INFORMATION HANDOUT

For Contract No. 07-255104
At 07-LA-60-R23.8/R24.5

Identified by
Project ID 0700000465

AGREEMENTS

US Fish and Wildlife Service - Least Bell's Vireo Survey

ENCROACHMENT PERMITS

City of Industry Construction Permit

MATERIALS INFORMATION

Final Foundation Report

Fiber Optic System As-Built Drawings

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Carlsbad Fish and Wildlife Office
2730 Loker Avenue West
Carlsbad, California 92008

JAN 1 9 2001

LEAST BELL'S VIREO SURVEY GUIDELINES

The following suggested guidelines are provided to facilitate accurate assessments of the presence/absence of the State and federally endangered least Bell's vireo (*Vireo bellii pusillus*, vireo), to provide the Fish and Wildlife Service with sufficient information to adequately respond to requests for applicable Federal permits and licenses, and to fulfill our mandate to conserve and recover the species. Currently, a recovery permit pursuant to section 10(a)(1)(A) of the Endangered Species Act is not required to conduct presence/absence surveys for the vireo, as long as this protocol is utilized and vocalization tapes are not used. These guidelines include minor modifications to our February 1992 guidelines and provide clarification of what we have been verbally recommending.

1. Under normal circumstances, all riparian areas and any other potential vireo habitats should be surveyed at least eight (8) times during the period from April 10 to July 31. However, we may concur, on a case by case basis, with a reduced effort if unusual circumstances dictate that this is a prudent course of action. For instance, intensive surveys of small, marginal or extralimital habitats by experienced personnel may well result in defensible conclusions that eight (or more) individual survey are unnecessary. Under such unusual circumstances, we will consider requests for reductions in the prescribed number of individual surveys. In any case, site visits should be conducted at least 10 days apart to maximize the detection of, for instance, late and early arrivals, females, particularly "non vocal" birds of both sexes, and nesting pairs.

2. Although the period from April 10 to July 31 encompasses the period during which most vireo nesting activity occurs, eight surveys are generally sufficient to detect most (if not all) vireo adults in occupied habitats. Precise vireo censuses and estimations of home range likely will not be possible unless surveys are conducted outside of this time window. Although focused surveys conducted in accordance with these guidelines substantially reduce the risk of an unauthorized take* that could potentially occur as a result of land development or other projects, individual project proponents may wish to conduct surveys that are more rigorous than those that would otherwise result from strict adherence to these survey guidelines. If additional information (e.g., extent of occupied habitat, total numbers of adult and juvenile vireos in study area) is desired or necessary, surveys should be extended to August 31 and conducted in such a manner as to collect the data necessary to prepare reports that reflect the methods and standards established in the current scientific literature on this subject. In particular, information collected after July

15 will reflect a broader extent to the riparian habitat and other adjacent habitat types that the vireo typically utilizes during the latter phase of the breeding season, especially when the young become independent of the adults.

3. Surveys should be conducted by a qualified biologist familiar with the songs, whisper songs, calls, scolds, and plumage characteristics of adult and juvenile vireos. These skills are essential to maximize the probability of detecting vireos and to avoid potentially harassing the species in occupied habitats.

4. Surveys should be conducted between dawn and 11:00 a.m. Surveys should not be conducted during periods of excessive or abnormal cold, heat, wind, rain, or other inclement weather that individually or collectively may reduce the likelihood of detection.

5. Surveyors should not survey more than 3 linear kilometers or more than 50 hectares of habitat on any given survey day. Although surveyors should generally station themselves in the best possible locations to hear or see vireos, care should be taken not to disturb potential or actual vireo habitats and nests or the habitat of any sensitive or listed riparian species.

6. All vireo detections (e.g., vocalization points, areas used for foraging, etc.) should be recorded and subsequently plotted to estimate the location and extent of habitats utilized. These data should be mapped on the appropriate USGS quadrangle map.

7. Data pertaining to vireo status and distribution (e.g., numbers and locations of paired or unpaired territorial males, ages and sexes of all birds encountered) should be noted and recorded during each survey. In addition, surveyors should look for leg bands on vireo adults and juveniles if, in fact, it is possible to do so without disturbing or harassing the birds. If leg bands or other markers are observed, then surveyors should record and report the detection and associated circumstances to us by telephone, facsimile, or electronic mail as soon as possible. Reports should include the colors and relative locations of any and all bands detected, the age and sex of the marked bird, and the precise location of the detection.

8. The numbers and locations of all brown-headed cowbirds (*Molothrus ater*) detected within vireo territories should be recorded during each survey and subsequently reported to us. In addition, all detections of the State and federally endangered southwestern willow flycatcher (*Empidonax trallii extimus*, flycatcher) and State endangered yellow-billed cuckoo (*Coccyzus americanus*, cuckoo) should be recorded and reported. Any and all cuckoo and flycatcher adults, young, or nests should not be approached, and taped vocalizations of these species should not be used unless authorized in advance by scientific permits to take* issued by us (if appropriate) and the California Department of Fish and Game. Flycatcher presence/absence surveys require a recovery permit issued by us per section 10(a)(1)(A) of the Endangered Species Act.

9. To avoid the potential harassment of vireos, flycatchers, and cuckoos resulting from vireo surveys, other riparian species survey efforts, or multiple surveys within a given riparian habitat patch, detections of these three species should be reported to us as soon possible by telephone, facsimile, or electronic mail.

10. A final report (including maps) should be prepared that depicts survey dates and times and includes descriptions or accounts of the methods, locations, data and information identified in preceding sections.

11. This final report should be provided to us (at the letterhead address) and to the local office of the Department of Fish and Game within 45 calendar days following the completion of the survey effort. Additionally, a summary of all vireo survey efforts conducted during the calendar year should be submitted to each of the above offices by January 31 of the following year.

Should you have data or information to report, or have any questions regarding these survey guidelines, please contact Christine Moen (christine_moen@fws.gov), or Loren Hays (loren_hays@fws.gov) of my staff at (760) 431-9440 (facsimile 760-431-9624), or John Gustafson (jgustafs@hq.dfg.ca.gov) with the Department of Fish and Game at (916) 654-4260 (facsimile 916-653-1019).

Sincerely,

Andrew R. Yuen

Ken S. Berg
Acting Field Supervisor

* The term "take," as defined in Section 3, paragraph 18 of the Endangered Species Act of 1973 as amended (Act), means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. "Take" (specifically "harass") is further defined to mean "an act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns, which include, but are not limited to, breeding, feeding, and sheltering" "Take" (specifically "harm") is further defined as an "act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding feeding or sheltering" (50 CFR 17.3). Please be advised that the take of the vireo and other listed species is prohibited by section 9 of the Act unless authorized by permits issued pursuant to section 7 or section 10 to the Act.

RETURN THIS COPY TO CITY ENGINEER WHEN JOB COMPLETED

CITY OF INDUSTRY
P.O. Box 3366, City of Industry, CA 91744
Administrative Offices: 15625 E. Stafford Street
(626) 333-2211 Fax: (626) 961-6795

JN: MP 99-31 #229 6207

APPLICATION FOR CONSTRUCTION PERMIT

(Print project/applicant name) Westbound On-Ramp at Grand Avenue/SR-60 Interchange EA 255104/Caltrans hereby makes application to construct on or in the public streets and rights of way, and City easements at the location described below, subject to the provisions of the ordinances of the City of Industry and THE ATTACHED REQUIREMENTS.

In consideration of the granting of this permit, it is further agreed by the applicant that the City of Industry and any of its officers or employees shall be saved harmless by the applicant from any liability or responsibility for any accident loss or damage to persons or property, happening or occurring as the proximate result of any work undertaken under the terms of this application and the permit or permits which may be granted in response thereto, and that all said liabilities are hereby assumed by the applicant.

Location: Grand Avenue/SR-60 Interchange in Diamond Bar and City of Industry

Description of Work: Removal of curb on Old Brea Cyn Rd. Installation of HMA dike, GDO inlet, and temporary construction entrance on Old Brea Cyn Rd. Temporary installation, maintenance, and removal of temporary fence (type ESA) along service road. Installation of temporary hydraulic mulch as necessary.

Permanent Resurfacing: Permitee ☒ City Forces ☐ N/A ☐

Special Requirements: See attached plans for work details. Permit expires once the westbound onramp has been fully constructed.

Signed: Syed A. Huq

Print Name: Syed Huq, Caltrans

Address: 100 S. Main St.

City and Zip Code: Los Angeles, CA 90012

Telephone (213)897-6714

Contractor: TBD

Telephone:

Lic. Class: #

Workers' Compensation Insurance:

On File ☐ Attached ☐

PERMIT REQUIRED PRIOR TO COMMENCING WORK

PERMIT

Permit Issued: Date 3/20/15 By Matthew Hudson No. C-2311

Permit Fee $ ϕ Bond Amount ϕ Checked By [illegible] Date 3/20/15

Make check payable to "City of Industry". This permit is nontransferable and is valid for six months from date of issuance. A copy of this permit is required on the job site at all times when work is in progress. **INSPECTION IS REQUIRED**: Call (626) 333-0336 at least 24 hours prior to start of any work. **To validate this permit, permitee must obtain an inquiry identification number from Underground Service Alert at 1-800-422-4133.**

Inquiry Identification Number: _____

COMPLETION NOTICE

When work is completed fill out copy and send to City Engineer's Office at above address.

Work Completed: _____
Company/Signature/Date Completed

Work Accepted by City of Industry: _____
Signature/Date

Work remains the responsibility of PERMITEE until accepted by the City.

(REV. 02/08)

JN: MP 99-31 #229 6207

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Work Completed: _____
Company/Signature/Date Completed

Work Accepted by City of Industry: _____
Signature/Date

Work remains the responsibility of PERMITEE until accepted by the City.

(REV. 02/08)

FINAL FOUNDATION REPORT

Retaining Wall No. 2 (Bridge No. 53E-0206)
SR-57/SR-60 Confluence Project, Phase I
Grand Avenue Westbound On-Ramp
Los Angeles County, California
07-LA-60, PM 24.3
EA 07-255101
EMI Project No. 08-170
Date: May 31, 2012

EARTH MECHANICS, INC.

Geotechnical and Earthquake Engineering

Earth Mechanics, Inc.

Geotechnical & Earthquake Engineering

May 31, 2012

EMI Project No. 08-170

WKE, Inc.
400 N. Tustin Avenue, Suite 275
Santa Ana, California 92705

Attention: Mr. Dan Weddell, P.E.

Subject: Final Foundation Report for Retaining Wall No. 2 (Bridge No. 53E-0206)
SR-57/SR-60 Confluence Project, Phase I
Grand Avenue Westbound On-Ramp
Cities of Industry and Diamond Bar, Los Angeles County, California
07-LA-60, PM 24.3, EA 07-255100

Dear Mr. Weddell:

Attached please find the Final Foundation Report for Retaining Wall No. 2 for the Grand Avenue Westbound On-Ramp, which is a part of the SR-57/SR-60 Confluence Project, Phase I. This report contains the findings and conclusions of our field investigation and laboratory testing program. This report also contains our recommendations for the design and construction of the wall foundations.

An earlier version of this report dated February 10, 2012 was submitted to Caltrans for review. Caltrans provided their comments in a Comments and Response Form dated March 26, 2012. Caltrans review comments and our responses are included in Appendix D. This report has been modified to include our responses.

We appreciate the opportunity to provide geotechnical design services for this project. If you have any questions, please call us.

Sincerely,

EARTH MECHANICS, INC.

REGISTERED PROFESSIONAL ENGINEER
S. PIRATHIVIRAJ
NO. GE 2963
EXP. 12/31/13
GEOTECHNICAL
STATE OF CALIFORNIA

5-31-2012

(Raja) S. Pirathiviraj, GE 2963
Senior Staff Engineer

REGISTERED PROFESSIONAL ENGINEER
LINO C. CHEANG
NO. GE 2345
EXP. 9/30/13
GEOTECHNICAL
STATE OF CALIFORNIA

5-31-2012

Lino Cheang, GE 2345
Project Manager

SP/sp,lcc

17800 Newhope Street, Suite B, Fountain Valley, California 92708 Tel: (714) 751-3826 Fax: (714) 751-3928

FINAL FOUNDATION REPORT

RETAINING WALL NO. 2 (BRIDGE NO. 53E-0206)
SR-57/SR-60 CONFLUENCE PROJECT, PHASE I
GRAND AVENUE WESTBOUND ON-RAMP
LOS ANGELES COUNTY, CALIFORNIA
07-LA-60, PM 24.3
EA 07-255100

Prepared for:

WKE, Inc.
400 N. Tustin Avenue, Suite 275
Santa Ana, California 92705

Prepared By:

Earth Mechanics, Inc.
17800 Newhope Street, Suite B
Fountain Valley, California 92708

EMI Project No. 08-170

May 31, 2012

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE OF STUDY

This Foundation Report presents the findings and conclusions of a geotechnical investigation conducted by Earth Mechanics, Inc. (EMI). It presents foundation design and construction recommendations for the proposed Retaining Wall No. 2 (RW-2) for the Grand Avenue Westbound On-Ramp, which is a part of the State Route (SR) 57/SR-60 Confluence Project (Phase I) in Los Angeles County, California. A Site Location Map is presented in Figure 1-1.

EMI is a subconsultant to WKE, Inc. (WKE). The geotechnical services provided for this project included the following tasks:

- Field exploration consisting of drilling and logging exploratory borings, and cone penetrometer soundings;
- Laboratory testing of selected bulk and relatively undisturbed soil samples;
- Engineering calculations and analysis to develop foundation design and construction recommendations; and
- Preparation of this report presenting our findings, conclusions, and recommendations.

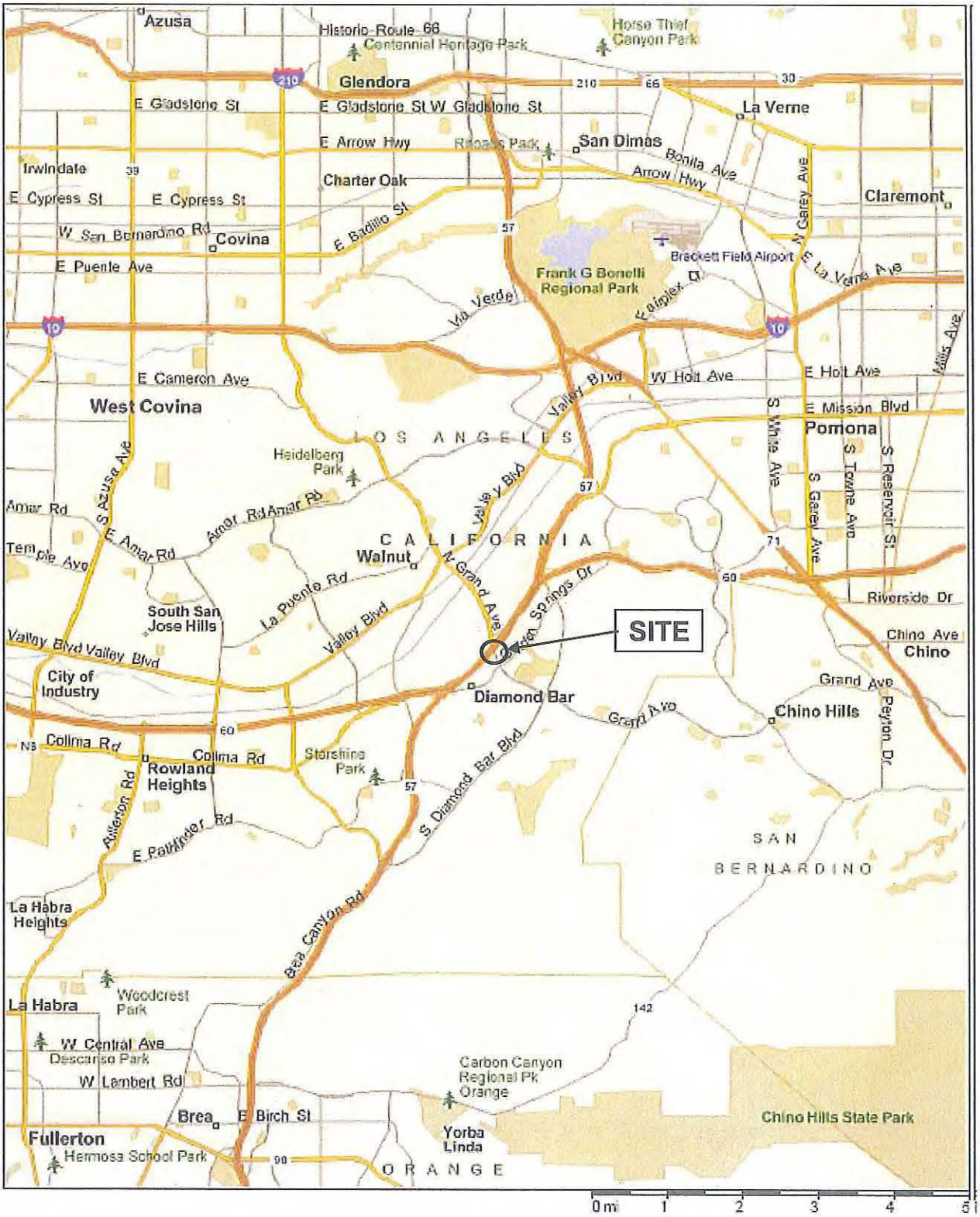
1.2 PROJECT DESCRIPTION

The SR-57/SR-60 confluence is located in the eastern part of Los Angeles County in the Cities of Industry and Diamond Bar. SR-57 is a major north-south freeway that originates in central Orange County and extends north to the City of Pomona in Los Angeles County. SR-60 serves as a major east-west freeway that originates in the Los Angeles metropolitan area and extends through Los Angeles County and into Riverside County. The SR-57/SR-60 confluence is a section of freeway where the SR-57 and SR-60 mainlines meet and exist as one mainline.

The proposed project constructs a direct WB on-ramp (ramp "WG-1") that diverges from Grand Avenue approximately 100 feet north of the existing Grand Avenue Overcrossing (OC) (Bridge No. 53-1864). The on-ramp continues as an auxiliary lane on the mainline from approximate mainline ("A" Line) Stations 1277+00 to 1261+00. The new ramp will consist of two lanes. The WB mainline will be widened approximately 12 feet to accommodate the auxiliary lane connecting to the existing two-lane additions at the SR-60 Bypass Connector.

RW-2 is proposed on the west side to retain a maximum embankment fill height of about 23 feet for the proposed WB on-ramp. This is designated as the Phase-1 project. A future SR-57/SR-60 Confluence Project (Phase 2) currently in the planning phase would reconstruct the Grand Avenue OC at a higher elevation, raising Grand Avenue and a portion of the WB on-ramp up to 8 feet, and this is designated as the RW-2 Phase-2 project. The PS&E package prepared by the Civil/Structural designers pertains to the Phase-1 work only. But foundations in this report were designed for the Phase-2 (ultimate) conditions. However, we fully anticipate the need to submit another foundation report to accompany the PS&E package for the Phase-2 project at a later date.

RW-2 is proposed to be a combination of Mechanically Stabilized Embankment (MSE) wall and Caltrans Standard Type 1 cantilevered wall.



SR57/60 Confluence Project, Phase I
Grand Avenue WB On Ramp Retaining Wall No. 2

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

SITE LOCATION MAP

Figure 1-1

Project No. 08-170 | Date: 01-25-2012

2.0 FIELD INVESTIGATION AND LABORATORY TESTING

2.1 FIELD INVESTIGATION

A geotechnical field investigation was conducted on April 26 and 27, 2010 for the proposed retaining wall. Four hollow-stem auger borings and two cone-penetration tests (CPT) were accomplished under the supervision of EMI. Boring information, including exploration number, stations, offsets, ground surface elevations, bottom of boring elevations and water level measurements are summarized in Table 2-1. Locations of the exploratory borings and CPTs are shown on the LOTB sheets provided in Appendix A.

Table 2-1. Geotechnical Exploration Information

Boring No.	Station Line	Station	Approx. Offset (feet)	Approx. Ground Surface El. (feet)	Approx. Bottom of Boring El. (feet)	Approx. Groundwater El. (feet)
A-10-004	A Line	1287+21	197 Lt	+676.0	+625.2	+661.5
A-10-005		1288+72	196 Lt	+679.2	+618.4	+663.4
A-10-006		1290+21	189 Lt	+681.0	+610.6	+670.2
A-10-007		1291+69	220 Lt	+690.0	+609.5	+669.1
CPT-10-009		1287+03	188 Lt	+676.0	+625.6	+665.0
CPT-10-010		1291+46	222 Lt	+690.0	+627.8	+671.0

Notes:
1. Stations and offsets are measured relative to the identified Station Lines and are approximate.
2. "A" Line = Mainline State Route 60.

Exploratory borings were drilled using a truck-mounted drill rig equipped with 8-inch diameter hollow-stem augers. Sampling was performed by alternating the Modified California Drive (MCD) sampler and Standard Penetration Test (SPT) sampler. The soil sampling interval is generally 5 feet. Relatively undisturbed soil samples were obtained using a 3.25-inch outer diameter MCD sampler lined with brass rings. Each of these brass rings is 1-inch long with a 2.5-inch outside diameter. The SPT sampler (1.4-inch inside diameter) was also used to obtain soil samples. The MCD and SPT samplers were driven 18 inches into the ground or until refusal was encountered using a 140-lb hammer free falling from a height of 30 inches. The numbers of blows to advance the sampler each 6 inches of penetration was recorded. The numbers of blows for the final 12 inches or shorter of driving are recorded on the LOTB sheets.

Charts published by Winterkorn and Fang (1975) can be used to determine a reduction factor used to convert blowcounts recorded using the MCD sampler into SPT blowcounts. Using those charts, we obtained a reduction factor of 0.5 which was used for this project.

The CPT sounding was performed using an electronic cone penetrometer in general accordance with current ASTM Standards (ASTM D5778 and ASTM D3441). The CPT equipment consisted of a cone penetrometer assembly mounted at the end of a series of hollow sounding rods. The cone penetrometer assembly consisted of a conical tip with a 60° apex angle and a projected cross sectional area of 1.55 in² (10 cm²) and a cylindrical friction sleeve with a surface area of 23.25 in² (150 cm²). The interior of the cone penetrometer is instrumented with strain

gauges that allow simultaneous measurements of cone tip and friction sleeve resistance during penetration. The cone penetrometer assembly is continuously pushed into the soil by a set of hydraulic rams at a standard rate of 0.79 inch per second (20 mm per second) while the cone tip resistance and sleeve friction resistance are recorded every 1.967 inches (50 mm) and stored in digital form. A specially designed all-wheel drive 25-ton truck provides the required reaction weight for pushing the cone assembly and is also used to transport and house the testing equipment. The computer generated graphical logs include tip resistance, friction resistance, and friction ratio. Soil behavior type interpretations are based on guidelines by Robertson and Campanella (1989).

2.2 LABORATORY TESTING

Soil samples considered representative of the subsurface conditions were tested to obtain or derive relevant physical and engineering soil properties. The following laboratory tests were conducted to supplement the observations recorded during the field investigation:

- In-situ Moisture Content and Unit Weight
- Percent Passing No. 200 Sieve
- Atterberg Limit
- Direct Shear
- Unconsolidated Undrained Triaxial
- Pocket Penetrometer
- Consolidation
- Minimum Resistivity, pH, Sulfate Content and Chloride Content

The laboratory tests were conducted in general accordance with California Test Methods or American Society for Testing and Materials (ASTM) Standards. Laboratory test results are included in Appendix B.

3.0 GEOLOGY AND SEISMICITY

3.1 PHYSIOGRAPHY

The site is located in the northern part of the Puente Hills, a northwesterly trending range of low-elevation, rounded hills between the Los Angeles basin to the west and the Upper Santa Ana River Valley on the east. These hills are underlain primarily by Miocene-age (+/- 10-15 million years old) marine sedimentary rocks that have been uplifted within the past million years or so (Pleistocene geologic epoch) by geologic forces. These rocks are primarily light-colored, well-bedded, mudstones, shales, and sandstones. The Miocene sedimentary rocks are intruded by Miocene-age volcanic rocks and underlain by older basement rocks at depths on the order of a mile or more. In many places, the Miocene rocks are covered by young slopewash and terrace sediments, and by Quaternary-age alluvium in the valleys and basins.

3.2 GEOLOGIC STRUCTURE

The rocks on the north side of the valley dip northerly at low to moderate angles. The formation on the south side of the valley dips primarily easterly or northerly. A fault may be present under the axis of the valley (Tan, 1998) but the fault is not known to be active.

The major earthquake fault in the site region is the Puente Hill Blind Thrust and Elsinore Fault Zone (Whittier Section). These faults are located in a southwest direction from the site and trend northwesterly along the southwest margin of the Puente Hills. The Chino fault lies to the east and the San Jose fault is to the north. No other geologic faults are known in the immediate site vicinity and no Alquist-Priolo Zones requiring special studies are designated by the California Division of Mines and Geology.

3.3 GEOLOGICAL HAZARDS

Geologic deformation and uplift in the area of the Puente Hills has resulted in folding of the sedimentary rocks. In some places, out-of-slope bedding orientations may result in unstable slopes and has contributed to the formation of landslides. Landslides are common and widespread throughout the hills. The Puente Formation is notorious for unstable slopes. The California Division of Mines and Geology (1976) has categorized the subject site area as having a moderately low potential for landsliding. However, no major landslides are known in the immediate site vicinity. The seismic hazard map of the San Dimas quadrangle (Division of Mines and Geology, 1999) shows abundant landsliding in the adjacent hills, it does not indicate a potential for earthquake-induced landslides at the specific project site.

The seismic hazard map for the San Dimas quadrangle (Division of Mines and Geology, 1999) identifies the site as having a potential for liquefaction during an earthquake. The potential for liquefaction is discussed in details in Section 5.2.

3.4 SEISMICITY

The southern California area is seismically active. Seismicity in the Los Angeles region is widespread but does not clearly correlate to specific surface faults. Seismicity of smaller magnitude (magnitudes smaller than about 3) randomly occurs frequently throughout the Los

Angeles region. There is little concentration or clustering of earthquakes in proximity to known faults, and it has been suggested that as much as 40% of the seismic energy in southern California is not released on known faults.

The largest historical earthquake within the Los Angeles Basin was the 1933 Long Beach earthquake of $M_W = 6.4$ ($M_L = 6.3$) which is believed to have been associated with the Newport-Inglewood fault near the Huntington Beach-Newport Beach area. The 1971 San Fernando ($M_L = 6.4$, $M_W = 6.7$) earthquake occurred along the northern margin of the San Fernando Valley on the western Sierra Madre fault system. The 1987 Whittier earthquake ($M_L = 5.9$, $M_W = 5.9$) and the 1994 Northridge ($M_L = 6.4$, $M_W = 6.7$) earthquakes occurred under the San Gabriel Valley and the San Fernando Valley but were not associated with surface faults.

The present-day seismotectonic stress field in the Los Angeles region is one of north-northeasterly compression. This is indicated by the geology, by earthquakes, and by satellite measurements. These data suggest the area is being squeezed together and becoming shorter at rates of about 1/4 to 1/3 of an inch per year.

4.0 SUBSURFACE CONDITIONS

4.1 SOIL CONDITIONS

An idealized soil profile is developed based on the recent soil borings and CPT soundings, and it is presented in Table 4-1. Based on the correlations with CPT soundings (Robertson and Campanella, 1989), SPT blowcounts (Lam and Martin, 1986) and laboratory test results, material shear strength parameters were selected and are included in Table 4-1. The shear strength parameters of the surficial clay layer in Table 4-1 for the MSE wall is based on correlation with CPT soundings. The remaining shear strength parameters are based on the lower of either correlation with SPT blowcount or laboratory test results. It should be pointed out that the shear strength parameters obtained from the laboratory strength tests are lower than those obtained from SPT blowcount correlation for the same idealized soil layer.

Table 4-1. Idealized Soil Profile and Strength Parameters

Approximate Elevation (feet)	Predominant Soil Type	Equivalent SPT Blowcount (blows/foot)	Total Unit Weight (pcf)	Friction Angle (degree)	Cohesion / Undrained Shear Strength (psf)
MSE Wall					
+680 to +625	Clay	(3) to >50 Average = 15	115	-	3300
+625 to +610	Weathered Claystone and Siltstone	>50	120	-	4000
Caltrans Standard Type 1 Retaining Wall					
+690 to +655	Clay	5 to (23) Average = 8	115	-	1800
+655 to +645	Sand	5 to (8) Average = 6	115	33	70
+645 to +635	Clay	4 to 17 Average = 8	115	-	1600
+635 to +610	Weathered Claystone	>50	120	-	4000

Values in ( ) are converted SPT blowcounts corrected for sampler size; correction factor from Modified California Drive sampler blowcounts to SPT blowcounts is 0.5.

4.2 GROUNDWATER CONDITIONS

Groundwater was encountered during drilling between elevations +661.5 and +671 feet during the recent field investigation. Groundwater was encountered in the as-built borings for Grand Avenue OC between elevations +658 and +665.2 feet. Based on California Geological Survey (CGS, 1998), the recorded highest historical groundwater at the project site is between 15 and 20 feet below the ground surface. Based on the measured and historical highest groundwater elevations, a groundwater elevation of +671 feet can be used for liquefaction assessment.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 SEISMIC DESIGN CRITERIA

A design ARS curve was determined based on the 2009 Caltrans Seismic Design Criteria (SDC) procedures (2009a and 2009c). This design ARS Curve is presented in Figure 5-1. The parameter of small-strain shear wave velocity (V_S^{30}) for the upper 100 feet of subsurface materials is correlated based on the SPT blowcounts presented in the attached LOTB sheets. The calculated V_S^{30} is 820 feet per second. The peak ground acceleration (PGA) is the zero-period spectral acceleration in the ARS curve. A PGA of 0.61g is obtained from the design ARS curve.

For analyzing global slope stability, Section 3.10 of the Caltrans Guidelines for Structures Foundation Reports (Caltrans, 2009b) recommends using a horizontal seismic coefficient equal to one-third of the peak acceleration but not exceeding 0.2. Therefore, a horizontal seismic coefficient of 0.2 was used in the pseudo-static slope stability analysis.

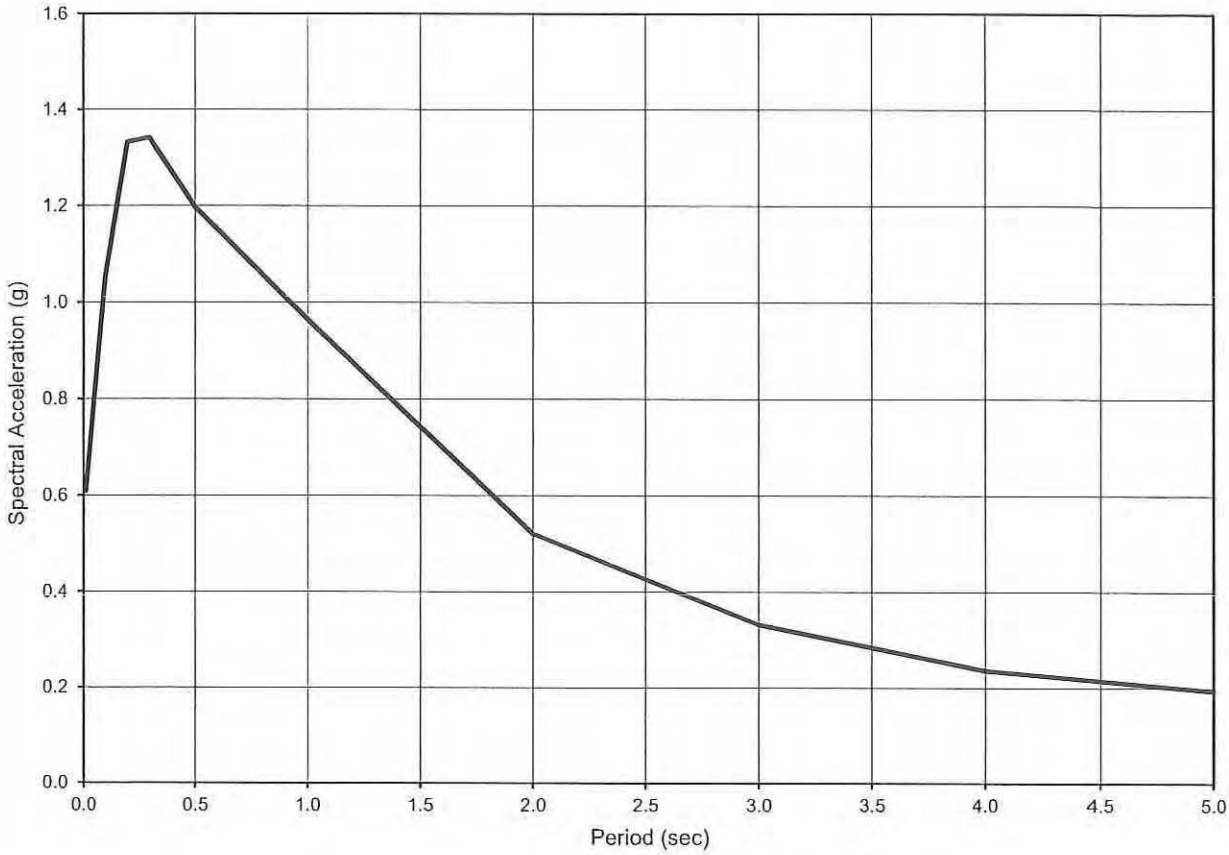
As presented in Section 11.8.6 of AASHTO (2007), seismic earth pressures can be computed using a seismic coefficient equal to half of the peak acceleration. Therefore, a seismic coefficient of 0.305g can be used for the computation of seismic earth pressures.

5.2 LIQUEFACTION

Liquefaction analysis was performed using the available site-specific subsurface information and the historical high groundwater elevation of +671 feet. Emphasis was placed on using the CPT data because CPT soundings provide continuous subsurface soil profiles and a more accurate representation of in-situ properties as compared to soil borings.

The liquefaction potential of the saturated, granular materials below the historical high groundwater table was evaluated using the procedures outlined by Seed et al. (1983), Seed and Harder (1990), and updated by NCEER (1997). Results of the liquefaction analysis are included in Appendix C. As shown in Appendix C, potentially liquefiable soil layers are encountered at both CPT locations and three of the four soil boring locations. However, these liquefiable soil layers do not appear to be continuous. Using the CPT soundings, the maximum thickness of these potentially liquefiable soil layers is less than 5 feet, and the resulting calculated seismically-induced settlement ranges from 1.0 to 2.0 inches.

We do not anticipate that the MSE wall will collapse under the above seismically-induced settlement because MSE can tolerate relatively large movements as compared to conventional cantilevered walls. The Caltrans Standard Type 1 retaining wall will be supported on a pile footing. At the above calculated settlement magnitude, we also do not anticipate that the pile-supported Type-1 retaining wall will collapse; the worst-case scenario would be an inch or so of settlement of the pile footing.



Latitude = 34.0104 °
Longitude = -117.8236 °
Small Strain Shear Wave Velocity V_s^{30} = 820 ft/s

Spectral Coordinates	
Period (sec)	Acc. (g)
0.010	0.609
0.100	1.052
0.200	1.332
0.300	1.342
0.500	1.197
1.000	0.964
2.000	0.521
3.000	0.332
4.000	0.236
5.000	0.193

Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	Retaining Wall No. 2	Design ARS Curve
	Project: 08-170 Date: 06/09/10	Figure 5-1

5.3 SOIL CORROSIVITY

Two soil samples were tested for pH, soluble chloride content and soluble sulfate content. The test results are summarized in Table 5-1. Additional corrosion test results are included in the Materials Report (EMI, 2011) for this project.

Table 5-1. Soil Corrosion Test Results

Boring	Station (Offset) / "Station Line"	Sample Depth (feet)	Soil Type	pH	Soluble Sulfate Content (ppm)	Soluble Chloride Content (ppm)
A-10-004	1287+21 (197 Lt) / "A" Line	5	CL	8.2	280	378
A-10-007	1291+69 (220 Lt) / "A" Line	5	CL	8.0	330	204

Based on the Caltrans Corrosion Guidelines (2003), soils are considered corrosive if the pH is 5.5 or less, or the chloride concentration is 500 ppm or greater, or the sulfate concentration is 2,000 ppm or greater. Based on the test results presented in Table 5-1 and the Materials Report (EMI, 2011), and the above Caltrans criteria, the on-site soils are considered to be non-corrosive to bare metals and concrete.

For the above measured chloride concentration, minimum concrete cover over reinforcement should be in accordance with Table 8.22.1 of the Caltrans BDS (Caltrans, 2003a) for "Non-Corrosive Atmosphere/Soil/Water". For the above measured sulfate concentration, cement type should be in accordance with Table 8.22.2 of the Caltrans BDS (Caltrans, 2003a) for "Sulfate Concentration from 0 to 1,499".

5.4 FOUNDATION DESIGN

RW-2 is a combination of MSE wall and Caltrans Standard Type 1 cantilevered retaining wall on pile footing.

RW-2 will be constructed in two phases. In Phase 1, the MSE wall heights will range from 7 to 22 feet, and the Caltrans Standard Type 1 retaining wall heights will range from 9 to 13 feet. In Phase 2, the MSE wall heights will be increased to 10 to 30 feet, and the Caltrans Standard Type 1 retaining wall heights will be increased to 16 to 20 feet. Recommendations presented in this report are for the ultimate wall heights. Some of the retaining wall pertinent data are presented in Table 5-2.

Table 5-2. Retaining Wall Pertinent Data

Wall Type	Location (WG-1 Line)		Length (feet)	Retaining Wall Height (feet)		Bottom of Footing / Top of Leveling Pad Elevations (feet)	Backfill Slope Condition
	Begin Wall	End Wall		Phase 1	Phase 2		
MSE	86+49.82 40.92 Lt	91+54 35.92 Lt	505.0	7 to 22	10 to 30	+673.75 to +683.75	Level
Type 1	91+54 35.92 Lt	92+21.93 71.17 Lt	77.3	9 to 13	16 to 20	+687.75 to +691.75	Level

5.4.1 Wall Construction Sequence

There are two options to construct these walls: (1) build the Type-1 wall slightly ahead of the MSE wall, or (2) build MSE wall first, then the Type-1 wall.

Option 1 will eliminate the need to install temporary shoring along the MSE wall backfill surface facing the Type-1 wall backfill. But this option will induce significant downdrag forces on the neighboring piles supporting the Type-1 wall. Option 2 will require temporary shoring in order to construct the MSE wall backfill facing the Type-1 wall backfill, but can eliminate most of the downdrag forces on the piles supporting the Type-1 wall by using a settlement period. Conventional Caltrans pile design practice is to eliminate all static downdrag forces, so we recommend using Option 2.

To further reduce or eliminate downdrag forces, we also recommend preloading a portion of the Type-1 wall area within the influence zone of the neighboring MSE wall. The preloading process involves placing earthen materials at the designated location. The weight of the earth will induce soil settlement. As shown in Figure 5-2, this settlement will be monitored by placing settlement hubs on top of the MSE wall backfill and the preloaded area. Once this settlement period is complete, the earthen material used in the preloading will be completely removed and the preloaded area will become available for the Type-1 wall foundation construction. The settlement period for the MSE wall backfill and the preloaded area is same as presented in Section 5.4.2.2.

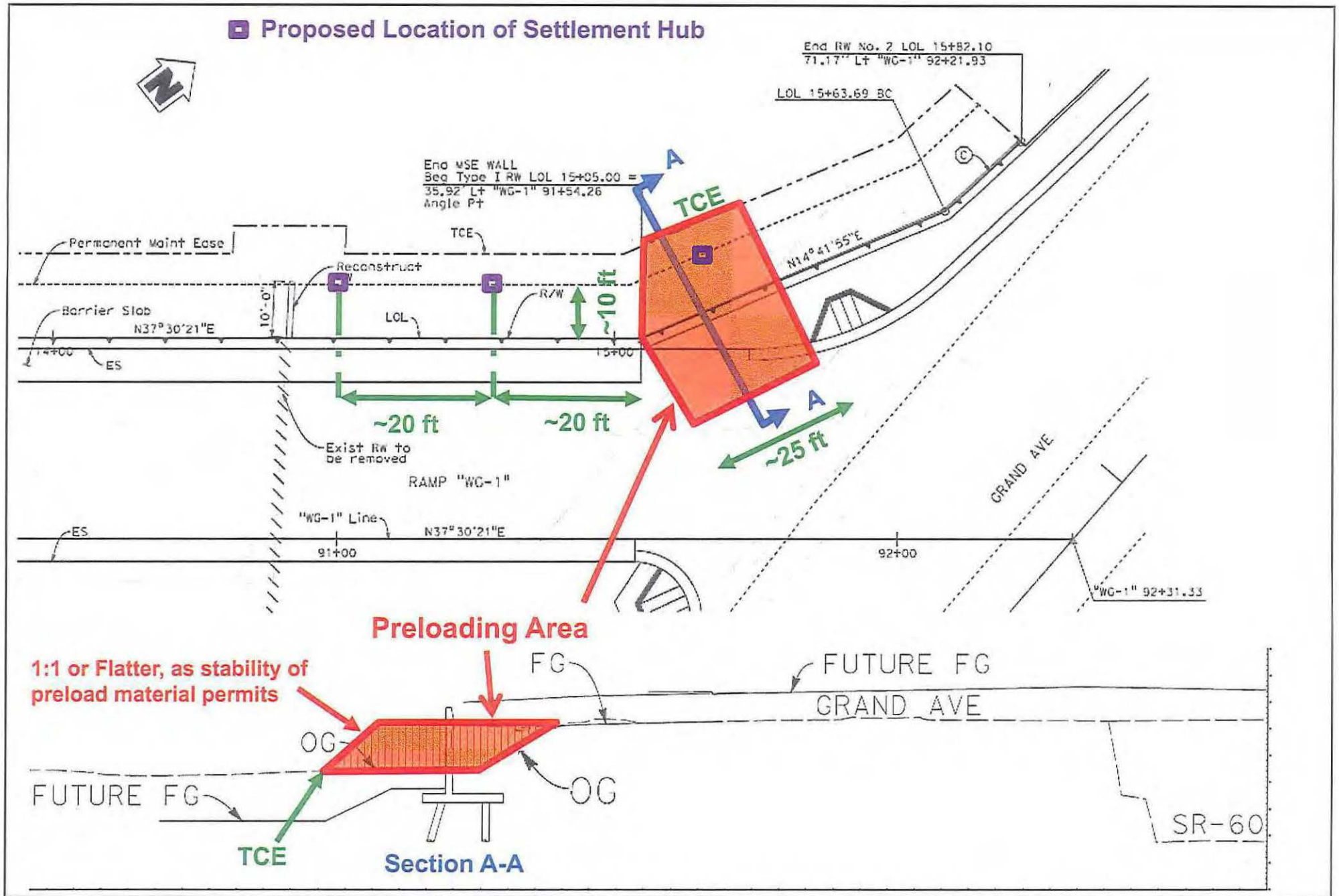
An approximate proposed preload foot-print and a typical section are presented in Figure 5-2. The top of preload embankment should be equal to or greater than the Phase-1 finished grade elevation. To minimize traffic impact, temporary shoring may need to be placed around the preload area to maximize the preload foot-print.

5.4.2 Mechanically Stabilized Embankment (MSE) Walls

Per Caltrans policy, MSE walls should be designed based on the Load and Resistant Factor Design (LRFD) guidelines provided in AASHTO (2007) and Caltrans Bridge Design Aids Section 3-8 (Caltrans, 2011). Gradation and property requirements for the MSE wall backfill shall conform to Section 47-2.02C of the Caltrans Standard Specifications (2010b). To direct the infiltrated water away from the walls, weep-holes and wall drain with filter/drainage materials should be installed according to Caltrans Bridge Design Aids Interim Section 3-8 (Caltrans, 2011) for MSE wall.

5.4.2.1 Bearing Capacity and Settlement

Per Caltrans policy, LRFD Service, Strength and Extreme Event Limit State load combinations are used for design of the MSE wall. Soil settlement calculations were performed for the MSE wall with a level backfill, using the Service bearing stress for Load Case 1 as shown in Caltrans Bridge Design Aids (BDA) Section 3-8 (Caltrans, 2011). The calculated settlements, the wall heights (H) and the base widths (BW) are presented in Table 5-3 along with the recommended minimum overexcavation depths. The base widths BW are the same as those listed in Caltrans BDA Section 3-8 (Caltrans, 2011) for the same wall heights H.



SR-57/60 Confluence Project, Phase I Grand Avenue WB On Ramp, Retaining Wall No. 2	PRELOADING CONFIGURATION Figure 5-2
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	Project No. 08-170 / Date: 05-23-12

Soil bearing capacity calculations were also performed using the base elevation shown on the wall plans, the recommended minimum overexcavation depth presented in Table 5-3, and the soil strength parameters presented in Table 4-1. Based on these calculations, the soil bearing capacity exceeds the applied bearing stresses for the Strength and Extreme Event Limit State presented in Caltrans BDS Section 3-8 for Load Case 1.

The groundwater table is expected to be about 5 feet below the bottom of the base of the MSE wall. Therefore, the overexcavation depth is limited to 2 feet. The MSE walls should be embedded at least 2 feet or 10% of the design wall height, whichever is larger, below the lowest adjacent grade. In addition, we recommend using a "slip-joint" for Phase 2 wall heights equal to or greater than 17.5 feet.

Table 5-3. Minimum Overexcavation Depths for MSE Walls

Phase 1 Wall Height (feet)	Phase 2 Incremental Wall Height (feet)	Final Wall Height (feet)	Base Width, BW (feet)	Calculated Settlement with Overexcavation (inch)			Recommended Minimum Overexcavation Depth Below Bottom of Base (feet)
				Phase 1	Phase 2	Total	
7.0	3.0	10.0	9.5	0.7	0.3	1.0	1.0
11.0	1.5	12.5	11.5	1.2	0.2	1.4	1.0
14.0	1.0	15.0	13.5	1.7	0.0	1.7	1.0
15.0	2.5	17.5	15.5	1.7	0.3	2.0	1.0
16.0	4.0	20.0	17.5	1.7	0.4	2.1	2.0
18.0	4.5	22.5	18.5	2.0	0.4	2.4	2.0
20.0	5.0	25.0	20.5	2.2	0.5	2.7	2.0
21.0	6.5	27.5	21.5	2.2	0.7	2.9	2.0
22.0	8.0	30.0	23.5	2.2	0.9	3.1	2.0

There are no published guidelines for allowable settlement for Caltrans MSE walls. AASHTO (Section 11.10.4.1, 2007) does provide a 2-inch allowable settlement for MSE wall constructed with full-height precast concrete facing panels. So, the Caltrans MSE walls can be designed for settlements larger than 2 inches because the Caltrans MSE walls use segmental rather than full-height precast concrete facing panels. Based on the above information, we settled on using an allowable settlement of 3 inches, which is one inch more than what AASHTO recommends for full height precast concrete facing panels.

It should be noted that an allowable settlement of 3 inches is considerably larger than most structural foundations for transportation facilities which are generally designed for an allowable settlement of one inch or less. However, it is well documented and widely recognized that MSE walls are used to accommodate large settlements. Nevertheless, we recommend close monitoring of the MSE wall construction with strict adherence to Contract Plans and Specifications. Geotechnical consultant should be contacted immediately if any unusual conditions occur in the field. In addition, we do not recommend the use of elaborated aesthetic on the wall panel face because any special aesthetic designs could require a more stringent settlement criterion.

The horizontal limits of the overexcavation should begin one foot from the outside bottom edge of the leveling pad and one foot from the inside edge of the MSE wall base, and extending downward at a 45-degree imaginary plane until the plane intersects the recommended minimum excavation depth presented in Table 5-3. Caltrans Structure Backfill should be used for backfilling with a minimum relative compaction of 95% of maximum density as determined by Caltrans Test Method 216. The overexcavation bottom should be proof rolled prior to backfilling. Further, the overexcavation bottom should be inspected by a qualified geotechnical engineer or technician to confirm the presence of an unyielding and competent surface.

After the overexcavation and recompaction is implemented, the allowable bearing capacity of the leveling pad footing supporting the MSE wall panels is 1.5 ksf provided the width of the pad is at least 1 feet and the embedment (measured from the lowest adjacent grade) is at least 2 feet.

5.4.2.2 Settlement Period and Settlement Monitoring

The uppermost level of wall facing, coping, roadway pavement, hardscape, and any other nearby improvements should not be constructed until remaining settlement is within acceptable limits (i.e., ½-inch or less). Therefore, a minimum settlement period of about 60 days is recommended for the Phase-1 construction. Finished subgrade may need to be re-established if there is differential settlement at the interface of the MSE wall and Type-1 wall, and this should eliminate any uneven ground surface (bump) at the interface.

Based on our experience, calculated settlement periods are approximations of actual field observations. Therefore, the minimum settlement period is for estimating purposes only; actual settlement period should be based on settlement monitoring.

Settlement hubs should be installed on top of the grading plane. Settlement hubs should be placed behind the wall layout line at a horizontal distance of about 10 feet at the locations shown in Figure 5-2.

Initial reading of each settlement hub should be taken at the time of their installations. Settlement monitoring of each settlement hub should continue as follows: two days after the initial reading, one week after the initial reading, and once during every two calendar weeks thereafter until it has been verified by the Engineer that the remaining settlement is acceptable.

5.4.3 Caltrans Standard Type 1 Retaining Wall

5.4.3.1 Foundation Type

Cast-in-Drilled-Hole (CIDH) piles are not recommended due to the presence of shallow groundwater and potentially caving soils; driven piles are preferred. Because of potential soil liquefaction and hard driving condition near the specified pile tip elevation, steel HP piles are preferred because steel piles can undergo larger deformation and can withstand hard driving better than concrete piles.

5.4.3.2 Foundation Data Provided By Structural Engineers

Per Caltrans policy, the LRFD Service Limit State I load and Strength and Extreme Event Limit State load combinations are used for the design of Caltrans Standard Type 1 Retaining Wall (Caltrans, 2010a) on pile footing.

The foundation design data sheet is presented in Table 5-4. Foundation loads were provided by the structural designers following the latest Caltrans Memo-to-Designers (Caltrans, 2008) and these loads are presented in Table 5-5. Based on these structural demands, we recommend using HP 10x42 piles.

Table 5-4. Foundation Design Data Sheet for Caltrans Standard Type 1 Retaining Wall

Design Height (feet)	Design Method	Pile Type	Finished Grade Elevation (feet)	Cut-off Elevation (feet)	Pile Cap Size (feet)		Permissible Settlement Under Service Load (inch)	Number of Pile per Support
					B	L		
16	LRFD	HP 10 x 42	+694.75	+692.17	13.5	29.1	1	13
20	LRFD	HP 10 x 42	+691.75	+688.17	15.0	48.0	1	28

Table 5-5. Pile Foundation Design Loads for Caltrans Standard Type 1 Retaining Wall

Design Height (feet)	Service-I Limit State (kips)			Strength Limit State (Controlling Group, kips)				Extreme Event Limit State (Controlling Group, kips)			
	Total Load		Permanent Load	Compression		Tension		Compression		Tension	
	Per Support	Max. Per Pile	Per Support	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile
16	876	87	809	1179	120	N/A	N/A	811	110	N/A	N/A
20	1886	75	1740	2551	103	N/A	N/A	1781	90	N/A	N/A

5.4.3.3 Axial Capacity

A double 6 feet by 6 feet reinforce concrete box (RCB) is located near the end of the Caltrans Standard Type 1 Retaining Wall (End RW No.2). In order to protect the RCB, two piles will need to be undersized-predrilled to the RCB invert elevation of +665 feet.

Foundation design recommendations are presented in Table 5-6. The Pile Data Table for the contract plans is presented in Table 5-7.

A pile-group efficiency factor (GEF) of 0.65 is used for a center-to-center pile spacing of 2.5 times the pile diameter, and a GEF of 1.0 is used for a center-to-center spacing of 4.0 times the pile diameter or greater (Section 10.8.3.6.3, AASHTO, 2007). Linear interpolation can be used to determine the GEF for intermediate spacing. Based on the pile layout provided by the structural designers, a GEF of 1.0 was used for the axial capacity calculations.

The pile capacity is also based on soil resistance only and may be further limited by the pile-head connection details and the strength of the pile materials.

Table 5-6. Pile Foundation Design Recommendations for Caltrans Standard Type 1 Retaining Wall

Design Height (feet)	Pile Type	Cut-off El. (feet)	Service-I Limit State Load per Pile (kips)	Total Wall Settl. (inch)	Required Factored Nominal Resistance (kips)				Design Tip El. (feet)	Spec. Tip El. (feet)	Nominal Driving Resis. Required (kips)
					Strength Limit		Extreme Event				
					Comp. (ϕ=0.7)	Tension (ϕ=0.7)	Comp. (ϕ=1.0)	Tension (ϕ=1.0)			
16 (Predrilled Piles)	HP 10 x 42	+692.17	87	1	120	N/A	110	N/A	+626 (a-I) +642 (a-II) +675 (c) +650 (d)	+626	180
16	HP 10 x 42	+692.17	87	1	120	N/A	110	N/A	+636 (a-I) +655 (a-II) +675 (c) +663 (d)	+636	180
20	HP 10 x 42	+688.17	75	1	103	N/A	90	N/A	+636 (a-I) +655 (a-II) +671 (c) +659 (d)	+636	150

Notes:
1. Design tip elevations are controlled by the following demands: (a-I) Compression (Strength Limit), (a-II) Compression (Extreme Event), (c) Settlement and (d) Lateral Load.
2. There are no design tip elevations for Tension.
3. The specified tip elevations shall not be raised above the design tip elevations for Settlement and Lateral Load.

Table 5-7. Pile Data Table for Caltrans Standard Type 1 Retaining Wall

Wall Height (feet)	Pile Type	Nominal Resistance (kips)		Design Tip Elevations (feet)	Specified Tip Elevation (feet)	Nominal Driving Resistance (kips)
		Compression	Tension			
16 (Predrilled Piles)	HP 10 x 42	180	N/A	+626 (a) +675 (c) +650 (d)	+626	180
16	HP 10 x 42	180	N/A	+636 (a) +675 (c) +663 (d)	+636	180
20	HP 10 x 42	150	N/A	+636 (a) +671 (c) +659 (d)	+636	150

Notes:
1. Design tip elevations are controlled by the following demands: (a) Compression, (c) Settlement and (d) Lateral Load.
2. There are no design tip elevations for Tension.
3. The specified tip elevations shall not be raised above the design tip elevations for Settlement and Lateral Load.

5.4.3.4 Lateral Capacity

Results of lateral pile analysis along the strong-axis and weak-axis of a single HP 10 x 42 steel pile with a free-head condition are presented in Appendix C and summarized in Table 5-8. The maximum bending moment and the location of maximum moment are also presented. The solutions presented in Table 5-8 are entirely based on soil resistance and linear pile properties.

Therefore, these values may be limited by the flexural strength (plastic moment) of the piles and pile-head connection details. The structural designer should compare the lateral pile demands with the results in Table 5-8 to determine whether the wall deflections are within tolerable limits.

Table 5-8. Lateral Pile Solutions for Caltrans Standard Type 1 Retaining Wall

Design Height (feet)	Pile Head Deflection (inch)	Pile Head Shear (kips)		Maximum Moment (kip-inch)		Depth to Max. Moment from Pile Top (feet)	
		Strong Axis	Weak Axis	Strong Axis	Weak Axis	Strong Axis	Weak Axis
16 and 20	¼	14.1	10.0	387	219	4.0	3.5
	½	20.2	14.1	631	356	5.0	3.5
	1	28.8	19.8	1029	583	5.5	4.0
	2	40.3	27.2	1679	955	6.0	4.5
	5	56.0	36.1	3132	1793	7.0	5.5

5.4.3.5 Lateral Earth Pressures

For retaining wall design, static active lateral earth pressure of 36 psf per foot of depth is recommended for a free draining, level and compacted backfill. For seismic incremental pressure, a triangular pressure distribution with a horizontal pressure of 24H psf (H is the height of the wall) at the bottom of the wall is recommended for a free draining, level and compacted backfill. The seismic incremental pressure should be added to the static pressure to determine the total pressure for earthquake design. The resultant of the static and seismic incremental pressures can be applied at the depth prescribed in Appendix A11.1.1.1 of the California Amendments to AASHTO LRFD Bridge Design Specifications (2007).

If applicable, a uniform lateral pressure due to traffic loading, equivalent to a vertical pressure produced by at least 2 feet of earth with a soil unit weight of 120 lb/ft^3, should be added to the above lateral earth pressure. Using an active earth pressure of 0.3, the recommended uniform lateral earth pressure due to traffic loading is 72 psf.

5.4.3.6 Wall Backfill

Materials placed behind the retaining wall should be Structure Backfill per Section 19-3.02B (Caltrans, 2010b). The Structure Backfill requirement should be supplemental to the pervious backfill requirement as described in Caltrans Standard Plans (Caltrans, 2010a) and Caltrans Standard Specifications (Caltrans, 2010b) under Section 19-3.02C. The horizontal limits of the Structure Backfill should begin one-foot from edge of the footing bottom and extending upward at a 45-degree imaginary plane until the plane intersects the ground surface. If the 45-degree imaginary plane intersects temporary shoring, then the horizontal limit can be altered to follow the vertical face of the shoring. Backfill should be placed in loose lifts not exceeding 8 inches in thickness, moisture-conditioned to near optimum moisture content, and compacted to at least 90 percent relative compaction. The relative compaction should be based on the maximum density determined by California Test 216. Jetting or flooding to compact backfill is not recommended. Heavy compaction equipment, such as vibratory rollers, dozers, or loaders,

should not be used adjacent to the retaining walls in order to avoid damaging the walls due to large lateral earth pressures.

5.5 GLOBAL STABILITY ANALYSES

Global stability analyses were conducted for both static and pseudo-static conditions using the computer program SLIDE 5.0 (Rocscience, 2006). The soil strength parameters in Table 4-1 were used in the static and pseudo-static analysis and the results are presented in Appendix C.

Analyses were performed at the critical section with the maximum Phase-2 wall height. The factor of safety for a deep-seated failure is greater than the required 1.5 under static condition with a 2-foot soil surcharge to represent traffic loading. Slope stability analysis under pseudo-static condition was performed using a seismic coefficient equal to 0.2g. Analysis indicates that the factor of safety is greater than the required 1.1 under pseudo-static condition.

6.0 CONSTRUCTION RECOMMENDATIONS

6.1 EARTHWORK

Earthwork should be performed in accordance with Caltrans Standard Specifications, Section 19 (Caltrans, 2010b). Appropriate measures should be taken to prevent damage to adjacent structures and utilities. Any design and construction of temporary sloping, sheeting, or shoring should be made the contractor's responsibility. It should be noted that it is the responsibility of the contractor to oversee the safety of the workers in the field during construction. The contractor shall conform to all applicable occupational and health standards, rules, regulations, and orders established by the State of California. In addition, other State, County, or Municipal regulations may supersede the recommendations presented in this section. If a trench shoring design and safety plan is required, the geotechnical consultant should review the plan to confirm that recommendations presented in this report have been applied to the design.

During the recent field investigation conducted on April 26 and 27, 2010, groundwater was encountered between elevations +661.5 and +671 feet. Groundwater was also encountered in the as-built borings for Grand Avenue OC between elevations +658 and +665.2 feet. Based on California Geological Survey (CGS, 1998), the recorded highest historical groundwater at the project site is between 15 and 20 feet below the ground surface. Using the above groundwater measurements, groundwater may be encountered during footing construction. Groundwater encountered during footing construction should be controlled in accordance with Section 19-3.03D of the Caltrans Standard Specifications (Caltrans, 2010b). If wet subgrade conditions are encountered during construction, the soft bottom will require stabilization prior to any earthwork. Subgrade stabilization can be accomplished by using a combination of geotextile, geogrid, gravel, or aggregate base. In addition, low ground pressure earthmoving equipment may be necessary during excavation and relatively lightweight equipment may be needed to compact the select material to minimize the potential for soil pumping.

6.2 PILE CONSTRUCTION

Piles should be driven at least to the specified tip elevation and the nominal driving resistance should be checked with the pile-driving formula given in Section 49-2.01A(4)(b) of the Caltrans Standard Specifications (2010b). However, if the specified tip elevation is reached without achieving the nominal driving resistance, pile driving should continue until the nominal driving resistance is attained. In this case, it may be prudent to allow the pile to "set up" before continuing the driving.

The selected pile-driving hammer such as diesel-type hammers should be able to deliver sufficient energy to drive the piles at a penetration rate of not less than 1/8 inch per blow at the required bearing value. Vibratory hammers or oversized drilling are not allowed for pile installation.

An existing double 6 feet by 6 feet RCB is located near the end of the Caltrans Standard Type 1 Retaining Wall (End RW No.2). In order to protect the RCB, two piles will need to be undersized-predrilled to the RCB invert elevation of +665 feet.

Based on the available soil boring data, hard driving is anticipated near and below El. +635 feet. Contractor should be prepared for hard driving conditions.

6.3 REVIEW OF CONSTRUCTION PLANS

Recommendations contained in this report are based on preliminary plans. The geotechnical consultant should review the final construction plans and specifications in order to confirm that the general intent of the recommendations contained in this report have been incorporated into the final construction documents. Recommendations contained in this report may require modification or additional recommendations may be necessary based on the final design.

6.4 GEOTECHNICAL OBSERVATION AND TESTING

It is recommended that inspections and testing be performed by the geotechnical consultant during the following stages of construction:

- Grading operations, including excavations and placement of compacted fill
- Shoring installation
- Spread and pile footing excavations and constructions
- Backdrain installation and backfilling of walls
- Removal or installation of support of buried utilities or structures
- When any unusual subsurface conditions are encountered

7.0 LIMITATIONS

This report is intended for the use of WKE, Inc., Cities of Industry and Diamond Bar, and the California Department of Transportation for the proposed Retaining Wall No. 2 at the Grand Avenue WB On-Ramp for the SR-57/SR-60 Confluence Project, Phase I. This report is based on the project as described and the information obtained from the exploratory borings at the approximate locations indicated on the attached plans. The findings and recommendations contained in this report are based on the results of the field investigation, laboratory tests, and engineering analyses. In addition, soils and subsurface conditions encountered in the exploratory borings are presumed to be representative of the project site. However, subsurface conditions and characteristics of soils between exploratory borings can vary. The findings reflect an interpretation of the direct evidence obtained. The recommendations presented in this report are based on the assumption that an appropriate level of quality control and quality assurance (inspections and tests) will be provided during construction. EMI should be notified of any pertinent changes in the project plans or if subsurface conditions are found to vary from those described herein. Such changes or variations may require a re-evaluation of the recommendations contained in this report.

The data, opinions, and recommendations contained in this report are applicable to the specific design element(s) and location(s) which is (are) the subject of this report. They have no applicability to any other design elements or to any other locations and any and all subsequent users accept any and all liability resulting from any use or reuse of the data, opinions, and recommendations without the prior written consent of EMI.

EMI has no responsibility for construction means, methods, techniques, sequences, or procedures; for safety precautions or programs in connection with the construction; for the acts or omissions of the CONTRACTOR or any other person performing any of the construction; or for the failure of any worker to carry out the construction in accordance with the Final Construction Drawings and Specifications.

Services performed by EMI have been conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. No other representation, expressed or implied, and no warranty or guarantee is included or intended.

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Appendix A

LOG OF TEST BORINGS SHEETS

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
07	LA	60	R23.87 / R24.48		

REGISTERED ENGINEER — DATE 05/23/12

REGISTERED PROFESSIONAL ENGINEER S. PIRATHIVIRAJ NO. C71662 EXP. 12/31/13 CIVIL STATE OF CALIFORNIA

PLANS APPROVAL DATE

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15625 EAST STAFFORD STREET
INDUSTRY, CA 91744

EARTH MECHANICS, INC.
17800 NEWHOPE STREET, SUITE B
FOUNTAIN VALLEY, CA 92708

BENCH MARK

Horizontal control is based on Caltrans GPS points 1001 and 1002 from TLI Control project done Jan 2000.

Coordinates shown are based on the California Coordinate System (CCS83) Zone 5, 1983 NAD (1992.88 EPOCH).

Vertical control is based on Caltrans Benchmark 38-C-74, a standard disk, down 1.2', 63' left of Centerline Baseline relocated 374+85.00. Elev = 1298.37 feet 1929 NGVD, 1978 Adjustment, dated Dec 1990.

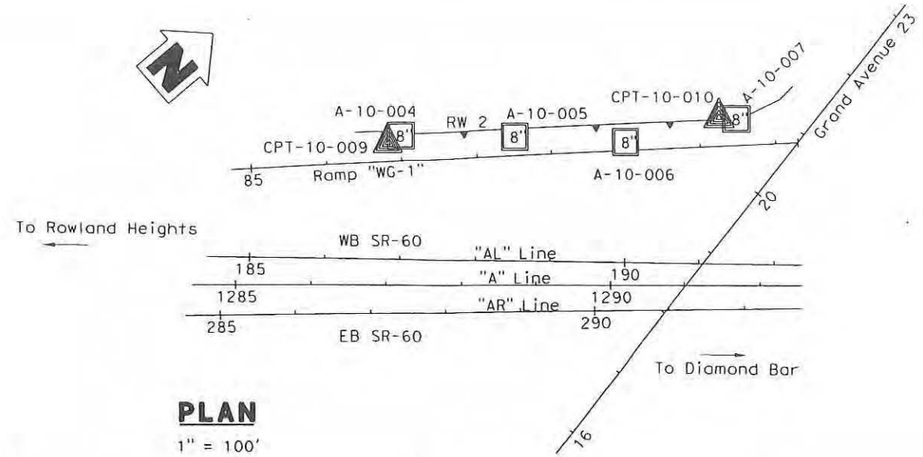
NOTES:

(1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (2010 Edition).

(2) 2.4" samples were taken using a California Modified Sampler.

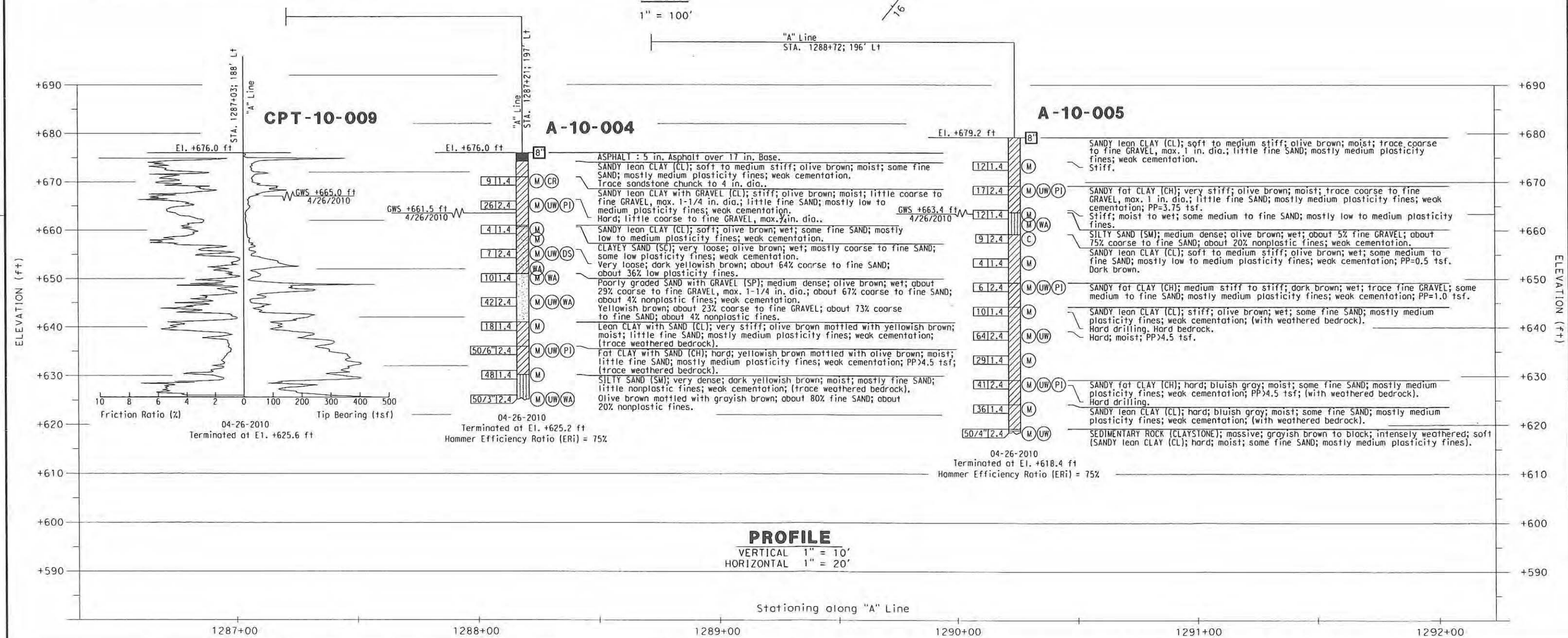
(3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive sampler.

(4) Conversion factor from 2.4" California Modified Sampler blowcounts to Standard Penetration Test (SPT) blowcounts is 0.5.



PLAN

1" = 100'



PROFILE

VERTICAL 1" = 10'
HORIZONTAL 1" = 20'

DESIGN OVERSIGHT	DRAWN BY	J. Fang	R. Jie FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	S. Pirathiviraj PROJECT ENGINEER	BRIDGE NO. 53E-0206	RETAINING WALL NO. 2
SIGN OFF DATE	CHECKED BY	S. Pirathiviraj	DATE: April 2010			POST MILES 24.3	LOG OF TEST BORINGS 1 OF 2

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 07
PROJECT NUMBER & PHASE: 255101

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES — SHEET — OF

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

BENCH MARK

Horizontal control is based on Caltrans GPS points 1001 and 1002 from TLI Control project done Jan 2000.

Coordinates shown are based on the California Coordinate System (CCS83) Zone 5, 1983 NAD (1992.88 EPOCH).

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(4) Conversion factor from 2.4" California Modified Sampler blowcounts to Standard Penetration Test (SPT) blowcounts is 0.5.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
07	LA	60	R23.87 / R24.48		

REGISTERED ENGINEER — DATE 05/23/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER S. PIRATHIVIRAJ NO. C71662 EXP. 12/31/13 CIVIL STATE OF CALIFORNIA

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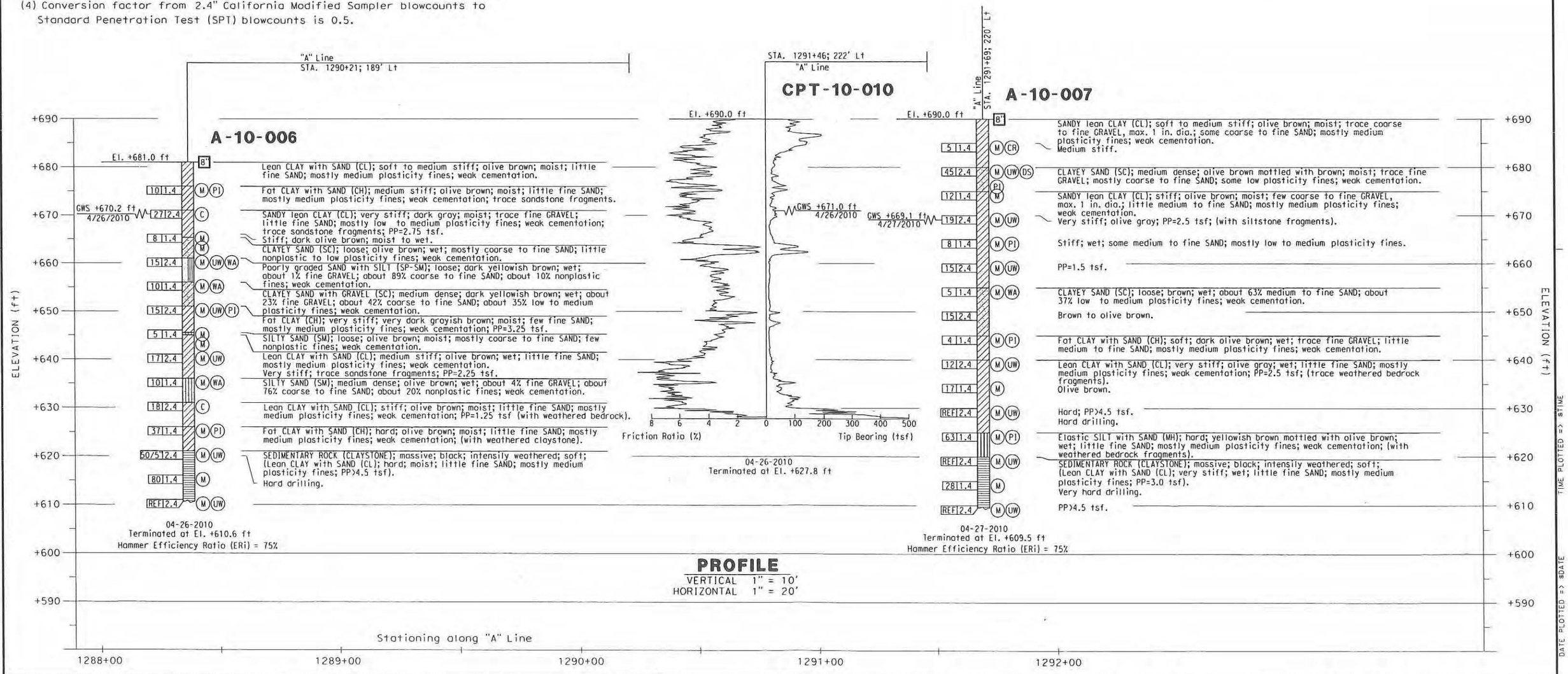

DESIGN OVERSIGHT	DRAWN BY	J. Fong	R. Jie FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	S. Pirathiviraj PROJECT ENGINEER	BRIDGE NO. 53E-0206
SIGN OFF DATE	CHECKED BY	S. Pirathiviraj	DATE: April 2010			POST MILES 24.3

RETAINING WALL NO. 2

LOG OF TEST BORINGS 2 OF 2

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 07
PROJECT NUMBER & PHASE: 255101

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES — SHEET — OF

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

Appendix B

LABORATORY TEST RESULTS

TABLE B-1 SUMMARY OF LABORATORY TEST RESULTS

Project No. : 08-170 Project Name : SR-57/SR-60 Confluence Projet, Phase I - Grand Avenue WB On Ramp: Retaining Wall 2

Boring No.	Sample No.	Sample Depth (ft)	Soil Identification (group symbol) ASTM	Moisture Content ASTM D2216 (%)	Total Unit Weight ASTM D2937 (pcf)	Pocket Penetrometer (tsf)	Torvane Shear (tsf)	Grain Size Distribution GR:SA:FI (%)	Sand Equivalent (CT-217)	Atterberg Limits ASTM D4318 (LL/PL/PI)	Soil-Minimum Resisivity CT-532 (ohm-cm)	Soil- pH CT-532	Soil-Soluble Sulfate Content CT-417 (ppm)	Soil-Moisture Free Chloride (ppm)
A-10-004	S-1	5	CL	33.9								8.2	280	378
A-10-004	D-2	10	CL	23.3	119.4	>4.5				46/20/26				
A-10-004	S-3-1	15	CL	24.0										
A-10-004	S-3-2	15.3	SC	24.8						36/17/19				
A-10-004	D-4	20	SC	31.6	119.4			0:64:36		38/18/20				
A-10-004	S-5	25	SP	15.8				29:67:4						
A-10-004	D-6	30	SP	10.7	138.7			23:73:4						
A-10-004	S-7	35	CL	34.0										
A-10-004	D-8	40	CH	30.8	112.0	>4.5				61/32/29				
A-10-004	S-9-1	45	CL	40.1										
A-10-004	S-9-2	45.5	SM	17.2										
A-10-004	D-10	50	SM	21.9	125.1			0:80:20						
A-10-005	S-1	5	CL	21.8										
A-10-005	D-2	10	CH	25.8	115.2	3.75				52/25/27				
A-10-005	S-3-1	15	CH	29.5						42/18/24				
A-10-005	S-3-2	15.5	SM	14.2				5:75:20						
A-10-005	D-4	20	CL			0.5								
A-10-005	S-5	25	CL	37.1										
A-10-005	D-6	30	CH	41.4	110.3	1.0				56/25/31				
A-10-005	S-7	35	CL	44.0										
A-10-005	D-8	40	CL	31.0	113.2	>4.5								
A-10-005	S-9	45	CL	32.6										
A-10-005	D-10	50	CH	28.0	116.4	>4.5				66/28/38				
A-10-005	S-11	55	CL	33.1										
A-10-005	D-12	60	CL	26.4	116.2	>4.5								
A-10-006	S-1	5	CH	19.4						60/26/34				
A-10-006	D-2	10	CL			2.75								
A-10-006	S-3-1	15	CL	20.1										
A-10-006	S-3-2	15.7	SC	16.7						40/18/22				
A-10-006	D-4	20	SP-SM	17.8	129.3			1:89:10						
A-10-006	S-5	25	SC	20.2				23:42:35		43/20/23				
A-10-006	D-6	30	CH	31.9	116.4	3.25				54/22/32				
A-10-006	S-7-1	35	CL	41.1										
A-10-006	S-7-2	35.6	SM	23.9										
A-10-006	D-8	40	CL	34.2	114.8	2.25								

TABLE B-1 SUMMARY OF LABORATORY TEST RESULTS

Project No. : 08-170 Project Name : SR-57/SR-60 Confluence Projet, Phase I - Grand Avenue WB On Ramp: Retaining Wall 2

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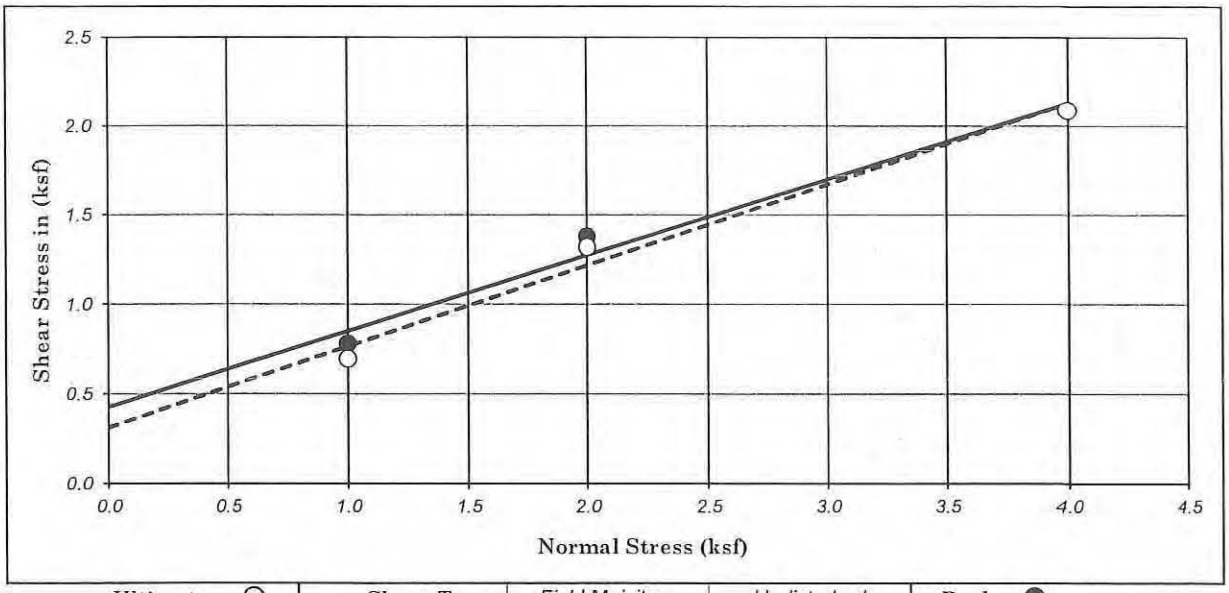
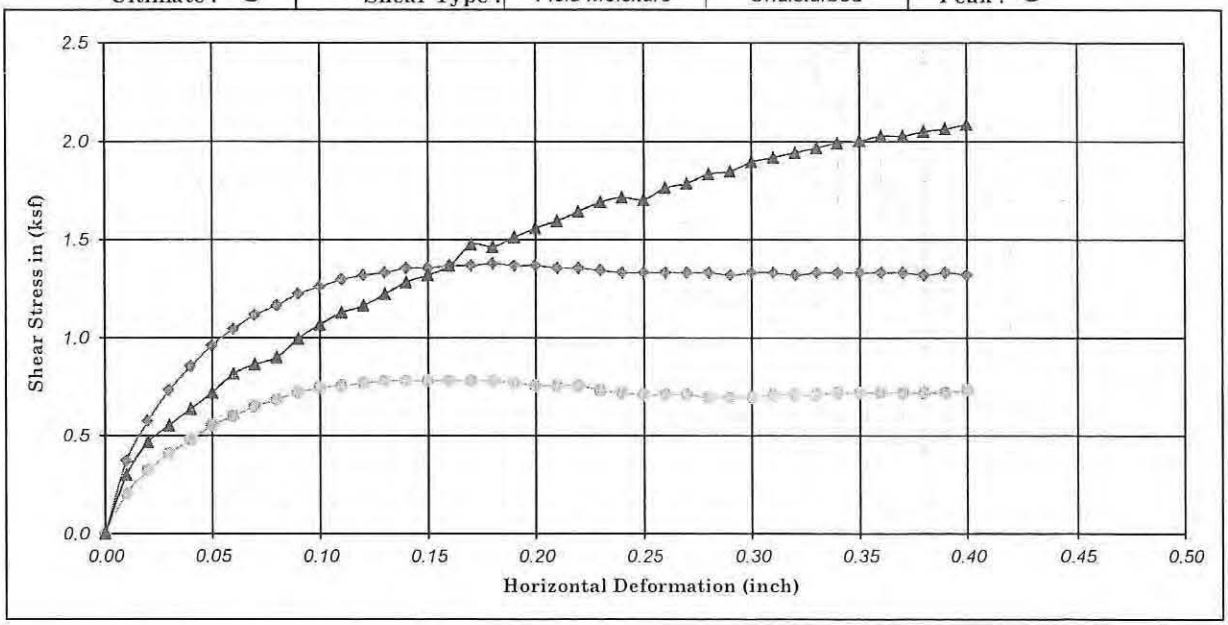
A-10-006	S-9	45	SM	22.2				4:76:20						
A-10-006	D-10	50	CL			1.25								
A-10-006	S-11	55	CH	37.9						55/24/31				
A-10-006	D-12	60	CL	39.8	111.0	>4.5								
A-10-006	S-13	65	CL	30.5										
A-10-006	D-14	70	CL	27.6	113.2	>4.5								
A-10-007	S-1	5	CL	21.5								8.0	330	204
A-10-007	D-2	10	SC	11.4	130.0					34/14/20				
A-10-007	S-3	15	CL	38.3										
A-10-007	D-4	20	CL	28.3	114.5	2.5								
A-10-007	S-5	25	CL	19.9						35/14/21				
A-10-007	D-6	30	CL	38.3	128.4	1.5								
A-10-007	S-7	35	SC	24.2				0:63:37		31/17/14				
A-10-007	D-8	40	SC							36/17/17				
A-10-007	S-9	45	CH	36.5						60/28/32				
A-10-007	D-10	50	CL	34.1	113.1	2.5								
A-10-007	S-11	55	CL	38.5										
A-10-007	D-12	60	CL	27.5	112.5	>4.5								
A-10-007	S-13	65	MH	38.4						69/34/35				
A-10-007	D-14	70	CL	34.9	112.4	3.0								
A-10-007	S-15	75	CL	24.2										
A-10-007	D-16	80	CL	27.2	118.1	>4.5								

np



Ultimate : ○	Shear Type :	Field Moisiture	Undisturbed	Peak : ●



Boring No. : A-10-004		Strength Intercept (C) :	0.43	(ksf)	Peak	0.31	(ksf)	Ultimate
Sample No. : D-4			20.40	(kPa)		14.94	(kPa)	
Depth (ft/m) : 20.0	0.00	Friction Angle (ϕ) :	22.99	Degree		24.35	Degree	
Description : Dark yellowish brown, CLAYEY SAND (SC)						Shear Rate (inch/minute) :	0.02	

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m^3)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	24.36	96.74	15.23	0.74	1.00	47.88	0.78	37.35	0.70	33.32
◆	29.40	94.40	14.86	0.79	2.00	95.76	1.38	66.07	1.32	63.20
▲	25.63	96.05	15.12	0.75	4.00	191.52	2.09	99.97	2.09	99.97

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

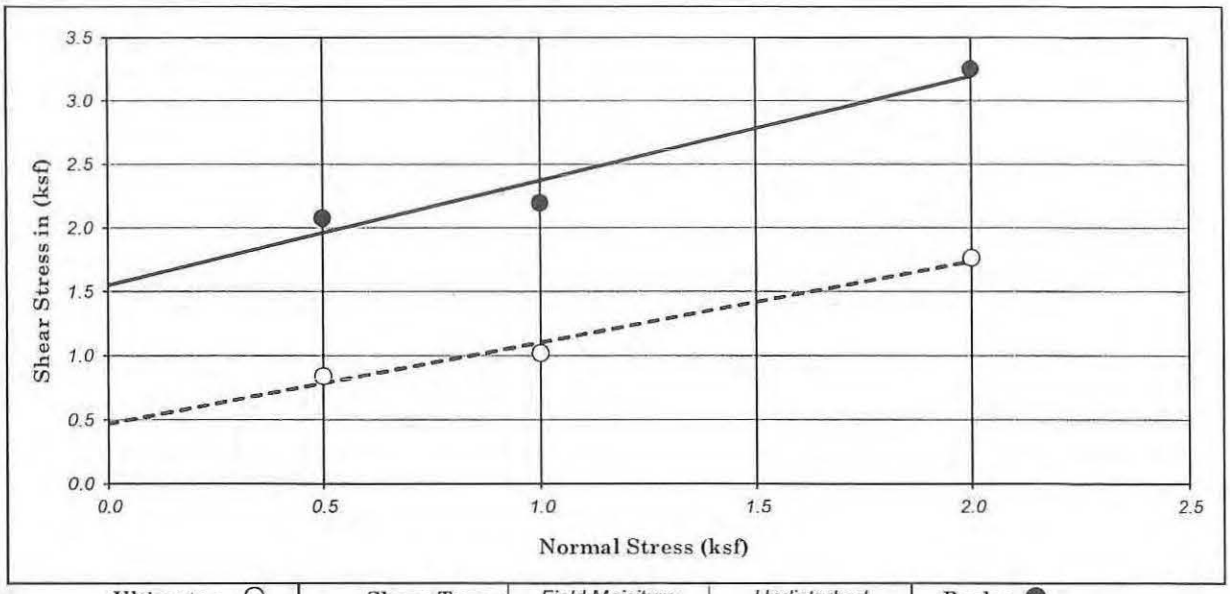
SR-57 60 Conflence Project, Phase I
Grand Avenue WB On-ramp

Retaining Wall No. 2

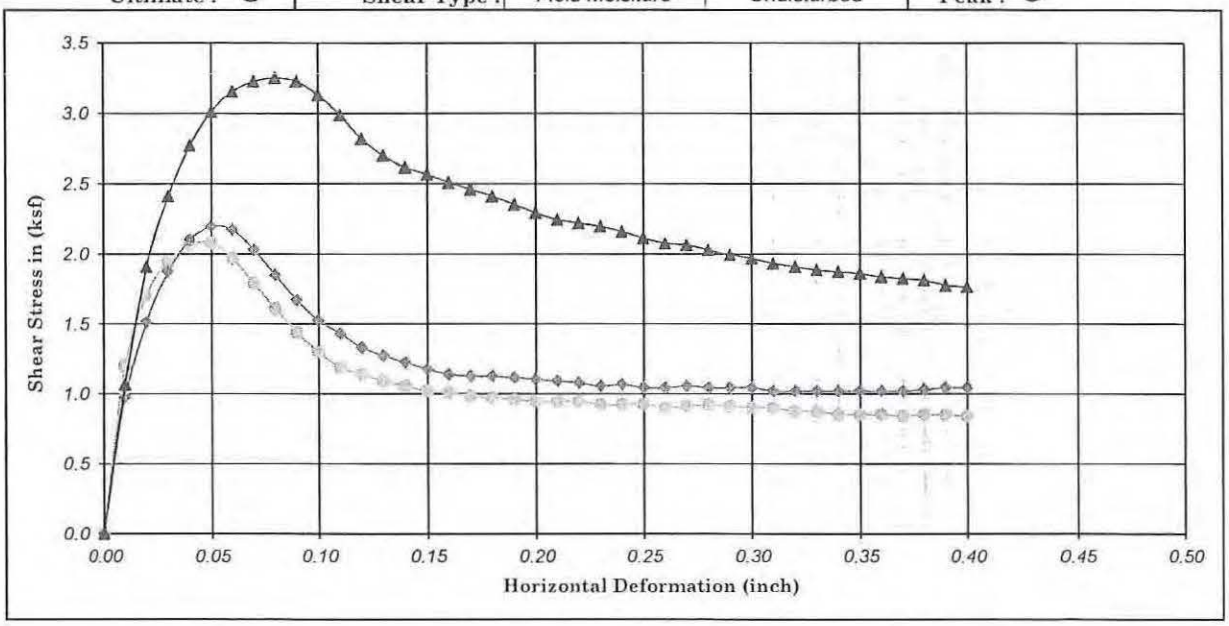
DIRECT SHEAR TEST (ASTM D-3080)

Project No. : 08-170 | Date : 05/28/10

Figure No. :



Ultimate : ○	Shear Type :	Field Moisiture	Undisturbed	Peak : ●



Boring No. : A-10-007		Strength Intercept (C) :	1.55	(ksf)	Peak	0.47	(ksf)	Ultimate
Sample No. : D-2			74.12	(kPa)		22.41	(kPa)	
Depth (ft/m) : 10.0	0.00	Friction Angle (ϕ) :	39.45	Degree		32.39	Degree	
Description : Dark brown, CLAYEY SAND (SC)						Shear Rate (inch/minute) :		0.02

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m^3)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	18.30	108.72	17.11	0.55	0.50	23.94	2.08	99.40	0.84	40.22
◆	14.09	115.09	18.11	0.46	1.00	47.88	2.20	105.14	1.02	48.84
▲	15.17	115.98	18.25	0.45	2.00	95.76	3.25	155.71	1.76	84.46

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

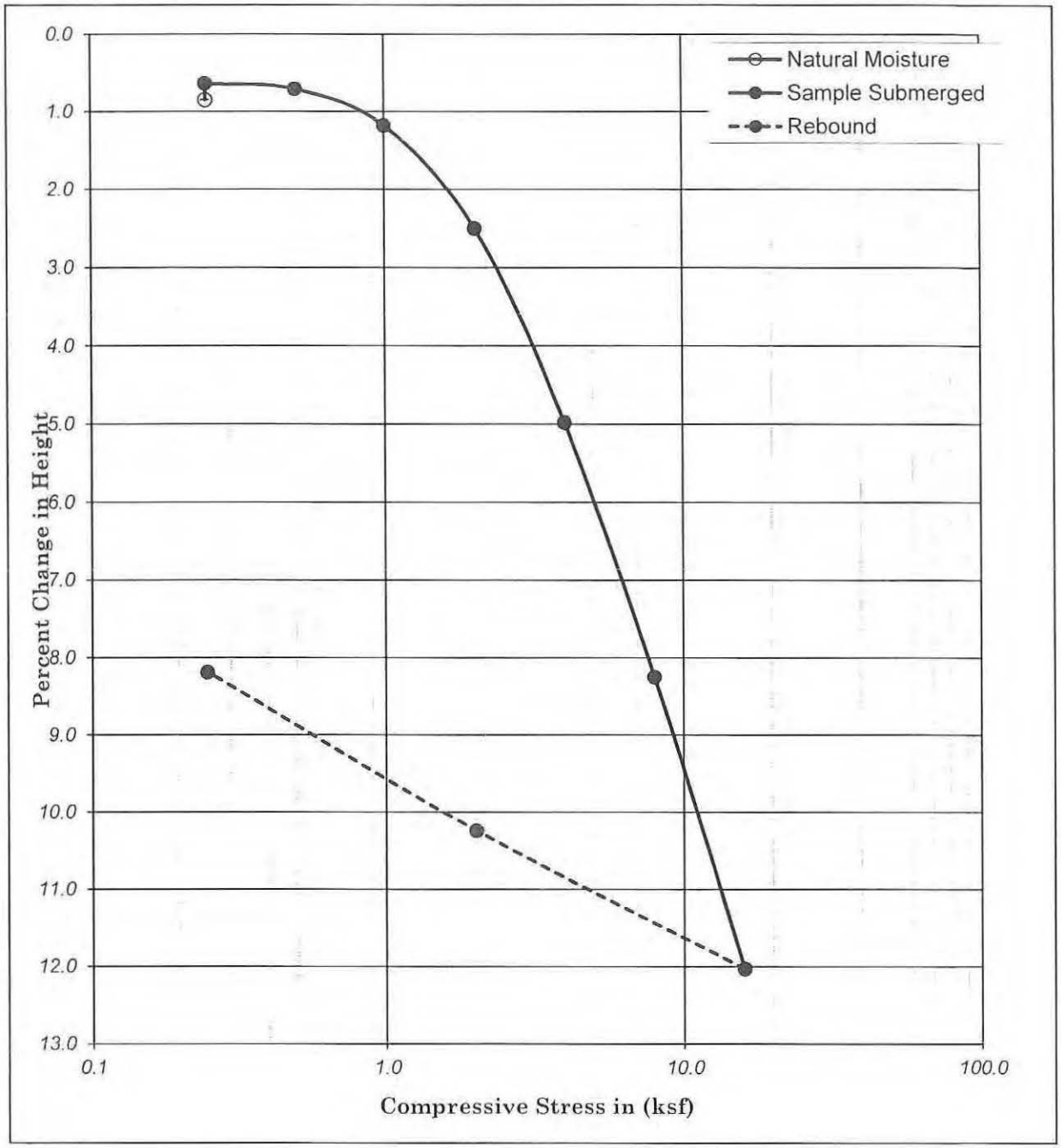
SR-57 60 Conflence Project, Phase I
Grand Avenue WB On-ramp

Retaining Wall No. 2

DIRECT SHEAR TEST (ASTM D-3080)

Project No. : 08-170 | Date : 05/28/10

Figure No. :



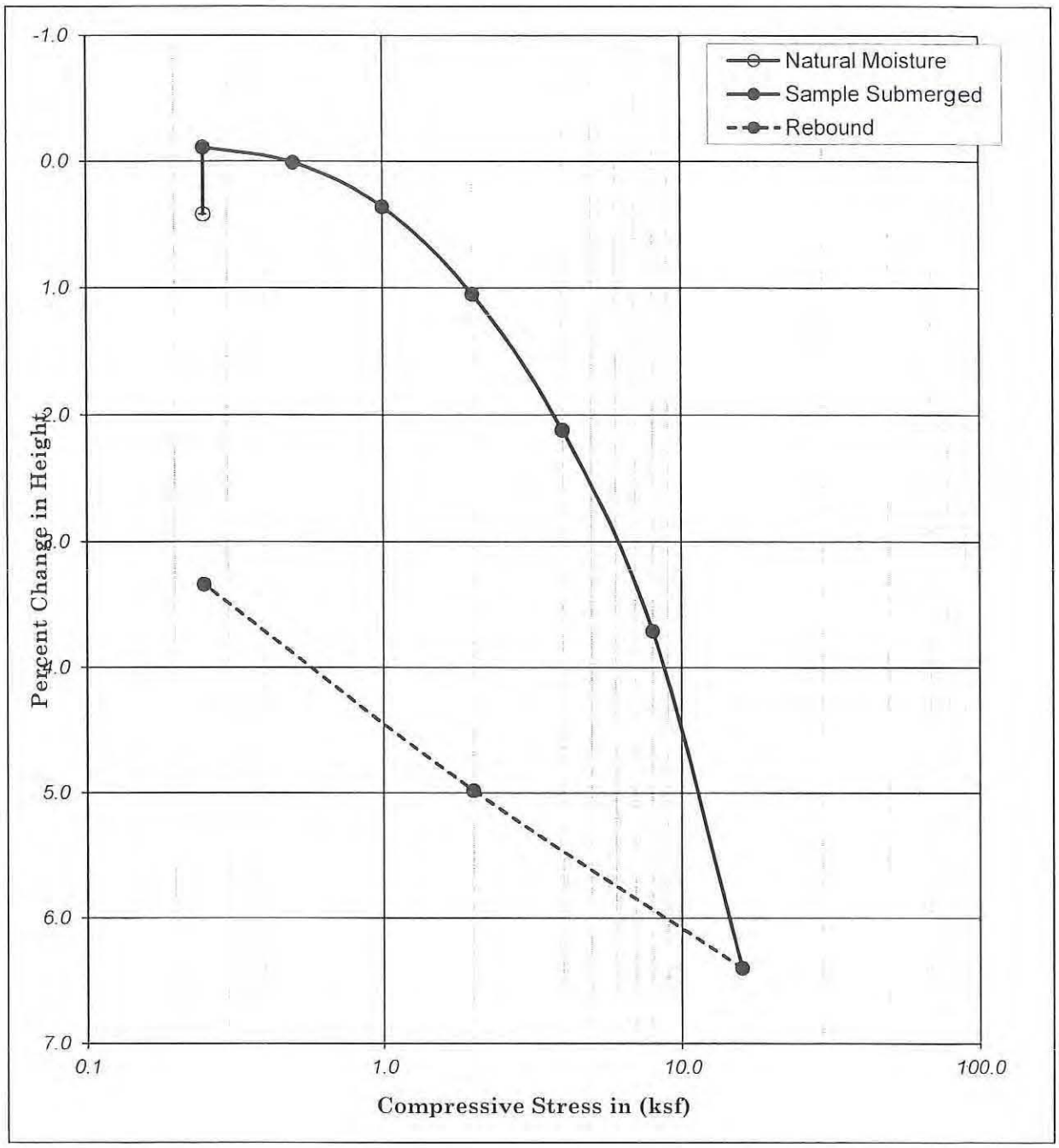
Boring No.	: A-10-005			Liquid Limit :	-		Moisture Content (%)	Dry Density (pcf)	Dry Density (kN/m³)	Percent Saturation	Void Ratio
Sample No.	: D-4			Plastic Limit :	-						
Depth	(ft) :	20.0	21.5	Plastic Index :	-	Initial	29.91	93.66	14.74	100.97	0.80
	(m) :	6.10	6.56	Specific Gravity :	2.70	Final	25.88	102.21	16.09	107.66	0.65
Description : very dark olive-gray, Lean CLAY (CL)											

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

SR-57/SR-60 Conflence Phase 1
Grand Avenue WB On-Ramp

Project No. : *08-170* *05/31/10*

CONSOLIDATION TEST
(ASTM D-2435 / CT-219)



Boring No.		: A-10-006		Liquid Limit :	-		Moisture Content (%)	Dry Density (pcf)	Dry Density (kN/m³)	Percent Saturation	Void Ratio
Sample No.		: D-2		Plastic Limit :	-						
Depth	(ft)	: 10.0	11.5	Plastic Index :	-	Initial	28.99	91.82	14.45	93.65	0.84
	(m)	: 3.05	3.51	Specific Gravity :	2.70	Final	29.60	95.03	14.96	103.30	0.77

Description : *Dark olive-gray, Lean CLAY with SAND and GRAVEL (CL)*

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

SR-57/SR-60 Conflence Project, Phase 1
Grand Avenue WB On-Ramp

Project No. : *08-170* *05/31/10*

CONSOLIDATION TEST
(ASTM D-2435 / CT-219)

Appendix C

DESIGN CALCULATIONS

SR-57/SR-60 Confluence Phase I, Grand Avenue WB On-Ramp - Retaining Wall 2 SP 08-170

LIQUEFACTION ANALYSIS; ACC. = 0.61 g 09-Feb-12

Liquefaction analysis is performed following Seed's Procedure, outlined by Seed et al (1985), Seed and Harder (1990), updated NCEER (1997)

Emean/E60 = Energy Ratio to correct to standard 60% Energy
Surcharge = Any surcharge on top of the ground (psf)
acc. max = maximum peak acceleration at the ground surface (g's)
$^{1}C_N$ = square root of (100 kPa or 1.04427 tsf/effective overburden)
The induced cyclic stress ratio (CSR i) by a given peak ground acceleration (acc. max) is:

CSR i = 0.65 x acc.max. x total normal stress x rd / (effective normal stress x g)

where: rd = stress reduction factor (Robertson and Wride (1996), Marcuson (USArmy Eng), per NCEER (1997))
g = acceleration of gravity

The resisting cyclic stress ratio (CSR r) is equal to:

CSR r = CSR x Cm x K sigma

where: Cm = Earthquake Magnitude Correction Factor (Blake, NCEER Table 3, Eq.4)
K sigma = Normalized resistance factor (Fig. 14 from NCEER Liquefaction workshop, Harder Boulanger)
CSR = Resisting Cyclic Stress Ratio. It is a function of the content of fines
(Figure 2, NCEER Workshop, after Seed et al 1985))

Factor of Safety, F sub L is:

F sub L = CSR r / CSR i

A-10-004

Emean (%) 75 Sur.= psf 676 =top of ground el. Borehole Diamete 8 671 =water table El. acc. max = 0.61 g Earthq. M= 7.3
C_E 1.25 C_B 1.15 Cm= 1.07

ELEVATION BASE OF LAYER (ft.)	TOP OF LAYER ELEVATION (ft.)	LAYER THICKNESS L (ft.)	TOTAL OVERBUR. PRESS. (tsf)	EFFEC. OVERBUR. PRESS. (tsf)	DEPTH BELOW SURFACE (ft)	C_N	C_R	C_S	C_{ST}	TOTAL UNIT WEIGHT (pcf)	SAMPLER TYPE 1=SPT 2=CA.MOD.	SAMPLER LINED 1=UNLINED 2=LINED	FIELD BLOW COUNT N	STRESS REDUC. COEFF. rd	INDUCED CYCLIC STRESS RATIO	CORRECT BLOW COUNT Nc	EST. PERCENT OF FINES (%)	(N1)60cs	K sigma	RESIST. CYCLIC STRESS RATIO M=7.5	RESIST. CYCLIC STRESS RATIO Overburd Cor Mag Corr	FACTOR OF SAFETY (F sub L)	WILL IT LIQUEFY?
-	-	-	-	-	-	-				-	-		-	-	-	-	-		-	-		-	-
671	676	5	0.29	0.29	5.00	1.91	0.75	1.20	1.00	115	1	1	9	0.99	0.39	23	51.0	33	1.00	high N	high N	LARGE	high N/fines
666	671	5	0.58	0.42	10.00	1.58	0.75	1.00	0.67	115	2	2	26	0.98	0.53	30	51.0	41	1.00	high N	high N	LARGE	high N/fines
661	666	5	0.86	0.55	15.00	1.38	0.85	1.20	1.00	115	1	1	4	0.97	0.60	9	36.0		Does Not liquefy per Chinese Criteria LL>35				
656	661	5	1.15	0.68	20.00	1.24	0.85	1.00	0.67	115	2	2	7	0.95	0.64	8	36.0		Does Not liquefy per Chinese Criteria LL>35				
651	656	5	1.44	0.81	25.00	1.13	0.95	1.20	1.00	115	1	1	10	0.94	0.66	19	4.0	19	1.00	0.20	0.22	0.33	yes
646	651	5	1.73	0.95	30.00	1.05	0.95	1.00	0.67	115	2	2	42	0.93	0.67	41	4.0	41	1.00	high N	high N	LARGE	high N
641	646	5	2.01	1.08	35.00	0.98	1.00	1.20	1.00	115	1	1	18	0.89	0.66	31	51.0	43	0.99	high N	high N	LARGE	high N/fines
636	641	5	2.30	1.21	40.00	0.93	1.00	1.00	0.67	115	2	2	100	0.85	0.64	90	51.0	113	0.97	high N	high N	LARGE	high N/fines
631	636	5	2.59	1.34	45.00	0.88	1.00	1.20	1.00	115	1	1	48	0.81	0.62	74	51.0	94	0.95	high N	high N	LARGE	high N/fines
626	631	5	2.88	1.47	50.00	0.84	1.00	1.00	0.67	115	2	2	100	0.77	0.59	81	20.0	92	0.93	high N	high N	LARGE	high N

SR-57/SR-60 Confluence Phase I, Grand Avenue WB On-Ramp - Retaining Wall 2 SP 08-170

LIQUEFACTION ANALYSIS; ACC. = 0.61 g 09-Feb-12

Liquefaction analysis is performed following Seed's Procedure, outlined by Seed et al (1985), Seed and Harder (1990), updated NCEER (1997)

Emean/E60 = Energy Ratio to correct to standard 60% Energy
Surcharge = Any surcharge on top of the ground (psf)
acc. max = maximum peak acceleration at the ground surface (g's)
[1]C_N = square root of (100 kPa or 1.04427 tsf/effective overburden)
The induced cyclic stress ratio (CSR i) by a given peak ground acceleration (acc. max) is:

CSR i = 0.65 x acc max. x total normal stress x rd / (effective normal stress x g)

where: rd = stress reduction factor (Robertson and Wride (1996), Marcuson (USArmy Eng), per NCEER (1997))
g = acceleration of gravity

The resisting cyclic stress ratio (CSR r) is equal to:

CSR r = CSR x Cm x K sigma

where: Cm = Earthquake Magnitude Correction Factor (Blake, NCEER Table 3, Eq.4)
K sigma = Normalized resistance factor (Fig. 14 from NCEER Liquefaction workshop, Harder Boulanger)
CSR = Resisting Cyclic Stress Ratio. It is a function of the content of fines
(Figure 2, NCEER Workshop, after Seed et al 1985))

Factor of Safety, F sub L is:

F sub L = CSR r / CSR i

A-10-005

Emean (%) 75 Sur.= psf 679.2 =top of ground el. Borehole Diamete 8 671 =water table El. acc. max = 0.61 g Earthq. M= 7.3
C_E 1.25 C_B 1.15 Cm= 1.07

ELEVATION BASE OF LAYER (ft.)	TOP OF LAYER ELEVATION (ft.)	LAYER THICKNESS L (ft.)	TOTAL OVERBUR. PRESS. (tsf)	EFFEC. OVERBUR. PRESS. (tsf)	DEPTH BELOW SURFACE (ft)	C_N	C_R	C_S	C_{ST}	TOTAL UNIT WEIGHT (pcf)	SAMPLER TYPE 1=SPT 2=CA.MOD.	SAMPLER LINED 1=UNLINED 2=LINED	FIELD BLOW COUNT N	STRESS REDUC. COEFF. rd	INDUCED CYCLIC STRESS RATIO	CORRECT BLOW COUNT Nc	EST. PERCENT OF FINES (%)	(N1)60cs	K sigma	RESIST. CYCLIC STRESS RATIO M=7.5	RESIST. CYCLIC STRESS RATIO Overburd Cor Mag Corr	FACTOR OF SAFETY (F sub L)	WILL IT LIQUEFY?
-	-	-	-	-	-	-				-	-		-	-	-	-	-		-	-	-	-	-
674.2	679.2	5	0.29	0.29	5.00	1.91	0.75	1.20	1.00	115	1	1	12	0.99	0.39	30	51.0	41	1.00	high N	high N	LARGE	AboveWT
669.2	674.2	5	0.58	0.42	10.00	1.58	0.75	1.00	0.67	115	2	2	17	0.98	0.53	20	51.0	29	1.00	0.41	0.44	0.83	fines
664.2	669.2	5	0.86	0.55	15.00	1.38	0.85	1.20	1.00	115	1	1	12	0.97	0.60	25	20.0	31	1.00	high N	high N	LARGE	high N
659.2	664.2	5	1.15	0.68	20.00	1.24	0.85	1.00	0.67	115	2	2	9	0.95	0.64	10	51.0	17	1.00	0.18	0.19	0.30	fines
654.2	659.2	5	1.44	0.81	25.00	1.13	0.95	1.20	1.00	115	1	1	4	0.94	0.66	8	51.0	15	1.00	0.16	0.17	0.26	fines
649.2	654.2	5	1.73	0.95	30.00	1.05	0.95	1.00	0.67	115	2	2	6	0.93	0.67	6	51.0	13	1.00	0.14	0.15	0.22	fines
644.2	649.2	5	2.01	1.08	35.00	0.98	1.00	1.20	1.00	115	1	1	10	0.89	0.66	17	51.0	26	0.99	0.31	0.33	0.50	fines
639.2	644.2	5	2.30	1.21	40.00	0.93	1.00	1.00	0.67	115	2	2	64	0.85	0.64	57	51.0	74	0.97	high N	high N	LARGE	high N/fines
634.2	639.2	5	2.59	1.34	45.00	0.88	1.00	1.20	1.00	115	1	1	29	0.81	0.62	45	51.0	59	0.95	high N	high N	LARGE	high N/fines
629.2	634.2	5	2.88	1.47	50.00	0.84	1.00	1.00	0.67	115	2	2	41	0.77	0.59	34	51.0	46	0.93	high N	high N	LARGE	high N/fines
624.2	629.2	5	3.16	1.60	55.00	0.81	1.00	1.20	1.00	115	1	1	36	0.73	0.57	51	51.0	67	0.92	high N	high N	LARGE	high N/fines
619.2	624.2	5	3.45	1.73	60.00	0.78	1.00	1.00	0.67	115	2	2	100	0.69	0.54	75	51.0	95	0.90	high N	high N	LARGE	high N/fines

SR-57/SR-60 Confluence Phase I, Grand Avenue WB On-Ramp - Retaining Wall 2 SP 08-170
LIQUEFACTION ANALYSIS; ACC. = 0.61 g 09-Feb-12

Liquefaction analysis is performed following Seed's Procedure, outlined by Seed et al (1985), Seed and Harder (1990), updated NCEER (1997)

Emean/E60 = Energy Ratio to correct to standard 60% Energy
Surcharge = Any surcharge on top of the ground (psf)
acc. max = maximum peak acceleration at the ground surface (g's)
$^{1}C_{N}$ = square root of (100 kPa or 1.04427 tsf/effective overburden)
The induced cyclic stress ratio (CSR i) by a given peak ground acceleration (acc. max) is:

CSR i = 0.65 x acc max. x total normal stress x rd / (effective normal stress x g)

where: rd = stress reduction factor (Robertson and Wride (1996), Marcuson (USArmy Eng), per NCEER (1997))
g = acceleration of gravity

The resisting cyclic stress ratio (CSR r) is equal to:

CSR r = CSR x Cm x K sigma

where: Cm = Earthquake Magnitude Correction Factor (Blake, NCEER Table 3, Eq.4)
K sigma = Normalized resistance factor (Fig. 14 from NCEER Liquefaction workshop, Harder Boulanger)
CSR = Resisting Cyclic Stress Ratio. It is a function of the content of fines
(Figure 2, NCEER Workshop, after Seed et al 1985))

Factor of Safety, F sub L is:

F sub L = CSR r / CSR i

A-10-006

Emean (%) 75 Sur.= psf 681 =top of ground el. Borehole Diamete 8 671 =water table El. acc. max = 0.61 g Earthq. M= 7.3
C_E 1.25 C_B 1.15 Cm= 1.07

ELEVATION BASE OF LAYER (ft.)	TOP OF LAYER ELEVATION (ft.)	LAYER THICKNESS L (ft.)	TOTAL OVERBUR. PRESS. (tsf)	EFFEC. OVERBUR. PRESS. (tsf)	DEPTH BELOW SURFACE (ft)	C_N	C_R	C_S	C_{ST}	TOTAL UNIT WEIGHT (pcf)	SAMPLER TYPE 1=SPT 2=CA,MOD.	SAMPLER LINED 1=UNLINED 2=LINED	FIELD BLOW COUNT N	STRESS REDUC. COEFF. rd	INDUCED CYCLIC STRESS RATIO	CORRECT BLOW COUNT Nc	EST. PERCENT OF FINES (%)	(N1)60cs	K sigma	RESIST. CYCLIC STRESS RATIO M=7.5	RESIST. CYCLIC STRESS RATIO Overburd Cor Mag Corr	FACTOR OF SAFETY (F sub L)	WILL IT LIQUEFY?
-	-	-	-	-	-	-				-	-		-	-	-	-	-		-	-		-	-
676	681	5	0.29	0.29	5.00	1.91	0.75	1.20	1.00	115	1	1	10	0.99	0.39	25	51.0	35	1.00	high N	high N	LARGE	AboveWT
671	676	5	0.58	0.58	10.00	1.35	0.75	1.00	0.67	115	2	2	27	0.98	0.39	27	51.0	38	1.00	high N	high N	LARGE	high N/fines
666	671	5	0.86	0.71	15.00	1.22	0.85	1.20	1.00	115	1	1	8	0.97	0.47	15	35.0		Does Not liquefy per Chinese Criteria LL>35				
661	666	5	1.15	0.84	20.00	1.12	0.85	1.00	0.67	115	2	2	15	0.95	0.52	14	10.0	16	1.00	0.17	0.18	0.35	yes
656	661	5	1.44	0.97	25.00	1.04	0.95	1.20	1.00	115	1	1	10	0.94	0.55	18	35.0		Does Not liquefy per Chinese Criteria LL>35				
651	656	5	1.73	1.10	30.00	0.97	0.95	1.00	0.67	115	2	2	15	0.93	0.58	14	51.0	22	0.99	0.24	0.26	0.44	fines
646	651	5	2.01	1.23	35.00	0.92	1.00	1.20	1.00	115	1	1	5	0.89	0.58	8	51.0	15	0.97	0.16	0.17	0.29	fines
641	646	5	2.30	1.36	40.00	0.87	1.00	1.00	0.67	115	2	2	17	0.85	0.57	15	51.0	23	0.95	0.26	0.26	0.46	fines
636	641	5	2.59	1.50	45.00	0.84	1.00	1.20	1.00	115	1	1	10	0.81	0.55	15	20.0	20	0.93	0.22	0.21	0.39	yes
631	636	5	2.88	1.63	50.00	0.80	1.00	1.00	0.67	115	2	2	18	0.77	0.54	14	51.0	22	0.91	0.24	0.24	0.44	fines
626	631	5	3.16	1.76	55.00	0.77	1.00	1.20	1.00	115	1	1	37	0.73	0.52	50	51.0	65	0.89	high N	high N	LARGE	high N/fines
621	626	5	3.45	1.89	60.00	0.74	1.00	1.00	0.67	115	2	2	100	0.69	0.50	72	51.0	92	0.88	high N	high N	LARGE	high N/fines
616	621	5	3.74	2.02	65.00	0.72	1.00	1.20	1.00	115	1	1	80	0.64	0.47	100	51.0	125	0.88	high N	high N	LARGE	high N/fines
611	616	5	4.03	2.15	70.00	0.70	1.00	1.00	0.67	115	2	2	100	0.60	0.45	67	51.0	86	0.87	high N	high N	LARGE	high N/fines

SR-57/SR-60 Confluence Phase I, Grand Avenue WB On-Ramp - Retaining Wall 2 SP 08-170

LIQUEFACTION ANALYSIS; ACC. = 0.61 g 09-Feb-12

Liquefaction analysis is performed following Seed's Procedure, outlined by Seed et al (1985), Seed and Harder (1990), updated NCEER (1997)

Emean/E60 = Energy Ratio to correct to standard 60% Energy
Surcharge = Any surcharge on top of the ground (psf)
acc. max = maximum peak acceleration at the ground surface (g's)
$^{1}C_N$ = square root of (100 kPa or 1.04427 tsf/effective overburden)
The induced cyclic stress ratio (CSR i) by a given peak ground acceleration (acc. max) is:

CSR i = 0.65 x acc max. x total normal stress x rd / (effective normal stress x g)

where: rd = stress reduction factor (Robertson and Wride (1996), Marcuson (USArmy Eng), per NCEER (1997))
g = acceleration of gravity

The resisting cyclic stress ratio (CSR r) is equal to:

CSR r = CSR x Cm x K sigma

where: Cm = Earthquake Magnitude Correction Factor (Blake, NCEER Table 3, Eq.4)
K sigma = Normalized resistance factor (Fig. 14 from NCEER Liquefaction workshop, Harder Boulanger)
CSR = Resisting Cyclic Stress Ratio. It is a function of the content of fines
(Figure 2, NCEER Workshop, after Seed et al 1985))

Factor of Safety, F sub L is:

F sub L = CSR r / CSR i

A-10-007

Emean (%) 75 Sur.= psf 690 =top of ground el. Borehole Diamete 8 671 =water table El. acc. max = 0.61 g Earthq. M= 7.3
C_E 1.25 C_B 1.15 Cm= 1.07

ELEVATION BASE OF LAYER (ft.)	TOP OF LAYER ELEVATION (ft.)	LAYER THICKNESS L (ft.)	TOTAL OVERBUR. PRESS. (tsf)	EFFEC. OVERBUR. PRESS. (tsf)	DEPTH BELOW SURFACE (ft)	C_N	C_R	C_E	C_{S1}	TOTAL UNIT WEIGHT (pcf)	SAMPLER TYPE 1=SPT 2=CA.MOD.	SAMPLER LINED 1=UNLINED 2=LINED	FIELD BLOW COUNT N	STRESS REDUC. COEFF. rd	INDUCED CYCLIC STRESS RATIO	CORRECT BLOW COUNT Nc	EST. PERCENT OF FINES (%)	(N1)60cs	K sigma	RESIST. CYCLIC STRESS RATIO M=7.5	RESIST. CYCLIC STRESS RATIO Overburd Cor Mag Corr	FACTOR OF SAFETY (F sub L)	WILL IT LIQUEFY?
-	-	-	-	-	-	-				-	-		-	-	-	-	-		-	-	-	-	-
685	690	5	0.29	0.29	5.00	1.91	0.75	1.20	1.00	115	1	1	5	0.99	0.39	13	51.0	21	1.00	0.23	0.24	0.62	AboveWT
680	685	5	0.58	0.58	10.00	1.35	0.75	1.00	0.67	115	2	2	45	0.98	0.39	44	37.0	58	1.00	high N	high N	LARGE	AboveWT
675	680	5	0.86	0.86	15.00	1.10	0.85	1.20	1.00	115	1	1	12	0.97	0.38	20	51.0	29	1.00	0.41	0.44	1.15	AboveWT
670	675	5	1.15	0.99	20.00	1.02	0.85	1.00	0.67	115	2	2	19	0.95	0.44	16	51.0	25	1.00	0.29	0.31	0.71	fines
665	670	5	1.44	1.13	25.00	0.96	0.95	1.20	1.00	115	1	1	8	0.94	0.48	13	51.0	21	0.98	0.23	0.24	0.50	fines
660	665	5	1.73	1.26	30.00	0.91	0.95	1.00	0.67	115	2	2	15	0.93	0.51	13	51.0	21	0.96	0.23	0.24	0.47	fines
655	660	5	2.01	1.39	35.00	0.87	1.00	1.20	1.00	115	1	1	5	0.89	0.51	8	37.0	15	0.95	0.16	0.16	0.32	yes
650	655	5	2.30	1.52	40.00	0.83	1.00	1.00	0.67	115	2	2	15	0.85	0.51	12	37.0		Does Not liquefy per Chinese Criteria LL>35				
645	650	5	2.59	1.65	45.00	0.80	1.00	1.20	1.00	115	1	1	4	0.81	0.50	6	51.0	13	0.91	0.14	0.14	0.27	fines
640	645	5	2.88	1.78	50.00	0.77	1.00	1.00	0.67	115	2	2	12	0.77	0.49	9	51.0	16	0.89	0.17	0.16	0.33	fines
635	640	5	3.16	1.91	55.00	0.74	1.00	1.20	1.00	115	1	1	17	0.73	0.48	22	51.0	32	0.87	high N	high N	LARGE	high N/fines
630	635	5	3.45	2.05	60.00	0.71	1.00	1.00	0.67	115	2	2	100	0.69	0.46	69	51.0	88	0.88	high N	high N	LARGE	high N/fines
625	630	5	3.74	2.18	65.00	0.69	1.00	1.20	1.00	115	1	1	63	0.64	0.44	76	51.0	97	0.87	high N	high N	LARGE	high N/fines
620	625	5	4.03	2.31	70.00	0.67	1.00	1.00	0.67	115	2	2	100	0.60	0.42	65	51.0	83	0.86	high N	high N	LARGE	high N/fines
615	620	5	4.31	2.44	75.00	0.65	1.00	1.20	1.00	115	1	1	28	0.56	0.39	32	51.0	44	0.84	high N	high N	LARGE	high N/fines
610	615	5	4.60	2.57	80.00	0.64	1.00	1.00	0.67	115	2	2	100	0.55	0.39	62	51.0	80	0.83	high N	high N	LARGE	high N/fines

Liquefaction Analysis with Cone Penetration Test (CPT) Data

Earth Mechanics, Inc.
17800 Newhope Street
Suite B
Fountain Valley, CA 92708

CPT Number: CPT-10-009
Project Name: SR-57/60 Confluence Phase I
Project Number: 08-170
Location: Grand Ave WB On-Ramp
City of Industry, California

Computed by: SP
Checked by:

Date: 02/01/12
Date:

Figure No.:

Reference:

1) Seed, R.B., et al, *Recent Advances in Soil Liquefaction Engineering: A Unified and Consistent Framework*, Keynote Presentation, 26th Annual ASCE Los Angeles Geotechnical Spring Seminar, April 30, 2003.
2) Youd, T.L. & Idriss, I.M., et al, *Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils*, ASCE Journal of Geotechnical and Geoenvironmental Engineering, Pp. 817-833, October 2001.
3) Pradel D., *Procedure to Evaluate Earthquake-induced Settlements in Dry Sandy Soils*, ASCE Journal of Geotechnical and Geoenvironmental Engineering, Pp. 364-368, April 1998.
4) Tokimatsu, K. & Seed, H.B., *Evaluation of Settlements in Sands due to Earthquake Shaking*, ASCE Journal of Geotechnical Engineering, Pp. 861-878, August 1987.
5) Jefferies, M.G. & Davies, M.P., *Use of CPT to Estimate Equivalent SPT N_{60}*, ASTM Geotechnical Testing Journal, Vol.17, No. 4, Pp. 458-567, 1993.
6) Robertson, P.K. et al, *Use of Piezometer Cone Data*, Proceedings of the ASCE Specialty Conference in Situ 86: Use of In Situ Tests in Geotechnical Engineering, Blacksburg, Pp. 1263-1280, 1986.

Surface Elevation = 676 ft MSL
Design Magnitude, M_w = 7.30
PGA, a_{max} = 0.61 g
Earthquake Scaling Factor, MSF = 1.071 for M_w = 7.3
Design Water Level = 671 ft MSL
Water Level at Investigation = 665 ft MSL
Req'd Factor of Safety = 1

Summary of Seismically Induced Settlement:

Dry Settlement (in)	0.067
Post-liquefaction Settlement (in)	1.981
Total Settlement (in)	**2.048**

Depth (ft)	Elev. (ft. MSL)	Unit Weight (pcf) γ'_{MOIST}	Unit Weight (pcf) γ'_{SAT}	q_c (tsf)	f_s (tsf)	Frict. Ratio (%)	% Fines	Equiv. N_{60}	Equiv. $(N_1)_{60}$	α	β	Equiv. $(N_1)_{60cs}$	Stresses at Exploration Water Level σ_v (tsf)	Stresses at Exploration Water Level σ'_v (tsf)	Stresses at Design Water Level σ_v (tsf)	Stresses at Design Water Level σ'_v (tsf)	I_c	Soil Type Character (SAND, SILT or non-LIQ CLAY)	Normalization of Tip Resistance n	Normalization of Tip Resistance C_Q	Normalization of Tip Resistance q_{c1N}	Fines Correction Kc	Fines Correction $(q_{c1N})_{cs}$	$CRR_{7.5}$	r_d	CSR_M	$CSR_{7.5}$	FS	a	b	Max Shear Modulus G_{max} (tsf)	Cyclic Shear Strain γ (%)	Norm. Vol. Strain ε_{vc} (%)	Dry Settle. ΔS (in)	Post-Liq. $(N_1)_{60cs}$	Post-Liq. Vol. Strain ε (%)	Layer Post-Liq. Settle. ΔS (in)
0.33	675.7	115.0	115.0	9.5	0.9	9.5	33	2	16	4.88	1.18	26	0.019	0.019	0.019	0.019	2.55	SILT	0.7	1.70	15.3	3.04	46.4	0.09	0.999	0.40	0.370	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
0.49	675.5	115.0	115.0	6.8	0.6	8.8	39	2	11	5.00	1.20	18	0.028	0.028	0.028	0.028	2.67	SILT	0.7	1.70	10.9	3.79	41.4	0.08	0.999	0.40	0.370	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
0.65	675.3	115.0	115.0	3.2	0.4	12.5	46	1	5	5.00	1.20	11	0.038	0.038	0.038	0.038	2.79	non-LIQ CLAY	1	1.70	NA	4.71	non-LIQ	non-LIQ	0.998	0.40	0.370	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
0.82	675.2	115.0	115.0	4.6	3.4	73.9	93	2	10	5.00	1.20	16	0.047	0.047	0.047	0.047	3.43	non-LIQ CLAY	1	1.70	NA	12.86	non-LIQ	non-LIQ	0.998	0.40	0.370	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
0.98	675.0	115.0	115.0	11.5	3.1	27.0	52	3	15	5.00	1.20	23	0.056	0.056	0.056	0.056	2.90	non-LIQ CLAY	1	1.70	NA	5.66	non-LIQ	non-LIQ	0.998	0.40	0.370	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
1.15	674.9	115.0	115.0	353.7	3.9	1.1	0	55	220	0.00	1.00	220	0.066	0.066	0.066	0.066	1.31	SAND	0.5	1.70	568.3	1.00	568.3	non-LIQ	0.997	0.40	0.370	Above Water	0.13	41526	567.9	0.01	0.00	0.000	NA	NA	0.000
1.31	674.7	115.0	115.0	225.2	3.8	1.7	4	38	142	0.00	1.00	142	0.075	0.075	0.075	0.075	1.55	SAND	0.5	1.70	361.8	1.00	361.8	non-LIQ	0.997	0.40	0.370	Above Water	0.13	38404	523.6	0.01	0.00	0.000	NA	NA	0.000
1.48	674.5	115.0	115.0	107.6	3.4	3.2	12	21	73	1.42	1.03	77	0.085	0.085	0.085	0.085	1.95	SAND	0.5	1.70	172.9	1.24	214.1	non-LIQ	0.997	0.40	0.370	Above Water	0.13	35693	446.5	0.02	0.00	0.000	NA	NA	0.000
1.64	674.4	115.0	115.0	56.9	3.1	5.3	22	13	44	3.91	1.09	51	0.094	0.094	0.094	0.094	2.28	SAND	0.5	1.70	94.6	1.89	179.3	non-LIQ	0.996	0.39	0.360	Above Water	0.13	33560	395.3	0.03	0.01	0.000	NA	NA	0.000
1.80	674.2	115.0	115.0	46.0	2.8	5.8	26	11	35	4.35	1.12	44	0.104	0.104	0.104	0.104	2.38	SAND	0.5	1.70	77.1	2.23	172.0	non-LIQ	0.996	0.39	0.360	Above Water	0.13	31737	366.3	0.04	0.02	0.001	NA	NA	0.000
1.97	674.0	115.0	115.0	37.3	2.5	6.7	31	9	28	4.76	1.16	37	0.113	0.113	0.113	0.113	2.50	SAND	0.5	1.70	59.9	2.78	166.7	non-LIQ	0.995	0.39	0.360	Above Water	0.13	30065	373.0	0.06	0.04	0.001	NA	NA	0.000
2.13	673.8	115.0	115.0	36.3	2.0	5.5	29	9	25	4.60	1.14	34	0.122	0.122	0.122	0.122	2.45	SAND	0.5	1.70	58.3	2.53	147.7	0.38	0.995	0.39	0.360	Above Water	0.13	28688	376.4	0.07	0.05	0.002	NA	NA	0.000
2.30	673.7	115.0	115.0	27.6	1.7	6.1	34	7	20	4.92	1.19	28	0.132	0.132	0.132	0.132	2.57	SAND	0.5	1.70	44.7	3.14	140.2	0.34	0.995	0.39	0.360	Above Water	0.13	27397	360.0	0.09	0.09	0.004	NA	NA	0.000
2.46	673.5	115.0	115.0	30.3	1.7	5.6	32	7	20	4.82	1.17	29	0.141	0.141	0.141	0.141	2.52	SAND	0.5	1.70	48.7	2.90	141.1	0.34	0.994	0.39	0.360	Above Water	0.13	26313	376.2	0.09	0.08	0.003	NA	NA	0.000
2.62	673.4	115.0	115.0	31.9	1.7	5.3	31	8	21	4.76	1.16	29	0.151	0.151	0.151	0.151	2.50	SAND	0.5	1.70	51.3	2.78	142.5	0.35	0.994	0.39	0.360	Above Water	0.13	25337	389.4	0.08	0.08	0.003	NA	NA	0.000
2.79	673.2	115.0	115.0	24.4	1.6	6.6	33	6	16	4.89	1.18	23	0.160	0.160	0.160	0.160	2.55	SILT	0.7	1.70	39.2	3.05	119.7	0.24	0.993	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
2.95	673.1	115.0	115.0	24.4	1.5	6.1	33	6	15	4.86	1.18	23	0.170	0.170	0.170	0.170	2.54	SILT	0.7	1.70	39.2	2.99	117.2	0.23	0.993	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
3.12	672.9	115.0	115.0	28.0	1.5	5.4	34	7	17	4.92	1.19	25	0.179	0.179	0.179	0.179	2.57	SAND	0.5	1.70	45.0	3.12	140.4	0.34	0.993	0.39	0.360	Above Water	0.13	22816	399.2	0.12	0.14	0.006	NA	NA	0.000
3.28	672.7	115.0	115.0	30.2	1.6	5.3	33	8	18	4.87	1.18	26	0.189	0.189	0.189	0.189	2.55	SAND	0.5	1.70	48.5	3.02	146.5	0.37	0.992	0.39	0.360	Above Water	0.13	22142	415.1	0.12	0.13	0.005	NA	NA	0.000
3.45	672.6	115.0	115.0	26.9	1.5	5.6	31	7	15	4.78	1.16	23	0.198	0.198	0.198	0.198	2.51	SILT	0.7	1.70	43.2	2.83	122.3	0.25	0.992	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
3.61	672.4	115.0	115.0	27.8	1.5	5.4	35	7	16	4.97	1.20	24	0.208	0.208	0.208	0.208	2.59	SAND	0.5	1.70	44.7	3.27	146.2	0.37	0.992	0.39	0.360	Above Water	0.13	20904	419.9	0.14	0.18	0.007	NA	NA	0.000
3.77	672.2	115.0	115.0	32.1	1.5	4.7	31	8	17	4.77	1.16	25	0.217	0.217	0.217	0.217	2.51	SAND	0.5	1.70	51.6	2.81	145.1	0.36	0.991	0.39	0.360	Above Water	0.13	20367	441.0	0.13	0.14	0.005	NA	NA	0.000
3.94	672.1	115.0	115.0	36.2	1.2	3.3	25	8	18	4.30	1.12	24	0.227	0.227	0.227	0.227	2.37	SAND	0.5	1.70	58.2	2.19	127.3	0.27	0.991	0.39	0.360	Above Water	0.13	19835	455.8	0.12	0.13	0.005	NA	NA	0.000
4.10	671.9	115.0	115.0	78.8	1.9	2.4	14	16	33	2.29	1.04	37	0.236	0.236	0.236	0.236	2.05	SAND	0.5	1.70	126.6	1.37	173.1	non-LIQ	0.990	0.39	0.360	Above Water	0.13	19367	572.4	0.06	0.03	0.001	NA	NA	0.000
4.27	671.7	115.0	115.0	87.4	2.4	2.7	15	18	37	2.48	1.05	41	0.246	0.246	0.246	0.246	2.07	SAND	0.5	1.70	140.4	1.40	197.0	non-LIQ	0.990	0.39	0.360	Above Water	0.13	18901	602.4	0.05	0.02	0.001	NA	NA	0.000
4.43	671.6	115.0	115.0	41.0	2.7	6.6	34	10	21	4.95	1.19	30	0.255	0.255	0.255	0.255	2.58	SAND	0.5	1.70	65.9	3.20	210.6	non-LIQ	0.990	0.39	0.360	Above Water	0.13	18488	510.6	0.10	0.09	0.003	NA	NA	0.000
4.59	671.4	115.0	115.0	38.2	1.7	4.5	29	9	18	4.67	1.15	26	0.264	0.264	0.264	0.264	2.47	SAND	0.5	1.70	61.4	2.63	161.2	non-LIQ	0.989	0.39	0.360	Above Water	0.13	18099	496.0	0.12	0.13	0.005	NA	NA	0.000
4.76	671.2	115.0	115.0	35.7	1.7	4.8	32	9	17	4.80	1.17	25	0.274	0.274	0.274	0.274	2.52	SAND	0.5	1.70	57.4	2.86	164.2	non-LIQ	0.989	0.39	0.360	Above Water	0.13	17708	494.6	0.13	0.15	0.006	NA	NA	0.000
4.92	671.1	115.0	115.0	32.3	1.7	5.3	35	8	16	4.96	1.19	24	0.283	0.283	0.283	0.283	2.58	SAND	0.5	1.70	51.9	3.24	168.0	non-LIQ	0.989	0.39	0.360	Above Water	0.13	17360	488.9	0.15	0.19	0.007	NA	NA	0.000
5.09	670.9	115.0	115.0	30.2	1.7	5.6	33	8	14	4.90	1.18	22	0.293	0.293	0.293	0.290	2.56	SILT	0.7	1.70	48.5	3.09	149.8	0.39	0.988	0.40	0.370	1.06	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
5.25	670.8	115.0	115.0	28.2	1.7	6.0	36	7	14	5.00	1.20	21	0.302	0.302	0.302	0.297	2.61	SILT	0.7	1.70	45.3	3.37	152.9	0.41	0.988	0.40	0.370	1.11	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
5.41	670.6	115.0	115.0	30.5	1.6	5.2	33	8	14	4.87	1.18	21	0.311	0.311	0.311	0.306	2.55	SILT	0.7	1.70	49.0	3.01	147.4	0.38	0.987	0.40	0.370	1.02	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
5.58	670.4	115.0	115.0	31.7	1.4	4.4	33	8	14	4.89	1.18	22	0.321	0.321	0.321	0.316	2.55	SAND	0.5	1.70	50.9	3.05	155.4	0.43	0.987	0.40	0.370	1.16	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
5.74	670.3	115.0	115.0	32.7	1.5	4.6	33	8	15	4.90	1.18	22	0.330	0.330	0.330	0.325	2.56	SAND	0.5	1.70	52.5	3.09	162.4	non-LIQ	0.987	0.40	0.370	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
5.91	670.1	115.0	115.0	30.4	1.7	5.6	35	8	14	4.96	1.19	21	0.340	0.340	0.340	0.335	2.59	SILT	0.7	1.70	48.8	3.24	158.1	0.45	0.986	0.40	0.370	1.21	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
6.07	669.9	115.0	115.0	30.7	1.9	6.2	36	8	14	5.00	1.20	22	0.349	0.349	0.349	0.344	2.62	SILT	0.7	1.70	49.3	3.46	170.7	non-LIQ	0.986	0.40	0.370	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
6.23	669.8	115.0	115.0	41.4	2.5	6.0	35	11	18	5.00	1.20	27	0.358	0.358	0.358	0.353	2.59	SAND	0.5	1.70	66.5	3.29	218.8	non-LIQ	0.985	0.40	0.370	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
6.40	669.6	115.0	115.0	59.5	2.5	4.2	25	14	23	4.33	1.12	30	0.368	0.368	0.368	0.363	2.37	SAND	0.5	1.70	95.4	2.21	210.9	non-LIQ	0.985	0.40	0.370	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
6.56	669.4	115.0	115.0	45.3	2.2	4.9	31	11	19	4.76	1.16	26	0.377	0.377	0.377	0.372	2.50	SAND	0.5	1.67	71.7	2.78	199.7	non-LIQ	0.985	0.40	0.370	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
6.73	669.3	115.0	115.0	56.2	3.1	5.5	30	14	23	4.72	1.16	31	0.387	0.387	0.387	0.382	2.49	SAND	0.5	1.65	87.6	2.72	238.6	non-LIQ	0.984	0.40	0.370	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
6.89	669.1	115.0	115.0	121.4	2.8	2.3	13	24	39	1.75	1.03	42	0.396	0.396	0.396	0.391	1.99	SAND	0.5	1.63	187.5	1.28	240.5	non-LIQ	0.984	0.40	0.370	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
7.05	669.0	115.0	115.0	112.8	3.8	3.4	17	23	38	3.03	1.06	43	0.405	0.405	0.405	0.400	2.14	SAND	0.5	1.62	172.2	1.53	264.3	non-LIQ	0.984	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
7.22	668.8	115.0	115.0	117.1	3.5	3.0	16	24	38	2.66	1.05	43	0.415	0.415	0.415	0.410	2.09	SAND	0.5	1.60	176.7	1.44	254.7	non-LIQ	0.983	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
7.38	668.6	115.0	115.0	90.1	2.8	3.1	18	19	30	3.29	1.07	35	0.424	0.424	0.424	0.419	2.18	SAND	0.5	1.58	134.5	1.61	217.1	non-LIQ	0.983	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
7.55	668.5	115.0	115.0	89.5	2.4	2.7	17	19	29	2.97	1.06	34	0.434	0.434	0.434	0.429	2.13	SAND	0.5	1.56	132.1	1.52	200.5	non-LIQ	0.982	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
7.71	668.3	115.0	115.0	149.7	2.7	1.8	9	28	43	0.70	1.02	45	0.443	0.443	0.443	0.438	1.86	SAND	0.5	1.54	218.6	1.15	252.3	non-LIQ	0.982	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
7.87	668.1	115.0	115.0	111.8	2.4	2.1	13	22	34	1.89	1.04	37	0.453	0.453	0.453	0.448	2.00	SAND	0.5	1.53	161.6	1.30	210.6	non-LIQ	0.982	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
8.04	668.0	115.0	115.0	83.9	2.7	3.2	20	18	27	3.57	1.08	33	0.462	0.462	0.462	0.457	2.22	SAND	0.5	1.51	120.0	1.72	206.4	non-LIQ	0.981	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
8.20	667.8	115.0	115.0	64.0	2.3	3.6	24	14	22	4.17	1.11	28	0.472	0.472	0.472	0.467	2.34	SAND	0.5	1.50	90.6	2.07	187.9	non-LIQ	0.981	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
8.37	667.6	115.0	115.0	59.0	2.4	4.1	27	14	20	4.44	1.13	27	0.481	0.481	0.481	0.476	2.40	SAND	0.5	1.48	82.7	2.33	192.7	non-LIQ	0.980	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
8.53	667.5	115.0	115.0	41.1	2.7	6.6	37	11	16	5.00	1.20	24	0.490	0.490	0.490	0.485	2.63	SILT	0.7	1.70	65.0	3.50	231.0	non-LIQ	0.980	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000

Liquefaction Analysis with Cone Penetration Test (CPT) Data

Depth (ft)	Elev. (ft, MSL)	Unit Weight (pcf) γ'_{MOIST}	Unit Weight (pcf) γ'_{SAT}	q_c (tsf)	f_s (tsf)	Frict. Ratio (%)	% Fines	Equiv. N_{60}	Equiv. $(N_1)_{60}$	α	β	Equiv. $(N_1)_{60cs}$	Stresses at Exploration Water Level σ_v (tsf)	Stresses at Exploration Water Level σ'_v (tsf)	Stresses at Design Water Level σ_v (tsf)	Stresses at Design Water Level σ'_v (tsf)	I_c	Soil Type Character (SAND, SILT or non-LIQ CLAY)	Normalization of Tip Resistance n	Normalization of Tip Resistance C_Q	Normalization of Tip Resistance q_{c1N}	Fines Correction Kc	Fines Correction $(q_{c1N})_{cs}$	$CRR_{7.5}$	r_d	CSR_M	$CSR_{7.5}$	FS	a	b	Max Shear Modulus G_{max} (tsf)	Cyclic Shear Strain γ (%)	Norm. Vol. Strain ε_{Nc} (%)	Dry Settle. ΔS (in)	Post-Liq. $(N_1)_{60cs}$	Post-Liq. Vol. Strain ε (%)	Layer Post-Liq. Settle. ΔS (in)
8.69	667.3	115.0	115.0	54.5	2.6	4.8	30	13	19	4.71	1.15	27	0.500	0.500	0.500	0.495	2.49	SAND	0.5	1.46	75.0	2.70	202.1	non-LIQ	0.980	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
8.86	667.1	115.0	115.0	37.6	2.2	5.9	36	10	14	5.00	1.20	22	0.509	0.509	0.509	0.504	2.62	SILT	0.7	1.67	59.3	3.46	205.2	non-LIQ	0.979	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
9.02	667.0	115.0	115.0	26.4	1.7	6.4	40	7	10	5.00	1.20	17	0.519	0.519	0.519	0.514	2.70	non-LIQ CLAY	1	1.70	NA	4.00	non-LIQ	non-LIQ	0.979	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
9.19	666.8	115.0	115.0	20.8	1.2	5.6	43	6	8	5.00	1.20	15	0.528	0.528	0.528	0.523	2.74	non-LIQ CLAY	1	1.70	NA	4.32	non-LIQ	non-LIQ	0.979	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
9.35	666.7	115.0	115.0	18.8	1.2	6.4	47	5	8	5.00	1.20	14	0.538	0.538	0.538	0.533	2.81	non-LIQ CLAY	1	1.70	NA	4.89	non-LIQ	non-LIQ	0.978	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
9.51	666.5	115.0	115.0	19.5	1.0	5.1	43	5	7	5.00	1.20	14	0.547	0.547	0.547	0.542	2.74	non-LIQ CLAY	1	1.70	NA	4.28	non-LIQ	non-LIQ	0.978	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
9.68	666.3	115.0	115.0	13.9	1.0	7.2	56	4	6	5.00	1.20	12	0.557	0.557	0.557	0.551	2.96	non-LIQ CLAY	1	1.70	NA	6.30	non-LIQ	non-LIQ	0.977	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
9.84	666.2	115.0	115.0	15.6	0.9	5.8	49	5	6	5.00	1.20	13	0.566	0.566	0.566	0.561	2.86	non-LIQ CLAY	1	1.70	NA	5.31	non-LIQ	non-LIQ	0.977	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
10.01	666.0	115.0	115.0	16.9	0.8	4.7	45	5	6	5.00	1.20	13	0.576	0.576	0.576	0.570	2.78	non-LIQ CLAY	1	1.70	NA	4.60	non-LIQ	non-LIQ	0.977	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
10.17	665.8	115.0	115.0	17.9	0.7	3.9	41	5	7	5.00	1.20	13	0.585	0.585	0.585	0.580	2.71	non-LIQ CLAY	1	1.70	NA	4.05	non-LIQ	non-LIQ	0.976	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
10.34	665.7	115.0	115.0	17.4	0.7	4.0	42	5	6	5.00	1.20	13	0.595	0.595	0.595	0.589	2.73	non-LIQ CLAY	1	1.70	NA	4.23	non-LIQ	non-LIQ	0.976	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
10.50	665.5	115.0	115.0	15.3	0.6	3.9	44	4	6	5.00	1.20	12	0.604	0.604	0.604	0.599	2.77	non-LIQ CLAY	1	1.70	NA	4.57	non-LIQ	non-LIQ	0.976	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
10.66	665.3	115.0	115.0	15.0	0.5	3.3	43	4	5	5.00	1.20	12	0.613	0.613	0.613	0.608	2.74	non-LIQ CLAY	1	1.70	NA	4.30	non-LIQ	non-LIQ	0.975	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
10.83	665.2	115.0	115.0	19.1	0.7	3.7	40	5	7	5.00	1.20	13	0.623	0.623	0.623	0.617	2.69	non-LIQ CLAY	1	1.70	NA	3.91	non-LIQ	non-LIQ	0.975	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
10.99	665.0	115.0	115.0	21.7	0.9	4.1	40	6	8	5.00	1.20	14	0.632	0.632	0.632	0.627	2.69	non-LIQ CLAY	1	1.67	NA	3.90	non-LIQ	non-LIQ	0.974	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
11.16	664.8	115.0	115.0	22.9	1.1	4.8	41	6	8	5.00	1.20	15	0.642	0.637	0.642	0.636	2.72	non-LIQ CLAY	1	1.66	NA	4.11	non-LIQ	non-LIQ	0.974	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
11.32	664.7	115.0	115.0	21.3	1.1	5.2	44	6	8	5.00	1.20	14	0.651	0.641	0.651	0.641	2.76	non-LIQ CLAY	1	1.65	NA	4.48	non-LIQ	non-LIQ	0.974	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
11.48	664.5	115.0	115.0	19.4	1.0	5.2	46	6	7	5.00	1.20	13	0.660	0.645	0.660	0.645	2.80	non-LIQ CLAY	1	1.64	NA	4.75	non-LIQ	non-LIQ	0.973	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
11.65	664.4	115.0	115.0	16.7	0.9	5.4	50	5	6	5.00	1.20	13	0.670	0.650	0.670	0.650	2.86	non-LIQ CLAY	1	1.63	NA	5.34	non-LIQ	non-LIQ	0.973	0.40	0.370	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
11.81	664.2	115.0	115.0	13.9	0.7	5.0	53	4	5	5.00	1.20	11	0.679	0.654	0.679	0.654	2.91	non-LIQ CLAY	1	1.62	NA	5.79	non-LIQ	non-LIQ	0.972	0.40	0.370	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
11.98	664.0	115.0	115.0	11.2	0.6	5.4	59	4	5	5.00	1.20	10	0.689	0.658	0.689	0.658	3.01	non-LIQ CLAY	1	1.61	NA	6.83	non-LIQ	non-LIQ	0.972	0.40	0.370	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
12.14	663.9	115.0	115.0	8.7	0.5	5.7	67	3	4	5.00	1.20	10	0.698	0.662	0.698	0.662	3.13	non-LIQ CLAY	1	1.60	NA	8.24	non-LIQ	non-LIQ	0.972	0.41	0.380	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
12.30	663.7	115.0	115.0	7.3	0.4	5.5	72	3	3	5.00	1.20	9	0.707	0.667	0.707	0.667	3.18	non-LIQ CLAY	1	1.59	NA	9.03	non-LIQ	non-LIQ	0.971	0.41	0.380	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
12.47	663.5	115.0	115.0	6.5	0.3	4.6	72	2	3	5.00	1.20	9	0.717	0.671	0.717	0.671	3.19	non-LIQ CLAY	1	1.58	NA	9.09	non-LIQ	non-LIQ	0.971	0.41	0.380	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
12.63	663.4	115.0	115.0	6.4	0.3	4.7	73	2	3	5.00	1.20	9	0.726	0.675	0.726	0.675	3.20	non-LIQ CLAY	1	1.57	NA	9.29	non-LIQ	non-LIQ	0.971	0.41	0.380	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
12.80	663.2	115.0	115.0	7.2	0.3	4.2	67	2	3	5.00	1.20	9	0.736	0.680	0.736	0.680	3.13	non-LIQ CLAY	1	1.56	NA	8.25	non-LIQ	non-LIQ	0.970	0.42	0.390	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
12.96	663.0	115.0	115.0	8.6	0.4	4.7	64	3	4	5.00	1.20	9	0.745	0.684	0.745	0.684	3.09	non-LIQ CLAY	1	1.55	NA	7.75	non-LIQ	non-LIQ	0.970	0.42	0.390	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
13.12	662.9	115.0	115.0	9.1	0.3	3.3	57	3	4	5.00	1.20	9	0.754	0.688	0.754	0.688	2.97	non-LIQ CLAY	1	1.54	NA	6.46	non-LIQ	non-LIQ	0.969	0.42	0.390	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
13.29	662.7	115.0	115.0	7.6	0.3	3.9	65	3	3	5.00	1.20	9	0.764	0.693	0.764	0.693	3.10	non-LIQ CLAY	1	1.53	NA	7.90	non-LIQ	non-LIQ	0.969	0.42	0.390	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
13.45	662.6	115.0	115.0	6.8	0.2	2.9	64	2	3	5.00	1.20	8	0.773	0.697	0.773	0.697	3.07	non-LIQ CLAY	1	1.52	NA	7.60	non-LIQ	non-LIQ	0.969	0.43	0.400	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
13.62	662.4	115.0	115.0	6.6	0.2	3.0	65	2	3	5.00	1.20	8	0.783	0.701	0.783	0.701	3.10	non-LIQ CLAY	1	1.51	NA	7.89	non-LIQ	non-LIQ	0.968	0.43	0.400	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
13.78	662.2	115.0	115.0	6.9	0.2	2.9	63	2	3	5.00	1.20	8	0.792	0.706	0.792	0.706	3.07	non-LIQ CLAY	1	1.50	NA	7.56	non-LIQ	non-LIQ	0.968	0.43	0.400	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
13.94	662.1	115.0	115.0	7.0	0.2	2.9	63	2	3	5.00	1.20	8	0.802	0.710	0.802	0.710	3.06	non-LIQ CLAY	1	1.49	NA	7.48	non-LIQ	non-LIQ	0.967	0.43	0.400	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
14.11	661.9	115.0	115.0	7.5	0.2	2.7	60	2	3	5.00	1.20	9	0.811	0.714	0.811	0.714	3.02	non-LIQ CLAY	1	1.48	NA	6.96	non-LIQ	non-LIQ	0.967	0.44	0.410	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
14.27	661.7	115.0	115.0	8.3	0.2	2.4	55	3	3	5.00	1.20	9	0.821	0.719	0.821	0.719	2.95	non-LIQ CLAY	1	1.47	NA	6.25	non-LIQ	non-LIQ	0.967	0.44	0.410	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
14.44	661.6	115.0	115.0	8.9	0.3	3.4	59	3	3	5.00	1.20	9	0.830	0.723	0.830	0.723	3.01	non-LIQ CLAY	1	1.46	NA	6.88	non-LIQ	non-LIQ	0.966	0.44	0.410	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
14.60	661.4	115.0	115.0	9.8	0.4	4.1	60	3	4	5.00	1.20	10	0.839	0.727	0.839	0.727	3.03	non-LIQ CLAY	1	1.46	NA	7.04	non-LIQ	non-LIQ	0.966	0.44	0.410	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
14.76	661.2	115.0	115.0	10.9	0.4	3.7	56	3	4	5.00	1.20	10	0.849	0.731	0.849	0.731	2.96	non-LIQ CLAY	1	1.45	NA	6.29	non-LIQ	non-LIQ	0.966	0.44	0.410	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
14.93	661.1	115.0	115.0	11.3	0.4	3.5	54	3	4	5.00	1.20	10	0.858	0.736	0.858	0.736	2.94	non-LIQ CLAY	1	1.44	NA	6.07	non-LIQ	non-LIQ	0.965	0.45	0.420	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
15.09	660.9	115.0	115.0	11.0	0.5	4.5	60	4	4	5.00	1.20	10	0.868	0.740	0.868	0.740	3.02	non-LIQ CLAY	1	1.43	NA	6.94	non-LIQ	non-LIQ	0.965	0.45	0.420	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
15.26	660.7	115.0	115.0	11.4	0.5	4.4	58	4	4	5.00	1.20	10	0.877	0.745	0.877	0.745	3.00	non-LIQ CLAY	1	1.42	NA	6.71	non-LIQ	non-LIQ	0.964	0.45	0.420	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
15.42	660.6	115.0	115.0	12.0	0.4	3.3	52	4	4	5.00	1.20	10	0.887	0.749	0.887	0.749	2.90	non-LIQ CLAY	1	1.41	NA	5.75	non-LIQ	non-LIQ	0.964	0.45	0.420	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
15.58	660.4	115.0	115.0	10.6	0.5	4.7	62	3	4	5.00	1.20	10	0.896	0.753	0.896	0.753	3.05	non-LIQ CLAY	1	1.41	NA	7.32	non-LIQ	non-LIQ	0.964	0.45	0.420	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
15.75	660.3	115.0	115.0	11.0	0.4	3.6	56	3	4	5.00	1.20	10	0.906	0.757	0.906	0.757	2.97	non-LIQ CLAY	1	1.40	NA	6.39	non-LIQ	non-LIQ	0.963	0.46	0.430	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
15.91	660.1	115.0	115.0	11.2	0.4	3.6	56	3	4	5.00	1.20	10	0.915	0.762	0.915	0.762	2.96	non-LIQ CLAY	1	1.39	NA	6.29	non-LIQ	non-LIQ	0.963	0.46	0.430	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
16.08	659.9	115.0	115.0	11.1	0.4	3.6	56	3	4	5.00	1.20	10	0.925	0.766	0.925	0.766	2.97	non-LIQ CLAY	1	1.38	NA	6.38	non-LIQ	non-LIQ	0.963	0.46	0.430	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
16.24	659.8	115.0	115.0	11.1	0.3	2.7	52	3	4	5.00	1.20	10	0.934	0.770	0.934	0.770	2.89	non-LIQ CLAY	1	1.37	NA	5.64	non-LIQ	non-LIQ	0.962	0.46	0.430	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
16.40	659.6	115.0	115.0	10.8	0.4	3.7	58	3	4	5.00	1.20	10	0.943	0.775	0.943	0.775	2.99	non-LIQ CLAY	1	1.37	NA	6.63	non-LIQ	non-LIQ	0.962	0.46	0.430	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
16.57	659.4	115.0	115.0	12.0	0.4	3.3	53	4	4	5.00	1.20	10	0.953	0.779	0.953	0.779	2.92	non-LIQ CLAY	1	1.36	NA	5.92	non-LIQ	non-LIQ	0.961	0.47	0.440	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
16.73	659.3	115.0	115.0	12.1	0.4	3.3	53	4	4	5.00	1.20	10	0.962	0.783	0.962	0.783	2.92	non-LIQ CLAY	1	1.35	NA	5.89	non-LIQ	non-LIQ	0.961	0.47	0.440	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
16.90	659.1	115.0	115.0	12.1	0.4	3.3	53	4	4	5.00	1.20	10	0.972	0.788	0.972	0.788	2.92	non-LIQ CLAY	1	1.34	NA	5.91	non-LIQ	non-LIQ	0.961	0.47	0.440	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
17.06	658.9	115.0	115.0	12.7	0.5	3.9	55	4	5	5.00	1.20	10	0.981	0.792	0.981	0.792	2.95	non-LIQ CLAY	1	1.34	NA	6.22	non-LIQ	non-LIQ	0.960	0.47	0.440	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
17.23	658.8	115.0	115.0	13.6	0.5	3.7	53	4	5	5.00	1.20	11	0.991	0.796	0.991	0.796	2.91	non-LIQ CLAY	1	1.33	NA	5.78	non-LIQ	non-LIQ	0.960	0.47	0.440	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
17.39	658.6	115.0	115.0	13.6	0.7	5.1	59	4	5	5.00	1.20	11	1.000	0.801	1.000	0.801	3.00	non-LIQ CLAY	1	1.32	NA	6.79	non-LIQ	non-LIQ	0.959	0.48	0.450	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
17.55	658.5	115.0	115.0	16.5	0.9	5.5	55	5	6	5.00	1.20	12	1.009	0.805	1.009	0.805	2.95	non-LIQ CLAY	1	1.31	NA	6.22	non-LIQ	non-LIQ	0.959	0.48	0.450	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
17.72	658.3	115.0	115.0	22.9	1.2	5.2	48	7	8	5.00	1.20	14	1.019	0.809	1.019	0.809	2.83	non-LIQ CLAY	1	1.31	NA	5.02	non-LIQ	non-LIQ	0.959	0.48	0.450	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
17.88	658.1	115.0	115.0	21.3	1.0	4.7	47	6	7	5.00	1.20	13	1.028	0.813	1.028	0.813	2.82	non-LIQ CLAY	1	1.30	NA	4.97	non-LIQ	non-LIQ	0.958	0.48	0.450	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
18.05	658.0	115.0	115.0	18.2	1.2	6.6	57	6	7	5.00	1.20	13	1.038	0.818	1.038	0.818	2.96	non-LIQ CLAY	1	1.29	NA	6.52	non-LIQ	non-LIQ	0.958	0.48	0.450	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
18.21	657.8	115.0	115.0	19.9	1.1	5.5	52	6	7	5.00	1.20	13	1.047	0.822	1.047	0.822	2.90	non-LIQ CLAY	1	1.29	NA	5.67	non-LIQ	non-LIQ	0.958	0.48	0.450	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
18.37	657.6	115.0	115.0	18.5	1.1	5.9	55	6	6	5.00	1.20	13	1.056	0.826	1.056	0.826	2.95	non-LIQ CLAY	1	1.28	NA	6.17	non-LIQ	non-LIQ	0.957	0.49	0.460	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
18.54	657.5	115.0	115.0	18.7	1.2	6.4	56	6	7	5.00	1.20	13	1.066	0.831	1.066	0.831	2.97	non-LIQ CLAY	1	1.27	NA	6.39	non-LIQ	non-LIQ	0.957	0.49	0.460	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
18.70	657.3	115.0	115.0	32.9	1.5	4.6	39	9	10	5.00	1.20	17	1.075	0.835	1.075	0.835	2.67	non-LIQ CLAY	1	1.27	NA	3.81	non-LIQ	non-LIQ	0.956	0.49	0.460	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
18.87	657.1	115.0	115.0	32.0	1.6	5.0	41	9	10	5.00	1.20	17	1.085	0.839	1.085	0.839	2.71	non-LIQ CLAY	1	1.26	NA	4.10	non-LIQ	non-LIQ	0.956	0.49	0.460	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
19.03	657.0	115.0	115.0	24.5	1.1	4.5	44	7	8	5.00	1.20	14	1.094	0.844	1.094	0.844	2.77	non-LIQ CLAY	1	1.25	NA	4.56	non-LIQ	non-LIQ	0.956	0.49	0.460	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
19.19	656.8	115.0	115.0	38.3	0.7	1.8	26	9	10	4.42	1.13	16	1.103	0.848	1.103	0.848	2.40	SAND	0.5	1.12	40.4	2.31	93.3	0.16	0.955	0.49	0.460	0.34	NA	NA	NA	NA	NA	0.000	12	2.310	0.044
19.36	656.6	115.0	115.0	41.9	0.5	1.2	21	9	10	3.76	1.09	15	1.113	0.852	1.113	0.852	2.26	SAND	0.5	1.11	44.1	1.81	80.0	0.13	0.955	0.49	0.460	0.28	NA	NA	NA	NA	NA	0.000	12	2.310	0.047
19.52	656.5	115.0	115.0	29.5	0.5	1.7	30	7	8	4.68	1.15	14	1.122	0.857	1.122	0.857	2.48	SAND	0.5	1.11	31.0	2.65	82.2	0.13	0.954	0.50	0.470	0.28	NA	NA	NA	NA	NA	0.000	10	2.620	0.050
19.69	656.3	115.0	115.0	19.3	0.5	2.5	41	5	6	5.00	1.20	12	1.132	0.861	1.132	0.861	2.71	non-LIQ CLAY	1	1.23	NA	4.09	non-LIQ	non-LIQ	0.954	0.50	0.470	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
19.85	656.2	115.0	115.0	19.9	0.6	3.0	43	5	6	5.00	1.20	12	1.141	0.865	1.141	0.865	2.74	non-LIQ CLAY	1	1.22	NA	4.33	non-LIQ	non-LIQ	0.954	0.50	0.470	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
20.01	656.0	115.0	115.0	19.1	0.6	3.1	44	5	6	5.00	1.20	12	1.151	0.869	1.151	0.869	2.77	non-LIQ CLAY	1	1.22	NA	4.56	non-LIQ	non-LIQ	0.953	0.50	0.470	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
20.18	655.8	115.0	115.0	20.5	0.6	2.9	42	6	6	5.00	1.20	12	1.160	0.874	1.160	0.874	2.73	non-LIQ CLAY	1	1.21	NA	4.21	non-LIQ	non-LIQ	0.953	0.50	0.470	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
20.34	655.7	115.0	115.0	37.0	0.5	1.4	24	8	9	4.18	1.11	14	1.170	0.878	1.170	0.878	2.34	SAND	0.5	1.10	38.4	2.08	79.9	0.13	0.953	0.50	0.470	0.27	NA	NA	NA	NA	NA	0.000	11	2.460	0.047
20.51	655.5	115.0	115.0	45.0	0.3	0.7	16	9	10	2.70	1.05	13	1.179	0.883	1.179	0.883	2.10	SAND	0.5	1.09	46.6	1.45	67.6	0.11	0.952	0.50	0.470	0.23	NA	NA	NA	NA	NA	0.000	11	2.460	0.050
20.67	655.3	115.0	115.0	40.3	0.4	1.0	20	9	10	3.64	1.08	14	1.189	0.887	1.189	0.887	2.23	SAND	0.5	1.09	41.6	1.75	72.9	0.12	0.952	0.51	0.480	0.24	NA	NA	NA	NA	NA	0.000	12	2.310	0.044
20.83	655.2	115.0	115.0	30.3	0.6	2.0	31	7	8	4.79	1.17	14	1.198	0.891	1.198	0.891	2.52	SAND	0.5	1.09	31.2	2.65	88.9	0.15	0.951	0.51	0.480	0.30	NA	NA	NA	NA	NA	0.000	11	2.460	0.047
21.00	655.0	115.0	115.0	26.6	0.8	3.0	36	7	8	5.00	1.20	14	1.208	0.895	1.208	0.895	2.65	non-LIQ CLAY	1	1.18	NA	3.65	non-LIQ	non-LIQ	0.951	0.51	0.480	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
21.16	654.8	115.0	115.0	26.5	0.9	3.4	40	7	8	5.00	1.20	14	1.217	0.900	1.217	0.900	2.69	non-LIQ CLAY	1	1.18	NA	3.91	non-LIQ	non-LIQ	0.951	0.51	0.480	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
21.33	654.7	115.0	115.0	26.1	0.7	2.5	35	7	8	5.00	1.20	14	1.226	0.904	1.226	0.904	2.60	SILT	0.7	1.12	29.6	3.31	98.1	0.17	0.950	0.51	0.480	0.35	NA	NA	NA	NA	NA	0.000	11	2.460	0.050
21.49	654.5	115.0	115.0	53.0	0.4	0.8	15	11	12	2.47	1.05	15	1.236	0.908	1.236	0.908	2.07	SAND	0.5	1.08	54.1	1.40	75.6	0.12	0.950	0.51	0.480	0.25	NA	NA	NA	NA	NA	0.000	13	2.150	0.041
21.65	654.4	115.0	115.0	59.9	0.2	0.3	9	11	12	0.65	1.02	13	1.245	0.913	1.245	0.913	1.85	SAND	0.5	1.08	61.0	1.15	70.0	0.11	0.950	0.51	0.480	0.23	NA	NA	NA	NA	NA	0.000	13	2.150	0.041
21.82	654.2	115.0	115.0	68.8	0.2	0.3	8	12	13	0.21	1.01	14	1.255	0.917	1.255	0.917	1.77	SAND	0.5	1.07	69.8	1.09	76.0	0.12	0.949	0.51	0.480	0.25	NA	NA	NA	NA	NA	0.000	14	2.000	0.041
21.98	654.0	115.0	115.0	83.3	0.2	0.2	5	15	16	0.01	1.00	16	1.264	0.921	1.264	0.921	1.67	SAND	0.5	1.07	84.4	1.01	85.5	0.14	0.949	0.52	0.490	0.28	NA	NA	NA	NA	NA	0.000	17	1.780	0.034
22.15	653.9	115.0	115.0	96.5	0.3	0.3	5	17	18	0.01	1.00	18	1.274	0.926	1.274	0.926	1.65	SAND	0.5	1.07	97.5	1.00	97.9	0.17	0.948	0.52	0.490	0.34	NA	NA	NA	NA	NA	0.000	19	1.649	0.034
22.31	653.7	115.0	115.0	115.1	0.5	0.4	5	20	21	0.01	1.00	21	1.283	0.930	1.283	0.930	1.65	SAND	0.5	1.07	116.0	1.01	116.7	0.23	0.948	0.52	0.490	0.46	NA	NA	NA	NA	NA	0.000	22	1.427	0.027
22.47	653.5	115.0	115.0	119.8	0.5	0.4	5	21	22	0.00	1.00	22	1.292	0.934	1.292	0.934	1.63	SAND	0.5	1.06	120.5	1.00	120.5	0.24	0.948	0.52	0.490	0.50	NA	NA	NA	NA	NA	0.000	23	1.365	0.026
22.64	653.4	115.0	115.0	117.5	1.0	0.9	5	22	23	0.42	1.01	24	1.302	0.939	1.302	0.939	1.82	SAND	0.5	1.06	117.9	1.12	132.0	0.29	0.947	0.52	0.490	0.60	NA	NA	NA	NA	NA	0.000	24	1.286	0.026

Liquefaction Analysis with Cone Penetration Test (CPT) Data

Depth (ft)	Elev. (ft, MSL)	Unit Weight (pcf) γ'MOIST	γ'SAT	q_c (tsf)	f_s (tsf)	Frict. Ratio (%)	% Fines	Equiv. N_{60}	Equiv. $(N_1)_{60}$	α	β	Equiv. $(N_1)_{60CS}$	Stresses at Exploration Water Level σ_v (tsf)	σ_v' (tsf)	Stresses at Design Water Level σ_v (tsf)	σ_v' (tsf)	I_c
22.80	653.2	115.0	115.0	121.2	0.9	0.7	8	22	23	0.20	1.01	24	1.311	0.943	1.311	0.943	1.77
22.97	653.0	115.0	115.0	133.1	1.1	0.8	7	24	25	0.19	1.01	26	1.321	0.947	1.321	0.947	1.77
23.13	652.9	115.0	115.0	143.0	0.5	0.3	3	24	25	0.00	1.00	25	1.330	0.952	1.330	0.952	1.53
23.30	652.7	115.0	115.0	155.9	2.1	1.3	10	29	31	0.73	1.02	32	1.340	0.956	1.340	0.956	1.86
23.46	652.5	115.0	115.0	192.3	3.4	1.8	10	36	38	0.95	1.02	40	1.349	0.960	1.349	0.960	1.89
23.62	652.4	115.0	115.0	116.1	2.9	2.5	17	24	25	3.11	1.06	30	1.358	0.964	1.358	0.964	2.15
23.79	652.2	115.0	115.0	89.4	1.4	1.6	15	18	19	2.63	1.05	23	1.368	0.969	1.368	0.969	2.09
23.95	652.1	115.0	115.0	73.6	0.7	1.0	13	15	15	2.03	1.04	18	1.377	0.973	1.377	0.973	2.02
24.12	651.9	115.0	115.0	46.7	0.9	1.9	25	11	11	4.31	1.12	17	1.387	0.978	1.387	0.978	2.37
24.28	651.7	115.0	115.0	25.4	0.5	2.0	35	6	7	5.00	1.20	13	1.396	0.982	1.396	0.982	2.60
24.44	651.6	115.0	115.0	24.4	0.3	1.2	31	6	6	4.76	1.16	12	1.405	0.986	1.405	0.986	2.50
24.61	651.4	115.0	115.0	42.3	0.4	0.9	20	9	9	3.60	1.08	14	1.415	0.990	1.415	0.990	2.23
24.77	651.2	115.0	115.0	48.3	0.4	0.8	17	10	10	3.06	1.06	14	1.424	0.995	1.424	0.995	2.15
24.94	651.1	115.0	115.0	47.9	0.6	1.3	21	10	11	3.74	1.08	15	1.434	0.999	1.434	0.999	2.25
25.10	650.9	115.0	115.0	56.7	0.4	0.7	14	12	12	2.11	1.04	15	1.443	1.003	1.443	1.003	2.03
25.26	650.7	115.0	115.0	58.7	0.6	1.0	17	12	12	2.92	1.06	16	1.452	1.008	1.452	1.008	2.13
25.43	650.6	115.0	115.0	57.5	0.2	0.3	10	11	11	1.00	1.02	12	1.462	1.012	1.462	1.012	1.90
25.59	650.4	115.0	115.0	49.8	0.1	0.2	10	9	10	0.84	1.02	11	1.471	1.016	1.471	1.016	1.88
25.76	650.2	115.0	115.0	33.7	0.3	0.9	23	8	8	4.04	1.10	12	1.481	1.021	1.481	1.021	2.31
25.92	650.1	115.0	115.0	26.5	0.4	1.5	32	7	7	4.83	1.17	13	1.490	1.025	1.490	1.025	2.53
26.08	649.9	115.0	115.0	21.8	0.5	2.3	41	6	6	5.00	1.20	12	1.500	1.029	1.500	1.029	2.71
26.25	649.8	115.0	115.0	14.0	0.5	3.6	59	4	5	5.00	1.20	10	1.509	1.034	1.509	1.034	3.00
26.41	649.6	115.0	115.0	21.3	0.5	2.3	42	6	6	5.00	1.20	12	1.519	1.038	1.519	1.038	2.73
26.58	649.4	115.0	115.0	47.4	0.6	1.3	21	10	10	3.82	1.09	15	1.528	1.042	1.528	1.042	2.27
26.74	649.3	115.0	115.0	86.7	1.2	1.4	15	18	18	2.53	1.05	21	1.538	1.046	1.538	1.046	2.08
26.90	649.1	115.0	115.0	126.1	2.3	1.8	14	25	25	2.22	1.04	29	1.547	1.051	1.547	1.051	2.04
27.07	648.9	115.0	115.0	215.5	6.1	3.8	17	45	45	3.04	1.06	51	1.557	1.055	1.557	1.055	2.14
27.23	648.8	115.0	115.0	451.9	6.5	1.4	5	77	77	0.00	1.00	77	1.566	1.059	1.566	1.059	1.62
27.40	648.6	115.0	115.0	164.1	7.7	4.7	22	36	36	3.95	1.09	44	1.576	1.064	1.576	1.064	2.29
27.56	648.4	115.0	115.0	161.1	1.3	0.8	6	29	28	0.06	1.01	29	1.585	1.068	1.585	1.068	1.72
27.72	648.3	115.0	115.0	170.0	0.6	0.4	3	28	28	0.00	1.00	28	1.594	1.072	1.594	1.072	1.49
27.89	648.1	115.0	115.0	154.7	2.0	1.3	10	29	29	0.79	1.02	30	1.604	1.077	1.604	1.077	1.87
28.05	648.0	115.0	115.0	172.9	3.2	1.9	12	33	33	1.48	1.03	36	1.613	1.081	1.613	1.081	1.96
28.22	647.8	115.0	115.0	244.8	4.0	1.6	9	45	44	0.42	1.01	46	1.623	1.085	1.623	1.085	1.82
28.38	647.6	115.0	115.0	247.9	2.5	1.0	5	43	42	0.01	1.00	43	1.632	1.090	1.632	1.090	1.65
28.54	647.5	115.0	115.0	237.2	2.5	1.1	6	42	41	0.02	1.00	41	1.641	1.094	1.641	1.094	1.68
28.71	647.3	115.0	115.0	174.1	1.2	0.7	5	30	30	0.01	1.00	30	1.651	1.098	1.651	1.098	1.65
28.87	647.1	115.0	115.0	124.8	0.6	0.5	6	22	21	0.02	1.00	22	1.660	1.102	1.660	1.102	1.68
29.04	647.0	115.0	115.0	69.0	0.4	0.4	8	16	16	0.30	1.01	16	1.670	1.107	1.670	1.107	1.79
29.20	646.8	115.0	115.0	58.6	0.7	1.2	19	12	12	3.34	1.07	16	1.679	1.111	1.679	1.111	2.19
29.36	646.6	115.0	115.0	44.8	0.7	1.6	25	10	10	4.25	1.11	15	1.688	1.115	1.688	1.115	2.36
29.53	646.5	115.0	115.0	59.0	1.8	3.1	29	14	14	4.60	1.14	20	1.698	1.120	1.698	1.120	2.45
29.69	646.3	115.0	115.0	76.6	1.9	2.5	23	17	17	4.01	1.10	22	1.707	1.124	1.707	1.124	2.30
29.86	646.1	115.0	115.0	76.4	2.0	2.6	23	17	17	4.10	1.10	22	1.717	1.129	1.717	1.129	2.32
30.02	646.0	115.0	115.0	67.4	1.7	2.5	24	15	15	4.23	1.11	21	1.726	1.133	1.726	1.133	2.35
30.19	645.8	115.0	115.0	30.6	1.1	3.6	43	8	8	5.00	1.20	15	1.736	1.137	1.736	1.137	2.74
30.35	645.7	115.0	115.0	21.2	0.7	3.3	49	6	6	5.00	1.20	12	1.745	1.141	1.745	1.141	2.86
30.51	645.5	115.0	115.0	20.8	0.5	2.4	45	6	6	5.00	1.20	12	1.754	1.146	1.754	1.146	2.78
30.68	645.3	115.0	115.0	24.1	0.5	2.1	40	6	6	5.00	1.20	12	1.764	1.150	1.764	1.150	2.69
30.84	645.2	115.0	115.0	23.6	0.7	3.0	45	7	6	5.00	1.20	13	1.773	1.154	1.773	1.154	2.79
31.01	645.0	115.0	115.0	25.8	1.2	4.7	51	8	7	5.00	1.20	14	1.783	1.159	1.783	1.159	2.88
31.17	644.8	115.0	115.0	51.8	1.4	2.7	29.2	12.4	11.8	4.6	1.1	16.0	1.79	1.16	1.79	1.16	2.47
31.33	644.7	115.0	115.0	95.0	2.3	2.4	20.2	20.5	19.6	3.6	1.1	25.0	1.80	1.17	1.80	1.17	2.23
31.50	644.5	115.0	115.0	76.8	2.6	3.4	26.7	17.9	17.0	4.5	1.1	24.0	1.81	1.17	1.81	1.17	2.41
31.66	644.3	115.0	115.0	62.2	2.5	4.0	31.9	15.4	14.6	4.8	1.2	22.0	1.82	1.18	1.82	1.18	2.53
31.83	644.2	115.0	115.0	71.1	2.5	3.5	28.2	16.9	16.0	4.6	1.1	23.0	1.83	1.18	1.83	1.18	2.44
31.99	644.0	115.0	115.0	50.4	2.3	4.6	38.0	13.2	12.5	5.0	1.2	20.0	1.84	1.18	1.84	1.18	2.65
32.15	643.9	115.0	115.0	31.2	1.8	5.8	51.3	9.3	8.8	5.0	1.2	16.0	1.85	1.19	1.85	1.19	2.89
32.32	643.7	115.0	115.0	39.5	1.7	4.3	41.5	10.7	10.1	5.0	1.2	17.0	1.86	1.19	1.86	1.19	2.72
32.48	643.5	115.0	115.0	59.2	1.7	2.9	28.2	14.0	13.2	4.6	1.1	20.0	1.87	1.20	1.87	1.20	2.44
32.65	643.4	115.0	115.0	64.1	2.0	3.1	28.2	15.2	14.3	4.6	1.1	21.0	1.88	1.20	1.88	1.20	2.44
32.81	643.2	115.0	115.0	53.6	2.2	4.1	35.7	13.8	12.9	5.0	1.2	20.0	1.89	1.21	1.89	1.21	2.61
32.97	643.0	115.0	115.0	56.7	2.7	4.8	37.1	14.8	13.8	5.0	1.2	22.0	1.90	1.21	1.90	1.21	2.64
33.14	642.9	115.0	115.0	113.4	2.3	2.0	16.7	23.5	21.9	2.9	1.1	26.0	1.91	1.21	1.91	1.21	2.13
33.30	642.7	115.0	115.0	220.2	2.1	1.0	5.9	38.7	36.1	0.0	1.0	36.0	1.91	1.22	1.91	1.22	1.69
33.47	642.5	115.0	115.0	246.9	2.0	0.8	4.4	42.2	39.2	0.0	1.0	39.0	1.92	1.22	1.92	1.22	1.60
33.63	642.4	115.0	115.0	232.6	2.1	0.9	5.3	40.4	37.5	0.0	1.0	38.0	1.93	1.23	1.93	1.23	1.66
33.79	642.2	115.0	115.0	228.8	1.8	0.8	4.7	39.3	36.4	0.0	1.0	36.0	1.94	1.23	1.94	1.23	1.62
33.96	642.0	115.0	115.0	221.6	1.1	0.5	2.9	36.6	33.8	0.0	1.0	34.0	1.95	1.24	1.95	1.24	1.50
34.12	641.9	115.0	115.0	202.4	0.8	0.4	2.5	33.1	30.6	0.0	1.0	31.0	1.96	1.24	1.96	1.24	1.48
34.29	641.7	115.0	115.0	182.0	0.9	0.5	3.9	30.7	28.3	0.0	1.0	28.0	1.97	1.25	1.97	1.25	1.57
34.45	641.6	115.0	115.0	168.8	1.6	0.9	7.6	30.6	28.1	0.2	1.0	29.0	1.98	1.25	1.98	1.25	1.78
34.61	641.4	115.0	115.0	182.4	3.6	2.0	12.5	35.7	32.8	1.7	1.0	36.0	1.99	1.25	1.99	1.25	1.98
34.78	641.2	115.0	115.0	142.7	4.7	3.3	19.9	30.7	28.2	3.6	1.1	34.0	2.00	1.26	2.00	1.26	2.23
34.94	641.1	115.0	115.0	91.0	4.9	5.4	31.6	22.4	20.5	4.8	1.2	29.0	2.01	1.26	2.01	1.26	2.52
35.11	640.9	115.0	115.0	97.3	4.6	4.7	28.8	23.2	21.2	4.6	1.1	29.0	2.02	1.27	2.02	1.27	2.46
35.27	640.7	115.0	115.0	128.9	5.3	4.1	23.7	29.1	26.5	4.1	1.1	33.0	2.03	1.27	2.03	1.27	2.33
35.43	640.6	115.0	115.0	133.2	5.6	4.2	23.7	30.0	27.3	4.1	1.1	34.0	2.04	1.28	2.04	1.28	2.33
35.60	640.4	115.0	115.0	116.5	5.9	5.1	27.7	27.5	25.0	4.5	1.1	33.0	2.05	1.28	2.05	1.28	2.43
35.76	640.2	115.0	115.0	117.2	6.1	5.2	28.1	27.8	25.2	4.6	1.1	33.0	2.06	1.28	2.06	1.28	2.44
35.93	640.1	115.0	115.0	133.8	6.2	4.6	25.0	30.6	27.7	4.3	1.1	35.0	2.07	1.29	2.07	1.29	2.36
36.09	639.9	115.0	115.0	124.6	6.2	5.0	26.8	29.1	26.3	4.5	1.1	34.0	2.08	1.29	2.08	1.29	2.41
36.26	639.7	115.0	115.0	102.6	5.4	5.3	29.9	24.8	22.4	4.7	1.2	31.0	2.08	1.30	2.08	1.30	2.48
36.42	639.6	115.0	115.0	90.8	5.3	5.8	33.1	22.7	20.5	4.9	1.2	29.0	2.09	1.30	2.09	1.30	2.55
36.58	639.4	115.0	115.0	105.2	5.7	5.4	30.1	25.5	22.9	4.7	1.2	31.0	2.10	1.31	2.10	1.31	2.49
36.75	639.3	115.0	115.0	153.0	5.8	3.8	21.1	33.5	30.1	3.8	1.1	36.0	2.11	1.31	2.11	1.31	2.26
36.91	639.1	115.0	115.0	166.3	5.1	3.1	17.9	34.9	31.4	3.2	1.1	37.0	2.12	1.31	2.12	1.31	2.17
37.08	638.9	115.0	115.0	209.0	3.7	1.8	10.8	39.8	35.7	1.1	1.0	38.0	2.13	1.32	2.13	1.32	1.92

Depth (ft)	Soil Type Character (SAND, SILT or non-LIQ CLAY)	Normalization of Tip Resistance n	C_Q	q_{c1N}	Fines Correction Kc	$(q_{c1N})_{cs}$	$CRR_{7.5}$	r_d	CSR_M	$CSR_{7.5}$	FS	a	b	Max Shear Modulus G_{max} (tsf)	Cyclic Shear Strain γ (%)	Norm. Vol. Strain ε_{Nc} (%)	Dry Settle. ΔS (in)	Post-Liq. $(N_1)_{60CS}$	Post-Liq. Vol. Strain ε (%)	Layer Post-Liq. Settle. ΔS (in)
22.80	SAND	0.5	1.06	121.3	1.09	131.7	0.29	0.947	0.52	0.490	0.60	NA	NA	NA	NA	NA	0.000	24	1.286	0.025
22.97	SAND	0.5	1.06	132.9	1.08	144.1	0.36	0.946	0.52	0.490	0.73	NA	NA	NA	NA	NA	0.000	26	1.145	0.023
23.13	SAND	0.5	1.05	142.5	1.00	142.5	0.35	0.946	0.52	0.490	0.71	NA	NA	NA	NA	NA	0.000	26	1.145	0.022
23.30	SAND	0.5	1.05	155.0	1.16	179.4	non-LIQ	0.946	0.53	0.490	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
23.46	SAND	0.5	1.05	190.8	1.18	225.6	non-LIQ	0.945	0.53	0.490	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
23.62	SAND	0.5	1.05	114.9	1.56	179.1	non-LIQ	0.945	0.53	0.490	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
23.79	SAND	0.5	1.05	88.3	1.44	126.7	0.27	0.945	0.53	0.490	0.55	NA	NA	NA	NA	NA	0.000	20	1.580	0.032
23.95	SAND	0.5	1.04	72.5	1.32	96.1	0.16	0.944	0.53	0.490	0.33	NA	NA	NA	NA	NA	0.000	16	1.870	0.036
24.12	SAND	0.5	1.04	45.9	2.20	100.9	0.18	0.944	0.53	0.490	0.36	NA	NA	NA	NA	NA	0.000	13	2.150	0.044
24.28	SILT	0.7	1.05	25.3	3.31	83.6	0.13	0.943	0.53	0.490	0.27	NA	NA	NA	NA	NA	0.000	10	2.620	0.050
24.44	SAND	0.5	1.04	23.9	2.79	66.6	0.11	0.943	0.53	0.490	0.22	NA	NA	NA	NA	NA	0.000	8	2.920	0.056
24.61	SAND	0.5	1.03	41.3	1.73	71.6	0.11	0.943	0.53	0.490	0.23	NA	NA	NA	NA	NA	0.000	11	2.460	0.050
24.77	SAND	0.5	1.03	47.1	1.54	72.6	0.12	0.942	0.53	0.490	0.24	NA	NA	NA	NA	NA	0.000	11	2.460	0.047
24.94	SAND	0.5	1.03	46.6	1.80	83.9	0.13	0.942	0.54	0.500	0.27	NA	NA	NA	NA	NA	0.000	13	2.150	0.044
25.10	SAND	0.5	1.03	57.0	1.34	76.2	0.12	0.941	0.54	0.500	0.24	NA	NA	NA	NA	NA	0.000	13	2.150	0.041
25.26	SAND	0.5	1.02	56.9	1.50	85.5	0.14	0.941	0.54	0.500	0.28	NA	NA	NA	NA	NA	0.000	13	2.150	0.041
25.43	SAND	0.5	1.02	55.6	1.19	66.1	0.11	0.941	0.54	0.500	0.21	NA	NA	NA	NA	NA	0.000	12	2.310	0.047
25.59	SAND	0.5	1.02	48.0	1.17	56.2	0.10	0.940	0.54	0.500	0.19	NA	NA	NA	NA	NA	0.000	11	2.460	0.047
25.76	SAND	0.5	1.02	32.4	1.98	64.1	0.10	0.940	0.54	0.500	0.21	NA	NA	NA	NA	NA	0.000	10	2.620	0.053
25.92	SAND	0.5	1.02	25.4	2.92	74.2	0.12	0.940	0.54	0.500	0.24	NA	NA	NA	NA	NA	0.000	10	2.620	0.050
26.08	non-LIQ CLAY	1	1.03	NA	4.05	non-LIQ	non-LIQ	0.939	0.54	0.500	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
26.25	non-LIQ CLAY	1	1.02	NA	6.79	non-LIQ	non-LIQ	0.939	0.54	0.500	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
26.41	non-LIQ CLAY	1	1.02	NA	4.19	non-LIQ	non-LIQ	0.938	0.54	0.500	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
26.58	SAND	0.5	1.01	45.1	1.84	83.2	0.13	0.938	0.55	0.510	0.26	NA	NA	NA	NA	NA	0.000	12	2.310	0.047
26.74	SAND	0.5	1.01	82.4	1.41	116.5	0.23	0.938	0.55	0.510	0.45	NA	NA	NA	NA	NA	0.000	19	1.649	0.032
26.90	SAND	0.5	1.00	119.6	1.36	162.2	non-LIQ	0.937	0.55	0.510	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
27.07	SAND	0.5	1.00	204.0	1.54	313.2	non-LIQ	0.937	0.55	0.510	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
27.23	SAND	0.5	1.00	426.8	1.00	426.8	non-LIQ	0.937	0.55	0.510	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
27.40	SAND	0.5	1.00	154.7	1.92	296.5	non-LIQ	0.936	0.55	0.510	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
27.56	SAND	0.5	1.00	151.5	1.05	159.2	0.46	0.936	0.55	0.510	0.89	NA	NA	NA	NA	NA	0.000	29	0.880	0.017
27.72	SAND	0.5	0.99	159.6	1.00	159.6	0.46	0.935	0.55	0.510	0.90	NA	NA	NA	NA	NA	0.000	29	0.880	0.017
27.89	SAND	0.5	0.99	144.9	1.16	168.8	non-LIQ	0.935	0.55	0.510	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
28.05	SAND	0.5	0.99	161.7	1.25	201.5	non-LIQ	0.935	0.55	0.510	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
28.22	SAND	0.5	0.99	228.4	1.12	255.8	non-LIQ	0.934	0.55	0.510	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
28.38	SAND	0.5	0.99	230.9	1.01	232.3	non-LIQ	0.934	0.55	0.510	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
28.54	SAND	0.5	0.98	220.5	1.03	226.1	non-LIQ	0.933	0.56	0.520	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
28.71	SAND	0.5	0.98	161.5	1.01	162.4	non-LIQ	0.933	0.56	0.520	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
28.87	SAND	0.5	0.98	115.5	1.02	118.3	0.23	0.933	0.56	0.520	0.45	NA	NA	NA	NA	NA	0.000	22	1.430	0.027
29.04	SAND	0.5	0.98	82.2	1.10	90.7	0.15	0.932	0.56	0.520	0.29	NA	NA	NA	NA	NA	0.000	17	1.780	0.036
29.20	SAND	0.5	0.98	54.0	1.63	88.2	0.14	0.932	0.56	0.520	0.28	NA	NA	NA	NA	NA	0.000	14	2.000	0.038
29.36	SAND	0.5	0.97	41.2	2.14	88.2	0.14	0.932	0.56	0.520	0.28	NA	NA	NA	NA	NA	0.000	12	2.310	0.044
29.53	SAND	0.5	0.97	54.2	2.53	137.2	0.32	0.931	0.56	0.520	0.62	NA	NA	NA	NA	NA	0.000	16	1.870	0.038
29.69	SAND	0.5	0.97	70.2	1.96	137.7	0.32	0.931	0.56	0.520	0.62	NA	NA	NA	NA	NA	0.000	19	1.649	0.032
29.86	SAND	0.5	0.97	69.9	2.02	141.2	0.34	0.930	0.56	0.520	0.66	NA	NA	NA	NA	NA	0.000	19	1.649	0.034
30.02	SAND	0.5	0.97	61.6	2.13	130.8	0.29	0.930	0.56	0.520	0.55	NA	NA	NA	NA	NA	0.000	17	1.780	0.034
30.19	non-LIQ CLAY	1	0.93	NA	4.30	non-LIQ	non-LIQ	0.928	0.56	0.520	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
30.35	non-LIQ CLAY	1	0.93	NA	5.29	non-LIQ	non-LIQ	0.927	0.56	0.520	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
30.51	non-LIQ CLAY	1	0.92	NA	4.64	non-LIQ	non-LIQ	0.926	0.56	0.520	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
30.68	non-LIQ CLAY	1	0.92	NA	3.91	non-LIQ	non-LIQ	0.924	0.56	0.520	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
30.84	non-LIQ CLAY	1	0.92	NA	4.71	non-LIQ	non-LIQ	0.923	0.56	0.520	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
31.01	non-LIQ CLAY	1	0.91	NA	5.55	non-LIQ	non-LIQ	0.922	0.56	0.520	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
31.17	SAND	0.5	0.95	47	2.60	121	0.246	0.920	0.560	0.520	0.47	NA	NA	NA	NA	NA	0.00	14.00	2.00	0.04
31.33	SAND	0.5	0.95	85	1.75	150	0.394	0.919	0.560	0.520	0.76	NA	NA	NA	NA	NA	0.00	22.00	1.43	0.03
31.50	SAND	0.5	0.95	69	2.34	161	non-LIQ	0.918	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
31.66	SAND	0.5	0.95	56	2.91	162	non-LIQ	0.916	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
31.83	SAND	0.5	0.95	64	2.50	159	0.455	0.915	0.560	0.520	0.87	NA	NA	NA	NA	NA	0.00	18.00	1.71	0.03
31.99	non-LIQ CLAY	1	0.89	NA	3.67	non-LIQ	non-LIQ	0.914	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
32.15	non-LIQ CLAY	1	0.89	NA	5.59	non-LIQ	non-LIQ	0.912	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
32.32	non-LIQ CLAY	1	0.89	NA	4.15	non-LIQ	non-LIQ	0.911	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
32.48	SAND	0.5	0.94	53	2.50	131	0.291	0.910	0.560	0.520	0.56	NA	NA	NA	NA	NA	0.00	15.00	1.94	0.04
32.65	SAND	0.5	0.94	57	2.50	142	0.346	0.908	0.560	0.520	0.67	NA	NA	NA	NA	NA	0.00	16.00	1.87	0.04
32.81	non-LIQ CLAY	1	0.88	NA	3.37	non-LIQ	non-LIQ	0.907	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
32.97	non-LIQ CLAY	1	0.87	NA	3.55	non-LIQ	non-LIQ	0.906	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
33.14	SAND	0.5	0.93	100	1.51	151	0.402	0.904	0.560	0.520	0.77	NA	NA	NA	NA	NA	0.00	23.00	1.37	0.03
33.30	SAND	0.5	0.93	194	1.03	200	non-LIQ	0.903	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
33.47	SAND	0.5	0.93	217	1.00	217	non-LIQ	0.902	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
33.63	SAND	0.5	0.93	204	1.01	206	non-LIQ	0.900	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
33.79	SAND	0.5	0.93	200	1.00	200	non-LIQ	0.899	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
33.96	SAND	0.5	0.93	194	1.00	194	non-LIQ	0.898	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
34.12	SAND	0.5	0.92	177	1.00	177	non-LIQ	0.896	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
34.29	SAND	0.5	0.92	159	1.00	159	0.451	0.895	0.560	0.520	0.87	NA	NA	NA	NA	NA	0.00	29.00	0.88	0.02
34.45	SAND	0.5	0.92	147	1.09	160	non-LIQ	0.894	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
34.61	SAND	0.5	0.92	158	1.28	203	non-LIQ	0.892	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
34.78	SAND	0.5	0.92	124	1.73	214	non-LIQ	0.891	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
34.94	SAND	0.5	0.92	79	2.87	226	non-LIQ	0.890	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
35.11	SAND	0.5	0.91	84	2.56	216	non-LIQ	0.888	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
35.27	SAND	0.5	0.91	111	2.05	228	non-LIQ	0.887	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
35.43	SAND	0.5	0.91	115	2.05	235	non-LIQ	0.886	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
35.60	SAND	0.5	0.91	100	2.45	245	non-LIQ	0.884	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
35.76	SAND	0.5	0.91	101	2.49	250	non-LIQ	0.883	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
35.93	SAND	0.5	0.91	115	2.17	249	non-LIQ	0.882	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
36.09	SAND	0.5	0.90	107	2.35	250	non-LIQ	0.880	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
36.26	SAND	0.5	0.90	88	2.68	235	non-LIQ	0.879	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
36.42	SAND	0.5	0.90	77	3.05	236	non-LIQ	0.878	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
36.58	SAND	0.5	0.90	90	2.70	242	non-LIQ	0.876	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
36.75	SAND	0.5	0.90	130	1.83	238	non-LIQ	0.875	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
36.91	SAND	0.5	0.90	141	1.59	224	non-LIQ	0.874	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
37.08	SAND	0.5	0.90	177	1.20	213	non-LIQ	0.872	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00

Liquefaction Analysis with Cone Penetration Test (CPT) Data

Depth (ft)	Elev. (ft, MSL)	Unit Weight (pcf) γ'_{MOIST}	Unit Weight (pcf) γ'_{SAT}	q_c (tsf)	f_s (tsf)	Frict. Ratio (%)	% Fines	Equiv. N_{60}	Equiv. $(N_1)_{60}$	α	β	Equiv. $(N_1)_{60cs}$	Stresses at Exploration Water Level σ_v (tsf)	Stresses at Exploration Water Level σ'_v (tsf)	Stresses at Design Water Level σ_v (tsf)	Stresses at Design Water Level σ'_v (tsf)	I_c	Soil Type Character (SAND, SILT or non-LIQ CLAY)	Normalization of Tip Resistance n	C_Q	q_{c1N}	Fines Correction Kc	$(q_{c1N})_{cs}$	$CRR_{7.5}$	r_d	CSR_M	$CSR_{7.5}$	FS	a	b	Max Shear Modulus G_{max} (tsf)	Cyclic Shear Strain γ (%)	Norm. Vol. Strain ε_{N15} (%)	Dry Settle. ΔS (in)	Post-Liq. $(N_1)_{60cs}$	Post-Liq. Vol. Strain ε (%)	Layer Post-Liq. Settle. ΔS (in)
37.24	638.8	115.0	115.0	235.7	2.7	1.1	6.9	42.1	37.7	0.1	1.0	38.0	2.14	1.32	2.14	1.32	1.74	SAND	0.5	0.89	199	1.06	212	non-LIQ	0.871	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
37.40	638.6	115.0	115.0	244.3	2.5	1.0	6.0	43.0	38.4	0.0	1.0	39.0	2.15	1.33	2.15	1.33	1.69	SAND	0.5	0.89	206	1.03	213	non-LIQ	0.870	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
37.57	638.4	115.0	115.0	242.2	1.8	0.7	4.3	41.3	36.8	0.0	1.0	37.0	2.16	1.33	2.16	1.33	1.60	SAND	0.5	0.89	204	1.00	204	non-LIQ	0.868	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
37.73	638.3	115.0	115.0	224.6	2.8	1.2	7.8	40.8	36.3	0.2	1.0	37.0	2.17	1.34	2.17	1.34	1.78	SAND	0.5	0.89	189	1.09	207	non-LIQ	0.867	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
37.90	638.1	115.0	115.0	212.8	3.2	1.5	9.4	39.7	35.3	0.7	1.0	37.0	2.18	1.34	2.18	1.34	1.86	SAND	0.5	0.89	179	1.15	206	non-LIQ	0.866	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
38.06	637.9	115.0	115.0	208.5	4.9	2.4	13.4	41.3	36.6	2.0	1.0	40.0	2.19	1.34	2.19	1.34	2.02	SAND	0.5	0.89	175	1.32	231	non-LIQ	0.864	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
38.22	637.8	115.0	115.0	185.9	5.4	2.9	16.4	38.3	34.0	2.9	1.1	39.0	2.20	1.35	2.20	1.35	2.12	SAND	0.5	0.89	156	1.49	232	non-LIQ	0.863	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
38.39	637.6	115.0	115.0	213.3	4.8	2.3	12.8	41.9	37.0	1.8	1.0	40.0	2.21	1.35	2.21	1.35	2.00	SAND	0.5	0.88	178	1.29	231	non-LIQ	0.862	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
38.55	637.5	115.0	115.0	265.3	3.5	1.3	7.2	47.7	42.1	0.1	1.0	43.0	2.22	1.36	2.22	1.36	1.75	SAND	0.5	0.88	221	1.07	238	non-LIQ	0.860	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
38.72	637.3	115.0	115.0	294.5	3.3	1.1	5.6	51.4	45.3	0.0	1.0	46.0	2.23	1.36	2.23	1.36	1.67	SAND	0.5	0.88	245	1.02	250	non-LIQ	0.859	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
38.88	637.1	115.0	115.0	309.7	3.5	1.1	5.4	53.9	47.4	0.0	1.0	48.0	2.24	1.37	2.24	1.37	1.66	SAND	0.5	0.88	258	1.01	260	non-LIQ	0.858	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
39.04	637.0	115.0	115.0	313.3	3.5	1.1	5.3	54.4	47.9	0.0	1.0	48.0	2.24	1.37	2.24	1.37	1.65	SAND	0.5	0.88	260	1.01	262	non-LIQ	0.856	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
39.21	636.8	115.0	115.0	311.4	3.5	1.1	5.4	54.1	47.5	0.0	1.0	48.0	2.25	1.37	2.25	1.37	1.66	SAND	0.5	0.88	258	1.01	261	non-LIQ	0.855	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
39.37	636.6	115.0	115.0	306.2	3.3	1.1	5.2	53.1	46.5	0.0	1.0	47.0	2.26	1.38	2.26	1.38	1.65	SAND	0.5	0.88	254	1.00	254	non-LIQ	0.854	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
39.54	636.5	115.0	115.0	299.4	3.0	1.0	4.9	51.6	45.1	0.0	1.0	45.0	2.27	1.38	2.27	1.38	1.63	SAND	0.5	0.87	247	1.00	247	non-LIQ	0.852	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
39.70	636.3	115.0	115.0	278.4	2.8	1.0	5.3	48.4	42.2	0.0	1.0	42.0	2.28	1.39	2.28	1.39	1.66	SAND	0.5	0.87	230	1.01	231	non-LIQ	0.851	0.560	0.520	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
39.86	636.1	115.0	115.0	257.2	2.7	1.0	6.0	45.3	39.5	0.0	1.0	40.0	2.29	1.39	2.29	1.39	1.69	SAND	0.5	0.87	212	1.03	219	non-LIQ	0.850	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
40.03	636.0	115.0	115.0	244.8	2.6	1.1	6.4	43.4	37.7	0.1	1.0	38.0	2.30	1.40	2.30	1.40	1.71	SAND	0.5	0.87	201	1.05	211	non-LIQ	0.848	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
40.19	635.8	115.0	115.0	255.9	2.7	1.1	6.1	45.1	39.2	0.0	1.0	39.0	2.31	1.40	2.31	1.40	1.70	SAND	0.5	0.87	210	1.04	218	non-LIQ	0.847	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
40.36	635.6	115.0	115.0	278.2	2.6	0.9	4.9	48.0	41.6	0.0	1.0	42.0	2.32	1.40	2.32	1.40	1.63	SAND	0.5	0.87	228	1.00	228	non-LIQ	0.846	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
40.52	635.5	115.0	115.0	293.2	2.5	0.9	4.2	49.8	43.2	0.0	1.0	43.0	2.33	1.41	2.33	1.41	1.59	SAND	0.5	0.87	240	1.00	240	non-LIQ	0.844	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
40.68	635.3	115.0	115.0	297.3	2.6	0.9	4.3	50.6	43.8	0.0	1.0	44.0	2.34	1.41	2.34	1.41	1.59	SAND	0.5	0.87	243	1.00	243	non-LIQ	0.843	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
40.85	635.2	115.0	115.0	293.5	2.7	0.9	4.6	50.3	43.4	0.0	1.0	43.0	2.35	1.42	2.35	1.42	1.61	SAND	0.5	0.86	240	1.00	240	non-LIQ	0.842	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
41.01	635.0	115.0	115.0	294.4	2.6	0.9	4.4	50.2	43.3	0.0	1.0	43.0	2.36	1.42	2.36	1.42	1.60	SAND	0.5	0.86	240	1.00	240	non-LIQ	0.840	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
41.18	634.8	115.0	115.0	310.4	3.1	1.0	4.8	53.4	46.0	0.0	1.0	46.0	2.37	1.43	2.37	1.43	1.63	SAND	0.5	0.86	253	1.00	253	non-LIQ	0.839	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
41.34	634.7	115.0	115.0	333.4	3.7	1.1	5.0	57.6	49.6	0.0	1.0	50.0	2.38	1.43	2.38	1.43	1.64	SAND	0.5	0.86	271	1.00	270	non-LIQ	0.838	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
41.50	634.5	115.0	115.0	353.4	4.2	1.2	5.2	61.2	52.6	0.0	1.0	53.0	2.39	1.43	2.39	1.43	1.65	SAND	0.5	0.86	287	1.00	287	non-LIQ	0.836	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
41.67	634.3	115.0	115.0	358.3	4.3	1.2	5.2	62.1	53.2	0.0	1.0	53.0	2.40	1.44	2.40	1.44	1.65	SAND	0.5	0.86	290	1.00	291	non-LIQ	0.835	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
41.83	634.2	115.0	115.0	357.2	4.4	1.2	5.4	62.1	53.2	0.0	1.0	53.0	2.41	1.44	2.41	1.44	1.66	SAND	0.5	0.86	289	1.01	292	non-LIQ	0.834	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
42.00	634.0	115.0	115.0	360.5	4.6	1.3	5.5	62.9	53.6	0.0	1.0	54.0	2.42	1.45	2.42	1.45	1.67	SAND	0.5	0.85	291	1.02	296	non-LIQ	0.832	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
42.16	633.8	115.0	115.0	365.5	4.9	1.3	5.8	64.1	54.7	0.0	1.0	55.0	2.42	1.45	2.42	1.45	1.68	SAND	0.5	0.85	295	1.03	302	non-LIQ	0.831	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
42.32	633.7	115.0	115.0	369.1	5.1	1.4	5.9	64.9	55.3	0.0	1.0	56.0	2.43	1.46	2.43	1.46	1.69	SAND	0.5	0.85	297	1.03	307	non-LIQ	0.830	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
42.49	633.5	115.0	115.0	357.8	5.0	1.4	6.2	63.2	53.8	0.0	1.0	54.0	2.44	1.46	2.44	1.46	1.70	SAND	0.5	0.85	288	1.04	299	non-LIQ	0.828	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
42.65	633.4	115.0	115.0	352.0	5.2	1.5	6.6	62.7	53.3	0.1	1.0	54.0	2.45	1.46	2.45	1.46	1.73	SAND	0.5	0.85	283	1.06	299	non-LIQ	0.827	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
42.82	633.2	115.0	115.0	350.8	5.5	1.6	7.1	62.9	53.4	0.1	1.0	54.0	2.46	1.47	2.46	1.47	1.75	SAND	0.5	0.85	281	1.07	301	non-LIQ	0.826	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
42.98	633.0	115.0	115.0	357.8	5.4	1.5	6.7	63.8	54.1	0.1	1.0	55.0	2.47	1.47	2.47	1.47	1.73	SAND	0.5	0.85	287	1.06	303	non-LIQ	0.824	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
43.15	632.9	115.0	115.0	380.5	5.3	1.4	5.9	66.8	56.5	0.0	1.0	57.0	2.48	1.48	2.48	1.48	1.69	SAND	0.5	0.85	304	1.03	313	non-LIQ	0.823	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
43.31	632.7	115.0	115.0	403.8	5.4	1.3	5.4	70.2	59.3	0.0	1.0	59.0	2.49	1.48	2.49	1.48	1.66	SAND	0.5	0.84	322	1.01	325	non-LIQ	0.822	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
43.47	632.5	115.0	115.0	405.6	5.4	1.3	5.3	70.5	59.4	0.0	1.0	60.0	2.50	1.49	2.50	1.49	1.66	SAND	0.5	0.84	323	1.01	326	non-LIQ	0.820	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
43.64	632.4	115.0	115.0	400.9	6.1	1.5	6.2	70.9	59.7	0.0	1.0	60.0	2.51	1.49	2.51	1.49	1.71	SAND	0.5	0.84	319	1.04	333	non-LIQ	0.819	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
43.80	632.2	115.0	115.0	382.0	7.0	1.8	7.8	69.4	58.4	0.3	1.0	59.0	2.52	1.50	2.52	1.50	1.79	SAND	0.5	0.84	304	1.10	333	non-LIQ	0.818	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
43.97	632.0	115.0	115.0	372.5	8.2	2.2	9.4	69.5	58.4	0.7	1.0	60.0	2.53	1.50	2.53	1.50	1.86	SAND	0.5	0.84	296	1.15	341	non-LIQ	0.816	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
44.13	631.9	115.0	115.0	358.0	5.0	1.4	6.2	63.3	53.1	0.0	1.0	53.0	2.54	1.50	2.54	1.50	1.71	SAND	0.5	0.84	284	1.04	296	non-LIQ	0.815	0.550	0.510	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
44.29	631.7	115.0	115.0	363.1	5.2	1.4	6.3	64.3	53.9	0.1	1.0	54.0	2.55	1.51	2.55	1.51	1.71	SAND	0.5	0.84	287	1.05	301	non-LIQ	0.814	0.540	0.500	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
44.46	631.5	115.0	115.0	365.0	5.5	1.5	6.7	65.0	54.4	0.1	1.0	55.0	2.56	1.51	2.56	1.51	1.73	SAND	0.5	0.84	289	1.06	305	non-LIQ	0.812	0.540	0.500	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
44.62	631.4	115.0	115.0	346.9	6.6	1.9	8.7	63.9	53.4	0.5	1.0	55.0	2.57	1.52	2.57	1.52	1.82	SAND	0.5	0.84	274	1.13	308	non-LIQ	0.811	0.540	0.500	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
44.79	631.2	115.0	115.0	336.3	7.6	2.3	10.3	63.6	53.0	1.0	1.0	55.0	2.58	1.52	2.58	1.52	1.89	SAND	0.5	0.83	265	1.18	314	non-LIQ	0.809	0.540	0.500	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
44.95	631.1	115.0	115.0	337.4	7.9	2.3	10.6	64.1	53.4	1.1	1.0	56.0	2.58	1.53	2.58	1.53	1.91	SAND	0.5	0.83	266	1.20	318	non-LIQ	0.808	0.540	0.500	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
45.11	630.9	115.0	115.0	353.6	7.5	2.1	9.5	66.0	54.9	0.7	1.0	57.0	2.59	1.53	2.59	1.53	1.86	SAND	0.5	0.83	278	1.15	321	non-LIQ	0.807	0.540	0.500	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
45.28	630.7	115.0	115.0	367.1	8.1	2.2	9.6	68.7	57.0	0.7	1.0	59.0	2.60	1.53	2.60	1.53	1.87	SAND	0.5	0.83	288	1.16	334	non-LIQ	0.806	0.540	0.500	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
45.44	630.6	115.0	115.0	299.5	11.7	3.9	16.6	61.9	51.3	2.9	1.1	57.0	2.61	1.54	2.61	1.54	2.12	SAND	0.5	0.83	235	1.50	352	non-LIQ	0.804	0.540	0.500	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
45.61	630.4	115.0	115.0	283.2	12.0	4.2	17.9	59.6	49.3	3.2	1.1	56.0	2.62	1.54	2.62	1.54	2.17	SAND	0.5	0.83	222	1.59	353	non-LIQ	0.803	0.540	0.500	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
45.77	630.2	115.0	115.0	310.4	9.6	3.1	13.8	61.8	51.1	2.1	1.0	55.0	2.63	1.55	2.63	1.55	2.03	SAND	0.5	0.83	243	1.34	326	non-LIQ	0.802	0.540	0.500	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
45.93	630.1	115.0	115.0	339.0	7.1	2.1	9.6	63.5	52.4	0.8	1.0	54.0	2.64	1.55	2.64	1.55	1.87	SAND	0.5	0.83	265	1.16	307	non-LIQ	0.800	0.540	0.500	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
46.10	629.9	115.0	115.0	355.0	6.9	1.9	8.8	65.6	54.1	0.5	1.0	55.0	2.65	1.56	2.65	1.56	1.83	SAND	0.5	0.82	277	1.13	312	non-LIQ	0.799	0.540	0.500	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
46.26	629.7	115.0	115.0	389.5	6.6	1.7	7.3	70.1	57.7	0.2	1.0	58.0	2.66	1.56	2.66	1.56	1.76	SAND	0.5	0.82	303	1.08	327	non-LIQ	0.798	0.540	0.500	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
46.43	629.6	115.0	115.0	407.9	5.9	1.4	5.9	71.7	59.0	0.0	1.0	59.0	2.67	1.56	2.67	1.56	1.69	SAND	0.5	0.82	317	1.03	327	non-LIQ	0.796	0.540	0.500	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
46.59	629.4	115.0	115.0	398.7	5.5	1.4	5.7	69.8	57.4	0.0	1.0	58.0	2.68	1.57	2.68	1.57	1.68	SAND	0.5	0.82	309	1.02	317	non-LIQ	0.795	0.540	0.500	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
46.75	629.3	115.0	115.0	340.4	5.0	1.5	7.0	61.0	50.0	0.1	1.0	51.0	2.69	1.57	2.69	1.57	1.74	SAND	0.5	0.82	264	1.07	282	non-LIQ	0.794	0.540	0.500	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
46.92	629.1	115.0	115.0	243.5	4.2	1.7	10.2	46.0	37.7	0.9	1.0	39.0	2.70	1.58	2.70	1.58	1.89	SAND	0.5	0.82	188	1.18	222	non-LIQ	0.792	0.540	0.500	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
47.08	628.9	115.0	115.0	147.1	4.5	3.1	19.9	31.7	25.9	3.6	1.1	32.0	2.71	1.58	2.71	1.58	2.23	SAND	0.5	0.82	114	1.74	197	non-LIQ	0.791	0.540	0.500	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
47.25	628.8	115.0	115.0	115.4	5.6	4.9	28.6	27.5	22.5	4.6	1.1	30.0	2.72	1.59	2.72	1.59	2.45	SAND	0.5	0.82	89	2.54	226	non-LIQ	0.789	0.540	0.500	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
47.41	628.6	115.0	115.0	133.7	4.6	3.4	22.3	29.7	24.2	4.0	1.1	30.0	2.73	1.59	2.73	1.59	2.29	SAND	0.5	0.82	103	1.93	199	non-LIQ	0.788	0.540	0.500	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
47.57	628.4	115.0	115.0	83.9	6.0	7.2	42.3	23.0	18.7	5.0	1.2	27.0	2.74	1.59	2.74	1.59	2.73	non-LIQ CLAY	1	0.66	NA	4.25	non-LIQ	non-LIQ	0.787	0.540	0.500	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
47.74	628.3	115.0	115.0	181.6	9.3	5.1	24.4	41.2	33.6	4.2	1.1	42.0	2.75	1.60	2.75	1.60	2.35	SAND	0.5	0.81	140	2.12	296	non-LIQ	0.785	0.530	0.490	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
47.90	628.1	115.0	115.0	255.0	12.3	4.8	20.5	55.4	45.0	3.7	1.1	52.0	2.75	1.60	2.75	1.60	2.25	SAND	0.5	0.81	196	1.78	349	non-LIQ	0.784	0.530	0.490	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
48.07	627.9	115.0	115.0	221.0	12.3	5.6	23.7	49.8	40.4	4.1	1.1	49.0	2.76	1.61	2.76	1.61	2.33	SAND	0.5	0.81	169	2.06	348	non-LIQ	0.763	0.530	0.490	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
48.23	627.8	115.0	115.0	200.7	10.6	5.3	23.9	45.4	36.7	4.2	1.1	45.0	2.77	1.61	2.77	1.61	2.34	SAND	0.5	0.81	154	2.07	318	non-LIQ	0.781	0.530	0.490	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
48.39	627.6	115.0	115.0	151.6	8.4	5.5	27.5	35.7	28.9	4.5	1.1	37.0	2.78	1.62	2.78	1.62	2.43	SAND	0.5	0.81	116	2.42	281	non-LIQ	0.780	0.530	0.490	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
48.56	627.4	115.0	115.0	133.5	7.2	5.4	28.6	31.8	25.7	4.6	1.1	34.0	2.79	1.62	2.79	1.62	2.45	SAND	0.5	0.81	102	2.53	258	non-LIQ	0.779	0.530	0.490	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
48.72	627.3	115.0	115.0	118.4	6.4	5.4	30.0	28.6	23.1	4.7	1.2	31.0	2.80	1.62	2.80	1.62	2.49	SAND	0.5	0.81	90	2.70	244	non-LIQ	0.778	0.530	0.490	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
48.89	627.1	115.0	115.0	124.7	7.1	5.7	30.2	30.2	24.4	4.7	1.2	33.0	2.81	1.63	2.81	1.63	2.49	SAND	0.5	0.81	95	2.72	258	non-LIQ	0.776	0.530	0.490	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
49.05	627.0	115.0	115.0	153.6	8.1	5.3	26.7	35.8	28.8	4.5	1.1	37.0	2.82	1.63	2.82	1.63	2.41	SAND	0.5	0.80	117	2.34	273	non-LIQ	0.775	0.530	0.490	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
49.22	626.8	115.0	115.0	181.6	9.5	5.2	24.6	41.5	33.3	4.3	1.1	41.0	2.83	1.64	2.83	1.64	2.36	SAND	0.5	0.80	138	2.16	298	non-LIQ	0.773	0.530	0.490	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
49.38	626.6	115.0	115.0	178.7	11.0	6.2	27.4	42.0	33.7	4.5	1.1	43.0	2.84	1.64	2.84	1.64	2.42	SAND	0.5	0.80	136	2.41	327	non-LIQ	0.772	0.530	0.490	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
49.54	626.5	115.0	115.0	186.0	11.1	6.0	26.5	43.3	34.7	4.4	1.1	44.0	2.85	1.65	2.85	1.65	2.40	SAND	0.5	0.80	141	2.32	327	non-LIQ	0.771	0.530	0.490	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
49.71	626.3	115.0	115.0	231.1	9.6	4.2	19.6	49.6	39.7	3.5	1.1	46.0	2.86	1.65	2.86	1.65	2.22	SAND	0.5	0.80	175	1.71	299	non-LIQ	0.769	0.530	0.490	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
49.87	626.1	115.0	115.0	264.4	11.6	4.4	19.2	56.5	45.2	3.5	1.1	52.0	2.87	1.65	2.87	1.65	2.21	SAND	0.5	0.80	200	1.68	336	non-LIQ	0.768	0.530	0.490	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
50.04	626.0	115.0	115.0	296.8	11.9	4.0	17.2	61.8	49.4	3.1	1.1	55.0	2.88	1.66	2.88	1.66	2.15	SAND	0.5	0.80	224	1.54	346	non-LIQ	0.767	0.530	0.490	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00

Liquefaction Analysis with Cone Penetration Test (CPT) Data

Earth Mechanics, Inc.
17800 Newhope Street
Suite B
Fountain Valley, CA 92708

CPT Number: CPT-10-010
Project Name: SR-57/60 Confluence Project
Project Number: 08-170
Location: Grand Ave WB On Ramp
City of Industry, California

Computed by: SP
Checked by:

Date: 02/01/12
Date:

Figure No.:

Reference:

1) Seed, R.B., et al, *Recent Advances in Soil Liquefaction Engineering: A Unified and Consistent Framework*, Keynote Presentation, 26th Annual ASCE Los Angeles Geotechnical Spring Seminar, April 30, 2003.
2) Youd, T.L. & Idriss, I.M., et al, *Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils*, ASCE Journal of Geotechnical and Geoenvironmental Engineering, Pp. 817-833, October 2001.
3) Pradel D., *Procedure to Evaluate Earthquake-Induced Settlements in Dry Sandy Soils*, ASCE Journal of Geotechnical and Geoenvironmental Engineering, Pp. 364-368, April 1998.
4) Tokimatsu, K. & Seed, H.B., *Evaluation of Settlements in Sands due to Earthquake Shaking*, ASCE Journal of Geotechnical Engineering, Pp. 861-878, August 1987.
5) Jefferies, M.G. & Davies, M.P., *Use of CPT to Estimate Equivalent SPT N_{60}*, ASTM Geotechnical Testing Journal, Vol.17, No. 4, Pp. 458-567, 1993.
6) Robertson, P.K, et al, *Use of Piezometer Cone Data*, Proceedings of the ASCE Specialty Conference in Situ 86: Use of In Situ Tests in Geotechnical Engineering, Blacksburg, Pp. 1263-1280, 1986.

Surface Elevation = 690 ft MSL
Design Magnitude, M_w = 7.30
PGA, a_{max} = 0.61 g
Earthquake Scaling Factor, MSF = 1.071 for M_w = 7.3
Design Water Level = 671 ft MSL
Water Level at Investigation = 671 ft MSL
Req'd Factor of Safety = 1

Summary of Seismically Induced Settlement:

Dry Settlement (in)	0.165
Post-liquefaction Settlement (in)	0.651
Total Settlement (in)	0.816

Depth (ft)	Elev. (ft, MSL)	Unit Weight (pcf) γ'_{MOIST}	Unit Weight (pcf) γ'_{SAT}	q_c (tsf)	f_s (tsf)	Frict. Ratio (%)	% Fines	Equiv. N_{60}	Equiv. $(N_1)_{60}$	α	β	Equiv. $(N_1)_{60cs}$	Stresses at Exploration Water Level σ_v (tsf)	Stresses at Exploration Water Level σ_v' (tsf)	Stresses at Design Water Level σ_v (tsf)	Stresses at Design Water Level σ_v' (tsf)	I_c	Soil Type Character (SAND, SILT or non-LIQ CLAY)	Normalization of Tip Resistance n	Normalization of Tip Resistance C_Q	Normalization of Tip Resistance q_{c1N}	Fines Correction Kc	Fines Correction $(q_{c1N})_{cs}$	$CRR_{7.5}$	r_d	CSR	$CSR_{7.5}$	FS	a	b	Max Shear Modulus G_{max} (tsf)	Cyclic Shear Strain γ (%)	Norm. Vol. Strain ε_{vc} (%)	Dry Settle. ΔS (in)	Post-Liq. $(N_1)_{60cs}$	Post-Liq. Vol. Strain ε (%)	Layer Post-Liq. Settle. ΔS (in)
0.33	689.7	115.0	115.0	99.6	3.2	3.2	9	18	138	0.53	1.02	140	0.019	0.019	0.019	0.019	1.84	SAND	0.5	1.70	160.0	1.13	181.4	non-LIQ	0.999	0.40	0.370	Above Water	0.12	87827	260.2	0.01	0.00	0.000	NA	NA	0.000
0.49	689.5	115.0	115.0	121.7	4.4	3.6	10	23	140	0.87	1.02	144	0.028	0.028	0.028	0.028	1.88	SAND	0.5	1.70	195.5	1.17	229.6	non-LIQ	0.999	0.40	0.370	Above Water	0.12	69261	319.2	0.01	0.00	0.000	NA	NA	0.000
0.66	689.3	115.0	115.0	108.6	3.8	3.5	11	21	109	1.10	1.02	113	0.038	0.038	0.038	0.038	1.91	SAND	0.5	1.70	174.5	1.20	209.4	non-LIQ	0.998	0.40	0.370	Above Water	0.12	57944	340.5	0.01	0.00	0.000	NA	NA	0.000
0.82	689.2	115.0	115.0	86.8	2.3	2.6	10	16	77	0.73	1.02	79	0.047	0.047	0.047	0.047	1.86	SAND	0.5	1.70	139.5	1.16	161.4	non-LIQ	0.998	0.40	0.370	Above Water	0.13	50868	337.8	0.02	0.00	0.000	NA	NA	0.000
0.98	689.0	115.0	115.0	86.4	3.0	3.5	13	17	73	1.76	1.03	78	0.056	0.056	0.056	0.056	1.99	SAND	0.5	1.70	138.8	1.28	178.2	non-LIQ	0.998	0.40	0.370	Above Water	0.13	45709	363.5	0.02	0.00	0.000	NA	NA	0.000
1.15	688.8	115.0	115.0	107.9	3.2	3.0	10	20	82	0.99	1.02	85	0.066	0.066	0.066	0.066	1.90	SAND	0.5	1.70	173.4	1.19	205.6	non-LIQ	0.997	0.40	0.370	Above Water	0.13	41526	408.3	0.02	0.00	0.000	NA	NA	0.000
1.31	688.7	115.0	115.0	101.2	3.7	3.7	13	20	75	1.91	1.04	79	0.075	0.075	0.075	0.075	2.00	SAND	0.5	1.70	162.6	1.31	212.4	non-LIQ	0.997	0.40	0.370	Above Water	0.13	38404	423.0	0.02	0.00	0.000	NA	NA	0.000
1.48	688.5	115.0	115.0	86.3	2.7	3.1	13	17	60	1.79	1.04	64	0.085	0.085	0.085	0.085	1.99	SAND	0.5	1.70	139.0	1.29	179.0	non-LIQ	0.997	0.40	0.370	Above Water	0.13	35693	417.3	0.02	0.01	0.000	NA	NA	0.000
1.64	688.4	115.0	115.0	71.1	2.3	3.2	15	14	48	2.39	1.05	53	0.094	0.094	0.094	0.094	2.06	SAND	0.5	1.70	114.2	1.39	158.5	0.45	0.996	0.39	0.360	Above Water	0.13	33560	408.2	0.03	0.01	0.000	NA	NA	0.000
1.80	688.2	115.0	115.0	66.1	2.6	3.0	13	17	54	1.88	1.04	58	0.104	0.104	0.104	0.104	2.00	SAND	0.5	1.70	138.3	1.30	180.1	non-LIQ	0.996	0.39	0.360	Above Water	0.13	31737	445.4	0.03	0.01	0.000	NA	NA	0.000
1.97	688.0	115.0	115.0	88.4	3.2	3.6	15	18	55	2.50	1.05	60	0.113	0.113	0.113	0.113	2.07	SAND	0.5	1.70	142.0	1.41	199.9	non-LIQ	0.995	0.39	0.360	Above Water	0.13	30065	467.4	0.03	0.01	0.000	NA	NA	0.000
2.13	687.9	115.0	115.0	64.4	3.5	4.1	17	18	52	3.04	1.06	58	0.122	0.122	0.122	0.122	2.14	SAND	0.5	1.70	135.6	1.54	208.5	non-LIQ	0.995	0.39	0.360	Above Water	0.13	28686	476.6	0.03	0.01	0.000	NA	NA	0.000
2.30	687.7	115.0	115.0	64.0	3.2	3.8	16	17	49	2.88	1.06	55	0.132	0.132	0.132	0.132	2.12	SAND	0.5	1.70	135.0	1.49	201.6	non-LIQ	0.995	0.39	0.360	Above Water	0.13	27397	487.0	0.03	0.01	0.000	NA	NA	0.000
2.46	687.5	115.0	115.0	77.7	3.0	3.9	17	16	44	3.11	1.06	50	0.141	0.141	0.141	0.141	2.15	SAND	0.5	1.70	124.8	1.56	194.4	non-LIQ	0.994	0.39	0.360	Above Water	0.13	26313	487.3	0.04	0.01	0.000	NA	NA	0.000
2.62	687.4	115.0	115.0	92.4	2.2	2.4	11	18	47	1.37	1.03	50	0.151	0.151	0.151	0.151	1.94	SAND	0.5	1.70	148.5	1.23	182.9	non-LIQ	0.994	0.39	0.360	Above Water	0.13	25337	513.0	0.03	0.01	0.000	NA	NA	0.000
2.79	687.2	115.0	115.0	111.1	2.9	2.6	11	21	55	1.34	1.03	56	0.160	0.160	0.160	0.160	1.94	SAND	0.5	1.70	178.5	1.23	219.3	non-LIQ	0.993	0.39	0.360	Above Water	0.13	24399	556.8	0.03	0.01	0.000	NA	NA	0.000
2.95	687.1	115.0	115.0	140.8	4.7	3.3	13	28	69	1.74	1.03	73	0.170	0.170	0.170	0.170	1.99	SAND	0.5	1.70	226.2	1.28	289.9	non-LIQ	0.993	0.39	0.360	Above Water	0.13	23596	617.5	0.02	0.01	0.000	NA	NA	0.000
3.12	686.9	115.0	115.0	187.2	7.2	3.8	13	37	89	1.78	1.04	94	0.179	0.179	0.179	0.179	1.99	SAND	0.5	1.70	300.8	1.29	387.2	non-LIQ	0.993	0.39	0.360	Above Water	0.13	22616	692.2	0.02	0.00	0.000	NA	NA	0.000
3.28	686.7	115.0	115.0	194.5	6.4	4.3	14	39	92	2.17	1.04	98	0.189	0.189	0.189	0.189	2.03	SAND	0.5	1.70	312.5	1.35	420.7	non-LIQ	0.992	0.39	0.360	Above Water	0.13	22142	716.8	0.02	0.00	0.000	NA	NA	0.000
3.45	686.5	115.0	115.0	194.8	8.2	4.2	14	39	89	2.12	1.04	95	0.198	0.198	0.198	0.198	2.03	SAND	0.5	1.70	313.0	1.34	416.7	non-LIQ	0.992	0.39	0.360	Above Water	0.13	21460	728.8	0.02	0.00	0.000	NA	NA	0.000
3.61	686.4	115.0	115.0	178.6	7.5	4.2	14	36	81	2.28	1.04	87	0.208	0.208	0.208	0.208	2.05	SAND	0.5	1.70	286.9	1.37	392.1	non-LIQ	0.992	0.39	0.360	Above Water	0.13	20804	720.6	0.02	0.00	0.000	NA	NA	0.000
3.77	686.2	115.0	115.0	151.9	6.9	4.5	16	31	69	2.82	1.06	76	0.217	0.217	0.217	0.217	2.11	SAND	0.5	1.70	244.1	1.46	361.1	non-LIQ	0.991	0.39	0.360	Above Water	0.13	20367	698.8	0.03	0.01	0.000	NA	NA	0.000
3.94	686.1	115.0	115.0	131.2	5.7	4.3	17	27	59	2.96	1.06	65	0.227	0.227	0.227	0.227	2.13	SAND	0.5	1.70	210.8	1.51	319.2	non-LIQ	0.991	0.39	0.360	Above Water	0.13	19835	677.0	0.03	0.01	0.000	NA	NA	0.000
4.10	685.9	115.0	115.0	117.3	4.8	4.1	17	24	52	3.00	1.06	58	0.236	0.236	0.236	0.236	2.14	SAND	0.5	1.70	188.5	1.53	287.8	non-LIQ	0.990	0.39	0.360	Above Water	0.13	19367	661.5	0.04	0.01	0.000	NA	NA	0.000
4.27	685.7	115.0	115.0	118.0	4.8	3.8	16	24	50	2.83	1.06	56	0.246	0.246	0.246	0.246	2.11	SAND	0.5	1.70	189.6	1.46	281.0	non-LIQ	0.990	0.39	0.360	Above Water	0.13	18901	669.7	0.04	0.01	0.000	NA	NA	0.000
4.43	685.6	115.0	115.0	119.8	4.8	4.0	17	25	51	2.98	1.06	57	0.255	0.255	0.255	0.255	2.13	SAND	0.5	1.70	192.5	1.52	292.4	non-LIQ	0.990	0.39	0.360	Above Water	0.13	18486	683.2	0.04	0.01	0.000	NA	NA	0.000
4.59	685.4	115.0	115.0	139.8	6.1	4.4	17	29	58	2.99	1.06	65	0.264	0.264	0.264	0.264	2.14	SAND	0.5	1.70	224.6	1.52	342.1	non-LIQ	0.989	0.39	0.360	Above Water	0.13	18099	728.0	0.03	0.01	0.000	NA	NA	0.000
4.76	685.2	115.0	115.0	147.5	6.4	4.3	17	30	60	2.92	1.06	66	0.274	0.274	0.274	0.274	2.13	SAND	0.5	1.70	237.0	1.50	356.4	non-LIQ	0.989	0.39	0.360	Above Water	0.13	17708	749.2	0.03	0.01	0.000	NA	NA	0.000
4.92	685.1	115.0	115.0	142.0	5.3	3.7	15	29	56	2.57	1.05	61	0.283	0.283	0.283	0.283	2.08	SAND	0.5	1.70	228.1	1.42	324.3	non-LIQ	0.989	0.39	0.360	Above Water	0.13	17360	743.5	0.04	0.01	0.000	NA	NA	0.000
5.09	684.9	115.0	115.0	142.1	4.8	3.4	14	28	54	2.29	1.04	59	0.293	0.293	0.293	0.293	2.05	SAND	0.5	1.70	228.0	1.37	312.2	non-LIQ	0.988	0.39	0.360	Above Water	0.13	17010	748.8	0.04	0.01	0.000	NA	NA	0.000
5.25	684.8	115.0	115.0	140.8	5.0	3.6	15	28	53	2.49	1.05	58	0.302	0.302	0.302	0.302	2.07	SAND	0.5	1.70	226.2	1.41	318.0	non-LIQ	0.988	0.39	0.360	Above Water	0.13	16697	756.7	0.04	0.01	0.000	NA	NA	0.000
5.41	684.6	115.0	115.0	126.2	5.7	4.5	19	27	49	3.36	1.07	56	0.311	0.311	0.311	0.311	2.19	SAND	0.5	1.70	202.8	1.64	332.7	non-LIQ	0.987	0.39	0.360	Above Water	0.13	16399	748.7	0.04	0.01	0.001	NA	NA	0.000
5.58	684.4	115.0	115.0	107.6	6.1	5.7	23	24	44	4.06	1.10	52	0.321	0.321	0.321	0.321	2.31	SAND	0.5	1.70	172.9	1.99	344.4	non-LIQ	0.987	0.39	0.360	Above Water	0.13	16097	730.0	0.05	0.02	0.001	NA	NA	0.000
5.74	684.3	115.0	115.0	98.7	5.8	5.9	24	22	40	4.23	1.11	49	0.330	0.330	0.330	0.330	2.35	SAND	0.5	1.70	158.6	2.12	336.0	non-LIQ	0.987	0.39	0.360	Above Water	0.13	15827	719.9	0.05	0.02	0.001	NA	NA	0.000
5.91	684.1	115.0	115.0	93.7	5.5	5.9	25	21	38	4.29	1.12	46	0.340	0.340	0.340	0.340	2.37	SAND	0.5	1.70	150.5	2.18	327.5	non-LIQ	0.986	0.39	0.360	Above Water	0.13	15552	716.1	0.05	0.02	0.001	NA	NA	0.000
6.07	683.9	115.0	115.0	88.8	3.7	4.2	21	19	34	3.78	1.09	40	0.349	0.349	0.349	0.349	2.26	SAND	0.5	1.70	142.7	1.82	259.9	non-LIQ	0.986	0.39	0.360	Above Water	0.13	15305	696.7	0.06	0.03	0.001	NA	NA	0.000
6.23	683.8	115.0	115.0	80.8	4.1	5.1	25	18	32	4.25	1.11	39	0.358	0.358	0.358	0.358	2.36	SAND	0.5	1.70	129.8	2.14	277.7	non-LIQ	0.985	0.39	0.360	Above Water	0.13	15058	692.6	0.07	0.04	0.001	NA	NA	0.000
6.40	683.6	115.0	115.0	96.7	3.9	4.0	20	21	35	3.63	1.08	42	0.368	0.368	0.368	0.368	2.23	SAND	0.5	1.70	155.0	1.75	270.9	non-LIQ	0.985	0.39	0.360	Above Water	0.13	14826	728.9	0.06	0.03	0.001	NA	NA	0.000
6.56	683.4	115.0	115.0	74.6	4.3	5.8	28	18	29	4.52	1.13	38	0.377	0.377	0.377	0.377	2.43	SAND	0.5	1.67	118.1	2.43	286.6	non-LIQ	0.985	0.39	0.360	Above Water	0.13	14608	693.7	0.07	0.04	0.002	NA	NA	0.000
6.73	683.3	115.0	115.0	69.6	3.7	5.3	27	16	27	4.50	1.13	35	0.387	0.387	0.387	0.387	2.42	SAND	0.5	1.65	108.8	2.40	260.6	non-LIQ	0.984	0.39	0.360	Above Water	0.13	14386	682.8	0.08	0.05	0.002	NA	NA	0.000
6.89	683.1	115.0	115.0	55.9	3.5	6.3	32	14	23	4.85	1.17	31	0.396	0.396	0.396	0.396	2.54	SAND	0.5	1.63	86.3	2.97	256.3	non-LIQ	0.984	0.39	0.360	Above Water	0.13	14184	651.7	0.10	0.08	0.003	NA	NA	0.000
7.05	683.0	115.0	115.0	50.0	3.3	6.6	35	13	21	4.97	1.20	30	0.405	0.405	0.405	0.405	2.59	SAND	0.5	1.62	76.3	3.26	249.0	non-LIQ	0.984	0.39	0.360	Above Water	0.13	13990	638.1	0.12	0.11	0.004	NA	NA	0.000
7.22	682.8	115.0	115.0	45.2	2.9	6.4	33	11	18	4.91	1.18	26	0.415	0.415	0.415	0.415	2.56	SILT	0.7	1.70	72.6	3.09	224.7	non-LIQ	0.983	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
7.38	682.6	115.0	115.0	40.6	2.3	5.7	33	10	16	4.89	1.18	24	0.424	0.424	0.424	0.424	2.55	SILT	0.7	1.70	65.2	3.05	198.7	non-LIQ	0.983	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
7.55	682.5	115.0	115.0	34.9	1.7	4.9	33	9	14	4.88	1.18	21	0.434	0.434	0.434	0.434	2.55	SILT	0.7	1.70	56.1	3.04	170.2	non-LIQ	0.982	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
7.71	682.3	115.0	115.0	38.3	2.0	5.2	35	10	15	5.00	1.20	23	0.443	0.443	0.443	0.443	2.60	SAND	0.5	1.54	55.9	3.33	186.0	non-LIQ	0.982	0.39	0.360	Above Water	0.14	13259	602.5	0.16	0.24	0.009	NA	NA	0.000
7.87	682.1	115.0	115.0	56.2	2.0	3.6	25	13	20	4.29	1.12	26	0.453	0.453	0.453	0.453	2.37	SAND	0.5	1.53	81.2	2.18	176.8	non-LIQ	0.982	0.39	0.360	Above Water	0.14	13096	664.4	0.13	0.12	0.005	NA	NA	0.000
8.04	682.0	115.0	115.0	32.5	2.1	6.5	36	8	13	5.00	1.20	20	0.462	0.462	0.462	0.462	2.61	non-LIQ CLAY	1	1.70	NA	3.38	non-LIQ	non-LIQ	0.981	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
8.20	681.8	115.0	115.0	32.5	1.9	5.8	38	9	13	5.00	1.20	20	0.472	0.472	0.472	0.472	2.65	SILT	0.7	1.70	52.2	3.63	189.7	non-LIQ	0.981	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
8.37	681.6	115.0	115.0	39.7	1.9	4.8	34	10	15	4.94	1.19	23	0.481	0.481	0.481	0.481	2.57	SAND	0.5	1.48	55.6	3.17	176.3	non-LIQ	0.980	0.39	0.360	Above Water	0.14	12621	624.0	0.19	0.25	0.010	NA	NA	0.000
8.53	681.5	115.0	115.0	29.5	1.9	6.4	38	8	11	5.00	1.20	19	0.490	0.490	0.490	0.490	2.65	non-LIQ CLAY	1	1.70	NA	3.66	non-LIQ	non-LIQ	0.980	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000

Liquefaction Analysis with Cone Penetration Test (CPT) Data

Depth (ft)	Elev. (ft, MSL)	Unit Weight (pcf) γ'_{MOIST}	Unit Weight (pcf) γ'_{SAT}	q_c (tsf)	f_s (tsf)	Frict. Ratio (%)	% Fines	Equiv. N_{60}	Equiv. $(N_1)_{60}$	α	β	Equiv. $(N_1)_{60cs}$	Stresses at Exploration Water Level σ_v (tsf)	Stresses at Exploration Water Level σ_v' (tsf)	Stresses at Design Water Level σ_v (tsf)	Stresses at Design Water Level σ_v' (tsf)	I_c	Soil Type Character (SAND, SILT or non-LIQ CLAY)	Normalization of Tip Resistance n	C_Q	q_{c1N}	Fines Correction Kc	$(q_{c1N})_{cs}$	$CRR_{7.5}$	r_d	CSR_M	$CSR_{7.5}$	FS	a	b	Max Shear Modulus G_{max} (tsf)	Cyclic Shear Strain γ (%)	Norm. Vol. Strain ϵ_{Nc} (%)	Dry Settle. ΔS (in)	Post-Liq. $(N_1)_{60cs}$	Post-Liq. Vol. Strain ϵ (%)	Layer Post-Liq. Settle. ΔS (in)
8.69	681.3	115.0	115.0	30.2	1.7	5.6	36	8	11	5.00	1.20	19	0.500	0.500	0.500	0.500	2.61	non-LIQ CLAY	1	1.70	NA	3.36	non-LIQ	non-LIQ	0.980	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
8.86	681.1	115.0	115.0	28.7	1.6	5.6	36	7	11	5.00	1.20	18	0.509	0.509	0.509	0.509	2.62	non-LIQ CLAY	1	1.70	NA	3.47	non-LIQ	non-LIQ	0.979	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
9.02	681.0	115.0	115.0	27.2	1.4	5.1	36	7	10	5.00	1.20	17	0.519	0.519	0.519	0.519	2.62	non-LIQ CLAY	1	1.70	NA	3.44	non-LIQ	non-LIQ	0.979	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
9.19	680.8	115.0	115.0	30.2	1.4	4.6	36	8	11	5.00	1.20	18	0.528	0.528	0.528	0.528	2.62	SILT	0.7	1.63	46.4	3.45	160.3	non-LIQ	0.979	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
9.35	680.7	115.0	115.0	32.5	1.6	4.9	36	8	12	5.00	1.20	19	0.538	0.538	0.538	0.538	2.62	SILT	0.7	1.61	49.3	3.45	170.5	non-LIQ	0.978	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
9.51	680.5	115.0	115.0	33.9	1.5	4.4	34	9	12	4.94	1.19	19	0.547	0.547	0.547	0.547	2.58	SILT	0.7	1.59	50.9	3.19	162.3	non-LIQ	0.978	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
9.68	680.3	115.0	115.0	33.2	1.4	4.2	34	8	12	4.93	1.19	19	0.557	0.557	0.557	0.557	2.57	SILT	0.7	1.57	49.2	3.16	155.6	0.43	0.977	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
9.84	680.2	115.0	115.0	31.4	1.1	3.5	34	8	11	4.94	1.19	18	0.566	0.566	0.566	0.566	2.58	SAND	0.5	1.37	40.6	3.18	129.2	0.28	0.977	0.39	0.360	Above Water	0.14	11453	609.3	0.31	0.61	0.024	NA	NA	0.000
10.01	680.0	115.0	115.0	26.7	0.9	3.4	35	7	9	4.96	1.19	16	0.576	0.576	0.576	0.576	2.58	SILT	0.7	1.53	38.6	3.22	124.5	0.26	0.977	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
10.17	679.8	115.0	115.0	25.1	1.0	4.0	35	6	9	5.00	1.20	15	0.585	0.585	0.585	0.585	2.60	non-LIQ CLAY	1	1.70	NA	3.33	non-LIQ	non-LIQ	0.976	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
10.34	679.7	115.0	115.0	23.3	1.1	4.7	40	6	8	5.00	1.20	15	0.595	0.595	0.595	0.595	2.68	non-LIQ CLAY	1	1.70	NA	3.87	non-LIQ	non-LIQ	0.976	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
10.50	679.5	115.0	115.0	21.2	1.1	5.2	43	6	8	5.00	1.20	14	0.604	0.604	0.604	0.604	2.75	non-LIQ CLAY	1	1.70	NA	4.35	non-LIQ	non-LIQ	0.976	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
10.66	679.3	115.0	115.0	22.1	1.0	4.5	40	6	8	5.00	1.20	14	0.613	0.613	0.613	0.613	2.70	non-LIQ CLAY	1	1.70	NA	3.97	non-LIQ	non-LIQ	0.975	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
10.83	679.2	115.0	115.0	23.9	0.9	3.8	36	6	8	5.00	1.20	15	0.623	0.623	0.623	0.623	2.62	non-LIQ CLAY	1	1.70	NA	3.45	non-LIQ	non-LIQ	0.975	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
10.99	679.0	115.0	115.0	23.3	0.9	3.9	37	6	8	5.00	1.20	14	0.632	0.632	0.632	0.632	2.64	non-LIQ CLAY	1	1.67	NA	3.59	non-LIQ	non-LIQ	0.974	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
11.16	678.8	115.0	115.0	20.6	1.0	4.9	43	6	7	5.00	1.20	14	0.642	0.642	0.642	0.642	2.76	non-LIQ CLAY	1	1.65	NA	4.42	non-LIQ	non-LIQ	0.974	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
11.32	678.7	115.0	115.0	20.4	1.1	5.4	46	6	7	5.00	1.20	14	0.651	0.651	0.651	0.651	2.80	non-LIQ CLAY	1	1.63	NA	4.75	non-LIQ	non-LIQ	0.974	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
11.48	678.5	115.0	115.0	29.5	1.1	3.7	36	8	10	5.00	1.20	17	0.660	0.660	0.660	0.660	2.61	SILT	0.7	1.39	38.8	3.40	131.9	0.29	0.973	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
11.65	678.4	115.0	115.0	40.1	1.5	3.7	33	10	13	4.87	1.18	20	0.670	0.670	0.670	0.670	2.55	SAND	0.5	1.26	47.6	3.01	143.3	0.35	0.973	0.39	0.360	Above Water	0.14	10350	695.8	0.26	0.43	0.018	NA	NA	0.000
11.81	678.2	115.0	115.0	46.9	1.8	3.8	31	11	14	4.77	1.16	21	0.679	0.679	0.679	0.679	2.51	SAND	0.5	1.25	55.3	2.80	155.0	0.43	0.972	0.39	0.360	Above Water	0.14	10266	731.9	0.22	0.31	0.012	NA	NA	0.000
11.98	678.0	115.0	115.0	28.5	1.4	4.9	39	8	9	5.00	1.20	16	0.689	0.689	0.689	0.689	2.68	non-LIQ CLAY	1	1.54	NA	3.83	non-LIQ	non-LIQ	0.972	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
12.14	677.9	115.0	115.0	22.0	1.2	5.5	46	6	8	5.00	1.20	14	0.698	0.698	0.698	0.698	2.80	non-LIQ CLAY	1	1.52	NA	4.76	non-LIQ	non-LIQ	0.972	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
12.30	677.7	115.0	115.0	23.6	1.3	5.5	45	7	8	5.00	1.20	15	0.707	0.707	0.707	0.707	2.78	non-LIQ CLAY	1	1.50	NA	4.63	non-LIQ	non-LIQ	0.971	0.39	0.360	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
12.47	677.5	115.0	115.0	26.5	1.3	4.9	41	7	9	5.00	1.20	15	0.717	0.717	0.717	0.717	2.71	non-LIQ CLAY	1	1.48	NA	4.09	non-LIQ	non-LIQ	0.971	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
12.63	677.4	115.0	115.0	21.9	1.5	6.8	51	7	8	5.00	1.20	14	0.726	0.726	0.726	0.726	2.88	non-LIQ CLAY	1	1.46	NA	5.53	non-LIQ	non-LIQ	0.971	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
12.80	677.2	115.0	115.0	26.3	1.7	6.5	47	8	9	5.00	1.20	16	0.736	0.736	0.736	0.736	2.81	non-LIQ CLAY	1	1.44	NA	4.87	non-LIQ	non-LIQ	0.970	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
12.96	677.0	115.0	115.0	31.5	2.2	7.0	45	9	11	5.00	1.20	18	0.745	0.745	0.745	0.745	2.78	non-LIQ CLAY	1	1.42	NA	4.64	non-LIQ	non-LIQ	0.970	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
13.12	676.9	115.0	115.0	37.9	2.3	6.1	40	10	12	5.00	1.20	19	0.754	0.754	0.754	0.754	2.68	non-LIQ CLAY	1	1.40	NA	3.89	non-LIQ	non-LIQ	0.969	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
13.29	676.7	115.0	115.0	42.3	2.5	5.9	38	11	13	5.00	1.20	21	0.764	0.764	0.764	0.764	2.65	non-LIQ CLAY	1	1.38	NA	3.63	non-LIQ	non-LIQ	0.969	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
13.45	676.6	115.0	115.0	49.8	2.6	5.2	35	13	15	4.97	1.20	23	0.773	0.773	0.773	0.773	2.59	SILT	0.7	1.25	58.6	3.26	191.0	non-LIQ	0.969	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
13.62	676.4	115.0	115.0	55.0	2.4	4.4	32	14	16	4.81	1.17	23	0.783	0.783	0.783	0.783	2.52	SAND	0.5	1.16	60.4	2.88	173.8	non-LIQ	0.968	0.38	0.350	Above Water	0.14	9424	811.2	0.18	0.23	0.009	NA	NA	0.000
13.78	676.2	115.0	115.0	72.6	2.4	3.3	24	17	19	4.22	1.11	25	0.792	0.792	0.792	0.792	2.35	SAND	0.5	1.16	79.5	2.11	168.1	non-LIQ	0.968	0.38	0.350	Above Water	0.14	9358	870.8	0.14	0.14	0.005	NA	NA	0.000
13.94	676.1	115.0	115.0	53.4	2.2	4.1	31	13	15	4.79	1.17	22	0.802	0.802	0.802	0.802	2.52	SAND	0.5	1.15	58.0	2.85	165.0	non-LIQ	0.967	0.38	0.350	Above Water	0.14	9293	808.8	0.19	0.25	0.010	NA	NA	0.000
14.11	675.9	115.0	115.0	27.8	1.7	6.1	46	8	9	5.00	1.20	16	0.811	0.811	0.811	0.811	2.81	non-LIQ CLAY	1	1.30	NA	4.83	non-LIQ	non-LIQ	0.967	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
14.27	675.7	115.0	115.0	23.7	1.5	6.3	50	7	8	5.00	1.20	15	0.821	0.821	0.821	0.821	2.87	non-LIQ CLAY	1	1.29	NA	5.43	non-LIQ	non-LIQ	0.967	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
14.44	675.6	115.0	115.0	49.3	2.3	4.7	35	13	14	4.96	1.19	22	0.830	0.830	0.830	0.830	2.56	SAND	0.5	1.13	52.6	3.23	170.1	non-LIQ	0.966	0.38	0.350	Above Water	0.15	9099	805.9	0.21	0.30	0.012	NA	NA	0.000
14.60	675.4	115.0	115.0	77.1	2.6	3.4	24	18	20	4.22	1.11	26	0.839	0.839	0.839	0.839	2.35	SAND	0.5	1.12	81.8	2.11	172.7	non-LIQ	0.966	0.38	0.350	Above Water	0.15	9039	904.7	0.14	0.14	0.005	NA	NA	0.000
14.76	675.2	115.0	115.0	75.0	2.2	2.9	23	17	19	4.06	1.10	25	0.849	0.849	0.849	0.849	2.31	SAND	0.5	1.12	79.1	1.99	157.6	0.44	0.966	0.38	0.350	Above Water	0.15	8980	895.1	0.15	0.15	0.006	NA	NA	0.000
14.93	675.1	115.0	115.0	51.7	1.6	3.1	28	12	14	4.59	1.14	20	0.858	0.858	0.858	0.858	2.45	SAND	0.5	1.11	54.2	2.52	136.5	0.32	0.965	0.38	0.350	Above Water	0.15	8919	809.9	0.22	0.33	0.014	NA	NA	0.000
15.09	674.9	115.0	115.0	36.9	1.8	4.9	39	10	11	5.00	1.20	18	0.868	0.868	0.868	0.868	2.67	non-LIQ CLAY	1	1.22	NA	3.76	non-LIQ	non-LIQ	0.965	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
15.26	674.7	115.0	115.0	28.5	1.6	5.6	46	8	9	5.00	1.20	16	0.877	0.877	0.877	0.877	2.80	non-LIQ CLAY	1	1.21	NA	4.75	non-LIQ	non-LIQ	0.964	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
15.42	674.6	115.0	115.0	22.1	1.3	5.9	52	7	7	5.00	1.20	14	0.887	0.887	0.887	0.887	2.90	non-LIQ CLAY	1	1.19	NA	5.69	non-LIQ	non-LIQ	0.964	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
15.58	674.4	115.0	115.0	26.6	1.3	4.9	45	7	8	5.00	1.20	15	0.896	0.896	0.896	0.896	2.78	non-LIQ CLAY	1	1.18	NA	4.65	non-LIQ	non-LIQ	0.964	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
15.75	674.3	115.0	115.0	31.0	1.9	6.1	46	9	10	5.00	1.20	16	0.906	0.906	0.906	0.906	2.81	non-LIQ CLAY	1	1.17	NA	4.84	non-LIQ	non-LIQ	0.963	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
15.91	674.1	115.0	115.0	33.2	1.8	5.4	43	9	10	5.00	1.20	17	0.915	0.915	0.915	0.915	2.75	non-LIQ CLAY	1	1.16	NA	4.37	non-LIQ	non-LIQ	0.963	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
16.08	673.9	115.0	115.0	24.2	1.4	5.8	51	7	8	5.00	1.20	14	0.925	0.925	0.925	0.925	2.88	non-LIQ CLAY	1	1.14	NA	5.48	non-LIQ	non-LIQ	0.963	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
16.24	673.8	115.0	115.0	17.0	1.0	5.9	59	5	6	5.00	1.20	12	0.934	0.934	0.934	0.934	3.01	non-LIQ CLAY	1	1.13	NA	6.83	non-LIQ	non-LIQ	0.962	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
16.40	673.6	115.0	115.0	18.2	0.9	4.9	54	6	6	5.00	1.20	12	0.943	0.943	0.943	0.943	2.94	non-LIQ CLAY	1	1.12	NA	6.07	non-LIQ	non-LIQ	0.962	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
16.57	673.4	115.0	115.0	29.5	1.0	3.4	38	8	8	5.00	1.20	15	0.953	0.953	0.953	0.953	2.66	non-LIQ CLAY	1	1.11	NA	3.73	non-LIQ	non-LIQ	0.961	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
16.73	673.3	115.0	115.0	23.9	1.2	5.0	49	7	7	5.00	1.20	14	0.962	0.962	0.962	0.962	2.85	non-LIQ CLAY	1	1.10	NA	5.25	non-LIQ	non-LIQ	0.961	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
16.90	673.1	115.0	115.0	21.8	1.0	4.6	50	6	7	5.00	1.20	13	0.972	0.972	0.972	0.972	2.86	non-LIQ CLAY	1	1.09	NA	5.33	non-LIQ	non-LIQ	0.961	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
17.06	672.9	115.0	115.0	22.5	1.1	4.9	50	7	7	5.00	1.20	13	0.981	0.981	0.981	0.981	2.87	non-LIQ CLAY	1	1.08	NA	5.43	non-LIQ	non-LIQ	0.960	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
17.23	672.8	115.0	115.0	22.3	1.1	4.9	51	7	7	5.00	1.20	13	0.991	0.991	0.991	0.991	2.88	non-LIQ CLAY	1	1.07	NA	5.52	non-LIQ	non-LIQ	0.960	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
17.39	672.6	115.0	115.0	20.0	1.0	5.0	54	6	6	5.00	1.20	13	1.000	1.000	1.000	1.000	2.93	non-LIQ CLAY	1	1.06	NA	5.97	non-LIQ	non-LIQ	0.959	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
17.55	672.5	115.0	115.0	18.9	1.0	5.3	56	6	6	5.00	1.20	12	1.009	1.009	1.009	1.009	2.97	non-LIQ CLAY	1	1.05	NA	6.39	non-LIQ	non-LIQ	0.959	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
17.72	672.3	115.0	115.0	15.4	0.9	5.8	64	5	5	5.00	1.20	11	1.019	1.019	1.019	1.019	3.07	non-LIQ CLAY	1	1.04	NA	7.61	non-LIQ	non-LIQ	0.959	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
17.88	672.1	115.0	115.0	15.2	0.9	5.9	64	5	5	5.00	1.20	11	1.028	1.028	1.028	1.028	3.09	non-LIQ CLAY	1	1.03	NA	7.75	non-LIQ	non-LIQ	0.958	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
18.05	672.0	115.0	115.0	15.6	0.8	5.1	61	5	5	5.00	1.20	11	1.038	1.038	1.038	1.038	3.03	non-LIQ CLAY	1	1.02	NA	7.09	non-LIQ	non-LIQ	0.958	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
18.21	671.8	115.0	115.0	21.0	1.5	7.1	61	7	7	5.00	1.20	13	1.047	1.047	1.047	1.047	3.03	non-LIQ CLAY	1	1.01	NA	7.10	non-LIQ	non-LIQ	0.958	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
18.37	671.6	115.0	115.0	38.1	2.0	5.2	43	10	10	5.00	1.20	18	1.056	1.056	1.056	1.056	2.74	non-LIQ CLAY	1	1.00	NA	4.31	non-LIQ	non-LIQ	0.957	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
18.54	671.5	115.0	115.0	38.5	2.2	5.7	44	11	11	5.00	1.20	18	1.066	1.066	1.066	1.066	2.77	non-LIQ CLAY	1	0.99	NA	4.52	non-LIQ	non-LIQ	0.957	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
18.70	671.3	115.0	115.0	27.4	1.8	6.6	54	8	8	5.00	1.20	15	1.075	1.075	1.075	1.075	2.92	non-LIQ CLAY	1	0.98	NA	5.94	non-LIQ	non-LIQ	0.956	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
18.87	671.1	115.0	115.0	25.3	1.4	5.5	52	8	8	5.00	1.20	14	1.085	1.085	1.085	1.085	2.90	non-LIQ CLAY	1	0.98	NA	5.73	non-LIQ	non-LIQ	0.956	0.38	0.350	Above Water	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
19.03	671.0	115.0	115.0	29.3	1.4	4.8	47	8	8	5.00	1.20	15	1.094	1.093	1.094	1.093	2.81	non-LIQ CLAY	1	0.97	NA	4.89	non-LIQ	non-LIQ	0.956	0.38	0.350	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
19.19	670.8	115.0	115.0	36.1	1.8	5.0	44	10	10	5.00	1.20	17	1.103	1.097	1.103	1.097	2.76	non-LIQ CLAY	1	0.96	NA	4.42	non-LIQ	non-LIQ	0.955	0.38	0.350	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
19.36	670.6	115.0	115.0	31.9	1.7	5.3	47	9	9	5.00	1.20	16	1.113	1.102	1.113	1.102	2.82	non-LIQ CLAY	1	0.96	NA	4.95	non-LIQ	non-LIQ	0.955	0.38	0.350	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
19.52	670.5	115.0	115.0	32.8	1.9	5.8	48	10	9	5.00	1.20	16	1.122	1.106	1.122	1.106	2.84	non-LIQ CLAY	1	0.96	NA	5.10	non-LIQ	non-LIQ	0.954	0.38	0.350	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
19.69	670.3	115.0	115.0	40.2	2.0	5.0	42	11	11	5.00	1.20	16	1.132	1.111	1.132	1.111	2.72	non-LIQ CLAY	1	0.95	NA	4.18	non-LIQ	non-LIQ	0.954	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
19.85	670.2	115.0	115.0	33.1	2.1	6.3	50	10	10	5.00	1.20	16	1.141	1.115	1.141	1.115	2.86	non-LIQ CLAY	1	0.95	NA	5.35	non-LIQ	non-LIQ	0.954	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
20.01	670.0	115.0	115.0	30.6	2.1	6.9	53	9	9	5.00	1.20	16	1.151	1.119	1.151	1.119	2.92	non-LIQ CLAY	1	0.95	NA	5.85	non-LIQ	non-LIQ	0.953	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
20.18	669.8	115.0	115.0	41.0	2.3	5.6	44	11	11	5.00	1.20	18	1.160	1.124	1.160	1.124	2.76	non-LIQ CLAY	1	0.94	NA	4.45	non-LIQ	non-LIQ	0.953	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
20.34	669.7	115.0	115.0	38.9	2.3	5.9	46	11	11	5.00	1.20	18	1.170	1.128	1.170	1.128	2.79	non-LIQ CLAY	1	0.94	NA	4.73	non-LIQ	non-LIQ	0.953	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
20.51	669.5	115.0	115.0	27.4	1.6	5.8	52	8	8	5.00	1.20	15	1.179	1.132	1.179	1.132	2.91	non-LIQ CLAY	1	0.93	NA	5.77	non-LIQ	non-LIQ	0.952	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
20.67	669.3	115.0	115.0	26.5	1.4	5.3	51	8	8	5.00	1.20	14	1.189	1.136	1.189	1.136	2.89	non-LIQ CLAY	1	0.93	NA	5.61	non-LIQ	non-LIQ	0.952	0.39	0.360	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
20.83	669.2	115.0	115.0	22.1	1.2	5.4	55	7	7	5.00	1.20	13	1.198	1.141	1.198	1.141	2.96	non-LIQ CLAY	1	0.93	NA	6.36	non-LIQ	non-LIQ	0.951	0.40	0.370	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
21.00	669.0	115.0	115.0	19.2	1.0	5.2	59	6	6	5.00	1.20	12	1.208	1.145	1.208	1.145	3.01	non-LIQ CLAY	1	0.92	NA	6.60	non-LIQ	non-LIQ	0.951	0.40	0.370	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
21.16	668.8	115.0	115.0	17.0	0.8	4.7	60	6	5	5.00	1.20	11	1.217	1.149	1.217	1.149	3.02	non-LIQ CLAY	1	0.92	NA	7.02	non-LIQ	non-LIQ	0.951	0.40	0.370	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
21.33	668.7	115.0	115.0	16.7	0.6	3.6	56	5	5	5.00	1.20	11	1.226	1.154	1.226	1.154	2.96	non-LIQ CLAY	1	0.92	NA	6.30	non-LIQ	non-LIQ	0.950	0.40	0.370	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
21.49	668.5	115.0	115.0	16.4	0.6	3.7	57	5	5	5.00	1.20	11	1.236	1.158	1.236	1.158	2.97	non-LIQ CLAY	1	0.91	NA	6.45	non-LIQ	non-LIQ	0.950	0.40	0.370	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
21.65	668.4	115.0	115.0	16.1	0.7	4.3	60	5	5	5.00	1.20	11	1.245	1.162	1.245	1.162	3.03	non-LIQ CLAY	1	0.91	NA	7.06	non-LIQ	non-LIQ	0.950	0.40	0.370	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
21.82	668.2	115.0	115.0	15.7	0.7	4.5	62	5	5	5.00	1.20	11	1.255	1.167	1.255	1.167	3.05	non-LIQ CLAY	1	0.91	NA	7.28	non-LIQ	non-LIQ	0.949	0.40	0.370	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
21.98	668.0	115.0	115.0	14.1	0.6	4.3	64	5	5	5.00	1.20	10	1.264	1.171	1.264	1.171	3.08	non-LIQ CLAY	1	0.90	NA	7.66	non-LIQ	non-LIQ	0.949	0.41	0.380	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
22.15	667.9	115.0	115.0	12.6	0.5	4.0	66	4	4	5.00	1.20	10	1.274	1.175	1.274	1.175	3.11	non-LIQ CLAY	1	0.90	NA	8.02	non-LIQ	non-LIQ	0.948	0.41	0.380	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
22.31	667.7	115.0	115.0	11.5	0.5	4.3	71	4	4	5.00	1.20	10	1.283	1.180	1.283	1.180	3.17	non-LIQ CLAY	1	0.90	NA	8.86	non-LIQ	non-LIQ	0.948	0.41	0.380	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
22.47	667.5	115.0	115.0	12.2	0.5	4.1	68	4	4	5.00	1.20	10	1.292	1.184	1.292	1.184	3.13	non-LIQ CLAY	1	0.89	NA	8.35	non-LIQ	non-LIQ	0.948	0.41	0.380	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
22.64	667.4	115.0	115.0	13.3	0.5	3.8	64	4	4	5.00	1.20	10	1.302	1.188	1.302	1.188	3.08	non-LIQ CLAY	1	0.89	NA	7.64	non-LIQ	non-LIQ	0.947	0.41	0.380	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000

Liquefaction Analysis with Cone Penetration Test (CPT) Data

Depth (ft)	Elev. (ft, MSL)	Unit Weight (pcf) γ'_{MOIST}	Unit Weight (pcf) γ'_{SAT}	q_c (tsf)	f_s (tsf)	Frict. Ratio (%)	% Fines	Equiv. N_{60}	Equiv. $(N_1)_{60}$	α	β	Equiv. $(N_1)_{60CS}$	Stresses at Exploration Water Level σ_v (tsf)	Stresses at Exploration Water Level σ_v' (tsf)	Stresses at Design Water Level σ_v (tsf)	Stresses at Design Water Level σ_v' (tsf)	I_c	Soil Type Character (SAND, SILT or non-LIQ CLAY)	Normalization of Tip Resistance n	Normalization of Tip Resistance C_Q	Normalization of Tip Resistance q_{c1N}	Fines Correction Kc	Fines Correction $(q_{c1n})_{cs}$	$CRR_{7.5}$	r_d	CSR_M	$CSR_{7.5}$	FS	a	b	Max Shear Modulus G_{max} (tsf)	Cyclic Shear Strain γ (%)	Norm. Vol. Strain ε_{Nc} (%)	Dry Settle. ΔS (in)	Post-Liq. $(N_1)_{60CS}$	Post-Liq. Vol. Strain ε (%)	Layer Post-Liq. Settle. ΔS (in)
22.80	667.2	115.0	115.0	14.4	0.6	4.2	64	5	5	5.00	1.20	10	1.311	1.192	1.311	1.192	3.07	non-LIQ CLAY	1	0.89	NA	7.59	non-LIQ	non-LIQ	0.947	0.41	0.380	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
22.97	667.0	115.0	115.0	15.5	0.6	3.9	60	5	5	5.00	1.20	11	1.321	1.197	1.321	1.197	3.03	non-LIQ CLAY	1	0.88	NA	7.03	non-LIQ	non-LIQ	0.946	0.41	0.380	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
23.13	666.9	115.0	115.0	15.7	0.6	3.8	60	5	5	5.00	1.20	11	1.330	1.201	1.330	1.201	3.02	non-LIQ CLAY	1	0.88	NA	6.95	non-LIQ	non-LIQ	0.946	0.42	0.390	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
23.30	666.7	115.0	115.0	15.2	0.5	3.3	58	5	5	5.00	1.20	10	1.340	1.206	1.340	1.206	2.99	non-LIQ CLAY	1	0.88	NA	6.68	non-LIQ	non-LIQ	0.946	0.42	0.390	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
23.46	666.5	115.0	115.0	15.6	0.6	3.8	60	5	5	5.00	1.20	11	1.349	1.210	1.349	1.210	3.03	non-LIQ CLAY	1	0.87	NA	7.04	non-LIQ	non-LIQ	0.945	0.42	0.390	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
23.62	666.4	115.0	115.0	16.8	0.7	4.2	60	5	5	5.00	1.20	11	1.358	1.214	1.358	1.214	3.02	non-LIQ CLAY	1	0.87	NA	6.96	non-LIQ	non-LIQ	0.945	0.42	0.390	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
23.79	666.2	115.0	115.0	17.3	0.7	4.0	59	6	5	5.00	1.20	11	1.368	1.218	1.368	1.218	3.00	non-LIQ CLAY	1	0.87	NA	6.76	non-LIQ	non-LIQ	0.945	0.42	0.390	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
23.95	666.1	115.0	115.0	18.6	0.8	4.3	56	6	6	5.00	1.20	12	1.377	1.223	1.377	1.223	2.99	non-LIQ CLAY	1	0.87	NA	6.65	non-LIQ	non-LIQ	0.944	0.42	0.390	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
24.12	665.9	115.0	115.0	21.1	0.9	4.3	55	7	6	5.00	1.20	12	1.387	1.227	1.387	1.227	2.94	non-LIQ CLAY	1	0.86	NA	6.13	non-LIQ	non-LIQ	0.944	0.42	0.390	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
24.28	665.7	115.0	115.0	22.7	1.0	4.4	54	7	6	5.00	1.20	13	1.396	1.231	1.396	1.231	2.93	non-LIQ CLAY	1	0.86	NA	5.95	non-LIQ	non-LIQ	0.943	0.42	0.390	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
24.44	665.6	115.0	115.0	23.9	1.1	4.6	53	7	7	5.00	1.20	13	1.405	1.236	1.405	1.236	2.92	non-LIQ CLAY	1	0.86	NA	5.90	non-LIQ	non-LIQ	0.943	0.43	0.400	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
24.61	665.4	115.0	115.0	25.4	1.1	4.3	51	8	7	5.00	1.20	13	1.415	1.240	1.415	1.240	2.88	non-LIQ CLAY	1	0.85	NA	5.53	non-LIQ	non-LIQ	0.943	0.43	0.400	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
24.77	665.2	115.0	115.0	24.0	1.2	5.0	55	7	7	5.00	1.20	13	1.424	1.244	1.424	1.244	2.95	non-LIQ CLAY	1	0.85	NA	6.16	non-LIQ	non-LIQ	0.942	0.43	0.400	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
24.94	665.1	115.0	115.0	25.7	1.3	5.1	54	8	7	5.00	1.20	14	1.434	1.249	1.434	1.249	2.93	non-LIQ CLAY	1	0.85	NA	5.95	non-LIQ	non-LIQ	0.942	0.43	0.400	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
25.10	664.9	115.0	115.0	28.1	1.6	5.7	54	9	8	5.00	1.20	14	1.443	1.253	1.443	1.253	2.93	non-LIQ CLAY	1	0.84	NA	5.99	non-LIQ	non-LIQ	0.941	0.43	0.400	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
25.26	664.7	115.0	115.0	29.2	1.7	5.8	54	9	8	5.00	1.20	15	1.452	1.257	1.452	1.257	2.92	non-LIQ CLAY	1	0.84	NA	5.94	non-LIQ	non-LIQ	0.941	0.43	0.400	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
25.43	664.6	115.0	115.0	30.1	1.7	5.6	52	9	8	5.00	1.20	15	1.462	1.262	1.462	1.262	2.91	non-LIQ CLAY	1	0.84	NA	5.75	non-LIQ	non-LIQ	0.941	0.43	0.400	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
25.59	664.4	115.0	115.0	29.8	1.5	5.0	51	9	8	5.00	1.20	15	1.471	1.266	1.471	1.266	2.88	non-LIQ CLAY	1	0.84	NA	5.47	non-LIQ	non-LIQ	0.940	0.43	0.400	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
25.76	664.2	115.0	115.0	31.1	2.0	6.4	54	10	9	5.00	1.20	15	1.481	1.270	1.481	1.270	2.94	non-LIQ CLAY	1	0.83	NA	6.06	non-LIQ	non-LIQ	0.940	0.43	0.400	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
25.92	664.1	115.0	115.0	54.8	2.5	4.6	38	14	13	5.00	1.20	21	1.490	1.274	1.490	1.274	2.64	non-LIQ CLAY	1	0.83	NA	3.61	non-LIQ	non-LIQ	0.940	0.44	0.410	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
26.08	663.9	115.0	115.0	74.3	2.8	3.8	29	18	16	4.64	1.15	23	1.500	1.279	1.500	1.279	2.46	SAND	0.5	0.91	63.9	2.58	164.9	non-LIQ	0.939	0.44	0.410	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
26.25	663.8	115.0	115.0	100.3	2.0	2.0	18	21	19	3.23	1.07	24	1.509	1.283	1.509	1.283	2.17	SAND	0.5	0.91	86.1	1.60	137.3	0.32	0.939	0.44	0.410	0.78	NA	NA	NA	NA	NA	0.000	21	1.484	0.030
26.41	663.6	115.0	115.0	114.5	1.1	1.0	11	22	20	1.12	1.03	21	1.519	1.287	1.519	1.287	1.91	SAND	0.5	0.91	98.1	1.20	117.9	0.23	0.938	0.44	0.410	0.57	NA	NA	NA	NA	NA	0.000	21	1.484	0.028
26.58	663.4	115.0	115.0	113.6	0.4	0.4	6	20	18	0.02	1.00	18	1.528	1.292	1.528	1.292	1.68	SAND	0.5	0.91	97.2	1.02	99.3	0.17	0.938	0.44	0.410	0.42	NA	NA	NA	NA	NA	0.000	19	1.620	0.033
26.74	663.3	115.0	115.0	85.0	0.6	0.7	11	16	15	1.36	1.03	17	1.538	1.296	1.538	1.296	1.94	SAND	0.5	0.90	72.6	1.23	89.4	0.15	0.938	0.44	0.410	0.36	NA	NA	NA	NA	NA	0.000	16	1.855	0.036
26.90	663.1	115.0	115.0	58.8	1.1	1.9	24	13	12	4.14	1.11	17	1.547	1.300	1.547	1.300	2.33	SAND	0.5	0.90	50.1	2.05	102.9	0.18	0.937	0.44	0.410	0.44	NA	NA	NA	NA	NA	0.000	14	2.000	0.038
27.07	662.9	115.0	115.0	51.1	1.5	2.9	31	13	11	4.78	1.16	18	1.557	1.305	1.557	1.305	2.51	SAND	0.5	0.90	43.5	2.82	122.5	0.25	0.937	0.44	0.410	0.61	NA	NA	NA	NA	NA	0.000	13	2.150	0.044
27.23	662.8	115.0	115.0	77.6	1.2	1.5	18	16	15	3.32	1.07	19	1.566	1.309	1.566	1.309	2.18	SAND	0.5	0.90	65.9	1.63	107.2	0.19	0.937	0.44	0.410	0.47	NA	NA	NA	NA	NA	0.000	17	1.760	0.034
27.40	662.6	115.0	115.0	127.2	0.7	0.6	7	23	20	0.10	1.01	21	1.576	1.313	1.576	1.313	1.74	SAND	0.5	0.90	107.9	1.06	114.6	0.22	0.936	0.45	0.420	0.52	NA	NA	NA	NA	NA	0.000	21	1.485	0.030
27.56	662.4	115.0	115.0	148.2	1.1	0.7	7	27	24	0.16	1.01	24	1.585	1.318	1.585	1.318	1.76	SAND	0.5	0.90	125.5	1.08	135.2	0.31	0.936	0.45	0.420	0.74	NA	NA	NA	NA	NA	0.000	25	1.191	0.023
27.72	662.3	115.0	115.0	144.2	0.6	0.4	5	25	22	0.00	1.00	22	1.594	1.322	1.594	1.322	1.63	SAND	0.5	0.89	121.9	1.00	121.9	0.25	0.935	0.45	0.420	0.59	NA	NA	NA	NA	NA	0.000	23	1.334	0.026
27.89	662.1	115.0	115.0	105.3	1.1	1.0	12	20	18	1.62	1.03	21	1.604	1.326	1.604	1.326	1.97	SAND	0.5	0.89	88.9	1.26	112.4	0.21	0.935	0.45	0.420	0.50	NA	NA	NA	NA	NA	0.000	19	1.623	0.033
28.05	662.0	115.0	115.0	60.7	1.0	1.6	22	13	12	3.94	1.09	17	1.613	1.331	1.613	1.331	2.29	SAND	0.5	0.89	51.2	1.91	98.0	0.17	0.935	0.45	0.420	0.40	NA	NA	NA	NA	NA	0.000	14	2.000	0.038
28.22	661.8	115.0	115.0	31.6	1.1	3.5	44	9	8	5.00	1.20	14	1.623	1.335	1.623	1.335	2.77	non-LIQ CLAY	1	0.79	NA	4.54	non-LIQ	non-LIQ	0.934	0.45	0.420	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
28.38	661.6	115.0	115.0	23.7	0.9	3.8	52	7	6	5.00	1.20	13	1.632	1.339	1.632	1.339	2.90	non-LIQ CLAY	1	0.79	NA	5.73	non-LIQ	non-LIQ	0.934	0.45	0.420	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
28.54	661.5	115.0	115.0	21.2	0.9	4.2	57	7	6	5.00	1.20	12	1.641	1.343	1.641	1.343	2.98	non-LIQ CLAY	1	0.79	NA	6.50	non-LIQ	non-LIQ	0.933	0.45	0.420	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
28.71	661.3	115.0	115.0	19.3	0.8	4.1	59	6	5	5.00	1.20	12	1.651	1.348	1.651	1.348	3.01	non-LIQ CLAY	1	0.79	NA	6.85	non-LIQ	non-LIQ	0.933	0.45	0.420	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
28.87	661.1	115.0	115.0	16.7	0.8	4.8	66	6	5	5.00	1.20	11	1.660	1.352	1.660	1.352	3.11	non-LIQ CLAY	1	0.78	NA	8.03	non-LIQ	non-LIQ	0.933	0.45	0.420	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
29.04	661.0	115.0	115.0	15.0	0.7	4.7	69	5	5	5.00	1.20	11	1.670	1.357	1.670	1.357	3.15	non-LIQ CLAY	1	0.78	NA	8.53	non-LIQ	non-LIQ	0.932	0.46	0.430	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
29.20	660.8	115.0	115.0	12.8	0.8	6.3	81	5	4	5.00	1.20	10	1.679	1.361	1.679	1.361	3.29	non-LIQ CLAY	1	0.78	NA	10.64	non-LIQ	non-LIQ	0.932	0.46	0.430	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
29.36	660.6	115.0	115.0	18.0	0.7	3.9	60	6	5	5.00	1.20	11	1.688	1.365	1.688	1.365	3.03	non-LIQ CLAY	1	0.78	NA	7.04	non-LIQ	non-LIQ	0.932	0.46	0.430	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
29.53	660.5	115.0	115.0	12.8	0.6	4.7	75	5	4	5.00	1.20	10	1.698	1.369	1.698	1.369	3.22	non-LIQ CLAY	1	0.77	NA	9.54	non-LIQ	non-LIQ	0.931	0.46	0.430	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
29.69	660.3	115.0	115.0	9.5	0.3	3.2	78	4	3	5.00	1.20	9	1.707	1.374	1.707	1.374	3.26	non-LIQ CLAY	1	0.77	NA	10.13	non-LIQ	non-LIQ	0.931	0.46	0.430	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
29.86	660.1	115.0	115.0	11.0	0.4	3.6	75	4	4	5.00	1.20	9	1.717	1.378	1.717	1.378	3.23	non-LIQ CLAY	1	0.77	NA	9.64	non-LIQ	non-LIQ	0.930	0.46	0.430	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
30.02	660.0	115.0	115.0	12.8	0.4	3.1	67	4	4	5.00	1.20	10	1.726	1.382	1.726	1.382	3.12	non-LIQ CLAY	1	0.77	NA	8.20	non-LIQ	non-LIQ	0.930	0.46	0.430	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
30.19	659.8	115.0	115.0	15.0	0.6	4.0	67	5	5	5.00	1.20	10	1.736	1.387	1.736	1.387	3.12	non-LIQ CLAY	1	0.76	NA	8.14	non-LIQ	non-LIQ	0.928	0.46	0.430	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
30.35	659.7	115.0	115.0	14.3	0.6	4.2	69	5	4	5.00	1.20	10	1.745	1.391	1.745	1.391	3.15	non-LIQ CLAY	1	0.76	NA	8.59	non-LIQ	non-LIQ	0.927	0.46	0.430	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
30.51	659.5	115.0	115.0	13.4	0.6	4.5	73	5	4	5.00	1.20	10	1.754	1.395	1.754	1.395	3.20	non-LIQ CLAY	1	0.76	NA	9.22	non-LIQ	non-LIQ	0.926	0.46	0.430	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
30.68	659.3	115.0	115.0	14.3	0.6	4.2	69	5	4	5.00	1.20	10	1.764	1.400	1.764	1.400	3.15	non-LIQ CLAY	1	0.76	NA	8.63	non-LIQ	non-LIQ	0.924	0.46	0.430	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
30.84	659.2	115.0	115.0	13.8	0.5	3.6	68	5	4	5.00	1.20	10	1.773	1.404	1.773	1.404	3.13	non-LIQ CLAY	1	0.75	NA	8.35	non-LIQ	non-LIQ	0.923	0.46	0.430	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
31.01	659.0	115.0	115.0	13.1	0.4	3.1	67	5	4	5.00	1.20	10	1.783	1.408	1.783	1.408	3.12	non-LIQ CLAY	1	0.75	NA	8.12	non-LIQ	non-LIQ	0.922	0.46	0.430	non-LIQ	NA	NA	NA	NA	NA	0.000	NA	NA	0.000
31.17	658.8	115.0	115.0	13.3	0.3	2.3	61.0	4.4	3.8	5.0	1.2	10.0	1.79	1.41	1.79	1.41	3.04	non-LIQ CLAY	1	0.75	NA	7.17	non-LIQ	non-LIQ	0.920	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
31.33	658.7	115.0	115.0	12.2	0.3	2.5	65.4	4.2	3.6	5.0	1.2	9.0	1.80	1.42	1.80	1.42	3.10	non-LIQ CLAY	1	0.75	NA	7.92	non-LIQ	non-LIQ	0.919	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
31.50	658.5	115.0	115.0	12.4	0.4	3.2	69.8	4.4	3.8	5.0	1.2	10.0	1.81	1.42	1.81	1.42	3.16	non-LIQ CLAY	1	0.74	NA	8.69	non-LIQ	non-LIQ	0.918	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
31.66	658.3	115.0	115.0	11.5	0.4	3.5	74.1	4.2	3.7	5.0	1.2	9.0	1.82	1.43	1.82	1.43	3.21	non-LIQ CLAY	1	0.74	NA	9.45	non-LIQ	non-LIQ	0.916	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
31.83	658.2	115.0	115.0	13.6	0.4	2.9	65.3	4.6	4.0	5.0	1.2	10.0	1.83	1.43	1.83	1.43	3.10	non-LIQ CLAY	1	0.74	NA	7.89	non-LIQ	non-LIQ	0.915	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
31.99	658.0	115.0	115.0	13.2	0.4	3.0	66.9	4.6	3.9	5.0	1.2	10.0	1.84	1.43	1.84	1.43	3.12	non-LIQ CLAY	1	0.74	NA	8.17	non-LIQ	non-LIQ	0.914	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
32.15	657.9	115.0	115.0	14.2	0.5	3.5	67.4	4.9	4.2	5.0	1.2	10.0	1.85	1.44	1.85	1.44	3.13	non-LIQ CLAY	1	0.74	NA	8.25	non-LIQ	non-LIQ	0.912	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
32.32	657.7	115.0	115.0	15.0	0.6	4.0	68.1	5.2	4.5	5.0	1.2	10.0	1.86	1.44	1.86	1.44	3.14	non-LIQ CLAY	1	0.73	NA	8.39	non-LIQ	non-LIQ	0.911	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
32.48	657.5	115.0	115.0	14.6	0.6	4.1	69.7	5.2	4.4	5.0	1.2	10.0	1.87	1.45	1.87	1.45	3.16	non-LIQ CLAY	1	0.73	NA	8.66	non-LIQ	non-LIQ	0.910	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
32.65	657.4	115.0	115.0	14.4	0.6	4.2	70.5	5.1	4.4	5.0	1.2	10.0	1.88	1.45	1.88	1.45	3.17	non-LIQ CLAY	1	0.73	NA	8.80	non-LIQ	non-LIQ	0.908	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
32.81	657.2	115.0	115.0	14.7	0.5	3.4	66.0	5.0	4.3	5.0	1.2	10.0	1.89	1.46	1.89	1.46	3.11	non-LIQ CLAY	1	0.73	NA	8.02	non-LIQ	non-LIQ	0.907	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
32.97	657.0	115.0	115.0	14.6	0.5	3.4	66.5	5.0	4.3	5.0	1.2	10.0	1.90	1.46	1.90	1.46	3.11	non-LIQ CLAY	1	0.72	NA	8.10	non-LIQ	non-LIQ	0.906	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
33.14	656.9	115.0	115.0	13.4	0.4	3.0	66.9	4.6	3.9	5.0	1.2	10.0	1.91	1.46	1.91	1.46	3.12	non-LIQ CLAY	1	0.72	NA	8.16	non-LIQ	non-LIQ	0.904	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
33.30	656.7	115.0	115.0	12.3	0.4	3.3	71.6	4.4	3.8	5.0	1.2	10.0	1.91	1.47	1.91	1.47	3.18	non-LIQ CLAY	1	0.72	NA	9.01	non-LIQ	non-LIQ	0.903	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
33.47	656.5	115.0	115.0	12.6	0.5	4.0	74.8	4.7	4.0	5.0	1.2	10.0	1.92	1.47	1.92	1.47	3.22	non-LIQ CLAY	1	0.72	NA	9.57	non-LIQ	non-LIQ	0.902	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
33.63	656.4	115.0	115.0	13.6	0.5	3.7	70.7	4.9	4.1	5.0	1.2	10.0	1.93	1.48	1.93	1.48	3.17	non-LIQ CLAY	1	0.72	NA	8.84	non-LIQ	non-LIQ	0.900	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
33.79	656.2	115.0	115.0	13.5	0.5	3.7	71.2	4.9	4.1	5.0	1.2	10.0	1.94	1.48	1.94	1.48	3.18	non-LIQ CLAY	1	0.71	NA	8.93	non-LIQ	non-LIQ	0.899	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
33.96	656.0	115.0	115.0	12.2	0.4	3.3	72.6	4.4	3.7	5.0	1.2	9.0	1.95	1.49	1.95	1.49	3.19	non-LIQ CLAY	1	0.71	NA	9.17	non-LIQ	non-LIQ	0.898	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
34.12	655.9	115.0	115.0	11.1	0.3	2.7	72.6	4.0	3.4	5.0	1.2	9.0	1.96	1.49	1.96	1.49	3.20	non-LIQ CLAY	1	0.71	NA	9.18	non-LIQ	non-LIQ	0.896	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
34.29	655.7	115.0	115.0	11.5	0.3	2.6	70.8	4.1	3.5	5.0	1.2	9.0	1.97	1.49	1.97	1.49	3.17	non-LIQ CLAY	1	0.71	NA	8.85	non-LIQ	non-LIQ	0.895	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
34.45	655.6	115.0	115.0	10.6	0.3	2.8	75.6	4.0	3.3	5.0	1.2	9.0	1.98	1.50	1.98	1.50	3.23	non-LIQ CLAY	1	0.71	NA	9.71	non-LIQ	non-LIQ	0.894	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
34.61	655.4	115.0	115.0	10.5	0.3	2.9	76.3	4.0	3.3	5.0	1.2	9.0	1.99	1.50	1.99	1.50	3.24	non-LIQ CLAY	1	0.70	NA	9.84	non-LIQ	non-LIQ	0.892	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
34.78	655.2	115.0	115.0	9.9	0.3	3.0	80.0	3.9	3.2	5.0	1.2	9.0	2.00	1.51	2.00	1.51	3.29	non-LIQ CLAY	1	0.70	NA	10.52	non-LIQ	non-LIQ	0.891	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
34.94	655.1	115.0	115.0	9.4	0.3	3.2	83.4	3.8	3.2	5.0	1.2	9.0	2.01	1.51	2.01	1.51	3.33	non-LIQ CLAY	1	0.70	NA	11.15	non-LIQ	non-LIQ	0.890	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
35.11	654.9	115.0	115.0	11.0	0.3	2.7	73.9	4.1	3.4	5.0	1.2	9.0	2.02	1.52	2.02	1.52	3.21	non-LIQ CLAY	1	0.70	NA	9.42	non-LIQ	non-LIQ	0.888	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
35.27	654.7	115.0	115.0	10.3	0.3	2.9	78.0	3.9	3.3	5.0	1.2	9.0	2.03	1.52	2.03	1.52	3.26	non-LIQ CLAY	1	0.70	NA	10.15	non-LIQ	non-LIQ	0.887	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
35.43	654.6	115.0	115.0	10.2	0.3	2.9	78.7	3.9	3.3	5.0	1.2	9.0	2.04	1.52	2.04	1.52	3.27	non-LIQ CLAY	1	0.69	NA	10.28	non-LIQ	non-LIQ	0.886	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
35.60	654.4	115.0	115.0	11.3	0.4	3.5	78.3	4.3	3.6	5.0	1.2	9.0	2.05	1.53	2.05	1.53	3.27	non-LIQ CLAY	1	0.69	NA	10.21	non-LIQ	non-LIQ	0.884	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
35.76	654.2	115.0	115.0	11.6	0.4	3.4	76.9	4.4	3.6	5.0	1.2	9.0	2.06	1.53	2.06	1.53	3.25	non-LIQ CLAY	1	0.69	NA	9.95	non-LIQ	non-LIQ	0.883	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
35.93	654.1	115.0	115.0	11.2	0.3	2.7	73.5	4.1	3.4	5.0	1.2	9.0	2.07	1.54	2.07	1.54	3.21	non-LIQ CLAY	1	0.69	NA	9.35	non-LIQ	non-LIQ	0.882	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
36.09	653.9	115.0	115.0	10.9	0.3	2.8	75.3	4.1	3.4	5.0	1.2	9.0	2.08	1.54	2.08	1.54	3.23	non-LIQ CLAY	1	0.69	NA	9.66	non-LIQ	non-LIQ	0.880	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
36.26	653.7	115.0	115.0	10.5	0.3	2.9	77.6	4.0	3.3	5.0	1.2	9.0	2.08	1.55	2.08	1.55	3.26	non-LIQ CLAY	1	0.68	NA	10.09	non-LIQ	non-LIQ	0.879	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
36.42	653.6	115.0	115.0	10.4	0.3	2.9	78.4	4.0	3.3	5.0	1.2	9.0	2.09	1.55	2.09	1.55	3.27	non-LIQ CLAY	1	0.68	NA	10.22	non-LIQ	non-LIQ	0.878	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
36.58	653.4	115.0	115.0	10.5	0.3	2.9	77.9	4.0	3.3	5.0	1.2	9.0	2.10	1.55	2.10	1.55	3.26	non-LIQ CLAY	1	0.68	NA	10.14	non-LIQ	non-LIQ	0.876	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
36.75	653.3	115.0	115.0	10.5	0.3	2.9	78.0	4.0	3.3	5.0	1.2	9.0	2.11	1.56	2.11	1.56	3.26	non-LIQ CLAY	1	0.68	NA	10.16	non-LIQ	non-LIQ	0.875	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
36.91	653.1	115.0	115.0	10.3	0.2	1.9	72.0	3.7	3.1	5.0	1.2	9.0	2.12	1.56	2.12	1.56	3.19	non-LIQ CLAY	1	0.68	NA	9.07	non-LIQ	non-LIQ	0.874	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
37.08	652.9	115.0	115.0	9.8	0.2	2.0	75.1	3.6	3.0	5.0	1.2	9.0	2.13	1.57	2.13	1.57	3.23	non-LIQ CLAY	1	0.67	NA	9.62	non-LIQ	non-LIQ	0.872	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00

Liquefaction Analysis with Cone Penetration Test (CPT) Data

Depth (ft)	Elev. (ft, MSL)	Unit Weight (pcf) γ'_{MOIST}	Unit Weight (pcf) γ'_{SAT}	q_c (tsf)	f_s (tsf)	Frict. Ratio (%)	% Fines	Equiv. N_{60}	Equiv. $(N_1)_{60}$	α	β	Equiv. $(N_1)_{60CS}$	Stresses at Exploration Water Level σ_v (tsf)	Stresses at Exploration Water Level σ_v' (tsf)	Stresses at Design Water Level σ_v (tsf)	Stresses at Design Water Level σ_v' (tsf)	I_c	Soil Type Character (SAND, SILT or non-LIQ CLAY)	Normalization of Tip Resistance n	Normalization of Tip Resistance C_Q	Normalization of Tip Resistance q_{c1N}	Fines Correction Kc	Fines Correction $(q_{c1n})_{cs}$	$CRR_{7.5}$	r_d	CSR_M	$CSR_{7.5}$	FS	a	b	Max Shear Modulus G_{max} (tsf)	Cyclic Shear Strain γ (%)	Norm. Vol. Strain ε_{Nc} (%)	Dry Settle. ΔS (in)	Post-Liq. $(N_1)_{60CS}$	Post-Liq. Vol. Strain ε (%)	Layer Post-Liq. Settle. ΔS (in)
37.24	652.8	115.0	115.0	10.1	0.3	3.0	80.9	4.0	3.3	5.0	1.2	9.0	2.14	1.57	2.14	1.57	3.30	non-LIQ CLAY	1	0.67	NA	10.68	non-LIQ	non-LIQ	0.871	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
37.40	652.6	115.0	115.0	10.9	0.3	2.8	76.3	4.1	3.4	5.0	1.2	9.0	2.15	1.58	2.15	1.58	3.24	non-LIQ CLAY	1	0.67	NA	9.85	non-LIQ	non-LIQ	0.870	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
37.57	652.4	115.0	115.0	12.2	0.4	3.3	75.3	4.6	3.7	5.0	1.2	9.0	2.16	1.58	2.16	1.58	3.23	non-LIQ CLAY	1	0.67	NA	9.66	non-LIQ	non-LIQ	0.868	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
37.73	652.3	115.0	115.0	12.9	0.5	3.9	76.6	4.9	4.0	5.0	1.2	10.0	2.17	1.59	2.17	1.59	3.25	non-LIQ CLAY	1	0.67	NA	9.90	non-LIQ	non-LIQ	0.867	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
37.90	652.1	115.0	115.0	14.1	0.5	3.5	71.7	5.1	4.2	5.0	1.2	10.0	2.18	1.59	2.18	1.59	3.18	non-LIQ CLAY	1	0.67	NA	9.01	non-LIQ	non-LIQ	0.866	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
38.06	651.9	115.0	115.0	13.6	0.5	3.7	73.8	5.0	4.1	5.0	1.2	10.0	2.19	1.59	2.19	1.59	3.21	non-LIQ CLAY	1	0.66	NA	9.39	non-LIQ	non-LIQ	0.864	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
38.22	651.8	115.0	115.0	13.3	0.4	3.0	70.9	4.8	3.9	5.0	1.2	10.0	2.20	1.60	2.20	1.60	3.17	non-LIQ CLAY	1	0.66	NA	8.87	non-LIQ	non-LIQ	0.863	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
38.39	651.6	115.0	115.0	13.7	0.5	3.6	73.6	5.0	4.1	5.0	1.2	10.0	2.21	1.60	2.21	1.60	3.21	non-LIQ CLAY	1	0.66	NA	9.36	non-LIQ	non-LIQ	0.862	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
38.55	651.5	115.0	115.0	14.5	0.5	3.4	70.6	5.2	4.2	5.0	1.2	10.0	2.22	1.61	2.22	1.61	3.17	non-LIQ CLAY	1	0.66	NA	8.81	non-LIQ	non-LIQ	0.860	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
38.72	651.3	115.0	115.0	15.6	0.6	3.8	70.2	5.6	4.5	5.0	1.2	10.0	2.23	1.61	2.23	1.61	3.16	non-LIQ CLAY	1	0.66	NA	8.76	non-LIQ	non-LIQ	0.859	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
38.88	651.1	115.0	115.0	16.1	0.6	3.7	68.6	5.7	4.6	5.0	1.2	10.0	2.24	1.62	2.24	1.62	3.14	non-LIQ CLAY	1	0.66	NA	8.48	non-LIQ	non-LIQ	0.858	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
39.04	651.0	115.0	115.0	15.3	0.5	3.3	68.0	5.3	4.3	5.0	1.2	10.0	2.24	1.62	2.24	1.62	3.13	non-LIQ CLAY	1	0.65	NA	8.36	non-LIQ	non-LIQ	0.856	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
39.21	650.8	115.0	115.0	14.4	0.5	3.5	71.4	5.2	4.2	5.0	1.2	10.0	2.25	1.62	2.25	1.62	3.18	non-LIQ CLAY	1	0.65	NA	8.96	non-LIQ	non-LIQ	0.855	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
39.37	650.6	115.0	115.0	13.2	0.5	3.8	76.4	5.0	4.0	5.0	1.2	10.0	2.26	1.63	2.26	1.63	3.24	non-LIQ CLAY	1	0.65	NA	9.87	non-LIQ	non-LIQ	0.854	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
39.54	650.5	115.0	115.0	12.0	0.5	4.2	82.4	4.6	3.8	5.0	1.2	10.0	2.27	1.63	2.27	1.63	3.32	non-LIQ CLAY	1	0.65	NA	10.95	non-LIQ	non-LIQ	0.852	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
39.70	650.3	115.0	115.0	11.9	0.4	3.4	78.4	4.6	3.7	5.0	1.2	9.0	2.28	1.64	2.28	1.64	3.27	non-LIQ CLAY	1	0.65	NA	10.23	non-LIQ	non-LIQ	0.851	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
39.86	650.1	115.0	115.0	13.2	0.6	4.5	80.6	5.2	4.2	5.0	1.2	10.0	2.29	1.64	2.29	1.64	3.29	non-LIQ CLAY	1	0.64	NA	10.63	non-LIQ	non-LIQ	0.850	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
40.03	650.0	115.0	115.0	22.5	0.3	1.3	43.6	6.2	5.0	5.0	1.2	11.0	2.30	1.65	2.30	1.65	2.76	non-LIQ CLAY	1	0.64	NA	4.44	non-LIQ	non-LIQ	0.848	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
40.19	649.8	115.0	115.0	51.2	0.3	0.6	17.4	10.7	8.6	3.1	1.1	12.0	2.31	1.65	2.31	1.65	2.15	SAND	0.5	0.80	39	1.56	60	0.100	0.847	0.470	0.440	0.23	NA	NA	NA	NA	NA	0.00	10.00	2.62	0.05
40.36	649.6	115.0	115.0	42.3	0.4	0.9	23.8	9.5	7.6	4.2	1.1	13.0	2.32	1.65	2.32	1.65	2.33	SAND	0.5	0.80	32	2.06	66	0.107	0.846	0.470	0.440	0.24	NA	NA	NA	NA	NA	0.00	10.00	2.62	0.05
40.52	649.5	115.0	115.0	20.8	0.4	1.9	50.7	6.2	4.9	5.0	1.2	11.0	2.33	1.66	2.33	1.66	2.88	non-LIQ CLAY	1	0.64	NA	5.50	non-LIQ	non-LIQ	0.844	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
40.68	649.3	115.0	115.0	12.6	0.4	3.2	75.7	4.7	3.8	5.0	1.2	10.0	2.34	1.66	2.34	1.66	3.23	non-LIQ CLAY	1	0.64	NA	9.73	non-LIQ	non-LIQ	0.843	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
40.85	649.2	115.0	115.0	14.6	0.4	2.7	67.5	5.1	4.0	5.0	1.2	10.0	2.35	1.67	2.35	1.67	3.13	non-LIQ CLAY	1	0.63	NA	8.29	non-LIQ	non-LIQ	0.842	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
41.01	649.0	115.0	115.0	15.0	0.3	2.0	61.4	4.9	3.9	5.0	1.2	10.0	2.36	1.67	2.36	1.67	3.04	non-LIQ CLAY	1	0.63	NA	7.23	non-LIQ	non-LIQ	0.840	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
41.18	648.8	115.0	115.0	12.2	0.3	2.5	72.6	4.4	3.5	5.0	1.2	9.0	2.37	1.68	2.37	1.68	3.19	non-LIQ CLAY	1	0.63	NA	9.17	non-LIQ	non-LIQ	0.839	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
41.34	648.7	115.0	115.0	11.5	0.5	4.3	86.5	4.8	3.8	5.0	1.2	10.0	2.38	1.68	2.38	1.68	3.36	non-LIQ CLAY	1	0.63	NA	11.74	non-LIQ	non-LIQ	0.838	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
41.50	648.5	115.0	115.0	13.0	0.3	2.3	69.2	4.6	3.6	5.0	1.2	9.0	2.39	1.68	2.39	1.68	3.15	non-LIQ CLAY	1	0.63	NA	8.58	non-LIQ	non-LIQ	0.836	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
41.67	648.3	115.0	115.0	15.0	0.5	3.3	70.7	5.4	4.2	5.0	1.2	10.0	2.40	1.69	2.40	1.69	3.17	non-LIQ CLAY	1	0.63	NA	8.84	non-LIQ	non-LIQ	0.835	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
41.83	648.2	115.0	115.0	17.9	0.9	5.0	72.9	6.5	5.2	5.0	1.2	11.0	2.41	1.69	2.41	1.69	3.20	non-LIQ CLAY	1	0.63	NA	9.23	non-LIQ	non-LIQ	0.834	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
42.00	648.0	115.0	115.0	25.6	1.1	4.3	59.0	8.2	6.5	5.0	1.2	13.0	2.42	1.70	2.42	1.70	3.01	non-LIQ CLAY	1	0.62	NA	6.83	non-LIQ	non-LIQ	0.832	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
42.16	647.8	115.0	115.0	37.9	0.6	1.6	31.0	9.3	7.3	4.8	1.2	13.0	2.42	1.70	2.42	1.70	2.51	SAND	0.5	0.79	28	2.81	79	0.126	0.831	0.470	0.440	0.29	NA	NA	NA	NA	NA	0.00	9.00	2.77	0.05
42.32	647.7	115.0	115.0	52.6	0.4	0.8	19.1	11.2	8.6	3.5	1.1	13.0	2.43	1.71	2.43	1.71	2.20	SAND	0.5	0.79	39	1.68	66	0.106	0.830	0.470	0.440	0.24	NA	NA	NA	NA	NA	0.00	11.00	2.46	0.05
42.49	647.5	115.0	115.0	44.1	0.8	1.8	30.0	10.7	8.4	4.7	1.2	14.0	2.44	1.71	2.44	1.71	2.49	SAND	0.5	0.79	33	2.70	88	0.144	0.828	0.470	0.440	0.33	NA	NA	NA	NA	NA	0.00	10.00	2.62	0.05
42.65	647.4	115.0	115.0	33.5	1.1	3.3	47.9	9.7	7.6	5.0	1.2	14.0	2.45	1.71	2.45	1.71	2.83	non-LIQ CLAY	1	0.62	NA	5.07	non-LIQ	non-LIQ	0.827	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
42.82	647.2	115.0	115.0	29.9	0.9	3.0	49.2	8.8	6.9	5.0	1.2	13.0	2.46	1.72	2.46	1.72	2.86	non-LIQ CLAY	1	0.62	NA	5.27	non-LIQ	non-LIQ	0.826	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
42.98	647.0	115.0	115.0	27.3	0.8	2.9	51.1	8.1	6.4	5.0	1.2	13.0	2.47	1.72	2.47	1.72	2.89	non-LIQ CLAY	1	0.61	NA	5.56	non-LIQ	non-LIQ	0.824	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
43.15	646.9	115.0	115.0	18.0	0.5	2.8	62.1	6.0	4.7	5.0	1.2	11.0	2.48	1.73	2.48	1.73	3.05	non-LIQ CLAY	1	0.61	NA	7.35	non-LIQ	non-LIQ	0.823	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
43.31	646.7	115.0	115.0	11.8	0.3	2.5	76.1	4.4	3.5	5.0	1.2	9.0	2.49	1.73	2.49	1.73	3.24	non-LIQ CLAY	1	0.61	NA	9.81	non-LIQ	non-LIQ	0.822	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
43.47	646.5	115.0	115.0	11.8	0.3	2.5	76.2	4.4	3.5	5.0	1.2	9.0	2.50	1.74	2.50	1.74	3.24	non-LIQ CLAY	1	0.61	NA	9.83	non-LIQ	non-LIQ	0.820	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
43.64	646.4	115.0	115.0	12.3	0.3	2.4	73.8	4.5	3.5	5.0	1.2	9.0	2.51	1.74	2.51	1.74	3.21	non-LIQ CLAY	1	0.61	NA	9.40	non-LIQ	non-LIQ	0.819	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
43.80	646.2	115.0	115.0	11.4	0.3	2.6	78.6	4.4	3.4	5.0	1.2	9.0	2.52	1.74	2.52	1.74	3.27	non-LIQ CLAY	1	0.61	NA	10.26	non-LIQ	non-LIQ	0.818	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
43.97	646.0	115.0	115.0	11.1	0.3	2.7	80.4	4.3	3.4	5.0	1.2	9.0	2.53	1.75	2.53	1.75	3.29	non-LIQ CLAY	1	0.60	NA	10.60	non-LIQ	non-LIQ	0.816	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
44.13	645.9	115.0	115.0	10.4	0.3	2.9	84.9	4.2	3.3	5.0	1.2	9.0	2.54	1.75	2.54	1.75	3.34	non-LIQ CLAY	1	0.60	NA	11.42	non-LIQ	non-LIQ	0.815	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
44.29	645.7	115.0	115.0	10.6	0.3	2.8	83.7	4.3	3.3	5.0	1.2	9.0	2.55	1.76	2.55	1.76	3.33	non-LIQ CLAY	1	0.60	NA	11.21	non-LIQ	non-LIQ	0.814	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
44.46	645.5	115.0	115.0	10.2	0.3	2.9	86.5	4.2	3.3	5.0	1.2	9.0	2.56	1.76	2.56	1.76	3.36	non-LIQ CLAY	1	0.60	NA	11.73	non-LIQ	non-LIQ	0.812	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
44.62	645.4	115.0	115.0	10.3	0.3	2.9	86.0	4.2	3.3	5.0	1.2	9.0	2.57	1.77	2.57	1.77	3.36	non-LIQ CLAY	1	0.60	NA	11.62	non-LIQ	non-LIQ	0.811	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
44.79	645.2	115.0	115.0	10.6	0.4	3.8	90.2	4.5	3.5	5.0	1.2	9.0	2.58	1.77	2.58	1.77	3.41	non-LIQ CLAY	1	0.60	NA	12.41	non-LIQ	non-LIQ	0.809	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
44.95	645.1	115.0	115.0	11.3	0.4	3.5	85.8	4.6	3.6	5.0	1.2	9.0	2.58	1.77	2.58	1.77	3.36	non-LIQ CLAY	1	0.60	NA	11.60	non-LIQ	non-LIQ	0.808	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
45.11	644.9	115.0	115.0	11.2	0.4	3.6	86.6	4.6	3.6	5.0	1.2	9.0	2.59	1.78	2.59	1.78	3.36	non-LIQ CLAY	1	0.59	NA	11.74	non-LIQ	non-LIQ	0.807	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
45.28	644.7	115.0	115.0	11.3	0.3	2.7	80.3	4.4	3.4	5.0	1.2	9.0	2.60	1.78	2.60	1.78	3.29	non-LIQ CLAY	1	0.59	NA	10.57	non-LIQ	non-LIQ	0.806	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
45.44	644.6	115.0	115.0	10.4	0.3	2.9	86.0	4.3	3.3	5.0	1.2	9.0	2.61	1.79	2.61	1.79	3.36	non-LIQ CLAY	1	0.59	NA	11.63	non-LIQ	non-LIQ	0.804	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
45.61	644.4	115.0	115.0	10.8	0.4	3.7	89.5	4.6	3.5	5.0	1.2	9.0	2.62	1.79	2.62	1.79	3.40	non-LIQ CLAY	1	0.59	NA	12.30	non-LIQ	non-LIQ	0.803	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
45.77	644.2	115.0	115.0	11.1	0.4	3.6	87.7	4.6	3.6	5.0	1.2	9.0	2.63	1.80	2.63	1.80	3.38	non-LIQ CLAY	1	0.59	NA	11.96	non-LIQ	non-LIQ	0.802	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
45.93	644.1	115.0	115.0	11.1	0.4	3.6	87.9	4.7	3.6	5.0	1.2	9.0	2.64	1.80	2.64	1.80	3.38	non-LIQ CLAY	1	0.59	NA	11.98	non-LIQ	non-LIQ	0.800	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
46.10	643.9	115.0	115.0	12.4	0.5	4.0	85.3	5.1	3.9	5.0	1.2	10.0	2.65	1.81	2.65	1.81	3.35	non-LIQ CLAY	1	0.59	NA	11.50	non-LIQ	non-LIQ	0.799	0.470	0.440	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
46.26	643.7	115.0	115.0	12.0	0.5	4.2	87.6	5.0	3.8	5.0	1.2	10.0	2.66	1.81	2.66	1.81	3.38	non-LIQ CLAY	1	0.58	NA	11.93	non-LIQ	non-LIQ	0.798	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
46.43	643.6	115.0	115.0	12.0	0.5	4.2	87.7	5.0	3.8	5.0	1.2	10.0	2.67	1.81	2.67	1.81	3.38	non-LIQ CLAY	1	0.58	NA	11.96	non-LIQ	non-LIQ	0.796	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
46.59	643.4	115.0	115.0	11.9	0.5	4.2	88.4	5.0	3.8	5.0	1.2	10.0	2.68	1.82	2.68	1.82	3.39	non-LIQ CLAY	1	0.58	NA	12.09	non-LIQ	non-LIQ	0.795	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
46.75	643.3	115.0	115.0	12.3	0.5	4.1	86.3	5.1	3.9	5.0	1.2	10.0	2.69	1.82	2.69	1.82	3.36	non-LIQ CLAY	1	0.58	NA	11.69	non-LIQ	non-LIQ	0.794	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
46.92	643.1	115.0	115.0	12.3	0.5	4.1	86.4	5.1	3.9	5.0	1.2	10.0	2.70	1.83	2.70	1.83	3.36	non-LIQ CLAY	1	0.58	NA	11.71	non-LIQ	non-LIQ	0.792	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
47.08	642.9	115.0	115.0	12.4	0.5	4.0	86.0	5.1	3.9	5.0	1.2	10.0	2.71	1.83	2.71	1.83	3.36	non-LIQ CLAY	1	0.58	NA	11.63	non-LIQ	non-LIQ	0.791	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
47.25	642.8	115.0	115.0	12.1	0.5	4.1	87.8	5.1	3.8	5.0	1.2	10.0	2.72	1.84	2.72	1.84	3.38	non-LIQ CLAY	1	0.58	NA	11.97	non-LIQ	non-LIQ	0.789	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
47.41	642.6	115.0	115.0	15.1	0.5	3.3	73.9	5.6	4.2	5.0	1.2	10.0	2.73	1.84	2.73	1.84	3.21	non-LIQ CLAY	1	0.58	NA	9.42	non-LIQ	non-LIQ	0.788	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
47.57	642.4	115.0	115.0	14.5	0.5	3.4	76.4	5.5	4.1	5.0	1.2	10.0	2.74	1.84	2.74	1.84	3.24	non-LIQ CLAY	1	0.57	NA	9.87	non-LIQ	non-LIQ	0.787	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
47.74	642.3	115.0	115.0	11.3	0.5	4.4	93.0	5.0	3.8	5.0	1.2	10.0	2.75	1.85	2.75	1.85	3.44	non-LIQ CLAY	1	0.57	NA	12.96	non-LIQ	non-LIQ	0.785	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
47.90	642.1	115.0	115.0	11.7	0.4	3.4	85.8	4.8	3.6	5.0	1.2	9.0	2.75	1.85	2.75	1.85	3.36	non-LIQ CLAY	1	0.57	NA	11.60	non-LIQ	non-LIQ	0.784	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
48.07	641.9	115.0	115.0	11.4	0.5	4.4	92.7	5.0	3.8	5.0	1.2	10.0	2.76	1.86	2.76	1.86	3.43	non-LIQ CLAY	1	0.57	NA	12.89	non-LIQ	non-LIQ	0.783	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
48.23	641.8	115.0	115.0	13.4	0.6	4.5	85.7	5.5	4.1	5.0	1.2	10.0	2.77	1.86	2.77	1.86	3.35	non-LIQ CLAY	1	0.57	NA	11.57	non-LIQ	non-LIQ	0.781	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
48.39	641.6	115.0	115.0	13.6	0.6	4.4	84.8	5.5	4.2	5.0	1.2	10.0	2.78	1.87	2.78	1.87	3.34	non-LIQ CLAY	1	0.57	NA	11.41	non-LIQ	non-LIQ	0.780	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
48.56	641.4	115.0	115.0	13.0	0.6	4.6	87.9	5.5	4.1	5.0	1.2	10.0	2.79	1.87	2.79	1.87	3.38	non-LIQ CLAY	1	0.57	NA	12.00	non-LIQ	non-LIQ	0.779	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
48.72	641.3	115.0	115.0	13.5	0.6	4.4	85.5	5.5	4.2	5.0	1.2	10.0	2.80	1.87	2.80	1.87	3.35	non-LIQ CLAY	1	0.56	NA	11.54	non-LIQ	non-LIQ	0.778	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
48.89	641.1	115.0	115.0	14.2	0.6	4.2	82.4	5.7	4.2	5.0	1.2	10.0	2.81	1.88	2.81	1.88	3.32	non-LIQ CLAY	1	0.56	NA	10.96	non-LIQ	non-LIQ	0.776	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
49.05	641.0	115.0	115.0	15.1	0.6	4.0	78.6	5.8	4.4	5.0	1.2	10.0	2.82	1.88	2.82	1.88	3.27	non-LIQ CLAY	1	0.56	NA	10.27	non-LIQ	non-LIQ	0.775	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
49.22	640.8	115.0	115.0	15.2	0.7	4.6	81.6	6.0	4.5	5.0	1.2	10.0	2.83	1.89	2.83	1.89	3.31	non-LIQ CLAY	1	0.56	NA	10.82	non-LIQ	non-LIQ	0.773	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
49.38	640.6	115.0	115.0	16.3	0.8	4.9	80.3	6.4	4.8	5.0	1.2	11.0	2.84	1.89	2.84	1.89	3.29	non-LIQ CLAY	1	0.56	NA	10.57	non-LIQ	non-LIQ	0.772	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
49.54	640.5	115.0	115.0	21.0	0.9	4.3	68.5	7.4	5.5	5.0	1.2	12.0	2.85	1.90	2.85	1.90	3.14	non-LIQ CLAY	1	0.56	NA	8.45	non-LIQ	non-LIQ	0.771	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
49.71	640.3	115.0	115.0	19.9	1.0	5.0	73.6	7.3	5.5	5.0	1.2	12.0	2.86	1.90	2.86	1.90	3.21	non-LIQ CLAY	1	0.56	NA	9.36	non-LIQ	non-LIQ	0.769	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
49.87	640.1	115.0	115.0	19.0	1.1	5.8	78.4	7.3	5.4	5.0	1.2	12.0	2.87	1.90	2.87	1.90	3.27	non-LIQ CLAY	1	0.56	NA	10.23	non-LIQ	non-LIQ	0.768	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
50.04	640.0	115.0	115.0	18.7	1.2	6.4	81.4	7.4	5.5	5.0	1.2	12.0	2.88	1.91	2.88	1.91	3.30	non-LIQ CLAY	1	0.55	NA	10.79	non-LIQ	non-LIQ	0.767	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
50.20	639.8	115.0	115.0	21.1	1.3	6.2	76.3	7.9	5.9	5.0	1.2	12.0	2.89	1.91	2.89	1.91	3.24	non-LIQ CLAY	1	0.55	NA	9.84	non-LIQ	non-LIQ	0.765	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
50.36	639.6	115.0	115.0	28.6	1.5	5.2	63.4	9.6	7.1	5.0	1.2	14.0	2.90	1.92	2.90	1.92	3.07	non-LIQ CLAY	1	0.55	NA	7.57	non-LIQ	non-LIQ	0.764	0.460	0.430	non-LIQ	NA	NA	NA	NA	NA	0.00	NA	NA	0.00

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Project SR 57/60 Confluence Phase I Grand Ave WB On-Ramp **Project No.** 08-170

By SP **Date** 01/30/12 **Checked By** LCC **Date** 2/8/2012 **Sheet** ___ **of** ___

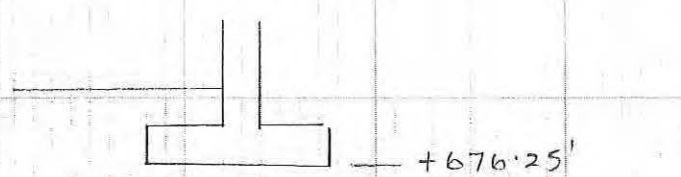
Mechanically Stabilized Embankment walls

Maximum wall height = 30'

base width = 23.5'

leveling pad elevation = +676.25'

soil profile is based on A-10-006, A-10-007, CPT-10-010



+676.25'

clay $N_{ave} = 8$, $s_u = 3300$, $C_c = 0.016$ (1) +671'

(2) +655

sand $N_{ave} = 8$, $\phi = 33$, $c = 40$ (3) +645

clay $N_{ave} = 7$, $s_u = 3300$, $C_c = 0.016$ (4) +635

clay $N_{ave} = 48$, $s_u = 4000$ (5)

Bearing capacity

$$q_u = cN_{cm} + \bar{q}N_{qm} + \frac{1}{2}\gamma B N_{\gamma m}$$

for footing on clay $N_c = 5.14$, $N_q = 1$, $N_\gamma = 0$

$N_{cm} = N_c s_c i_c$, $N_{qm} = N_q s_q i_q d_q$

shape factors s_c, s_q, inclination factors $i_c, i_q = 1$

depth factor $d_q = 1.2$

$q_u = 5.14 \times 3.3 + 0.15 \times 3 \times 1.2 = 17.5$ ksf

for layered soil

$q_u = q\, e^{2k \tan\phi\, H/B (1 + B/L)}$

H = over excavation depth

$\phi = 36°$ for select material

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$$k = \frac{1-\sin^2 36}{1+\sin^2 36} = 0.49$$

H = 2 feet of overexcavation

for strength limit
(BDA 3-8)

$B' = 15.74$ ft

$$q_{all} = \phi q_u = 0.45 \times 17.5\, e^{2 \times 0.49 \tan 36 \times \frac{2}{15.74}\left(1+\frac{15.74}{115}\right)}$$

$= 8.7$ ksf > 7.76 ksf

for extreme event limit
(BDA 3-8)

$B' = 10.89$ ft

$$q_{all} = \phi q_u = 1.0 \times 17.5\, e^{2 \times 0.49 \tan 36 \frac{2}{10.89}\left(1+\frac{10.89}{115}\right)}$$

$= 20.2$ ksf > 7.72 ksf

service limit state

settlement

consider bearing pressure of 5.25 ksf
overexcavation = 2 feet $B' = 16.06$ ft

σ_{vo}	$\Delta\sigma$	settlement
① $6.5 \times 115 = 0.75$	$5.25 \times 0.96 = 5.14$	$3 \times \frac{1}{60} \log\left(\frac{0.75+5.14}{0.75}\right) = 0.54$
② $8 \times 115 + 8 \times 52.6 = 1.39$	$5.25 \times 0.6 = 3.15$	$16 \times 0.016 \log\left(\frac{1.39+3.15}{1.39}\right) = 1.61$
③ $8 \times 115 + 21 \times 52.6 = 2.02$	$5.25 \times 0.3 = 1.56$	$10 \times \frac{1}{40} \log\left(\frac{2.02+1.56}{2.02}\right) = 0.75$
④ $8 \times 115 + 31 \times 52.6 = 2.55$	$5.25 \times 0.15 = 0.79$	$10 \times 0.016 \log\left(\frac{2.55+0.79}{2.55}\right) = 0.23$
		$3.13''$

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Project SR-57/60 confluence Phase I Grand Ave NB on-Ramp **Project No.** 08-170

By SP **Date** 02/02/12 **Checked By** LEC **Date** 2/8/2012 **Sheet** ___ **of** ___

wall ht (ft) (H)	Base width (ft) (BW)	Service Limit (ksf)	Strength Limit (ksf)	Extreme Event (ksf)	settlement (inch)	minimum overexcavation (ft)
30.0	23.5	5.25	8.7	20.2	3.1	2
27.5	21.5	4.90	8.9	20.7	2.9	2
25.0	20.5	4.30	8.9	20.6	2.7	2
22.5	18.5	4.00	9.0	21.0	2.4	2
20.0	17.5	3.50	9.0	20.9	2.1	2
17.5	15.5	3.20	8.5	19.4	2.0	1
15.0	13.5	2.90	8.6	19.8	1.7	1
12.5	11.5	2.50	8.8	20.3	1.4	1
10.0	9.5	2.20	9.1	21.2	1.0	1

Waiting Period

for 90 % consolidation

$T_v = -0.933 \log(1-0.9) - 0.085$

$= 0.848$

$C_v = 1.0$ ft/day

for soil layer thickness = 16'

$t = \frac{0.848 \times 8^2}{1.0} = 54$ days

Recommend 60 days

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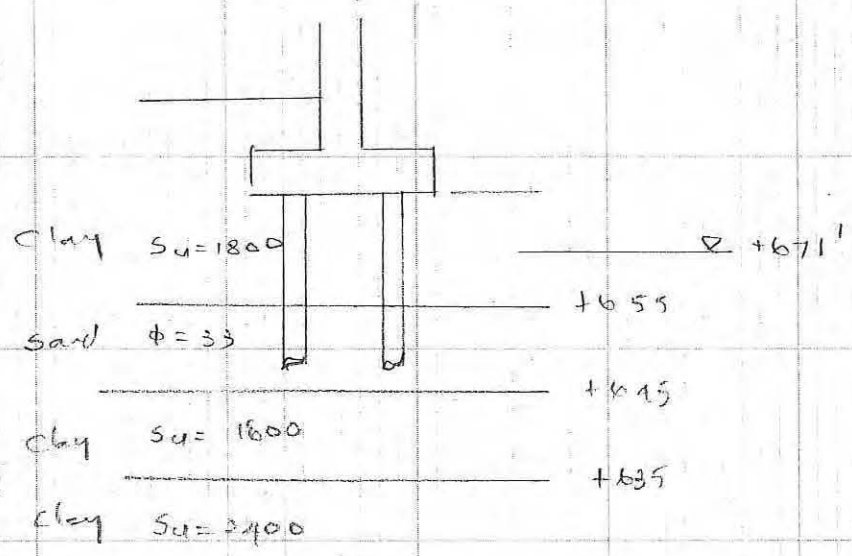
Project SR 57/60 confluence Phase I Grand Ave WB On-Ramp **Project No.** 08-170

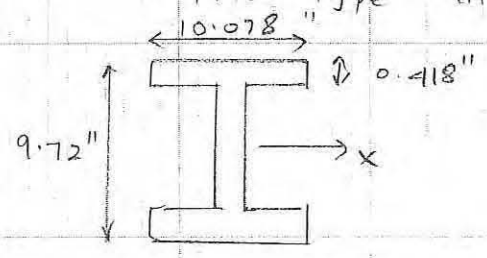
By SP **Date** 01/30/11 **Checked By** LCC **Date** 2/5/2012 **Sheet** ____ **of** ____

Caltans Standard Type 1 Retaining walls

wall hight =	20'	16'
footing width =	15'	13.5'
bottom of footing =	+687.75	+691.75



Pile type HP 10x42



$A = 12.41 \text{ in}^2$

$I_{xx} = 211 \text{ in}^4$

$I_{yy} = 71.9 \text{ in}^4$

pile spacing = 5.4d

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Project SR-57/60 confluence Phase I Grand Ave WB On-Ramp Project No. 08-170

By SP Date 05/23/12 Checked By HCL Date 5/23/12 Sheet ___ of ___

foundation design loads per pile

for 16' high wall	compression	Tension
strength limit state =	120 kips	—
Extreme event =	110 kips	—

for 20' high walls

strength limit state =	103 kips	—
Extreme event =	90 kips	—

Nominal resistance per pile

	16' wall	20' wall
strength limit state =	$\frac{120}{0.7} = 171$ kips consider 180 kips	$\frac{103}{0.7} = 147$ kips consider 150 kips
Extremement event =	$\frac{110}{1.0} = 110$ kips	$\frac{90}{1.0} = 90$ kips

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By SP **Date** 5/23/12 **Checked By** HCC **Date** 5/23/12 **Sheet** ___ **of** ___

from analysis

for 16 feet wall height

strength limit state

at 52 feet, pile capacity = 180.1 kips > 180 kips

pile tip elevation for compression = 691 − 52
= +639 feet

available group nominal resistance = 13 × 180 = 2340 kips

required group nominal resistance = $\frac{1179}{0.7}$ = 1684 kips < 2340 kips

available group nominal resistance exceeds required group nominal resistance.

for piles near RCB, pile drilling depth = 691 − 665 = 26 feet.

pile tip elevation for compression = 639 − $\frac{26}{2}$ = +626 feet.

all the other piles, consider pile length = 55 feet

pile tip elevation for compression = 691 − 55 = +636 feet.

Extreme event limit state

at 36 feet, pile capacity = 113 kips > 110 kips

pile tip elevation for compression = 691 − 36 = +655 feet.

available group nominal resistance = 13 × 113 = 1469 kips

required group nominal resistance = 811 kips < 1469

for piles near RCB, pile tip elevation for compression = 655 − $\frac{26}{2}$ = +642 ft

for other piles, pile tip elevation for compression = +655 feet

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for 20 feet wall height

strength limit state
at 43 feet, pile capacity = 151 kip > 150 kip
pile tip elevation for compression = 687 - 43 = + 644 ft
available group nominal resistance = 28 x 151 = 4228 kip
required group nominal resistance = $\frac{2551}{0.7}$ = 3644 kip < 4228
available group nominal resistance exceeds required group nominal resistance.

considered pile length = 51 feet
pile tip elevation for compression
= 687 - 51
= +636 feet

Extreme limit state

at 32 feet, pile capacity = 94 kip > 90 kip
pile tip elevation for compression = 687 - 32 = +655 feet
available group nominal resistance = 94 x 28 = 2632 kip
required group nominal resistance = 1781 kip < 2632 kip

pile tip elevation for compression = +655 feet

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*******************************************************************************
SR-57/SR-60 Confluence Projct, Phase I Grand Avenue WB On-Ramp, 01/30/2012 SP
HP 10 x 42
*******************************************************************************
```

SOIL DATA

NUMBER OF SOIL UNITS = 7
DEPTH TO WATER TABLE = 17.00'
UNIT WEIGHT OF WATER = .0624 kcf

SOIL UNIT	DEPTH (ft)	UNIT WT. (kcf)	CLAY: SAND:	c (ksf) PHI (deg)	Nc Nq	Cac Khc	Cat Kht	delta (deg)
1	.0 - 8.0	.115	CLAY	1.80	0.	.37	.37	
2	8.0 - 17.0	.115	CLAY	1.80	0.	.48	.48	
3	17.0 - 25.0	.115	CLAY	1.80	0.	.55	.55	
4	25.0 - 33.0	.115	CLAY	1.80	0.	.60	.60	
5	33.0 - 43.0	.115	SAND	33.00	0.	1.00	.67	28.00
6	43.0 - 53.0	.115	CLAY	1.60	0.	.60	.60	
7	53.0 - 80.0	.115	CLAY	2.40	0.	.63	.63	

PILE DATA

		PILE TOP	PILE TIP
DEPTH	=	.00	78.00'
CIRCUMFERENCE	=	3.300	3.300'
CROSS-SECTIONAL AREA	=	.0860	.0860 ft2

PILE STIFFNESS AE/L = 99999. kips/ft
DISPLACEMENT TO MOBILIZE FULL SKIN FRICTION = 1.670E-02' (= 2.004E-01")
DISPLACEMENT TO MOBILIZE FULL END BEARING = 6.700E-02' (= 8.040E-01")
DEPTH INCREMENT FOR CAPACITY CALCULATIONS = 1.00'
FACTOR OF SAFETY FOR SKIN FRICTION = 1.00
FACTOR OF SAFETY FOR END-BEARING = 1.00

SOIL UNIT -	DEPTH (ft)	EFF. STRESS (ksf)	UNIT SKIN FRICT COMPR. (ksf)	UPLIFT (ksf)	UNIT END BEARING (ksf)	CUM.FR. COMPR. (kips)	END BEARING (kips)	CAPACITY COMPRESS (kips)	UPLIFT (kips)
1	.00	.00	.67	.67	.0	.0	.0	.0	.0
1	1.00	.12	.67	.67	.0	2.2	.0	2.2	2.2
1	2.00	.23	.67	.67	.0	4.4	.0	4.4	4.4
1	3.00	.35	.67	.67	.0	6.6	.0	6.6	6.6
1	4.00	.46	.67	.67	.0	8.8	.0	8.8	8.8
1	5.00	.58	.67	.67	.0	11.0	.0	11.0	11.0
1	6.00	.69	.67	.67	.0	13.2	.0	13.2	13.2
1	7.00	.81	.67	.67	.0	15.4	.0	15.4	15.4
1	8.00	.92	.67	.67	.0	17.6	.0	17.6	17.6
2	8.00	.92	.86	.86	.0	17.6	.0	17.6	17.6
2	9.00	1.03	.86	.86	.0	20.4	.0	20.4	20.4
2	10.00	1.15	.86	.86	.0	23.3	.0	23.3	23.3
2	11.00	1.26	.86	.86	.0	26.1	.0	26.1	26.1
2	12.00	1.38	.86	.86	.0	29.0	.0	29.0	29.0
2	13.00	1.49	.86	.86	.0	31.8	.0	31.8	31.8
2	14.00	1.61	.86	.86	.0	34.7	.0	34.7	34.7
2	15.00	1.72	.86	.86	.0	37.5	.0	37.5	37.5
2	16.00	1.84	.86	.86	.0	40.4	.0	40.4	40.4
2	17.00	1.95	.86	.86	.0	43.2	.0	43.2	43.2
3	17.00	1.95	.99	.99	.0	43.2	.0	43.2	43.2
3	18.00	2.01	.99	.99	.0	46.5	.0	46.5	46.5
3	19.00	2.06	.99	.99	.0	49.8	.0	49.8	49.8
3	20.00	2.11	.99	.99	.0	53.0	.0	53.0	53.0
3	21.00	2.17	.99	.99	.0	56.3	.0	56.3	56.3
3	22.00	2.22	.99	.99	.0	59.6	.0	59.6	59.6
3	23.00	2.27	.99	.99	.0	62.8	.0	62.8	62.8
3	24.00	2.32	.99	.99	.0	66.1	.0	66.1	66.1
3	25.00	2.38	.99	.99	.0	69.4	.0	69.4	69.4
4	25.00	2.38	1.08	1.08	.0	69.4	.0	69.4	69.4
4	26.00	2.43	1.08	1.08	.0	72.9	.0	72.9	72.9
4	27.00	2.48	1.08	1.08	.0	76.5	.0	76.5	76.5
4	28.00	2.53	1.08	1.08	.0	80.1	.0	80.1	80.1
4	29.00	2.59	1.08	1.08	.0	83.6	.0	83.6	83.6
4	30.00	2.64	1.08	1.08	.0	87.2	.0	87.2	87.2
4	31.00	2.69	1.08	1.08	.0	90.8	.0	90.8	90.8
4	32.00	2.74	1.08	1.08	.0	94.3	.0	94.3	94.3
4	33.00	2.80	1.08	1.08	.0	97.9	.0	97.9	97.9
5	33.00	2.80	1.49	1.00	.0	97.9	.0	97.9	97.9
5	34.00	2.85	1.51	1.02	.0	102.8	.0	102.8	101.2
5	35.00	2.90	1.54	1.03	.0	107.9	.0	107.9	104.6
5	36.00	2.95	1.57	1.05	.0	113.0	.0	113.0	108.0
5	37.00	3.01	1.60	1.07	.0	118.3	.0	118.3	111.5
5	38.00	3.06	1.63	1.09	.0	123.6	.0	123.6	115.1
5	39.00	3.11	1.65	1.11	.0	129.0	.0	129.0	118.7
5	40.00	3.16	1.68	1.13	.0	134.5	.0	134.5	122.4
5	41.00	3.22	1.71	1.15	.0	140.1	.0	140.1	126.2
5	42.00	3.27	1.74	1.16	.0	145.8	.0	145.8	130.0
5	43.00	3.32	1.77	1.18	.0	151.6	.0	151.6	133.9
6	43.00	3.32	.96	.96	.0	151.6	.0	151.6	133.9

6	44.00	3.38	.96	.96	.0	154.7	.0	154.7	137.0
6	45.00	3.43	.96	.96	.0	157.9	.0	157.9	140.2
6	46.00	3.48	.96	.96	.0	161.1	.0	161.1	143.4
6	47.00	3.53	.96	.96	.0	164.2	.0	164.2	146.5
6	48.00	3.59	.96	.96	.0	167.4	.0	167.4	149.7
6	49.00	3.64	.96	.96	.0	170.6	.0	170.6	152.9
6	50.00	3.69	.96	.96	.0	173.8	.0	173.8	156.0
6	51.00	3.74	.96	.96	.0	176.9	.0	176.9	159.2
6	52.00	3.80	.96	.96	.0	180.1	.0	180.1	162.4
6	53.00	3.85	.96	.96	.0	183.3	.0	183.3	165.5
7	53.00	3.85	1.51	1.51	.0	183.3	.0	183.3	165.5
7	54.00	3.90	1.51	1.51	.0	188.2	.0	188.2	170.5
7	55.00	3.95	1.51	1.51	.0	193.2	.0	193.2	175.5
7	56.00	4.01	1.51	1.51	.0	198.2	.0	198.2	180.5
7	57.00	4.06	1.51	1.51	.0	203.2	.0	203.2	185.5
7	58.00	4.11	1.51	1.51	.0	208.2	.0	208.2	190.5
7	59.00	4.16	1.51	1.51	.0	213.2	.0	213.2	195.5
7	60.00	4.22	1.51	1.51	.0	218.2	.0	218.2	200.5
7	61.00	4.27	1.51	1.51	.0	223.2	.0	223.2	205.5
7	62.00	4.32	1.51	1.51	.0	228.2	.0	228.2	210.4
7	63.00	4.37	1.51	1.51	.0	233.2	.0	233.2	215.4
7	64.00	4.43	1.51	1.51	.0	238.1	.0	238.1	220.4
7	65.00	4.48	1.51	1.51	.0	243.1	.0	243.1	225.4
7	66.00	4.53	1.51	1.51	.0	248.1	.0	248.1	230.4
7	67.00	4.58	1.51	1.51	.0	253.1	.0	253.1	235.4
7	68.00	4.64	1.51	1.51	.0	258.1	.0	258.1	240.4
7	69.00	4.69	1.51	1.51	.0	263.1	.0	263.1	245.4
7	70.00	4.74	1.51	1.51	.0	268.1	.0	268.1	250.4
7	71.00	4.80	1.51	1.51	.0	273.1	.0	273.1	255.4
7	72.00	4.85	1.51	1.51	.0	278.1	.0	278.1	260.3
7	73.00	4.90	1.51	1.51	.0	283.0	.0	283.0	265.3
7	74.00	4.95	1.51	1.51	.0	288.0	.0	288.0	270.3
7	75.00	5.01	1.51	1.51	.0	293.0	.0	293.0	275.3
7	76.00	5.06	1.51	1.51	.0	298.0	.0	298.0	280.3
7	77.00	5.11	1.51	1.51	.0	303.0	.0	303.0	285.3
7	78.00	5.16	1.51	1.51	.0	308.0	.0	308.0	290.3

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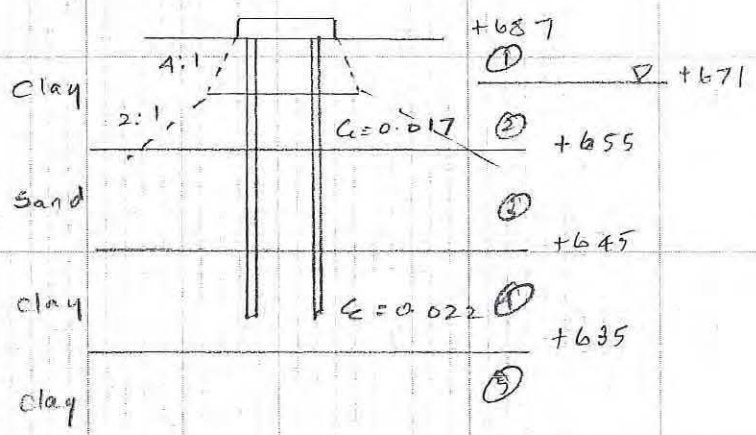
Project SR57/60 confluence Phase I Grand Ave WB on-Ramp **Project No.** 08-170

By SP **Date** 01/31/12 **Checked By** LCC **Date** 5/22/12 **Sheet** ____ **of** ____

settlement



Pile cap 15' x 42.92'

Total load = 1712 kips

permanent load = 1601 kips

consider pile length D = 16'

$\frac{2D}{3} = 10.7'$

equivalent footing = $(15 + \frac{10.7}{4} \times 2) \times (42.92 + \frac{10.7}{4} \times 2)$

$= 20.35' \times 48.27'$

$q = \frac{1712}{20.35 \times 48.27} = 1.74$ ksf for immediate settlement

$q = \frac{1601}{20.35 \times 48.27} = 1.63$ ksf for consolidation settlement

consolidation settlement

	σ_{vo}	$\Delta\sigma$	settlement
⑤	$16 \times 115 + 8 \times 52.6 = 2.26$	$\frac{1601}{(20.35+13.3)(48.27+13.3)} = 0.77$	$16 \times 0.017 \log\left(\frac{2.26+0.77}{2.26}\right) = 0.92$
①	$16 \times 115 + 31 \times 52.6 = 3.47$	$\frac{1601}{(20.35+36.3)(48.27+36.3)} = 0.33$	$10 \times 0.022 \log\left(\frac{3.47+0.33}{3.47}\right) = 0.1$
⑤	$16 \times 115 + 41 \times 52.6 = 4.0$	$\frac{1601}{(20.35+46.3)(48.27+46.3)} = 0.25$	$10 \times 0.022 \log\left(\frac{4+0.25}{4}\right) = 0.07$

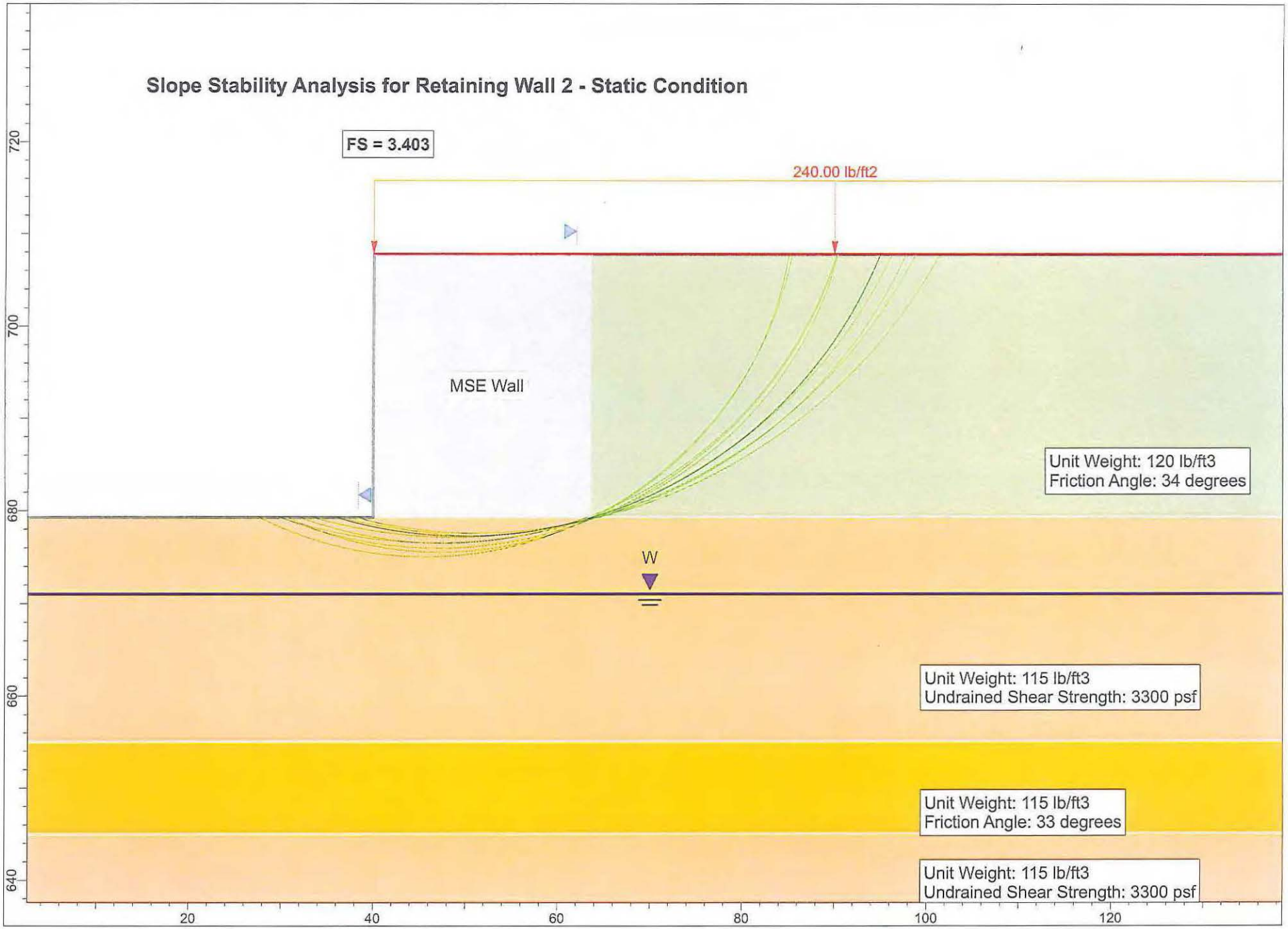
immediate settlement = $5.3 \times \frac{1}{60} \log\left(\frac{1.53+1.37}{1.53}\right) + 10 \times \frac{1}{50} \log\left(\frac{2.94+0.5}{2.94}\right) = 0.96$

for 20' wall WB

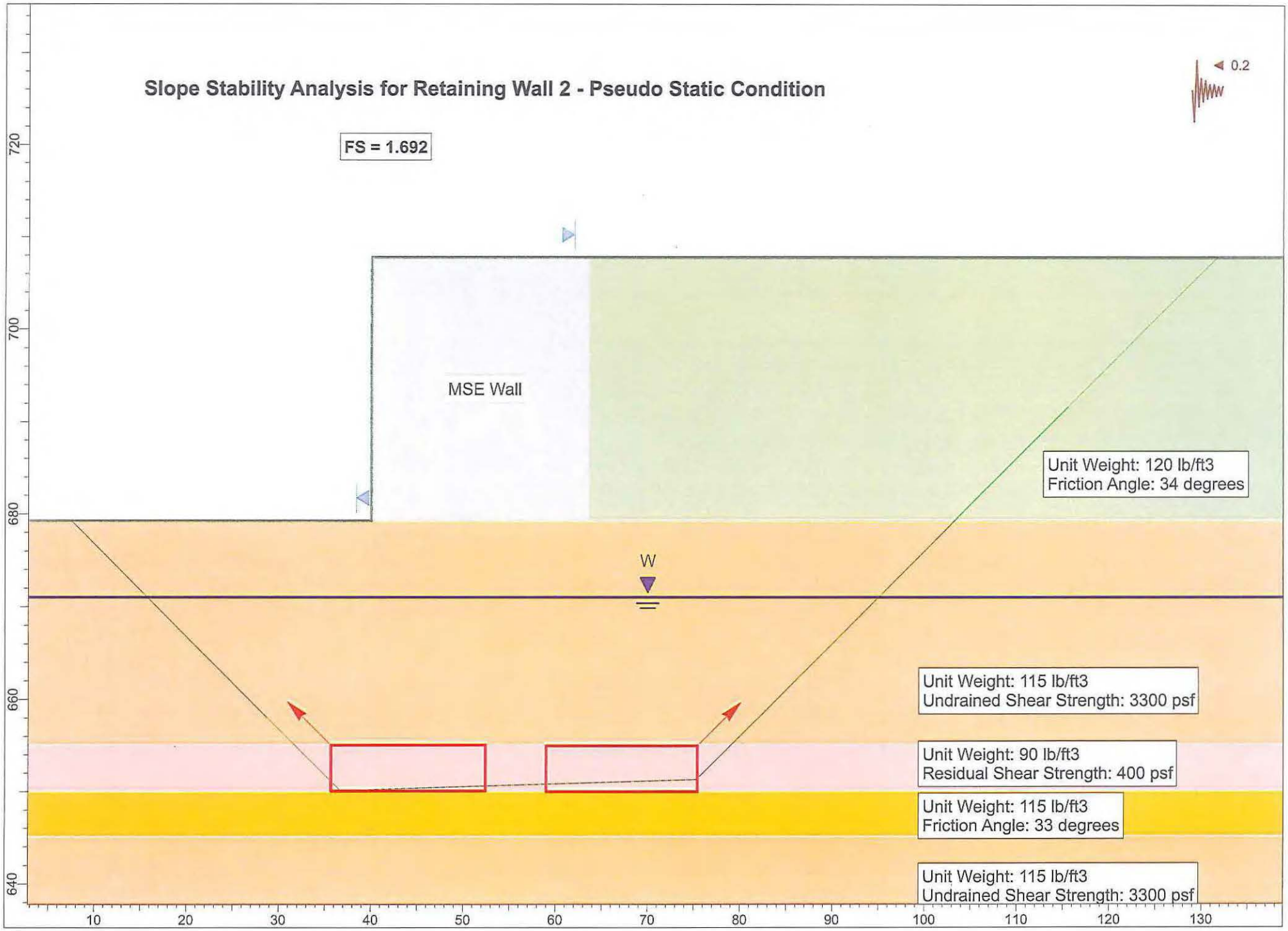
pile tip elevation for settlement = 687 − 16 = +671 feet

for 16' wall pile tip for settlement = 691 − 16 = +675 feet

Slope Stability Analysis for Retaining Wall 2 - Static Condition



Slope Stability Analysis for Retaining Wall 2 - Pseudo Static Condition



Appendix D

CALTRANS REVIEW COMMENTS AND EMI RESPONSES

Office of Special Funded Projects
Comment & Response Form

General Project Information	Review Phase		Reviewer Information
Dist: 07 EA: 255100 Project Name: 57/60 Confluence Project, Phase 1 OSFP Liaison: Richard Hartzell Phone: 916-227-8772 e-mail: _____	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☒ Type Selection ☒ 65% PS&E Unchecked Details ☐ PS&E (Review No. _) ☐ Construction Support ☐ Other: **Structure Information** (Use when necessary to document comments by individual structure) Structure Name: Retaining Wall No. 2 Br No: 53E-0206		Reviewer Name: Kristopher Barker Functional Unit: OGDS1 Cost Center: 3658 Phone Number: 213-620-2334 e-mail: kristopher_barker@dot.ca.gov Date of Review: 3/26/12

Consultant Information (to be filled in by Consultant)

Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date
_____	_____	_____	_____	_____

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	✓
1	FR		The title "Foundation Report" is usually reserved for bridges. Design reports for retaining walls should be named "Geotechnical Design Report".	No Change: This is a non-standard retaining wall. Non-standard walls require a foundation report. Only standard walls are included in the GDR.	
2	FR	5.4.1.2	Will there be problems with differential settlement between the two wall types during either phase? Please provide differential settlement for the retaining wall and the MSE wall.	Calculated MSE wall settlement (adjacent to the Type-1 wall) is close to 3 inches. Since Type-1 wall is founded on piles, settlement of the Type-1 wall should be less than an inch. Therefore, a differential settlement of about 2 inches could occur at and near the MSE wall and Type-1 wall interface. We discussed this issue with the wall (structural) designer. There will be a construction joint between the MSE wall and Type-1 wall, and this will minimize the potential for structural distress due to relative movement between the MSE wall and Type-1 wall. A waiting (settlement) period is also recommended for the MSE wall. The last MSE wall panel and coping and paving are not allowed to be constructed until the waiting period is	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓ = Comment Resolved (for Reviewer's use)

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	✓
				complete; finished subgrade may need to be re-established if there is differential settlement at the interface of the MSE wall and Type-1 wall, and this should eliminate any uneven ground surface (bump) at the interface.	
3	Plans	LOTB	Per the Caltrans memo dated April 8,2010, all geotechnical products prepared by staff and consultants must use the procedures in the *Soil and Rock Logging, Classification, and Presentation Manual* (2010 Edition). Change note 1 to reflect adherence to the 2010 manual.	We will comply.	
4	Plans	LOTB	Plan view should be on first page only. Move all boring locations from second page to first.	We will comply.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
07	LA	57,60	R5.2/R7.3, R36.1/R40.0	551	863

Conway Chu 10/7/02
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12-2-02
PLANS APPROVAL DATE

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CONDUIT AND CONDUCTOR SCHEDULE (THIS SHEET ONLY)

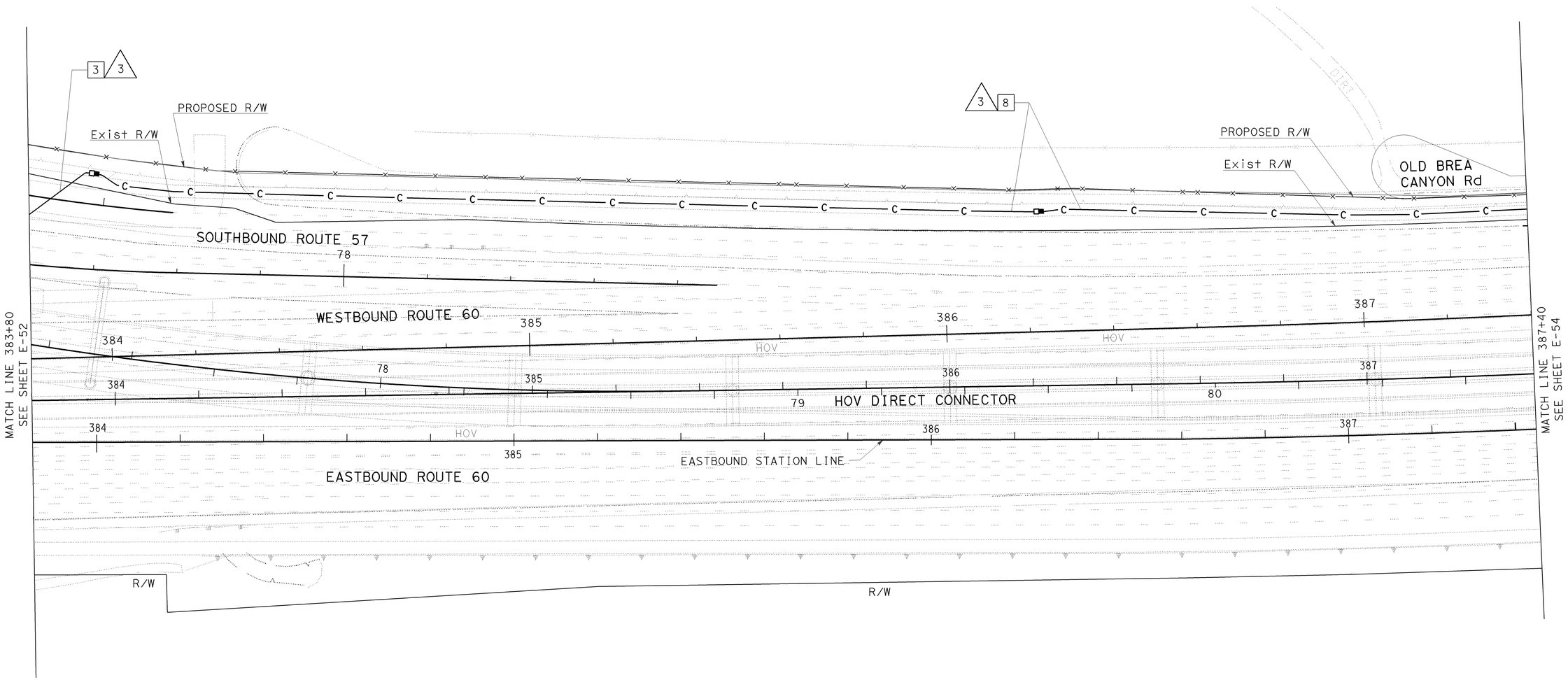
CONDUIT/ CONDUCTOR	FUNCTION	RUN				
		3				
48SMFO CABLE	DATA DISTRIBUTION	1				
72SMFO CABLE	VIDEO / DATA		1			
36SMFO CABLE	VIDEO DISTRIBUTION			1		
INNERDUCT (SIZE 25)		1	1	1	1	
CONDUIT SIZE		103				103

AS-BUILT

Contract No. 07- 1257U4

Resident Engineer: MARTIN SANDOVAL

Completion Date: 07/30/2007



COMMUNICATION SYSTEM ROUTING
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	4/02	CF	10/02

CALCULATED/DESIGNED BY: CANDACE FUNG 4/02
CHECKED BY: CONWAY CHU 4/02

PROJECT ENGINEER: CONWAY CHU

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EA 1257U1

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07	LA	57,60	R5.2/R7.3, R36.1/R40.0	552	863

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CONDUIT/ CONDUCTOR	FUNCTION	RUN △3				
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72SMFO CABLE	VIDEO / DATA		1			
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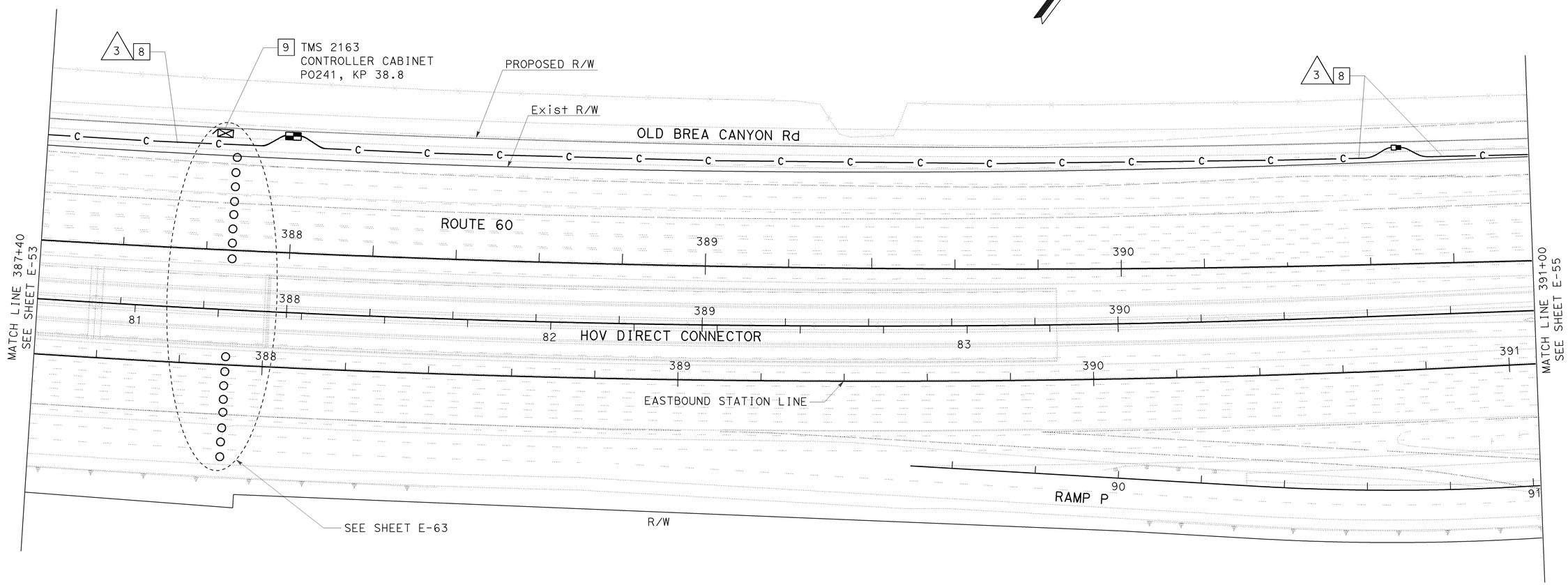
INNERDUCT (SIZE 25)		1	1	1	1	
CONDUIT SIZE		103				103



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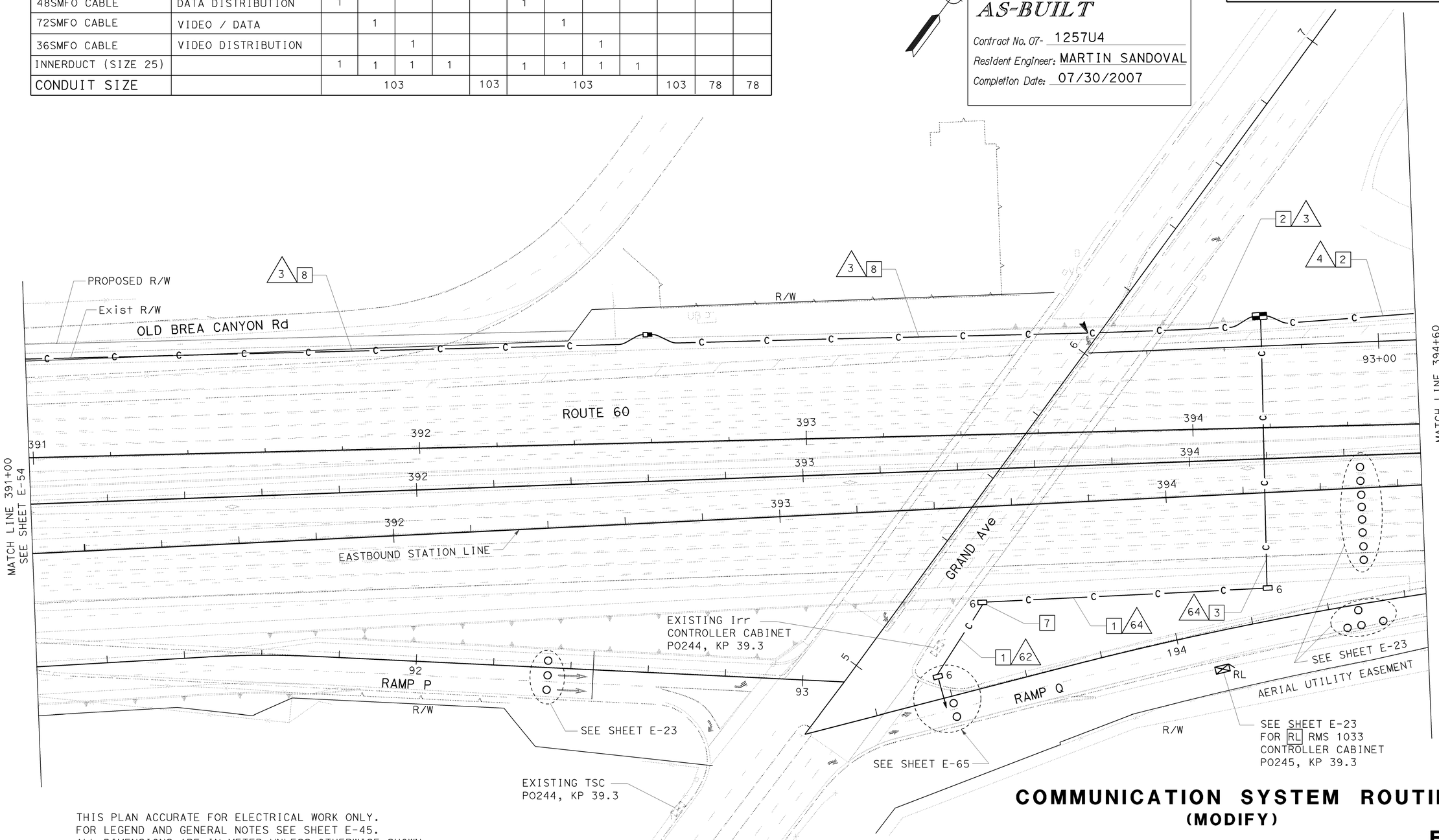
72SMFO CABLE	VIDEO / DATA		1					1					
36SMFO CABLE	VIDEO DISTRIBUTION			1					1				
INNERDUCT (SIZE 25)		1	1	1	1		1	1	1	1			
CONDUIT SIZE		103				103	103				103	78	78



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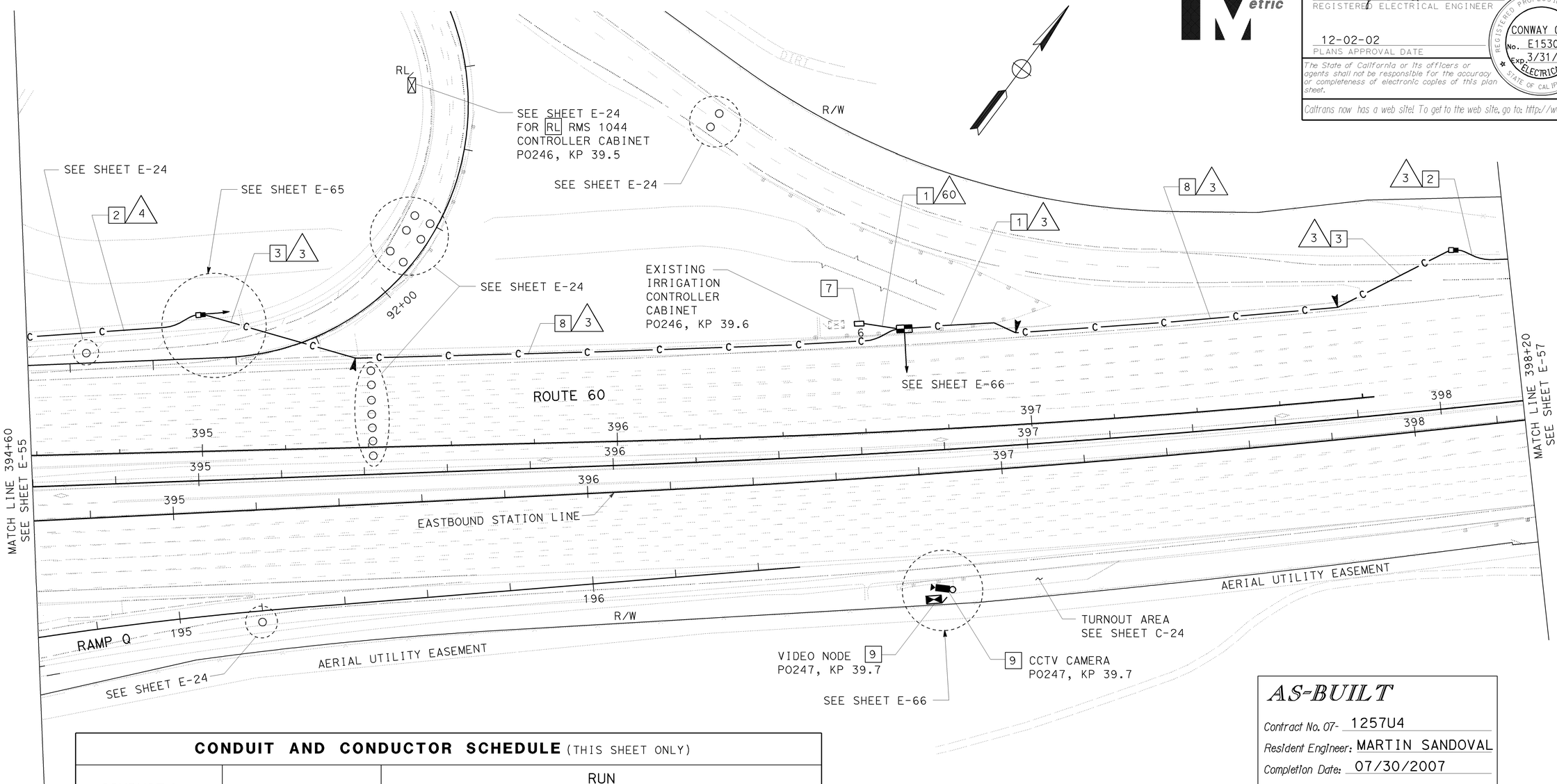

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Completion Date: 07/30/2007

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CONDUIT/ CONDUCTOR	FUNCTION	RUN										
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72SMFO CABLE	VIDEO / DATA		1					1				
36SMFO CABLE	VIDEO DISTRIBUTION			1					1			
INNERDUCT (SIZE 25)		1	1	1	1		1	1	1	1		
CONDUIT SIZE		103				103	103				103	78

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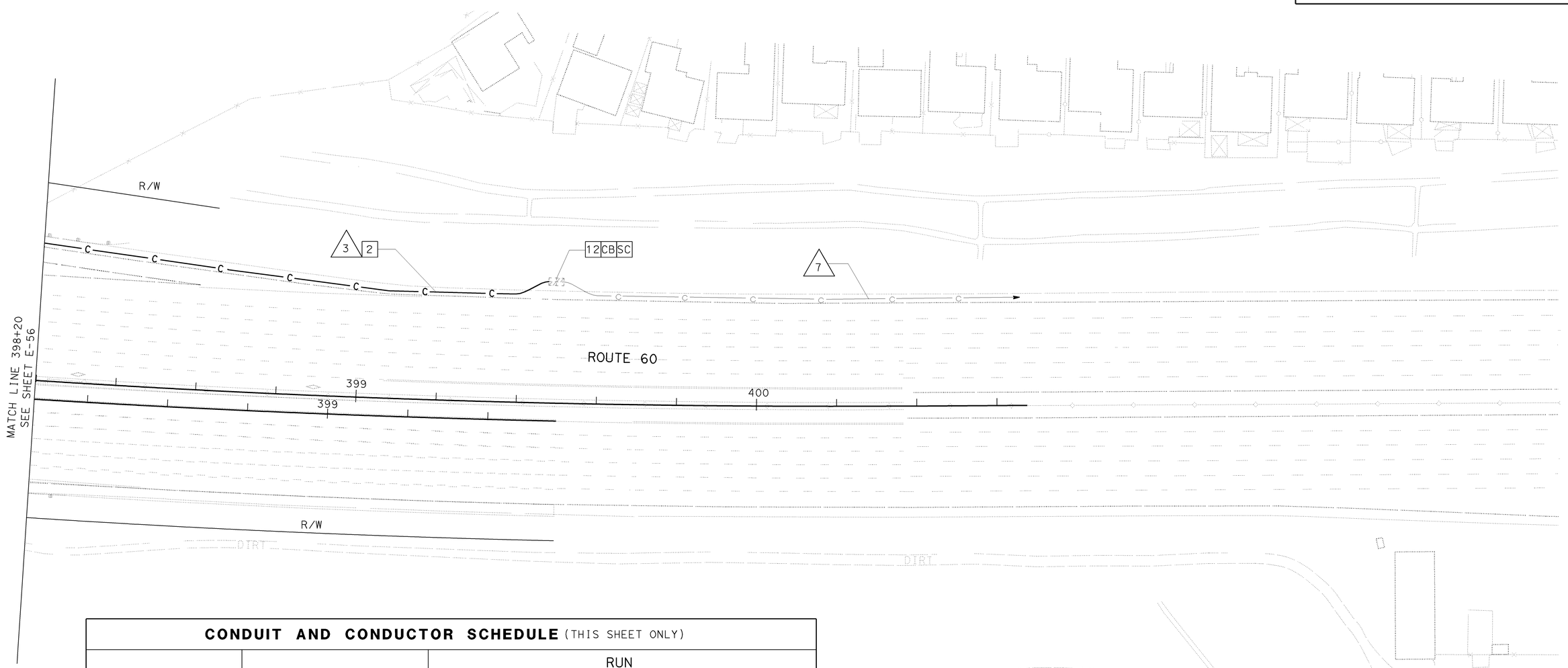

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CONDUIT SIZE		103				103	103(E)				103(E)

(E) EXISTING

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