particularly those which will not add to the tax burden of residents and local businesses.
Program 18.1: Promote a diverse economic base by implementing the Economic Development Strategic Plan.

**ECONOMIC VITALITY COMMITTEE ACTION**
At its April 17, 2025, meeting, the Economic Vitality Committee received an update on the City's efforts to create a business roadmap which provides a clear pathway for zoning and permitting for the Life Sciences and Biotechnology sectors. Staff presented the proposed recommendations to amend the PMC to update the industrial definitions and establish a third type of industrial use definition – "Innovation-Based Business" (IBB), modify the list of permitted uses, modify the design review requirements, modify development standards for industrial districts, and enhance City website content to provide zoning information for prospective businesses. The EVC members asked clarifying questions regarding the recommendations. No formal action was taken other than to receive the update and provide feedback.

**PUBLIC NOTICE**
Notice of this meeting was published as a legal display ad in the Pleasanton Weekly in accordance with the noticing requirements of the PMC. At the time this report was published, no comments were received by staff. Public comments received after publication of this report will be forwarded to the Planning Commission as supplemental information prior to the hearing.

**ENVIRONMENTAL ASSESSMENT**
The proposed text amendments to the zoning code are exempt from environmental review under CEQA Guidelines Section 15061(b)(3) in that CEQA only applies to projects that have the potential for causing a significant effect on the environment. Since it can be seen with certainty that there is no possibility that the proposed text amendments will have a significant effect on the environment, no additional environmental review is required.

The proposed amendments involve uses that are less intensive than existing industrial uses in the City and do not generate significant impacts to adjacent properties. Such uses would be subject to conformance to specific performance standards to control the potential effects of noise, odors, vibration, and other similar external and/or off-site impacts, including for new IBBs proposed to be located adjacent to existing residential development. Any IBBs that involve the use of hazardous materials or produce hazardous waste are required to follow federal, state, and local regulations. Those regulations impose extensive environmental, health, and safety regulations on such uses. While the regulations would provide somewhat more permissive standards with respect to allowable building heights, such heights are similar to those which are already seen within Hacienda Business Park and in the vicinity of the two BART stations, and design review requirements, and design standards would ensure that buildings are properly designed and sited to ensure compatibility with surrounding development.

In light of the extensive regulatory requirements, less restrictive local zoning regulations for IBBs involving hazardous materials or hazardous waste would not result in any new environmental impacts. CEQA review, if any, for future projects would be conducted on a project-by-project basis, should there be unique characteristics of a proposed use or location that warranted such review.

## SUMMARY/CONCLUSION

Based on the analysis detailed in this report, staff has developed and proposed updates to improve the City's Industrial Zoning. The updates are incorporated into the proposed Resolution (Exhibit A) and zoning text amendments (Exhibit B). The proposed Zoning updates will remove outdated regulatory barriers and, in so doing, will facilitate the attraction of high-value, tech-centered industrial uses that provide high-quality jobs and economic vitality to Pleasanton.

**Primary Authors**:
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**Reviewed/Approved By**:
Ellen Clark, Director of Community Development
Kimberly Cilley, Assistant City Attorney

**EXHIBIT A**

# RESOLUTION NO. PC-2025-13

**A RESOLUTION OF THE PLANNING COMMISSION OF THE CITY OF PLEASANTON RECOMMENDING THE CITY COUNCIL FIND THE PROPOSED AMENDMENTS TO THE ZONING CODE ARE EXEMPT FROM THE CALIFORNIA ENVIRONMENTAL QUALITY ACT UNDER GUIDLEINES SECTION 15061(B)(3) AND APPROVE AMENDMENTS TO CHAPTERS 18.08, 18.20, 18.40, 18.48, 18.84, 18.88, 18.92, AND TABLE 18.44.080 OF THE PLEASANTON MUNICIPAL CODE (PMC) TO: (1) MODIFY THE DEFINITION OF LIGHT INDUSTRIAL; (2) ESTABLISH THE DEFINITION OF AN INNOVATION-BASED BUSINESS (IBB); (3) MODIFY TABLE 18.44.080 TO PERMIT OR CONDITIONALLY PERMIT IBB USES IN THE I-P, I-G, O, PUD-C-O, PUD-I, PUD-I/C-O, AND PUD-MU DISTRICTS, AND THE FOLLOWING DISTRICTS OF THE HACIENDA PUD AREA: THE OGPD, OPD, OMPD, CDP, IPD, MOIPD, MCOIRPD, AND MCOIPD); (4) MODIFY THE DESIGN REVIEW REQUIREMENTS FOR (A) INDUSTRIAL TENANTS LEASING SPACE IN A PREVIOUSLY REVIEWED AND APPROVED BUILDING; AND (B) INDUSTRIAL TENANTS THAT ARE PERMITTED BY RIGHT WITHIN AN INDUSTRIAL ZONE; AND (5) MODIFY SPECIFIC AND RELATED DEVELOPMENT STANDARDS FOR IBB USES, AS FILED UNDER CASE NO. P25-0192**

**WHEREAS**, on April 6, 2025, the City of Pleasanton proposed to amend Chapters 18.08, 18.20, 18.40, 18.48, 18.84, 18.88, 18.92, and Table 18.44.080 of the Pleasanton Municipal Code (PMC) to: (1) modify the definition of Light Industrial; (2) establish the definition of an Innovation-Based Business (IBB); (3) modify Table 18.44.080 to permit or conditionally permit IBB uses in the I-P, I-G, O, PUD-C-O, PUD-I, PUD-I/C-O, and PUD-MU Districts, and the following Districts of the Hacienda PUD Area: OGPD, OPD, OMPD, CDP, IPD, MOIPD, MCOIRPD, and MCOIPD; (4) modify the Design Review requirements for (a) industrial tenants leasing space in a previously reviewed and approved building; and (b) industrial tenants that are permitted by right within an industrial zone; and (5) modify specific and related development standards for IBB uses (hereinafter “Project”); and

**WHEREAS**, the subject/affected properties are zoned I-P, I-G, O, PUD-C-O, PUD-I, PUD-I/C-O, and PUD-MU Districts, and the following Districts of the Hacienda PUD Area: the OGPD, OPD, OMPD, CDP, IPD, MOIPD, MCOIRPD, and MCOIPD Districts; and

**WHEREAS**, on May 28, 2025, the Planning Commission held a duly noticed public hearing to consider the Project, all public comments and testimony, and findings.

**NOW, THEREFORE BE IT RESOLVED,** the Planning Commission of the City of Pleasanton, does resolve, declare, determine, and order the following:

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**Section 1:** Prior to taking action on the Project, and at a properly noticed public meeting, the Planning Commission reviewed written and oral staff reports, conducted a public hearing on the Project and took testimony, and received into the record all pertinent documents related to the Project (collectively, the "Record Evidence"). The Planning Commission's determination is based on the Record Evidence, which is incorporated into this Resolution by reference**.**

**Section 2:** The Project is consistent with the adopted General Plan as it aligns with the applicable land use designations and supports the General Plan's Programs, Policies, and Goals related to sustainability, community development, industrial, commercial, office, and the economic and fiscal element. As such, the Project complies with the requirements of Government Code Section 65860 regarding zoning consistency with the General Plan.

**Section 3:** The Planning Commission recommends the City Council find the proposed text amendments to the zoning code are exempt from environmental review under CEQA Guidelines Section 15061(b)(3) in that CEQA only applies to projects that have the potential for causing a significant effect on the environment. Since it can be seen with certainty that there is no possibility that the proposed text amendments will have a significant effect on the environment, no additional environmental review is required. The proposed amendments involve uses that are less intensive than existing industrial uses in the City and do not generate significant impacts to adjacent properties. Any innovation-based businesses that involve the use of hazardous materials or produce hazardous waste are required to follow federal, state, and local regulations. Those regulations impose extensive environmental, health, and safety regulations on such uses. In light of the extensive regulatory requirements, less restrictive local zoning regulations for innovation-based businesses involving hazardous materials or hazardous waste would not result in any new environmental impacts. CEQA review, if any, for future projects may be conducted on a project-by-project basis.

**Section 4:** The Planning Commission further recommends the City Council approve Case No. P25-0192, the application of the City of Pleasanton to amend Chapters 18.08, 18.20, 18.40, 18.48, 18.84, 18.88, 18.92, and Table 18.44.080 of the Pleasanton Municipal Code (PMC) to: (1) modify the definition of Light Industrial; (2) establish the definition of an Innovation-Based Business (IBB); (3) modify Table 18.44.080 to permit or conditionally permit IBB uses in the I-P, I-G, O, PUD-C-O, PUD-I, PUD-I/C-O, and PUD-MU Districts, and the following Districts of the Hacienda PUD Area: OGPD, OPD, OMPD, CDP, IPD, MOIPD, MCOIRPD, and MCOIPD; (4) modify the Design Review requirements for (a) industrial tenants leasing space in a previously reviewed and approved building; and (b) industrial tenants that are permitted by right within an industrial zone; and (5) modify specific and related development standards for IBB uses, as shown in Exhibit A, attached hereto and made part of this case by reference.

**Section 5:** This resolution shall become effective immediately upon its passage and adoption.

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**PASSED, APPROVED AND ADOPTED by the Planning Commission of the City of Pleasanton at a regular meeting held on May 28, 2025, by the following vote:**

Ayes:
Noes:
Absent:
Abstain:

**ATTEST:**

_____
Melinda Denis
Secretary, Planning Commission

_____
Ken Morgan
Chair

**APPROVED AS TO FORM:**

_____
Kimberly Cilley
Assistant City Attorney

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# EXHIBIT A
# DRAFT AMENDMENTS TO CHAPTERS 18.08, 18.20, 18.40, 18.48, 18.84, 18.88, 18.92, AND TABLE 18.44.080 OF THE PLEASANTON MUNICIPAL CODE (PMC)

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**Chapter 18.08 Definitions** (See entire Chapter here: PMC Chapter 18.08) is hereby amended to read:

**§ 18.08.263. Industrial, light.**

"Light industrial" means a category of less intrusive industrial uses that is capable of operation in such a manner as to control the external effects of manufacturing processes such as smoke, noise, vibration, soot, and odor. It includes, but is not limited to:

a. Warehousing, storage, wholesaling, logistics, and distribution uses.
b. Printing, contractors, and business services not generally patronized by the general public.
c. Food processing, recycling, laundry plants, light assembly and fabrication, and other industrial operations with minimal risk of off-site impacts.
d. Outdoor storage and construction yard space.
e. Artist or artisan workspace that involves the production of an applied art or craft strictly using hand tools or small mechanical equipment.

~~limited intensity levels of manufacturing and assembly activities primarily from previously prepared or refined materials, or from raw materials that do not need refining, warehousing with limited direct public access, research and development, packaging, and associated offices and similar uses as determined by the director of community development within an enclosed building. This use category includes, but is not limited to, food processing, contractors, call centers, textiles, wood products, printing, pharmaceuticals, machinery manufacturing, research and development, laundry plants, laboratories, and regional distribution, but excludes basic industrial processing from raw materials, and vehicle/equipment services.~~

**§ 18.08.264. Industrial, Innovation-Based Business.**

"Innovation-Based Business" ("IBB") means industrial activities characterized by: (a) use of advanced technology; (b) smaller scale production and/or focus on research & development; (c) operations that are entirely indoors; and (d) industrial processes that may involve higher investment in equipment and utilities compared to light industrial uses but do not generate excessive impacts to adjacent properties. Includes Research & Development (R&D), data centers, pilot production, machinery manufacturing, small-to-medium-scale production facilities focused on scientific research and the design, development, and testing of electrical, electronic, magnetic, optical, pharmaceutical, chemical, and biotechnology components and products, or any other similar uses as determined by the Zoning Administrator or Planning Commission pursuant to Chapter 18.128. Uses may include the handling of some hazardous materials but regulated so as to mitigate the risk of off-site impacts. In any district that permits innovation-based businesses, design review shall be required as prescribed by Chapter 18.20.

**Chapter 18.20 Design Review** (See entire Chapter here: PMC Chapter 18.20) is hereby amended to read:

**§ 18.20.010. Projects subject to design review.**

In order to preserve and enhance the city's aesthetic values and to ensure the preservation of the public health, safety, and general welfare, the following projects shall be subject to discretionary design review.

A. The planning commission is empowered to review and make decisions concerning the following classes of projects:

1. All outdoor uses, new improvements and structures, or expansions thereof, proposed within all zoning districts except the PUD district.

2. Any matter referred to it by the zoning administrator for decision.

3. Appeals of items acted upon by the zoning administrator.

B. The zoning administrator shall review and make decisions concerning the following classes of projects:

1. All accessory structures which exceed 10 feet in height, measured from average ground level to the highest point on the structure.

2. Additions to single-family houses which exceed 10 feet in height, as height is defined in this title.

3. Fences, walls, and hedges greater than six feet in height, as height is defined in this title.

4. All models of single-family projects.

5. All custom single-family homes.

6. All outdoor uses, new improvements, and structures in PUD districts in which the conditions of approval specifically have delegated decision making authority over design issues to the preexisting design review board.

7. All signs.

8. All satellite earth stations and microwave dish antennas, whether located in a residential or nonresidential district.

9. Minor building additions in "straight zoned" (non-PUD) districts. (Minor building additions in PUD districts would continue to be treated as minor modifications, subject to staff approval.)

10. Exterior improvements or expansions to unreinforced masonry buildings, as defined in Section 18.08.580 of this title.

11. Commercial and noncommercial towers, spires, cupolas, chimneys, penthouses, water tanks, fire towers, flagpoles, monuments, scenery lofts, and similar structures.

12. Commercial and noncommercial radio and television antennas and transmission towers, personal wireless service facilities, and receive-only antennas greater than 10 feet in height.

13. All covered front porches that are located in the front yard setback area in the R-1, RM zoning districts and PUD zoned residential properties referencing the R-1/RM development standards of this code.

14. Small electricity generator facilities, and small fuel cell facilities.

15. Additions and exterior modifications/alterations listed below to single-family houses in residential zoning districts within the Downtown Specific Plan Area that are considered historic resources as defined by the Downtown Specific Plan:

    a. Wall and foundation cladding including, but not limited to, material, finish, shape, orientation, and joinery.

    b. Porches and balconies including, but not limited to, banisters/railings, balusters, posts/supports, and

material.

c. Windows including, but not limited to, window shape, size, placement, operation, material, trim/surround, mullions/glazing pattern, and recess from the exterior wall.

d. Roofs including, but not limited to, roof form, eaves, material, color, and pitch.

e. Chimneys including, but not limited to, material, finish, location, size, and shape.

f. Front doors.

g. Architectural trim and details including, but not limited to, corbels, knee braces, brackets, cornice, dentils, etc.

The zoning administrator may refer any of the above items to the planning commission for review and action.

16. All construction of a new building(s) or require a significant building addition(s) as determined by the zoning administrator associated with innovation-based businesses prescribed by Chapter 18.08. Innovation-based businesses that are occupying a previously approved building(s) with no exterior changes, minor building addition(s)/modification(s), or site plan only modification(s) as determined by the zoning administrator shall not be subject to design review.

C. Modifications or deviations from an approved plan, if deemed substantial by the zoning administrator, shall be reviewed in accordance with the procedures for the original use or structure classification.

D. The zoning administrator may waive review altogether or administratively process an application if a new or modified use or structure shall not be visible from any public street or area held open to the public.

**Chapter 18.40 Office District** (See entire Chapter here: PMC Chapter 18.40) is hereby amended to read:

**§ 18.40.055. Service Equipment.**

In all applicable O Districts and any district that permits innovation-based businesses, equipment required for building services such as transformers, emergency generators, gas meters, and similar components shall be sited so as to minimize visual impact from public open spaces and primary pedestrian and vehicular routes and such equipment shall be screened per the requirements of Chapter 18.84.

**Table 18.44.080 Permitted and Conditional Uses** (See entire Table here: PMC Table 18.44.080) is hereby amended to read:

| The following uses shall be permitted uses or conditional uses in a commercial, mixed-use, office, or industrial district according to the following legend: | | | |
|---|---|---|---|
| P | Permitted Use | MU-T | Mixed Use Transitional |
| C | Conditional Use | CR | Regional Commercial District |
| MCUP | Minor Conditional Use | CS | Service Commercial District |
| TC | Temporary Conditional Use | CF | Freeway Interchange Commercial District |
| CN | Neighborhood Commercial District | O | Office District |
| CC | Central Commercial District | IP | Industrial Park District |
| MU-D | Mixed Use Downtown | IG | General Industrial District |
| If a property is zoned PUD, then the PUD shall be consulted for permitted and conditionally permitted uses before consulting this table. Where there is a conflict between Table 18.44.080 and the PUD, the PUD shall govern. | | | |

| **USES** | **C-N** | **C-C** | C-R (m[1]) | C-R (p[2]) | **C-S** | **C-F** | **O** | **I-P** | **I-G** | **MU-D** | **MU-T[35]** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Heavy industrial | | | | | | | | C[13] | C[13] | | |
| Light industrial[33] | | | | | P | | | P | P | | |
| Innovation-Based Business[36, 37] | | | | | | | MCUP[36] | P[36] | P[36] | | |
| Microbreweries[16] | | P | P | P | P | | | P | P | P | |
| "Radioactive materials uses" as defined in Section 18.08.445 of this title | | | | | C | | | | C[13] | | |
| Rental yards, including the rental of hand tools, garden tools, power tools, trucks and trailers and other similar equipment | | | | | C | | | | | | |
| Warehousing, not including storage of fuel or flammable liquids[33] | | P[11, 17, 18] | | | MCUP | | | MCUP | P | | |
| Wineries[16] | | P | P | P | P | | | P | P | P | |
| Nursery schools[4, 5] | C | | C | C | | | | | | | |
| Schools and colleges with more than 20 students in the facility at any one time. This category includes trade schools, business schools, heritage schools, music and art schools, tutoring, but does not include general purpose schools[5, 6] | MCUP | MCUP[18] | MCUP | MCUP | MCUP | MCUP | C | MCUP | MCUP | MCUP[18] | C |
| Offices, including, but not limited to, business, professional and administrative offices | P | P[18] | P | P | | | P | P | P | P[18] | P |
| Personal services[26] | P | P[18] | P | P | | | P | MCUP | | P[18] | P |
| Hotels and motels | | P | | C | | P | P | P | | MCUP | |

| **Notes:** | |
|---|---|
| 1 | Uses which are part of a completely enclosed mall complex, except where specifically allowed outside of the mall, all activities take place entirely indoors. |
| 2 | Uses on peripheral sites physically separated from a central enclosed mall. |
| 4 | State-mandated outdoor play areas shall face new or existing landscaping sufficient to buffer the play area from view, shall be separated from customer parking areas by a heavy wood fence or comparable barrier, shall be isolated from loading docks and associated delivery truck circulation areas, and shall contain landscaping for outdoor children's activities. The standard city noise ordinance applies. |
| 5 | The use is subject to the following conditions: (1) The facility shall adhere to all occupancy, ADA, California Building Code, and exiting requirements; (2) The zoning administrator finds that adequate parking is available for the said use, and the proposal has an effective traffic circulation system including pick-up and drop-off for business patrons; (3) The standard city noise ordinance applies; (4) If applicable, an outdoor play area proposed would not cause the ambient noise |

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| | levels at the property plane to increase by 4 dB Ldn. The zoning administrator may request a noise study or other professional study in order to determine whether the use meets or exceeds this threshold. |
| 6 | Music and art schools shall be at least 150 feet from an R district. |
| 11 | A conditional use permit shall be required for special downtown accessory entertainment uses, as defined in Chapter **18.08** of this title, and the use does not comply with the hour restrictions and/or conditions required for the use to be a permitted use or a temporary conditional use. |
| 13 | The city planning commission shall make a specific finding that the use will conform with each of the required conditions prescribed in Sections **18.48.040** through **18.48.120** of this chapter, in addition to the findings prescribed in Section **18.48.060**. |
| 16 | The following conditions shall apply to microbreweries and wineries: (1) The zoning administrator finds that adequate parking is available for said use; (2) If the zoning administrator determines that the use will be or is creating odor problems, an odor abatement device determined to be appropriate by the zoning administrator shall be installed within the exhaust ventilation system to mitigate brewery odors; (3) The applicant is in compliance with all applicable requirements of Chapter **9.04** of this code; (4) If operation of the use results in conflicts pertaining to parking, noise, odors, traffic, or other factors, the zoning administrator may modify or add conditions to mitigate such impacts, or may revoke the zoning certificate for the use. |
| 17 | Basement storage as defined in Section **18.08.057** shall be permitted as warehousing in the central commercial (C-C) zoning district, subject to meeting all of the following criteria: |
| | a. Basement storage shall be limited to the C-C zoning district within the downtown specific plan area and limited to commercial buildings only; |
| | b. Basement storage shall be limited to nontoxic, nonhazardous materials only. It is the responsibility of the storage space operator to prepare a list of prohibited storage items, to have the list approved by the Livermore-Pleasanton fire department, and to require all storage space users to agree in writing that no items on the list or other hazardous materials will be stored. The storage space shall be used for storage only and no other activities and/or uses are allowed; |
| | c. Prior to allowing basement storage, the building owner shall contact the building and safety division and fire department to ensure that the basement meets applicable building and fire codes. If required, the building owner and/or responsible party shall secure all applicable permits and/or make any required changes to the basement space to ensure the space meets current code standards for fire, safety, and accessibility; |
| | d. The hours of access for basement storage use shall be: Monday through Friday from 6:00 a.m. to 10:00 p.m. and Saturday and Sunday from 10:00 a.m. to 6:00 p.m. only; |
| | e. One parking space per on-site storage employee and one parking space for storage customers. This parking requirement is in addition to the parking required for other uses on-site; |
| | f. Prior to allowing and/or renting space for basement storage, the property owner and/or responsible party shall submit a zoning certificate application and secure a business license. The zoning certificate application shall be accompanied by a narrative that describes the type of storage proposed, where parking will be allowed, and the use(s) of the building and shall include a site plan and basement storage floor plan that clearly defines, but is not limited to, the following: (1) The defined area(s) and square-footage in which storage will take place; (2) How the individual storage areas will be delineated (e.g., cages, walls, etc.); (3) Access and ADA accessibility. |
| 18 | Use is not permitted on the ground floor when the property is also located in the Active Ground-Floor Overlay District, except where an exemption is granted as set forth in Chapter **18.81**. |
| 26 | Any use not in conjunction with a medical use that includes massage service of four or more technicians at any one time shall be subject to a minor conditional use permit as prescribed in Chapter **18.124**. Massage establishments shall meet the requirements of Chapter **6.24**. |
| 33 | If the subject tenant space exceeds 75,000 gross square feet, the use shall be subject to a conditional use permit as prescribed in Chapter **18.124**. This requirement does not apply to light industrial uses located in Hacienda, an area defined by Ordinance 1325 and as subsequently amended. |
| 35 | Any use shall operate only between the hours of 6:00 a.m. and 11:00 p.m. |
| 36 | In addition to the Districts identified in Table 18.44.080, innovation-based businesses shall be Permitted uses in the following Districts:<br>• I-P, I-G, PUD-C-O, PUD-I, PUD-I/C-O, and PUD-MU; and<br>• The following zones within Hacienda PUD Area (OGPD, OPD, OMPD, CDP, IPD, MOIPD, MCOIRPD, and MCOIPD)<br><br>An MCUP shall be required for any innovation-based business in which controlled hazardous materials are to be used, stored or disposed of on-site<br><br>An MCUP shall be required for any innovation-based business to be located adjacent to any existing residential use and/or other similar sensitive receptor use as determined by the zoning administrator and shall be subject to the following performance standards:<br>• Innovation-based businesses shall be permitted a maximum of two loading docks that can accommodate medium-duty delivery trucks as determined by the zoning administrator<br>• Use of any loading docks and delivery/receiving/shipping hours of operation shall be determined acceptable on a case-by-case basis as determined by the zoning administrator<br><br>Ancillary uses/equipment including, but not limited to HVAC equipment, transformers, emergency generators, gas meters, backflow devices, storage, etc. shall be sited to minimize noise and visual impacts as determined acceptable by the zoning administrator |
| 37 | A CUP and Design Review approval shall be required for any data center use where an innovation-based business is Permitted or Conditionally Permitted |

**Chapter 18.48 I Industrial Districts** (See entire Chapter here: PMC Chapter 18.48) is hereby amended to read:

### § 18.48.060. Emissions.

~~No use shall be permitted which creates any emission which endangers human health, can cause damage to animals, vegetation or other property, or which can cause soiling at any point beyond the boundaries of the site. All uses that emit any of the air contaminants listed in the bay area air pollution control district's Regulation 2, shall comply with the regulations contained therein.~~ Any industrial use with potentially hazardous emissions, as determined by the zoning administrator, shall be regulated in compliance with all applicable Federal, State, and Bay Area Air Quality Management District (BAAQMD)

regulations.

**§ 18.48.165. Service Equipment.**
In all applicable I Districts and any district that permits innovation-based businesses, equipment required for building services such as transformers, emergency generators, gas meters, and similar components shall be sited so as to minimize visual impact from public open spaces and primary pedestrian and vehicular routes and such equipment shall be screened per the requirements of Chapter 18.84.

**§ 18.48.200. Design Review.**
In all applicable I Districts and any district that permits innovation-based businesses, design review shall be required as prescribed by Chapter 18.20.

**Chapter 18.84 Site, Yard, Bulk, Usable Open Space And Landscaping Regulations** (See entire Chapter here: PMC Chapter 18.84) is hereby amended to read:

**§ 18.84.150. Height limits—Exceptions.**

A. Architectural building elements such as towers, cupolas, and similar structures, and appurtenances such as spires, chimneys, elevator and stairway enclosures, building-mounted flagpoles, screens for rooftop equipment, and similar structures covering not more than 10 percent of the ground area covered by the structure may be erected to a height of not more 15 feet above the height limit prescribed by the regulations for the district in which the site is located, with design review approval specified under Chapter 18.20 of this title.

B. Except as otherwise allowed by this title, subject to design review approval specified under Chapter 18.20 of this title, free-standing appurtenant structures such as water tanks, fire towers, flagpoles, monuments, and similar structures; residential radio and television aerials and antennas; receive-only antennas; may be erected to a height of not more than 65 feet or not more than 25 feet above the height limit prescribed by the regulations for the district in which the site is located, whichever is less.

C. The height and location of commercial radio and television aerials, antennas, and transmission towers shall be subject to design review approval specified under Chapter 18.20 of this title, and shall be based on a visual analysis demonstrating that views of the aerial/ antenna/tower are minimized or are substantially screened from residential land uses, the I-580 and/or I-680 rights-of-way, or other sensitive land uses such as parks, schools, or major streets, and shall be based on an engineering analysis justifying the height of the proposed aerial/antenna/tower. Any parabolic dish mounted on the aerial/antenna/tower shall be less than two feet in diameter. The base of the aerial/antenna/tower and any switching facility located at the base that is visible to the public shall be architecturally treated and/or screened from view utilizing on-and/or off-site vegetation or other approved screening mechanism.

D. Wire-carrying power distribution poles and transmission towers and communication poles located in any zoning district shall not be subject to the height limits prescribed in the district regulations.

**E.** For innovation-based businesses in the I-P, O, PUD-C-O, PUD-I, PUD-I/C-O, and PUD-MU Districts, and the following Districts of the Hacienda PUD Area: OGPD, OPD, OMPD, CDP, IPD, MOIPD, MCOIRPD, and MCOIPD, the maximum height for new buildings shall be:

a. 85 feet, five inches for uses located within one mile of a Bay Area Rapid Transit (BART) station

b. 55 feet for uses located more than one mile from a Bay Area Rapid Transit (BART) station.
c. An additional 15 feet of building height shall be permitted to accommodate screening of all roof-mounted building systems, antennae, and any other non-architectural roof features.
d. For buildings over 40 feet in height, the development of a pedestrian scale shall be required through the manipulation of building mass, detailing of the building façade(s), and landscape planting to the satisfaction of the zoning administrator.
e. For buildings over 40 feet in height that are adjacent to or within close proximity to existing residential and/or other similar sensitive receptor uses, all levels beyond the second level shall be set back from the wall planes of the lower levels to the satisfaction of the zoning administrator.

**Chapter 18.88 Off-Street Parking Facilities** (See entire Chapter here: PMC Chapter 18.88) is hereby amended to read:

**§ 18.88.030. Schedule of off-street parking space requirements.**
**C. Office, Commercial and Industrial Uses not in the C-N or C-R District.**

13. Unless subject to more limited parking requirements established by State law or local policies with respect to sites within specified distance of major transit stops such as BART, manufacturing plants and other industrial uses, innovation-based businesses, warehouses, storage buildings, and storage facilities combined with commercial or industrial uses—one space for each employee on the maximum shift, or one space for each 300 square feet of gross floor area.

**Chapter 18.92 Off-Street Loading Facilities** (See entire Chapter here: PMC Chapter 18.92) is hereby amended to read:

**§ 18.92.030. Schedule of off-street loading berth requirements.**
**E. Manufacturing plants, other industrial uses:**

| Gross Floor Area | Minimum Number of Berths | Dimension of Berth |
|---|---|---|
| 0—3,999 sq. ft. | 0 | — |
| 4,000—29,999 sq. ft. | 1 | 12 x 45 |
| 30,000—69,999 sq. ft. | 2 | 12 x 45 |
| 70,000—120,000 sq. ft. | 3 | 12 x 45 |
| One berth for each additional 100,000 sq. ft. | | 12 x 45 |

***Alternative off-street loading facilities requirements may be considered and granted on a case-by-case basis by the zoning administrator.**

THE CITY OF PLEASANTON

# Planning Commission Agenda Report

May 28, 2025
Item 7

**SUBJECT: Committee, Commission, and Task Force List**

## Bicycle, Pedestrian, and Trails Committee

Advise the Parks and Recreation Commission and the City's Traffic Engineering Division on bicycle, pedestrian and trail-related items. The committee reviews and prioritizes potential projects and provides input on policies related to bikeways and trails.

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| Meeting Time: | Fourth Monday of every other month at 6:45 p.m. |
| Meeting Location: | Pleasanton Senior Center, 5353 Sunol Blvd., Pleasanton |
| Representative: | Commissioner Jain |
| Alternate: | Commissioner Pace |
| Staff Contacts: | Matt Nelson, Traffic Engineer, 931-5671; Matt Gruber, Landscape Architect, 931-5672 |

## Civic Arts Commission

Promote the acquisition, construction and installment of works of public art in Pleasanton. Make recommendations to the City Council regarding the City Civic Arts Program.

| | |
|---|---|
| Meeting Time: | First Monday of each month at 7 p.m. |
| Meeting Location: | City Council Chamber, 200 Old Bernal Ave., Pleasanton |
| Staff Contact: | Lia Bushong, Asst. Director, Library and Recreation, 931-3412 |

## Committee on Energy and the Environment

Works closely with City staff to prepare an Energy and Environmental Priorities Plan focusing on energy and environmental issues and strategies reflecting community opportunities, needs and interests.

| | |
|---|---|
| Meeting Time: | Fourth Wednesday of every other month at 5:00 p.m. |
| Meeting Location: | Operations Service Center, 3333 Busch Rd., Pleasanton |
| Staff Contact: | Megan Campbell, Associate Planner, 931-5610 |

## Economic Vitality Committee

Assess the current and ongoing business climate in the City of Pleasanton and offer suggestions and recommendations to the City Council intended to maintain a strong economic development base in the City.

| | |
|---|---|
| Meeting Time: | Third Thursday of each month at 7:30 a.m. |
| Meeting Location: | Remillard Conference Room, 3333 Busch Rd., Pleasanton |
| Staff Contact: | Lisa Adamos, Economic Development Manager, 931-5039 |

## Heritage Tree Board of Appeals

Make findings of fact upholding, reversing or modifying the director's decision with regard to heritage tree removal permits.

| | |
|---|---|
| Meeting Time: | As needed |
| Meeting Location: | City Council Chamber, 200 Old Bernal Ave., Pleasanton |
| Representatives: | Commissioners Wedge and Mohan |
| Alternate: | Commissioner Jagoe |
| Staff Contact: | Sarah Hosterman, Landscape Architect Asst., 931-5514 |

## Human Services Commission

Advise the City Council on the human service needs of the community and methods of fulfilling these needs. Particular emphasis is given by the commission to the human service needs of the socially and economically disadvantaged, the elderly and the youth of the community.

| | |
|---|---|
| Meeting Time: | First Wednesday of each month at 7 p.m. |
| Meeting Location: | City Council Chamber, 200 Old Bernal Ave., Pleasanton |
| Staff Contact: | Lia Bushong, Asst. Director, Library and Recreation, 931-3412 |

## Library Commission

Advise the City Council on matters related to the Pleasanton Library and library services in general. Promote the use of library services to the community.

| | |
|---|---|
| Meeting Time: | First Thursday of each month at 7 p.m. |
| Meeting Location: | City Council Chamber, 200 Old Bernal Ave., Pleasanton |
| Staff Contact: | Heidi Murphy, Director of Library and Recreation, 931-3400 |

## Parks and Recreation Commission

Advise the City Council, City Manager, and Parks and Community Services Department on matters related to the development and provision of services pertaining to parks and recreation facilities, programs and services.

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|---|---|
| Meeting Time: | Second Thursday of each month at 7 p.m. |
| Meeting Location: | City Council Chamber, 200 Old Bernal Ave., Pleasanton |
| Staff Contact: | Heidi Murphy, Director of Library and Recreation, 931-3400 |

## Youth Commission

Act as the liaison between Pleasanton's youth community and the City Council; advise the Council on youth-related issues; promote an understanding and appreciation of community affairs among the youth of Pleasanton.

| | |
|---|---|
| Meeting Time: | Second Wednesday of each month at 7 p.m., September-May |
| Meeting Location: | Remillard Conference Room, 3333 Busch Rd., Pleasanton |
| Staff Contact: | Nicole Thomas, Recreation Supervisor, 931-3432 |

THE CITY OF PLEASANTON

# Planning Commission Agenda Report

May 28, 2025
Item 8

**SUBJECT: Actions of the City Council**

**May 20, 2025**

Consent Calendar:

Actions of the Zoning Administrator and Planning Commission

Review proposals and award a Maintenance Services Agreement to St. Francis Electric for traffic signal maintenance and emergency repair services for a not-to-exceed annual amount of $1,000,000, for an initial two-year term through June 30, 2027, with a total not-to-exceed amount of $5,000,000 over the allowable five-year term of the agreement

Adopt a resolution approving the Affordable Housing Agreement with Square Mile Pleasanton, LLC for the multi-family affordable rental housing project at 3300 Busch Road, part of the Villages at the Quarry residential development

Adopt a resolution affirming the City's commitment to take steps toward achieving compliance with the Metropolitan Transportation Commission's (MTC's) Transit-Oriented Communities (TOC) Policy as a condition for MTC to allocate regional discretionary funding under the TOC Planning and Implementation Grants Program

*Council approved the consent calendar, as recommended.*

# Planning Commission Agenda Report

May 28, 2025
Item 9

**SUBJECT: Future Planning Calendar**

No items to report.