FINAL GEOTECHNICAL DESIGN REPORT

Interstate 5 HOV Improvement Project (Segment 3)
Pacific Coast Highway to San Juan Creek Road
Orange County, California
12-ORA-5, PM 6.2/8.7
Caltrans Project No. 1200020279 (EA 12-0F96E1)
EMI Project No. 11-137
Date: October 5, 2012

EARTH MECHANICS, INC.

Geotechnical and Earthquake Engineering

Earth Mechanics, Inc.

Geotechnical & Earthquake Engineering

October 5, 2012

EMI Project No. 11-137

TRC Solutions, Inc.
123 Technology Drive West
Irvine, California 92618

Attention: Dr. Ayman Salama, P.E.

Subject: Final Geotechnical Design Report
Interstate 5 HOV Improvement Project (Segment 3)
Pacific Coast Highway to San Juan Creek Road
Orange County, California
12-ORA-5, PM 6.2/8.7
Caltrans Project No. 1200020279 (EA 12-0F96E1)

Dear Dr. Salama:

Attached please find the Final Geotechnical Design Report (GDR) for the Interstate 5 HOV Improvement Project (Segment 3) from Pacific Coast Highway to San Juan Creek Road. This GDR describes the geotechnical conditions at the project site based on information obtained from our field investigation and laboratory soil testing. This report also contains our recommendations for the design and construction of the roadway embankments and Caltrans Standard walls.

An earlier version of this report dated March 29, 2012 was submitted to Caltrans for review. Caltrans provided their comments in a memorandum dated July 20, 2012. Caltrans review comments and EMI responses are included in Appendix D. Our responses to all the review comments have been incorporated into this report.

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

Sincerely,

EARTH MECHANICS, INC.

10/5/12

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FINAL GEOTECHNICAL DESIGN REPORT

INTERSTATE 5 HOV IMPROVEMENT PROJECT (SEGMENT 3)
PACIFIC COAST HIGHWAY TO SAN JUAN CREEK ROAD
ORANGE COUNTY, CALIFORNIA
12-ORA-5, PM 6.2/8.7
CALTRANS PROJECT NO. 1200020279 (EA 12-0F96E1)

Prepared for:

TRC Solutions, Inc.
123 Technology Drive West
Irvine, California 92618

Prepared By:

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EMI Project No. 11-137

October 5, 2012

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1.0 INTRODUCTION

This Geotechnical Design Report (GDR) presents the findings and conclusions of a geotechnical study conducted by Earth Mechanics, Inc. (EMI) for the Interstate 5 (I-5) High-Occupancy Vehicle Lanes (HOV) Improvement Project from Pacific Coast Highway (PCH) to San Juan Creek Road located in County of Orange, California. The project location is shown on the Site Location Map in Figure 1-1. The purpose of the geotechnical study was to obtain subsurface information and develop design and construction recommendations to assist TRC Solutions, Inc. (TRC) in preparing the Project Plans, Specifications, and Estimates.

EMI's scope of work included preparing this GDR per Topic 113 of the Caltrans Highway Design Manual (HDM, 2008). This report was prepared in accordance with the "Guidelines for Preparing Geotechnical Design Reports" (2006). Recommendations for pavement structural sections and corrosion issues are addressed in the Materials Report (EMI, 2012g) for this project.

The geotechnical scope of work for preparing this GDR included the following tasks:

- Performance of geotechnical field exploration consisting of 42 exploratory borings and 11 cone-penetration test soundings;
- Laboratory testing of selected subsurface soil samples;
- Evaluation of slope stability, settlement, and liquefaction potential of subsurface soils;
- Performance of engineering calculations and analysis to develop foundation design and construction recommendations for retaining walls, soundwalls and culverts;
- Development of recommendations for earthwork; and
- Preparation of this report presenting our findings, conclusions and recommendations.

The purpose of this report is to document subsurface geotechnical conditions, provide analyses of anticipated site conditions as they pertain to the project described herein, and recommend design and construction criteria for the roadway portions of the project. This report also establishes a geotechnical baseline to be used in assessing the existence and scope of changed site conditions.

This report is intended for use by the project roadway design engineer, construction personnel, bidders, and contractors.

I-5 HOV Improvement Project PCH to San Juan Creek Road	SITE LOCATION MAP	
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	Figure 1-1	
	Project No. 11-137	Date: 01-23-2012

2.0 EXISTING FACILITIES AND PROPOSED IMPROVEMENTS

2.1 EXISTING FACILITIES

The project is located in Orange County along the I-5 corridor and includes connections to PCH/Camino Las Ramblas. The project's southern terminus is approximately 0.6 mile south of the PCH/Camino Las Ramblas Interchange (I-5 Mainline Station 340+00) in the City of Dana Point. The northern terminus of the project is approximately 0.2 mile south of San Juan Creek Road (I-5 Mainline Station 465+00) in the City of San Juan Capistrano. The total project length along the I-5 corridor is approximately 2.5 miles. The segment of I-5 within the project limits currently provides five through-lanes in each direction north of PCH/Camino Las Ramblas Interchange and four through-lanes in each direction south of PCH/Camino Las Ramblas Interchange, with auxiliary lanes for some of the on- and off-ramps.

There are four existing bridge structures affected by this project:

- Via California Overcrossing (Bridge No. 55-0225)
- 5/N5-N1 Connector Separation (Bridge No. 55-0226)
- Route 5/1 Separation (Bridge No. 55-0510)
- Camino Capistrano Undercrossing (Bridge No. 55-0227)

Via California crosses over I-5 (Bridge No. 55-0225) about 850 feet south of the PCH/Camino Las Ramblas Interchange. The existing PCH/Camino Las Ramblas and I-5 is a full cloverleaf interchange with an extra direct connector from I-5 NB to PCH NB. PCH/Camino Las Ramblas crosses under I-5 at Route 5/1 Separation (Bridge No. 55-0510), and direct connector from I-5 NB to PCH NB crosses under I-5 at 5/N5-N1 Connector Separation (Bridge No. 55-0226). The existing Stonehill Drive and I-5 Interchange consists of an on-ramp from Camino Capistrano to I-5 NB which crosses under I-5 at Camino Capistrano UC (Bridge No. 55-0227).

The general drainage patterns within the project vicinity are from east to west, toward the Pacific Ocean. Regional drainage facilities include San Juan Creek-Reach 1 and Prima Deshecha Creek; the Prima Deshecha Creek crosses the project site in the southern portion of the project. All of these facilities discharge to the Pacific Ocean further down south. Existing drainage systems within the project limits generally drain to San Juan Creek-Reach 1 and/or Prima Deshecha Creek. Onsite runoff is collected by drainage systems in the median and on the shoulders which connect to existing cross culverts that discharge to earthen channels or concrete lined trapezoidal channels which parallel the mainline.

There are several existing utility lines which are running parallel to or crossing the I-5 mainline. The following major utility lines cross the I-5 mainline:

- An 8-inch sewer line between I-5 mainline Stations 344+00 and 345+00, and a 12-inch sewer line in a 22-inch casing between I-5 mainline Stations 370+00 and 371+00.
- A 21-inch waterline in a 36-inch casing and a 24-inch waterline between I-5 mainline Stations 349+00 and 350+00.

There are existing soundwalls and/or retaining walls within the project limits. Walls are located:

- Along I-5 NB, from the southern project limit to the PCH/Camino Las Ramblas Interchange
- Along I-5 NB, just north of the Route 5/1 Connector (Bridge No. 55-0510)
- Along I-5 SB, from the northern project limit to just north of Camino Capistrano UC (Bridge No. 55-0227)
- Along I-5 SB, from just south of the Camino Capistrano UC to the I-5 SB Off-Ramp to PCH
- Along I-5 SB, from Via California OC (Bridge No. 55-0255) to the southern project limit

Walls are also located along a portion of the I-5 NB Off-Ramp to PCH, beginning at Camino Las Ramblas and running along the PCH NB On-Ramp to I-5 NB, and between the I-5 mainline and the elevated Via Lopez.

2.2 PROPOSED IMPROVEMENTS

According to the Project Report prepared in October 2011, the Preferred Alternative provides continuous access HOV lanes from I-5 Mainline Stations 340+00 (southern project limit) to 407+50. From I-5 Mainline Stations 407+50 to 465+00 (northern project limit), the proposed project will restripe the existing pavements only. Therefore, this report applies to I-5 Mainline Stations 340+00 to 407+50. The Preferred Alternative would include the following improvements:

- Add one HOV lane per direction on I-5 throughout the project limits
- Re-establish existing auxiliary lanes
- Realign, reconstruct and widen PCH SB to I-5 SB connector to a two-lane connector
- Realign and reconstruct PCH SB loop on-ramp
- Realign PCH SB off-ramp and PCH NB on- and off-ramps
- Realign I-5 NB connector
- Widen both sides of Route 5/1 Connector (Bridge No. 55-0510)
- Widen both sides of 5/N5-N1 Connector Separation (Bridge No. 55-0226)
- Widen the west side of Camino Capistrano UC (Bridge No. 55-0227)
- Modify Via California OC (Bridge No. 55-0225) by adding a retaining wall below and on each side of the western abutment
- Construct retaining walls along I-5 SB on the south and north side of Camino Capistrano UC and a retaining concrete barrier on the north side of Camino Capistrano UC
- Construct sound walls at multiple locations throughout the project limits
- Construct sign structures at multiple locations throughout the project limits
- Construct various sized Reinforced Concrete Pipe culverts and drainage inlets throughout the project limits

3.0 PERTINENT REPORTS AND INVESTIGATIONS

3.1 PERTINENT PREVIOUS REPORTS AND INVESTIGATIONS

No previous geotechnical studies were performed specifically for the improvements addressed in this report.

3.2 RELATED REPORTS PREPARED FOR THE PROPOSED IMPROVEMENTS

Separate Foundation Reports have been prepared for the bridges, non-standard walls and sign structures (EMI, 2012a through 2012f):

- 5/N5-N1 Connector Separation Widening (Bridge No. 55-0226),
- Route 5/1 Separation Widening (Bridge No. 55-0510),
- Camino Capistrano UC Widening (Bridge No. 55-0227),
- Via California Modification (Bridge No. 55-0225),
- Non-Standard Walls, and
- Overhead Sign Structures

A Materials Report (EMI, 2012g) has also been prepared for this project, which addresses pavement structural section design and soil corrosion issues for buried drainage devices.

4.0 PHYSICAL SETTING

4.1 CLIMATE

Weather in the coastal Orange County area is a Mediterranean-type, semi-arid climate characterized by warm dry summers and mild winters. A dominating factor in the weather is the semi-permanent north Pacific high pressure system that migrates northward in summer, holding storm tracks well to the north, and as a result Southern California receives little or no precipitation during the summers. In winter, the north Pacific high migrates southward permitting storm centers to swing across Southern California. These storms generate moderate, but occasionally severe, precipitation events. When changes in the circulation pattern permit storms to approach from a southwesterly direction, the colder northern air masses merge with subtropical air masses and bring copious amounts of moisture with the northeastward streaming air ("pineapple express"). This results in heavy rain and often produces widespread flooding, especially in the spring when it coincides with runoff from melting snow in the mountains.

Summer is a dry period over most of the area. With the northward migration of the Pacific high most storm tracks are deflected far to the north during summer, and southern California seldom receives precipitation from Pacific storms during this time of year. Occasionally, during the summer months, moist air drifts northward from the Gulf of Mexico or the Gulf of California creating monsoonal conditions. At such times, scattered, locally heavy thunder showers occur, mostly in the desert and inland mountain areas.

The average annual high temperature is 73 degrees (Fahrenheit) and the average low about 52 degrees. The hottest months are July, August and September when high temperatures average in the high 70s, and low temperatures average in the high 50s. The coolest temperatures are in the winter months of December, January and February when average highs are in the high 60s and average lows are in the low to mid 40s.

The extreme high temperatures occur during July, August and September with the record high of 108 degrees in September. These high temperatures are commonly associated with adiabatic heating associated with winds called Santa Ana winds. The extreme low temperatures average about 44 degrees in December through February with a record low of 21 degrees. Freezing occurs occasionally on the winter nights, but is generally of short duration (a couple hours) and does not commonly result in a "hard" freeze.

Annual precipitation averages about 14 inches. The wettest months are November through March with an average of 3.4 inches in February. Snow is not uncommon in the surrounding high mountains and results in snow-capped peaks for several days, snow fall is extremely rare in the site area.

The prevailing wind direction is from the southwest. Generally these light winds bring cool ocean air that moderates the local climate. A typical weather characteristic in the area results from the juxtaposition of cool marine waters and dry hot desert air. As the moist marine air masses drift over colder water, a bank of fog or low clouds, locally referred to as the "marine layer", sweeps inland a short distance before evaporating. Characteristically, the marine layer extends inland a mile or two and then recedes offshore during the heat of the afternoon.

Occasionally the layer may extend to the bordering hills and mountains during the night. During May and June, the marine layer can remain the entire day.

4.2 MAN-MADE AND NATURAL FEATURES OF ENGINEERING AND CONSTRUCTION SIGNIFICANCE

4.2.1 Man Made Features

4.2.1.1 Utilities

Based on the project utility plans, many utilities lie within the project area. There are several existing utility lines which are running parallel to or crossing I-5 mainline. The following major utility lines cross the I-5 mainline:

- An 8-inch sewer line between I-5 mainline Stations 344+00 and 345+00, and a 12-inch sewer line in a 22-inch casing between I-5 mainline Stations 370+00 and 371+00.
- A 21-inch waterline in a 36-inch casing and a 24-inch waterline between I-5 mainline Stations 349+00 and 350+00.

All utility lines impacted by the proposed construction will need to be protected in-place, abandoned, or relocated.

4.2.1.2 Drainage

The general drainage patterns within the project vicinity are from east to west, toward the Pacific Ocean. Regional drainage facilities include San Juan Creek-Reach 1 and Prima Deshecha Creek; San Juan Creek parallels the project area near the Camino Capistrano UC and the Prima Deshecha Creek crosses the project site in the southern portion of the project. All of these facilities discharge to the Pacific Ocean further down south. Existing drainage systems within the project limits generally drain to San Juan Creek-Reach 1 and/or Prima Deshecha Creek. Onsite runoff is collected by drainage systems in the median and on the shoulders which connect to existing cross culverts that discharge to earthen channels or concrete lined trapezoidal channels which parallel the mainline.

Based on current plans, fills are proposed throughout the project area; impact of fills at least 5 feet in height should be evaluated for drainage structures that fall within a 45-degree projection below the footprint of fills.

4.2.1.3 Fill

Fill of varying thickness is present throughout the project site. Portions of existing mainline embankment, on- and off-ramp embankments, and bridge approach embankments are believed to be composed of artificial fill. Relatively thin fills are presumed to be present along the existing mainline. The actual thickness of fills throughout the project area is unknown and documentation regarding placement of existing fills was not reviewed by EMI. Fill materials encountered in the exploratory boreholes generally consisted of interlayered fine- and coarse-grained soils derived from the Capistrano Formation bedrock and local surficial deposits.

4.2.2 Natural Features

A large ancient McCracken Hill Landslide is located north of PCH/Camino Las Ramblas Interchange on the west to northwest descending slope and extends about 7000 feet along the eastern edge of the I-5 southbound. In addition a smaller more recent landslide is located on the southeastern side of the PCH NB on-ramp to I-5 SB. Stability and impact of these landslides are described in Section 4.3.5.

No other natural features are present that affect the project design or construction. Moderate to dense low-growth vegetation is present on existing unpaved ground and slopes, which must be removed prior to placing compacted fill. Loose, soft, dry, wet, unstable, or otherwise unsuitable materials should be removed from areas to receive fill. Excavation bottoms should be firm and unyielding prior to placement of new fill.

4.3 REGIONAL GEOLOGY AND SEISMICITY

4.3.1 Topography

As shown in Figure 4-1, the project area extends in a curving southwest to southeast direction for a distance of about 1½ miles from the southern end of the San Joaquin Hills of south Orange County. The project corridor is in the northwestern portion of the Peninsular Ranges geomorphic province. Elevations along the alignment range from about 94 feet above sea level near the Camino Capistrano UC to about 205 feet above sea level near Via California. The alignment is along the rolling hills bordering the Santa Ana Mountains which rise to elevations up to 1675 feet.

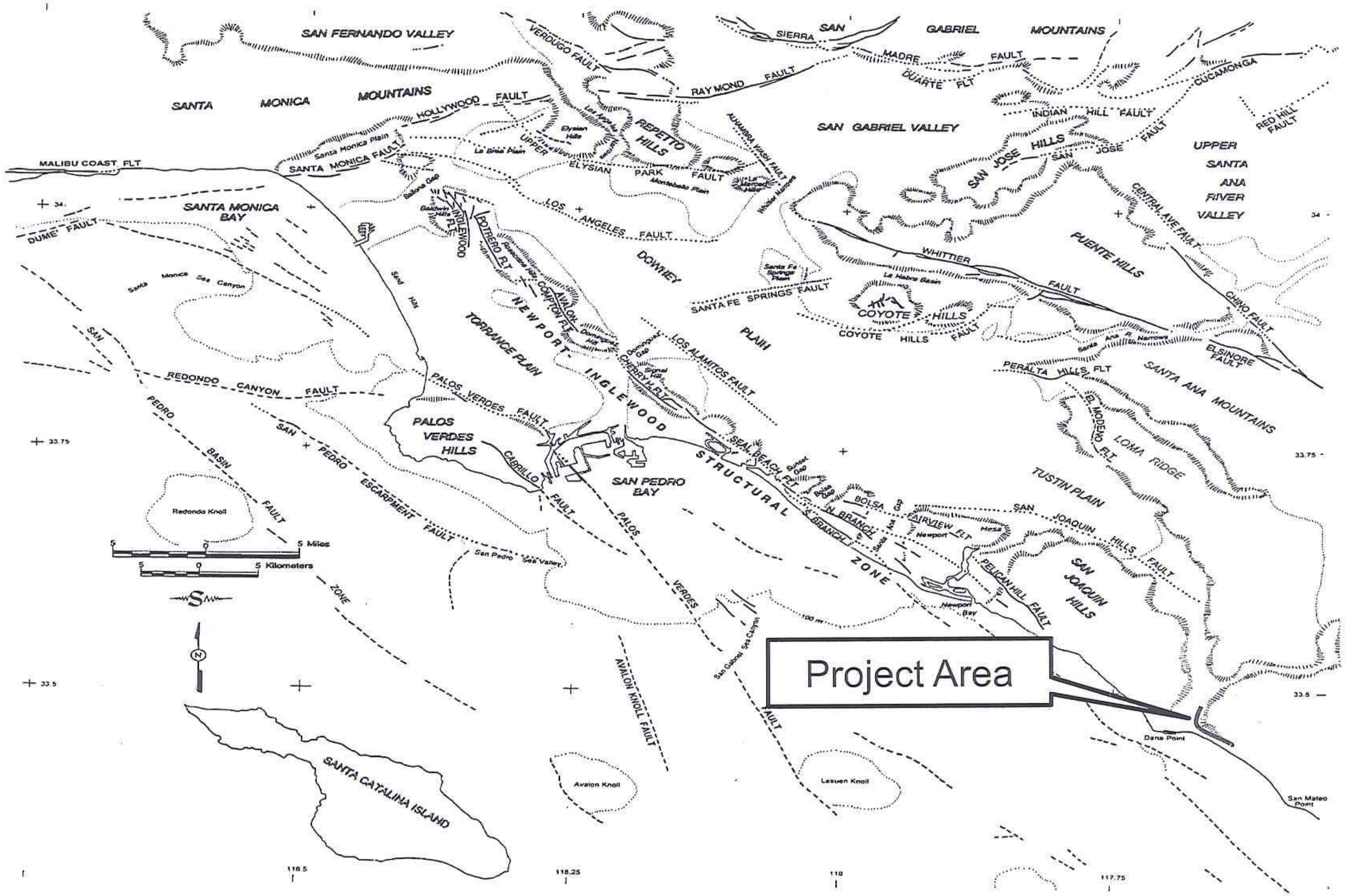
Major rivers within south Orange County are San Juan Creek and San Mateo Creek. The northerly portion of the project alignment is easterly of and parallels San Juan Creek which originates in the Santa Ana Mountains to the east and flows to the Pacific Ocean in Dana Point. San Mateo Creek is located southwesterly of the project site. It also originates in the Santa Ana Mountains to the east and flows to the Pacific Ocean in San Clemente.

Drainages in proximity to the project area flow from the Santa Ana Mountains on the northeast. These include, from north to south, San Juan Creek and Prima Deshecha Canada. San Juan Creek parallels the project area near the Camino Capistrano UC, no natural drainages actually cross this segment of the project corridor.

4.3.2 Physiography

The project area is in the northwestern part of the Peninsular Ranges physiographic province. The Peninsular Ranges comprise a northwest-southeast trending group of fault-bounded ranges between the Salton Trough and the Pacific Ocean. The Santa Ana Mountains, Puente Hills, and San Joaquin Hills are ranges within the Peninsular Ranges.

The site is located on the low lying rolling hills westerly of the Santa Ana Mountains at the southerly end of the San Joaquin Hills in an area referred to as the Capistrano Embayment.



I-5 HOV Improvement Project (Segment 3)
PCH to San Juan Creek Road

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REGIONAL MAP OF ACTIVE FAULTS AND PHYSIOGRAPHY

Figure 4-1

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Date: 03-01-12

4.3.3 Stratigraphy

The geologic units encountered at the site are described below.

- Capistrano Formation (Tc): These marine sedimentary deposits generally consist of brown to gray silty claystone, claystone and siltstone. Secondary gypsum is commonly found deposited along joints, fractures and shears. The formation is generally soft when moist and has engineering properties similar to stiff to very stiff clayey soils. The formation consists generally of soft, weakly cemented to uncemented material that can be disaggregated with finger pressure. A few hard beds occur throughout the formation. Within the site area, the Capistrano Formation consists of an oxidized (weathered) zone defined by a light brown to brown color with a mottled appearance, underlain by an unoxidized zone that is generally dark brown to dark gray with a greater degree of induration.
- Undifferentiated Marine and Non-Marine Terrace Deposits (Qt): Portions of the project area, mostly south of the PCH/Camino Las Ramblas Interchange, are capped by Terrace Deposits. Shell fragments were found associated with the marine terrace deposits. The terrace deposits were observed to unconformably overlie the bedrock units of the Capistrano Formation directly. These Pleistocene terrace deposits are characterized by a basal cobble sequence fining upward to light brown and yellow brown fine to coarse grained sands, silty sand, sandy silt and clayey silt.
- Older Ancient Landslide Deposits (Qols) and Landslide Deposits (Qls): The older ancient landslide deposits of the McCracken Hill landslide consist of large displaced blocks of Capistrano Formation bedrock. The lithology of the deposits is similar to the undisturbed bedrock however the degree of weathering and oxidation of the landslide deposits is considerably greater. Younger landslide deposits derived from smaller scale landslides may exhibit a greater degree of disturbance of the bedrock materials with greater variability in bedding orientations and a greater degree of weathering and oxidation.
- Alluvium (Qal): The drainages and canyons crossing the project corridor are mantled by a relatively thin cover of alluvium. These deposits are generally derived from the surrounding bedrock units and terrace deposits, and are located in the lower elevations of the site. Where encountered in the borings the alluvium was observed to consist of silty sand to sandy clay.
- Artificial Fill (Af): Artificial fill placed during construction of the I-5 Freeway and adjacent residential and commercial developments is located along the project corridor. The fill materials were most likely to be derived from excavation of the Capistrano Formation bedrock and local surficial deposits. Little or no documentation of the limits of fills or the observation and testing of the fill placement were examined.

4.3.4 Geologic Structure

The geological structure at the site consists of slightly to moderately folded bedrock of the Capistrano formation overlain by horizontally bedded Quaternary terrace deposits and alluvium without any notable geological structures such as faults, folds, or unconformities. The northerly portion of the project is underlain by deposits of the McCracken Hill landslide which is described in Sections 4.3.5 and 7.1.3.

The Capistrano Formation is widespread throughout the southern part of Orange County, which is known geologically as the Capistrano Embayment. The Capistrano Embayment is the name given to the structural/stratigraphic block west of the Cristianitos Fault. Geologic faults in the region are shown on Figure 4-1. Geological structure in the Capistrano Embayment area consists primarily of a broad, gentle syncline of the Monterey and Capistrano Formations between the San Joaquin Hills and the Santa Ana Mountains. This structure originated as a deep submarine structural trough that has since been uplifted at least 3000 feet from the marine environment to its present position above sea level (Ehlig, 1989). Subsequent regional uplift during the late Pliocene and Pleistocene time resulted in folding of the bedrock units.

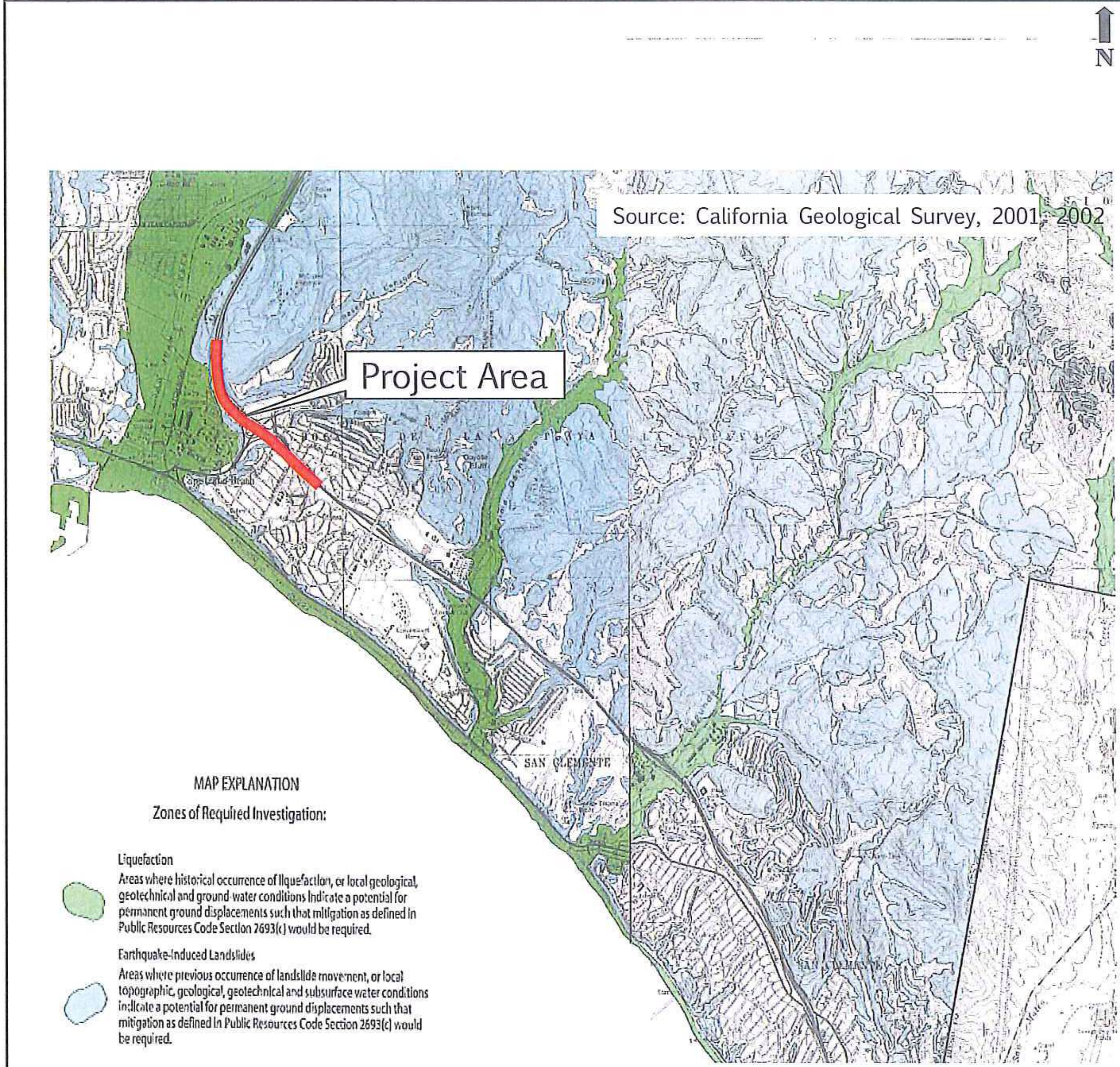
The bedrock of the Capistrano Formation underlying the site was found to be massive to poorly bedded. Where bedding was observed, the strikes were generally to the northeast with shallow dips less than about 10 degrees westerly. Throughout the project corridor, the dominant structural pattern is high-angle joints and fractures within the Capistrano bedrock.

Pleistocene Terrace Deposits unconformably overlie the Capistrano Formation. The contact is generally undulatory, with a slight overall dip seaward averaging about 2 degrees. This erosional contact is marked by cobble and boulder rich beds of varying thicknesses.

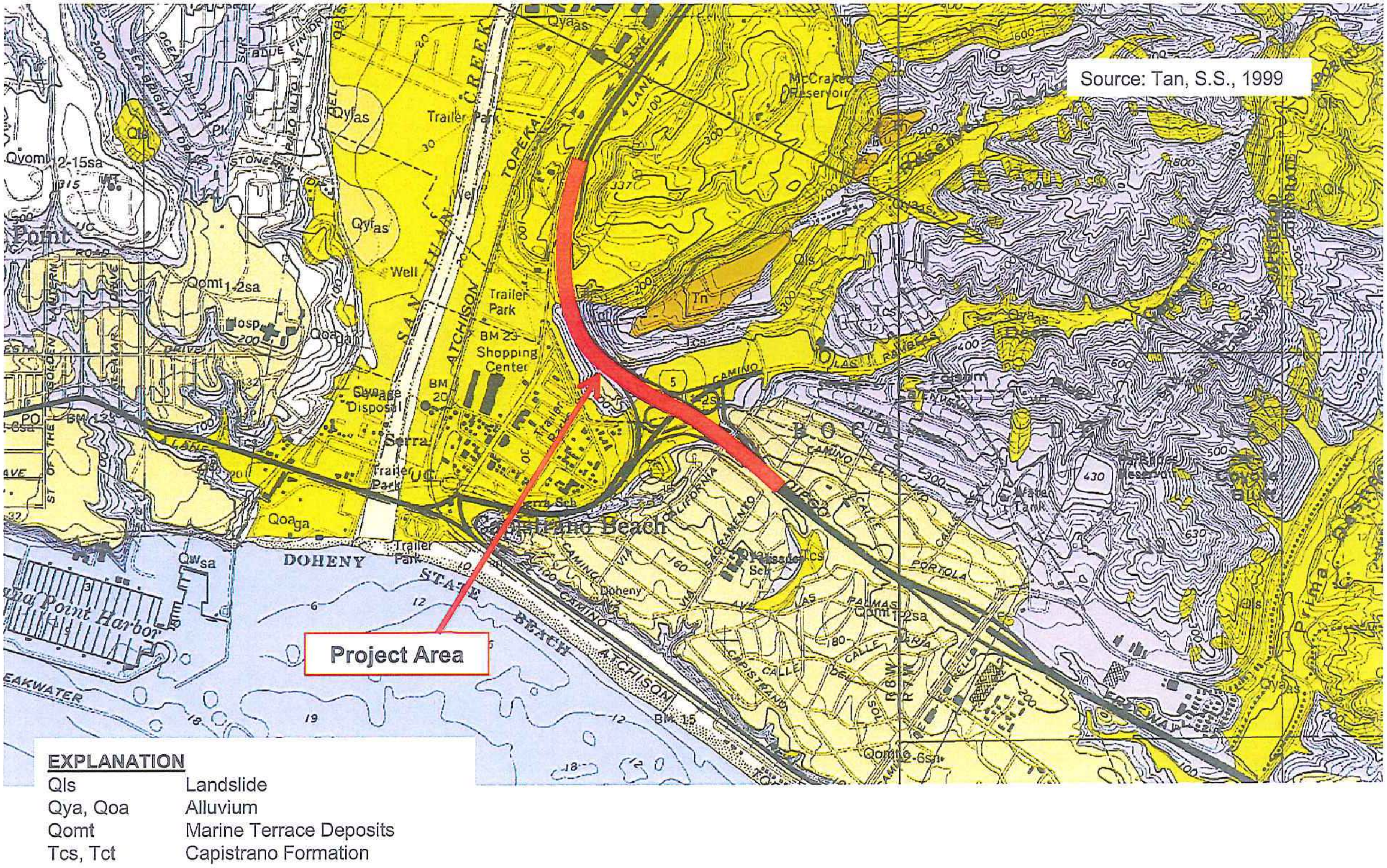
4.3.5 Geologic Hazards

The geological hazards present at the site include earthquake shaking and landsliding. The site lies outside identified tsunami inundation zones (CGS, 2009), and there are no large bodies of water within the site area that could generate a seiche. There are no volcanos in the region and there are no known active surface faults within the project area so ground rupture is not a factor. As shown in Figure 4-2, the California Geological Survey (CGS, 2001a) has indicated that the project alignment has a low susceptibility to liquefaction during a strong earthquake. The potential for liquefaction is discussed in detail in Section 8.1.2.1.

The Capistrano Formation bedrock underlying the majority of the site is notoriously susceptible to landsliding. The landslides are shown in Figure 4-3. At the north of PCH/Camino Las Ramblas Interchange, the I-5 alignment traverses the McCracken Hill Landslide. The remnant headscarp of this ancient landslide is defined by a west to northwest facing slope that extends for about 7000 feet on the eastern side of the I-5 Freeway (AMEC, 2006a and 2006b). It is believed that the landslide occurred between 11,000 to 30,000 years ago when the sea level was lower than present day and San Juan Creek carved a deep channel on its course to the Pacific Ocean. During the Pleistocene, the climate was considerably wetter than present day and this combined with the loss of support at the toe of the slope due to erosion by San Juan Creek are believed to have been causative factors in the landslide failure. Since the landslide failure, a considerable thickness of alluvium has infilled the ancestral San Juan Creek channel with deposits more than 130 feet thick forming a natural buttress for the landslide mass. Extensive investigations of the landslide performed by Leighton and Associates (Leighton, 2004) and AMEC (AMEC, 2006a, 2006b, and 2000a through 2000e) in conjunction with proposed residential developments in the area indicate that the landslide is stable.



I-5 HOV Improvement Project (Segment 3) PCH to San Juan Creek Road	MAP OF LIQUEFACTION POTENTIAL Figure 4-2	
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	Project No. 11-137	Date: 03-01-12



I-5 HOV Improvement Project (Segment 3)
PCH to San Juan Creek Road

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GEOLOGICAL MAP

Figure 4-3

Project No. 11-137

Date: 03-01-12

The headscarp of the McCracken Hill landslide is thought to have been on the order of 50 to 70 degrees (AMEC, 2006a and 2006b). Such a high, steep slope would be expected to degrade quickly as a result of the wetter climatic conditions. Degradation of the headscarp occurred as a series of relatively large, ancient block-type failures. The failures were controlled by shallow northwest dipping clay layers in the Capistrano Formation bedrock and exhibited an active wedge-passive block mode of failure (AMEC, 2006a and 2006b). The resulting landslide deposits are difficult to distinguish from in-place, highly weathered Capistrano formation bedrock.

Two cross-sections were prepared at I-5 Mainline (A-Line) Stations 389+00 and 390+00 to map the McCracken Hill landslide. These cross-sections are shown in Figure 4-4 and Figure 4-5.

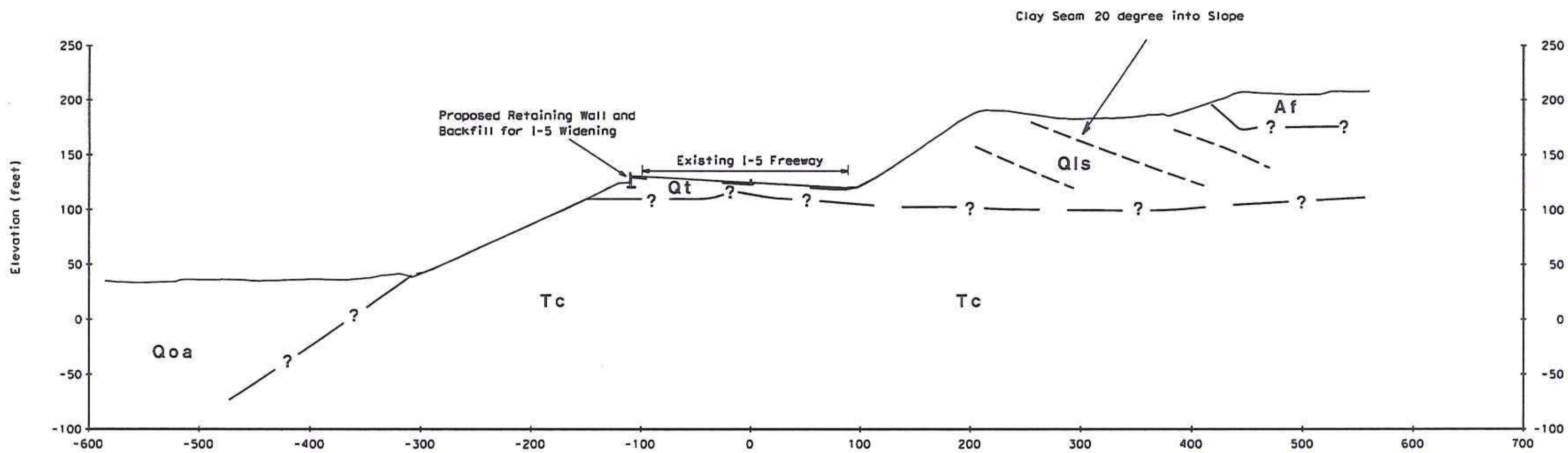
The cross-section at I-5 Mainline Station 389+00 crosses the project alignment at the southern boundary of the McCracken Hill Landslide near one of the ancient block failure landslides formed during the degradation of the headscarp. Portions of this secondary landslide have been removed and replaced with engineered fill as part of the Pacific Point development (AMEC, 2006a and 2006b). A clay seam dipping 20 degrees to the east was observed (and removed) during grading in this area.

The cross-section at I-5 Mainline Station 390+00 crosses the alignment just north of the southerly edge of the McCracken Hill Landslide. The ancient deep-seated landslide deposits of the McCracken Hill landslide are overlain in part by the block failure debris from an ancient landslide derived from degradation of the headscarp of the older landslide. Portions of both these landslides have been removed and replaced with engineered fill as part of the Pacific Point development (AMEC, 2006a and 2006b). A clay seam dipping 6 degrees to the west was observed (and removed) during grading in this area.

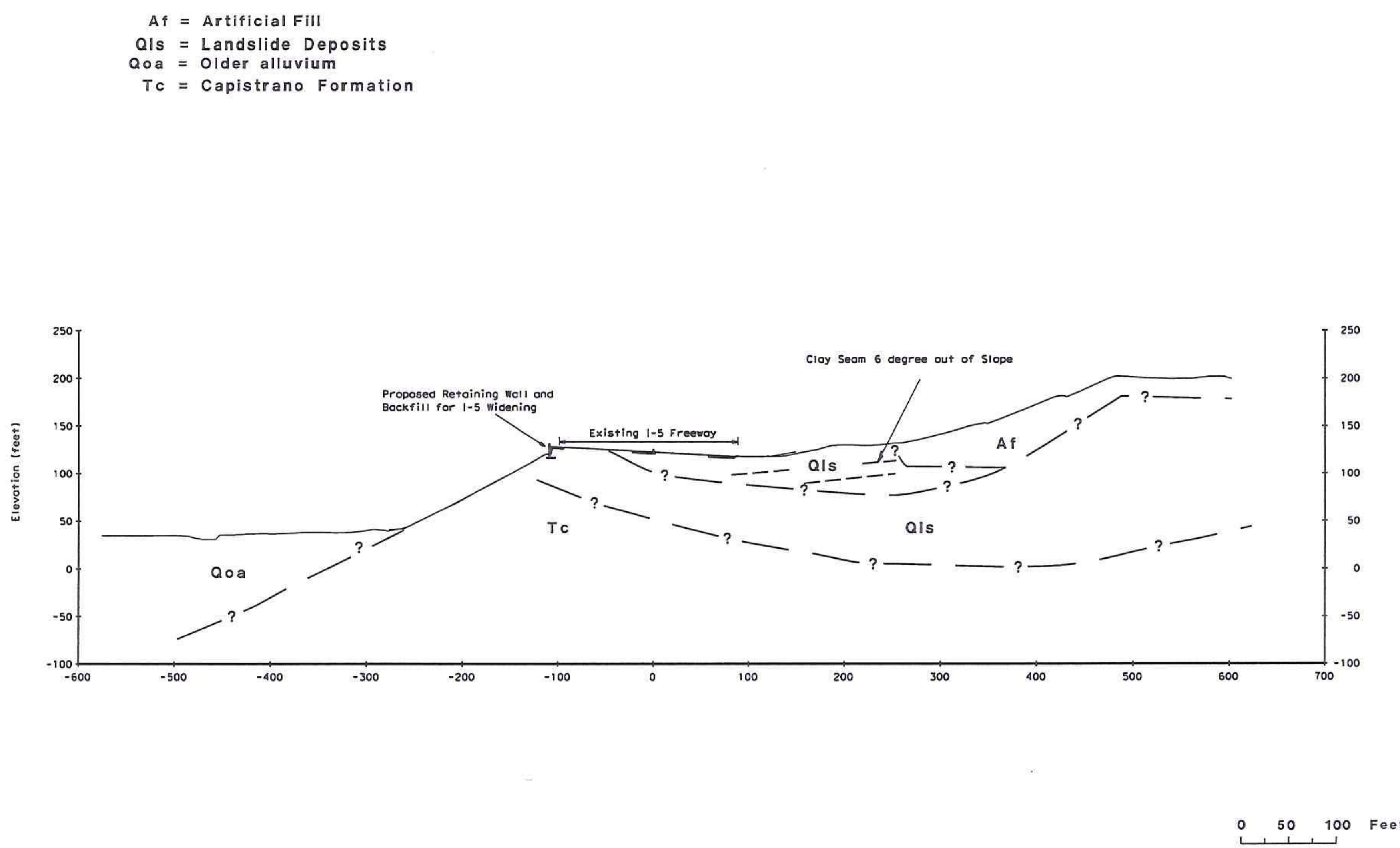
In addition, a smaller landslide is present along the PCH NB on-ramp to I-5 SB. A cross-section at Camino Las Ramblas (CLR-Line) Station 35+00 was developed to map this landslide. The cross-section is presented in Figure 4-6. The slope ascending from the PCH NB on-ramp to I-5 SB is underlain by Quaternary Terrace Deposits overlying bedrock of the Capistrano Formation. A landslide measuring approximately 150 feet wide by 300 feet long was observed on this slope during field mapping. Research of files at the City of Dana Point did not reveal any geologic reports relating to the landslide or details of when it occurred. Based on the geomorphology of the slide it appears to have been a shallow failure involving the Terrace Deposits and possibly the weathered upper portion of the underlying bedrock. It is estimated the landslide is likely less than about 30 feet deep.

Bedrock exposures along Via Canon (southwesterly of the landslide, outside the limits of the geologic map) indicate that the bedding is variable but generally dips south to southeast at angles ranging from 5 to 22 degrees. This bedding orientation is generally considered favorable to the gross stability of the slope. Proposed grading performed in conjunction with the project is not considered to have an impact on this landslide.

Af = Artificial Fill
Qls = Landslide Deposits
Qt = Undifferentiated Marine and Non-Marine Terrace Deposits
Qoa = Older alluvium
Tc = Capistrano Formation



Earth Mechanics, Inc. Geotechnical & Earthquake Engineering	**INTERSTATE 5 HOV IMPROVEMENT PROJECT (SEGMENT 3)** **PCH TO SAN JUAN CREEK ROAD** Project No.: 11-137 Date: 03-08-2012	Geologic Cross-Section at I-5 Mainline Station 389+00 Figure 4-4



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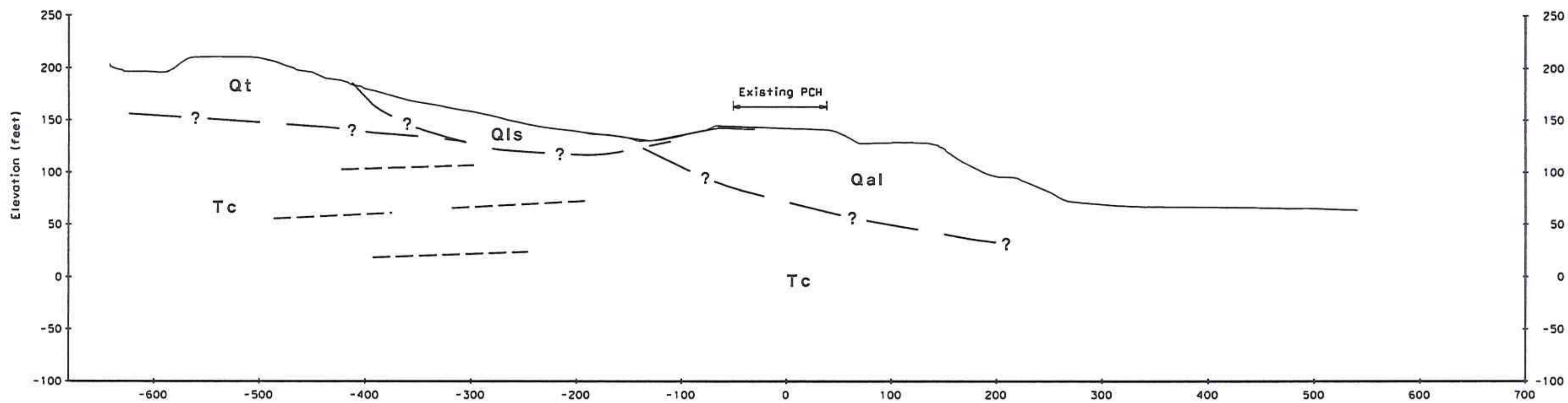
Geologic Cross-Section at
I-5 Mainline Station 390+00

Figure 4-5

Qal = Alluvium
Qt = Undifferentiated Marine or Non-Marine Deposits
Qls = Landslide Deposits
Tc = Capistrano Formation



Bedding Dip Ranges from 0 to 15 degrees into Slope

0 50 100 Feet

Earth Mechanics, Inc. Geotechnical & Earthquake Engineering	INTERSTATE 5 HOV IMPROVEMENT PROJECT (SEGMENT 3) PCH TO SAN JUAN CREEK ROAD		Geologic Cross-Section at Camino Las Ramblas Station 35+00
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4.3.6 Seismicity

The project is in seismically active Southern California. The present-day seismotectonic stress field in the Los Angeles region is one of north-northeasterly compression. This is indicated by the geologic structures, earthquake focal-mechanism solutions, and geodetic measurements. These data suggest crustal shortening of between 0.2 and 0.35 inch per year across the greater Los Angeles area (Argus et al., 1999).

Historical earthquake epicenter maps show widespread seismicity throughout the region. Although historical earthquakes occur in proximity to known faults, they are difficult to directly associate with mapped faults. Part of this difficulty is due to the fact that the basin is underlain by several poorly known subsurface thrust faults, generally referred to as blind thrust faults. Ward (1994) estimated that about 40 percent of seismic moment cannot be associated with known faults. Earthquakes occur primarily as loose clusters along the Newport-Inglewood Structural Zone (NISZ), the southern margin of the Santa Monica Mountains, the margin between the Santa Susana-San Fernando Valley and the southern margin of the San Gabriel Mountains, and in the Coyote Hills-Puente Hills area. There is no clustering or alignment of earthquakes in proximity to the site. There are fewer earthquakes in the site region than anywhere else in the Los Angeles Basin area. This apparent lack of earthquake activity suggests that the site area is tectonically stable and suggests that there are no unrecognized active faults at the site.

The largest historical earthquake within the Los Angeles Basin was the 1933 Long Beach event which had a moment magnitude (M_W) of about 6.4 (M_L = 6.3). This earthquake did not rupture the surface but is believed to have been associated with the NISZ (Benioff, 1938). The association was based on abundant ground failures along the NISZ trend but no unequivocal surface rupture was identified. Reevaluation of the seismicity data by Hauksson and Gross (1991) relocated the 1933 earthquake hypocenter to a depth of about 6 miles below the Huntington Beach-Newport Beach city boundary.

Other major earthquakes in the region include the 1994 Northridge and the 1971 San Fernando earthquake both of which occurred in the San Fernando Valley region. The 1994 earthquake had a M_W of about 6.7 (M_S = 6.8, M_L = 6.4), and occurred on a southerly dipping subsurface fault which was unknown prior to the earthquake. The main shock occurred at a depth of about 12 miles. Earthquake aftershocks clearly defined the rupture surface dipping about 35 degrees southerly from a depth of about 1.2 or 1.9 miles to 14 miles (Hauksson et al, 1995). The causative fault was never identified with certainty. The event may have occurred on an eastern extension of the Oakridge fault (Yeats and Huftile, 1995), a southerly dipping feature fault bounding the Ventura Basin and the Santa Susana Mountains.

The 1971 San Fernando earthquake was of similar size (M_W = 6.7, M_S = 6.4, M_L = 6.4) to the 1994 event but did involve surface rupture. The 1971 event occurred on a northerly dipping thrust fault that dips from the northern side of the San Fernando Valley to a depth of about 9 miles under the San Gabriel Mountains. Several mapped surface faults were involved such as the Sylmar fault, Tujunga fault, and Lakeview fault. These faults are commonly considered to be part of the Sierra Madre fault system which extends easterly from the San Fernando Valley, along the base of the San Gabriel Mountains on the north side of the San Gabriel Valley, and to the Cucamonga fault in the San Bernardino area.

The 1987 Whittier earthquake (M_L = 5.9, M_W = 5.9) occurred on a subsurface fault dipping under the Puente Hills to about 10 miles beneath the San Gabriel Basin (Shaw and Shearer, 1999; Shaw et al., 2002). This event did not rupture the ground surface.

A magnitude 5.4 earthquake occurred at a depth of about 9 miles on 29 July 2008. The epicenter was in the Chino Hills area between the Chino fault and the Whittier fault. Preliminary data were inconclusive with regard to the causative fault. Detailed analysis by Shao and Hauksson (2009) indicated a rupture plane striking N71°W, dipping 62 degrees northeast. They suggested a preference for the Whittier fault being the causative fault but were uncertain, primarily because the Whittier fault is supposed to dip at about 80 degrees. The aftershock pattern formed a subhorizontal alignment indicating the possibility that the event could have been associated with a subsurface thrust fault such as one of the blind faults of the Puente Hills Blind Thrust Fault System or with a blind fault under the Peralta Hills.

Another significant earthquake was the 1812 earthquake which caused damage at the San Juan Capistrano Mission. The location and magnitude of the 1812 earthquake are unknown because of the sparse population at the time, but geological studies (Jacoby et al., 1988; Fumal et al., 1993; Weldon et al., 2004) postulate that it did not occur in the Capistrano area, but rather was a large ($M_W > 7.0$) distant event on the San Andreas fault in the Wrightwood area of the San Gabriel Mountains.

The earliest documented earthquake in the region was reported by the Portola′ expedition as they camped near the Santa Ana River in 1769. This event has been attributed by various geoscientists to just about every fault in the Los Angeles area but it could just as well have been a distant event that shook a wide area as did the 1971 San Fernando, the 1987 Whittier, and the 1994 Northridge events, as well as many other more-distant events (for example, 1992 Landers event).

4.4 SOIL SURVEY MAPPING

Soil Survey maps were not reviewed for the subject project.

5.0 EXPLORATION

5.1 DRILLING AND SAMPLING

A geotechnical field investigation was conducted between September 26 and October 20, 2011. Forty-two exploratory borings were excavated and eleven cone-penetration test (CPT) sounding were conducted under the supervision of EMI. Exploration information is summarized in Table 5-1. Surveyed locations of borings and CPTs are shown on Figure 5-1 through Figure 5-7. Logs of borings and Log of Test Boring (LOTB) sheets are presented in Appendix A.

Table 5-1. Soil Exploration Information

Boring/ CPT	Easting	Northing	Station (A Line) (feet)	Offset (feet)	Top of Boring Ele. (feet)	Bottom of Boring Ele. (feet)	Ground Water Ele. (feet)	Drilling Method
A-11-301	6,130,882	2,114,643	339+88	84 Lt	+194.9	+188.4	NE	HSA
A-11-302	6,130,994	2,114,857	340+41	151 Rt	+205.7	+189.2	NE	HSA
A-11-303	6,130,944	2,114,821	340+56	92 Rt	+194.8	+163.3	+176.3	HSA
A-11-304	6,130,588	2,115,147	345+39	112 Rt	+196.9	+145.4	+159.4	HSA
A-11-305	6,130,395	2,115,326	348+01	125 Rt	+198.6	+147.1	NE	HSA
CPT-11-306	6,130,115	2,115,554	351+62	119 Rt	+200.5	+186.3	NM	CPT
HA-11-307	6,129,912	2,115,670	353+92	77 Rt	+202.6	+197.6	NE	HA
HA-11-308	6,129,650	2,116,069	358+49	214 Rt	+191.5	+186.5	NE	HA
CPT-11-309	6,129,956	2,115,431	352+05	77 Lt	+201.9	+189.3	NM	CPT
A-11-310	6,129,685	2,115,561	354+96	152 Lt	+225.9	+184.4	NE	HSA
CPT-11-311	6,129,491	2,115,811	358+05	86 Lt	+199.3	+189.3	NM	CPT
A-11-312	6,129,110	2,116,072	362+65	131 Lt	+184.9	+133.4	NE	HSA
A-11-313	6,129,322	2,115,848	359+58	166 Lt	+225.6	+174.1	NE	HSA
A-11-314	6,128,895	2,115,939	363+53	371 Lt	+225.1	+194.2	NE	HSA
A-11-315	6,129,445	2,115,963	359+38	70 Rt	+196.8	+190.3	NE	HSA
A-11-316	6,129,314	2,116,186	361+81	87 Rt	+192.6	+91.1	+168.6	HSA
A-11-317	6,128,966	2,116,220	364+78	104 Lt	+179.3	+78.8	NE	HSA
CPT-11-318	6,129,171	2,116,296	363+60	80 Rt	+165.5	+140.6	NM	CPT
A-11-319	6,128,859	2,116,300	366+17	98 Lt	+152.4	+70.9	+137.4	HSA
A-11-320	6,129,117	2,116,336	364+25	79 Rt	+166.6	+85.1	NE	HSA
CPT-11-321	6,128,816	2,116,323	366+68	101 Lt	+152.7	+72.6	NM	CPT
A-11-322	6,129,042	2,116,418	365+30	101 Rt	+186.7	+85.2	NE	HSA
A-11-323	6,128,742	2,116,378	367+63	91 Lt	+173.0	+72.3	NE	HSA
A-11-324	6,128,875	2,116,510	367+14	89 Rt	+180.6	+69.1	+82.6	HSA
CPT-11-325	6,128,605	2,116,429	369+12	109 Lt	+148.7	+83.7	NM	CPT
A-11-326	6,128,753	2,116,563	368+42	77 Rt	+150.8	+69.3	NE	HSA
A-11-327	6,128,507	2,116,472	370+20	115 Lt	+168.5	+67.0	+91.0	HSA
A-11-328	6,128,658	2,116,615	369+48	80 Rt	+174.5	+73.0	NE	HSA
A-11-329	6,128,653	2,116,174	367+37	312 Lt	+156.4	+124.9	+136.2	HSA
A-11-330	6,128,138	2,115,673	369+90	995 Lt	+136.9	+130.4	NE	HSA
A-11-331	6,128,327	2,116,380	371+39	278 Lt	+154.2	+147.7	NE	HSA
CPT-11-332	6,130,323	2,115,101	347+11	93 Lt	+198.5	+190.8	NM	CPT

Boring/ CPT	Easting	Northing	Station (A Line) (feet)	Offset (feet)	Top of Boring Ele. (feet)	Bottom of Boring Ele. (feet)	Ground Water Ele. (feet)	Drilling Method
HA-11-333	6,129,842	2,115,786	355+20	121 Rt	+197.3	+192.3	NE	HA
HA-11-334	6,127,757	2,116,905	378+48	154 Lt	+156.6	+151.6	NE	HA
A-11-335	6,128,522	2,116,601	370+63	6 Rt	+169.6	+163.1	NE	HSA
HA-11-336	6,128,292	2,116,957	374+49	214 Rt	+148.0	+143.0	NE	HA
A-11-337	6,128,177	2,116,893	375+16	98 Rt	+154.0	+123.5	NE	HSA
HA-11-338	6,128,122	2,116,709	374+62	87 Lt	+164.6	+159.6	NE	HA
A-11-339	6,128,082	2,116,519	374+03	269 Lt	+157.8	+126.3	NE	HSA
A-11-340	6,127,912	2,117,010	378+05	81 Rt	+147.9	+141.4	NE	HSA
HA-11-341	6,127,711	2,117,320	381+83	90 Rt	+137.8	+132.8	NE	HA
A-11-342	6,127,523	2,117,230	382+22	114 Lt	+147.6	+106.1	NE	HSA
A-11-343	6,127,468	2,117,598	385+60	79 Rt	+129.6	+123.1	NE	HSA
HA-11-344	6,127,381	2,118,042	390+22	99 Rt	+117.3	+112.3	NE	HA
CPT-11-345	6,127,229	2,117,892	389+15	85 Lt	+130.4	+36.0	NM	CPT
A-11-346	6,127,243	2,118,302	393+10	88 Rt	+115.6	+109.1	NE	HSA
CPT-11-347	6,127,140	2,118,412	394+26	85 Lt	+120.3	+30.4	NM	CPT
A-11-348	6,127,141	2,118,721	397+27	74 Lt	+116.9	+15.4	NE	HSA
A-11-349	6,127,118	2,118,868	398+69	102 Lt	+81.7	+0.2	+63.7	HSA
CPT-11-349	6,127,118	2,118,868	398+69	102 Lt	+81.7	-23.6	NM	CPT
A-11-350	6,127,160	2,119,046	400+46	75 Lt	+113.1	+12.5	+42.4	HSA
CPT-11-351	6,127,209	2,119,341	403+38	73 Lt	+110.4	+63.4	NM	CPT
A-11-352	6,127,221	2,118,836	398+43	80 Rt	+109.3	+102.8	NE	HSA

Notes:
(1) A Line = I-5 Mainline; NE = Not Encountered; NM = Not Measured.
(2) CPT = Cone Penetration Test boring; HA = Hand Auger boring; HSA = Hollow-Stem Auger boring.

Boring A-11-349 and CPT-11-349 were performed at the same location in order to calibrate the CPT data.

Hollow-stem auger 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. Automatic hammer were used to drive samplers in the truck-mounted drill rig. The numbers of blows to advance the sampler each 6 inches of penetration were recorded. The number of blows for the final 12 inches or shorter of driving was recorded on the boring logs and LOTB sheets. Charts published by Winterkorn and Fang (1975) can be used to determine a reduction factor used to convert blowcounts recorded using the California Drive sampler into SPT blowcounts. Using those charts, we obtained a reduction factor of 0.5 which was used for this project.

Hand-auger borings were drilled using a 3-inch diameter stainless steel hand-auger. Bulk samples were collected from the hand-auger borings.

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 in^2 (10 cm^2) and a cylindrical friction sleeve with a surface area of 23.25 in^2 (150 cm^2). 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).

Seismic Cone Penetration Test (SCPT) was performed in CPT-11-321 and CPT-11-349 to measure shear wave velocities (V_s^{30}) at various depths. A small rugged velocity seismometer has been incorporated into an electronic cone penetrometer. The SCPT was pushed into the ground at the standard rate. The penetration was stopped at desired depths and shear waves were generated at the surface by hitting a beam with a sledge hammer. The time for the shear waves to reach the seismometer was measured and the V_s^{30} was calculated. The time measurements and the calculated V_s^{30} values at each depth are presented in Appendix A.

5.2 GEOLOGIC MAPPING

Published geological maps (Morton and Miller, 1981; Tan, 1999; Kennedy et al, 2007) show the area is underlain by Pleistocene marine and non-marine terrace deposits (Qt), Quaternary-age alluvium (Qal) and landslide deposits (Qls, Qols) and Miocene to Pliocene-age Capistrano Formation bedrock (Tc). A Geological Map has been presented in Figure 4-3.

The geological units at the project site as mapped by the certified engineering geologist are presented in Figure 5-1 through Figure 5-7.

5.3 GEOPHYSICAL STUDIES

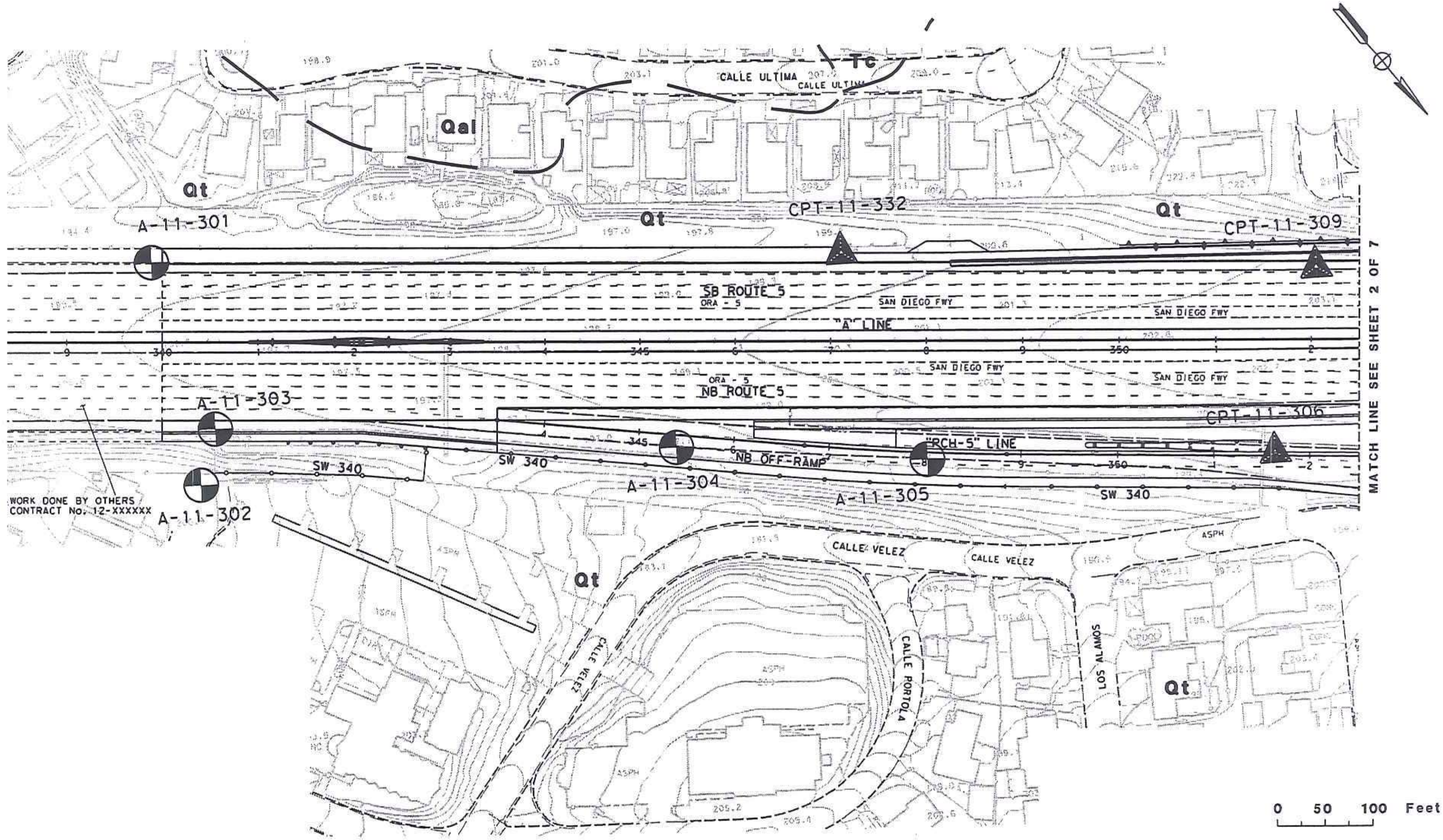
Geophysical studies were not necessary and therefore were not performed for the project.

5.4 INSTRUMENTATION

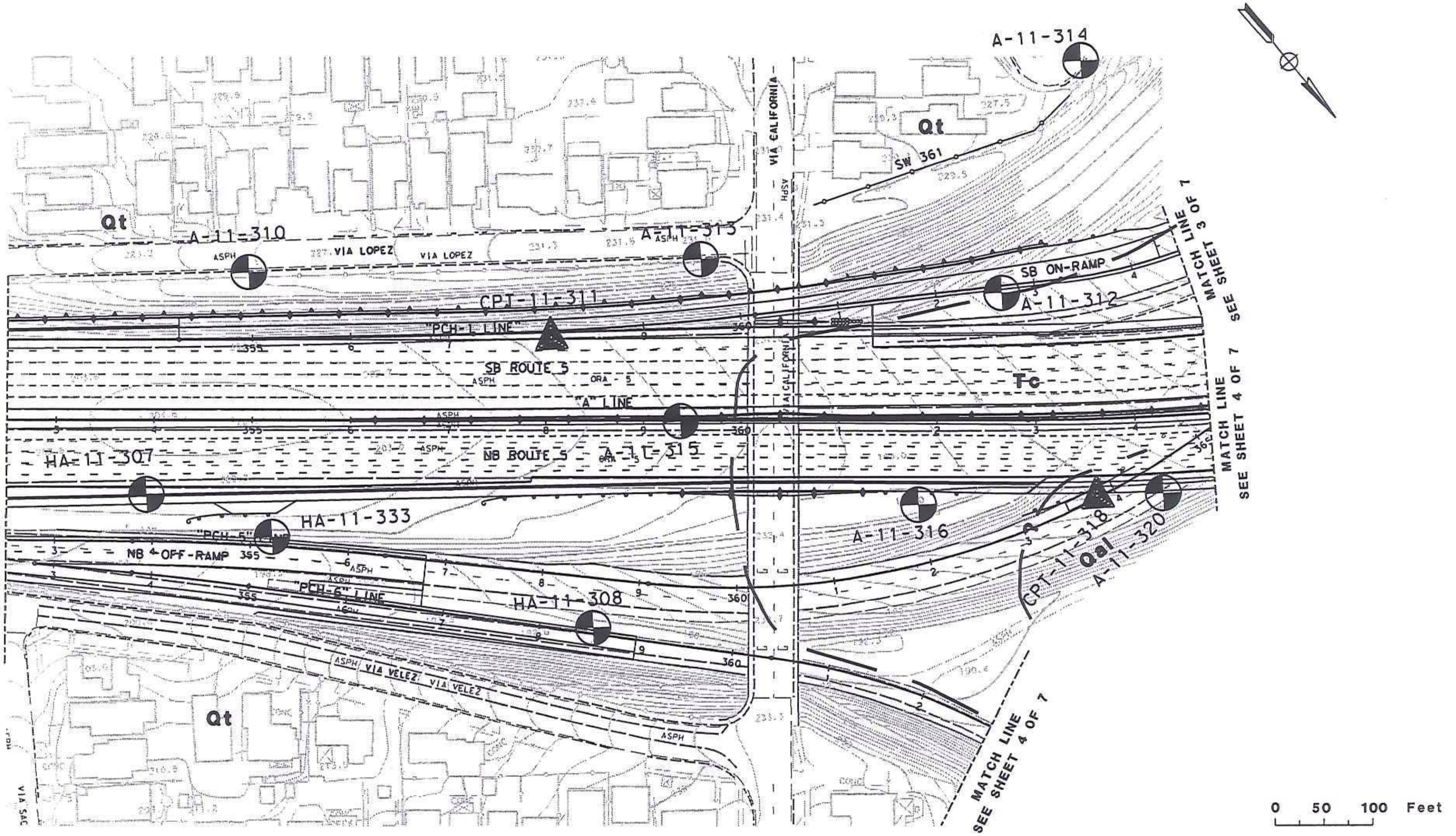
Instrumentation was not necessary and therefore not installed as part of the field investigation program.

5.5 EXPLORATION NOTES

No unique conditions were encountered or observed during the field exploration.



Earth Mechanics, Inc. Geotechnical & Earthquake Engineering	INTERSTATE 5 HOV IMPROVEMENT PROJECT (SEGMENT 3) PCH TO SAN JUAN CREEK ROAD		Exploratory Boring Location Map (1 of 7)
	Project No.: 11-137	Date: 03-08-2012	Figure 5-1



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INTERSTATE 5 HOV IMPROVEMENT PROJECT (SEGMENT 3)
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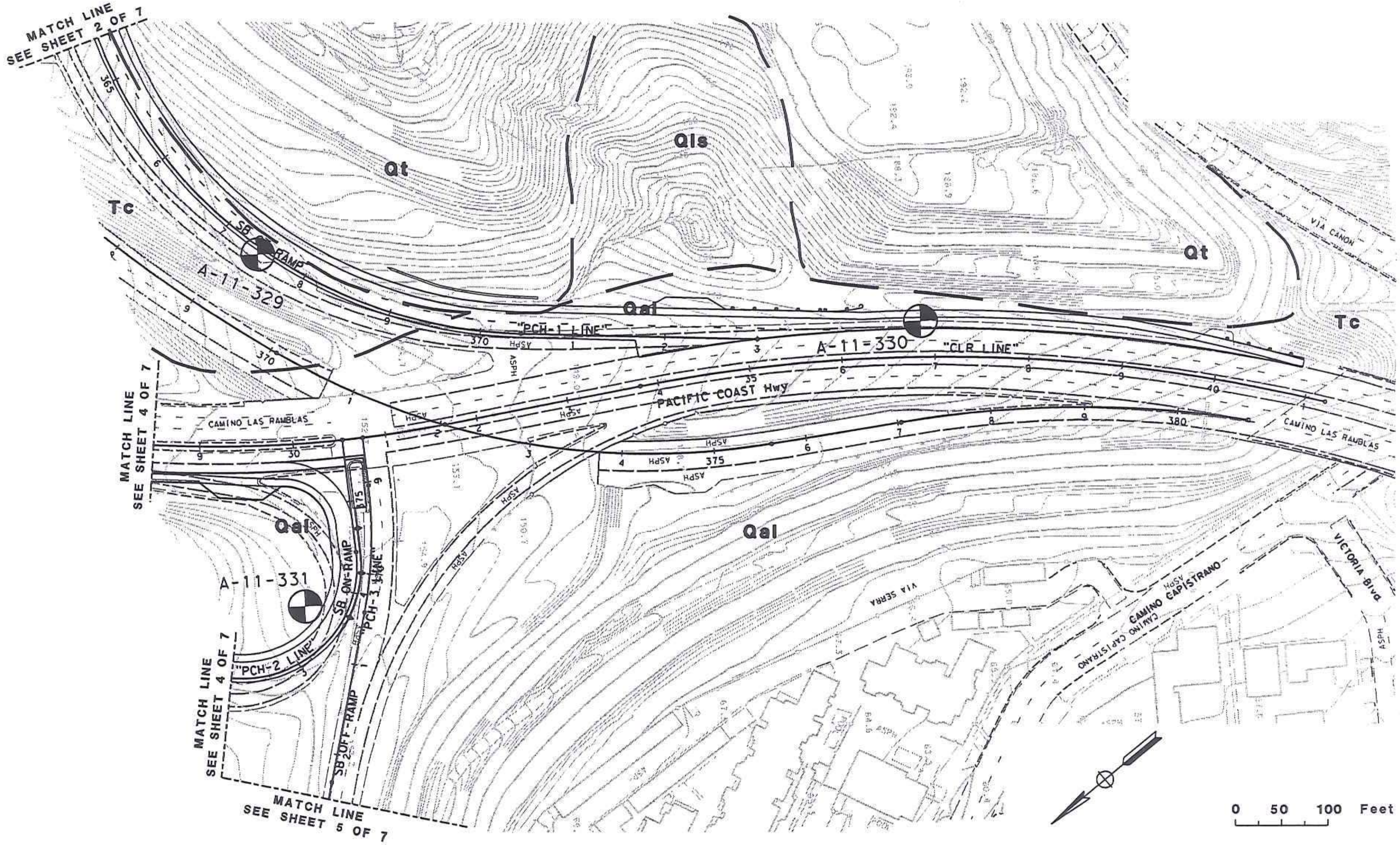
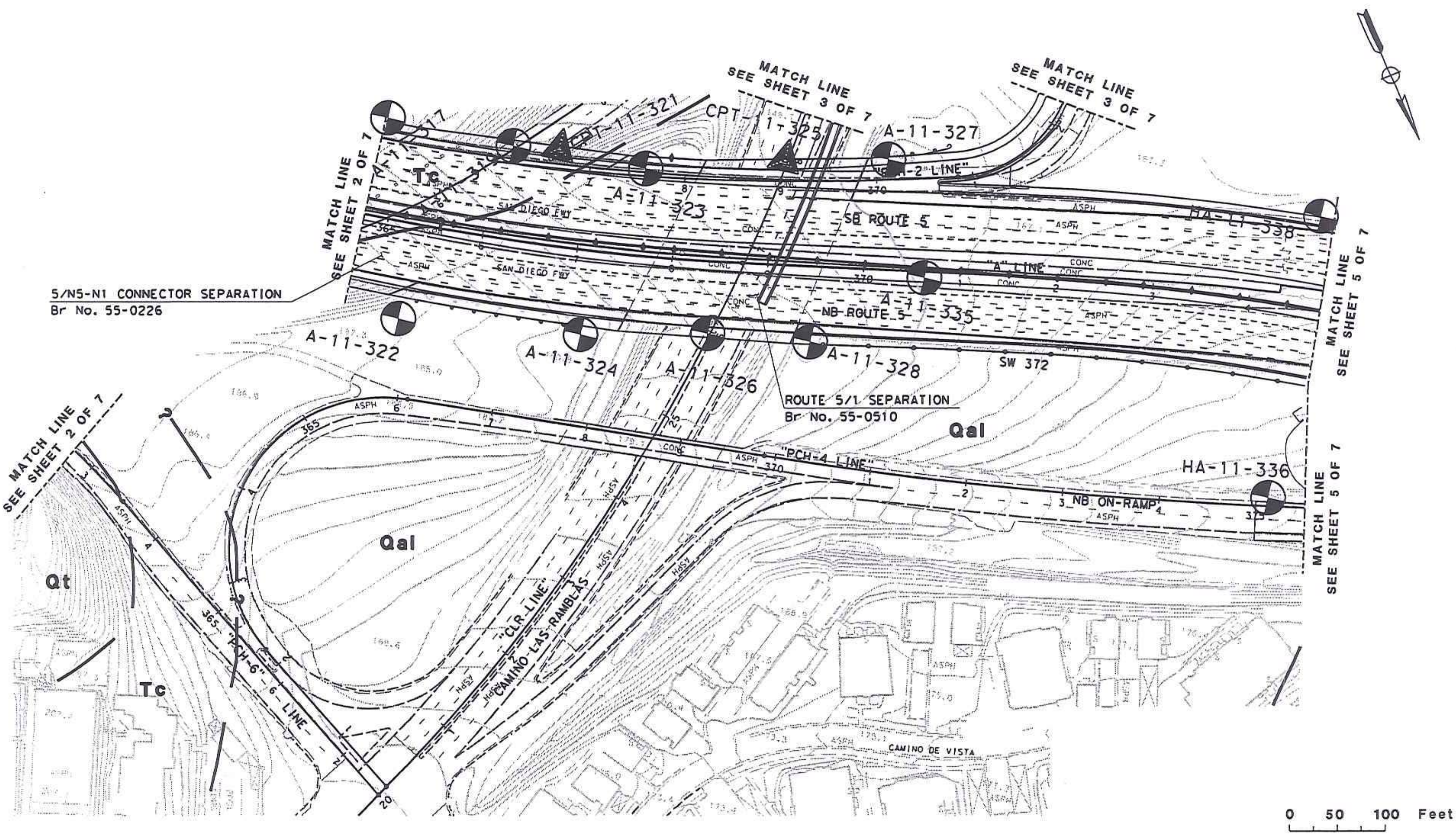
Exploratory Boring Location Map (2 of 7)

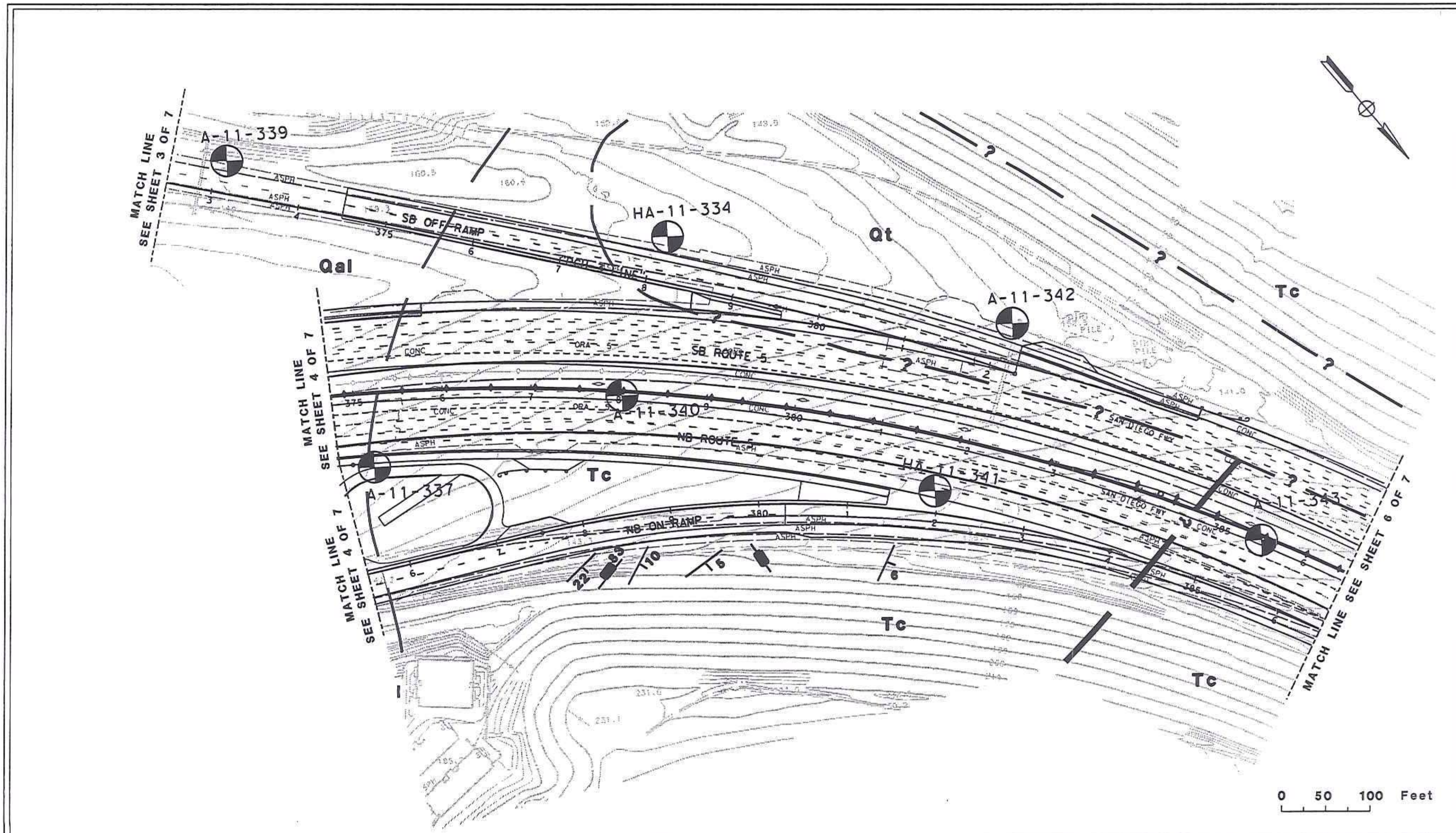
Figure 5-2



Earth Mechanics, Inc. Geotechnical & Earthquake Engineering	INTERSTATE 5 HOV IMPROVEMENT PROJECT (SEGMENT 3) PCH TO SAN JUAN CREEK ROAD	Exploratory Boring Location Map (3 of 7)
	Project No.: 11-137 / Date: 03-08-2012	Figure 5-3



Earth Mechanics, Inc. Geotechnical & Earthquake Engineering	INTERSTATE 5 HOV IMPROVEMENT PROJECT (SEGMENT 3) PCH TO SAN JUAN CREEK ROAD	Exploratory Boring Location Map (4 of 7)
	Project No.: 11-137 / Date: 03-08-2012	Figure 5-4



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INTERSTATE 5 HOV IMPROVEMENT PROJECT (SEGMENT 3)
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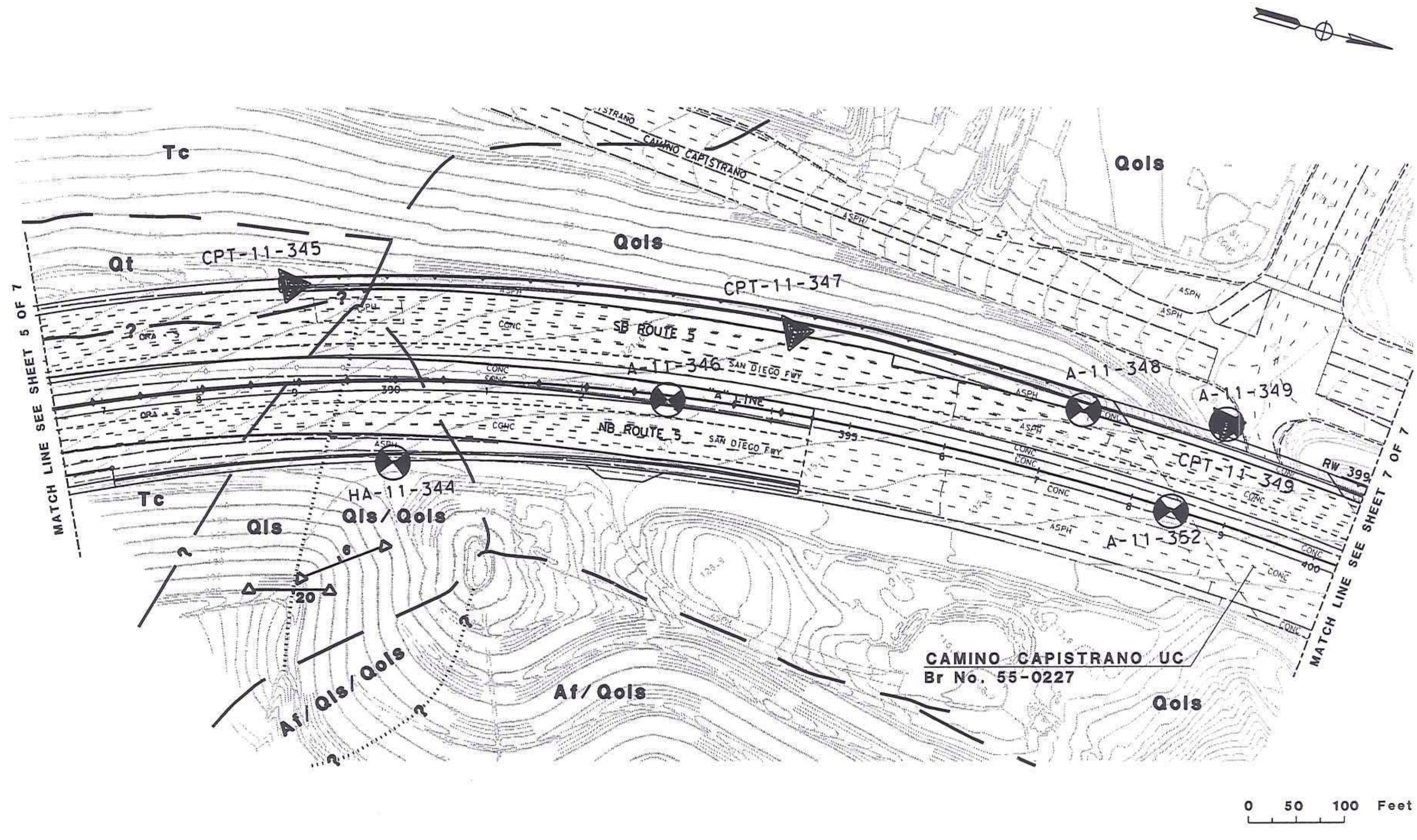
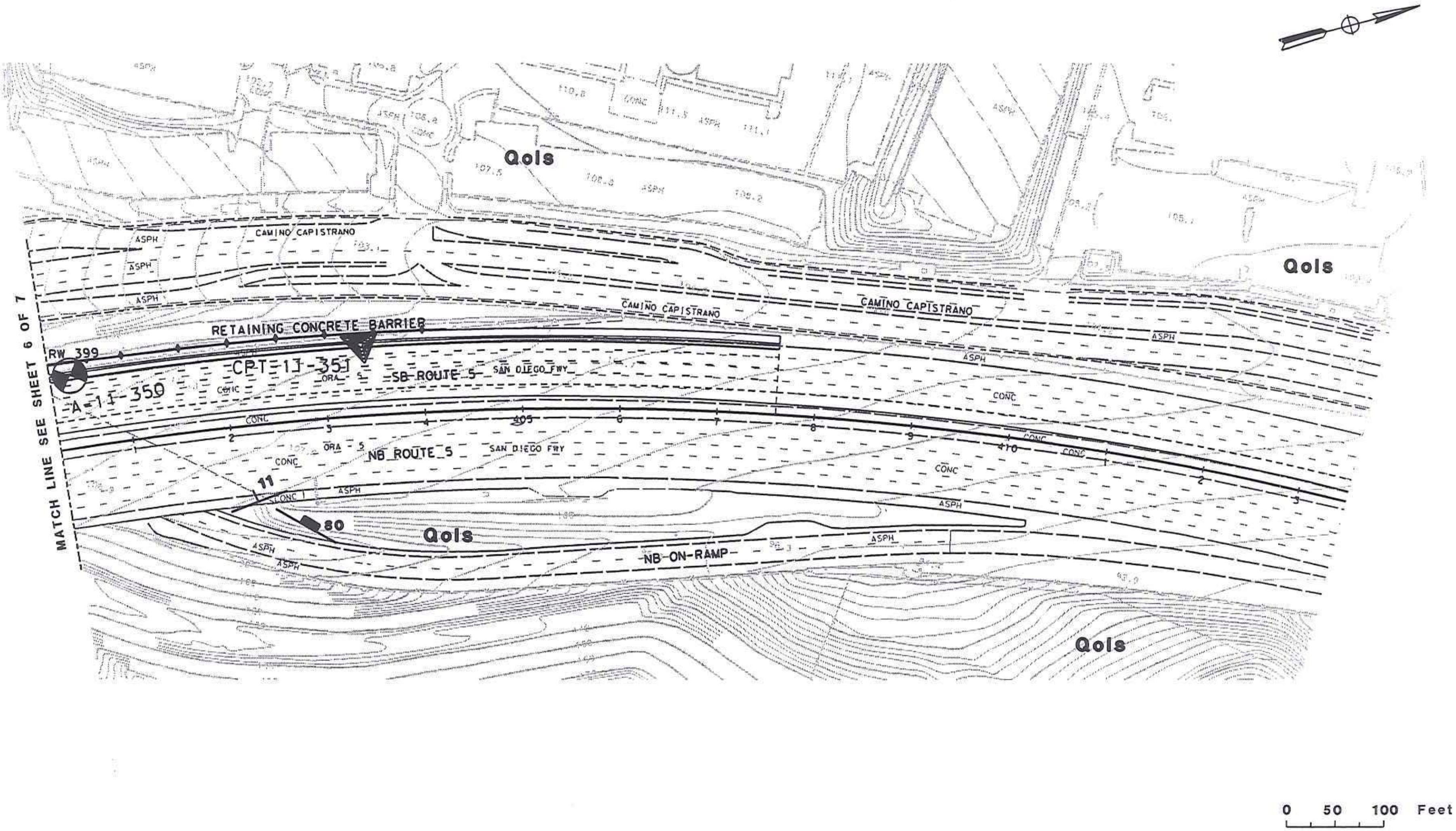
Exploratory Boring Location Map (5 of 7)

Figure 5-5



Earth Mechanics, Inc. Geotechnical & Earthquake Engineering	INTERSTATE 5 HOV IMPROVEMENT PROJECT (SEGMENT 3) PCH TO SAN JUAN CREEK ROAD	Exploratory Boring Location Map (6 of 7)
	Project No.: 11-137 / Date: 03-08-2012	Figure 5-6



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INTERSTATE 5 HOV IMPROVEMENT PROJECT (SEGMENT 3)
PCH TO SAN JUAN CREEK ROAD

Project No.: 11-137	Date: 03-08-2012

Exploratory Boring Location Map (7 of 7)

Figure 5-7

6.0 GEOTECHNICAL TESTING

6.1 IN-SITU TESTING

Blowcounts from the SPT and MCD samplers were recorded during the exploration. The blowcounts are shown on the borings logs and LOTB sheets in Appendix A.

6.2 LABORATORY SOIL 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
- Grain Size Analysis
- Atterberg Limits
- Direct Shear
- Unconsolidated Undrained Triaxial
- Consolidation
- Pocket Penetrometer
- Minimum Resistivity, pH, Sulfate Content and Chloride Content
- Maximum Density and Optimum Moisture Content
- Sand Equivalent
- R-Value

The laboratory soil tests were conducted in general accordance with California Test methods or American Society for Testing and Materials standards. Laboratory test results are presented in Appendix B.

R-value tests noted on the boring logs and LOTB sheets in Appendix A were conducted for preparation of the Materials Report (EMI, 2012g). The R-value test results were not used in preparation of the recommendations included in this report and therefore, they were omitted from Appendix B.

7.0 GEOTECHNICAL CONDITIONS

7.1 SITE GEOLOGY

7.1.1 Lithology

The project area is underlain by silty claystone, claystone and siltstone of the Capistrano Formation, Terrace Deposits, Alluvium consisting of non-indurated silty sand with clay and gravel, landslide deposits derived from units of the Capistrano Formation, and artificial fills.

7.1.2 Geologic Structure

The geologic structure of the site was described in Section 4.3.4.

7.1.3 Natural Slope Stability

A smaller more-recent landslide is located on the southeastern side of the southbound PCH on-ramp. This landslide appears to have been a relatively shallow and recent failure. Details of this landslide have been discussed in Section 4.3.5. A cross-section showing the landslide features superimposed by the existing and proposed grades has been presented in Figure 4-6. As shown in Figure 4-6 and supplemented by the discussions in Section 4.3.5, the proposed grading to accommodate the roadway improvements (ramp widening) is shallow and relatively small in size as compared to the landslide. As a result, the proposed ramp improvement will not impact this landslide and mitigation is not required.

The large ancient landslide at the northern portion of the site is called the McCracken Hill Landslide. As discussed in Section 4.3.5, extensive investigations of the landslide performed by Leighton and Associates (Leighton, 2004) and AMEC (AMEC, 2006a, 2006b, and 2000a through 2000e) in conjunction with proposed residential developments in the area indicate that the landslide is stable. Two cross-sections showing the landslide features superimposed by the existing and proposed grades have been presented in Figure 4-4 and Figure 4-5. As shown in Figure 4-4 and Figure 4-5, and supplemented by the discussions in Section 4.3.5, proposed grading performed in conjunction with this project is not considered to have an impact on this landslide and mitigation is not required.

7.2 SUBSURFACE SOIL CONDITIONS

7.2.1 Material Strength Parameters

Materials encountered during the field investigation consist of fill, alluvium, terrace deposits and Capistrano bedrock. The shear strength parameters for various soil types are summarized in Table 7-1.

Table 7-1. Soil Strength Parameters

Predominant Soil Type	Equivalent SPT Blowcount (blows/foot)*	Total Unit Weight (pcf)	Friction Angle (degree)	Cohesion / Undrained Shear Strength (psf)
Sand, Silty Sand and Sand with Silt	(6) to 17 Average = 10	120	32	100
Lean and Fat Clay	4 to 8 Average = 6	115	-	1,500
Lean Clay	8 to 22 Average = 14	115	-	2,000
Bedrock – Elastic Silt and Fat Clay	16 to >50 Average = 40	120	-	3,000

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

The strength parameters for the coarse-grained and fine-grained soils in Table 7-1 were obtained based on either correlations with SPT blowcounts (Lam and Martin, 1986) or CPT data (Robertson and Campanella, 1989) or laboratory test results. As shown in Appendix B, the undrained shear strength of the bedrock obtained from laboratory UU-tests ranges from 7,900 to 10,300 psf. Undrained shear strengths of the bedrock obtained from CPT correlations vary from 2,000 to over 10,000 psf. Based on this, it appears the laboratory measured shear strength is close to the average shear strength obtained from the CPT correlation. A closer examination of the CPT interpreted logs show a majority of the undrained shear strength values immediately below the bedrock contact varies from 2,000 to 6,000 psf. Conservatively, an undrained shear strength value of 3,000 psf was selected for the bedrock in Table 7-1.

7.2.2 Expansion Potential

Lean and fat clay layers with various amounts of sand encountered in the borings have a medium to very high expansion potential. Therefore, on-site soils including existing fill materials within the project area should not be considered as backfill for the retaining walls and footing excavations. Mitigation measures such as overexcavation for the pavement subgrade are discussed in the Materials Report (EMI, 2012g).

7.2.3 Settlement Potential

Based on consolidation test results, clayey soils at the site are susceptible to consolidation settlement. Settlement due to embankment construction is discussed in Section 8.3.

7.3 WATER

7.3.1 Surface Water

No permanent standing surface water was encountered at the site. Drainage along I-5 in the project area is controlled by man-made facilities such as culverts and storm drains that flow into local channels. There are no lakes, streams or retention basins in immediate proximity to the subject site.

Scour: This site is located within an area that is presently improved; roadway surfaces are paved and drainage is controlled by engineered facilities. Therefore, scour is not considered a design issue.

Erosion: Where present, the clayey surficial soils along the project corridor are expected to expand when wet, and crack upon drying. Cracking allows infiltration of water from storms and irrigation, ultimately causing loosening of the surficial soils. This results in increase of the soil erodibility. Surficial soils that are sandy can be susceptible to gullying, piping and accelerated erosion on steep slopes. Currently most of the slopes adjacent to the project corridor are densely vegetated and erosion impacts are minimal. Prompt revegetation of graded slopes should be performed to minimize erosion.

7.3.2 Groundwater

As shown in Table 5-1, groundwater was encountered at selective borings between elevations +42.4 and +176.3 feet during drilling in September and October, 2011. At the 5/N5-N1 Connector Separation (Bridge No. 55-0226), the as-built LOTB sheets show groundwater was encountered between elevations +135 and +155 feet in 1969. At the Camino Capistrano UC (Bridge No. 55-0227), groundwater was encountered between elevations +24 and +57 feet in 1956, at elevation +59.7 feet in 1965, and between elevations +57.5 and +61 feet in 1992. Groundwater was not shown on the as-built LOTB sheets for Route 5/1 Separation (Bridge No. 55-0510) and Via California OC (Bridge No. 55-0225) for soil borings drilled in January 1968 and August 1955, respectively.

The above groundwater data appears to indicate that the groundwater depth is deeper (with respect to the existing freeway surface) in the north end as compared to the south end of the project limits. There is also no significant permanent lowering or rising of the groundwater surface between the late 1950's and now. The groundwater encountered during EMI investigation in September and October of 2011 appears to be perched water because at several locations, where side-by-side borings are less than 50 feet apart, groundwater was only encountered in one of the borings. Nevertheless, groundwater during construction will likely be different from those reported above because groundwater level can fluctuate due to variations in seasonal precipitation, irrigation, groundwater injection or extraction, or numerous other man-made and natural influences.

Based on California Geological Survey, Division of Mines and Geology (CGS, 2001b), the highest historical groundwater at the project site is 5 to 10 feet below the ground surface. So, there is a major discrepancy between the CGS data and measured groundwater data described above. Based on our past experience, the CGS historical high groundwater data is often based on limited data and may or may not reflect actual site conditions. We believe the historical high groundwater data reported by CGS is likely to be either a perched water zone or the original ground surface is significantly lower than the current ground surface. In both cases, it does not appear to be representative of the site conditions and should not be used for liquefaction assessment for this project.

7.4 PROJECT SITE SEISMICITY

The regional seismicity was discussed in Section 4.3.6.

7.4.1 Maximum Earthquakes

The principal faults, which might generate earthquakes affecting the project design, are listed in Table 7-2 along with their maximum earthquake magnitude. Fault data is obtained from the Caltrans 2007 Fault Database (Caltrans, 2009a and 2009b), and the distance to the fault is measured from the Caltrans 2007 Deterministic PGA Map (Shantz and Merriam, 2007). Other known faults in the region were also analyzed but were found not to be capable of generating ground motion at the site in excess of the faults listed on Table 7-2.

Table 7-2. Nearby Earthquake Faults

Fault Name	Fault ID	Maximum Magnitude M_{Max}	Distance (Direction) from Site (miles)	Fault Type*
Newport Inglewood-Rose Canyon Fault Zone (Offshore or Dana Point Section)	222	7.5	3.9 (Southwest)	RLSS
San Joaquin Hills Blind Thrust	7	6.6	5.8 (North)	R

*R = Reverse, RLSS = Right Lateral Strike Slip

7.4.2 Ground Rupture

There are no active faults through the project area, therefore the potential for ground rupture is remote to nil.

7.4.3 Earthquake-Induced Landslides

The Seismic Hazard Zone Report for the Dana Point Quadrangle (CGS, 2001) identifies areas where the potential exists for permanent ground displacements as a result of a seismic event (i.e. landslides). The areas where this potential has been identified are marked in blue on Figure 4-2. Locations defined as having a seismically induced landslide potential of low or higher were included on the map as well as all areas that have had landslide activity at any time in the past.

The criteria used by the California Geologic Survey for delineating these areas include bedrock type, past landslide activity and slope angle. Along the project corridor, areas identified as having potential for earthquake-induced landslides include the McCracken Hill Landslide and slopes descending to the freeway underlain by bedrock of the Capistrano Formation. The majority slopes in the area covered by the Dana Point Quadrangle that are underlain by the Capistrano Formation have been classified as being susceptible to possible earthquake-induced landsliding. The Seismic Hazard Zone Report explains that this is the result of the generally low shear strength values of this unit and does not take into account the orientation of the bedding in relation to the slope.

The dominant bedrock unit underlying the project alignment and indeed most of this portion of south Orange County is the Capistrano Formation which is notoriously susceptible to landslide along adversely oriented clay seams. Based on the criteria used in the Seismic Hazard Zone Report, landslide potential as a result of seismic activity is a widespread risk throughout most portions of the I-5 corridor in south Orange County.

8.0 GEOTECHNICAL ANALYSES AND DESIGN

8.1 DYNAMIC ANALYSES

8.1.1 Parameter Selection

We determined the design ARS curve based on the 2010 Caltrans Seismic Design Criteria (SDC) (Caltrans, 2010a) and Geotechnical Services Design Manual (Caltrans, 2009c) procedures. The peak ground acceleration (PGA) is the zero-period spectral acceleration in the ARS curve. A PGA of 0.4g is obtained from the design ARS curve.

For analyzing global slope stability, Section 3.10 of the Caltrans Guidelines for Structures Foundation Reports (Caltrans, 2009d) 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 0.133 was used in the slope stability analyses and presented in Sections 8.2.1, 8.3.2 and 8.4.

8.1.2 Evaluation

Liquefaction potential and seismically-induced settlement are discussed below.

8.1.2.1 Liquefaction

Liquefaction analysis was performed using the available site-specific subsurface information. As discussed in Section 7.3.2, there is a major discrepancy between CGS groundwater data and measured groundwater data. Therefore, conservatively, a groundwater depth of 5 feet below the top of borings and CPTs is used for the liquefaction analyses.

The liquefaction potential of saturated, granular materials below the groundwater table was evaluated using the procedures outlined by Seed et al. (1983), Seed and Harder (1990), and updated by NCEER (1997). Analyses were performed on soil borings and CPTs with a termination depth of at least 15 feet. Results of the liquefaction analyses are included in Appendix C and summarized in Table 8-1. Table 8-1 presents the approximate elevations of liquefiable layers, thickness of liquefiable layers, and approximate seismically-induced settlement for seven CPTs and twenty-four soil borings. All liquefiable layers thinner than 0.2 feet have been omitted from Table 8-1.

Table 8-1. Summary of Liquefaction Analyses

Boring/ CPT	Location (A-Line Station)	Top of Boring Elevation (feet)	Approximate Elevations of Liquefiable Layers (feet)	Thickness of Liquefiable Layer (feet)	Approximate Seismically Induced Settlement (inches)
A-11-303	340+56, 92 Rt	+194.8	No Liquefaction	-	-
A-11-304	345+39, 112 Rt	+196.9	No Liquefaction	-	-
A-11-305	348+01, 125 Rt	+198.6	No Liquefaction	-	-
A-11-310	354+96, 152 Lt	+225.9	No Liquefaction	-	-
A-11-312	362+65, 131 Lt	+184.9	No Liquefaction	-	-

Boring/ CPT	Location (A-Line Station)	Top of Boring Elevation (feet)	Approximate Elevations of Liquefiable Layers (feet)	Thickness of Liquefiable Layer (feet)	Approximate Seismically Induced Settlement (inches)
A-11-313	359+58, 166 Lt	+225.6	+220.6 to +219.6	1.0	0.1
A-11-314	363+53, 371 Lt	+225.1	No Liquefaction	-	-
A-11-316	361+81, 87 Rt	+192.6	No Liquefaction	-	-
A-11-317	364+78, 104 Lt	+179.3	No Liquefaction	-	-
CPT-11-318	363+60, 80 Rt	+165.5	No Liquefaction	-	-
A-11-319	366+17, 98 Lt	+152.4	+127.4 to +122.4	5.0	1.7
A-11-320	364+25, 79 Rt	+166.6	No Liquefaction	-	-
CPT-11-321	366+68, 101 Lt	+152.7	+145.0 to +140.9 +136.1 to +135.5 +128.3 to +127.3 +121.7 to +121.2	4.1 0.6 1.0 0.5	1.4 0.2 0.3 0.1
A-11-322	365+30, 101 Rt	+186.7	No Liquefaction	-	-
A-11-323	367+63, 91 Lt	+173.0	No Liquefaction	-	-
A-11-324	367+14, 89 Rt	+180.6	No Liquefaction	-	-
CPT-11-325	369+12, 109 Lt	+148.7	+137.9 to +136.2	1.7	0.3
A-11-326	368+42, 77 Rt	+150.8	No Liquefaction	-	-
A-11-327	370+20, 115 Lt	+168.5	No Liquefaction	-	-
A-11-328	369+48, 80 Rt	+174.5	No Liquefaction	-	-
A-11-329	367+37, 312 Lt	+156.4	+141.4 to +136.4 +131.4 to +130.4	5.0 1.0	1.8
A-11-337	375+16, 98 Rt	+154.0	No Liquefaction	-	-
A-11-339	374+03, 269 Lt	+157.8	No Liquefaction	-	-
A-11-342	382+22, 114 Lt	+147.6	+117.6 to +112.6	5.0	1.3
CPT-11-345	389+15, 85 Lt	+130.4	+119.6 to +118.8	0.8	0.2
CPT-11-347	394+26, 85 Lt	+120.3	No Liquefaction	-	-
A-11-348	397+27, 74 Lt	+116.9	No Liquefaction	-	-
A-11-349	398+69, 102 Lt	+81.7	No Liquefaction	-	-
CPT-11-349	398+69, 102 Lt	+81.7	+76.5 to +75.0	1.5	0.7
A-11-350	400+46, 75 Lt	+113.1	No Liquefaction	-	-
CPT-11-351	403+38, 73 Lt	+110.4	No Liquefaction	-	-

We have the following observations based on the data presented in from Table 8-1:

- Granular materials susceptible to liquefaction were encountered only in four CPTs and four borings.
- The liquefiable layers in the borings are either 1.0 foot or 5.0 feet thick. The 5-foot thick layers coincide with the soil sampling interval. Therefore, actual thickness of the liquefiable layers can be less than 5 feet.
- The liquefiable layers in the CPTs are up to 1.7 feet thick except a 4-foot thick layer was encountered in CPT-11-321.

Based on the above observations, the liquefiable layers are relatively thin, isolated and discontinuous, and are not anticipated to impact the proposed improvements. Therefore, the liquefaction potential is concluded to be low. Furthermore, as discussed in Section 4.3.5, the

California Geological Survey (CGS, 2001a) has also indicated that the project alignment has a low susceptibility to liquefaction during a strong earthquake.

8.1.2.2 Seismically-Induced Settlement

The seismically-induced settlements are presented in Appendix C and summarized in Table 8-1. In the liquefiable layers, seismically-induced settlements are expected to be up to 1.8 inches. However, the liquefiable layers are relatively thin, isolated and discontinuous. Therefore, the seismically-induced settlement is not expected to adversely impact this project.

8.2 CUTS AND EXCAVATIONS

Based on the Profile Sheets provided by TRC, most of the cuts and excavations are relatively minor (about 5 feet) except at the following locations:

- Up to about 25 feet of cut is required for the realignment of the I-5 SB On-Ramp from PCH (PCH-1 Line) underneath Via California OC (Bridge No. 55-0225). Tieback and soil nail walls will be constructed to accommodate the proposed excavation.
- Up to about 15 feet of cut is required for realignment of the I-5 SB Loop On-Ramp from PCH (PCH-2 Line). The finish grade will be 4H:1V or flatter.
- Up to 13 feet of cut is required for widening of the I-5 NB between Stations 340+00 and 340+50. The finish grade will be 2H:1V or flatter.
- Up to 8 feet of excavation is required for the widening of the I-5 NB between Stations 375+00 and 376+25. The side slope will be 4H:1V or flatter.

8.2.1 Slope Stability

Per Caltrans HDM Topic 304 (Caltrans, 2008), side slopes with a steepness of 4H:1V or flatter will be globally and surficially stable. Side slopes with a 2H:1V gradient and a maximum height of 5 feet are also globally stable.

Stability of the cut underneath Via California OC (Bridge No. 55-0225) will be addressed in a separate foundation report (EMI, 2012d).

Slope stability analysis was performed for the 13 feet of cut between I-5 Mainline Stations 340+00 and 340+50 along I-5 Northbound. The analysis was performed using the computer program SLIDE 5.0 (Rocscience, 2006). The soil strength parameters in Table 7-1 were used in the static and pseudo-static analysis. Results indicate that the calculated factors-of-safety meet the minimum requirements of 1.5 and 1.1 for static and pseudo-static condition, respectively.

Surficial stability analysis was performed using the infinite slope method. Based on laboratory strength test results of the onsite soils, the calculated factor of safety is at least 1.5 provided the slope gradient is 2H:1V or flatter. Proper maintenance with erosion protection and drainage control in accordance with Section 21 of Caltrans Standard Specifications (2010c) are also recommended.

8.2.2 Rippability

Excavations are anticipated to be performed within existing fill, alluvium, terrace deposit and Capistrano bedrock. These on-site materials can be excavated using conventional heavy-duty earth-moving equipment and the materials are not expected to pose a rippability problem.

8.2.3 Earthwork Factors

The volume change of on-site materials upon excavation and compaction will vary with soil type and soil density. Although accurate grading factors cannot be determined, the volume change after compaction is estimated to be on the order of +7 percent to -8 percent for sandy soils and +3 percent to -9 percent for clayey soils for determining preliminary earthwork quantities. Excavated materials may be assumed to bulk 3 to 10 percent for hauling purposes.

8.3 EMBANKMENTS

8.3.1 Description

Based on the Profile Sheets and cross-sections provided by TRC, the following fills will be placed for this project. Other embankment fills not listed below are relatively minor (5 feet or less).

- Up to 22 feet of backfill will be placed in between the existing and proposed retaining walls near Camino Capistrano UC (Bridge No. 55-0227).
- Up to 15 feet of sliver fill will need to be placed to construct the approaches to each bridge widening.
- Up to 6 feet of backfill will be placed for the proposed Caltrans Standard retaining wall near Camino Capistrano UC (Bridge No. 55-0227).

Per Caltrans HDM Topic 304 (2008a), side slopes should be constructed (where possible) no steeper for 4H to 1V. Design exception will be required for side slopes with gradients steeper than 4H to 1V.

8.3.2 Stability and Settlement

Stability and settlement of the bridge approach fill embankments and non-standard retaining wall backfills are addressed in the foundation reports (EMI, 2012a through 2012e). The stability and settlement of the Caltrans Standard retaining wall are addressed in Section 8.4.2.

Fill embankments at locations other than retaining walls and bridges are globally stable for a maximum slope gradient of 2H:1V and a maximum height of 5 feet.

Surficial stability analysis was performed using the infinite slope method. The results indicates that the factor of safety is greater than 1.5 for 2H:1V slopes provided the outer 4 feet of the slope face is composed of soil possessing a minimum internal friction angle of 20 degrees and a minimum cohesion of 225 psf. This select material should be properly keyed and benched into the sloping ground. Proper maintenance with erosion protection and drainage control in accordance with Section 21 of Caltrans Standard Specifications (2010c) are also recommended.

8.4 EARTH RETAINING STRUCTURES

Earth retaining structures consisting of two non-standard walls, a Caltrans Standard Type 1 cantilevered retaining wall, and a retaining concrete barrier are proposed for this project. In addition to the earth retaining structures, soundwalls on barrier on piles, soundwalls on pile cap, and a soundwall on retaining wall on spread footing are also proposed for the project. The Caltrans standard wall, retaining concrete barrier and soundwalls are shown in Figure 8-1.

8.4.1 Non-Standard Walls

Walls 349 and 387 are a combination of tieback and soil nail walls, and a Caltrans Standard Type-1 cantilevered retaining wall on piles, respectively. Wall 349 is located near and underneath the Via California OC (Bridge No. 55-0225). Wall 387 is located near the Camino Capistrano UC (Bridge No. 55-0227). Separate foundation reports will be prepared for these walls (EMI, 2012d and 2012e).

8.4.2 Caltrans Standard Type 1 Retaining Wall 399

Wall 399 is a Caltrans Standard Type 1 retaining wall (Caltrans, 2010b). The pertinent wall data is summarized in Table 8-2 and the wall location is shown in Figure 8-1.

Table 8-2. Proposed Caltrans Standard Type 1 Retaining Wall Pertinent Data

Retaining Wall	Location (A-Line Stations)		Length (feet)	Height (feet)	Bottom of Footing Elevation (feet)	Backfill Slope Condition	Pertinent Borings
	Begin Wall	End Wall					
399	399+96.19 90.50 Lt	400+73.99 88.98 Lt	80	6 to 10	+104.63 to +108.13	Level	A-11-348 A-11-349 A-11-350

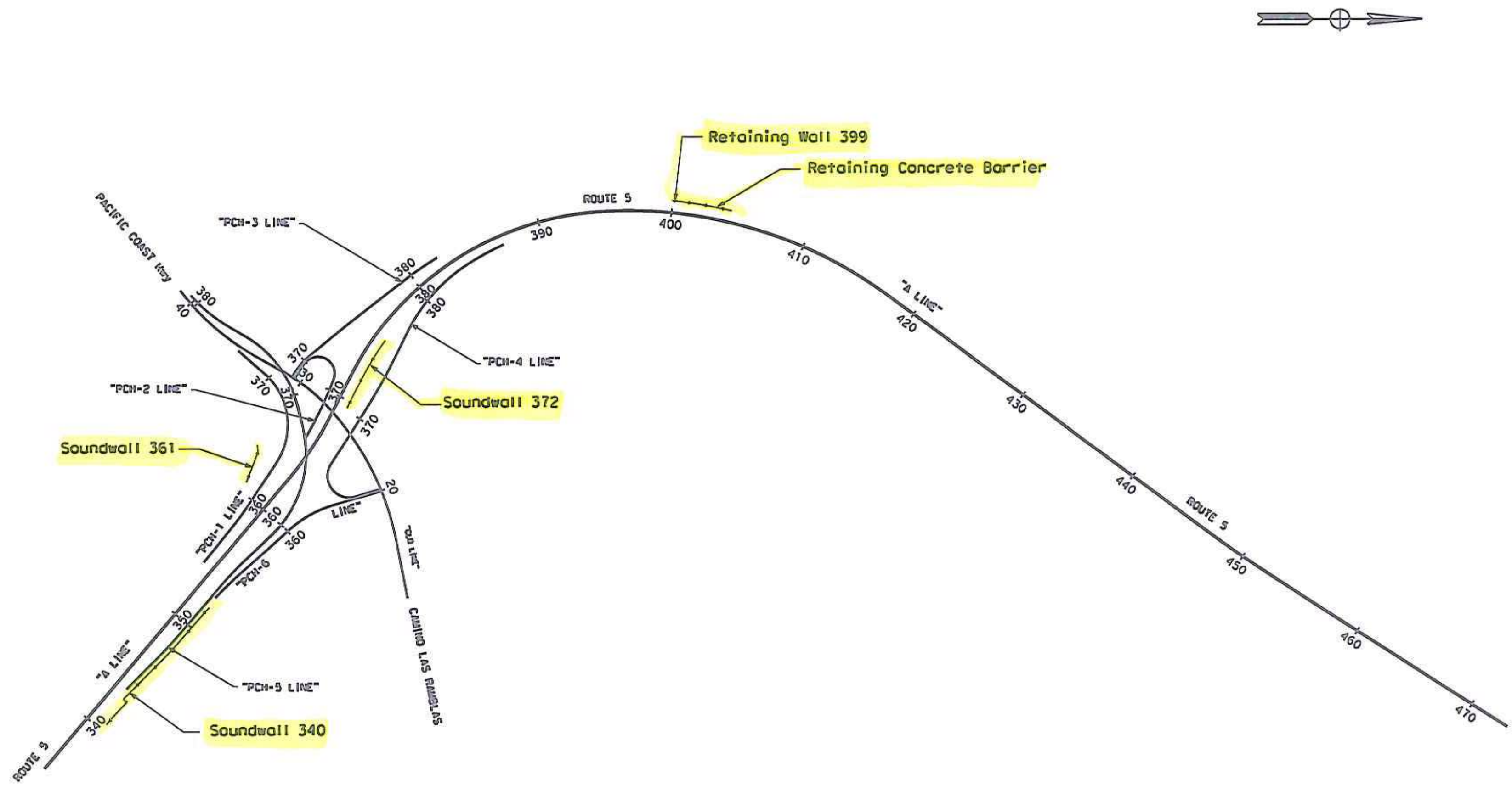
Based on the recent field investigation, this retaining wall is underlain by lean clay, sandy lean clay and lean clay with sand followed by Capistrano bedrock. The idealized soil profile and design strength parameters for retaining wall foundation design are presented in Table 8-3.

Table 8-3. Idealized Soil Profile and Strength Parameters for Wall 399

Approximate Elevation (feet)	Predominant Soil Type	Equivalent SPT Blowcounts* (blows/foot)	Total Unit Weight (pcf)	Undrained Shear Strength (psf)
+110 to +45	Lean Clay, Sandy lean Clay and Lean Clay with Sand	5 to (16) Average = 10	115	2000
+45 to +12	Bedrock – Silt and Lean Clay	29 to >50 Average = 72	120	3000

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

Material shear strength of the first soil layer is the average of the undrained shear strength values from triaxial UU-tests. As presented in Table 7-1, an undrained shear strength value of 3,000 psf was selected for the bedrock.



Earth Mechanics, Inc. Geotechnical & Earthquake Engineering	INTERSTATE 5 HOV IMPROVEMENT PROJECT (SEGMENT 3) PCH TO SAN JUAN CREEK ROAD	Walls Location Map
	Project No.: 11-137 / Date: 03-08-2012	Figure 8-1

Soil settlement calculations were performed for the wall foundations using the footing bottom elevation shown on the wall plans, the Service Limit State bearing stress and footing width as shown in the Caltrans Standard Plans (Caltrans, 2010b). The settlement calculations are presented in Appendix C. One foot of overexcavation and recompaction are recommended for the soils below the footing bottom.

Soil bearing capacity calculations were also performed using the footing bottom elevation shown on the wall plans and the recommended overexcavation and recompaction depths. Based on these calculations included in Appendix C, the factored gross nominal bearing resistance for Strength Limit State exceeds the bearing stresses for the Strength Limit State presented in the Caltrans Standard Plans (Caltrans, 2010b).

The horizontal limits of the overexcavation should begin one foot from each edge of the footing bottom and extending downward at a 45-degree imaginary plane until the plane intersects the recommended minimum overexcavation depth. In some areas, the 45-degree imaginary plane could intersect temporary shoring. In this case only, the horizontal limit of the overexcavation should begin from the edge of the footing bottom and extending out a minimum of 1 foot and down until the plane intersects the recommended minimum overexcavation depth. 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.

Minimum footing embedment and offset (from a slope face) should conform to Section 4.4.5.1 of the Caltrans Bridge Design Specifications (2003b).

Global stability analyses were performed at the maximum wall height location. The soil strength parameters in Table 8-3 were used in the static and pseudo-static analysis and the results are presented in Appendix C. The factor-of-safety for a deep-seated failure is greater than 1.5 under the static condition with a 2-foot soil surcharge to represent traffic loading. Stability analysis for the pseudo-static condition was performed using a seismic coefficient equal to 0.133. Analysis indicates that the factor-of-safety is greater than 1.1 under the pseudo-static condition.

8.4.3 Retaining Concrete Barrier

A Retaining Concrete Barrier is proposed to accommodate the I-5 Southbound widening just north of Wall 399. The Retaining Concrete Barrier is Caltrans Standard Concrete Barrier Type 60C (Caltrans Standard Plan A76A, 2010b), and this barrier will retain up to 3-feet of soil. The Retaining Concrete Barrier pertinent data is presented in Table 8-4 and the barrier location is shown in Figure 8-1.

Table 8-4. Proposed Retaining Concrete Barrier Pertinent Data

Retaining Concrete Barrier Type	Approximate Location (A-Line Stations)		Length (feet)	Retained Height (feet)	Bottom of Barrier Elevation (feet)	Backfill Slope Condition	Pertinent Borings
	Begin Wall	End Wall					
Standard Plan A76A Type 60C	400+83 89 Lt	404+48 89 Lt	365	3	+107 to +111	Level	A-11-350 CPT-11-351

LRFD Service Limit State I and Strength Limit State foundation loads for the Retaining Concrete Barrier were provided by the structural engineers. The Extreme Event Limit State foundation loads were not provided by the structural engineers. The LRFD Service Limit State I and Strength Limit State bearing pressures are 0.97 and 1.29 ksf, respectively.

Soil settlement calculations were performed for the retaining concrete barrier using the bottom elevations shown on the retaining concrete barrier plans, the Service Limit State bearing stress, and the bottom barrier width of 2 feet. The settlement calculations are presented in Appendix C. One foot of overexcavation and recompaction are recommended for the soils below the barrier bottom.

Soil bearing capacity calculations were also performed using the bottom elevations shown on the retaining concrete barrier plans, and the recommended overexcavation and recompaction depth. Based on these calculations included in Appendix C, the factored gross nominal bearing resistance for Strength Limit State exceeds the bearing stresses for the Strength Limit State.

The horizontal limits of the overexcavation should begin one foot from each edge of the bottom of barrier and extending downward at a 45-degree imaginary plane until the plane intersects the recommended minimum overexcavation depth. 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.

8.4.4 Lateral Earth Pressures

For Wall 399 and Retaining Concrete Barrier, static active lateral earth pressure of 36 psf per foot of depth is recommended for a free draining, level and compacted backfill. 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.

8.4.5 Retaining Wall Backfill and Backdrain

Onsite soils are not suitable for use as wall backfill for Wall 399 and Retaining Concrete Barrier. Materials placed behind Wall 399 should be Structure Backfill per Section 19-3.0E (Caltrans, 2010c).

The Retaining Concrete Barrier will be backfilled by roadway pavement materials; the roadway pavement materials are suitable for use as backfill.

Backfill should be compacted in accordance with Section 19-5 of the Caltrans Standard Specifications (2010c). 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 Method 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 walls in order to avoid damaging the walls due to large lateral earth pressures.

For Wall 399, backdrains should be installed behind the wall to relieve hydrostatic pressure. Backdrains should be constructed in accordance with Bridge Detail 3-1 on Sheet B0-3 per Caltrans Standard Plans (2010b) or the geocomposite drain alternative per Section 6 of the Caltrans Bridge Design Details (1992).

8.5 SOUNDWALLS

Three Soundwalls (SW 340, SW 361 and SW 372) are proposed for this project. The soundwall pertinent data is presented in Table 8-5 and the wall locations are shown in Figure 8-1.

Table 8-5. Proposed Soundwalls Pertinent Data

SW	Soundwall Type	Approx. Location		Length (feet)	Approx. Final Grade / Bottom of Footing Elevations (feet)	Barrier Height / Retained Height (feet)	Soundwall Height	Pertinent Borings
		Begin Wall	End Wall					
340	SW on Pile Cap	340+55 138 Rt	342+73 111 Rt	254	+194 to +206	-	16' – 0"	A-11-302 A-11-303 A-11-304 A-11-305 CPT-11-306
	SW on Barrier Type 736S	342+73 111 Rt	344+17 123 Rt	144	+195 to +196	-	16' – 4"	
	SW on Barrier Type 736SV	344+17 123 Rt	345+69 137 Rt	152	+196 to +197	2 to 4	16' – 4"	
	SW on RW Type 1SWB	345+69 137 Rt	346+25 141 Rt	56	+191.25	6	16' – 4"	
	SW on Barrier Type 736SV	346+25 141 Rt	351+94 160 Rt	568	+195 to +196	3 and 4	16' – 4"	
361	SW on Pile Cap	10+00 (Wall LOL)	12+88 (Wall LOL)	288	+226 to +230	-	10' – 0"	A-11-313 A-11-314
372	SW on Barrier Type 736S	369+50 83 Rt	375+27 81 Rt	564	+154 to +175	-	14' – 4"	A-11-328 A-11-337

*Stations and offsets are approximate and based on I-5 Mainline (A-Line) unless indicated.

All the soundwalls on Pile Cap and Barrier Types 736S/736SV are supported on 16-inch diameter Cast-In-Drilled-Hole (CIDH) piles per Caltrans Standard Plans (Caltrans, 2010b).

Soundwall 340 on Retaining Wall Type 1SWB is supported on a spread footing. The footing width is 6.75 feet. In addition, the Retaining Wall Type 1SWB is located above an existing triple

5 feet by 4 feet Reinforced Concrete Box (RCB). The crown elevation of the RCB is +181.11 feet and the bottom of footing elevation of the retaining wall is +191.25 feet.

Based on the recent field investigation, these soundwalls are underlain by lean clay, sandy lean clay and lean clay with sand followed by Capistrano bedrock. The idealized soil profiles and design strength parameters for soundwall design are presented in Table 8-3.

Table 8-6. Idealized Soil Profile and Soil Strength Parameters for Soundwalls

Approximate Elevation (feet)	Predominant Soil Type	Equivalent SPT Blowcounts* (blows/foot)	Total Unit Weight (pcf)	Friction Angle (degree)	Undrained Shear Strength (psf)
		Soundwall 340			
+206 to +185	Silty Sand, Sand and Lean Clay	3 to (>50) Average = 23	115	32	100
+185 to +160	Lean Clay and Fat Clay	8 to (31) Average = 16	115	-	2000
+160 to +145	Bedrock – Lean Clay and Silt	24 to (>50) Average = 70	120	-	3000
		Soundwall 361			
+230 to +222	Silty Sand and Clayey Sand	(6) to (16) Average = 11	115	32	100
+222 to +190	Silt and Lean Clay	15 to (39) Average = 24	115	-	2000
+190 to +175	Silty Sand and Sand with Silt	27 to (>50) Average = 39	120	30	240
		Soundwall 372			
+175 to +140	Lean Clay and Silty Sand	(11) to (24) Average = 20	115	-	2000
+140 to +75	Bedrock –Elastic Silt and Fat Clay	31 to (>50) Average = 70	120	-	3000

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

Material shear strength parameters for coarse-grained and fine-grained soils were selected based on the correlations with SPT blowcounts (Lam and Martin, 1986), CPT data (Robertson and Campanella, 1989) and laboratory test results. Shear strength parameters are the lower-bound values from correlations with SPT blowcounts, correlation with CPT data, direct shear tests or triaxial UU-test results. As presented in Table 7-1, an undrained shear strength value of 3,000 psf was selected for the bedrock.

8.5.1 Soundwalls on Pile Cap and Concrete Barrier Types 736S/736SV

According to the project plans, the Soundwalls on Pile Cap and Concrete Barrier Types 736S/736SV are based on the Caltrans Standard Plans (Caltrans, 2010b). The Standard Plans for Soundwalls can only be used for cohesionless material with internal friction angles of 25, 30 and 35 degrees for Case-1 ground condition and 30 and 35 degrees for Case-2 ground condition. Case-1 and Case-2 ground conditions are defined in the Caltrans Standard Plans for soundwalls

(Caltrans, 2010b). Case-1 ground line is level on both sides of the soundwall, and Case-2 ground line is level on one side and sloping at a gradient of 2H:1V or flatter on the other side.

Since onsite soils are predominantly cohesive, lateral pile analyses were performed to determine the minimum pile length and pile spacing.

Lateral pile analyses were performed using the computer program LPILE (Ensoft, 2010) and the soil strength parameters presented in Table 8-6. Based on the information provided by the structural engineers, two load cases (Group 2 and Group 3) were used for foundation design of the soundwalls. The Group-2 load case includes dead load, wind load, lateral earth pressure and surcharge load. The Group-3 load case includes dead load, lateral earth pressure and seismic dead load. For Soundwall on Concrete Barrier Type 736S, there is no lateral earth pressure. The resulting load demands as provided by the structural engineers are presented in Table 8-7.

Portions of SW 340 on Barrier Type 736S is crossing existing utility lines between Wall LOL Stations 19+00 and 20+00. These portions of SW 340 on Barrier Type 736S are proposed to be supported on 24-inch diameter CIDH piles. All the other soundwalls are proposed to be supported on 16-inch diameter CIDH piles.

Table 8-7. Foundation Loads for Soundwalls on Pile Cap and Concrete Barrier Types 736S/736SV

SW	Soundwall Type	Soundwall Height	Load Cases	Pile-Head Axial Load (kips/ft)	Pile-Head Shear (kips/ft)	Pile-Head Moment (kip-ft/ft)
340	SW on Pile Cap (16-inch CIDH)	16' – 0"	Group 2	1.85	0.41	3.17
			Group 3	1.85	0.82	5.80
	SW on Barrier Type 736S (16-inch CIDH)	16' – 4"	Group 2	1.88	0.46	3.61
			Group 3	1.88	0.69	5.18
	SW on Barrier Type 736S (24-inch CIDH)	16' – 4"	Group 2	3.39	1.48	6.88
			Group 3	3.39	1.39	8.74
	SW on Barrier Type 736SV (16-inch CIDH)	16' – 4"	Group 2	2.64	1.02	6.32
			Group 3	2.64	1.65	8.02
361	SW on Pile Cap (16-inch CIDH)	10' – 0"	Group 2	1.32	0.28	1.40
			Group 3	1.32	0.61	2.63
372	SW on Barrier Type 736S (16-inch CIDH)	14' – 4"	Group 2	1.51	0.41	2.80
			Group 3	1.51	0.62	4.05

Results of the lateral pile analysis are presented in Table 8-8 for the two ground conditions.

Table 8-8. Lateral Pile Solutions for Soundwalls on Pile Cap and Concrete Barrier Types 736S/736SV

SW	SW Type	Load Case	Ground Condition	Max. Pile Spacing (feet)	Min. Pile Length (feet)	Pile Head Shear (kips)	Max. Shear (kips)	Max. Moment (kip-inch)	Depth to Max. Moment from Pile Top (feet)	Pile Head Deflection (inch)
340	SW on Pile Cap (16-inch CIDH)	Group 2	Case 1	9D	12.0	4.9	7.5	511	1.7	0.25
			Case 2	6D	14.0	3.3	5.3	350	2.2	0.25
		Group 3	Case 1	9D	12.0	9.8	14.3	982	2.3	0.63
			Case 2	6D	14.0	6.6	10.2	678	2.7	0.60
	SW on Barrier Type 736S (16-inch CIDH)	Group 2	Case 1	7.5D	13.0	4.6	7.2	489	1.8	0.25
			Case 2	4D	13.0	2.5	4.2	279	2.8	0.25
		Group 3	Case 1	7.5D	13.0	6.9	10.6	722	2.2	0.44
			Case 2	4D	13.0	3.7	6.4	416	3.4	0.43
	SW on Barrier Type 736S (24-inch CIDH)	Group 2	Case 1	5D	15.0	14.8	14.8	1175	3.5	0.24
			Case 2	4D	18.0	11.8	15.3	1140	5.8	0.46
		Group 3	Case 1	5D	15.0	13.9	16.5	1354	3.3	0.27
			Case 2	4D	18.0	11.1	16.4	1263	5.4	0.50
	SW on Barrier Type 736SV (16-inch CIDH)	Group 2	Case 1	4D	14.0	5.4	7.0	467	1.8	0.24
			Case 2	3D	14.0	4.1	5.3	374	2.5	0.25
		Group 3	Case 1	4D	14.0	8.8	9.8	647	2.4	0.41
			Case 2	3D	14.0	6.6	7.7	528	3.1	0.45
361	SW on Pile Cap (16-inch CIDH)	Group 2	Case 1	12D	10.0	4.5	5.0	321	2.0	0.15
			Case 2	11.25D	16.0	4.2	5.6	325	2.9	0.25
		Group 3	Case 1	12D	10.0	9.8	12.0	664	2.6	0.47
			Case 2	11.25D	16.0	9.2	11.6	689	3.7	0.68
372	SW on Barrier Type 736S (16-inch CIDH)	Group 2	Case 1	12D	12.0	6.6	11.4	598	1.6	0.22
			Case 2	9D	12.0	4.9	8.7	457	1.8	0.22
		Group 3	Case 1	12D	12.0	9.9	15.5	889	1.8	0.42
			Case 2	9D	12.0	7.4	11.9	683	2.2	0.41

The structural designers can use the results presented in Table 8-8 to determine whether or not the Caltrans Standard Plan Sheets B15-3 through B15-8 are applicable for this project.

8.5.2 Soundwall on Retaining Wall Type 1SWB

Portion of the Soundwall 340 is a Caltrans Standard Soundwall on Retaining Wall Type 1SWB (Caltrans, 2010b). The Retaining Wall Type 1SWB is supported on spread footings.

Per Caltrans policy, the LRFD Service Limit State, Strength Limit State and Extreme Event Limit State load combinations are used for the foundation design. Foundation data and foundation loads for Soundwall on Retaining Wall Type 1SWB were provided by the structural designers and presented in the Table 8-9.

Table 8-9. Spread Footing Foundation Design Loads for Soundwall on Retaining Wall Type 1SWB

Wall Height (feet)	Footing Width (feet)	Minimum Embedment Depth (feet)	Foundation Loads (ksf)		
			Service Limit State II	Strength Limit State	Extreme Event Limit State
6	6.75	3.00	2.10	2.90	7.60

Spread footing design recommendations are presented in Table 8-10. The design data presented in Table 8-10 are valid provided overexcavation and recompaction are performed for soils immediately below the footings. The recommended minimum overexcavation depths are also included in Table 8-10.

The minimum embedment and offset (from a slope face) of the footings should be based on Section 4.4.5.1 of the Caltrans BDS (2003b).

Table 8-10. Foundation Design Recommendations for Soundwall on Retaining Wall Type 1SWB on Spread Footings

Wall Height (feet)	Footing Width (feet)	Bottom of Footing El. (feet)	Min. Footing Embed. Depth (feet)	LRFD			Recommended Minimum Overexcavation Depth (feet)
				Service	Strength	Extreme Event	
				Permissible Net Contact Stress (ksf)	Factored Gross Nominal Bearing Resistance (ksf)	Factored Gross Nominal Bearing Resistance (ksf)	
6	6.75	+191.25	3.00	2.5	7.3	16.2	1

The horizontal limits of the overexcavation should begin one foot from each edge of the footing bottom and extending downward at a 45-degree imaginary plane until the plane intersects the recommended minimum excavation depth presented in Table 8-10. In some areas, the 45-degree imaginary plane would intersect temporary shoring. In this case only, the horizontal limit of the overexcavation should begin from the edge of the footing bottom and extending out a minimum of 1 foot and down until the plane intersects the recommended excavation depths. Caltrans Structure Backfill should be used for backfilling. The backfill material should be compacted to 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.

Onsite soils are not suitable for use as wall backfill for Soundwall on Retaining Wall Type 1SWB. Materials placed behind the retaining wall should be Structure Backfill per Section 19-3.0E (Caltrans, 2010c). Backfill should be compacted in accordance with Section 19-5 of the Caltrans Standard Specifications (2010c). 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 Method 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 walls in order to avoid damaging the walls due to large lateral earth pressures.

Backdrains should be installed behind the wall to relieve hydrostatic pressure. Backdrains should be constructed in accordance with Bridge Detail 3-1 on Sheet B0-3 per Caltrans Standard Plans (2010b) or the geocomposite drain alternative per Section 6 of the Caltrans Bridge Design Details (1992).

8.6 CULVERT FOUNDATIONS

Based on current plans, RCP culverts with diameters of 18-, 24-, and 36-inch are proposed at various locations. There are no special foundation preparation and design requirements for the proposed RCP culverts. The foundation and bedding requirements presented in the Caltrans Standard Plans (2010b) and Standard Specifications (2010c) are sufficient for these proposed culverts.

Also, based on current plans, fills are proposed throughout the project area; impact of fills at least 5 feet in height should be evaluated for drainage structures that fall within a 45-degree projection below the footprint of fills. Furthermore, Soundwall 340 is proposed on top of an existing triple 5 feet by 4 feet RCB located between I-5 Mainline Stations 345+69 and 346+25. Impact of Soundwall 340 bearing pressure on the RCB should be evaluated. The vertical stress on the top slab of the RCB can be determined by distributing the soundwall footing pressure downward using the 60-degree rule-of-thumb. This rule-of-thumb consists of an imaginary line extending downward from each outside edge of the soundwall footing at a gradient of 2V:1H until the line intersects the RCB. For example, if the soundwall footing width is 5 feet and the distance between the footing bottom and top slab of the RCB is 10 feet, the vertical stress on the top slab of the RCB can be approximated by multiply the footing pressure by a ratio of 5/15. In addition, all existing culverts that will remain in-place should be inspected, then rehabilitated or replaced (if necessary).

8.7 SOIL CORROSIVITY

Twenty-two soil samples were tested to determine minimum resistivity, pH, soluble sulfate content, and soluble chloride content using procedures described in California Test Methods 417, 422, and 643, respectively. The test results are presented in Table 8-11. Minimum resistivities ranged from 220 to 2,200 ohm-cm. The pH ranged from 6.0 to 8.4. The soluble sulfate measurements ranged from 120 to 6,400 parts per million (ppm), and the soluble chloride ranged from 112 to 3,970 ppm.

Table 8-11. Soil Corrosion Test Results

Boring	Location (A-Line Stations)		Sample Depth (feet)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Soluble Sulfate Content (ppm)	Soluble Chloride Content (ppm)
	Station (feet)	Offset (feet)						
A-11-302	340+41	151 Rt	2.5	CL	250	7.4	280	2,005
A-11-303	340+56	92 Rt	0-5.0	SM	1,796	7.9	256	240
A-11-304	345+39	112 Rt	2.5	CL	480	8.1	800	644
HA-11-308	358+49	214 Rt	0-5.0	SC	294	7.5	3,161	300
A-11-310	354+96	152 Lt	10.0	ML	220	7.2	240	3,970
A-11-312	362+65	131 Lt	5.0	CL	1,000	8.4	560	516
A-11-313	359+58	166 Lt	10.0	ML	380	6.0	400	881
A-11-316	361+81	87 Rt	5.0	CL	310	7.2	5,060	1,187
A-11-317	364+78	104 Lt	5.0	CL to SP-SM	840	7.3	500	296
A-11-319	366+17	98 Lt	10.0	CL	560	6.7	2,600	266
A-11-320	364+25	79 Rt	5.0	MH	300	6.8	1,160	1,699
A-11-322	365+30	101 Rt	0-5.0	SC	500	7.5	1,574	1,200
A-11-323	367+63	91 Lt	5.0	SM	2,200	7.7	150	204
A-11-324	367+14	89 Rt	10.0	CL	360	7.4	4,040	463
A-11-326	368+42	77 Rt	5.0	CL	900	7.6	120	112
A-11-327	370+20	115 Lt	0-5.0	CL	1,115	7.5	446	180
A-11-327	370+20	115 Lt	35.0	CL	420	7.7	550	350
HA-11-341	381+83	90 Rt	0-5.0	ML	2,070	7.3	168	180
A-11-342	382+22	114 Lt	0-5	SM	1,055	7.3	1,720	120
A-11-348	397+27	74 Lt	20.0	CL	270	7.6	6,400	649
A-11-349	398+69	102 Lt	5.0	CL	760	8.1	680	392
A-11-349	398+69	102 Lt	50.0	CL	510	8.0	1,800	341

Based on the Caltrans Corrosion Guidelines (2003c), soils are considered corrosive if the pH is 5.5 or less, or the sulfate concentration is 2,000 ppm or greater, or the chloride concentration is 500 ppm or greater. Based on the test results and the Caltrans criteria, the on-site soils are considered to be 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 "Corrosive soil above MLLW level with chloride concentration between 500 and 5,000 ppm". 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 2,000 to 15,000". Additional corrosion protection requirements for concrete structural members are presented in Section 8.22 of the Caltrans BDS (Caltrans, 2003a).

9.0 MATERIAL SOURCES

The Materials Report (EMI, 2012g) provides a list of potential commercial suppliers for sand, gravel, aggregate base, and concrete. Pulverizing existing pavement, during construction, might be performed. Pulverized AC material (or Reclaimed Asphalt Pavement – RAP) can be used as aggregate base (AB) provided the material meets the quality requirements of AB specified in Section 26 (Aggregate Bases) of the Caltrans Standard Specifications (2010c). Pulverized AC material may also be used within certain Hot Mix Asphalt (HMA) mixes, such as HMA Type A, if pulverized AC material and its processing complies with Section 39 (Hot Mix Asphalt) of Caltrans Standard Specifications (2010c).

10.0 MATERIAL DISPOSAL

Based on information provided by the civil designer, the project requires cuts and fills to achieve proposed grades. Furthermore, as presented in the Materials Report (EMI, 2012g), 4-feet of the overexcavation is recommended for pavement subgrade. On-site soils are anticipated to be expansive and may contain aerially deposited lead. Disposal of onsite soils containing aerially deposited lead shall confirm to Caltrans requirements.

11.0 CONSTRUCTION CONSIDERATIONS

11.1 CONSTRUCTION ADVISORIES

All work should be performed in accordance with the Caltrans Standard Specifications (2010c) except as indicated in the Special Provisions prepared for the project improvements.

On-site subsurface materials are primarily compressible and expansive clayey soils. Overexcavation and recompaction of the onsite soils are required for this project and contractor should be prepared to handle this type of materials, particularly under a wet condition.

11.2 CONSTRUCTION CONSIDERATIONS THAT INFLUENCE DESIGN

No construction considerations influenced the analyses or design of proposed improvements described in this report.

11.3 CONSTRUCTION CONSIDERATIONS THAT INFLUENCE SPECIFICATIONS

Special Provisions that are influenced by geotechnical factors include shoring requirements, dewatering requirements, and corrosion protection specifications. Temporary construction slopes, bracing, and shoring should be made the contractor's responsibility. Also, specific activities for dewatering including preparing a dewatering plan are the responsibility of the contractor.

Complete removal of compressible surficial materials including topsoil, loose or soft alluvium, and unsuitable fill is required prior to fill placement. A minimum overexcavation and recompaction of 18 inches is recommended within all areas to receive compacted fill, and the overexcavation depth is measured from the existing grade. The overexcavation should extend horizontally a minimum distance of 18 inches from edges of new fills. In cut areas, the minimum overexcavation and recompaction depth is 12 inches below finish grade if the difference between the finished and existing grade is 2 feet or less, and overexcavation is not required if the difference between the finished and existing grade is greater than 2 feet. Unless specified on the contract plans or specifications, the excavated soils (in both fill and cut areas) may be reused as compacted fill.

Overexcavations should be performed beneath all new embankments and structures. Bottoms of overexcavations should be firm and unyielding prior to placing compacted fill. Remedial excavations, in areas where new pavement is proposed, are addressed in the Materials report (EMI, 2012g).

11.4 CONSTRUCTION MONITORING AND INSTRUMENTATION

Qualified geotechnical personnel should perform inspections and materials testing during the following stages of construction:

- Grading operations, including excavations and placement of compacted fill.
- Excavations for footings.
- Excavations for drainage structures and utility trenches.
- Removal or support of buried structures or utilities.

- Shoring installation, if necessary.
- When any unusual conditions are encountered.

Temporary backcuts and shoring, if used during earthwork or construction, should be monitored by the contractor and qualified geotechnical personnel.

11.5 HAZARDOUS WASTE CONSIDERATIONS

Evaluating the presence and concentration of hazardous contaminants except Aerially Deposited Lead (ADL) is beyond EMI's scope of work and therefore is not addressed herein. A separate report will be prepared to address the ADL (EMI, 2010h). Except ADL, EMI has assumed that no other hazardous or contaminated materials exist within the project area; therefore, no hazardous waste considerations are provided. If for any reason hazardous or toxic materials are believed to exist within the project area, an environmental consultant should be retained.

11.6 DIFFERING SITE CONDITIONS

The analyses and recommendations contained in this report are based on the data obtained from the review of available geologic references, our site reconnaissance, soil borings, CPTs and laboratory testing. The soil boring logs and CPT soundings indicate subsurface conditions only at specific locations and times performed, and only to the depths penetrated. Borings and CPTs do not necessarily reflect subsurface variations that may exist between such locations. If variations in subsurface conditions from those described in this report are noted during construction, the recommendations presented in this report must be re-evaluated. In the event that any changes in the nature, design, or location of the proposed facilities occur, the conclusions and recommendations in this report should not be considered valid unless the changes are reviewed and conclusions of this report are verified in writing by the designer. Therefore, upon encountering any site conditions that are perceived to differ materially from those conditions anticipated in this report, the resident engineer should contact the geotechnical designer immediately.

12.0 RECOMMENDATIONS AND SPECIFICATIONS

Below are recommendations for the proposed improvement project. If designers have questions or disagree with the recommendations, or, if variations in subsurface conditions from those described herein are observed during construction, the geotechnical designer should be contacted to verify the applicability of the recommendations. Recommendations in this report may require modification based on actual subsurface conditions encountered during construction.

- Minor to significant amounts of earthwork, depending on the area of improvement, are expected. In areas where compacted fill will be placed, complete removal of compressible surficial materials including topsoil, loose or soft alluvium or fill soil, dry or saturated soil, or otherwise unsuitable material is required prior to fill placement. A minimum overexcavation and recompaction of 18 inches is recommended within all areas to receive compacted fill, and the overexcavation depth is measured from the existing grade. The overexcavation should extend horizontally a minimum distance of 18 inches from edges of new fills. In cut areas, the minimum overexcavation and recompaction depth is 12 inches if the difference between the finished and existing grade is 2 feet or less, and overexcavation is not required if the difference between the finished and existing grade is greater than 2 feet. In cut areas, the overexcavation depth is measured from the finished grade. Unless specified on the contract plans or specifications, the excavated soils (in both fill and cut areas) may be reused as compacted fill. Actual depths and extent of remedial removals should be determined in the field by qualified geotechnical personnel during earthwork activities. Remedial excavations, in areas where new pavement is proposed are addressed in the Materials report (EMI, 2012g). Overexcavation and recompaction for the construction of Caltrans Standard earth retaining structures are presented in Section 8.4, and for Caltrans Standard soundwalls are presented in Section 8.5.
- All overexcavations should be observed by qualified geotechnical personnel to verify that firm and unyielding bottoms are exposed. Overexcavated areas should be cleaned of loose soils and debris and should be observed to be firm and unyielding before receiving fill.
- Fills placed against sloping ground shall be keyed and benched into the sloping ground and placed as specified in Section 19-6 of the Caltrans Standard Specifications (Caltrans, 2010c).
- The site is underlain by wet, saturated and compressible clayey soil. Fill embankments will undergo settlement during construction. The maximum calculated settlement due to the approach embankment construction is presented in foundation reports (EMI, 2012a through 2012f). Any "hard" improvements, such as buried pipes, pavements, and other above-ground structures should not be constructed until remaining settlement is determined to be within tolerable limits. It is likely that contractor will be required to re-establish the finish subgrade surface prior to constructing pavement.
- On-site soils affected by the proposed construction are expected to have medium to very high expansion potential. On-site native soil and existing fill material within the project area should not be considered for use as backfill for walls. Additional laboratory tests may be required during earthwork operations to verify the expansion potential of soils used in specific areas.
- To mitigate possible uneven movements of buried drainage devices, we recommend surrounding the bottom of these drainage lines using Sand Bedding. Limits and

configurations of the Sand Bedding should conform to Caltrans Standard Plan Sheet A62D (2010b). Material properties of the Sand Bedding should conform to Caltrans Standard Specifications, Section 19-3.02E(2) (2010c).

- Based on the project civil plans, gradient of embankment slope faces are 2H:1V or flatter. For this condition and to minimize slope erosion and surficial instability, the outer 4 feet of soil, measured perpendicular from the slope face, should compose of soil possessing a minimum friction angle of 20 degrees and a minimum cohesion of 225 psf. This material should be properly keyed and benched into the sloping ground. Majority of the onsite soils, if placed in accordance with the contract plans and specifications, should be able to meet the above minimum friction angle and minimum cohesion requirements.
- In general, the erosion potential at this site is expected to be minor considering the provisions for site drainage, slope planting and other measures required by Caltrans. In order to minimize potential erosion, all finish slopes should be planted as soon as practical after grading. Local areas may require additional measures at the discretion of the geotechnical personnel present on-site during construction.
- Design of temporary construction slopes and shoring is the contractor's responsibility during construction.
- It shall be made the contractor's responsibility to control subsurface and surface water. The contractor should dewater the site as necessary, if groundwater is encountered. Water should not be allowed to stand in any excavations. If excavations become flooded, at least the bottom 8 inches of soil should be removed and replaced, and re-compacted to a minimum 95 percent relative compaction. Additional removals may be required at the discretion of the resident engineer or geotechnical personnel.

13.0 LIMITATIONS

This report is intended for the use of OCTA, TRC and Caltrans for design and construction of the I-5 HOV Improvement Project (Segment 3) between I-5 Mainline Stations 340+00 and 407+50. 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 herein are applicable to the specific design elements and locations which are the subject of this report. Data, opinions, and recommendations herein 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 is not responsible for construction means, methods, techniques, sequences, or procedures, or for safety precautions or programs in connection with the construction. EMI is not responsible for the acts or omissions of the Contractor, or any other person performing any construction, or for the failure of any worker to carry out construction in accordance with the Final construction drawings and specifications.

Services performed by EMI were 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.

14.0 REFERENCES

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Appendix A

Log of Test Boring Sheets

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION	CONSULTANT FUNCTIONAL SUPERVISOR	CALCULATED-DESIGNED BY	J. FANG	REVISED BY
Caltrans	LINO CHEANG	CHECKED BY	S. PIRATHIVIRAJ	DATE REVISED

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	5	6.2/8.7		

REGISTERED ENGINEER — DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

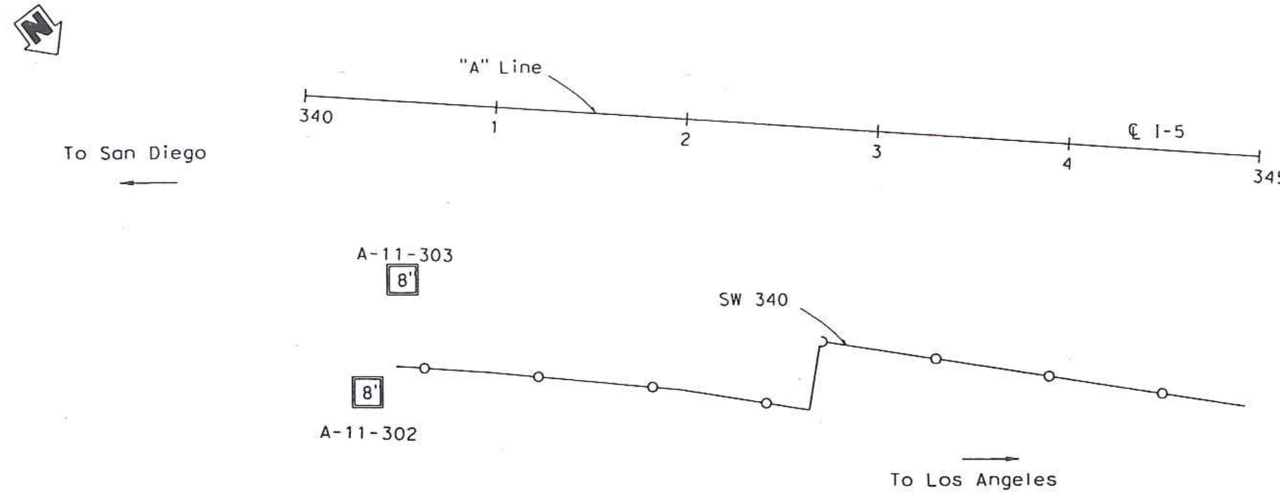
REGISTERED PROFESSIONAL ENGINEER — S. PIRATHIVIRAJ — NO. GE 2963 — EXP. 12-31-13 — GEOTECHNICAL — STATE OF CALIFORNIA

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

ORANGE COUNTY
TRANSPORTATION AUTHORITY
550 S. MAIN STREET
ORANGE, CA 92863-1584

BENCH MARK

Designation: F-785 Elev = 75.717 feet (NAVD 88); 73.413 feet (NGVD29) Described by OCS 2003 - Found 3¼" US Coast and Geodectic Survey Bronzed Disk Stamped "F 785 1946", Set in the Top of a Concrete Bridge Abutment. Monument is Located in the Southwesterly Corner of the Atchinso\Topeka and Santa Fe Railway Overcrossing of San Mateo Creek, 69 ft. Northerly Along the Railway from the Centerline of the Interstate 5 Freeway Southbound Onramp at Camino Capistrano Prolonged to the West and 150± Westerly from the Centerline of Camino Capistrano. Monument is Set 2.0 ft. below the Tracks.



PLAN

1" = 50'

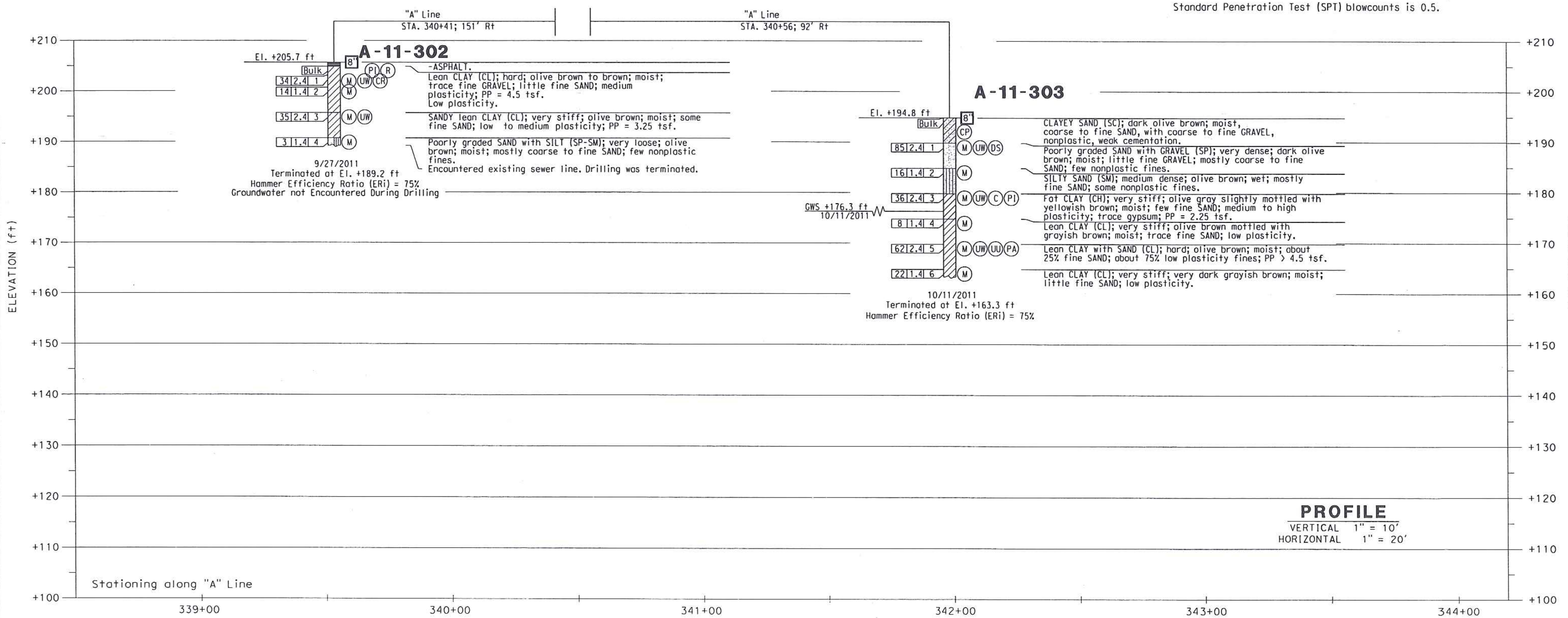
NOTES:

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

(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" Modified California Ring Sampler blowcounts to Standard Penetration Test (SPT) blowcounts is 0.5.



PROFILE

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

LOG OF TEST BORINGS NO. 1
SW NO. 340

SCALE AS SHOWN

SW-7

LAST REVISION DATE PLOTTED => $DATE

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION	CONSULTANT FUNCTIONAL SUPERVISOR	CALCULATED-DESIGNED BY	J. FANG	REVISED BY
Caltrans	LINO CHEANG	CHECKED BY	S. PIRATHIVIRAJ	DATE REVISED

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	5	6.2/8.7		

REGISTERED ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — S. PIRATHIVIRAJ — No. GE 2963 — Exp. 12-31-13 — GEOTECHNICAL — STATE OF CALIFORNIA

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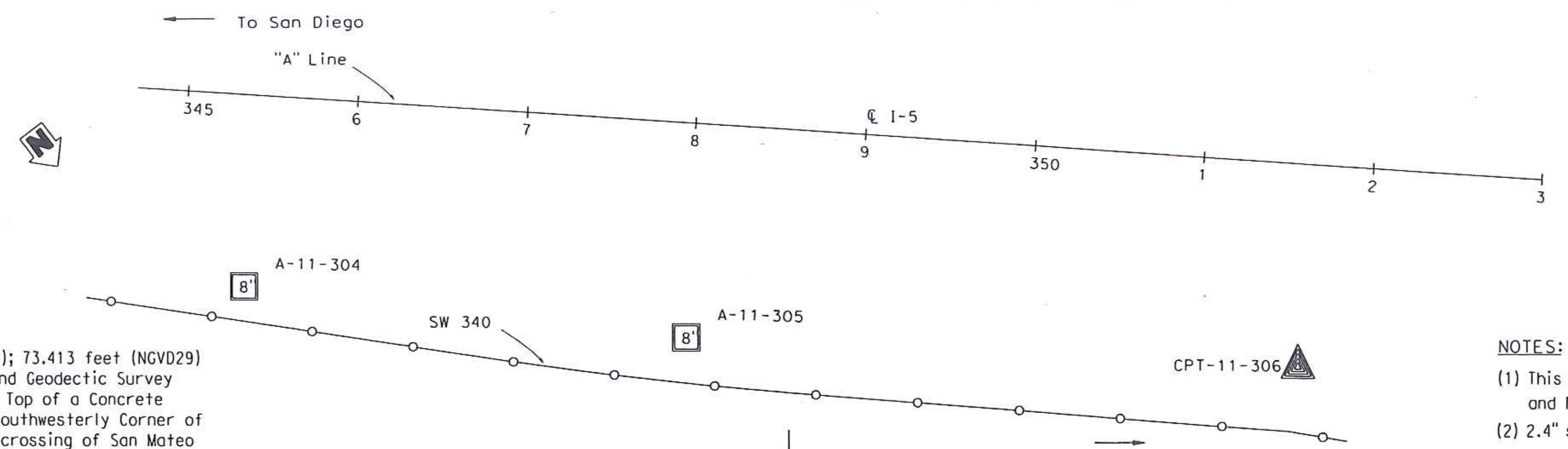
FOUNTAIN VALLEY, CA 92708

ORANGE COUNTY
TRANSPORTATION AUTHORITY
550 S. MAIN STREET
ORANGE, CA 92863-1584



PLAN

1" = 50'

BENCH MARK

Designation: F-785 Elev = 75.717 feet (NAVD 88); 73.413 feet (NGVD29) Described by OCS 2003 - Found 3¾" US Coast and Geodectic Survey Bronzed Disk Stamped "F 785 1946", Set in the Top of a Concrete Bridge Abutment. Monument is Located in the Southwesterly Corner of the Atchinso\Topeka and Santa Fe Railway Overcrossing of San Mateo Creek, 69 ft. Northerly Along the Railway from the Centerline of the Interstate 5 Freeway Southbound Onramp at Camino Capistrano Prolonged to the West and 150± Westerly from the Centerline of Camino Capistrano. Monument is Set 2.0 ft. below the Tracks.

NOTES:

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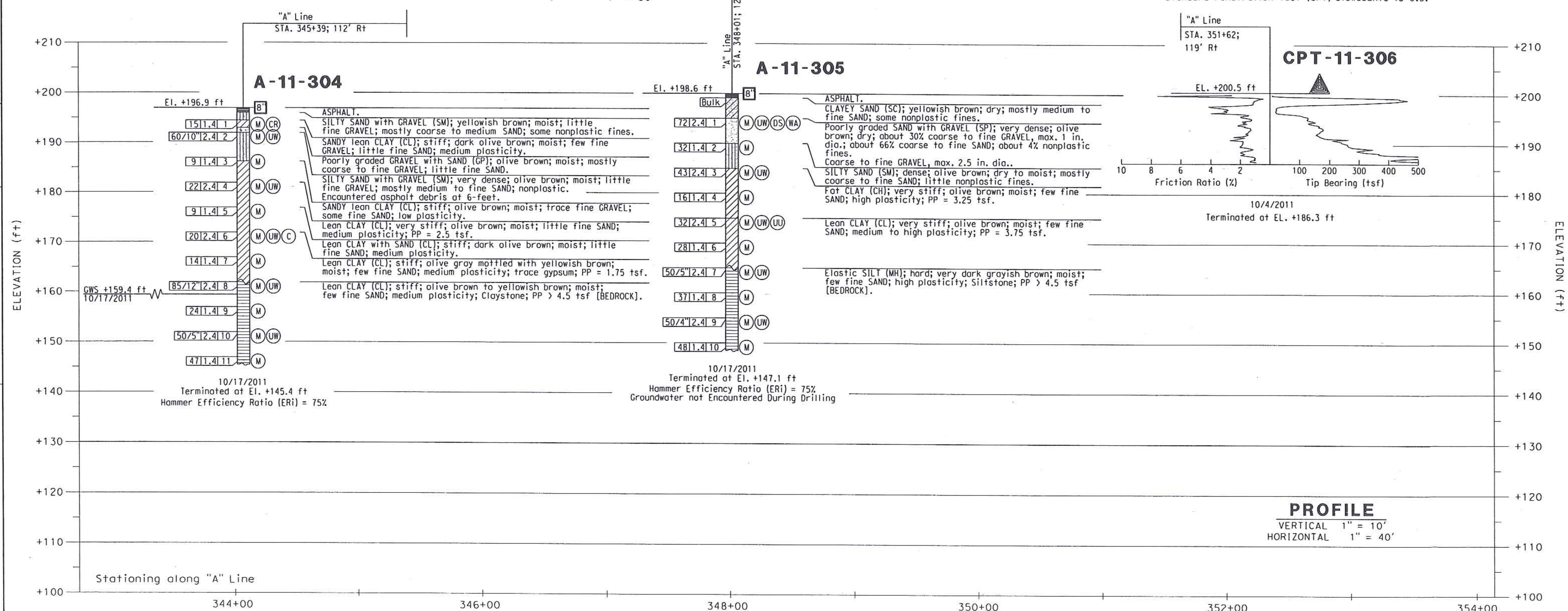
(3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive sampler.

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



PROFILE

VERTICAL 1" = 10'
HORIZONTAL 1" = 40'

LOG OF TEST BORINGS NO. 2
SW NO. 340

SCALE AS SHOWN

SW-8

LAST REVISION | DATE PLOTTED => $DATE

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION	CONSULTANT FUNCTIONAL SUPERVISOR	CALCULATED-DESIGNED BY	J. FANG	REVISED BY
Caltrans	LINO CHEANG	CHECKED BY	S. PIRATHIVIRAJ	DATE REVISED

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	5	6.2/8.7		

REGISTERED ENGINEER   DATE

PLANS APPROVAL DATE

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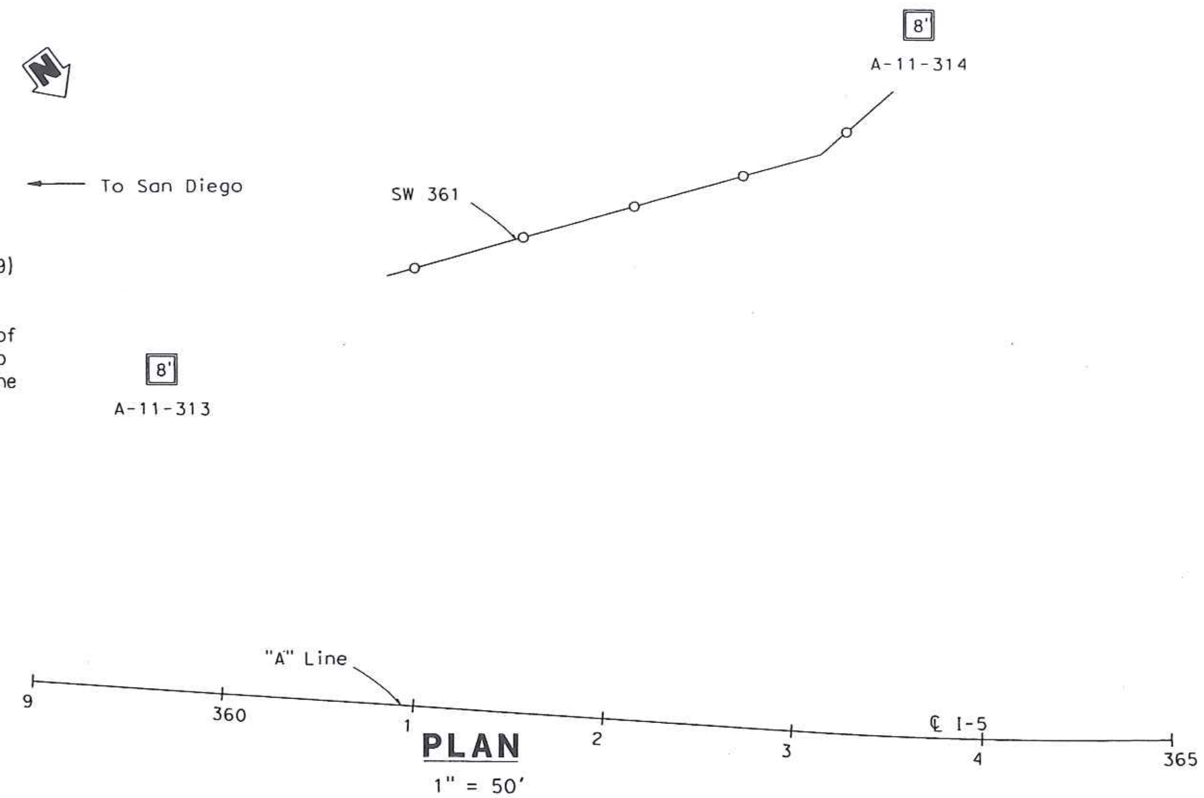
REGISTERED PROFESSIONAL ENGINEER — S. PIRATHIVIRAJ — NO. GE 2963 — EXP. 12-31-13 — GEOTECHNICAL — STATE OF CALIFORNIA

EARTH MECHANICS, INC. 17800 NEWHOPE STREET, SUITE B FOUNTAIN VALLEY, CA 92708	ORANGE COUNTY TRANSPORTATION AUTHORITY 550 S. MAIN STREET ORANGE, CA 92863-1584

BENCH MARK

Designation: F-785 Elev = 75.717 feet (NAVD 88); 73.413 feet (NGVD29) Described by OCS 2003 - Found 3¾" US Coast and Geodetic Survey Bronzed Disk Stamped "F 785 1946", Set in the Top of a Concrete Bridge Abutment. Monument is Located in the Southwesterly Corner of the Atchinso\Topeka and Santa Fe Railway Overcrossing of San Mateo Creek, 69 ft. Northerly Along the Railway from the Centerline of the Interstate 5 Freeway Southbound Onramp at Camino Capistrano Prolonged to the West and 150± Westerly from the Centerline of Camino Capistrano. Monument is Set 2.0 ft. below the Tracks.



PLAN
1" = 50'

NOTES:

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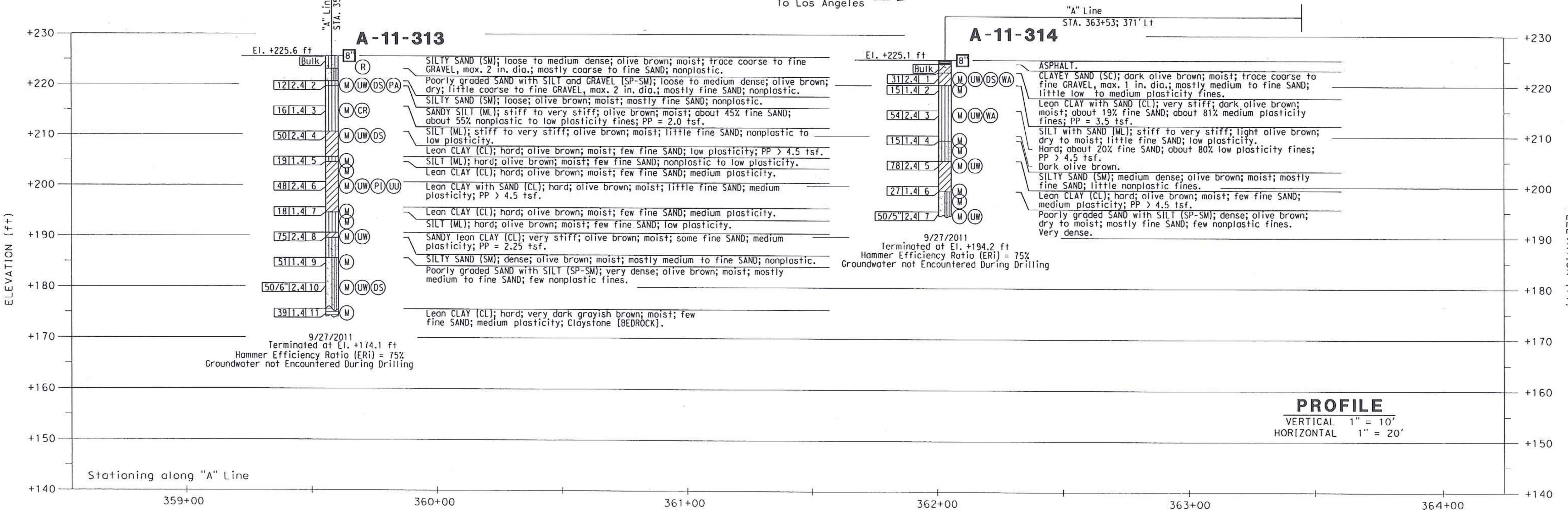

PROFILE
VERTICAL 1" = 10'
HORIZONTAL 1" = 20'

LOG OF TEST BORINGS NO. 1
SW NO. 361

SCALE AS SHOWN

SW-11

LAST REVISION | DATE PLOTTED => $DATE

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION	CONSULTANT FUNCTIONAL SUPERVISOR	CALCULATED-DESIGNED BY	J. FANG	REVISED BY
Caltrans	LINO CHEANG	CHECKED BY	S. PIRATHIVIRAJ	DATE REVISED

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	5	6.2/8.7		

REGISTERED ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER S. PIRATHIVIRAJ No. GE 2963 Exp. 12-31-13 GEOTECHNICAL STATE OF CALIFORNIA

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BENCH MARK

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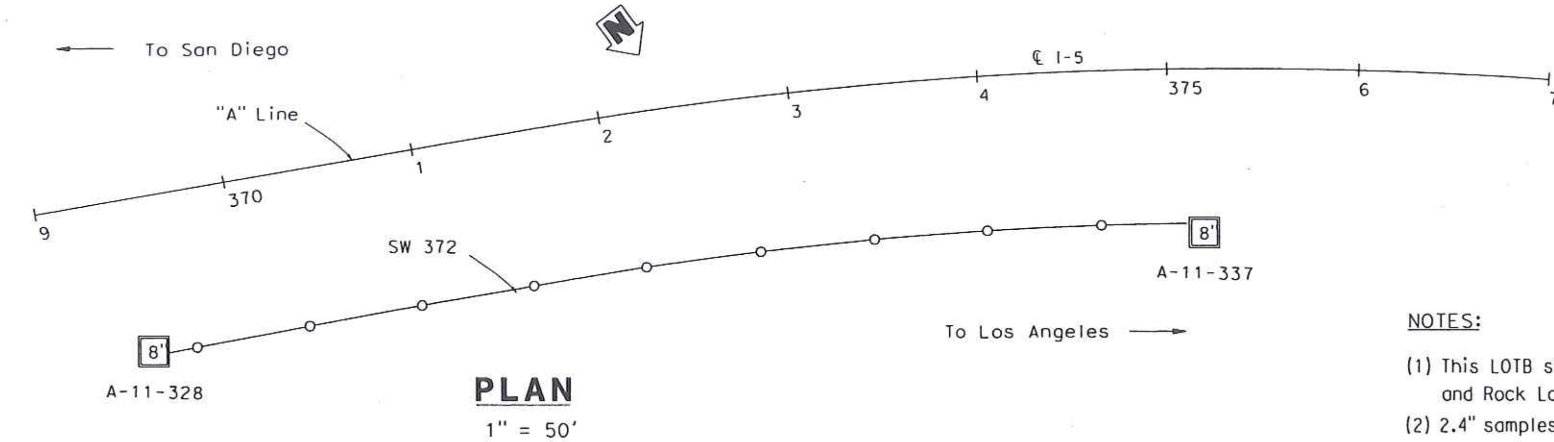

PLAN
1" = 50'

NOTES:

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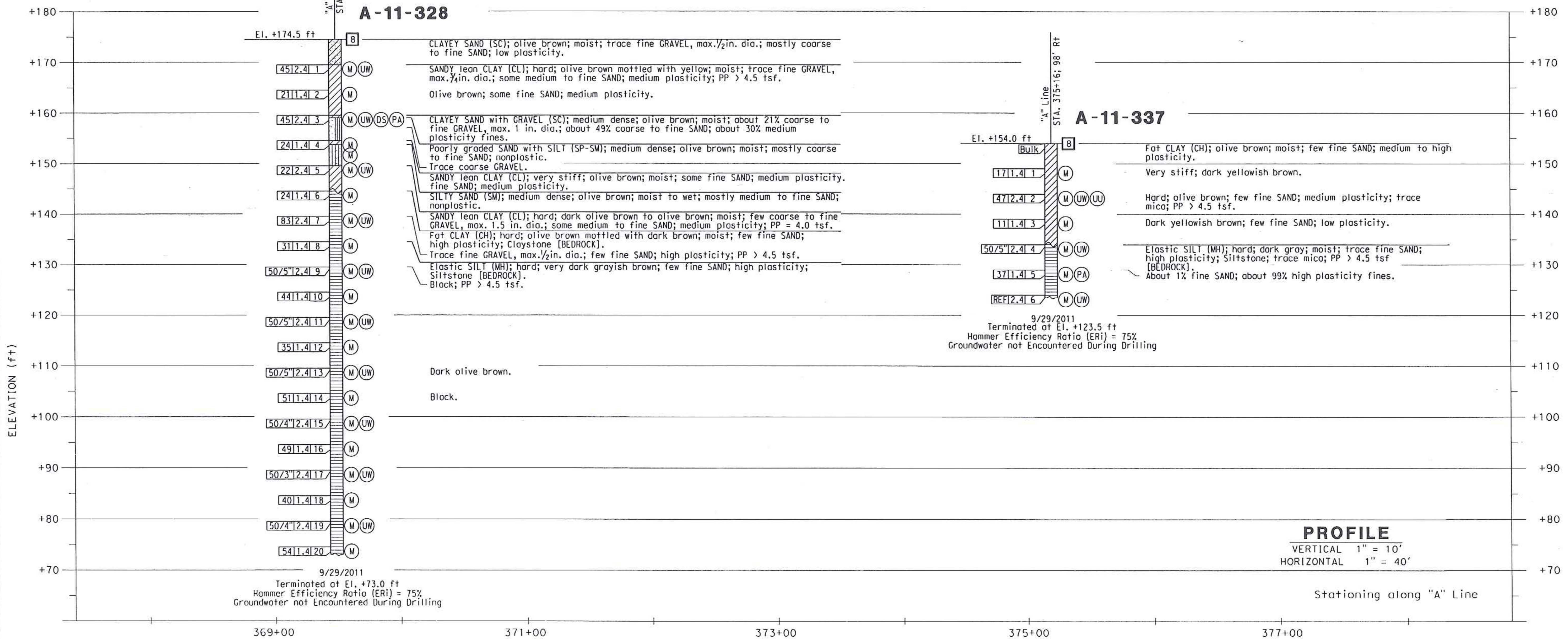

PROFILE
VERTICAL 1" = 10'
HORIZONTAL 1" = 40'

LOG OF TEST BORINGS NO. 1
SW NO. 372

SCALE AS SHOWN

SW-15

LAST REVISION DATE PLOTTED => $DATE

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION	CONSULTANT FUNCTIONAL SUPERVISOR	CALCULATED-DESIGNED BY	J. FANG	REVISED BY
Caltrans	LINO CHEANG	CHECKED BY	S. PIRATHIVIRAJ	DATE REVISED

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	5	6.2/8.7		

REGISTERED ENGINEER DATE

PLANS APPROVAL DATE

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ORANGE COUNTY TRANSPORTATION AUTHORITY
550 S. MAIN STREET
ORANGE, CA 92863-1584

BENCH MARK

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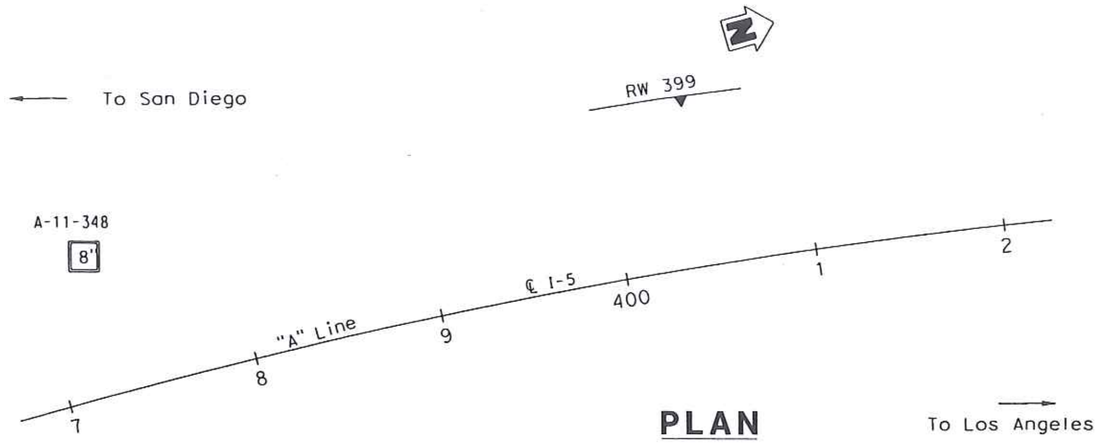

PLAN
1" = 50'

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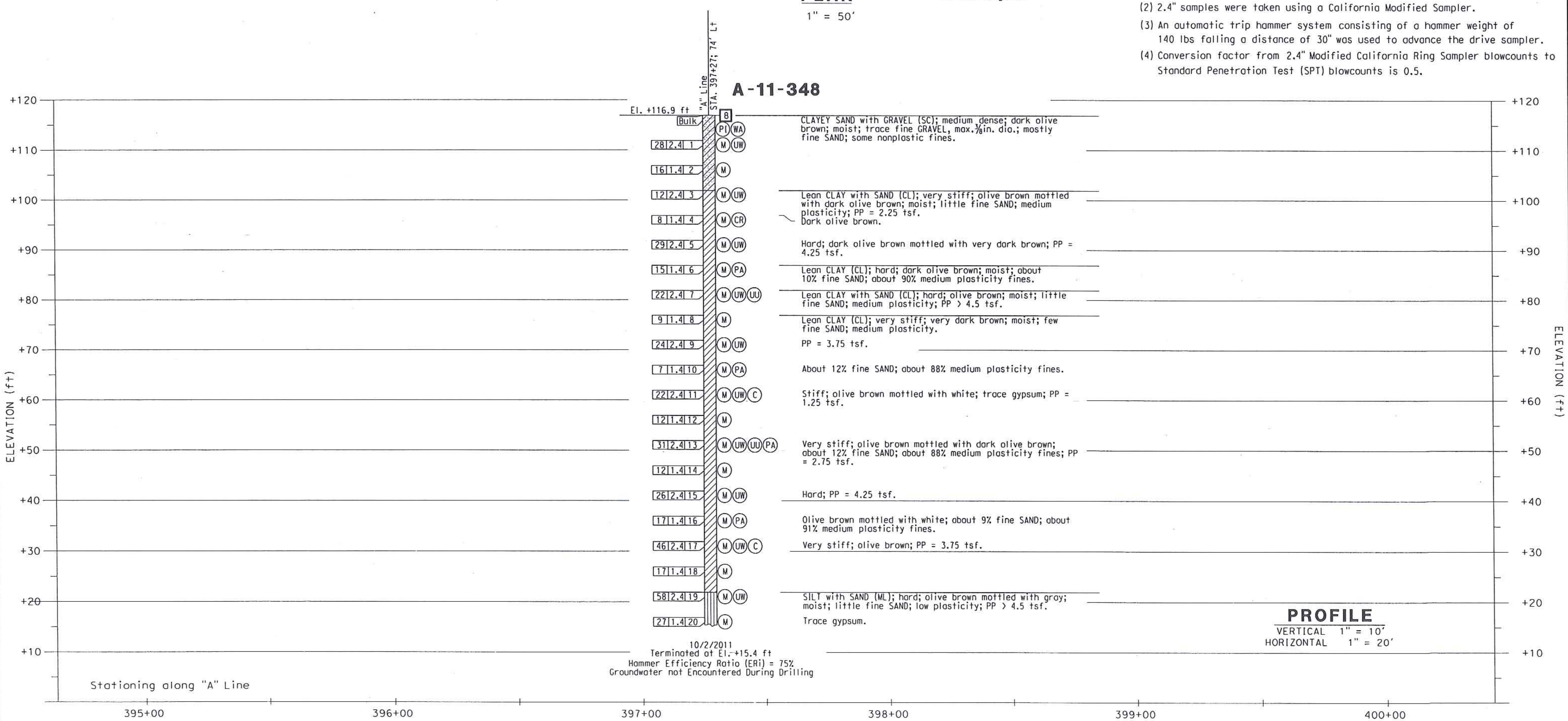

PROFILE
VERTICAL 1" = 10'
HORIZONTAL 1" = 20'

LOG OF TEST BORINGS NO. 1
RW NO. 399

SCALE AS SHOWN

R-2

LAST REVISION DATE PLOTTED => $DATE

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	5	6.2/8.7		

REGISTERED ENGINEER — DATE

PLANS APPROVAL DATE

(Seal: REGISTERED PROFESSIONAL ENGINEER — S. PIRATHIVIRAJ — NO. GE 2963 — EXP. 12-31-13 — GEOTECHNICAL — STATE OF CALIFORNIA)

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17800 NEWHOPE STREET,
SUITE B
FOUNTAIN VALLEY, CA 92708

ORANGE COUNTY
TRANSPORTATION AUTHORITY
550 S. MAIN STREET
ORANGE, CA 92863-1584

NOTES:

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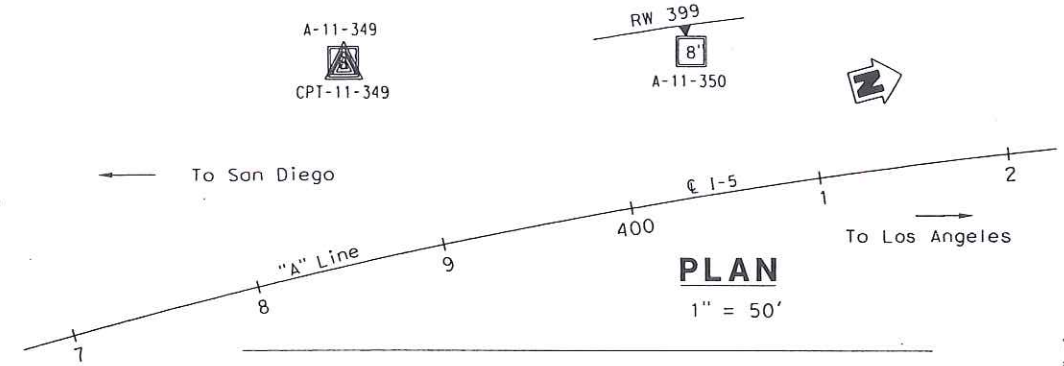

BENCH MARK

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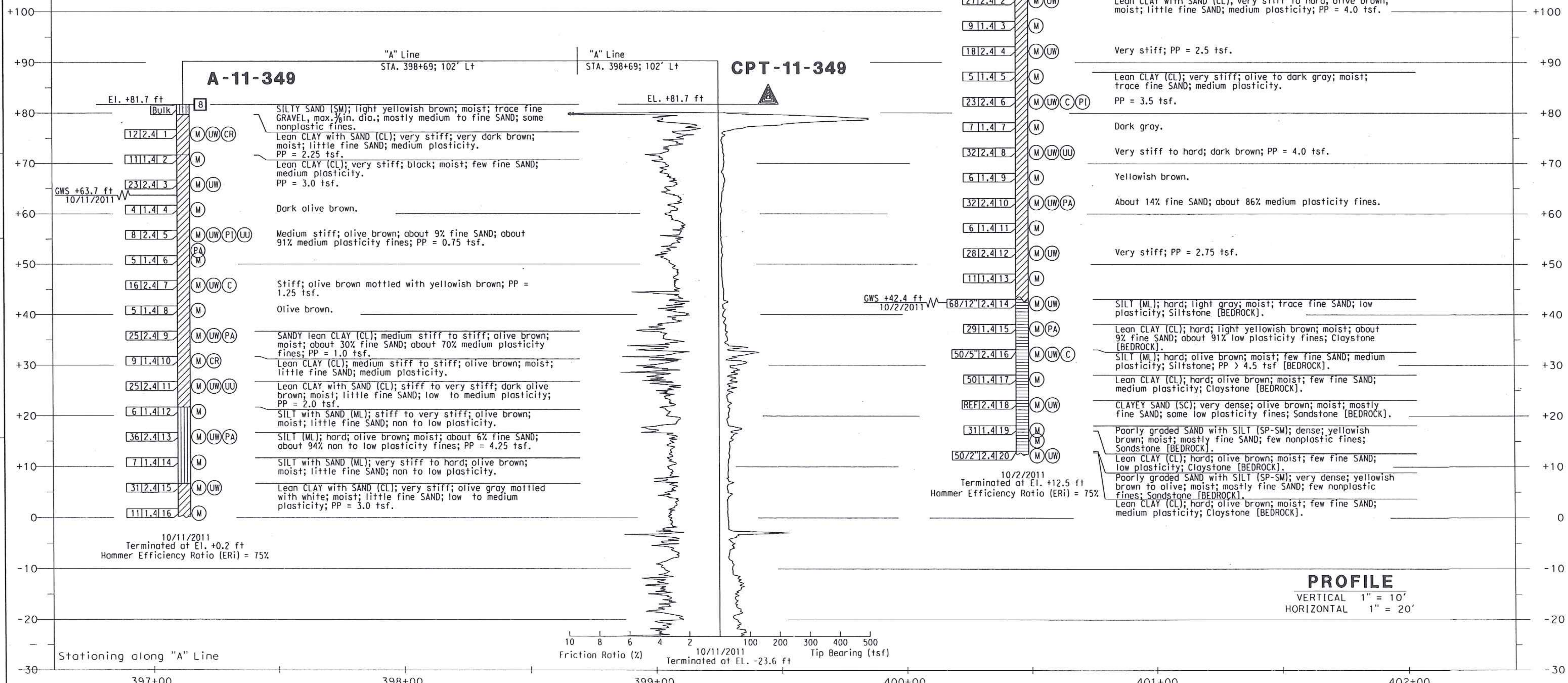

LOG OF TEST BORINGS NO. 2
RW NO. 399

SCALE AS SHOWN

R-3

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION	CONSULTANT FUNCTIONAL SUPERVISOR	CALCULATED-DESIGNED BY	J. FANG	REVISED BY
Caltrans®	LINO CHEANG	CHECKED BY	S. PIRATHIVIRAJ	DATE REVISED

LAST REVISION | DATE PLOTTED => $DATE

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	ORA	5	6.2/8.7		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

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

ORANGE COUNTY TRANSPORTATION AUTHORITY
550 S. MAIN STREET
ORANGE, CA 92863-1584

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

BENCH MARK

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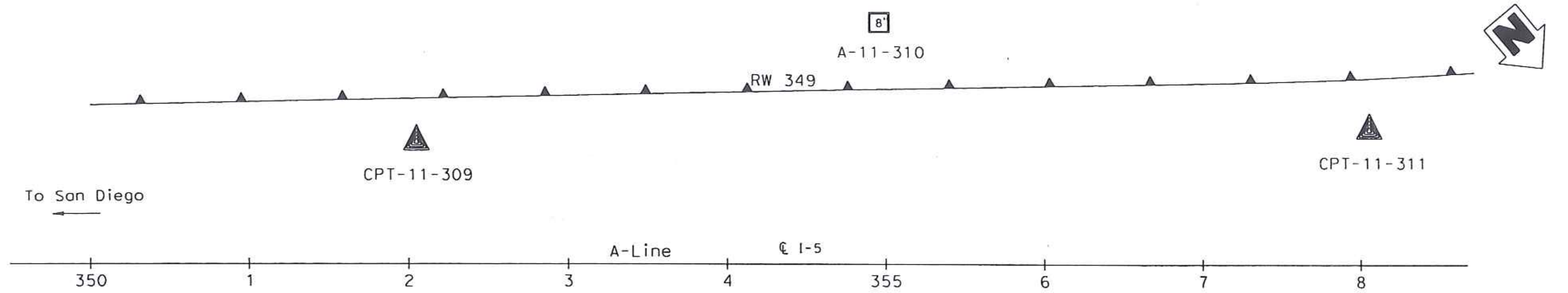

PLAN

1" = 50'

NOTES:

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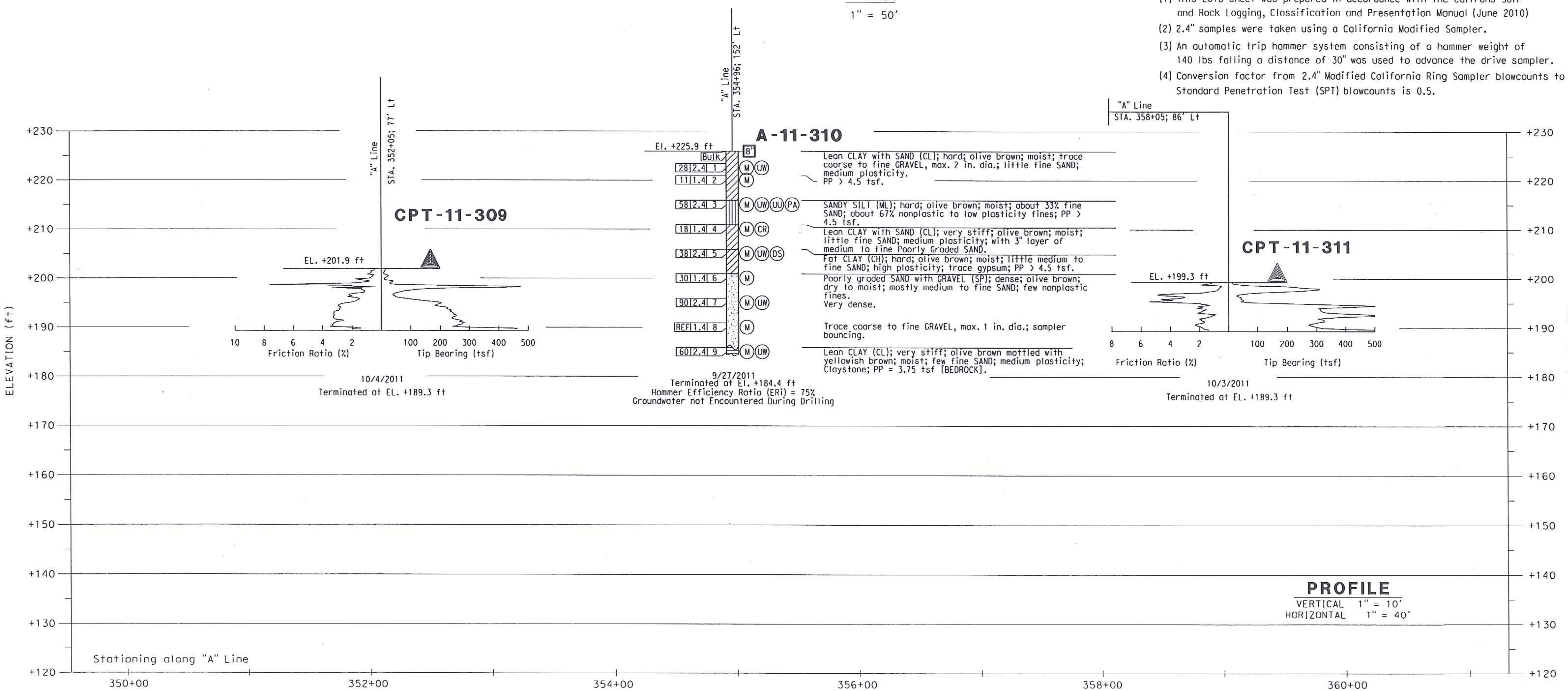


PROFILE

VERTICAL 1" = 10'
HORIZONTAL 1" = 40'

DESIGN OVERSIGHT	DRAWN BY	J. Fong	R. Jie	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	S. PIRATHIVIRAJ	BRIDGE NO.	RETAINING WALL NO. 349
SIGN OFF DATE	CHECKED BY	S. PIRATHIVIRAJ	FIELD INVESTIGATION BY: DATE: 9/2011, 10/2011		PROJECT ENGINEER	-	LOG OF TEST BORINGS 1 OF 2
						POST MILES 6.62	

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

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 2998
PROJECT NUMBER & PHASE: 12000202791

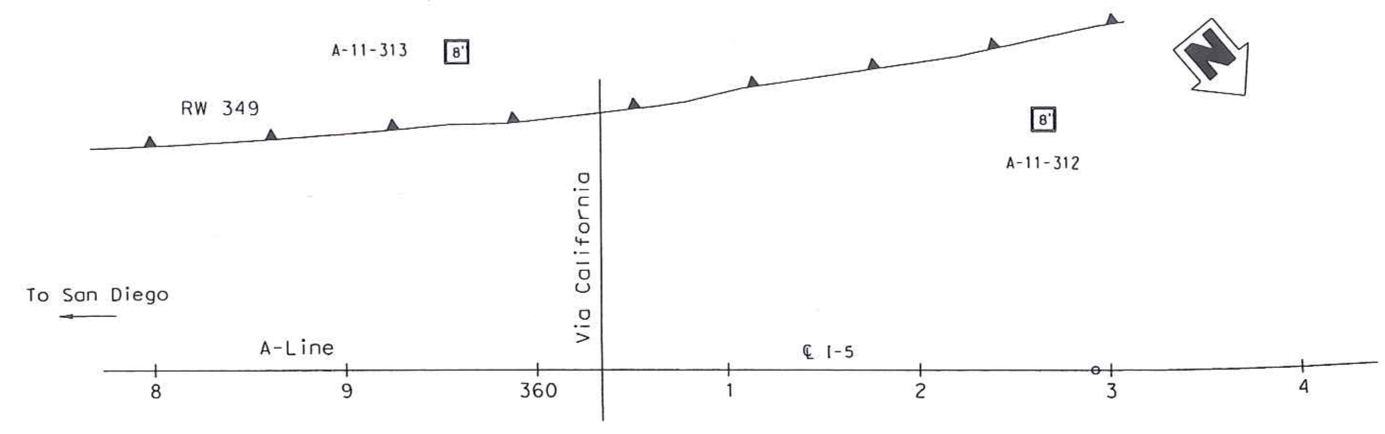
DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET | OF

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

BENCH MARK

Designation: F-785 Elev = 75.717 feet (NAVD 88); 73.413 feet (NGVD29) Described by OCS 2003 - Found 3¼" US Coast and Geodetic Survey Bronzed Disk Stamped "F 785 1946", Set in the Top of a Concrete Bridge Abutment. Monument is Located in the Southwesterly Corner of the Atchinso\Topeka and Santa Fe Railway Overcrossing of San Mateo Creek, 69 ft. Northerly Along the Railway from the Centerline of the Interstate 5 Freeway Southbound Onramp at Camino Capistrano Prolonged to the West and 150± Westerly from the Centerline of Camino Capistrano. Monument is Set 2.0 ft. below the Tracks.



PLAN
1" = 50'

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
12	ORA	5	6.2/8.7		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

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

ORANGE COUNTY TRANSPORTATION AUTHORITY
550 S. MAIN STREET
ORANGE, CA 92863-1584

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

NOTES:

(1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2010)
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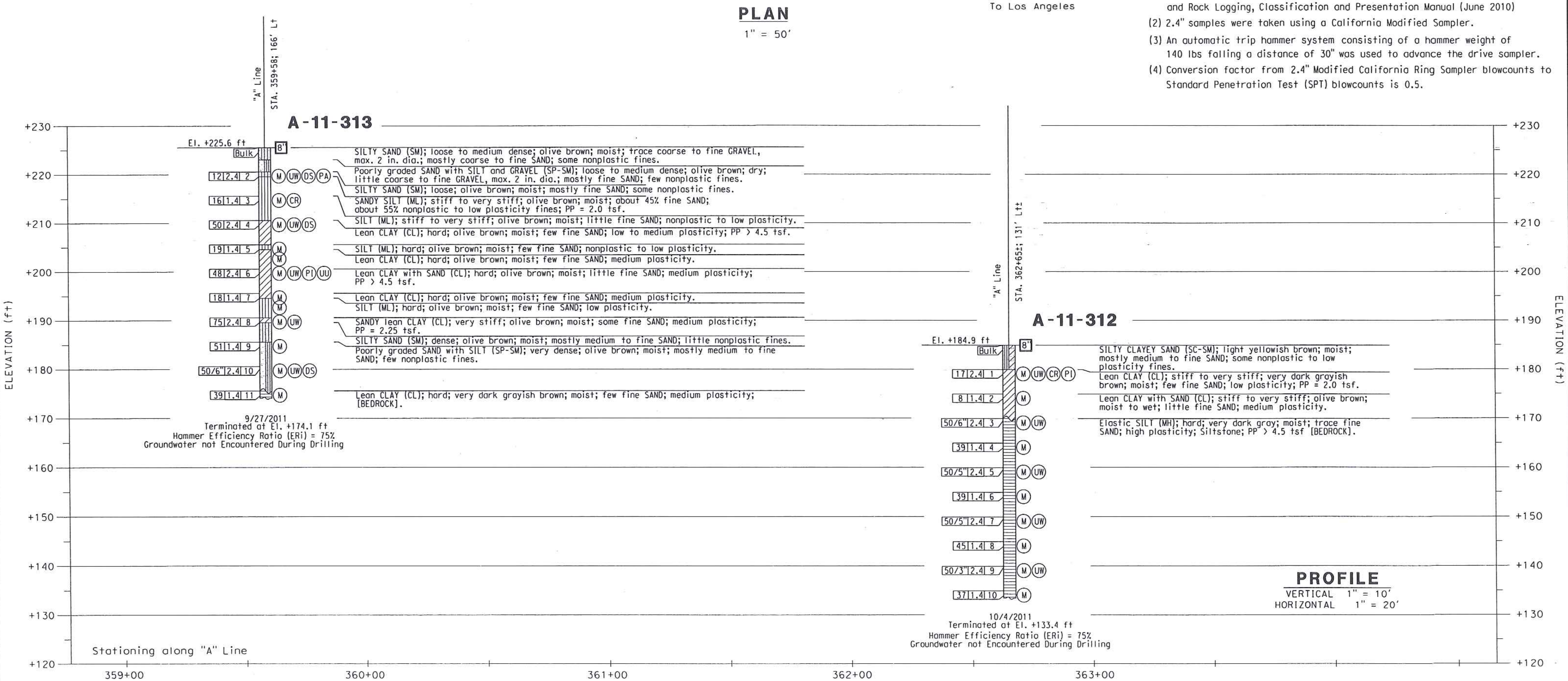
(3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive sampler.
(4) Conversion factor from 2.4" Modified California Ring Sampler blowcounts to Standard Penetration Test (SPT) blowcounts is 0.5.



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

DESIGN OVERSIGHT	DRAWN BY	J. Fang	R. Jie	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	S. PIRATHIVIRAJ PROJECT ENGINEER	BRIDGE NO. -	RETAINING WALL NO. 349
SIGN OFF DATE	CHECKED BY	S. PIRATHIVIRAJ	FIELD INVESTIGATION BY: DATE: 9/2011, 10/2011			POST MILES 6.62	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: 2998
PROJECT NUMBER & PHASE: 12000202791

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET | OF

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

BENCH MARK

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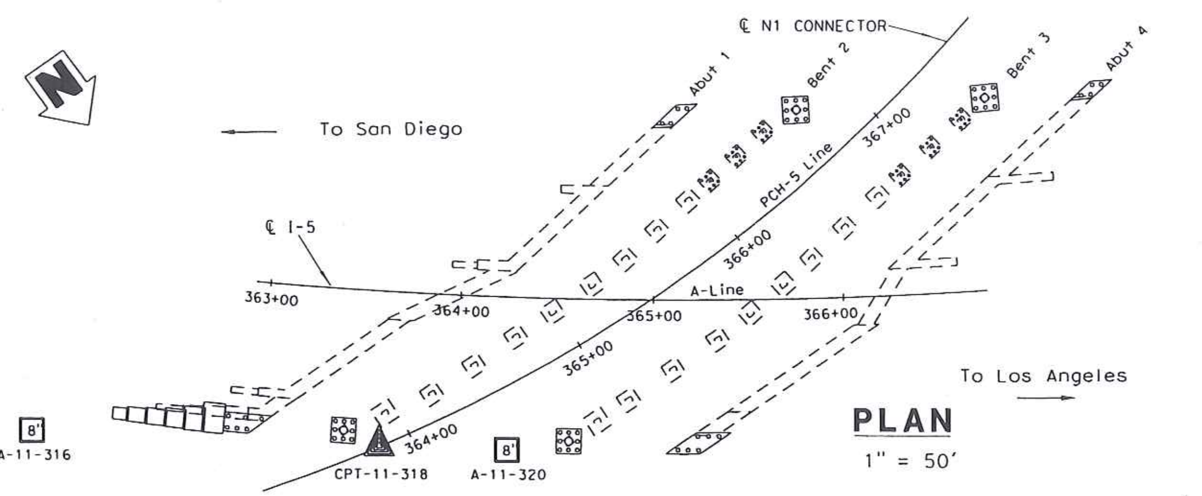

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	ORA	5	6.2/8.7		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

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

ORANGE COUNTY TRANSPORTATION AUTHORITY
550 S. MAIN STREET
ORANGE, CA 92863-1584

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

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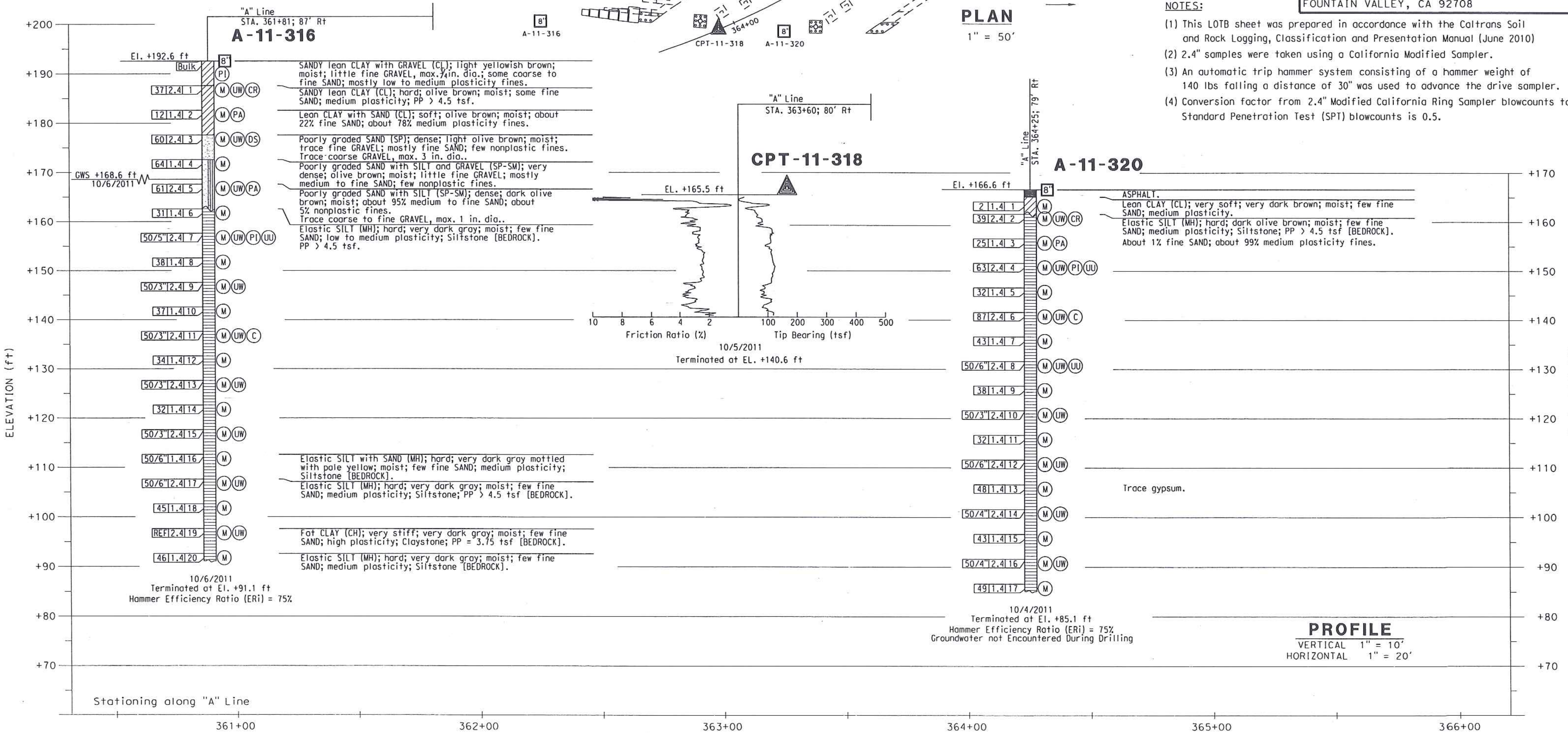

DESIGN OVERSIGHT	DRAWN BY: J. Fong	R. Jie FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
SIGN OFF DATE	CHECKED BY: S. PIRATHIVIRAJ	DATE: 9/2011, 10/2011	

S. PIRATHIVIRAJ
PROJECT ENGINEER

BRIDGE NO. 55-0226
POST MILES 6.70

5/N5-N1 CONNECTOR SEPARATION (WIDEN)
LOG OF TEST BORINGS 1 OF 3

UNIT: 2998
PROJECT NUMBER & PHASE: 12000202791

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES SHEET OF

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

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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

BENCH MARK

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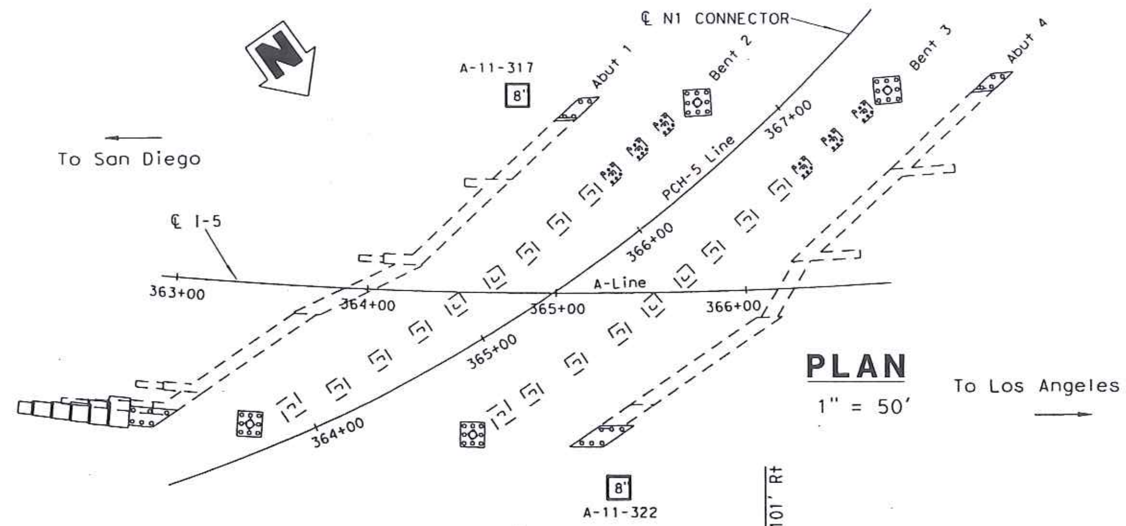

PLAN
1" = 50'

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	ORA	5	6.2/8.7		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER S. PIRATHIVIRAJ No. GE 2963 Exp. 12-31-13 GEOTECHNICAL STATE OF CALIFORNIA

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ORANGE COUNTY TRANSPORTATION AUTHORITY
550 S. MAIN STREET
ORANGE, CA 92863-1584

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

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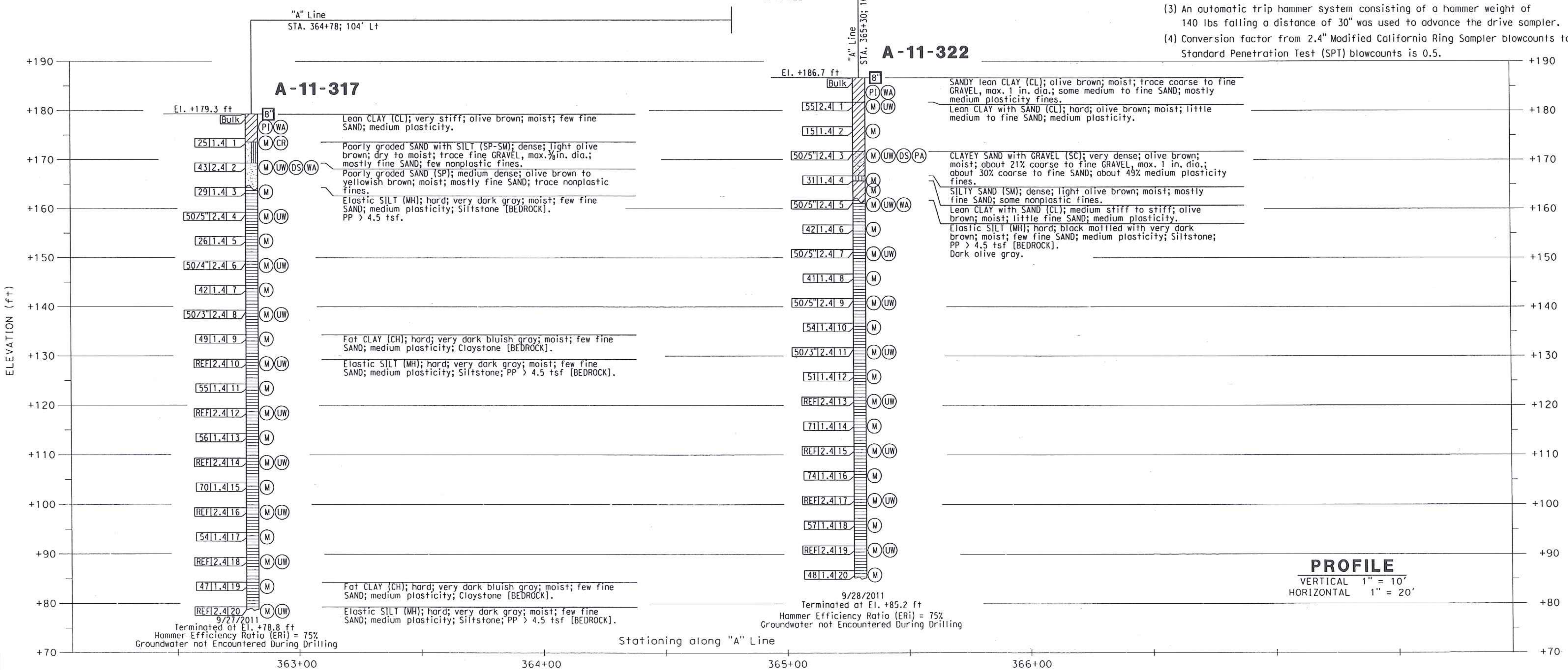

PROFILE
VERTICAL 1" = 10'
HORIZONTAL 1" = 20'

DESIGN OVERSIGHT	DRAWN BY	J. Fang	R. Jie FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	S. PIRATHIVIRAJ	DATE: 9/2011, 10/2011

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. PIRATHIVIRAJ
PROJECT ENGINEER

UNIT: 2998
PROJECT NUMBER & PHASE: 12000202791

BRIDGE NO. 55-0226
POST MILES 6.70

5/N5-N1 CONNECTOR SEPARATION (WIDEN)

LOG OF TEST BORINGS 2 OF 3

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET | OF

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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

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

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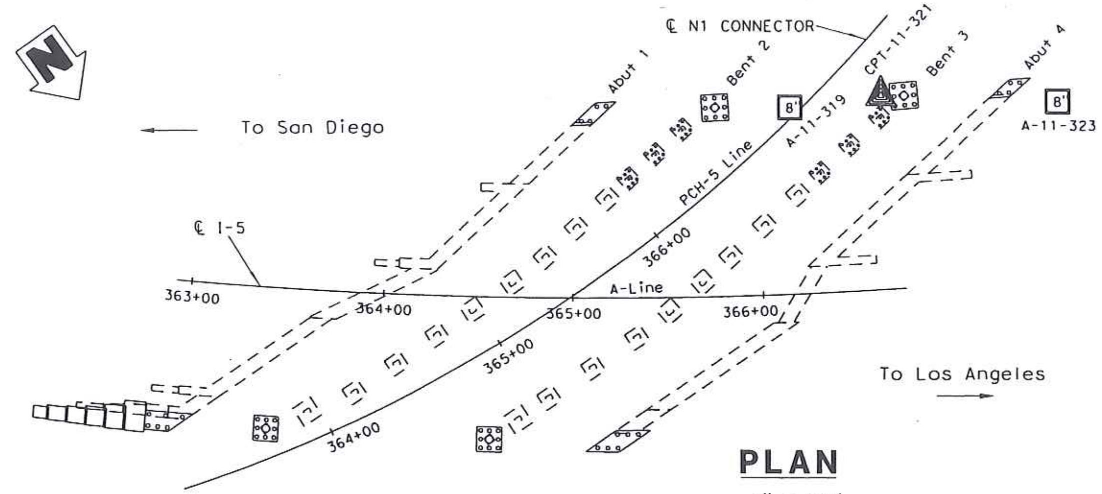

PLAN

1" = 50'

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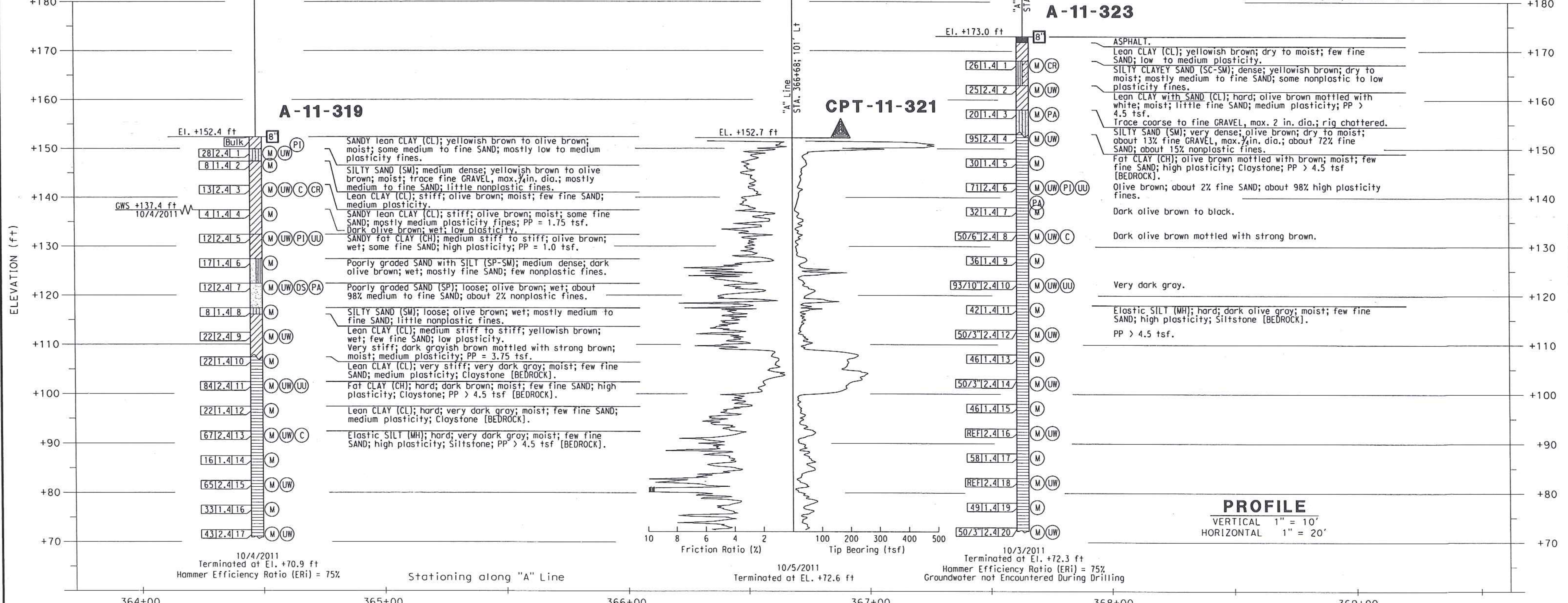

PROFILE

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

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	ORA	5	6.2/8.7		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

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

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

ORANGE COUNTY TRANSPORTATION AUTHORITY
550 S. MAIN STREET
ORANGE, CA 92863-1584

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

DESIGN OVERSIGHT	DRAWN BY	J. Fang
SIGN OFF DATE	CHECKED BY	S. PIRATHIVIRAJ

R. Jie
FIELD INVESTIGATION BY:
DATE: 9/2011, 10/2011

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

S. PIRATHIVIRAJ
PROJECT ENGINEER

BRIDGE NO. 55-0226
POST MILES 6.70

5/N5-N1 CONNECTOR SEPARATION (WIDEN)

LOG OF TEST BORINGS 3 OF 3

UNIT: 2998
PROJECT NUMBER & PHASE: 12000202791

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET | OF

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

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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

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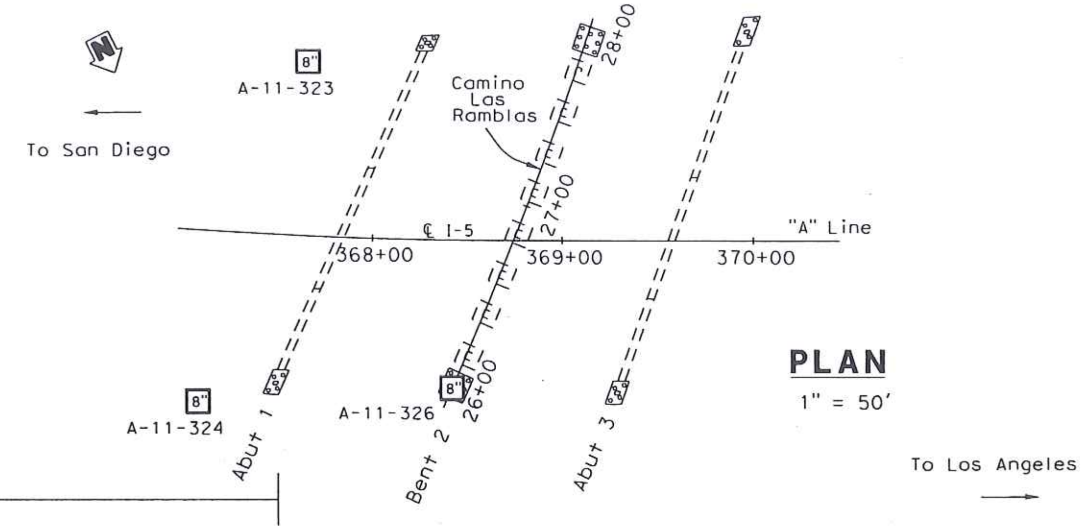

PLAN

1" = 50'

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	ORA	5	6.2/8.7		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

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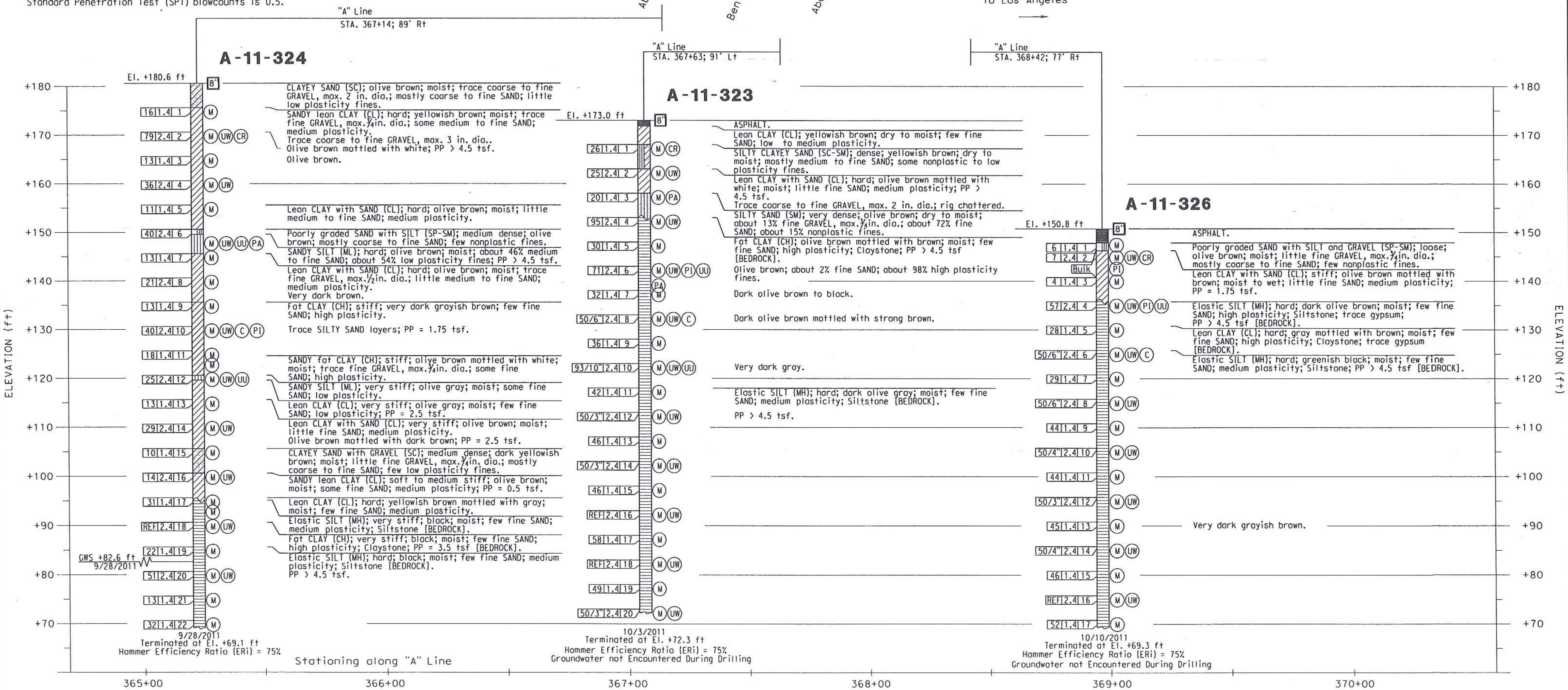
REGISTERED PROFESSIONAL ENGINEER S. PIRATHIVIRAJ NO. GE 2963 EXP. 12-31-13 GEOTECHNICAL STATE OF CALIFORNIA

ORANGE COUNTY TRANSPORTATION AUTHORITY
550 S. MAIN STREET
ORANGE, CA 92863-1584

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



DESIGN OVERSIGHT	DRAWN BY: J. Fang	R. Jie FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
SIGN OFF DATE	CHECKED BY: S. PIRATHIVIRAJ	DATE: 9/2011, 10/2011	

S. PIRATHIVIRAJ PROJECT ENGINEER

BRIDGE NO. 55-0510

POST MILES 6.76

ROUTE 5/1 SEPARATION (WIDEN)

LOG OF TEST BORINGS 1 OF 2

UNIT: 2998

PROJECT NUMBER & PHASE: 12000202791

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES SHEET OF

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

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

BENCH MARK

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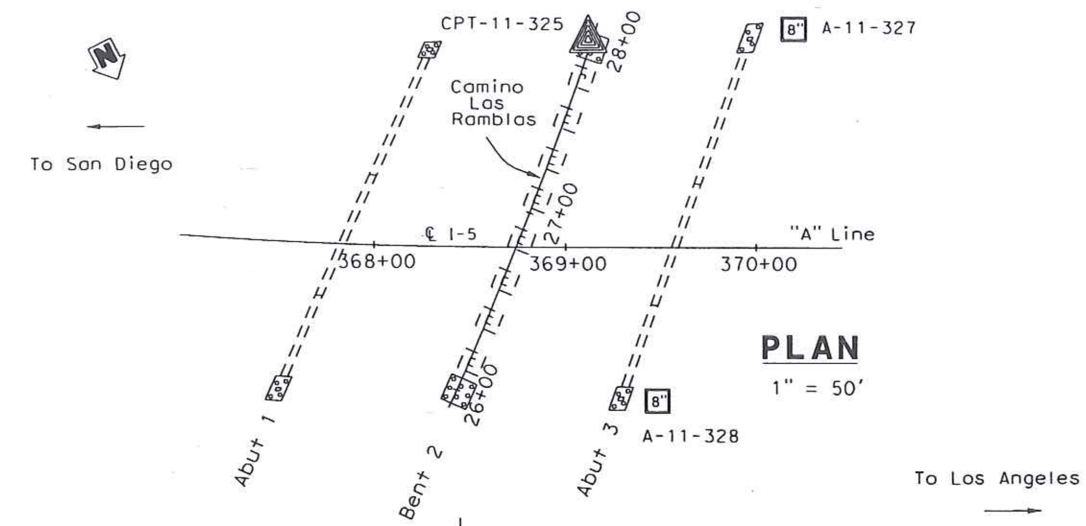
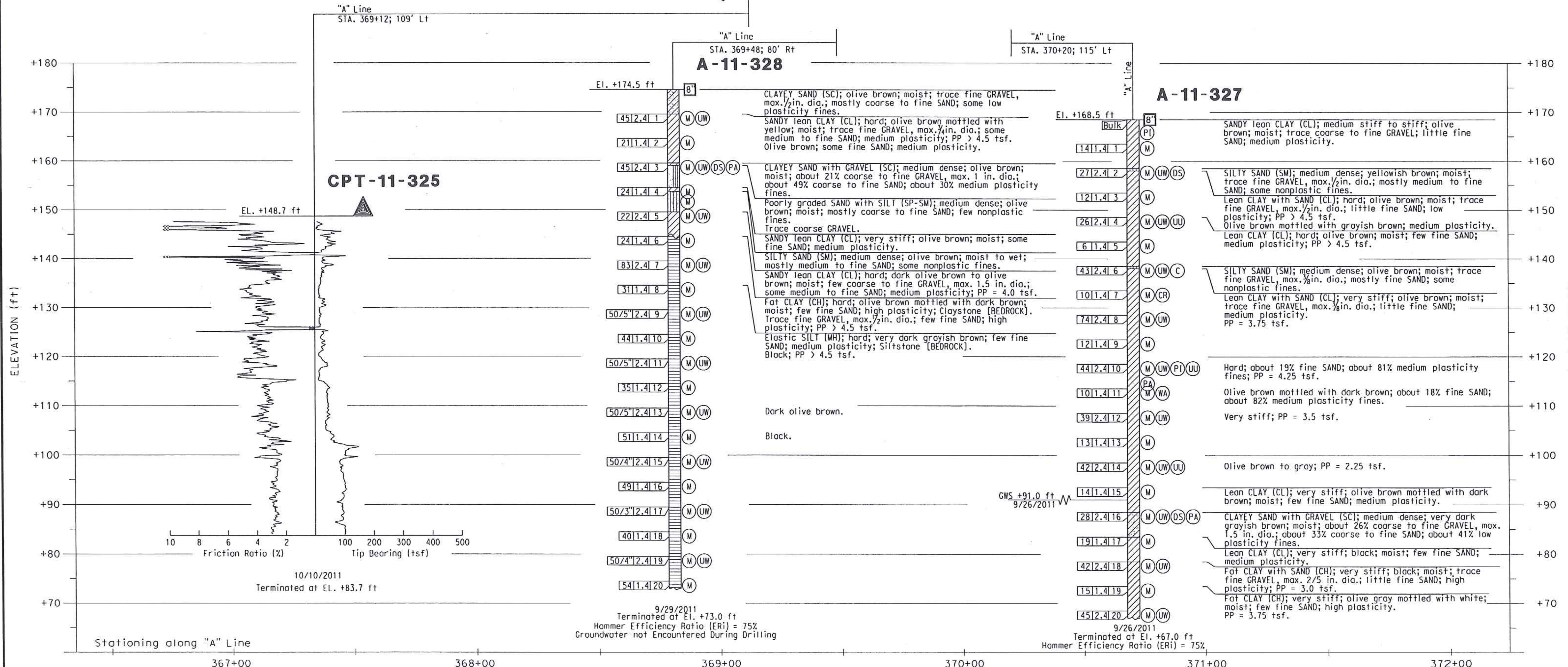


PLAN

1" = 50'



DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	ORA	5	6.2/8.7		

GEOTECHNICAL PROFESSIONAL DATE

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

PLANS APPROVAL DATE

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ORANGE COUNTY TRANSPORTATION AUTHORITY
550 S. MAIN STREET
ORANGE, CA 92863-1584

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

DESIGN OVERSIGHT	DRAWN BY	J. Fong
SIGN OFF DATE	CHECKED BY	S. PIRATHIVIRAJ

R. Jie
FIELD INVESTIGATION BY:
DATE: 9/2011, 10/2011

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

S. PIRATHIVIRAJ
PROJECT ENGINEER

BRIDGE NO. 55-0510
POST MILES 6.76

ROUTE 5/1 SEPARATION (WIDEN)

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: 2998
PROJECT NUMBER & PHASE: 12000202791

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET | OF

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

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION	CONSULTANT FUNCTIONAL SUPERVISOR	CALCULATED-DESIGNED BY	J. FANG	REVISED BY
Caltrans	LINO CHEANG	CHECKED BY	S. PIRATHIVIRAJ	DATE REVISED

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	5	6.2/8.7		

REGISTERED ENGINEER — DATE

PLANS APPROVAL DATE

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

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

ORANGE COUNTY
TRANSPORTATION AUTHORITY
550 S. MAIN STREET
ORANGE, CA 92863-1584

BENCH MARK

Designation: F-785 Elev = 75.717 feet (NAVD 88); 73.413 feet (NGVD29) Described by OCS 2003 - Found 3¼" US Coast and Geodectic Survey Bronzed Disk Stamped "F 785 1946", Set in the Top of a Concrete Bridge Abutment. Monument is Located in the Southwesterly Corner of the Atchinso\Topeka and Santa Fe Railway Overcrossing of San Mateo Creek, 69 ft. Northerly Along the Railway from the Centerline of the Interstate 5 Freeway Southbound Onramp at Camino Capistrano Prolonged to the West and 150± Westerly from the Centerline of Camino Capistrano. Monument is Set 2.0 ft. below the Tracks.

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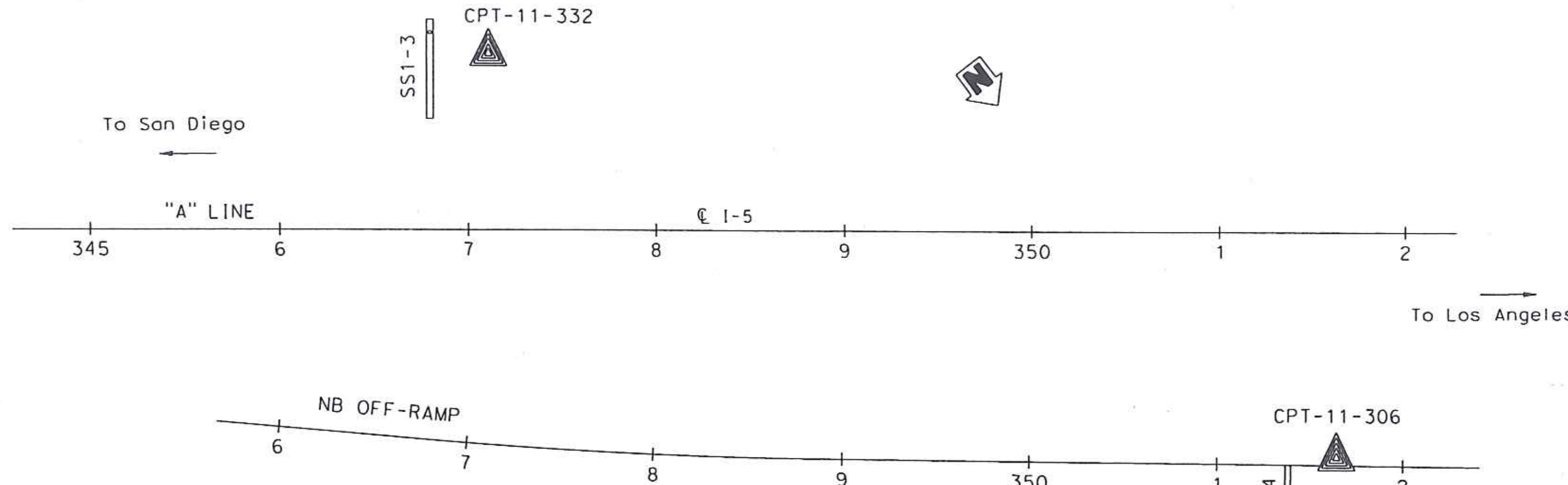
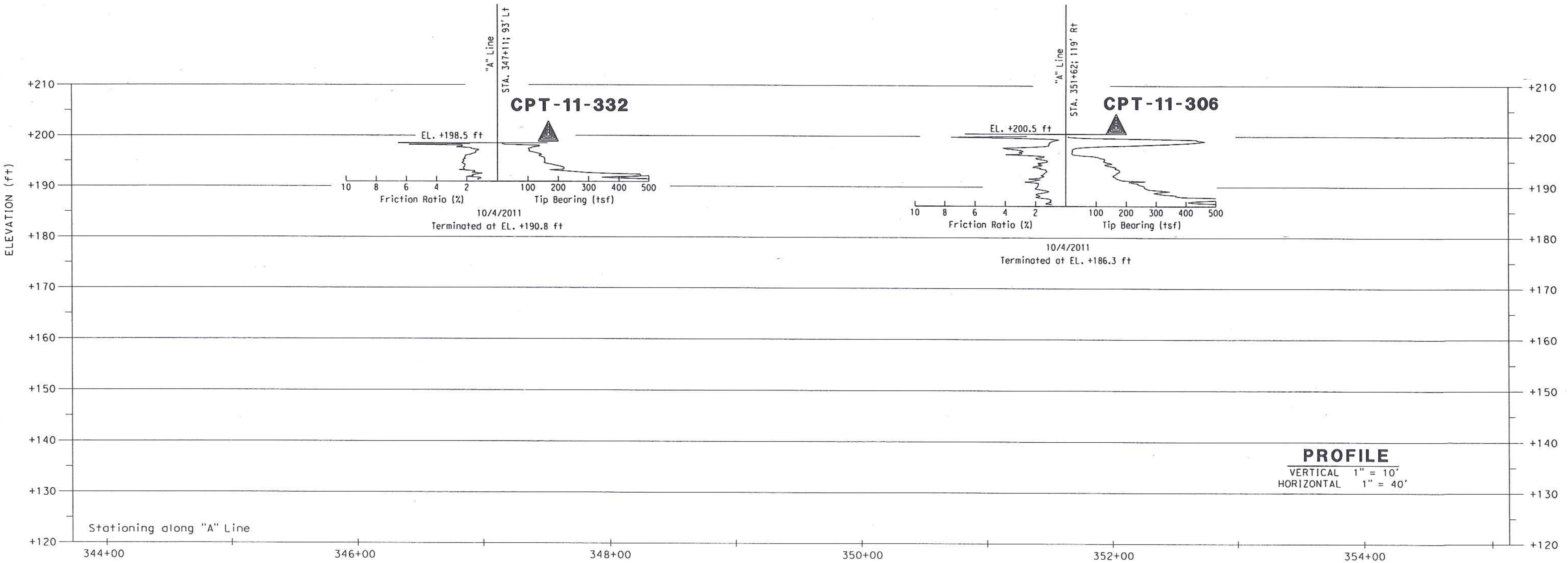


PLAN
1" = 50'



PROFILE
VERTICAL 1" = 10'
HORIZONTAL 1" = 40'

LOG OF TEST BORING NO. 1
SIGN STRUCTURES SS1-3 AND SS1-4

SCALE AS SHOWN

SD-12

LAST REVISION | DATE PLOTTED => $DATE

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION	CONSULTANT FUNCTIONAL SUPERVISOR	CALCULATED-DESIGNED BY	J. FANG	REVISED BY
Caltrans	LINO CHEANG	CHECKED BY	S. PIRATHIVIRAJ	DATE REVISED

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	5	6.2/8.7		

REGISTERED ENGINEER DATE

PLANS APPROVAL DATE

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

EARTH MECHANICS, INC.	ORANGE COUNTY
17800 NEWHOPE STREET,	TRANSPORTATION AUTHORITY
SUITE B	550 S. MAIN STREET
FOUNTAIN VALLEY, CA 92708	ORANGE, CA 92863-1584

BENCH MARK

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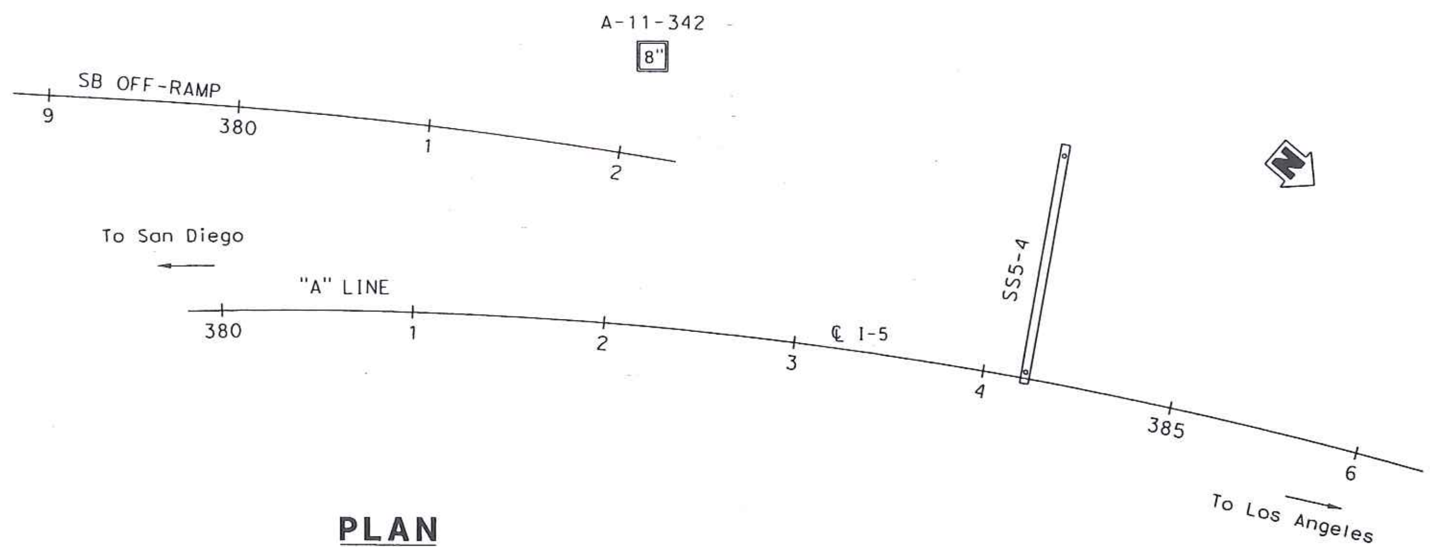
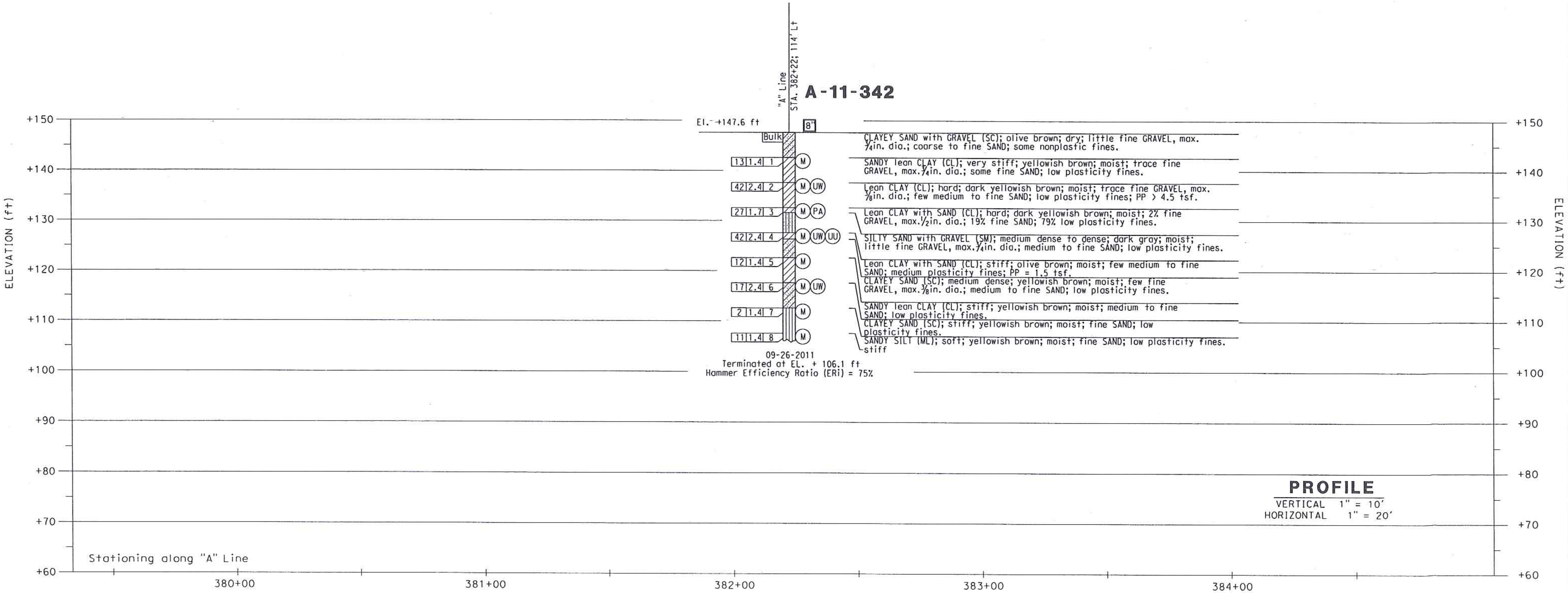


PLAN

1" = 50'



PROFILE

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

LOG OF TEST BORING NO. 1
SIGN STRUCTURE SS5-4

SCALE AS SHOWN

SD-14

LAST REVISION DATE PLOTTED => $DATE

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	ORA	5	6.2/8.7		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER S. PIRATHIVIRAJ No. GE 2963 Exp. 12-31-13 GEOTECHNICAL STATE OF CALIFORNIA

ORANGE COUNTY TRANSPORTATION AUTHORITY
550 S. MAIN STREET
ORANGE, CA 92863-1584

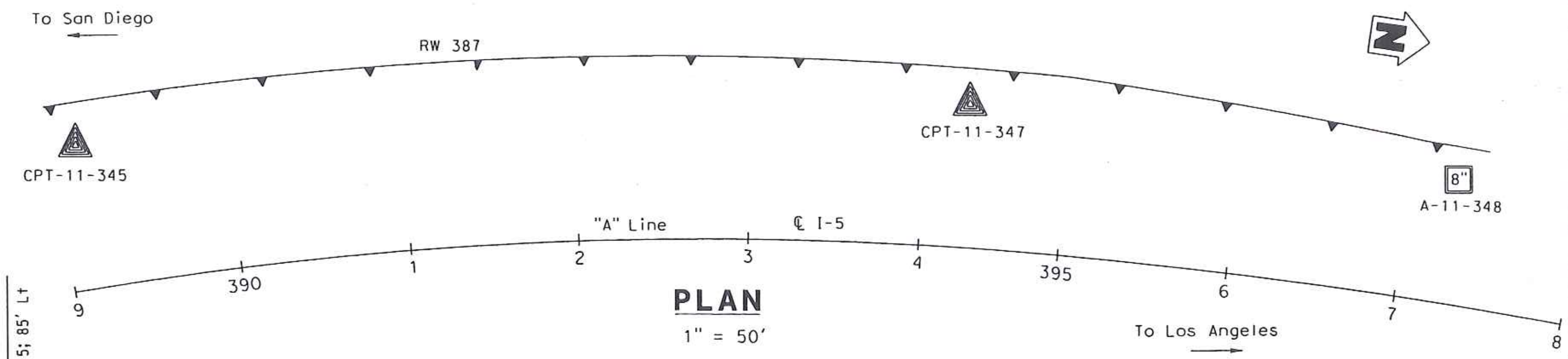
EARTH MECHANICS, INC.
17800 NEWHOPE STREET, SUITE B
FOUNTAIN VALLEY, CA 92708

BENCH MARK

Designation: F-785 Elev = 75.717 feet (NAVD 88); 73.413 feet (NGVD29) Described by OCS 2003 - Found 3¼" US Coast and Geodectic Survey Bronzed Disk Stamped "F 785 1946", Set in the Top of a Concrete Bridge Abutment. Monument is Located in the Southwesterly Corner of the Atchinso\Topeka and Santa Fe Railway Overcrossing of San Mateo Creek, 69 ft. Northerly Along the Railway from the Centerline of the Interstate 5 Freeway Southbound Onramp at Camino Capistrano Prolonged to the West and 150± Westerly from the Centerline of Camino Capistrano. Monument is Set 2.0 ft. below the Tracks.

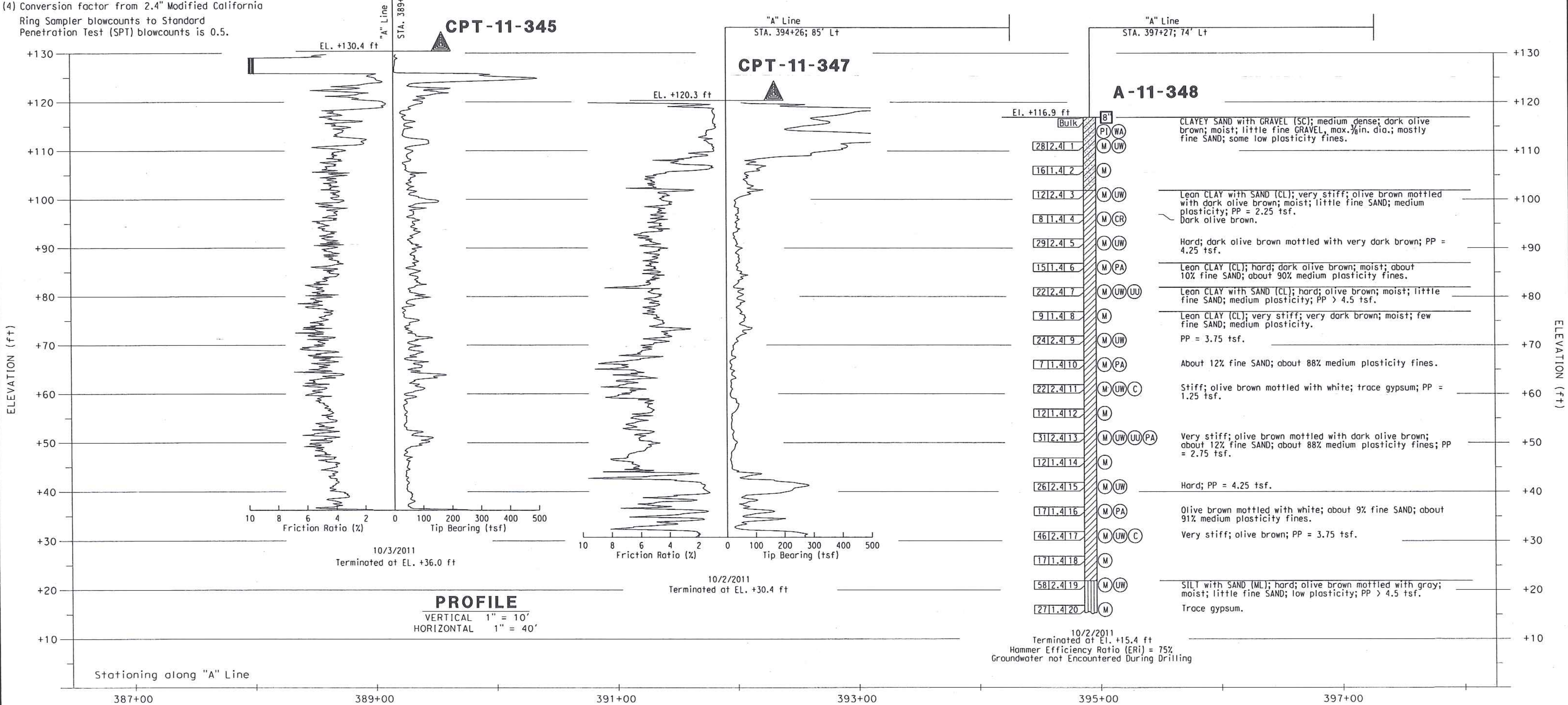
NOTES:

(1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2010).
(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 to advance the drive sampler.
(4) Conversion factor from 2.4" Modified California Ring Sampler blowcounts to Standard Penetration Test (SPT) blowcounts is 0.5.



PLAN

1" = 50'



PROFILE

VERTICAL 1" = 10'
HORIZONTAL 1" = 40'

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. -	RETAINING WALL 387
SIGN OFF DATE	CHECKED BY: S. PIRATHIVIRAJ	DATE: 9/2011, 10/2011			POST MILES 7.2	LOG OF TEST BORINGS 1 OF 1

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

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 2998
PROJECT NUMBER & PHASE: 12000202791

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES SHEET OF

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

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION	CONSULTANT FUNCTIONAL SUPERVISOR	CALCULATED-DESIGNED BY	J. FANG	REVISED BY
Caltrans®	LINO CHEANG	CHECKED BY	S. PIRATHIVIRAJ	DATE REVISED

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	5	6.2/8.7		

REGISTERED ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER S. PIRATHIVIRAJ No. GE 2963 Exp. 12-31-13 GEOTECHNICAL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

EARTH MECHANICS, INC. 17800 NEWHOPE STREET, SUITE B FOUNTAIN VALLEY, CA 92708	ORANGE COUNTY TRANSPORTATION AUTHORITY 550 S. MAIN STREET ORANGE, CA 92863-1584

BENCH MARK

Designation: F-785 Elev = 75.717 feet (NAVD 88); 73.413 feet (NGVD29) Described by OCS 2003 - Found 3¾" US Coast and Geodectic Survey Bronzed Disk Stamped "F 785 1946", Set in the Top of a Concrete Bridge Abutment. Monument is Located in the Southwesterly Corner of the Atchinso\Topeka and Santa Fe Railway Overcrossing of San Mateo Creek, 69 ft. Northerly Along the Railway from the Centerline of the Interstate 5 Freeway Southbound Onramp at Camino Capistrano Prolonged to the West and 150± Westerly from the Centerline of Camino Capistrano. Monument is Set 2.0 ft. below the Tracks.

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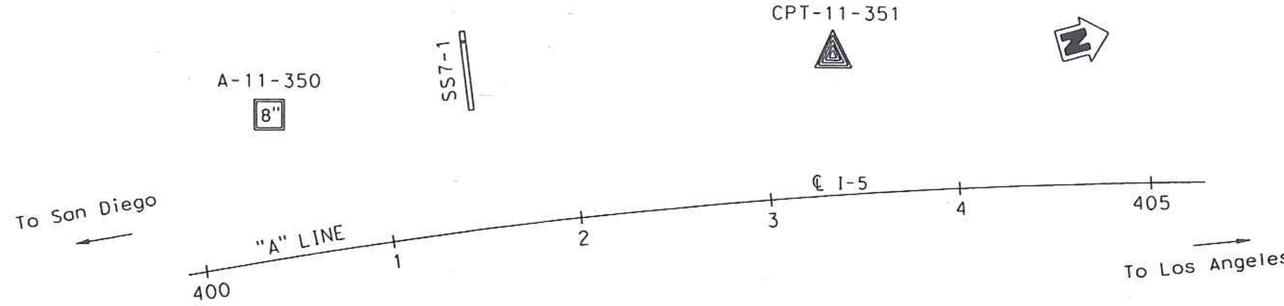
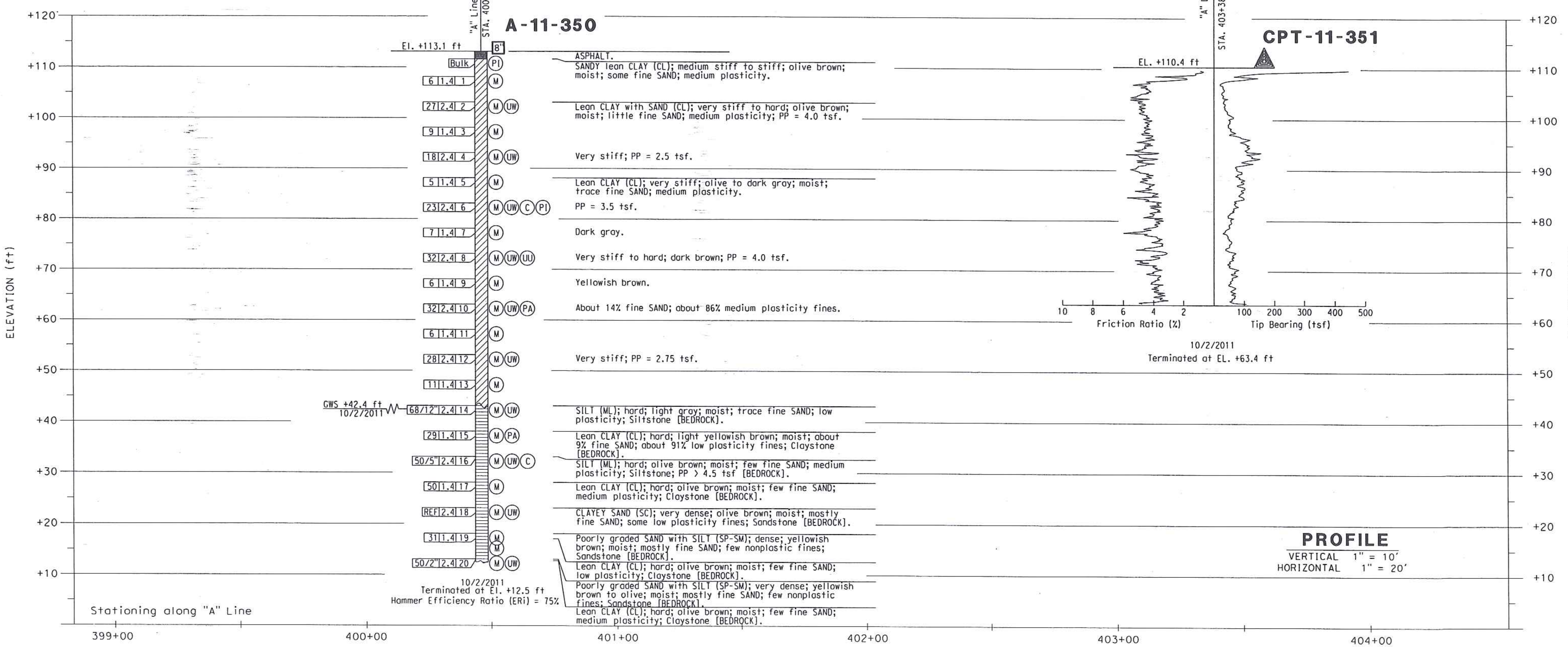
(4) Conversion factor from 2.4" Modified California Ring Sampler blowcounts to Standard Penetration Test (SPT) blowcounts is 0.5.



PLAN
1" = 50'



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

LOG OF TEST BORING NO. 1
SIGN STRUCTURE SS7-1

SCALE AS SHOWN

SD-15

LAST REVISION DATE PLOTTED => $DATE

LOG OF BORING NO. A-11-301

Grade Elevation:	**194.9 ft**				
Boring Depth:	**6.5 ft**	Driller:	**2R Drilling**	SHEET **1 of 1**	
Borehole Diameter:	**8"**	Type of Rig:	**CME 75**	Comments: Hammer Energy Efficiency: 75%	
Date Drilled:	**9-28-11**	Hammer Data:	**Automatic hammer 140-lbs/30-inch drop**	Northing: 2,114,643 Easting: 6,130,882	
Logged By:	**KK**	Groundwater Reading:	**Not Encountered**		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0					SILT (ML); dark olive brown; moist.			
		0						CP, R
		1	35		SILTY SAND with GRAVEL (SM); medium dense; dark olive brown; moist; little fine GRAVEL, max. 3/4 in. dia.; mostly medium to fine SAND; little nonplastic fines.			
5					Very dense; coarse to fine SAND.			
		2	45					
					Bottom of borehole at 6.5 ft bgs			
10								
15								
20								
25								

EMI BORING LOG 11-137 I-5 HOV SEGMENT 3 1-18-2012.GPJ EMI LIBRARY CALTRANS 2010.GLB 3/25/12

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

Interstate 5 HOV Improvement Project
PCH to San Juan Creek Road

Project Number: 11-137 | Date: 2-22-12

LOG OF BORING NO. HA-11-307

Grade Elevation:	**202.6 ft**				
Boring Depth:	**1.5 ft**	Driller:	**Hand auger**	SHEET **1 of 1**	
Borehole Diameter:		Type of Rig:		Comments:	
Date Drilled:	**10-4-11**	Hammer Data:	**Hand auger**	Northing: 2,115,670 Easting: 6,129,912	
Logged By:	**KK**	Groundwater Reading:	**Not Encountered**		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0		0			CLAYEY SAND with GRAVEL (SC); olive brown; dry; little fine GRAVEL, max. 1/2 in. dia.; mostly medium to fine SAND; little low plasticity fines.			
					Bottom of borehole at 1.5 ft bgs			
5								
10								
15								
20								
25								

EMI BORING LOG 11-137 I-5 HOV SEGMENT 3 1-18-2012.GPJ EMI LIBRARY CALTRANS 2010.GLB 3/25/12

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

Interstate 5 HOV Improvement Project
PCH to San Juan Creek Road

Project Number: 11-137 | Date: 2-22-12

LOG OF BORING NO. HA-11-308

Grade Elevation:	191.5 ft				
Boring Depth:	2.0 ft	Driller:	Hand auger		SHEET 1 of 1
Borehole Diameter:		Type of Rig:		Comments:	
Date Drilled:	10-4-11	Hammer Data:	Hand auger	Northing: 2,116,069 Easting: 6,129,650	
Logged By:	KK	Groundwater Reading:	Not Encountered		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0		0			CLAYEY SAND with GRAVEL (SC); olive brown; moist; little coarse to fine GRAVEL, max. 1 1/2 in. dia.; mostly medium to fine SAND; little low plasticity fines.			PI, R
					Bottom of borehole at 2.0 ft bgs			
5								
10								
15								
20								
25								

EMI BORING LOG 11-137 I-5 HOV SEGMENT 3 1-18-2012.GPJ EMI LIBRARY CALTRANS 2010.GLB 3/25/12

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

Interstate 5 HOV Improvement Project
PCH to San Juan Creek Road

Project Number: 11-137 | Date: 2-22-12

LOG OF BORING NO. A-11-315

Grade Elevation:	**196.8 ft**			
Boring Depth:	**6.5 ft**	Driller:	**2R Drilling**	SHEET **1 of 1**
Borehole Diameter:	**8"**	Type of Rig:	**CME 75**	Comments: Hammer Energy Efficiency: 75% Northing: 2,116,016 Easting: 6,129,490
Date Drilled:	**10-20-11**	Hammer Data:	**Automatic hammer 140-lbs/30-inch drop**	
Logged By:	**KK**	Groundwater Reading:	**Not Encountered**	

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0					ASPHALT.			
		0			SILTY SAND (SM); olive brown; moist; mostly medium to fine SAND; little nonplastic fines.			
		1	9		SANDY lean CLAY (CL); stiff; olive brown; moist; some medium to fine SAND; mostly medium plasticity fines.			
5		2	34					
					Bottom of borehole at 6.5 ft bgs			
10								
15								
20								
25								

EMI BORING LOG 11-137 I-5 HOV SEGMENT 3 1-18-2012.GPJ EMI LIBRARY CALTRANS 2010.GLB 3/25/12

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

Interstate 5 HOV Improvement Project
PCH to San Juan Creek Road

Project Number: 11-137 | Date: 2-22-12

LOG OF BORING NO. A-11-329

Grade Elevation:	156.4 ft			
Boring Depth:	31.5 ft	Driller:	2R Drilling	SHEET 1 of 2
Borehole Diameter:	8"	Type of Rig:	CME 75	Comments: Hammer Energy Efficiency: 75%
Date Drilled:	9-27-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop	Northing: 2,116,174 Easting: 6,128,653
Logged By:	KK	Groundwater Reading:	20.2 ft on 9-27-11	

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0					CLAYEY SAND (SC); olive brown; moist; trace fine GRAVEL, max. 3/4 in. dia.; mostly coarse to fine SAND; some low plasticity fines.			
		0						PI, R
5		1	9		SILTY SAND (SM); medium dense; olive brown; moist; mostly medium to fine SAND; little nonplastic fines.	8		
10		2	30		Lean CLAY with SAND (CL); very stiff; yellowish brown to olive brown; moist; trace fine GRAVEL, max. 1/2 in. dia.; little fine SAND; mostly medium plasticity fines; PP = 2.5 tsf. Encountered interbedded SILTY SAND layers.	14	108	
15		3	9		Poorly graded SAND with SILT (SP-SM); medium dense; olive brown; moist; mostly medium to fine SAND; few nonplastic fines.	9		
20 ▽		4	54		Dense; light olive brown; wet.	27	92	DS
25								

(continued)

(CONTINUED) LOG OF BORING NO. A-11-329

Date Drilled:	9-27-11	Comments: Hammer Energy Efficiency: 75%	SHEET 2 of 2
Logged By:	KK		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
25		5	7		SILTY SAND (SM); loose; light olive brown; moist; mostly fine SAND; little nonplastic fines.	25		
					Lean CLAY (CL); very stiff; light olive brown; moist; few fine SAND; mostly medium plasticity fines.			
30		6	35		Fat CLAY (CH); very stiff; dark yellowish brown; moist; trace fine SAND; mostly high plasticity fines; PP = 3.0 tsf.	37	81	C
					Bottom of borehole at 31.5 ft bgs			
35								
40								
45								
50								

EMI BORING LOG 11-137 I-5 HOV SEGMENT 3 1-18-2012.GPJ EMI LIBRARY CALTRANS 2010.GLB 3/25/12

LOG OF BORING NO. A-11-330

Grade Elevation:	**136.9 ft**					
Boring Depth:	**6.5 ft**	Driller:	**2R Drilling**		SHEET **1 of 1**	
Borehole Diameter:	**8"**	Type of Rig:	**CME 75**	Comments: Hammer Energy Efficiency: 75%		
Date Drilled:	**9-27-11**	Hammer Data:	**Automatic hammer 140-lbs/30-inch drop**	Northing: 2,115,673 Easting: 6,128,138		
Logged By:	**KK**	Groundwater Reading:	**Not Encountered**			

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0		0			SILTY SAND with GRAVEL (SM); medium dense; brown; dry; little coarse to fine GRAVEL, max. 1.5 in. dia.; mostly coarse to fine SAND; little nonplastic fines; trace COBBLES.			
		1	12		SILT (ML); very stiff; olive brown; dry; few fine SAND; mostly nonplastic fines.			
5		2	55		Moist.			
					Bottom of borehole at 6.5 ft bgs			
10								
15								
20								
25								

LOG OF BORING NO. A-11-331

Grade Elevation:	154.2 ft				
Boring Depth:	6.5 ft	Driller:	2R Drilling	SHEET 1 of 1	
Borehole Diameter:	8"	Type of Rig:	CME 75	Comments: Hammer Energy Efficiency: 75%	
Date Drilled:	9-26-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop	Northing: 2,116,380 Easting: 6,128,327	
Logged By:	KK	Groundwater Reading:	Not Encountered		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0					SILTY SAND (SM); brown; dry; mostly coarse to fine SAND; some nonplastic fines.			
		0						
					Lean CLAY with SAND (CL); very stiff; olive brown; moist; little fine SAND; mostly medium plasticity fines.			
		1	21					
					Trace coarse to fine GRAVEL, max. 1 in. dia..			
5					Encounter roots.			
		2	57					
					Bottom of borehole at 6.5 ft bgs			
10								
15								
20								
25								

EM BORING LOG 11-137 I-5 HOV SEGMENT 3 1-18-2012.GPJ EM LIBRARY CALTRANS 2010.GLB 3/25/12

LOG OF BORING NO. HA-11-333

Grade Elevation:	197.3 ft				
Boring Depth:	1.5 ft	Driller:	Hand auger		SHEET 1 of 1
Borehole Diameter:		Type of Rig:		Comments:	
Date Drilled:	10-4-11	Hammer Data:	Hand auger	Northing: 2,115,786 Easting: 6,129,842	
Logged By:	KK	Groundwater Reading:	Not Encountered		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0		0			CLAYEY SAND with GRAVEL (SC); olive brown; dry; some fine GRAVEL, max. 1/2 in. dia.; mostly medium to fine SAND; little low plasticity fines.			
					Bottom of borehole at 1.5 ft bgs			
5								
10								
15								
20								
25								

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

Interstate 5 HOV Improvement Project
PCH to San Juan Creek Road

Project Number: 11-137 | Date: 2-22-12

LOG OF BORING NO. HA-11-334

Grade Elevation:	156.6 ft				
Boring Depth:	5.0 ft	Driller:	Hand auger		SHEET 1 of 1
Borehole Diameter:		Type of Rig:		Comments:	
Date Drilled:	9-26-11	Hammer Data:	Hand auger	Northing: 2,116,905 Easting: 6,127,757	
Logged By:	KK	Groundwater Reading:	Not Encountered		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0					SILTY SAND with GRAVEL (SM); yellowish brown; moist; little fine GRAVEL, max. 3/4 in. dia.; mostly medium to fine SAND; some nonplastic fines.			
		0						
5					Bottom of borehole at 5.0 ft bgs			
10								
15								
20								
25								

LOG OF BORING NO. A-11-335

Grade Elevation:	**169.6 ft**				
Boring Depth:	**6.5 ft**	Driller:	**2R Drilling**		SHEET **1 of 1**
Borehole Diameter:	**8"**	Type of Rig:	**CME 75**	Comments: Hammer Energy Efficiency: 75% Northing: 2,116,601 Easting: 6,128,522	
Date Drilled:	**10-20-11**	Hammer Data:	**Automatic hammer 140-lbs/30-inch drop**		
Logged By:	**KK**	Groundwater Reading:	**Not Encountered**		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0					ASPHALT.			
		0			SILTY SAND with GRAVEL (SM); brown; moist; little fine GRAVEL, max. 1/2 in. dia.; mostly coarse to fine SAND; some nonplastic fines.			CP, R
		1	6		Lean CLAY with SAND (CL); stiff to very stiff; gray to olive gray; moist; little fine SAND; mostly medium plasticity fines.			
5		2	27					
					Bottom of borehole at 6.5 ft bgs			
10								
15								
20								
25								

LOG OF BORING NO. HA-11-336

Grade Elevation:	148.0 ft				
Boring Depth:	5.0 ft	Driller:	Hand auger		SHEET 1 of 1
Borehole Diameter:		Type of Rig:		Comments:	
Date Drilled:	10-11-11	Hammer Data:	Hand auger	Northing: 2,116,957 Easting: 6,128,292	
Logged By:	CP	Groundwater Reading:	Not Encountered		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0					SILTY SAND (SM); light yellowish brown; moist; trace fine GRAVEL, max. 1/2 in. dia.; mostly coarse to fine SAND; little nonplastic fines.			
		0						R
5					Bottom of borehole at 5.0 ft bgs			
10								
15								
20								
25								

EMI BORING LOG 11-137 I-5 HOV SEGMENT 3 1-18-2012.GPJ EMI LIBRARY CALTRANS 2010.GLB 3/25/12

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

Interstate 5 HOV Improvement Project
PCH to San Juan Creek Road

Project Number: 11-137 | Date: 2-22-12

LOG OF BORING NO. HA-11-338

Grade Elevation:	164.6 ft				
Boring Depth:	5.0 ft	Driller:	Hand auger	SHEET 1 of 1	
Borehole Diameter:		Type of Rig:		Comments:	
Date Drilled:	10-11-11	Hammer Data:	Hand auger	Northing: 2,116,709 Easting: 6,128,122	
Logged By:	CP	Groundwater Reading:	Not Encountered		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0					SILTY SAND (SM); light yellowish brown; moist; trace fine GRAVEL, max. 1/2 in. dia.; mostly fine SAND; little nonplastic fines.			
		0						R
5					Bottom of borehole at 5.0 ft bgs			
10								
15								
20								
25								

LOG OF BORING NO. A-11-339

Grade Elevation:	157.8 ft				
Boring Depth:	31.5 ft	Driller:	2R Drilling		SHEET 1 of 2
Borehole Diameter:	8"	Type of Rig:	CME 75	Comments: Hammer Energy Efficiency: 75% Northing: 2,116,519 Easting: 6,128,082	
Date Drilled:	9-26-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop		
Logged By:	KK	Groundwater Reading:	Not Encountered		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0		0			SILTY SAND with GRAVEL (SM); brown; dry; little fine GRAVEL, max. 3/4 in. dia.; mostly coarse to fine SAND; little nonplastic fines.			R
					SANDY lean CLAY with GRAVEL (CL); stiff; yellowish brown; moist; little fine GRAVEL, max. 3/4 in. dia.; some medium to fine SAND; mostly low plasticity fines.			
5		1	27			13		
10		2	49		SANDY lean CLAY (CL); hard; yellowish brown; moist; trace fine GRAVEL, max. 3/4 in. dia.; some medium to fine SAND; mostly low plasticity fines; PP > 4.5 tsf.	14	113	
15		3	15		Lean CLAY with SAND (CL); hard; dark yellowish brown; moist; little medium to fine SAND; mostly low plasticity fines.	22		
20		4	25		SANDY lean CLAY (CL); hard; olive brown; moist; trace fine GRAVEL, max. 1/2 in. dia.; some medium to fine SAND; mostly low to medium plasticity fines; PP > 4.5 tsf.	17	108	UU
25								

(continued)

(CONTINUED) LOG OF BORING NO. A-11-339

Date Drilled:	9-26-11	Comments: Hammer Energy Efficiency: 75%	SHEET 2 of 2
Logged By:	KK		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
25		5	14		SANDY SILT (ML); hard; light yellowish brown; moist; some fine SAND; mostly low plasticity fines.	13		
30		6	34		PP > 4.5 tsf.	15	107	
					Bottom of borehole at 31.5 ft bgs			
35								
40								
45								
50								

LOG OF BORING NO. A-11-340

Grade Elevation:	147.9 ft				
Boring Depth:	5.8 ft	Driller:	2R Drilling		SHEET 1 of 1
Borehole Diameter:	8"	Type of Rig:	CME 75	Comments: Hammer Energy Efficiency: 75% Northing: 2,117,048 Easting: 6,127,948	
Date Drilled:	10-20-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop		
Logged By:	KK	Groundwater Reading:	Not Encountered		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0					ASPHALT.			
		0			Fat CLAY (CH); very stiff; dark olive gray; moist; few fine SAND; mostly high plasticity fines; Claystone [BEDROCK].			
		1	21					
5		2	50/4 "					
					Bottom of borehole at 5.8 ft bgs			
10								
15								
20								
25								

EMI BORING LOG 11-137 I-5 HOV SEGMENT 3 1-18-2012.GPJ EMI LIBRARY CALTRANS 2010.GLB 3/25/12

LOG OF BORING NO. HA-11-341

Grade Elevation:	**137.8 ft**				
Boring Depth:	**5.0 ft**	Driller:	**Hand auger**		SHEET **1 of 1**
Borehole Diameter:		Type of Rig:		Comments:	
Date Drilled:	**10-17-11**	Hammer Data:	**Hand auger**	Northing: 2,117,320 Easting: 6,127,711	
Logged By:	**CP**	Groundwater Reading:	**Not Encountered**		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0					SANDY SILT (ML); yellowish brown; moist; trace fine GRAVEL, max. 1/2 in. dia.; little fine SAND; mostly nonplastic fines.			
		0						CP, R
5					Bottom of borehole at 5.0 ft bgs			
10								
15								
20								
25								

LOG OF BORING NO. A-11-343

Grade Elevation:	129.6 ft				
Boring Depth:	6.5 ft	Driller:	2R Drilling		SHEET 1 of 1
Borehole Diameter:	8"	Type of Rig:	CME 75	Comments: Hammer Energy Efficiency: 75% Northing: 2,117,621 Easting: 6,127,511	
Date Drilled:	10-20-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop		
Logged By:	KK	Groundwater Reading:	Not Encountered		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0					ASPHALT.			
		0			SANDY lean CLAY (CL); stiff; olive gray to olive brown; moist; some medium to fine SAND; mostly medium plasticity fines.			
		1	10					
5								
		2	28					
					Bottom of borehole at 6.5 ft bgs			
10								
15								
20								
25								

EMI BORING LOG 11-137 I-5 HOV SEGMENT 3 1-18-2012.GPJ EMI LIBRARY CALTRANS 2010.GLB 3/25/12

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

Interstate 5 HOV Improvement Project
PCH to San Juan Creek Road

Project Number: 11-137 | Date: 2-22-12

LOG OF BORING NO. HA-11-344

Grade Elevation:	**117.3 ft**				
Boring Depth:	**5.0 ft**	Driller:	**Hand auger**		SHEET **1 of 1**
Borehole Diameter:		Type of Rig:		Comments:	
Date Drilled:	**10-11-11**	Hammer Data:	**Hand auger**	Northing: 2,118,042 Easting: 6,127,381	
Logged By:	**CP**	Groundwater Reading:	**Not Encountered**		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0					CLAYEY SAND with GRAVEL (SC); yellowish brown; moist; little fine GRAVEL, max. 3/8 in. dia.; mostly coarse to fine SAND; some low plasticity fines.			
		0						PI, R, WA
5					Bottom of borehole at 5.0 ft bgs			
10								
15								
20								
25								

EMI BORING LOG 11-137 I-5 HOV SEGMENT 3 1-18-2012.GPJ EMI LIBRARY CALTRANS 2010.GLB 7/2/12

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

Interstate 5 HOV Improvement Project
PCH to San Juan Creek Road

Project Number: 11-137 | Date: 6-25-12

LOG OF BORING NO. A-11-346

Grade Elevation:	**115.6 ft**				
Boring Depth:	**6.5 ft**	Driller:	**2R Drilling**	SHEET **1 of 1**	
Borehole Diameter:	**8"**	Type of Rig:	**CME 75**	Comments: Hammer Energy Efficiency: 75% Northing: 2,118,314 Easting: 6,127,323	
Date Drilled:	**10-20-11**	Hammer Data:	**Automatic hammer 140-lbs/30-inch drop**		
Logged By:	**KK**	Groundwater Reading:	**Not Encountered**		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0					ASPHALT.			
		0			SANDY lean CLAY with GRAVEL (CL); soft; olive gray; little fine GRAVEL, max. 3/8 in. dia.; little medium to fine SAND; mostly low to medium plasticity fines.			CP, PI, R
		1	2					
5		2	26		SANDY lean CLAY (CL); medium stiff to stiff; olive brown; some medium to fine SAND; mostly medium plasticity fines.			
					Bottom of borehole at 6.5 ft bgs			
10								
15								
20								
25								

EMI BORING LOG 11-137 I-5 HOV SEGMENT 3 1-18-2012.GPJ EMI LIBRARY CALTRANS 2010.GLB 3/25/12

LOG OF BORING NO. A-11-352

Grade Elevation:	109.3 ft				
Boring Depth:	6.5 ft	Driler:	2R Drilling		SHEET 1 of 1
Borehole Diameter:	8"	Type of Rig:	CME 75	Comments: Hammer Energy Efficiency: 75% Northing: 2,118,832 Easting: 6,127,298	
Date Drilled:	10-20-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop		
Logged By:	KK	Groundwater Reading:	Not Encountered		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0					ASPHALT.			
		0			SANDY lean CLAY with GRAVEL (CL); medium stiff; olive brown; moist; little fine GRAVEL, max. 3/8 in. dia.; some medium to fine SAND; mostly medium plasticity fines.			
		1	8					PI, R
5		2	32		SANDY lean CLAY (CL); medium stiff; olive brown; moist; some medium to fine SAND; mostly medium plasticity fines.			
					Bottom of borehole at 6.5 ft bgs			
10								
15								
20								
25								

EMI BORING LOG 11-137 I-5 HOV SEGMENT 3 1-18-2012.GPJ EMI LIBRARY CALTRANS 2010.GLB 3/25/12

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

Interstate 5 HOV Improvement Project
PCH to San Juan Creek Road

Project Number: 11-137 | Date: 2-22-12

GROUP SYMBOLS AND NAMES

Graphic / Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly graded SAND Poorly graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic / Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTS

C	Consolidation (ASTM D 2435-04)
CL	Collapse Potential (ASTM D 5333-03)
CP	Compaction Curve (CTM 216 - 06)
CR	Corrosion, Sulfates, Chlorides (CTM 643 - 99; CTM 417 - 06; CTM 422 - 06)
CU	Consolidated Undrained Triaxial (ASTM D 4767-02)
DS	Direct Shear (ASTM D 3080-04)
EI	Expansion Index (ASTM D 4829-03)
M	Moisture Content (ASTM D 2216-05)
OC	Organic Content (ASTM D 2974-07)
P	Permeability (CTM 220 - 05)
PA	Particle Size Analysis (ASTM D 422-63 [2002])
PI	Liquid Limit, Plastic Limit, Plasticity Index (AASHTO T 89-02, AASHTO T 90-00)
PL	Point Load Index (ASTM D 5731-05)
PM	Pressure Meter
PP	Pocket Penetrometer
R	R-Value (CTM 301 - 00)
SE	Sand Equivalent (CTM 217 - 99)
SG	Specific Gravity (AASHTO T 100-06)
SL	Shrinkage Limit (ASTM D 427-04)
SW	Swell Potential (ASTM D 4546-03)
TV	Pocket Torvane
UC	Unconfined Compression - Soil (ASTM D 2166-06) Unconfined Compression - Rock (ASTM D 2938-95)
UU	Unconsolidated Undrained Triaxial (ASTM D 2850-03)
UW	Unit Weight (ASTM D 4767-04)
VS	Vane Shear (AASHTO T 223-96 [2004])
WA	Wash Analysis (ASTM D 1140-97)

SAMPLER GRAPHIC SYMBOLS

- Standard Penetration Test (SPT)
- Standard California Sampler
- Modified California Sampler
- Shelby Tube
- Piston Sampler
- NX Rock Core
- HQ Rock Core
- Bulk Sample
- Other (see remarks)

DRILLING METHOD SYMBOLS

- Auger Drilling
- Rotary Drilling
- Dynamic Cone or Hand Driven
- Diamond Core

WATER LEVEL SYMBOLS

- First Water Level Reading (during drilling)
- Static Water Level Reading (short-term)
- Static Water Level Reading (long-term)

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

BORING RECORD LEGEND

Interstate 5 HOV Improvement Project PCH to San Juan Creek Road

Project Number: 11-137 | Date: 6-25-12 | SHEET 1 of 2

CONSISTENCY OF COHESIVE SOILS				
Descriptor	Unconfined Compressive Strength (tsf)	Pocket Penetrometer (tsf)	Torvane (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 - 0.50	0.25 - 0.50	0.12 - 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 - 1.0	0.50 - 1.0	0.25 - 0.50	Can be penetrated several inches by thumb with moderate effort
Stiff	1.0 - 2.0	1.0 - 2.0	0.50 - 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2.0 - 4.0	2.0 - 4.0	1.0 - 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

APPARENT DENSITY OF COHESIONLESS SOILS	
Descriptor	SPT N_{60} - Value (blows / foot)
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE	
Descriptor	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS	
Descriptor	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

SOIL PARTICLE SIZE		
Descriptor		Size
Boulder		> 12 inches
Cobble		3 to 12 inches
Gravel	Coarse	3/4 inch to 3 inches
	Fine	No. 4 Sieve to 3/4 inch
Sand	Coarse	No. 10 Sieve to No. 4 Sieve
	Medium	No. 40 Sieve to No. 10 Sieve
	Fine	No. 200 Sieve to No. 40 Sieve
Silt and Clay		Passing No. 200 Sieve

PLASTICITY OF FINE-GRAINED SOILS	
Descriptor	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled, and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll, and not much time is required to reach the plastic limit; it cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

CEMENTATION	
Descriptor	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

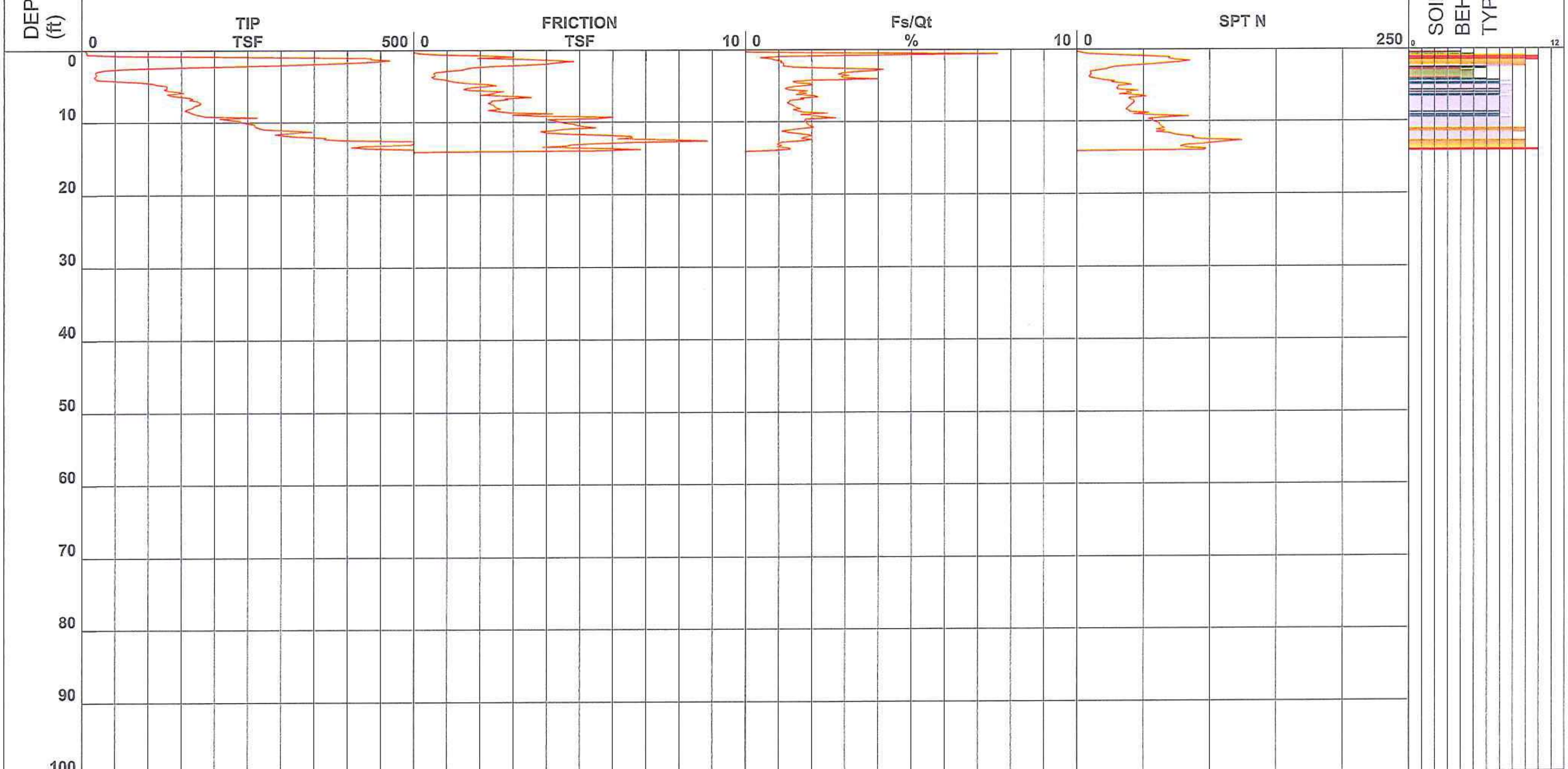
<u>NOTE</u>:
This legend sheet provides descriptors and associated criteria for required soil description components only. Refer to Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010 Edition), Section 2, for tables of additional soil description components and discussion of soil description and identification.

REF = Refusal; During drilling seating interval (first 6-inch interval) is not achieved.

Earth Mechanics

Location	I-5 HOV Widening Segment 3	Operator	BH-DM	Filename	SDF(526).cpt
Job Number	11-137	Cone Number	DSG1104	GPS	
Hole Number	CPT-11-306	Date and Time	10/4/2011 11:06:50 PM	Maximum Depth	14.27 ft
Water Table Depth	>14.27 ft				

CPT DATA



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Depth Increment

*Soil behavior type and SPT based on data from UBC-1983

I-5 HOV Widening Segment 3

Project ID: Earth Mechanics
Data File: SDF(526).cpt
CPT Date: 10/4/2011 11:06:50 PM
GW During Test: No GW

Page: 1
Sounding ID: CPT-11-306
Project No: 11-137
Cone/Rig: DSG1104

.	.	*	.	.	.	.	*	*	.	.	.	*	*	*	.	.	*	*	*	*	*	*
Depth ft	qc PS tsf	qcln PS -	qlncs PS -	Slv Stss tsf	pore prss (psi)	Frct Rato %	Mat Typ Zon	Material Behavior Description	Unit Wght pcf	Qc to N	SPT R-N 60%	SPT R-N1 60%	Rel Den %	Ftn Ang deg	Und Shr tsf	OCR -	Fin Ic %	Nk -	Vol Strn %	Dry Stlmt 0.00	Liq Stlmt 0.01	Cycl SStn %
0.33	7.6	12.3	28.2	0.0	0.0	0.1	5	silty SAND to sandy SILT	120	4.0	2	3	5	47	-	-	26	16	N/A	0.00	N/A	N/A
0.49	6.9	11.0	-	0.2	0.0	2.6	3	silty CLAY to CLAY	115	1.5	5	7	-	-	0.5	9.9	54	15	N/A	0.00	N/A	N/A
0.66	8.5	13.7	-	0.6	0.0	7.6	3	silty CLAY to CLAY	115	1.5	6	9	-	-	0.6	9.9	69	15	N/A	0.00	N/A	N/A
0.82	58.2	93.4	192.5	2.1	0.0	3.7	5	silty SAND to sandy SILT	120	4.0	15	23	65	48	-	-	24	16	N/A	0.00	N/A	N/A
0.98	269.9	432.8	432.8	3.0	0.4	1.1	6	clean SAND to silty SAND	125	5.0	54	87	95	48	-	-	5	16	N/A	0.00	N/A	N/A
1.15	435.4	698.3	698.3	1.9	0.7	0.4	7	grvly SAND to dense SAND	130	6.0	73	100	95	48	-	-	5	16	N/A	0.00	N/A	N/A
1.31	435.2	698.0	698.0	3.4	0.6	0.8	7	grvly SAND to dense SAND	130	6.0	73	100	95	48	-	-	5	16	N/A	0.00	N/A	N/A
1.48	463.6	743.5	743.5	4.2	1.2	0.9	6	clean SAND to silty SAND	125	5.0	93	100	95	48	-	-	5	16	N/A	0.00	N/A	N/A
1.64	442.5	709.6	709.6	4.8	1.4	1.1	6	clean SAND to silty SAND	125	5.0	88	100	95	48	-	-	5	16	N/A	0.00	N/A	N/A
1.80	407.4	653.4	653.4	4.3	1.4	1.1	6	clean SAND to silty SAND	125	5.0	81	100	95	48	-	-	5	16	N/A	0.00	N/A	N/A
1.97	351.1	563.0	563.0	4.0	1.6	1.1	6	clean SAND to silty SAND	125	5.0	70	100	95	48	-	-	5	16	N/A	0.00	N/A	N/A
2.13	292.2	468.6	468.6	3.3	1.8	1.1	6	clean SAND to silty SAND	125	5.0	58	94	95	48	-	-	5	16	N/A	0.00	N/A	N/A
2.30	207.7	333.1	333.1	2.4	1.9	1.1	6	clean SAND to silty SAND	125	5.0	42	67	95	48	-	-	5	16	N/A	0.00	N/A	N/A
2.46	121.8	195.4	218.2	1.8	2.1	1.4	6	clean SAND to silty SAND	125	5.0	24	39	89	48	-	-	8	16	N/A	0.00	N/A	N/A
2.62	64.8	103.9	165.7	1.6	2.2	2.4	5	silty SAND to sandy SILT	120	4.0	16	26	68	47	-	-	18	16	N/A	0.00	N/A	N/A
2.79	34.9	56.0	161.1	1.4	1.6	4.2	4	clayy SILT to silty CLAY	115	2.0	17	28	-	-	2.5	9.9	32	15	N/A	0.00	N/A	N/A
2.95	25.2	40.4	-	1.0	1.3	3.9	4	clayy SILT to silty CLAY	115	2.0	13	20	-	-	1.8	9.9	36	15	N/A	0.00	N/A	N/A
3.12	20.6	33.1	-	0.7	1.3	3.3	4	clayy SILT to silty CLAY	115	2.0	10	17	-	-	1.4	9.9	36	15	N/A	0.00	N/A	N/A
3.28	20.6	33.0	106.6	0.6	0.9	2.9	4	clayy SILT to silty CLAY	115	2.0	10	17	-	-	1.4	9.9	35	15	2.12	-	0.01	51.2
3.45	22.4	36.0	108.0	0.6	0.8	2.8	4	clayy SILT to silty CLAY	115	2.0	11	18	-	-	1.6	9.9	33	15	2.09	-	0.01	51.2
3.61	20.7	33.1	-	0.6	0.7	3.1	4	clayy SILT to silty CLAY	115	2.0	10	17	-	-	1.4	9.9	35	15	-	-	0.00	-
3.77	18.9	30.2	-	0.5	0.7	2.9	4	clayy SILT to silty CLAY	115	2.0	9	15	-	-	1.3	9.9	36	15	-	-	0.00	-
3.94	20.7	33.1	107.6	0.6	0.6	3.0	4	clayy SILT to silty CLAY	115	2.0	10	17	-	-	1.4	9.9	35	15	2.20	-	0.00	51.2
4.10	23.4	37.5	-	0.9	0.5	4.0	4	clayy SILT to silty CLAY	115	2.0	12	19	-	-	1.6	9.9	37	15	-	-	0.00	-
4.27	53.1	85.2	135.2	1.1	0.5	2.0	5	silty SAND to sandy SILT	120	4.0	13	21	62	45	-	-	18	16	0.59	-	0.00	3.1
4.43	88.7	142.2	170.0	1.3	0.4	1.4	6	clean SAND to silty SAND	125	5.0	18	28	79	47	-	-	11	16	0.00	-	0.00	0.0
4.59	106.6	171.0	197.6	1.6	0.2	1.5	6	clean SAND to silty SAND	125	5.0	21	34	85	48	-	-	10	16	0.00	-	0.00	0.0
4.76	112.3	180.0	222.7	2.2	0.1	2.0	6	clean SAND to silty SAND	125	5.0	22	36	86	48	-	-	12	16	0.00	-	0.00	0.0
4.92	127.5	204.5	244.2	2.5	0.0	2.0	6	clean SAND to silty SAND	125	5.0	25	41	91	48	-	-	11	16	0.00	-	0.00	0.0
5.09	128.9	206.8	232.6	2.0	0.0	1.6	6	clean SAND to silty SAND	125	5.0	26	41	91	48	-	-	9	16	0.00	-	0.00	0.0
5.25	128.0	205.2	221.3	1.6	0.0	1.3	6	clean SAND to silty SAND	125	5.0	26	41	91	48	-	-	7	16	0.00	-	0.00	0.0
5.41	124.3	199.3	213.9	1.5	-0.1	1.2	6	clean SAND to silty SAND	125	5.0	25	40	90	48	-	-	7	16	0.00	-	0.00	0.0
5.58	130.4	209.2	226.9	1.7	-0.1	1.3	6	clean SAND to silty SAND	125	5.0	26	42	91	48	-	-	7	16	0.00	-	0.00	0.0
5.74	145.0	232.6	267.6	2.7	-0.2	1.9	6	clean SAND to silty SAND	125	5.0	29	47	95	48	-	-	9	16	0.00	-	0.00	0.0
5.91	153.5	246.2	270.7	2.5	-0.2	1.6	6	clean SAND to silty SAND	125	5.0	31	49	95	48	-	-	8	16	0.00	-	0.00	0.0
6.07	128.9	206.2	241.6	2.4	-0.1	1.8	6	clean SAND to silty SAND	125	5.0	26	41	91	48	-	-	10	16	0.00	-	0.00	0.0
6.23	132.8	209.6	234.7	2.0	0.0	1.5	6	clean SAND to silty SAND	125	5.0	27	42	91	48	-	-	8	16	0.00	-	0.00	0.0
6.40	146.5	228.1	271.4	3.1	0.1	2.1	6	clean SAND to silty SAND	125	5.0	29	46	94	48	-	-	10	16	0.00	-	0.00	0.0
6.56	162.4	249.7	295.3	3.5	0.1	2.2	6	clean SAND to silty SAND	125	5.0	32	50	95	48	-	-	10	16	0.00	-	0.00	0.0
6.73	166.8	253.2	278.9	2.8	-0.3	1.7	6	clean SAND to silty SAND	125	5.0	33	51	95	48	-	-	8	16	0.00	-	0.00	0.0
6.89	162.7	244.0	273.7	2.8	-0.1	1.7	6	clean SAND to silty SAND	125	5.0	33	49	95	48	-	-	9	16	0.00	-	0.00	0.0
7.05	174.0	257.7	270.3	2.3	-0.3	1.3	6	clean SAND to silty SAND	125	5.0	35	52	95	48	-	-	6	16	0.00	-	0.00	0.0
7.22	177.6	260.1	271.7	2.4	-0.2	1.3	6	clean SAND to silty SAND	125	5.0	36	52	95	48	-	-	6	16	0.00	-	0.00	0.0
7.38	179.0	259.1	267.4	2.2	-0.2	1.3	6	clean SAND to silty SAND	125	5.0	36	52	95	48	-	-	6	16	0.00	-	0.00	0.0
7.55	176.5	252.7	265.2	2.3	-0.2	1.3	6	clean SAND to silty SAND	125	5.0	35	51	95	48	-	-	6	16	0.00	-	0.00	0.0
7.71	169.8	240.3	258.4	2.4	-0.1	1.4	6	clean SAND to silty SAND	125	5.0	34	48	95	48	-	-	7	16	0.00	-	0.00	0.0
7.87	168.2	235.5	255.2	2.4	-0.1	1.5	6	clean SAND to silty SAND	125	5.0	34	47	95	48	-	-	7	16	0.00	-	0.00	0.0
8.04	164.7	228.2	251.1	2.5	-0.1	1.5	6	clean SAND to silty SAND	125	5.0	33	46	94	48	-	-	8	16	0.00	-	0.00	0.0
8.20	158.9	217.9	246.3	2.6	-0.1	1.7	6	clean SAND to silty SAND	125	5.0	32	44	93	48	-	-	9	16	0.00	-	0.00	0.0
8.37	155.5	211.1	233.0	2.3	0.0	1.5	6	clean SAND to silty SAND	125	5.0	31	42	92	48	-	-	8	16	0.00	-	0.00	0.0
8.53	162.0	217.8	244.2	2.6	0.0	1.6	6	clean SAND to silty SAND	125	5.0	32	44	93	48	-	-	9	16	0.00	-	0.00	0.0
8.69	165.2	219.9	251.4	2.9	-0.1	1.7	6	clean SAND to silty SAND	125	5.0	33	44	93	48	-	-	9	16	0.00	-	0.00	0.0
8.86	170.0	224.1	281.6	4.2	-0.2	2.5	6	clean SAND to silty SAND	125	5.0	34	45	94	48	-	-	12	16	0.00	-	0.00	0.0
9.02	178.0	232.5	260.8	3.0	-0.2	1.7	6	clean SAND to silty SAND	125	5.0	36	47	95	48	-	-	9	16	0.00	-	0.00	0.0
9.19	186.0	240.7	281.7	3.8	-0.2	2.0	6	clean SAND to silty SAND	125	5.0	37	48	95	48	-	-	10	16	0.00	-	0.00	0.0
9.35	263.8	338.4	383.8	6.0	-0.5	2.3	6	clean SAND to silty SAND	125	5.0	53	68	95	48	-	-	9	16	0.00	-	0.00	0.0
9.51	208.2	264.7	330.6	5.6	-0.3	2.7	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	13.8	9.9	12	16	0.00	-	0.00	0.0
9.68	223.5	281.9	311.4	4.0	0.0	1.8	6	clean SAND to silty SAND	125	5.0	45	56	95	48	-	-	8	16	0.00	-	0.00	0.0
9.84	238.9	298.8	326.1	4.3	0.1	1.8	6	clean SAND to silty SAND	125	5.0	48	60	95	48	-	-	8	16	0.00	-	0.00	0.0
10.01	239.2	296.6	326.0	4.4	0.1	1.8	6	clean SAND to silty SAND	125	5.0	48	59	95	48	-	-	8	16	0.00	-	0.00	0.0
10.17	250.1	307.5	335.4	4.6	0.1	1.8	6	clean SAND to silty SAND	125	5.0	50	62	95	48	-	-	8	16	0.00	-	0.00	0.0
10.34	260.2	317.3	346.3	4.8	0.1	1.9	6	clean SAND to silty SAND	125	5.0	52	63	95	48	-	-	8	16	0.00	-	0.00	0.0
10.50	260.5	315.2	345.7	4.9	0.1	1.9	6	clean SAND to silty SAND	125	5.0	52	63	95	48	-	-	8	16	0.00	-	0.00	0.0
10.66	262.0	314.5	348.4	5.2	0.2	2.0	6	clean SAND to silty SAND	125	5.0	52	63	95	48	-	-	8	16	0.00	-	0.00	0.0
10.83	268.0	319.2	355.9	5.5	0.2	2.0	6	clean SAND to silty SAND	125	5.0	54	64	95	48	-	-	8	16	0.00	-	0.00	0.0
10.99	274.5	324.5	344.2	4.6	-0.1	1.7	6	clean SAND to silty SAND	125	5.0	55	65	95	48	-	-	7	16	0.00	-	0.00	0.0
11.16	315.6	370.2	370.2	4.3	-0.1	1.4	6	clean SAND to silty SAND	125	5.0	63	74	95	48	-	-	5	16	0.00	-	0.00	0.0
11.32	346.5	403.6	403.6	3.8	0.2	1.1	6	clean SAND to silty SAND	125	5.0	69	81	95	48	-	-	5	16	0.00	-	0.00	0.0
11.48	313.1	362.0	362.0	4.0	0.3	1.3	6	clean SAND to silty SAND	125	5.0	63	72	95	48	-	-	5	16	0.00	-	0.00	0.0
11.65	291.6	334.8	349.8	4.7	0.1	1.6	6	clean SAND to silty SAND	125	5.0	58	67	95	48	-	-	6	16	0.00	-	0.00	0.0
11.81	304.8	347.4	375.8	5.8	0.1	1.9	6	clean SAND to silty SAND	125	5.0	61	69	95	48	-	-	7	16	0.00	-	0.00	0.0
11.98	326.5	369.5	401.1	6.5	0.1	2.0	6	clean SAND to silty SAND	125	5.0	65	74	95	48	-	-	7	16	0.00	-	0.00	0.0
12.14	367.4	412.9	429.8	6.6	0.0	1.8	6	clean SAND to silty SAND	125	5.0	73	83	95	48	-	-	6	16	0.00	-	0.00	0.0
12.30	365.4	407.9	418.7	6.1	0.2	1.7	6	clean SAND to silty SAND	125	5.0	73	82	95	48	-	-	6	16	0.00	-	0.00	0.0
12.47	390.1	432.5	458.4	7.7	0.1	2.0	6	clean SAND to silty SAND	125	5.0	78	87	95	48	-	-	7	16	0.00	-	0.00	0.0
12.63	517.1	569.6	569.6	8.9	-0.4	1.7	6	clean SAND to silty SAND	125	5.0	100	100	95	48	-	-	5	16	0.00	-	0.00	0.0
12.80	591.5	647.3	647.3	6.6	-0.3	1.1	6	clean SAND to silty SAND	125	5.0	100	100	95	48	-	-	5	16	0.00	-	0.00	0.0
12.96	538.8	585.7	585.7	5.5	-0.7	1.0	6	clean SAND to silty SAND	125	5.0	100	100	95	48	-	-	5	16	0.00	-	0.00	0.0
13.12	495.8	535.6	535.6	4.8	-0.5	1.0	6	clean SAND to silty SAND	125	5.0	99	100	95	48	-	-	5	16	0.00	-	0.00	0.0
13.29	426.3	457.6	457.6	4.6	-0.3	1.1	6	clean SAND to silty SAND	125	5.0	85	92	95	48	-	-	5	16	0.00	-	0.00	0.0
13.45	406.8	434.0	434.0	3.9	-0.5	1.0	6	clean SAND to silty SAND	125	5.0	81	87	95	48	-	-	5	16	0.00	-	0.00	0.0
13.62	432.9	459.0	459.0	5.6	-0.4	1.3	6	clean SAND to silty SAND	125	5.0	87	92	95	48	-	-	5	16	0.00	-	0.00	0.0
13.78	508.6	536.0	536.0	6.8	-0.2	1.3	6	clean SAND to silty SAND	125	5.0	100	100	95	48	-	-	5	16	0.00	-	0.00	0.0
13.94	599.3	627.9	627.9	5.5	-1.5	0.9	6	clean SAND to silty SAND	125	5.0	100	100	95	48	-	-	5	16	0.00	-	0.00	0.0

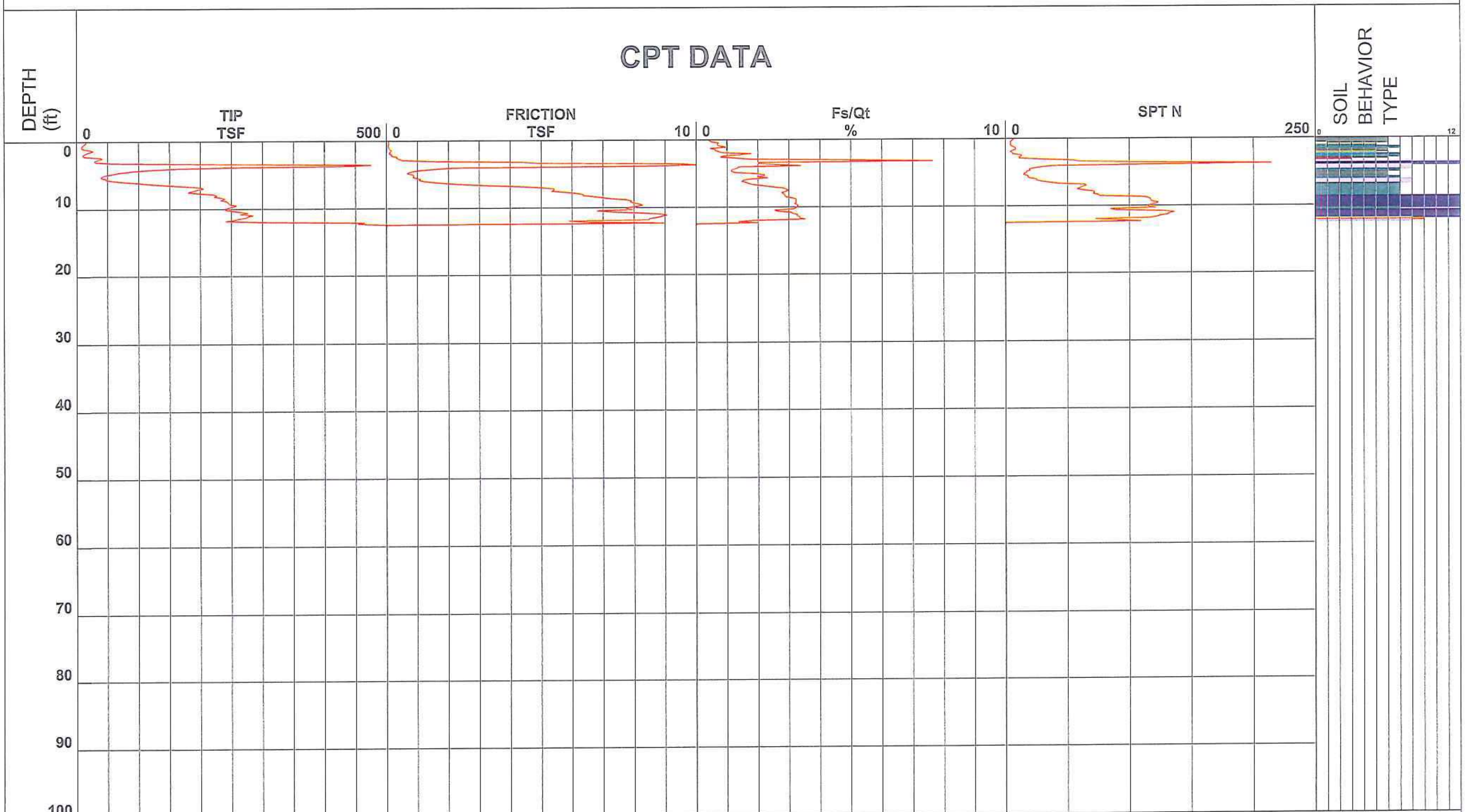
* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

Middle Earth Geo Testing

Earth Mechanics

Location	I-5 HOV Widening Segment 3	Operator	BH-TF	Filename	SDF(522).cpt
Job Number	11-137	Cone Number	DSG1104	GPS	
Hole Number	CPT-11-309	Date and Time	10/4/2011 2:21:40 AM	Maximum Depth	12.63 ft
Water Table Depth	>12.63 ft				

CPT DATA



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Depth Increment

*Soil behavior type and SPT based on data from UBC-1983

I-5 HOV Widening Segment 3

Project ID: Earth Mechanics
Data File: SDF(522).cpt
CPT Date: 10/4/2011 2:21:40 AM
GW During Test: No GW

Page: 1
Sounding ID: CPT-11-309
Project No: 11-137
Cone/Rig: DSG1104

Depth ft	qc PS tsf	* qcln PS -	q1ncs PS -	Slv Stss tsf	pore prss (psi)	Frct Rato %	* Mat Typ Zon	* Material Behavior Description	Unit Wght pcf	Qc to N	SPT R-N 60%	* SPT R-N1 60%	* Rel Den %	* Ftn Ang deg	Und Shr tsf	OCR -	* Fin Ic %	* Nk -	* Vol Strn %	* Dry Stlmt 0.02	* Liq Stlmt 0.02	* Cycl SStn %
0.33	14.1	22.6	44.3	0.1	0.0	0.5	5	silty SAND to sandy SILT	120	4.0	4	6	18	48	-	-	23	16	N/A	0.02	N/A	N/A
0.49	11.2	18.0	46.7	0.1	0.0	0.7	5	silty SAND to sandy SILT	120	4.0	3	4	10	47	-	-	29	16	N/A	0.02	N/A	N/A
0.66	9.6	15.4	43.8	0.1	0.0	0.7	5	silty SAND to sandy SILT	120	4.0	2	4	5	45	-	-	31	16	N/A	0.02	N/A	N/A
0.82	8.1	13.0	42.0	0.1	0.0	0.7	5	silty SAND to sandy SILT	120	4.0	2	3	5	43	-	-	35	16	N/A	0.02	N/A	N/A
0.98	7.7	12.4	-	0.1	0.0	0.8	4	clayy SILT to silty CLAY	115	2.0	4	6	-	-	0.5	9.9	37	15	N/A	0.01	N/A	N/A
1.15	10.2	16.3	50.3	0.1	0.0	1.0	5	silty SAND to sandy SILT	120	4.0	3	4	7	43	-	-	33	16	N/A	0.01	N/A	N/A
1.31	21.6	34.6	52.1	0.1	0.1	0.5	5	silty SAND to sandy SILT	120	4.0	5	9	32	46	-	-	17	16	N/A	0.01	N/A	N/A
1.48	25.8	41.4	60.8	0.2	0.1	0.6	5	silty SAND to sandy SILT	120	4.0	6	10	38	46	-	-	16	16	N/A	0.01	N/A	N/A
1.64	20.3	32.6	54.9	0.1	0.0	0.6	5	silty SAND to sandy SILT	120	4.0	5	8	30	44	-	-	19	16	N/A	0.01	N/A	N/A
1.80	14.8	23.8	51.3	0.1	0.0	0.7	5	silty SAND to sandy SILT	120	4.0	4	6	20	42	-	-	25	16	N/A	0.00	N/A	N/A
1.97	11.4	18.2	49.5	0.1	0.1	0.8	5	silty SAND to sandy SILT	120	4.0	3	5	11	40	-	-	30	16	N/A	0.00	N/A	N/A
2.13	9.8	15.7	-	0.2	0.0	1.8	4	clayy SILT to silty CLAY	115	2.0	5	8	-	-	0.7	9.9	41	15	N/A	0.00	N/A	N/A
2.30	12.4	19.8	62.7	0.2	0.1	1.4	4	clayy SILT to silty CLAY	115	2.0	6	10	-	-	0.9	9.9	34	15	N/A	0.00	N/A	N/A
2.46	38.3	61.5	84.2	0.3	0.2	0.9	6	clean SAND to silty SAND	125	5.0	8	12	51	45	-	-	14	16	N/A	0.00	N/A	N/A
2.62	41.3	66.3	85.7	0.3	0.1	0.8	6	clean SAND to silty SAND	125	5.0	8	13	53	45	-	-	13	16	N/A	0.00	N/A	N/A
2.79	33.1	53.1	88.2	0.4	0.1	1.3	5	silty SAND to sandy SILT	120	4.0	8	13	46	44	-	-	19	16	N/A	0.00	N/A	N/A
2.95	29.0	46.5	94.2	0.5	0.1	1.7	5	silty SAND to sandy SILT	120	4.0	7	12	42	43	-	-	23	16	N/A	0.00	N/A	N/A
3.12	30.3	48.6	-	1.5	0.1	4.9	4	clayy SILT to silty CLAY	115	2.0	15	24	-	-	2.1	9.9	36	15	N/A	0.00	N/A	N/A
3.28	57.5	92.2	299.6	4.4	0.2	7.6	9	very stiff fine SOIL	120	2.0	29	46	64	46	-	-	35	30	0.00	-	0.02	0.0
3.45	244.5	392.1	422.3	4.9	0.2	2.0	6	clean SAND to silty SAND	125	5.0	49	78	95	48	-	-	7	16	0.00	-	0.02	0.0
3.61	474.4	760.9	760.9	9.6	0.2	2.0	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	31.4	9.9	5	16	0.00	-	0.02	0.0
3.77	447.5	717.7	769.5	11.8	0.4	2.6	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	29.6	9.9	7	16	0.00	-	0.02	0.0
3.94	245.7	394.1	490.4	8.3	0.3	3.4	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	16.3	9.9	12	16	0.00	-	0.02	0.0
4.10	158.6	254.4	268.0	2.2	1.0	1.4	6	clean SAND to silty SAND	125	5.0	32	51	95	48	-	-	7	16	0.00	-	0.02	0.0
4.27	120.5	193.3	213.2	1.6	1.4	1.3	6	clean SAND to silty SAND	125	5.0	24	39	89	48	-	-	8	16	0.00	-	0.02	0.0
4.43	94.4	151.5	172.2	1.2	1.4	1.2	6	clean SAND to silty SAND	125	5.0	19	30	81	47	-	-	9	16	0.00	-	0.02	0.0
4.59	77.3	124.0	145.0	0.9	1.4	1.1	6	clean SAND to silty SAND	125	5.0	15	25	74	46	-	-	10	16	0.34	-	0.02	2.1
4.76	64.1	102.8	126.5	0.7	1.3	1.1	6	clean SAND to silty SAND	125	5.0	13	21	68	45	-	-	11	16	1.25	-	0.02	5.4
4.92	54.7	87.8	116.2	0.7	1.3	1.2	6	clean SAND to silty SAND	125	5.0	11	18	63	45	-	-	13	16	1.95	-	0.02	14.1
5.09	45.1	72.3	120.3	0.8	0.2	1.9	5	silty SAND to sandy SILT	120	4.0	11	18	56	44	-	-	19	16	1.71	-	0.01	17.5
5.25	40.4	64.8	122.6	0.9	0.1	2.2	5	silty SAND to sandy SILT	120	4.0	10	16	53	43	-	-	22	16	1.60	-	0.01	19.1
5.41	39.2	62.8	121.4	0.9	0.0	2.2	5	silty SAND to sandy SILT	120	4.0	10	16	52	43	-	-	22	16	1.70	-	0.01	24.5
5.58	47.0	75.3	126.3	0.9	-0.2	2.0	5	silty SAND to sandy SILT	120	4.0	12	19	58	44	-	-	19	16	1.43	-	0.01	11.2
5.74	47.7	76.6	136.5	1.1	-0.2	2.3	5	silty SAND to sandy SILT	120	4.0	12	19	58	44	-	-	21	16	0.86	-	0.00	5.0
5.91	60.2	96.5	138.5	1.1	-0.3	1.8	5	silty SAND to sandy SILT	120	4.0	15	24	66	45	-	-	15	16	0.77	-	0.00	3.8
6.07	79.1	126.9	159.2	1.2	-0.3	1.5	6	clean SAND to silty SAND	125	5.0	16	25	75	46	-	-	12	16	0.20	-	0.00	1.6
6.23	104.2	165.3	192.6	1.5	-0.4	1.5	6	clean SAND to silty SAND	125	5.0	21	33	84	47	-	-	10	16	0.00	-	0.00	0.0
6.40	122.3	191.4	220.7	2.0	-0.4	1.6	6	clean SAND to silty SAND	125	5.0	24	38	88	47	-	-	9	16	0.00	-	0.00	0.0
6.56	149.3	230.7	260.2	2.6	-0.5	1.7	6	clean SAND to silty SAND	125	5.0	30	46	95	48	-	-	9	16	0.00	-	0.00	0.0
6.73	179.9	274.3	306.7	3.4	-0.5	1.9	6	clean SAND to silty SAND	125	5.0	36	55	95	48	-	-	8	16	0.00	-	0.00	0.0
6.89	200.5	302.0	344.0	4.3	-0.5	2.2	6	clean SAND to silty SAND	125	5.0	40	60	95	48	-	-	9	16	0.00	-	0.00	0.0
7.05	204.4	304.2	358.1	5.0	-0.5	2.4	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	13.5	9.9	10	16	0.00	-	0.00	0.0
7.22	194.6	286.4	355.0	5.4	-0.4	2.8	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	12.9	9.9	12	16	0.00	-	0.00	0.0
7.38	186.8	271.9	345.6	5.4	-0.3	2.9	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	12.4	9.9	12	16	0.00	-	0.00	0.0
7.55	180.5	260.1	336.6	5.4	-0.2	3.0	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	11.9	9.9	13	16	0.00	-	0.00	0.0
7.71	199.2	284.1	357.8	5.8	-0.2	2.9	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	13.2	9.9	12	16	0.00	-	0.00	0.0
7.87	221.4	312.6	380.3	6.1	-0.2	2.8	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	14.6	9.9	11	16	0.00	-	0.00	0.0
8.04	226.2	316.2	385.5	6.3	-0.1	2.8	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	15.0	9.9	11	16	0.00	-	0.00	0.0
8.20	222.5	308.1	379.9	6.4	-0.1	2.9	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	14.7	9.9	11	16	0.00	-	0.00	0.0
8.37	234.3	321.3	393.3	6.7	0.0	2.9	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	15.5	9.9	11	16	0.00	-	0.00	0.0
8.53	239.0	324.8	399.4	7.0	0.0	2.9	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	15.8	9.9	11	16	0.00	-	0.00	0.0
8.69	233.1	313.8	397.6	7.3	-0.2	3.1	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	15.4	9.9	12	16	0.00	-	0.00	0.0
8.86	241.1	321.7	409.7	7.8	-0.2	3.2	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	15.9	9.9	12	16	0.00	-	0.00	0.0
9.02	244.0	322.7	411.4	7.9	-0.2	3.2	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	16.1	9.9	12	16	0.00	-	0.00	0.0
9.19	245.3	321.6	409.5	7.9	-0.2	3.2	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	16.2	9.9	12	16	0.00	-	0.00	0.0
9.35	246.7	320.7	409.6	8.0	-0.1	3.2	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	16.3	9.9	12	16	0.00	-	0.00	0.0
9.51	257.3	331.7	418.2	8.2	-0.1	3.2	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	17.0	9.9	12	16	0.00	-	0.00	0.0
9.68	253.7	324.4	414.1	8.3	-0.1	3.3	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	16.8	9.9	12	16	0.00	-	0.00	0.0
9.84	245.9	311.9	403.0	8.1	0.0	3.3	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	16.3	9.9	13	16	0.00	-	0.00	0.0
10.01	240.5	302.6	392.3	7.8	0.1	3.3	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	15.9	9.9	13	16	0.00	-	0.00	0.0
10.17	241.1	300.9	388.4	7.7	0.1	3.2	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	15.9	9.9	13	16	0.00	-	0.00	0.0
10.34	251.7	311.8	396.7	7.9	0.1	3.2	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	16.6	9.9	12	16	0.00	-	0.00	0.0
10.50	267.0	328.2	386.3	6.8	0.2	2.6	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	17.7	9.9	10	16	0.00	-	0.00	0.0
10.66	276.4	337.3	398.5	7.3	0.2	2.6	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	18.3	9.9	10	16	0.00	-	0.00	0.0
10.83	265.0	320.9	402.0	8.1	0.4	3.1	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	17.5	9.9	12	16	0.00	-	0.00	0.0
10.99	284.4	342.0	425.5	8.9	0.3	3.1	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	18.8	9.9	12	16	0.00	-	0.00	0.0
11.16	276.6	330.2	420.9	9.1	0.3	3.3	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	18.3	9.9	12	16	0.00	-	0.00	0.0
11.32	273.3	324.0	413.6	8.9	0.4	3.3	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	18.1	9.9	12	16	0.00	-	0.00	0.0
11.48	261.6	308.0	401.7	8.8	0.4	3.4	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	17.3	9.9	13	16	0.00	-	0.00	0.0
11.65	255.0	298.1	391.1	8.5	0.4	3.3	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	16.9	9.9	13	16	0.00	-	0.00	0.0
11.81	241.5	280.4	381.0	8.5	0.4	3.5	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	16.0	9.9	14	16	0.00	-	0.00	0.0
11.98	305.7	352.6	382.1	5.9	0.3	1.9	6	clean SAND to silty SAND	125	5.0	61	71	95	48	-	-	7	16	0.00	-	0.00	0.0
12.14	464.7	532.2	532.2	6.4	0.2	1.4	6	clean SAND to silty SAND	125	5.0	93	100	95	48	-	-	5	16	0.00	-	0.00	0.0
12.30	454.5	516.9	534.3	9.0	0.4	2.0	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	30.1	9.9	6	16	0.00	-	0.00	0.0

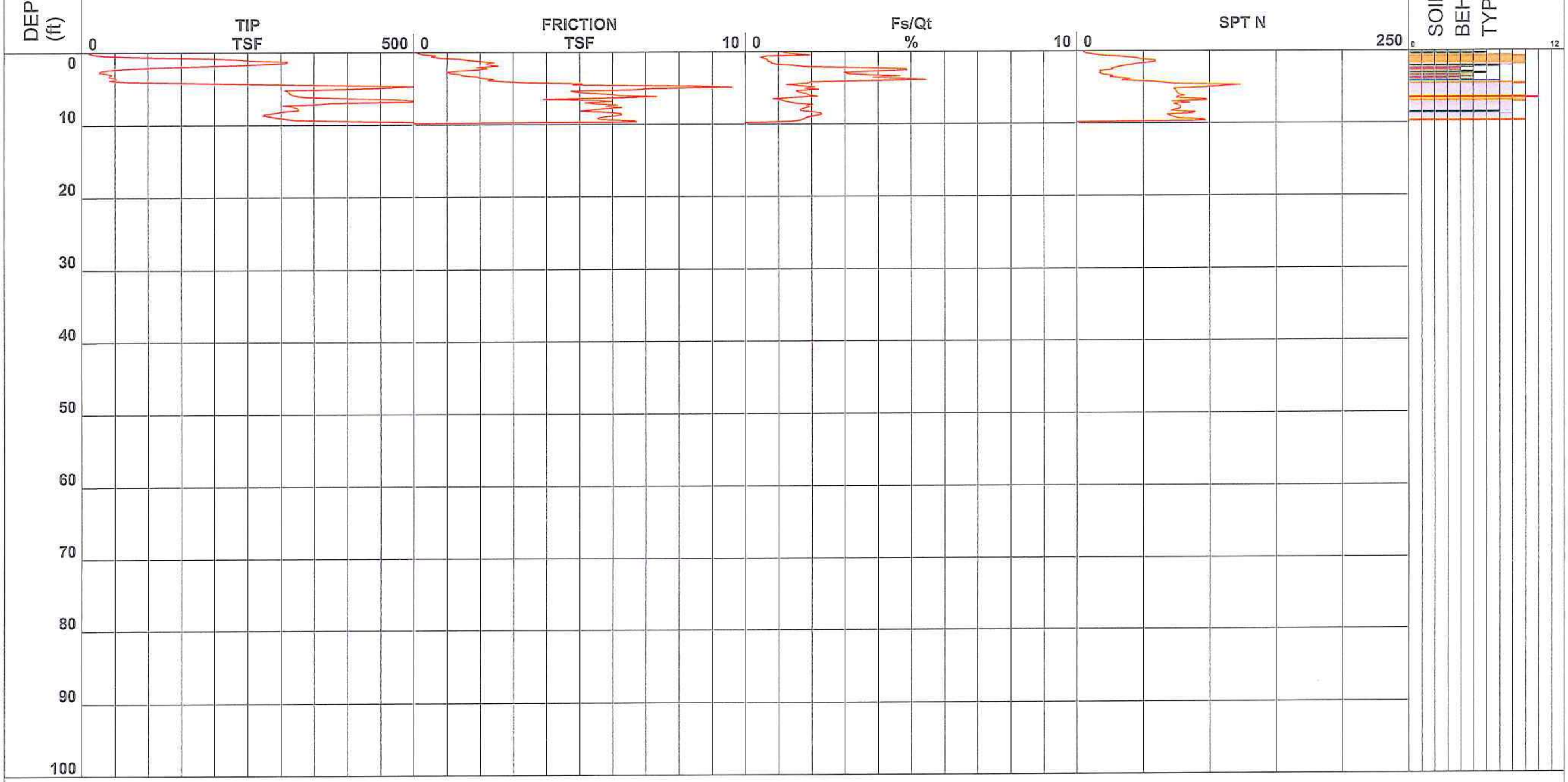
* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

Middle Earth Geo Testing

Earth Mechanics

Location	I-5 HOV Widening Segment 3	Operator	BH-TF	Filename	SDF(520).cpt
Job Number	11-137	Cone Number	DSG1104	GPS	
Hole Number	CPT-11-311	Date and Time	10/3/2011 11:41:05 PM	Maximum Depth	10.01 ft
Water Table Depth	>10.01 ft				

CPT DATA



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Depth Increment

*Soil behavior type and SPT based on data from UBC-1983

I-5 HOV Widening Segment 3

Project ID: Earth Mechanics
Data File: SDF(520).cpt
CPT Date: 10/3/2011 11:41:05 PM
GW During Test: No GW

Sounding ID: CPT-11-311
Project No: 11-137
Cone/Rig: DSG1104

Depth ft	qc PS tsf	* qc1n PS -	q1ncs PS -	Slv Stss tsf	pore prss (psi)	Frct Rato %	* Mat Typ Zon	* Material Behavior Description	Unit Wght pcf	Qc to N	SPT R-N 60%	* SPT R-N1 60%	* Rel Den %	* Ftn Ang deg	Und Shr tsf	OCR - -	* Fin Ic %	* Nk -	* Vol Strn %	* Dry Stlmt 0.00	* Liq Stlmt 0.00	* Cycl SStn %
0.33	17.6	28.2	71.8	0.3	0.0	1.5	5	silty SAND to sandy SILT	120	4.0	4	7	25	48	-	-	29	16	N/A	0.00	N/A	N/A
0.49	34.8	55.8	106.7	0.7	0.1	1.9	5	silty SAND to sandy SILT	120	4.0	9	14	48	48	-	-	22	16	N/A	0.00	N/A	N/A
0.66	83.0	133.0	137.2	0.5	-0.1	0.6	6	clean SAND to silty SAND	125	5.0	17	27	76	48	-	-	6	16	N/A	0.00	N/A	N/A
0.82	176.0	282.2	282.2	0.8	-0.2	0.5	6	clean SAND to silty SAND	125	5.0	35	56	95	48	-	-	5	16	N/A	0.00	N/A	N/A
0.98	231.1	370.6	370.6	1.4	-0.1	0.6	6	clean SAND to silty SAND	125	5.0	46	74	95	48	-	-	5	16	N/A	0.00	N/A	N/A
1.15	252.3	404.6	404.6	1.7	0.0	0.7	6	clean SAND to silty SAND	125	5.0	50	81	95	48	-	-	5	16	N/A	0.00	N/A	N/A
1.31	309.9	497.0	497.0	2.0	0.4	0.7	7	grvly SAND to dense SAND	130	6.0	52	83	95	48	-	-	5	16	N/A	0.00	N/A	N/A
1.48	308.6	495.0	495.0	2.4	0.4	0.8	6	clean SAND to silty SAND	125	5.0	62	99	95	48	-	-	5	16	N/A	0.00	N/A	N/A
1.64	280.7	450.1	450.1	2.2	0.6	0.8	6	clean SAND to silty SAND	125	5.0	56	90	95	48	-	-	5	16	N/A	0.00	N/A	N/A
1.80	237.1	380.3	380.3	2.3	0.6	1.0	6	clean SAND to silty SAND	125	5.0	47	76	95	48	-	-	5	16	N/A	0.00	N/A	N/A
1.97	167.5	268.7	287.3	2.5	0.7	1.5	6	clean SAND to silty SAND	125	5.0	34	54	95	48	-	-	7	16	N/A	0.00	N/A	N/A
2.13	106.9	171.5	207.2	1.9	0.8	1.8	6	clean SAND to silty SAND	125	5.0	21	34	85	48	-	-	11	16	N/A	0.00	N/A	N/A
2.30	61.8	99.1	195.8	2.2	0.9	3.6	5	silty SAND to sandy SILT	120	4.0	15	25	67	48	-	-	23	16	N/A	0.00	N/A	N/A
2.46	40.0	64.1	187.8	1.9	0.9	4.9	4	clayy SILT to silty CLAY	115	2.0	20	32	-	-	2.8	9.9	32	15	N/A	0.00	N/A	N/A
2.62	28.5	45.8	-	1.4	1.1	4.9	4	clayy SILT to silty CLAY	115	2.0	14	23	-	-	2.0	9.9	37	15	N/A	0.00	N/A	N/A
2.79	26.6	42.6	136.5	1.0	1.0	3.8	4	clayy SILT to silty CLAY	115	2.0	13	21	-	-	1.9	9.9	34	15	N/A	0.00	N/A	N/A
2.95	36.9	59.2	137.2	1.1	1.1	3.0	4	clayy SILT to silty CLAY	115	2.0	18	30	-	-	2.6	9.9	26	15	N/A	0.00	N/A	N/A
3.12	45.2	72.5	153.6	1.4	1.1	3.1	5	silty SAND to sandy SILT	120	4.0	11	18	56	45	-	-	24	16	N/A	0.00	N/A	N/A
3.28	40.9	65.6	160.5	1.5	1.1	3.6	4	clayy SILT to silty CLAY	115	2.0	20	33	-	-	2.9	9.9	28	15	0.00	-	0.00	0.0
3.45	41.8	67.0	187.5	1.9	1.1	4.7	4	clayy SILT to silty CLAY	115	2.0	21	34	-	-	2.9	9.9	31	15	0.00	-	0.00	0.0
3.61	52.0	83.5	186.5	2.0	1.0	3.9	4	clayy SILT to silty CLAY	115	2.0	26	42	-	-	3.7	9.9	26	15	0.00	-	0.00	0.0
3.77	52.3	83.9	207.5	2.4	1.0	4.6	4	clayy SILT to silty CLAY	115	2.0	26	42	-	-	3.7	9.9	28	15	0.00	-	0.00	0.0
3.94	41.3	66.3	205.1	2.2	0.9	5.5	4	clayy SILT to silty CLAY	115	2.0	21	33	-	-	2.9	9.9	33	15	0.00	-	0.00	0.0
4.10	70.5	113.0	214.3	2.6	0.8	3.7	5	silty SAND to sandy SILT	120	4.0	18	28	71	46	-	-	22	16	0.00	-	0.00	0.0
4.27	172.5	276.7	312.5	3.4	0.6	2.0	6	clean SAND to silty SAND	125	5.0	35	55	95	48	-	-	9	16	0.00	-	0.00	0.0
4.43	270.1	433.2	453.0	5.1	0.4	1.9	6	clean SAND to silty SAND	125	5.0	54	87	95	48	-	-	6	16	0.00	-	0.00	0.0
4.59	387.6	621.7	621.7	4.8	-0.4	1.2	6	clean SAND to silty SAND	125	5.0	78	100	95	48	-	-	5	16	0.00	-	0.00	0.0
4.76	512.0	821.1	821.1	8.2	0.0	1.6	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	33.9	9.9	5	16	0.00	-	0.00	0.0
4.92	458.0	734.5	739.8	9.6	0.2	2.1	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	30.3	9.9	5	16	0.00	-	0.00	0.0
5.09	398.5	639.1	639.1	7.1	0.3	1.8	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	26.4	9.9	5	16	0.00	-	0.00	0.0
5.25	305.7	490.2	523.1	6.7	0.1	2.2	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	20.2	9.9	7	16	0.00	-	0.00	0.0
5.41	310.6	498.2	498.2	4.8	0.1	1.5	6	clean SAND to silty SAND	125	5.0	62	100	95	48	-	-	5	16	0.00	-	0.00	0.0
5.58	312.9	501.9	501.9	4.9	0.2	1.6	6	clean SAND to silty SAND	125	5.0	63	100	95	48	-	-	5	16	0.00	-	0.00	0.0
5.74	313.1	502.2	502.6	5.4	0.3	1.7	6	clean SAND to silty SAND	125	5.0	63	100	95	48	-	-	5	16	0.00	-	0.00	0.0
5.91	317.4	509.0	519.6	5.9	0.4	1.9	6	clean SAND to silty SAND	125	5.0	63	100	95	48	-	-	6	16	0.00	-	0.00	0.0
6.07	323.0	518.0	531.9	6.2	0.4	1.9	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	21.4	9.9	6	16	0.00	-	0.00	0.0
6.23	338.4	536.5	565.2	7.3	0.5	2.2	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	22.4	9.9	7	16	0.00	-	0.00	0.0
6.40	399.0	624.8	624.8	5.8	0.7	1.5	6	clean SAND to silty SAND	125	5.0	80	100	95	48	-	-	5	16	0.00	-	0.00	0.0
6.56	472.5	730.4	730.4	3.9	0.7	0.8	7	grvly SAND to dense SAND	130	6.0	79	100	95	48	-	-	5	16	0.00	-	0.00	0.0
6.73	507.7	774.3	774.3	5.6	-0.7	1.1	6	clean SAND to silty SAND	125	5.0	100	100	95	48	-	-	5	16	0.00	-	0.00	0.0
6.89	510.3	768.7	768.7	6.0	-0.8	1.2	6	clean SAND to silty SAND	125	5.0	100	100	95	48	-	-	5	16	0.00	-	0.00	0.0
7.05	375.3	558.4	558.4	5.2	-0.3	1.4	6	clean SAND to silty SAND	125	5.0	75	100	95	48	-	-	5	16	0.00	-	0.00	0.0
7.22	355.5	522.7	522.7	5.5	-0.1	1.5	6	clean SAND to silty SAND	125	5.0	71	100	95	48	-	-	5	16	0.00	-	0.00	0.0
7.38	302.8	440.0	467.9	6.1	-0.1	2.0	6	clean SAND to silty SAND	125	5.0	61	88	95	48	-	-	7	16	0.00	-	0.00	0.0
7.55	317.8	456.7	470.6	5.8	-0.1	1.8	6	clean SAND to silty SAND	125	5.0	64	91	95	48	-	-	6	16	0.00	-	0.00	0.0
7.71	324.2	460.8	481.2	6.3	-0.1	1.9	6	clean SAND to silty SAND	125	5.0	65	92	95	48	-	-	6	16	0.00	-	0.00	0.0
7.87	326.0	458.3	468.5	5.8	0.0	1.8	6	clean SAND to silty SAND	125	5.0	65	92	95	48	-	-	6	16	0.00	-	0.00	0.0
8.04	326.3	453.8	456.4	5.4	0.0	1.7	6	clean SAND to silty SAND	125	5.0	65	91	95	48	-	-	5	16	0.00	-	0.00	0.0
8.20	304.6	419.3	426.5	5.0	-0.4	1.7	6	clean SAND to silty SAND	125	5.0	61	84	95	48	-	-	6	16	0.00	-	0.00	0.0
8.37	294.8	401.7	428.6	5.8	-0.4	2.0	6	clean SAND to silty SAND	125	5.0	59	80	95	48	-	-	7	16	0.00	-	0.00	0.0
8.53	277.3	374.1	417.1	6.2	-0.4	2.3	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	18.3	9.9	8	16	0.00	-	0.00	0.0
8.69	273.2	365.3	410.6	6.3	-0.4	2.3	8	stiff SAND to clayy SAND	115	1.0	100	100	-	-	18.1	9.9	9	16	0.00	-	0.00	0.0
8.86	282.5	374.3	413.0	6.1	-0.4	2.2	6	clean SAND to silty SAND	125	5.0	56	75	95	48	-	-	8	16	0.00	-	0.00	0.0
9.02	292.6	384.1	411.7	5.7	-0.5	1.9	6	clean SAND to silty SAND	125	5.0	59	77	95	48	-	-	7	16	0.00	-	0.00	0.0
9.19	305.7	397.6	417.0	5.5	-0.5	1.8	6	clean SAND to silty SAND	125	5.0	61	80	95	48	-	-	6	16	0.00	-	0.00	0.0
9.35	321.1	413.8	428.1	5.6	-0.6	1.8	6	clean SAND to silty SAND	125	5.0	64	83	95	48	-	-	6	16	0.00	-	0.00	0.0
9.51	398.5	509.0	509.0	6.6	-0.7	1.7	6	clean SAND to silty SAND	125	5.0	80	100	95	48	-	-	5	16	0.00	-	0.00	0.0
9.68	504.9	639.3	639.3	6.7	-0.8	1.3	6	clean SAND to silty SAND	125	5.0	100	100	95	48	-	-	5	16	0.00	-	0.00	0.0

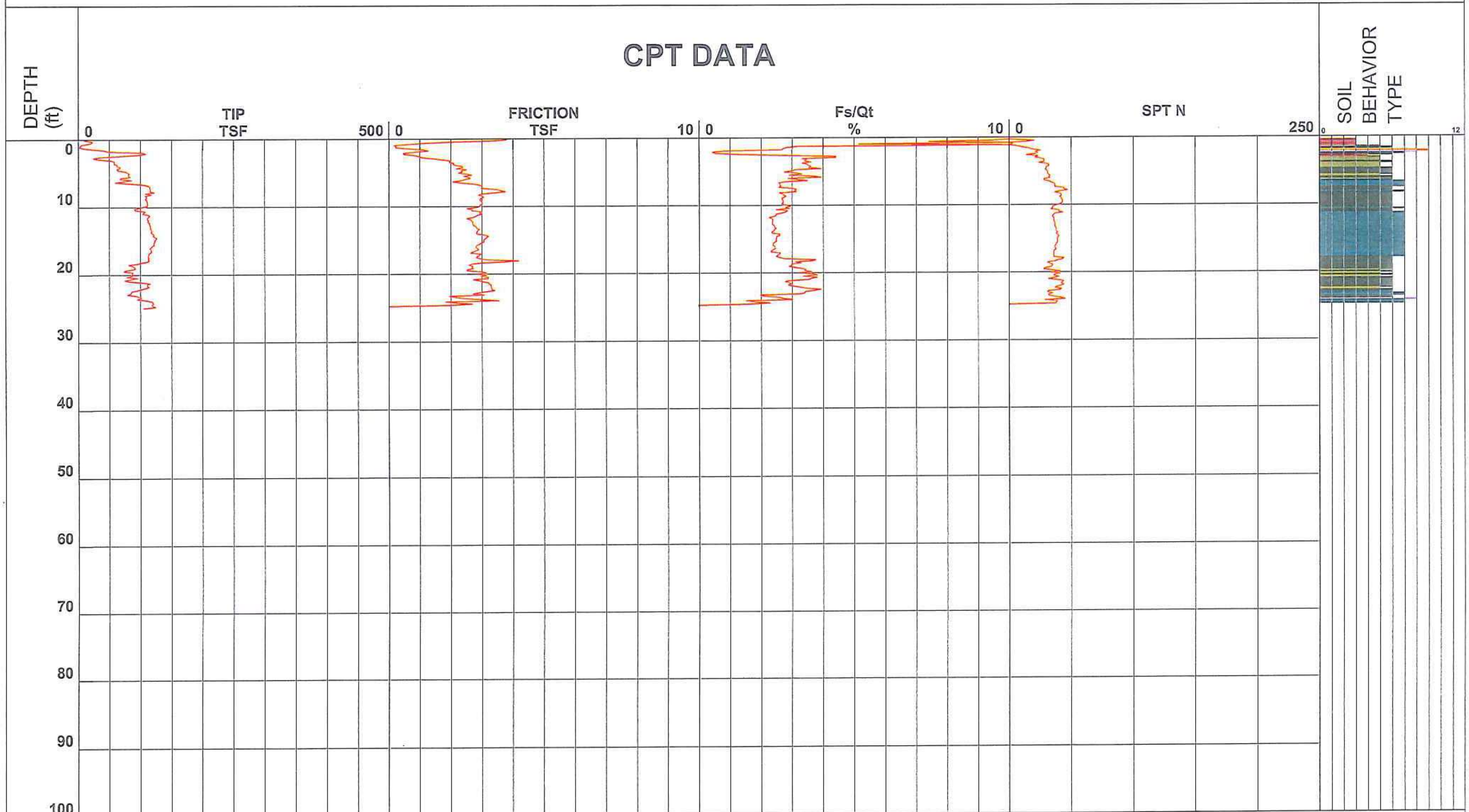
* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

Middle Earth Geo Testing

Earth Mechanics

Location	I-5 HOV Widening Segment 3	Operator	BH-DM	Filename	SDF(527).cpt
Job Number	11-137	Cone Number	DSG1104	GPS	
Hole Number	CPT-11-318	Date and Time	10/5/2011 12:06:49 AM	Maximum Depth	24.93 ft
Water Table Depth	>24.93 ft				

CPT DATA



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

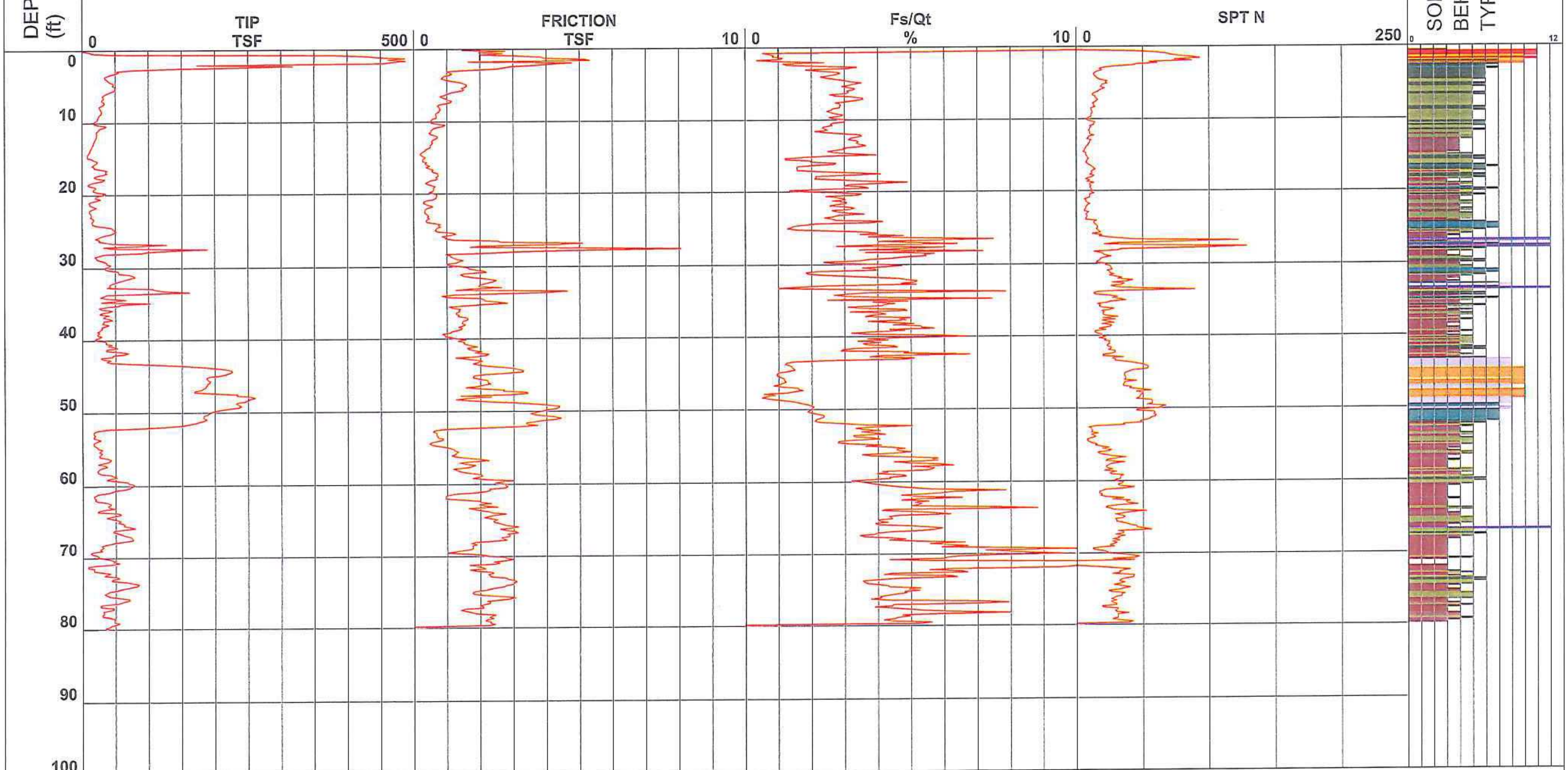
Depth Increment

*Soil behavior type and SPT based on data from UBC-1983

Earth Mechanics

Location	I-5 HOV Widening Segment 3	Operator	BH-DM	Filename	SDF(528)-2.cpt
Job Number	11-137	Cone Number	DSG1104	GPS	
Hole Number	CPT-11-321	Date and Time	10/5/2011 1:33:38 AM	Maximum Depth	80.05 ft
Water Table Depth	17.00 ft				

CPT DATA



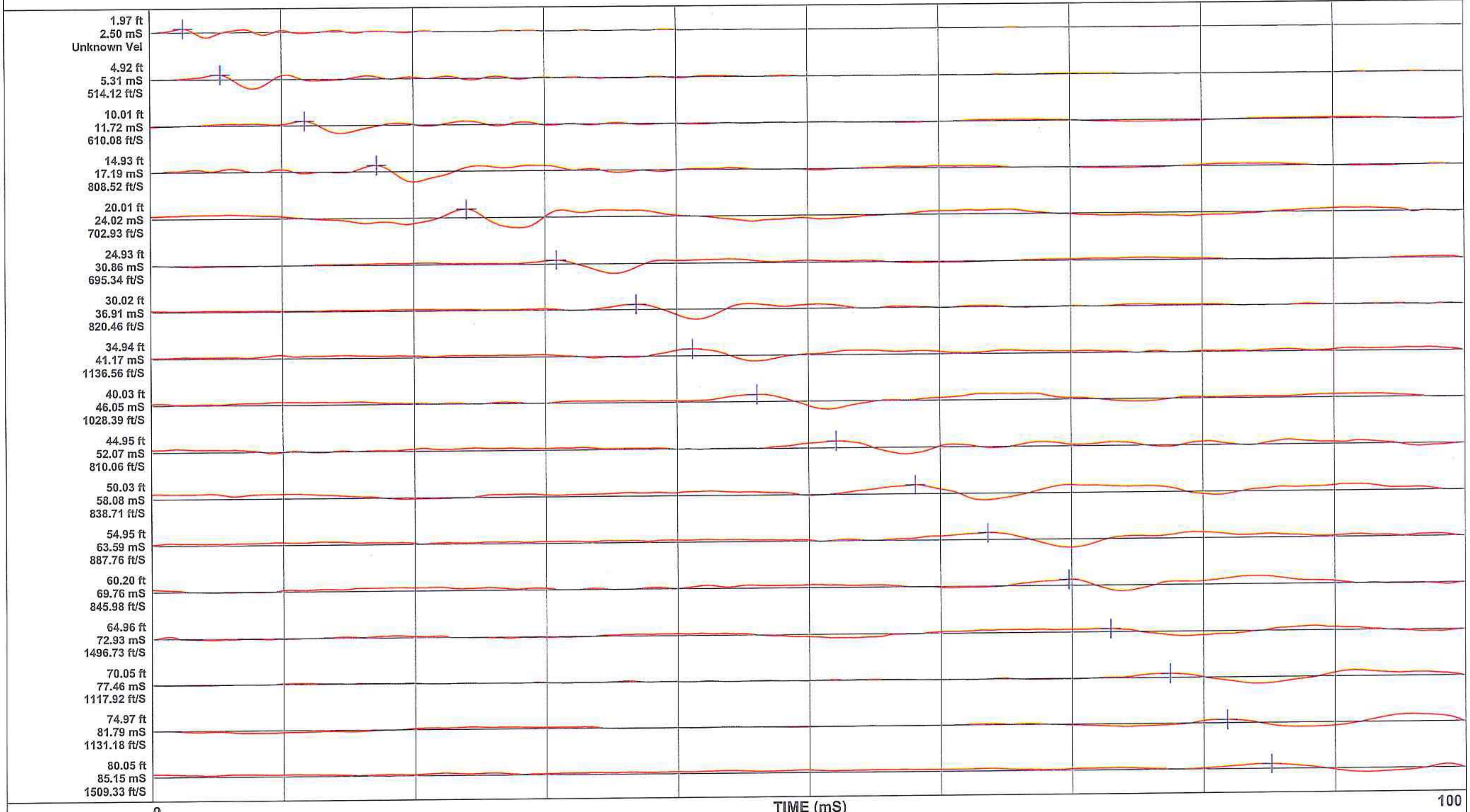
1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Depth Increment

*Soil behavior type and SPT based on data from UBC-1983

Earth Mechanics

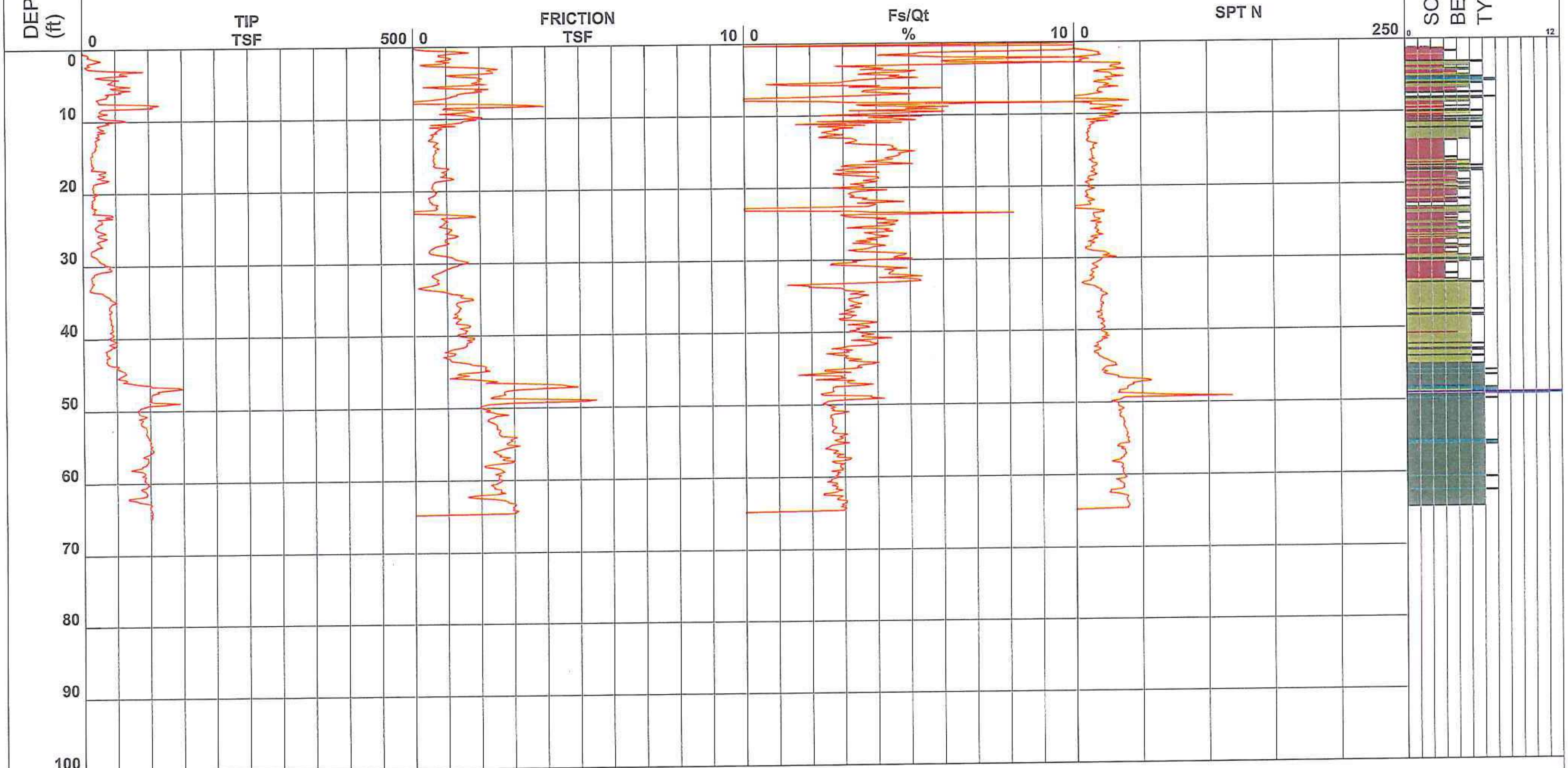
Location	I-5 HOV Widening Segment 3	Operator	BH-DM	GPS	
Job Number	11-137	Cone Number	DSG1104		
Hole Number	CPT-11-321	Date and Time	10/5/2011 1:33:38 AM		



Earth Mechanics

Location	I-5 HOV Widening Segment 3	Operator	BH-JC	Filename	SDF(572).cpt
Job Number	11-137	Cone Number	DSG1023	GPS	
Hole Number	CPT-11-325	Date and Time	10/10/2011 11:10:38 PM	Maximum Depth	64.96 ft
Water Table Depth	57.00 ft				

CPT DATA



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

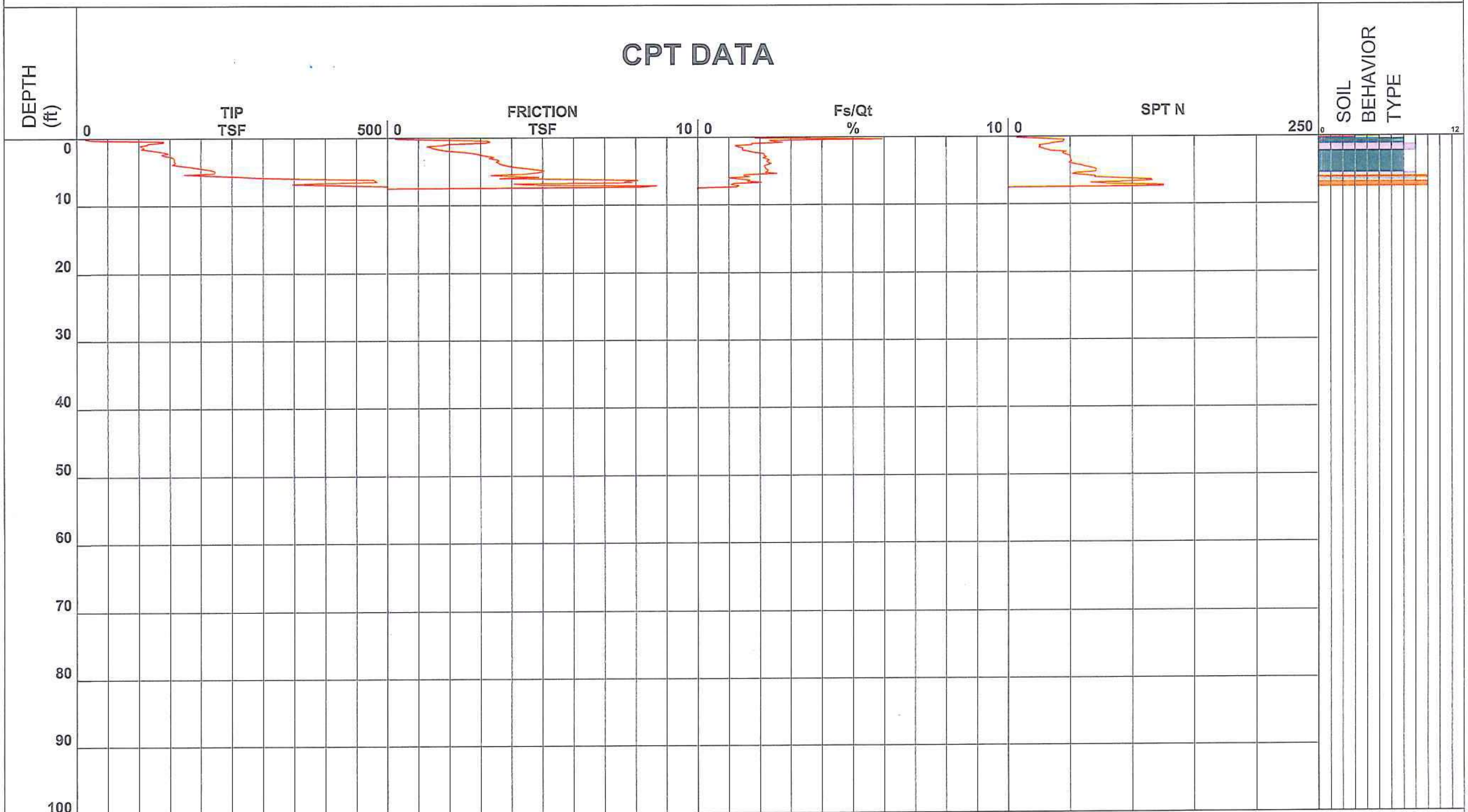
Depth Increment

*Soil behavior type and SPT based on data from UBC-1983

Earth Mechanics

Location	I-5 HOV Widening Segment 3	Operator	BH-TF	Filename	SDF(523).cpt
Job Number	11-137	Cone Number	DSG1104	GPS	
Hole Number	CPT-11-332	Date and Time	10/4/2011 3:07:33 AM	Maximum Depth	7.71 ft
Water Table Depth	>7.71 ft				

CPT DATA



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

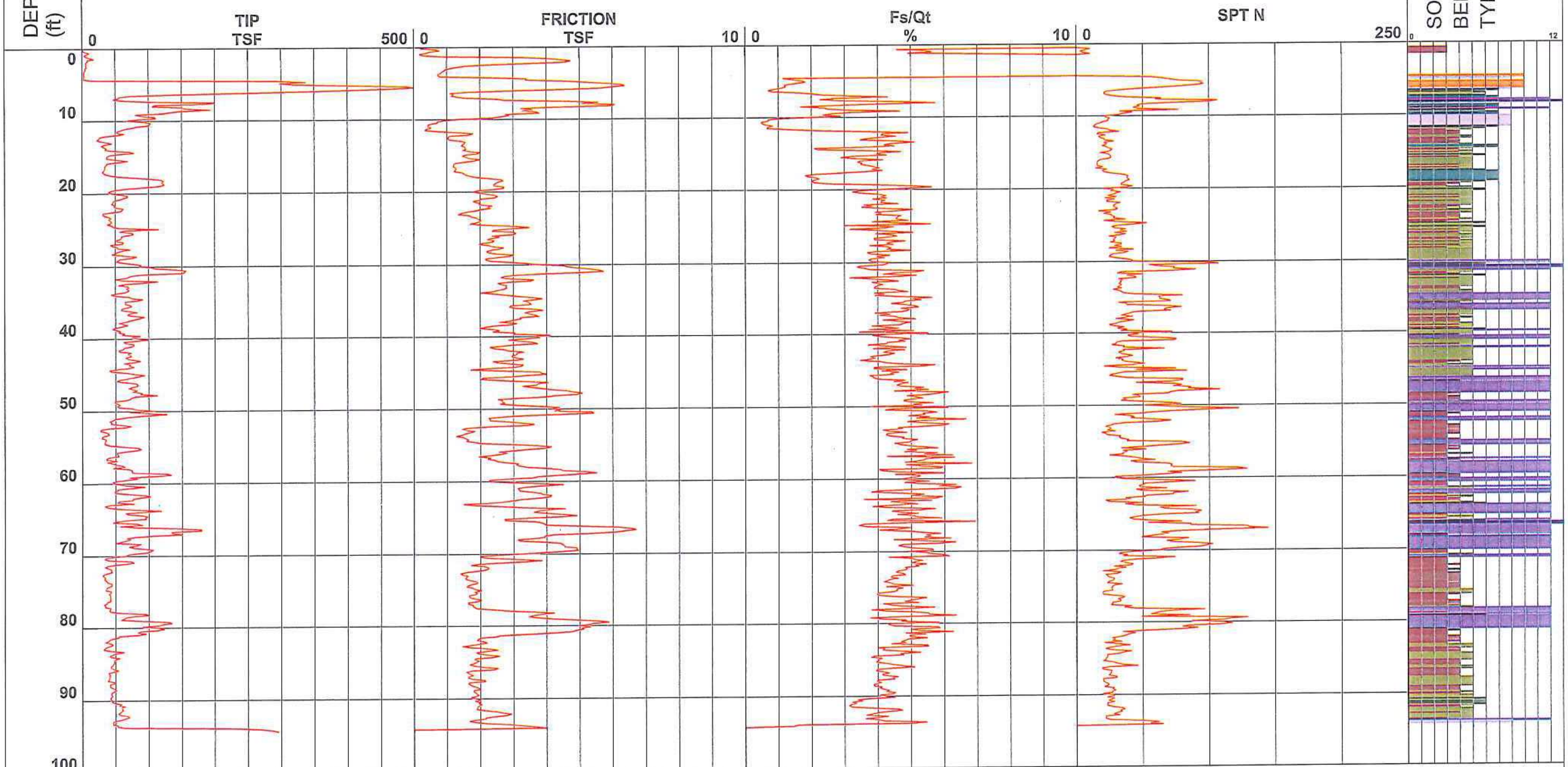
Depth Increment

*Soil behavior type and SPT based on data from UBC-1983

Earth Mechanics

Location	I-5 HOV Widening Segment 3	Operator	BH-TF	Filename	SDF(519).cpt
Job Number	11-137	Cone Number	DSG1104	GPS	
Hole Number	CPT-11-345	Date and Time	10/3/2011 1:40:54 AM	Maximum Depth	94.49 ft
Water Table Depth	>94.49 ft				

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

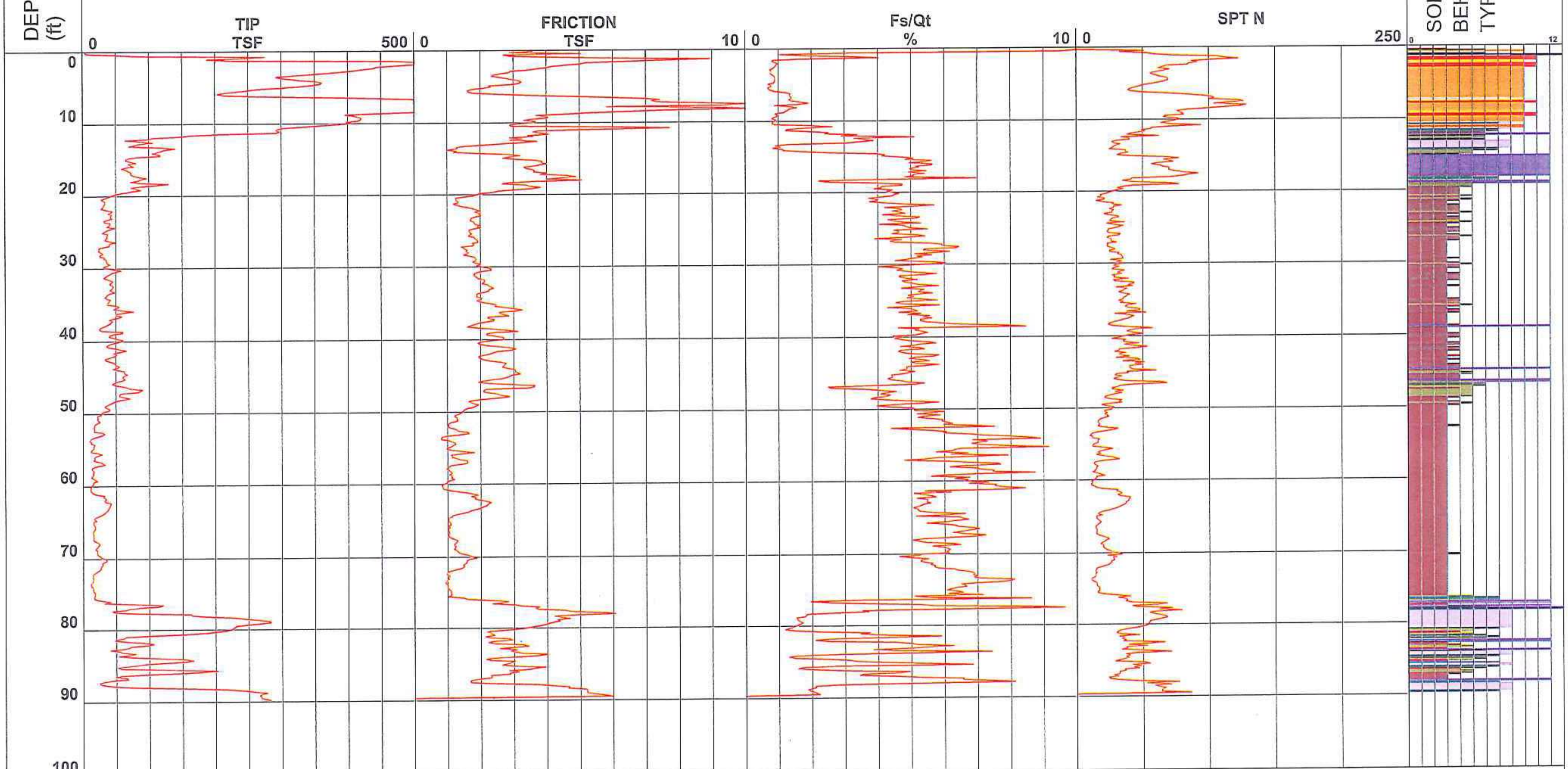
Depth Increment

*Soil behavior type and SPT based on data from UBC-1983

Earth Mechanics

Location	I-5 HOV Widening Segment 3	Operator	BH-TF	Filename	SDF(517).cpt
Job Number	11-137	Cone Number	DSG1104	GPS	
Hole Number	CPT-11-347	Date and Time	10/2/2011 11:53:38 PM	Maximum Depth	89.89 ft
Water Table Depth	>89.89 ft				

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

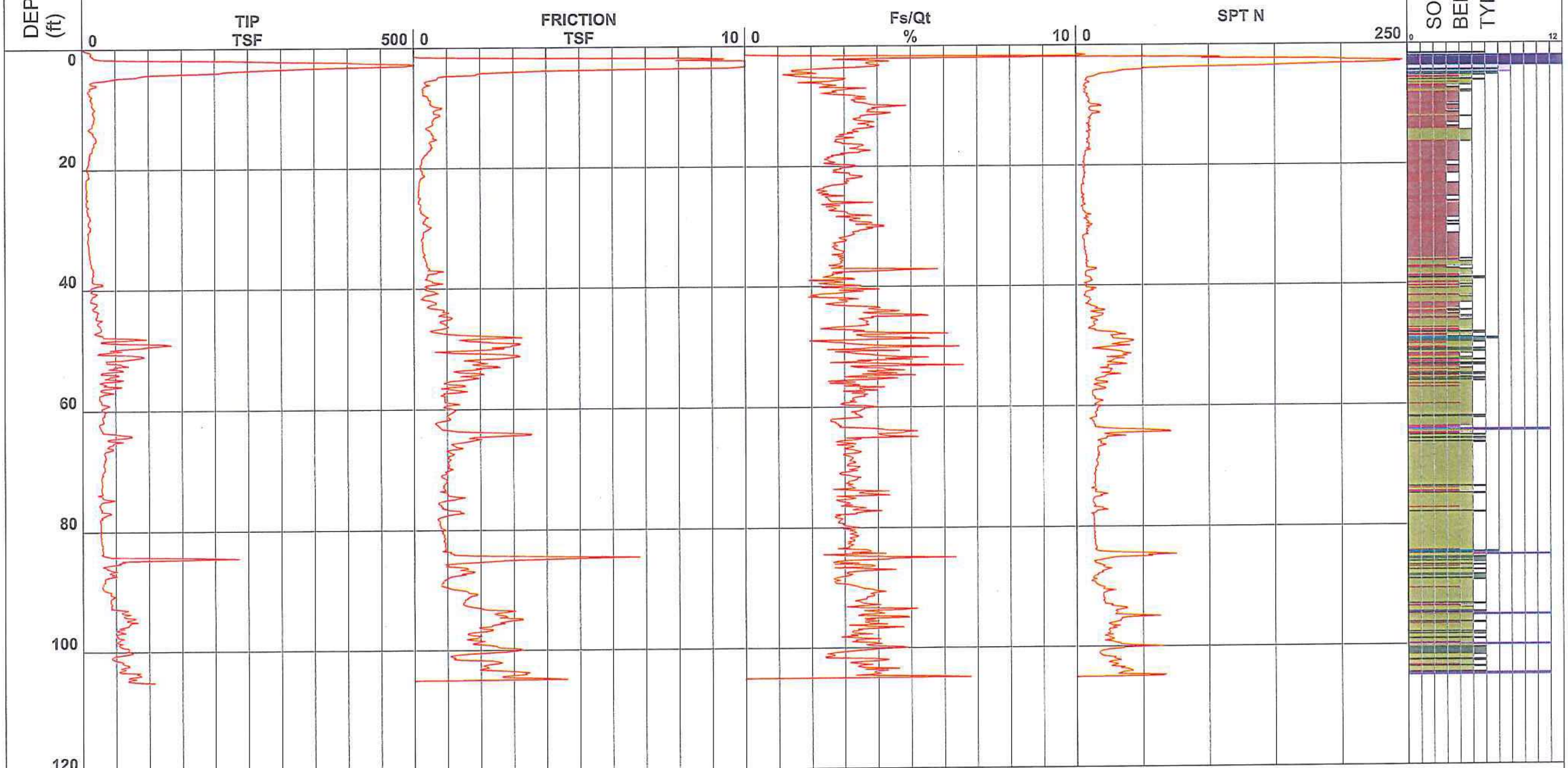
Depth Increment

*Soil behavior type and SPT based on data from UBC-1983

Earth Mechanics

Location	I-5 HOV Widening Segment 3	Operator	BH-JC	Filename	SDF(575).cpt
Job Number	11-137	Cone Number	DSG1023	GPS	
Hole Number	CPT-11-349	Date and Time	10/11/2011 1:20:42 AM	Maximum Depth	105.31 ft
Water Table Depth	18.00 ft				

CPT DATA



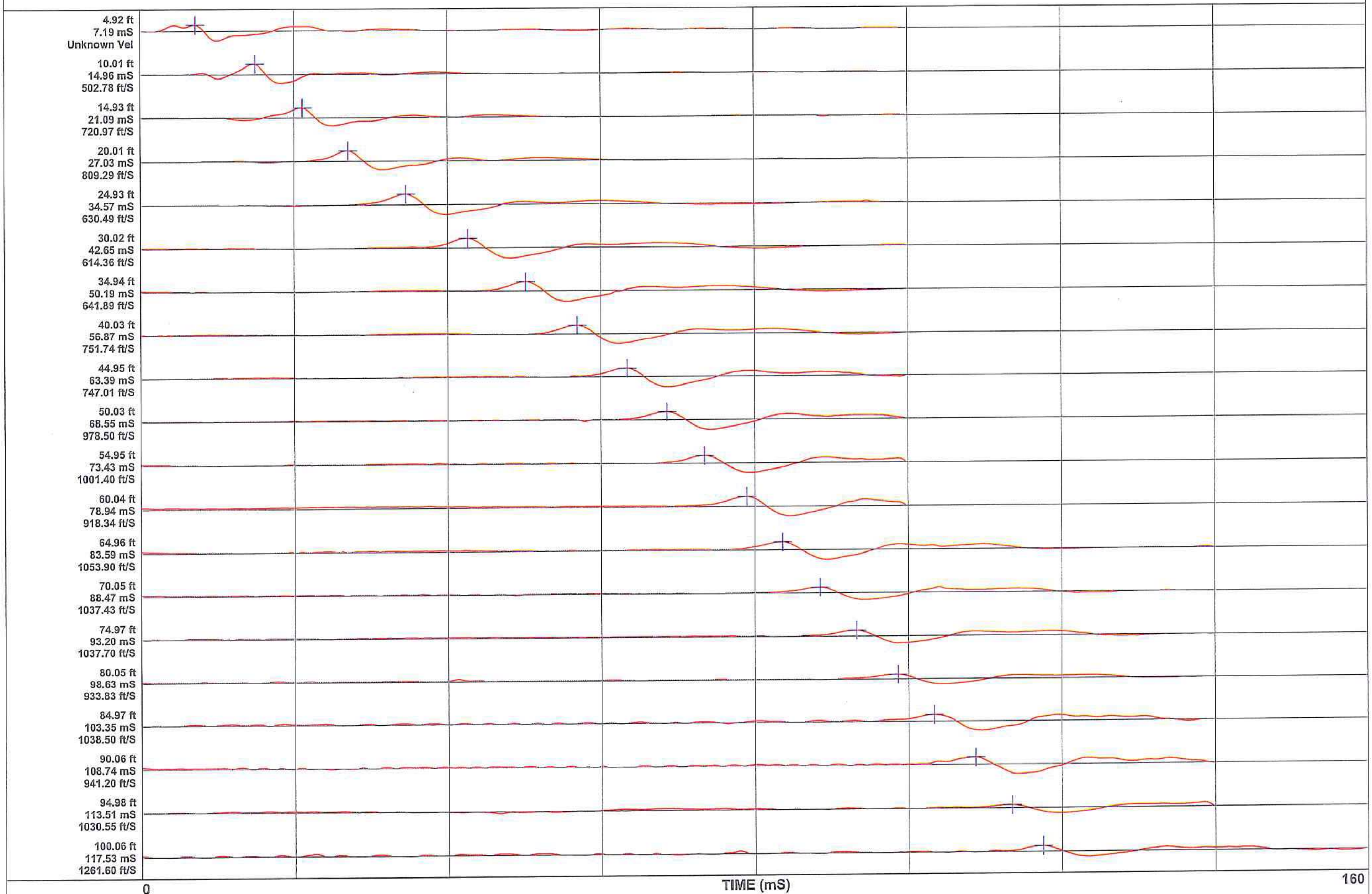
- 1 - sensitive fine grained
- 2 - organic material
- 3 - clay
- 4 - silty clay to clay
- 5 - clayey silt to silty clay
- 6 - sandy silt to clayey silt
- 7 - silty sand to sandy silt
- 8 - sand to silty sand
- 9 - sand
- 10 - gravelly sand to sand
- 11 - very stiff fine grained (*)
- 12 - sand to clayey sand (*)

Depth Increment

*Soil behavior type and SPT based on data from UBC-1983

Earth Mechanics

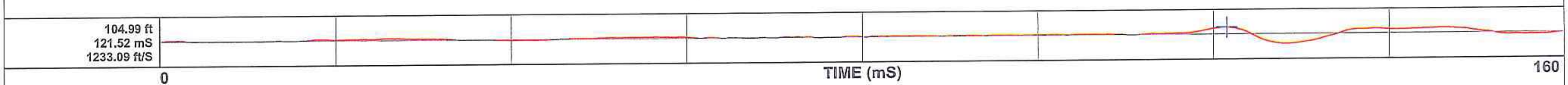
Location	I-5 HOV Widening Segment 3	Operator	BH-JC	GPS	
Job Number	11-137	Cone Number	DSG1023		
Hole Number	CPT-11-349	Date and Time	10/11/2011 1:20:42 AM		



Earth Mechanics

Location	I-5 HOV Widening Segment 3	Operator	BH-JC
Job Number	11-137	Cone Number	DSG1023
Hole Number	CPT-11-349	Date and Time	10/11/2011 1:20:42 AM

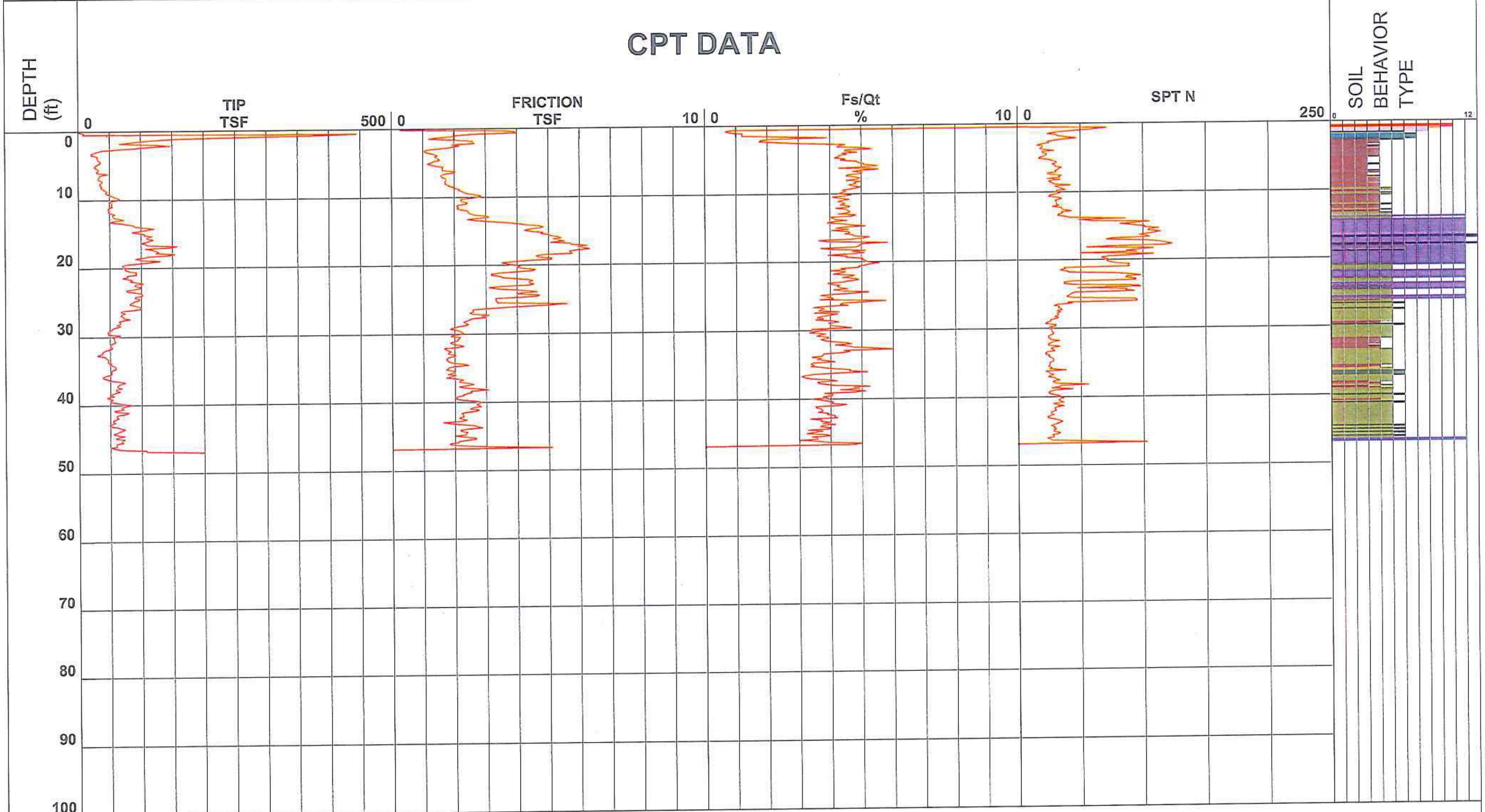
GPS



Earth Mechanics

Location	I-5 HOV Widening Segment 3	Operator	BH-TF
Job Number	11-137	Cone Number	DSG1104
Hole Number	CPT-11-351	Date and Time	10/2/2011 10:29:53 PM
Water Table Depth	>47.08 ft		
Filename	SDF(513).cpt	GPS	
Maximum Depth	47.08 ft		

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Depth Increment

*Soil behavior type and SPT based on data from UBC-1983

Appendix B

Laboratory Test Results

TABLE B-1 SUMMARY OF LABORATORY TEST RESULTS

Project No. : 11-137   Project Name : I-5 HOV Improvement Project - PCH to San Juan Creek Road

Boring No.	Sample No.	Sample Depth (ft)	Soil Identification (group symbol) ASTM D2488/D2487	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 Content CT-422 (ppm)
A-11-302	B-0	0.8-5	CL							41/14/27				
A-11-302	D-1	2.5	CL	18.7	130.8	4.5					250	7.4	280	2005
A-11-302	S-2	5	CL	16.2										
A-11-302	D-3	10	CL	18.9	128.5	3.25								
A-11-302	S-4	15	SP-SM	5.6										
A-11-303	B-0	0-5	SC					0:69:31		22/13/9				
A-11-303	D-1	5	SP	4.8	121.8									
A-11-303	S-2	10	SM	24.3										
A-11-303	D-3	15	CH	26.1	121.4	2.25				55/26/29				
A-11-303	S-4	20	CL	32.8										
A-11-303	D-5	25	CL	23.4	126.5	>4.5		0:25:75						
A-11-303	S-6	30	CL	24.3										
A-11-304	S-1	2.5	CL	9.9							480	8.1	800	644
A-11-304	D-2	5	SM	7.7	119.1									
A-11-304	S-3	10	SM to CL	15.2										
A-11-304	D-4	15	CL	20.3	124.1	2.5								
A-11-304	S-5	20	CL	17.8										
A-11-304	D-6	25	CL	31.9	117.7	1.75								
A-11-304	S-7	30	CL	31.4										
A-11-304	D-8	35	CL	28.4	119.6	>4.5								
A-11-304	S-9	40	CL	32.0										
A-11-304	D-10	45	CL	26.3	120.4	>4.5								
A-11-304	S-11	50	CL	29.0										
A-11-305	B-0	0.9-5	SC					0:80:20		30/12/18				
A-11-305	D-1	5	SP	2.3	113.1			30:66:4						
A-11-305	S-2	10	SM	11.0										
A-11-305	D-3	15	CH	30.7	121.0	3.25								
A-11-305	S-4	20	CH	29.8										
A-11-305	D-5	25	CL	32.5	118.2	3.75								
A-11-305	S-6	30	CL	27.0										
A-11-305	D-7	35	MH	26.6	122.3	>4.5								
A-11-305	S-8	40	MH	27.2										
A-11-305	D-9	45	MH	28.5	119.3	>4.5								
A-11-305	S-10	50	MH	27.7										
A-11-310	D-1	2.5	CL	11.4	119.2	>4.5								
A-11-310	S-2	5	CL	17.6										
A-11-310	D-3	10	ML	13.3	119.4	>4.5		0:33:67			220	7.2	240	3970
A-11-310	S-4	15	CL	20.1										
A-11-310	D-5	20	CH	31.0	116.5	>4.5								
A-11-310	S-6	25	SP-SM	2.1										
A-11-310	D-7	30	SP-SM	3.2	99.6									
A-11-310	S-8	35	SP-SM	3.6										
A-11-310	D-9	40	CL	20.7	154.4	3.75								

TABLE B-1 SUMMARY OF LABORATORY TEST RESULTS

Project No. : 11-137   Project Name : I-5 HOV Improvement Project - PCH to San Juan Creek Road

Boring No.	Sample No.	Sample Depth (ft)	Soil Identification (group symbol) ASTM D2488/D2487	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 Content CT-422 (ppm)
A-11-312	D-1	5	CL	19.6	121.8	2.0				34/16/18	1000	8.4	560	516
A-11-312	S-2	10	CL	21.9										
A-11-312	D-3	15	MH	28.7	115.4	>4.5								
A-11-312	S-4	20	MH	41.5										
A-11-312	D-5	25	MH	26.5	120.5	>4.5								
A-11-312	S-6	30	MH	28.3										
A-11-312	D-7	35	MH	29.2	119.4	>4.5								
A-11-312	S-8	40	MH	29.3										
A-11-312	D-9	45	MH	26.9	122.4	>4.5								
A-11-312	S-10	50	MH	25.0										
A-11-313	D-2	5	ML to SM	12.6	118.1	2.0		0:45:55						
A-11-313	S-3	10	ML	11.5							380	6.0	400	881
A-11-313	D-4	15	CL	12.0	126.5	>4.5								
A-11-313	S-5T	20	ML	16.4										
A-11-313	S-5B	21	CL	17.9										
A-11-313	D-6	25	CL	18.7	125.8	>4.5								
A-11-313	S-7T	30	CL	21.4										
A-11-313	S-7B	31	ML	16.4										
A-11-313	D-8	35	CL to SM	17.8	122.6	2.25								
A-11-313	S-9	40	SP-SM	2.5										
A-11-313	D-10	45	SP-SM	4.3	98.9									
A-11-313	S-11	50	CL	26.8										
A-11-314	D-1	2.5	CL	9.6	112.3	3.5		0:19:81						
A-11-314	S-2	5	ML	7.3										
A-11-314	D-3	10	ML	9.2	114.8	>4.5		0:20:80						
A-11-314	S-4T	15	ML	9.7										
A-11-314	S-4B	16	SM	6.1										
A-11-314	D-5	20	CL	11.1	126.2	>4.5								
A-11-314	S-6T	25	CL	10.8										
A-11-314	S-6B	26	SP-SM	1.7										
A-11-314	D-7	30	SP-SM	1.3	105.0									
A-11-316	B-0	0-5	CL							44/15/29				
A-11-316	D-1	5	CL	14.9	129.3	>4.5					310	7.2	5060	1187
A-11-316	S-2	10	CL	19.0				0:22:78						
A-11-316	D-3	15	SP	2.2	101.1									
A-11-316	S-4	20	SP-SM	2.6		0.0								
A-11-316	D-5	25	SP-SM	26.7	121.5			0:95:5						
A-11-316	S-6	30	MH	31.1										
A-11-316	D-7	35	MH	25.7	118.9	>4.5				60/33/27				
A-11-316	S-8	40	MH	31.5										
A-11-316	D-9	45	MH	29.8	117.4	>4.5								

TABLE B-1 SUMMARY OF LABORATORY TEST RESULTS

Project No. : 11-137 Project Name : I-5 HOV Improvement Project - PCH to San Juan Creek Road

Boring No.	Sample No.	Sample Depth (ft)	Soil Identification (group symbol) ASTM D2488/D2487	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 Content CT 422 (ppm)
A-11-316	S-10	50	MH	29.5										
A-11-316	D-11	55	MH	29.1	116.1	>4.5								
A-11-316	S-12	60	MH	29.8										
A-11-316	D-13	65	MH	30.9	115.0	>4.5								
A-11-316	S-14	70	MH	35.8										
A-11-316	D-15	75	MH	33.5	114.2	>4.5								
A-11-316	S-16	80	MH	22.4										
A-11-316	D-17	85	MH	40.6	110.1	>4.5								
A-11-316	S-18	90	MH	30.9										
A-11-316	D-19	95	CH	32.7	115.8	3.75								
A-11-316	S-20	100	MH	34.9										
A-11-317	B-0	0-5	CL					0:26:74		34/18/16				
A-11-317	S-1	5	CL to SP-SM	10.5							840	7.3	500	296
A-11-317	D-2	10	SP	26.5	114.6			0:96:4						
A-11-317	S-3	15	MH	27.4										
A-11-317	D-4	20	MH	26.6	115.0	>4.5								
A-11-317	S-5	25	MH	30.1						65/38/27				
A-11-317	D-6	30	MH	26.8	121.6	>4.5								
A-11-317	S-7	35	MH	27.8										
A-11-317	D-8	40	MH	26.0	120.3	>4.5								
A-11-317	S-9	45	CH	27.8										
A-11-317	D-10	50	MH	28.2	113.7	>4.5								
A-11-317	S-11	55	MH	30.3										
A-11-317	D-12	60	MH	26.5	117.1	>4.5								
A-11-317	S-13	65	MH	27.5										
A-11-317	D-14	70	MH	25.9	119.9	>4.5								
A-11-317	S-15	75	MH	25.9										
A-11-317	D-16	80	MH	33.2	121.3	>4.5								
A-11-317	S-17	85	MH	24.1										
A-11-317	D-18	90	MH	24.7	121.7	>4.5								
A-11-317	S-19	95	CH	26.4										
A-11-317	D-20	100	MH	30.3	114.6	>4.5								
A-11-319	B-0	0-2.5	CL							33/17/16				
A-11-319	D-1	2.5	SM	8.6	125.1									
A-11-319	S-2	5	CL	25.2										
A-11-319	D-3	10	CL	22.9	119.9	1.75					560	6.7	2600	266
A-11-319	S-4	15	ML	26.0										
A-11-319	D-5	20	CH	26.0	119.9	1.0				51/22/29				
A-11-319	S-6	25	SP-SM	19.0										
A-11-319	D-7	30	SP	17.9	121.5			0:98:2						
A-11-319	S-8	35	CL	24.5										
A-11-319	D-9	40	CL	34.4	115.9	3.75								

TABLE B-1 SUMMARY OF LABORATORY TEST RESULTS

Project No. : 11-137 Project Name : I-5 HOV Improvement Project - PCH to San Juan Creek Road

Boring No.	Sample No.	Sample Depth (ft)	Soil Identification (group symbol) ASTM D2488/D2487	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 Content CT-422 (ppm)
A-11-319	S-10	45	CL	32.5										
A-11-319	D-11	50	CH	28.7	115.5	>4.5								
A-11-319	S-12	55	CL	35.9										
A-11-319	D-13	60	MH	33.0	116.1	>4.5								
A-11-319	S-14	65	MH	35.3										
A-11-319	D-15	70	MH	28.0	119.1	4..5								
A-11-319	S-16	75	MH	35.2										
A-11-319	D-17	80	MH	32.7	115.9	>4.5								
A-11-320	S-1	2.5	CL	27.3										
A-11-320	D-2	5	MH	34.1	111.9	>4.5					300	6.8	1160	1699
A-11-320	S-3	10	MH	35.7				0:1:99						
A-11-320	D-4	15	MH	29.0	115.4	>4.5				70/38/32				
A-11-320	S-5	20	MH	31.2										
A-11-320	D-6	25	MH	35.4	113.1	>4.5								
A-11-320	S-7	30	MH	29.5										
A-11-320	D-8	35	MH	26.7	118.2	>4.5								
A-11-320	S-9	40	MH	26.1										
A-11-320	D-10	45	MH	26.0	118.8	>4.5								
A-11-320	S-11	50	MH	29.6										
A-11-320	D-12	55	MH	27.9	119.7	>4.5								
A-11-320	S-13	60	MH	27.3										
A-11-320	D-14	65	MH	26.5	121.1	>4.5								
A-11-320	S-15	70	MH	24.7										
A-11-320	D-16	75	MH	24.1	119.4	>4.5								
A-11-320	S-17	80	MH	26.2										
A-11-322	B-0	0-5	CL					0:33:67		35/15/20				
A-11-322	D-1	5	CL	21.1	118.7	>4.5								
A-11-322	S-2	10	CL	14.1										
A-11-322	D-3	15	SC	8.7	128.8			21:30:49						
A-11-322	S-4T	20	SM	5.0										
A-11-322	S-4B	21	CL	27.3										
A-11-322	D-5	25	MH	30.8	117.6	>4.5		0:2:98		61/38/23				
A-11-322	S-6	30	MH	27.3										
A-11-322	D-7	35	MH	27.2	120.8	>4.5								
A-11-322	S-8	40	MH	30.6										
A-11-322	D-9	45	MH	25.5	121.0	>4.5								
A-11-322	S-10	50	MH	28.1										
A-11-322	D-11	55	MH	29.3	115.8	>4.5								
A-11-322	S-12	60	MH	27.7										
A-11-322	D-13	65	MH	26.4	122.0	>4.5								
A-11-322	S-14	70	MH	30.8										

TABLE B-1 SUMMARY OF LABORATORY TEST RESULTS

Project No. : *11-137* Project Name : I-5 HOV Improvement Project - PCH to San Juan Creek Road

Boring No.	Sample No.	Sample Depth (ft)	Soil Identification (group symbol) ASTM D2488/D2487	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 Content CT-422 (ppm)
A-11-322	*D-15*	75	MH	37.8	118.9	>4.5								
A-11-322	*S-16*	80	MH	27.8										
A-11-322	*D-17*	85	MH	19.7	124.4	>4.5								
A-11-322	*S-18*	90	MH	25.2										
A-11-322	*D-19*	95	MH	24.4	120.7	>4.5								
A-11-322	*S-20*	100	MH	25.5										
A-11-323	*S-1*	5	SM	9.3							2200	7.7	150	204
A-11-323	*D-2*	10	CL	12.1	127.8	>4.5								
A-11-323	*S-3*	15	SM	3.5				13:72:15						
A-11-323	*D-4*	20	CH	23.5	120.9	>4.5								
A-11-323	*S-5*	25	CH	25.3										
A-11-323	*D-6*	30	CH	20.2	122.3	>4.5		0:2:98		68/32/36				
A-11-323	*S-7*	35	CH	28.9										
A-11-323	*D-8*	40	CH	30.1	117.4	>4.5								
A-11-323	*S-9*	45	CH	29.2										
A-11-323	*D-10*	50	CH	28.1	118.5	>4.5								
A-11-323	*S-11*	55	MH	30.1										
A-11-323	*D-12*	60	MH	30.5	116.5	>4.5								
A-11-323	*S-13*	65	MH	28.2										
A-11-323	*D-14*	70	MH	27.6	117.2	>4.5								
A-11-323	*S-15*	75	MH	25.4										
A-11-323	*D-16*	80	MH	25.2	121.3	>4.5								
A-11-323	*S-17*	85	MH	25.3										
A-11-323	*D-18*	90	MH	24.6	121.2	>4.5								
A-11-323	*S-19*	95	MH	26.0										
A-11-323	*D-20*	100	MH	27.8	119.6	>4.5								
A-11-324	*S-1*	5	CL	13.1										
A-11-324	*D-2*	10	CL	13.7	116.4	>4.5					360	7.4	4040	463
A-11-324	*S-3*	15	CL	21.9										
A-11-324	*D-4*	20	CL	24.6	130.0	>4.5								
A-11-324	*S-5*	25	CL	25.4										
A-11-324	*D-6*	30	SP-SM to ML	36.8	123.3	>4.5		0:46:54						
A-11-324	*S-7*	35	CL	16.5										
A-11-324	*D-8*	40	CL	14.2										
A-11-324	*S-9*	45	CH	23.9										
A-11-324	*D-10*	50	CH	20.4	125.4	1.75				50/16/34				
A-11-324	*S-11T*	55	CH	25.6										
A-11-324	*S-11B*	56	CH	16.8										
A-11-324	*D-12*	60	ML/CL	27.1	118.4	2.5								
A-11-324	*S-13*	65	CL	35.4										

TABLE B-1 SUMMARY OF LABORATORY TEST RESULTS

Project No. : 11-137 Project Name : I-5 HOV Improvement Project - PCH to San Juan Creek Road

Boring No.	Sample No.	Sample Depth (ft)	Soil Identification (group symbol) ASTM D2488/D2487	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 Content CT-422 (ppm)
A-11-324	D-14	70	CL	27.6	118.9	2.5								
A-11-324	S-15	75	SC	15.9										
A-11-324	D-16	80	CL	20.1	130.4	0.5								
A-11-324	S-17T	85	CL	32.8										
A-11-324	S-17B	85.5	MH	31.4										
A-11-324	D-18	90	CH	29.8	116.0	3.5								
A-11-324	S-19	95	MH	32.7										
A-11-324	D-20	100	MH	33.1	114.3	>4.5								
A-11-324	S-21	105	MH	34.2										
A-11-324	S-22	110	MH	30.7										
A-11-326	S-1	2.5	SP-SM	4.0										
A-11-326	D-2	5	CL	19.7	122.6	1.75					900	7.6	120	112
A-11-326	S-3	10	CL	21.9										
A-11-326	D-4	15	MH	28.5	117.9	>4.5				63/33/30				
A-11-326	S-5	20	CL	28.4										
A-11-326	D-6	25	MH	27.5	120.0	>4.5				61/33/28				
A-11-326	S-7	30	MH	26.0										
A-11-326	D-8	35	MH	27.5	118.8									
A-11-326	S-9	40	MH	26.7										
A-11-326	D-10	45	MH	27.5	118.5									
A-11-326	S-11	50	MH	28.1										
A-11-326	D-12	55	MH	30.4	114.7	>4.5								
A-11-326	S-13	60	MH	26.8										
A-11-326	D-14	65	MH	27.9	119.1	>4.5								
A-11-326	S-15	70	MH	26.4										
A-11-326	D-16	75	MH	25.2	121.9	>4.5								
A-11-326	S-17	80	MH	25.0										
A-11-327	B-0	0-5	CL							40/18/22				
A-11-327	S-1	5	CL	12.2										
A-11-327	D-2	10	SM to CL	10.2	115.2	>4.5								
A-11-327	S-3	15	CL	13.7										
A-11-327	D-4	20	CL	16.7	128.0	>4.5								
A-11-327	S-5	25	CL	18.9										
A-11-327	D-6	30	SM to CL	15.5	111.4									
A-11-327	S-7	35	CL	21.5							420	7.7	550	350
A-11-327	D-8	40	CL	20.5	127.5	3.75								
A-11-327	S-9	45	CL	19.4										
A-11-327	D-10	50	CL	17.9	126.7	4.25		0:19:81		44/20/24				
A-11-327	S-11	55	CL	20.6				0:18:82						
A-11-327	D-12	60	CL	22.1	126.2	3.5								
A-11-327	S-13	65	CL	20.5										

TABLE B-1 SUMMARY OF LABORATORY TEST RESULTS

Project No. : 11-137 Project Name : I-5 HOV Improvement Project - PCH to San Juan Creek Road

Boring No.	Sample No.	Sample Depth (ft)	Soil Identification (group symbol) ASTM D2488/D2487	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 Content CT 422 (ppm)
A-11-327	D-14	70	CL	18.5	126.1	2.25								
A-11-327	S-15	75	CL	30.0										
A-11-327	D-16	80	SC	8.7	133.1			26:33:41						
A-11-327	S-17	85	CL	18.3										
A-11-327	D-18	90	CH	19.9	126.9	3.0								
A-11-327	S-19	95	CH	32.2										
A-11-327	D-20	100	CH	29.5	115.9	3.75								
A-11-328	D-1	5	CL	13.9	111.8	>4.5								
A-11-328	S-2	10	CL	13.4										
A-11-328	D-3	15	SC to SP-SM	5.8	126.0			21:49:30						
A-11-328	S-4T	20	CL	22.5										
A-11-328	S-4B	20.8	SM	18.1										
A-11-328	D-5	25	CL	13.0	123.6	4.0								
A-11-328	S-6	30	CH	25.4										
A-11-328	D-7	35	CH	31.5	118.2	>4.5								
A-11-328	S-8	40	MH	26.1										
A-11-328	D-9	45	MH	27.2	120.0	>4.5								
A-11-328	S-10	50	MH	27.3										
A-11-328	D-11	55	MH	26.5	120.8	>4.5								
A-11-328	S-12	60	MH	31.1										
A-11-328	D-13	65	MH	24.6	122.6	>4.5								
A-11-328	S-14	70	MH	27.8										
A-11-328	S-15	75	MH	27.7	118.9	>4.5								
A-11-328	S-16	80	MH	27.5										
A-11-328	D-17	85	MH	27.5	118.5	>4.5								
A-11-328	S-18	90	MH	28.7										
A-11-328	D-19	95	MH	28.5	117.8	>4.5								
A-11-328	S-20	100	MH	27.3										
A-11-329	B-0	0-5	CL					0:49:51		30/17/13				
A-11-329	S-1	5	SM	8.4										
A-11-329	D-2	10	CL	14.2	123.6	2.5								
A-11-329	S-3	15	SP-SM	9.5										
A-11-329	D-4	20	SP-SM	27.0	117.4									
A-11-329	S-5	25	SM to CL	25.0										
A-11-329	D-6	30	CH	37.1	110.8	3.0								
A-11-337	B-0	0-5	CH					0:4:96		55/27/28				
A-11-337	S-1	5	CL	30.1										
A-11-337	D-2	10	CL	34.6	113.0	>4.5								
A-11-337	S-3	15	CL	38.3										
A-11-337	D-4	20	MH	29.3	115.3	>4.5								
A-11-337	S-5	25	MH	29.5				0:1:99						
A-11-337	D-6	30	MH	28.6	116.5									

TABLE B-1 SUMMARY OF LABORATORY TEST RESULTS

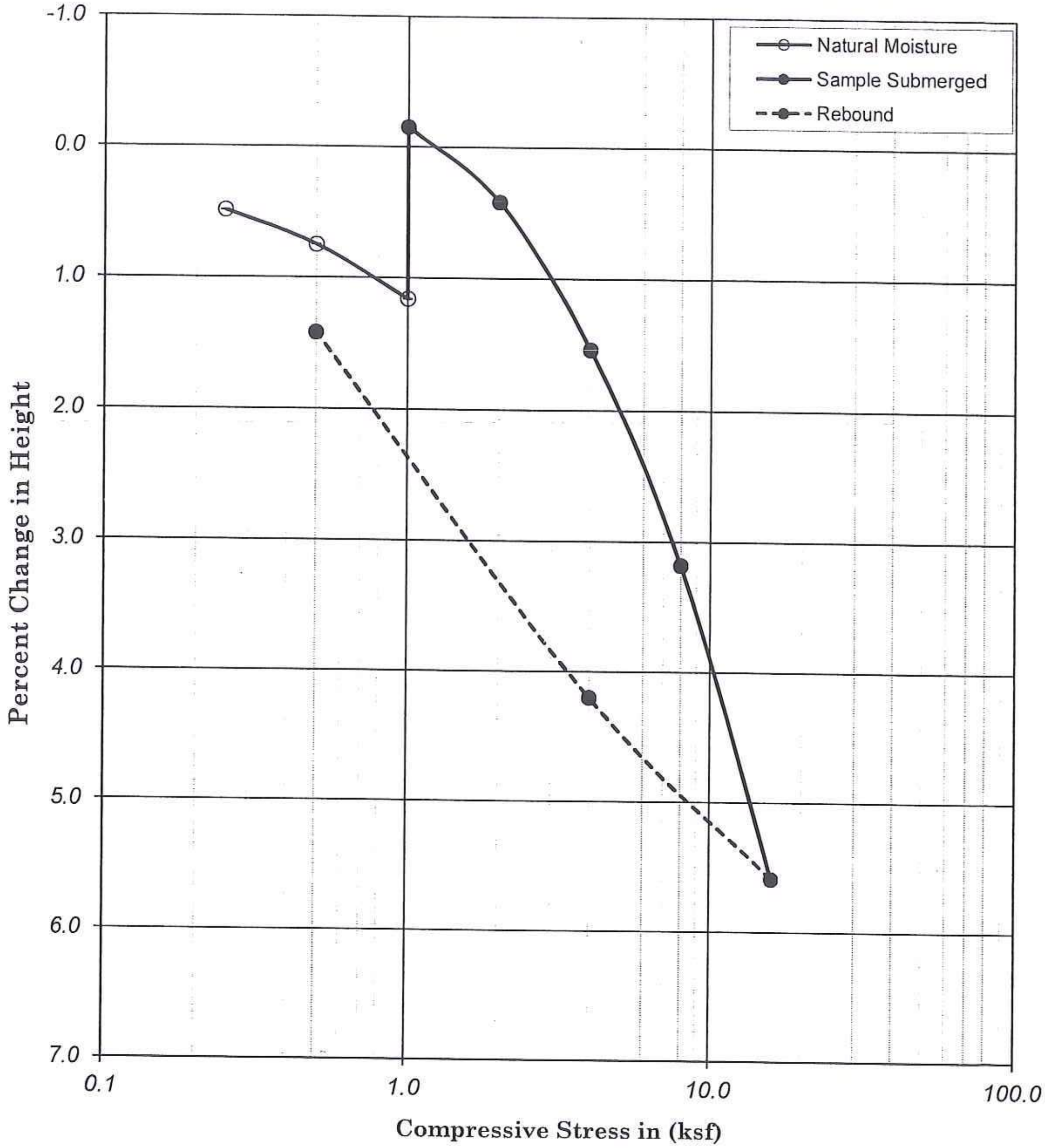
Project No. : 11-137   Project Name : I-5 HOV Improvement Project - PCH to San Juan Creek Road

Boring No.	Sample No.	Sample Depth (ft)	Soil Identification (group symbol) ASTM D2488/D2487	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 Content CT-422 (ppm)
A-11-339	B-0	0-2.5	CL					0:33:67		44/19/25				
A-11-339	S-1	5	CL	12.6										
A-11-339	D-2	10	CL	13.7	128.3	>4.5								
A-11-339	S-3	15	CL	21.8										
A-11-339	D-4	20	CL	16.6	125.6	>4.5								
A-11-339	S-5	25	ML	13.3										
A-11-339	D-6	30	ML	15.0	123.5	>4.5								
A-11-342	B-0	0-5	SC					0:77:23		30/18/12				
A-11-342	S-1	5	CL	23.1										
A-11-342	D-2	10	CL	19.6	127.6	>4.5								
A-11-342	S-3	15	CL	17.5				2:19:79						
A-11-342	D-4T	20	CL	24.5	121.6	1.5								
A-11-342	D-4B	21	CL to SC	7.3	129.3									
A-11-342	S-5	25	CL	23.7										
A-11-342	D-6	30	SC	21.6	120.6									
A-11-342	S-7	35	ML	22.6										
A-11-342	S-8	40	ML	22.6										
A-11-348	B-0	0-5	SC					0:72:28		29/17/12				
A-11-348	D-1	5	SM	4.1	127.2									
A-11-348	S-2	10	SM	5.3										
A-11-348	D-3	15	CL	25.5	116.2	2.25								
A-11-348	S-4	20	CL	25.3							270	7.6	6400	649
A-11-348	D-5	25	CL	22.2	121.3	4.25								
A-11-348	S-6	30	CL	21.1				0:10:90						
A-11-348	D-7	35	CL	18.2	121.4	>4.5								
A-11-348	S-8	40	CL	20.7										
A-11-348	D-9	45	CL	20.9	124.7	3.75								
A-11-348	S-10	50	CL	25.5				0:12:88						
A-11-348	D-11	55	CL	25.4	122.1	1.25								
A-11-348	S-12	60	CL	24.9										
A-11-348	D-13	65	CL	24.3	123.7	2.75		0:12:88						
A-11-348	S-14	70	CL	24.5										
A-11-348	D-15	75	CL	22.4	125.2	4.25								
A-11-348	S-16	80	CL	24.1				0:9:91						
A-11-348	D-17	85	CL	25.1	123.9	3.75								
A-11-348	S-18	90	CL	22.8										
A-11-348	D-19	95	ML	22.0	125.1	>4.5								
A-11-348	S-20	100	CL	23.7										
A-11-349	D-1	5	CL	26.1	116.3	2.25					760	8.1	680	392
A-11-349	S-2	10	CL	20.5										
A-11-349	D-3	15	CL	21.4	125.8	3.0								
A-11-349	S-4	20	CL	28.5										
A-11-349	D-5	25	CL	23.1	122.7	0.75		0:9:91		35/19/16				

TABLE B-1 SUMMARY OF LABORATORY TEST RESULTS

Project No. : 11-137 Project Name : I-5 HOV Improvement Project - PCH to San Juan Creek Road

Boring No.	Sample No.	Sample Depth (ft)	Soil Identification (group symbol) ASTM D2488/D2487	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 Content CT-422 (ppm)
A-11-349	S-6	30	CL	27.1										
A-11-349	D-7	35	CL	26.6	122.8	1.25								
A-11-349	S-8	40	CL	25.4										
A-11-349	D-9	45	CL	23.0	125.4	1.0		0:30:70						
A-11-349	S-10	50	CL	25.2							510	8.0	1800	341
A-11-349	D-11	55	CL	23.1	125.5	2.0								
A-11-349	S-12	60	ML	26.5										
A-11-349	D-13	65	ML	26.0	121.9	4.25		0:6:94						
A-11-349	S-14	70	ML	27.7										
A-11-349	D-15	75	CL	23.8	124.2	3.0								
A-11-349	S-16	80	CL	27.9										
A-11-350	B-0	40944	CL					0:50:50		34/16/18				
A-11-350	S-1	5	CL	20.7										
A-11-350	D-2	10	CL	21.7	123.6	4.0								
A-11-350	S-3	15	CL	22.0										
A-11-350	D-4	20	CL	24.8	117.1	2.5								
A-11-350	S-5	25	CL	19.9										
A-11-350	D-6	30	CL	20.2	123.3	3.5				38/19/19				
A-11-350	S-7	35	CL	23.2										
A-11-350	D-8	40	CL	19.4	126.4	4.0								
A-11-350	S-9	45	CL	26.4										
A-11-350	D-10	50	CL	28.5	120.6			0:14:86						
A-11-350	S-11	55	CL	29.1										
A-11-350	D-12	60	CL	29.4	120.0	2.75								
A-11-350	S-13	65	CL	27.4										
A-11-350	D-14	70	ML	27.4	119.4									
A-11-350	S-15	75	CL	30.5				0:9:91						
A-11-350	D-16	80	ML	28.5	121.5	>4.5								
A-11-350	S-17	85	CL	25.1										
A-11-350	D-18	90	SC	28.1	121.5									
A-11-350	S-19T	95	SP-SM	20.2										
A-11-350	S-19B	96	CL	27.5										
A-11-350	D-20	100	SP to CL	20.0	122.6									
A-11-301	B-0	0-2.5	SC					0:66:34		26/13/13				
A-11-303	B-0	0-5	SM								1796	7.9	256	240
HA-11-307	B-0	0-1.5	SC					0:62:38		31/19/12				
HA-11-308	B-0	0-5	SC							30/15/15	294	7.5	3161	300
A-11-322	B-0	0-5	SC								500	7.5	1574	1200
A-11-327	B-0	0-5	CL								1115	7.5	446	180
A-11-335	B-0	1.5-5.0	CL					0:34:66		45/19/26				
HA-11-336	B-0	0-5	CL					0:42:58		33/19/14				
HA-11-338	B-0	0-5	SM					0:63:37		NP				
HA-11-341	B-0	0-5	SM					0:63:37		37/29/8	2070	7.3	168	180
A-11-342	B-0	0-5	SM								1055	7.3	1720	120
HA-11-344	B-0	0-5	SC					0:55:45		34/20/14				
A-11-346	B-0	1.3-5	CL					0:47:53		38/20/18				
A-11-352	B-0	2.1-5	CL					0:20:80		42/20/22				



Boring No.	: A-11-303		Liquid Limit :	-		Moisture Content (%)	Dry Density (pcf)	Dry Density (kN/m³)	Percent Saturation	Void Ratio
Sample No.	: D-3		Plastic Limit :	-						
Depth (ft)	: 15.0	16.5	Plastic Index :	-	Initial	29.03	94.41	14.86	99.79	0.79
Depth (m)	: 4.58	5.03	Specific Gravity :	2.70	Final	31.21	95.78	15.08	110.90	0.76

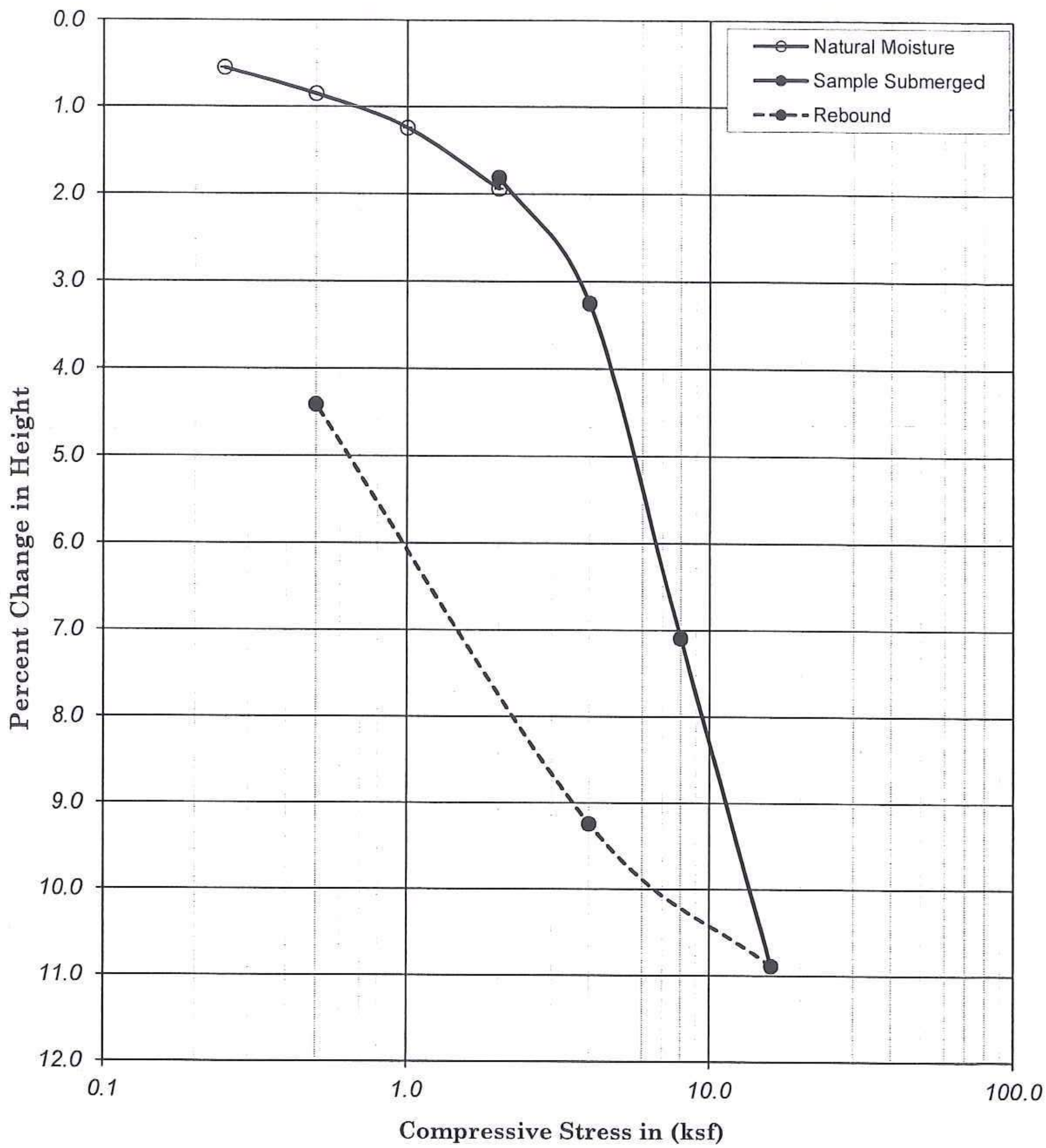
Description : Olive-gray with yellowish brown , Lean CLAY (CL)

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

Project No. : 11-137 12/04/11

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



Boring No.		: A-11-304		Liquid Limit :	-		Moisture Content (%)	Dry Density		Percent Saturation	Void Ratio
Sample No.		: D-6		Plastic Limit :	-			(pcf)	(kN/m^3)		
Depth	(ft)	: 15.0	16.5	Plastic Index :	-	Initial	33.36	87.44	13.76	97.09	0.93
	(m)	: 4.58	5.03	Specific Gravity :	2.70	Final	32.43	91.49	14.40	103.94	0.84

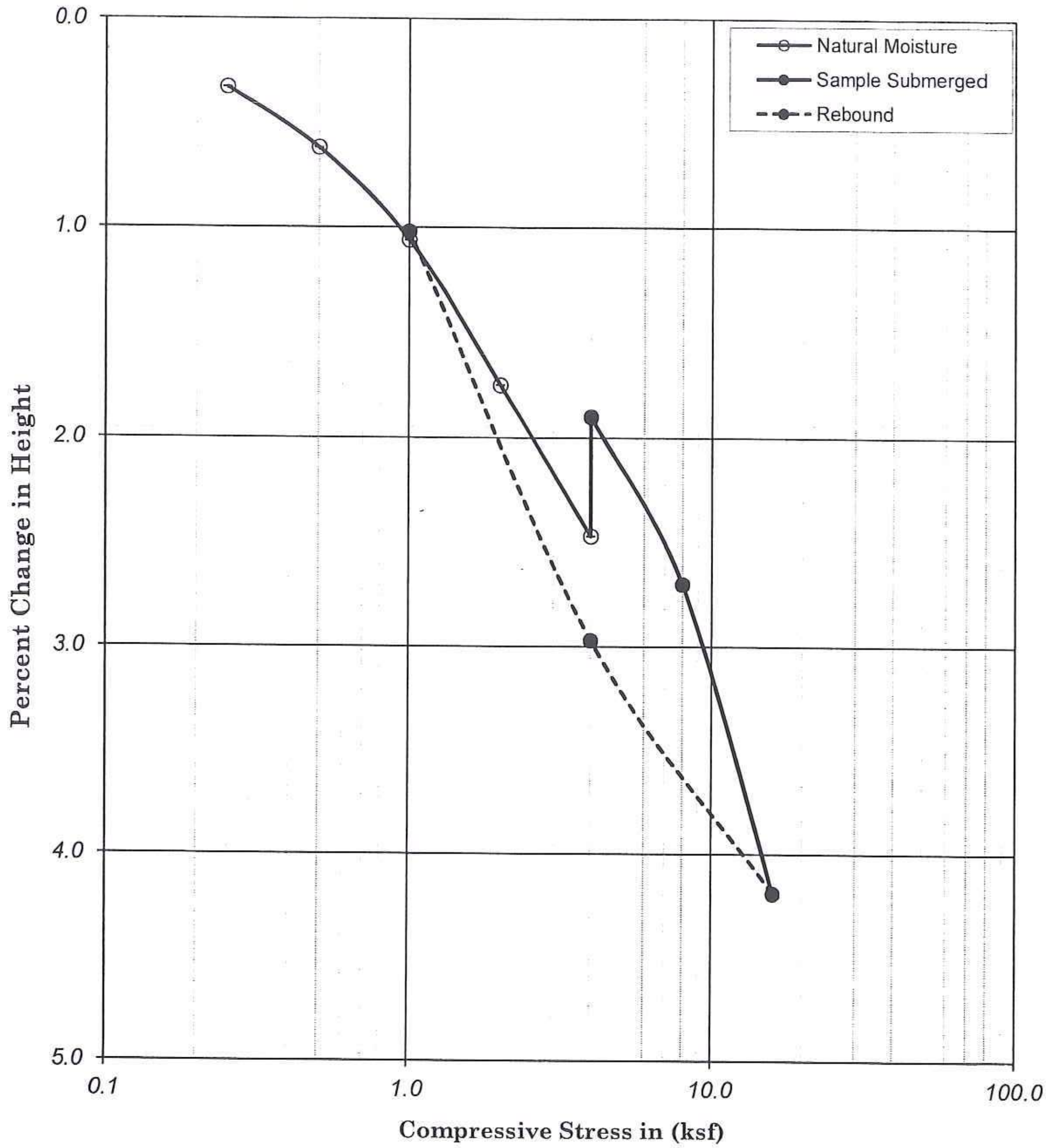
Description : *Olive-gray with yellowish brown , Lean CLAY (CL)*

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

Project No. : *11-137* *12/04/11*

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



Boring No.	: A-11-316		Liquid Limit :	-		Moisture Content (%)	Dry Density (pcf)	Dry Density (kN/m³)	Percent Saturation	Void Ratio
Sample No.	: D-11		Plastic Limit :	-						
Depth (ft)	: 55.0	56.5	Plastic Index :	-	Initial	29.92	92.63	14.58	98.54	0.82
Depth (m)	: 16.78	17.23	Specific Gravity :	2.70	Final	35.98	93.59	14.73	121.28	0.80

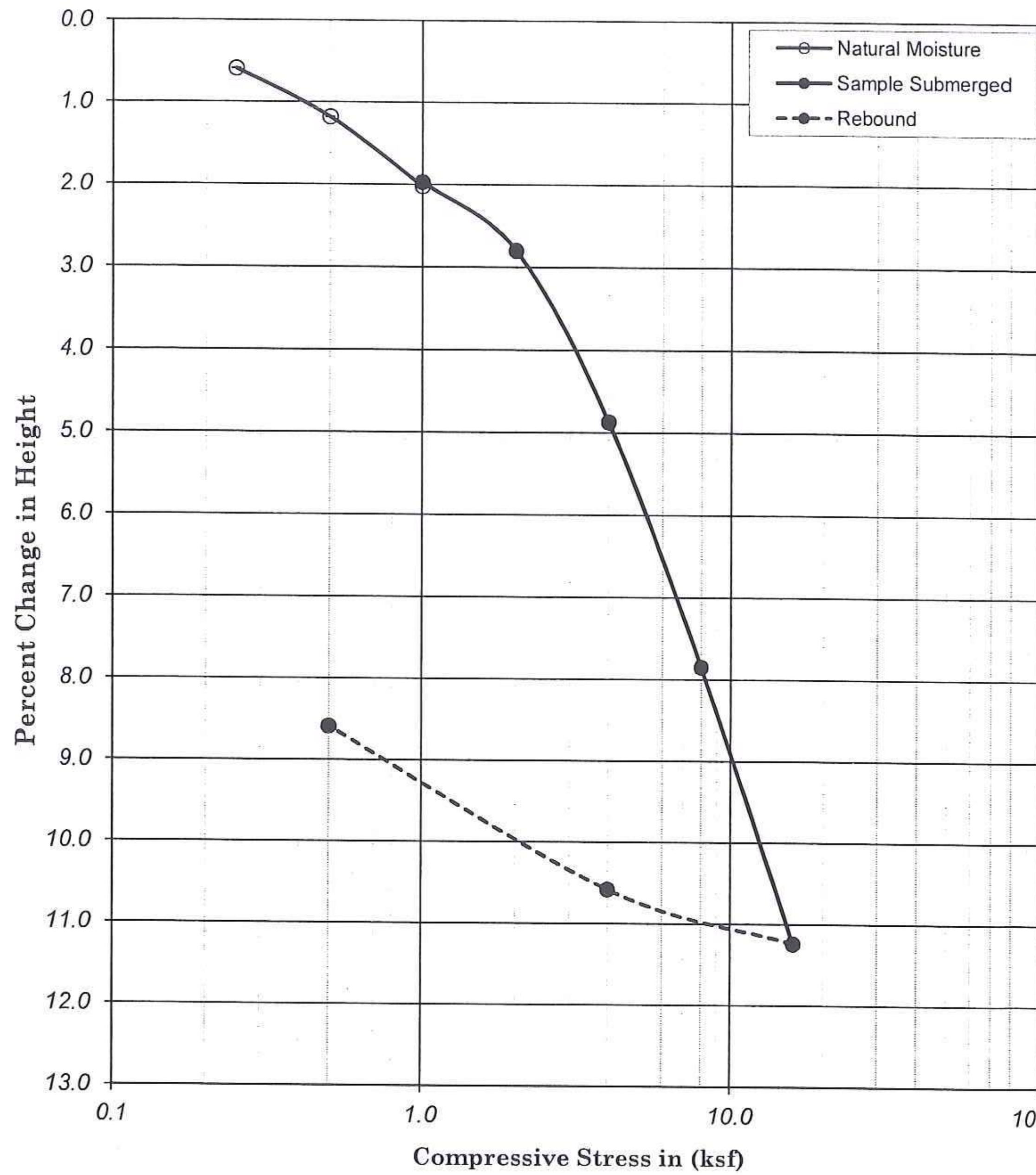
Description : *Very dark gray, Elastic SILT (MH)*

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

Project No. : *11-137* *12/04/11*

I-5 HOV Improvement Project
PCH to San Juan Creek Road

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



							Moisture Content (%)	Dry Density (pcf)	Dry Density (kN/m³)	Percent Saturation	Void Ratio
Boring No.	:A-11-319		Liquid Limit :	-							
Sample No.	: D-3		Plastic Limit :	-							
Depth (ft)	: 15.0	16.5	Plastic Index :	-	Initial		24.03	98.00	15.43	90.11	0.72
Depth (m)	: 4.58	5.03	Specific Gravity :	2.70	Final		21.19	107.25	16.88	100.10	0.57

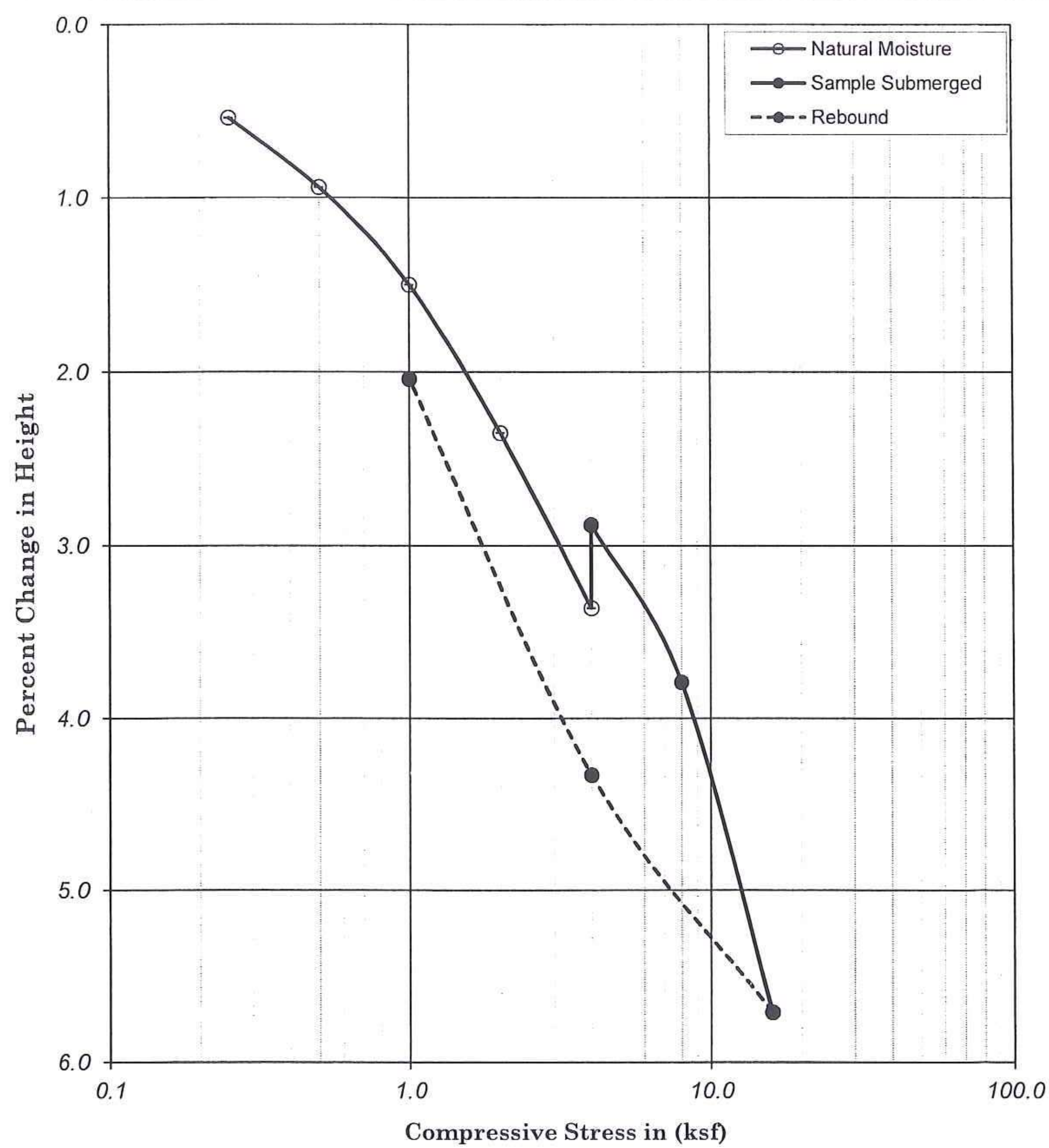
Description : Olive-gray with yellowish brown , Lean CLAY (CL)

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

Project No. : 11-137 12/04/11

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



Boring No.		: A-11-319		Liquid Limit :	-		Moisture Content (%)	Dry Density (pcf)	Dry Density (kN/m³)	Percent Saturation	Void Ratio
Sample No.		: D-13		Plastic Limit :	-						
Depth	(ft) :	60.0	61.5	Plastic Index :	-	Initial	33.85	84.62	13.32	92.12	0.99
	(m) :	18.30	18.76	Specific Gravity :	2.70	Final	36.30	86.39	13.60	103.05	0.95

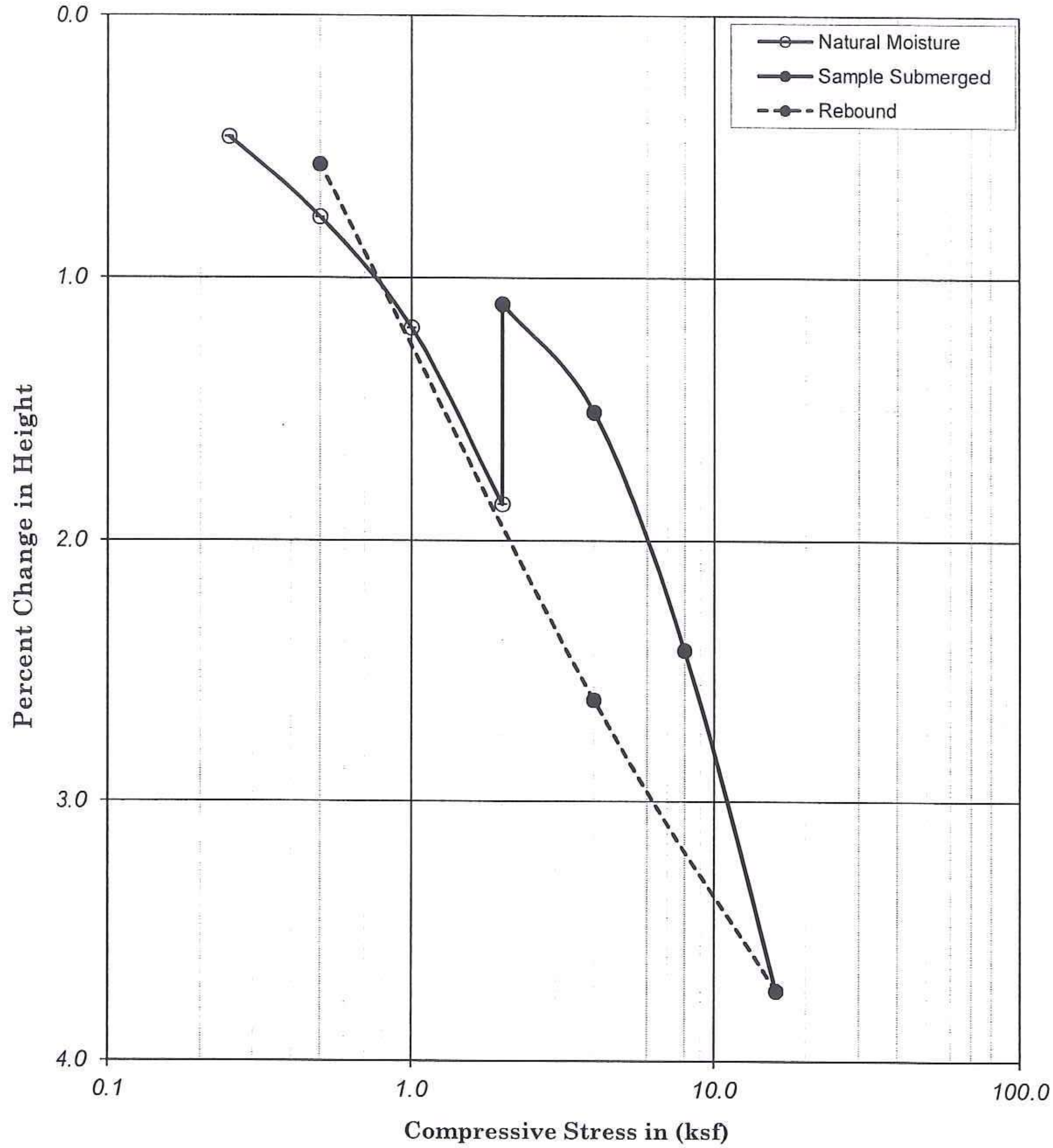
Description : *Very dark gray, Elastic SILT (MH)*

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

Project No. : 11-137 12/04/11

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



Boring No.	: A-11-320		Liquid Limit :	-		Moisture Content (%)	Dry Density (pcf)	Dry Density (kN/m³)	Percent Saturation	Void Ratio
Sample No.	: D-6		Plastic Limit :	-						
Depth (ft)	: 25.0	26.5	Plastic Index :	-	Initial	34.14	85.74	13.50	95.42	0.97
Depth (m)	: 7.63	8.08	Specific Gravity :	2.70	Final	36.96	86.24	13.57	104.54	0.95

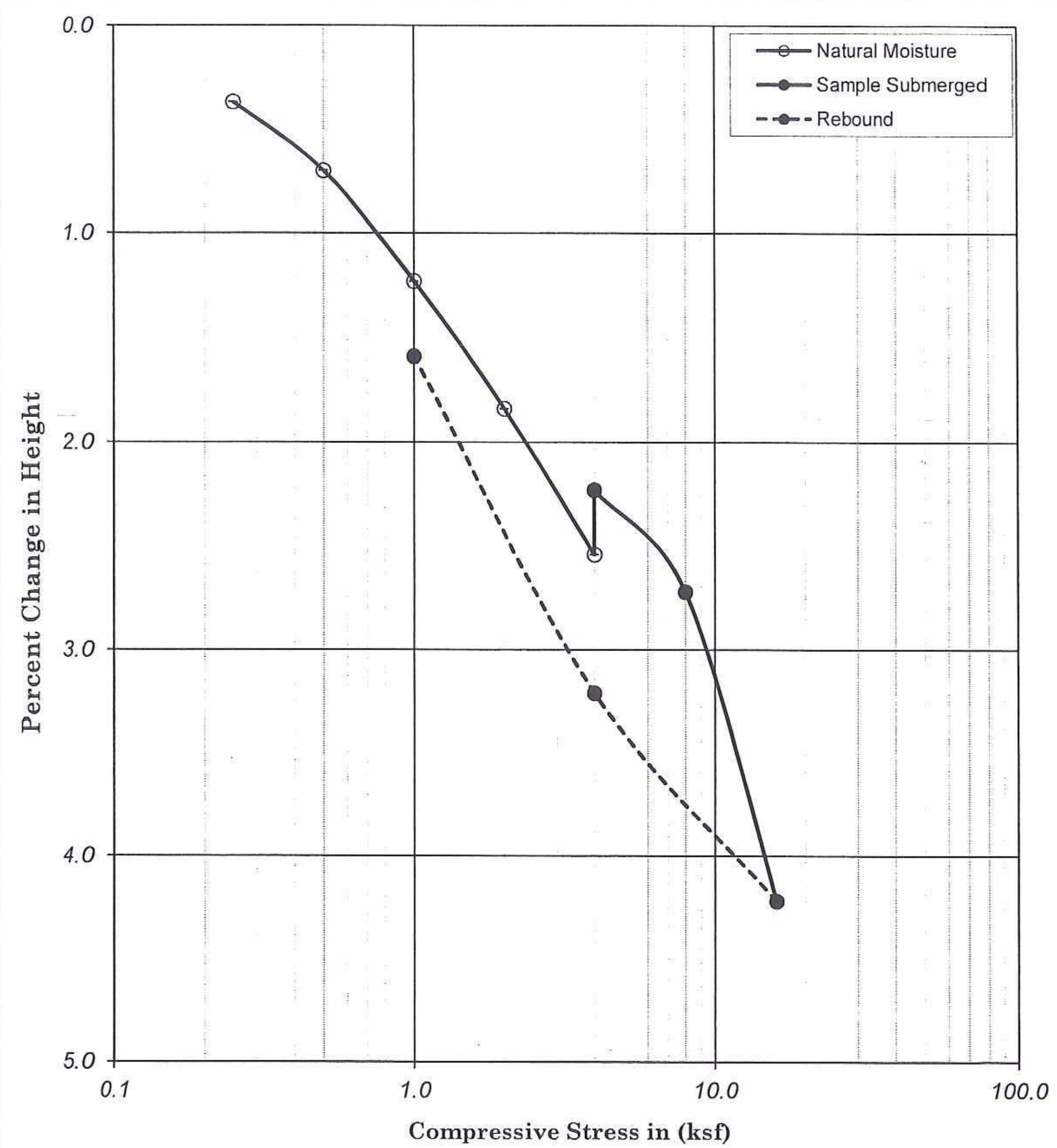
Description : *Very dark gray, Elastic SILT (MH)*

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

Project No. : 11-137 12/04/11

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



Boring No.	: A-11-323		Liquid Limit :	-		Moisture Content (%)	Dry Density (pcf)	Dry Density (kN/m³)	Percent Saturation	Void Ratio
Sample No.	: D-8		Plastic Limit :	-						
Depth (ft)	: 40.0	41.5	Plastic Index :	-	Initial	30.21	88.40	13.91	89.93	0.91
Depth (m)	: 12.20	12.66	Specific Gravity :	2.70	Final	31.75	89.87	14.15	97.91	0.88

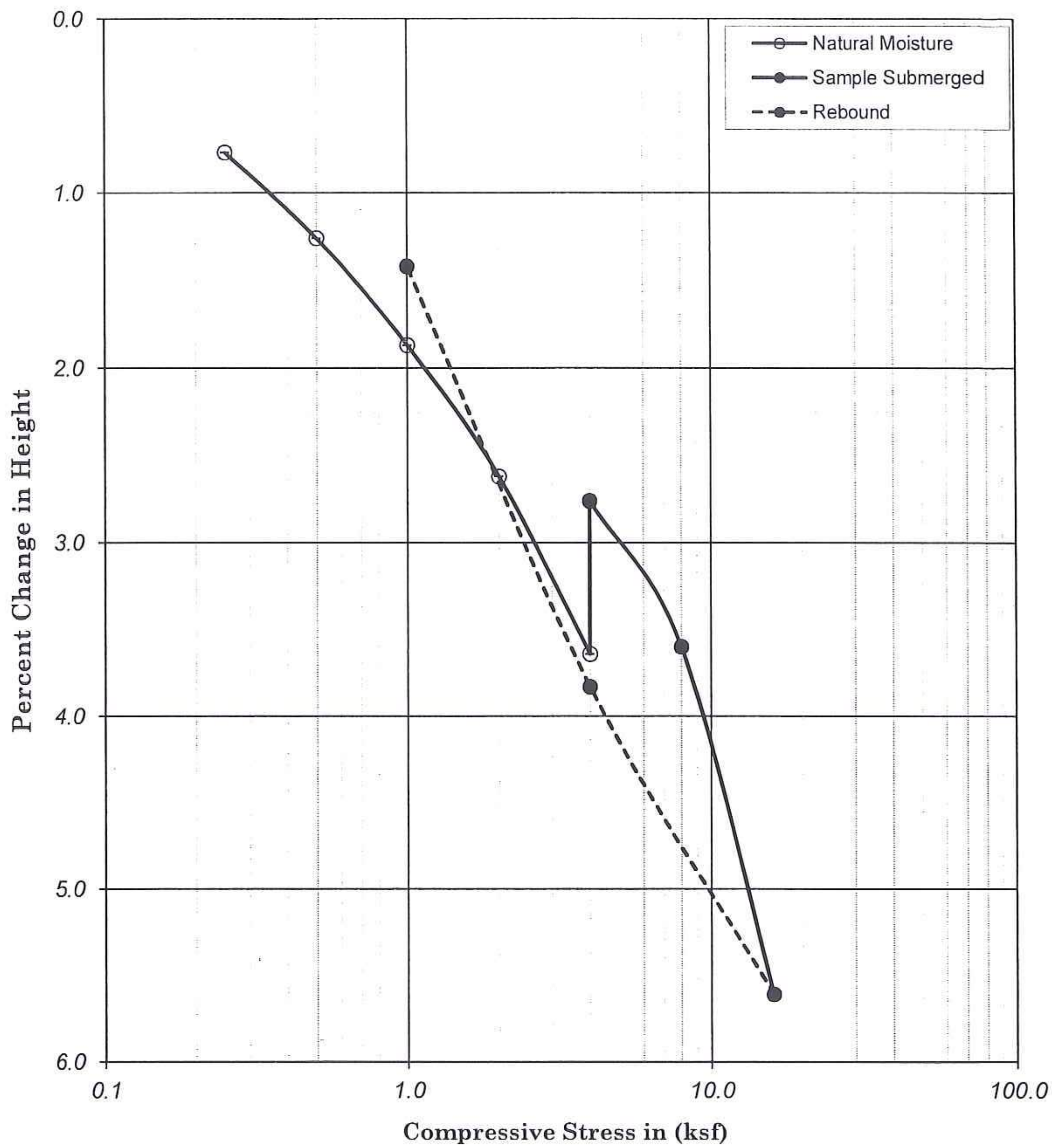
Description : *Very dark grayish brown, Elastic SILT (MH)*

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

Project No. : 11-137 12/04/11

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



Boring No.	: A-11-324		Liquid Limit :	-		Moisture Content (%)	Dry Density (pcf)	Dry Density (kN/m³)	Percent Saturation	Void Ratio
Sample No.	: D-10		Plastic Limit :	-						
Depth (ft)	: 40.0	41.5	Plastic Index :	-	Initial	23.75	102.39	16.12	99.23	0.65
Depth (m)	: 12.20	12.66	Specific Gravity :	2.70	Final	23.95	103.88	16.35	103.85	0.62

Description : *Very dark grayish brown, Fat CLAY (CH)*

Earth Mechanics, Inc.
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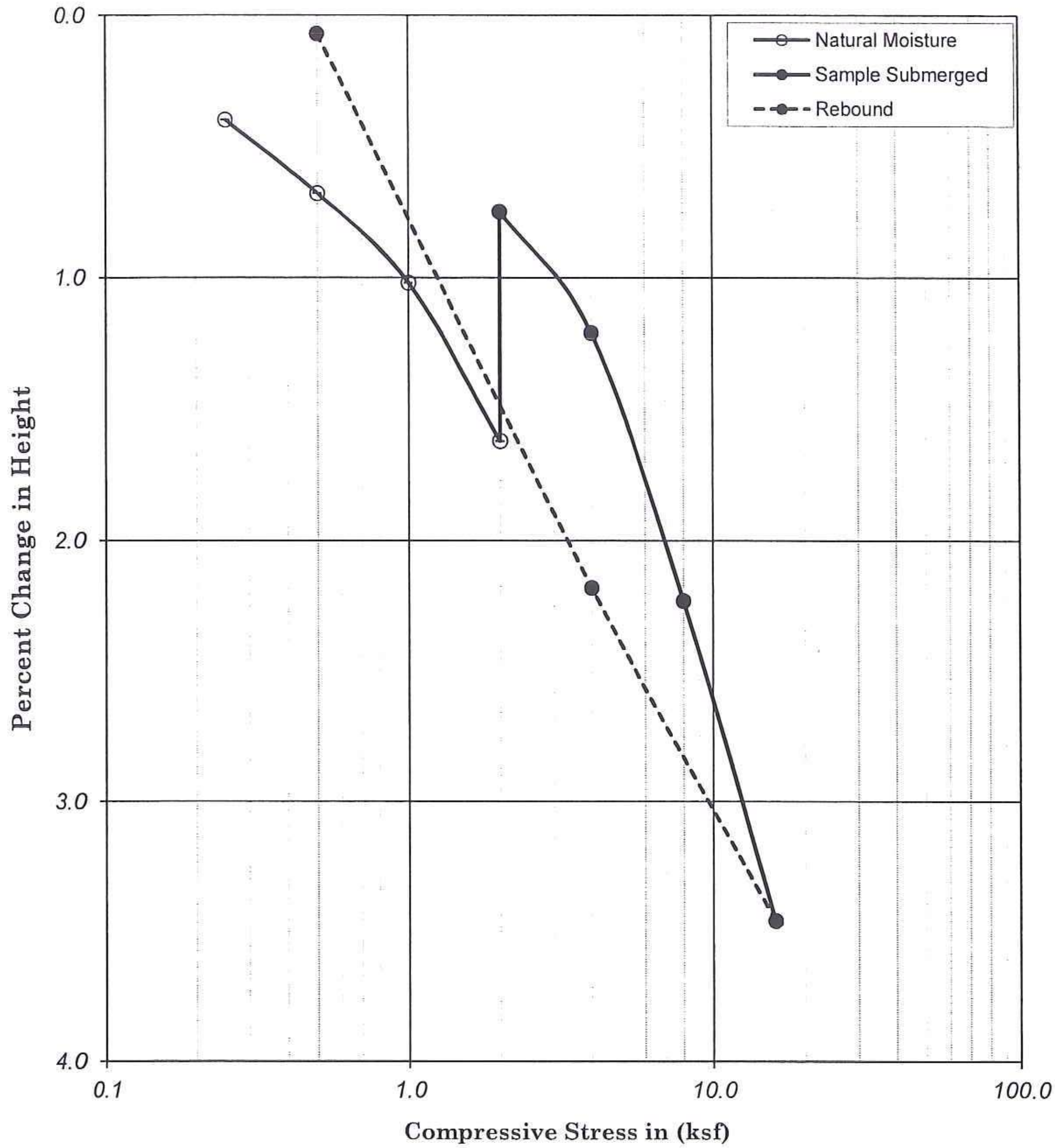
I-5 HOV Improvement Project
PCH to San Juan Creek Road

Project No. : 11-137 12/04/11

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



Boring No. : A-11-326			Liquid Limit :	-		Moisture Content (%)	Dry Density (pcf)	Dry Density (kN/m³)	Percent Saturation	Void Ratio
Sample No. : D-6			Plastic Limit :	-						
Depth	(ft) : 25.0	26.5	Plastic Index :	-	Initial	27.37	95.44	15.02	96.46	0.77
	(m) : 7.63	8.08	Specific Gravity :	2.70	Final	29.30	95.53	15.04	103.47	0.76

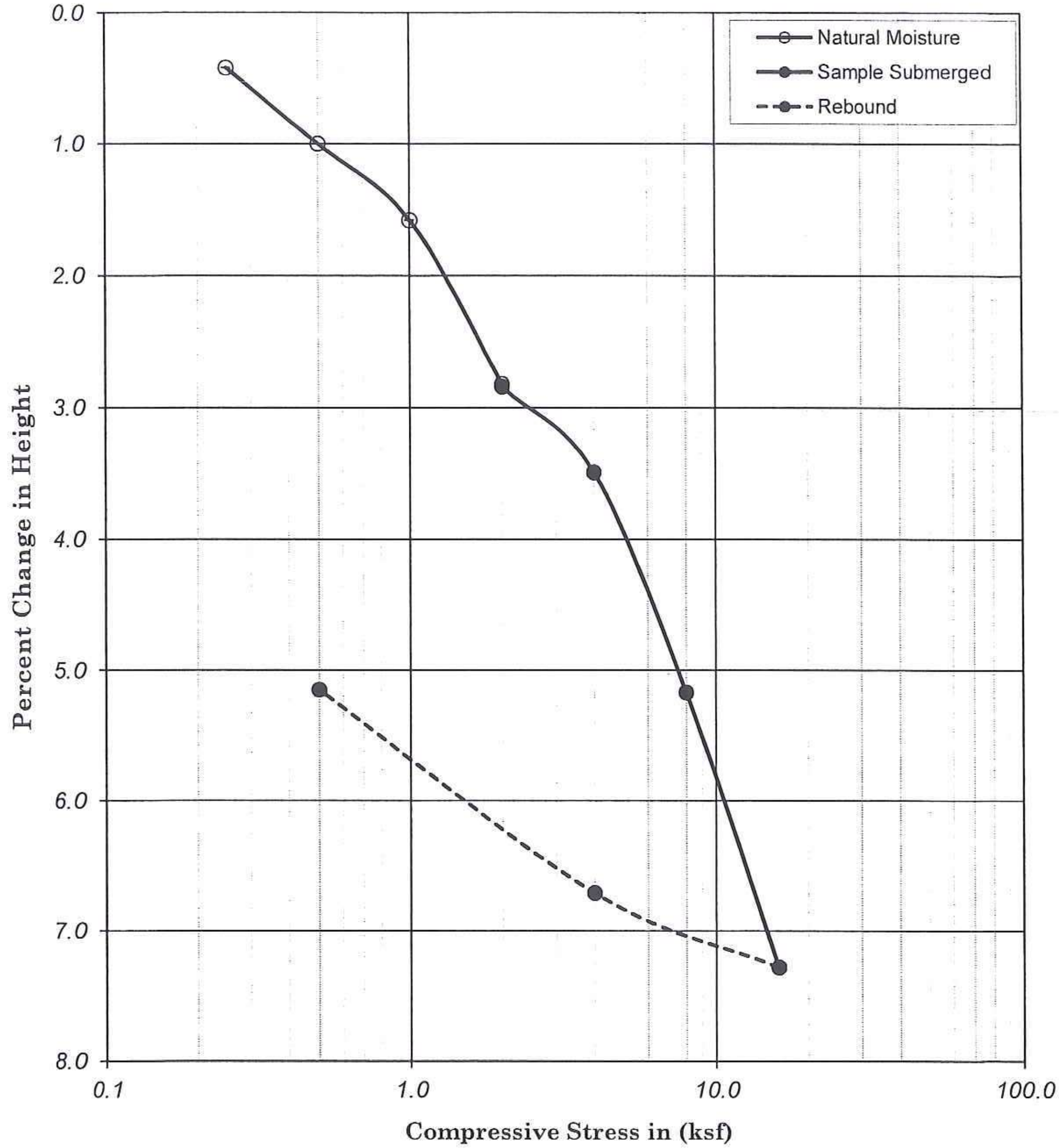
Description : *Very dark gray, Elastic SILT (MH)*

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

Project No. : 11-137 12/04/11

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



Boring No.		: A-11-327		Liquid Limit :	-		Moisture Content (%)	Dry Density		Percent Saturation	Void Ratio
Sample No.		: D-8		Plastic Limit :	-			(pcf)	(kN/m³)		
Depth	(ft) :	40.0	41.5	Plastic Index :	-	Initial	19.74	107.55	16.93	93.98	0.57
	(m) :	12.20	12.66	Specific Gravity :	2.70	Final	19.28	113.42	17.85	107.08	0.49

Description : *Olive-brown, Lean CLAY with SAND (CL)*

Earth Mechanics, Inc.
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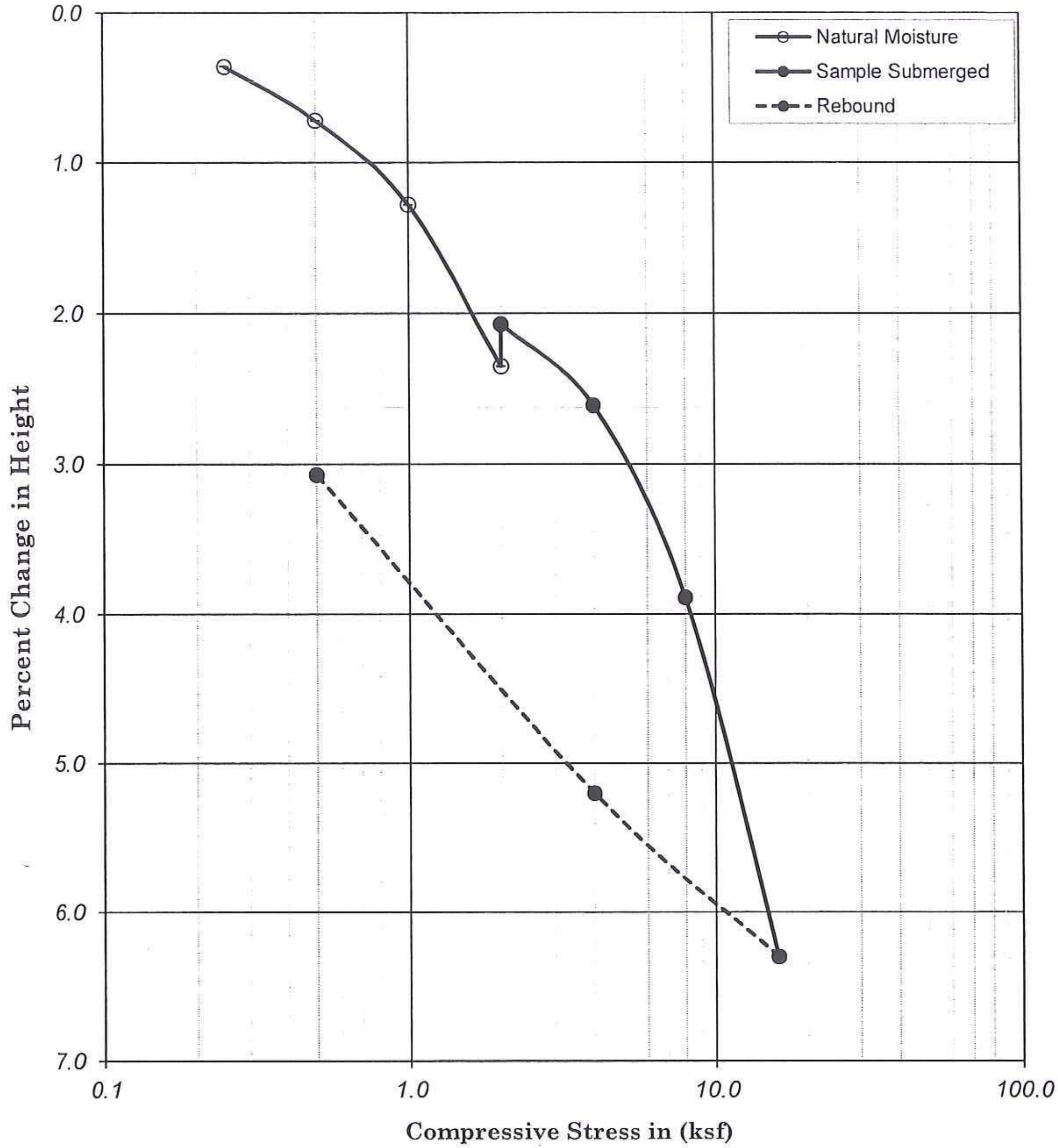
I-5 HOV Improvement Project
PCH to San Juan Creek Road

Project No. : 11-137 12/04/11

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



Boring No.	: A-11-329		Liquid Limit :	-		Moisture Content (%)	Dry Density (pcf)	Dry Density (kN/m³)	Percent Saturation	Void Ratio
Sample No.	: D-6		Plastic Limit :	-						
Depth (ft)	: 30.0	31.5	Plastic Index :	-	Initial	38.90	80.72	12.71	96.51	1.09
Depth (m)	: 9.15	9.61	Specific Gravity :	2.70	Final	38.80	83.28	13.11	102.30	1.02

Description : *Olive-brown, Fat CLAY (CH)*

Earth Mechanics, Inc.
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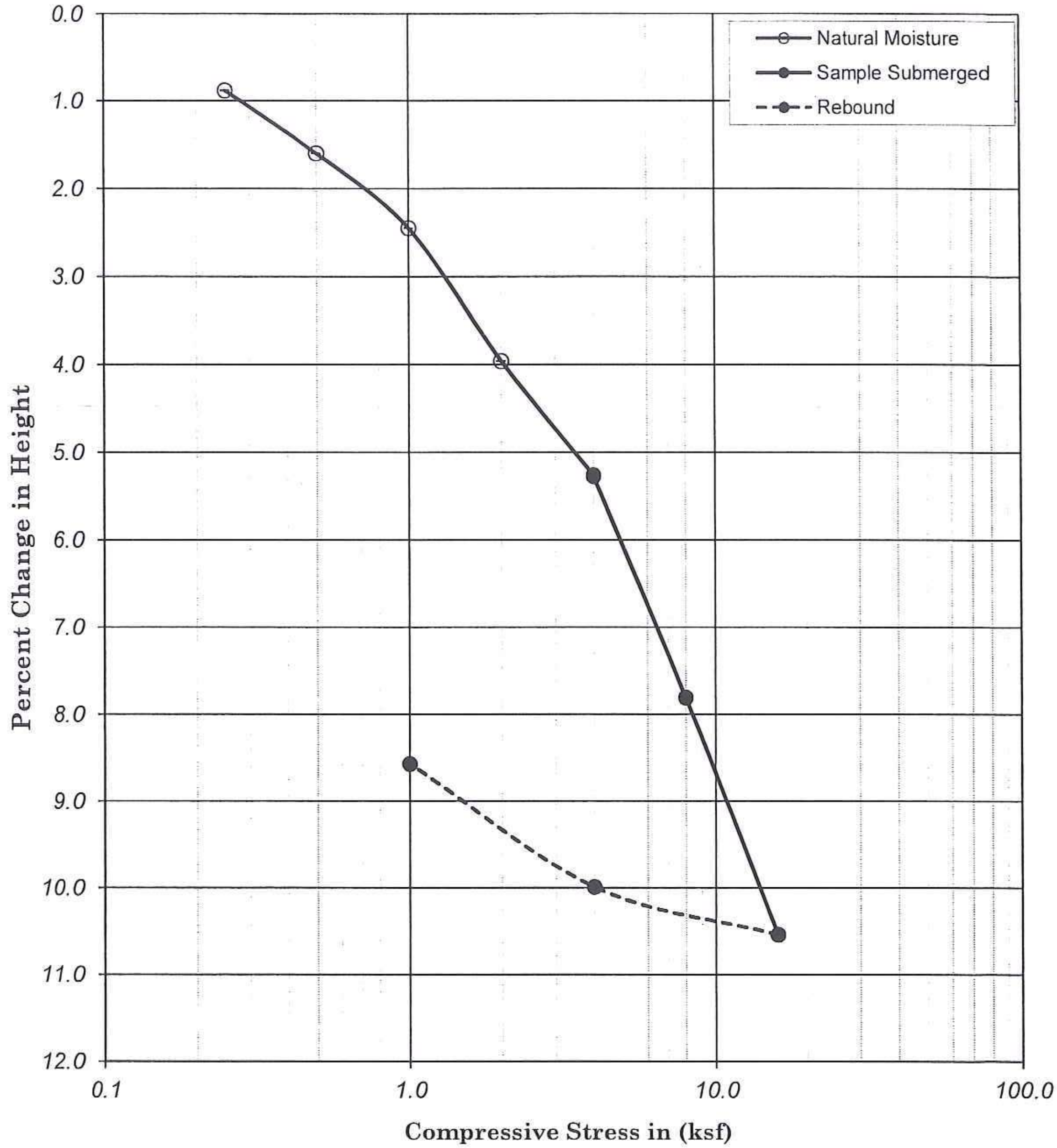
I-5 HOV Improvement Project
PCH to San Juan Creek Road

Project No. : 11-137 12/04/11

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



Boring No.	: A-11-348		Liquid Limit :	-		Moisture Content (%)	Dry Density		Percent Saturation	Void Ratio
Sample No.	: D-11		Plastic Limit :	-			(pcf)	(kN/m³)		
Depth (ft)	: 55.0	56.5	Plastic Index :	-	Initial	26.38	96.76	15.23	95.99	0.74
Depth (m)	: 16.78	17.23	Specific Gravity :	2.70	Final	22.77	105.84	16.66	103.74	0.59

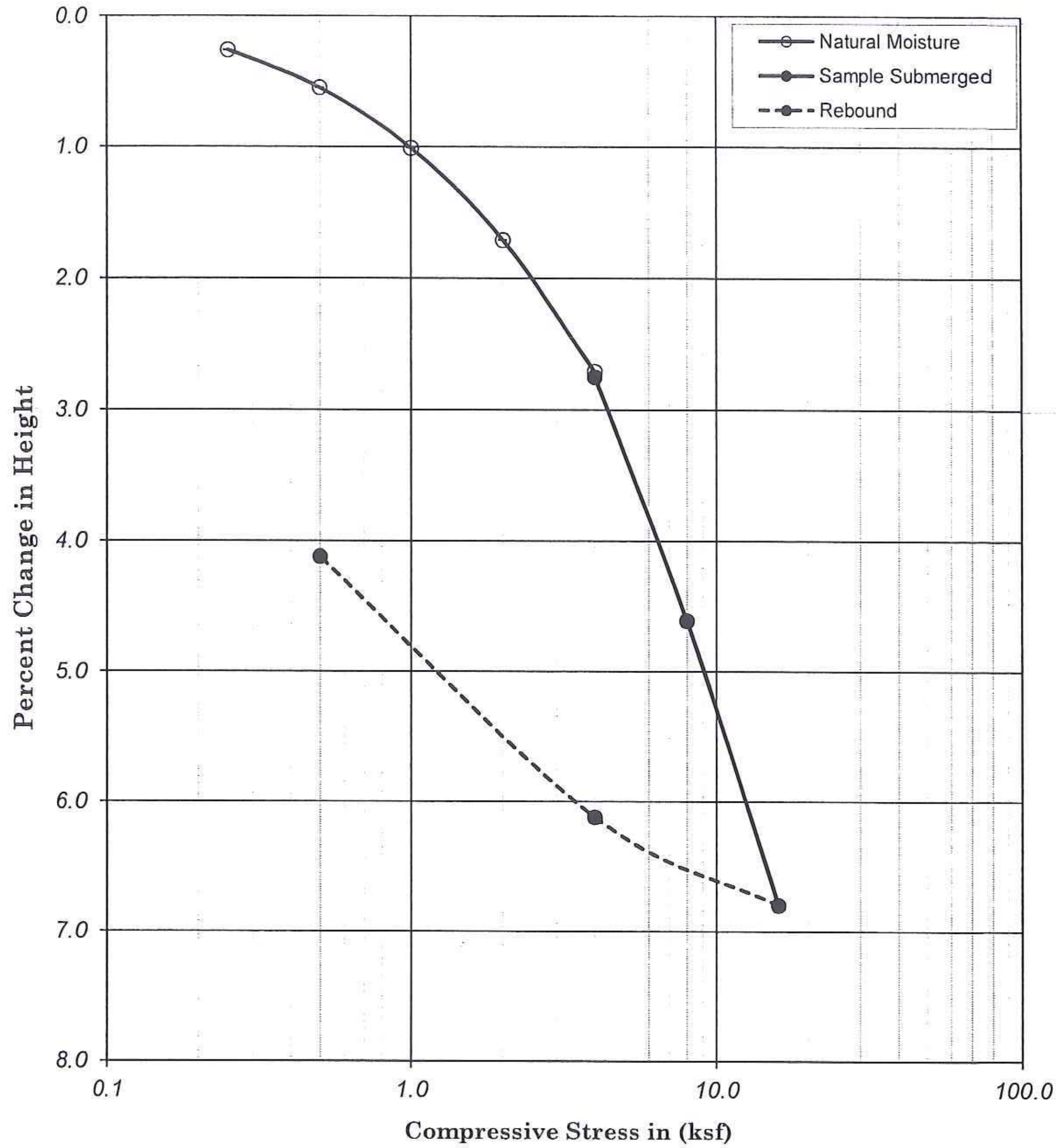
Description : *Very dark gray, Elastic SILT (MH)*

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

Project No. : *11-137* *12/04/11*

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



Boring No.	: A-11-348		Liquid Limit :	-		Moisture Content (%)	Dry Density (pcf)	Dry Density (kN/m³)	Percent Saturation	Void Ratio
Sample No.	: D-17		Plastic Limit :	-						
Depth (ft)	: 85.0	86.5	Plastic Index :	-	Initial	26.59	98.69	15.53	101.43	0.71
Depth (m)	: 25.93	26.38	Specific Gravity :	2.70	Final	26.20	102.94	16.20	110.98	0.64

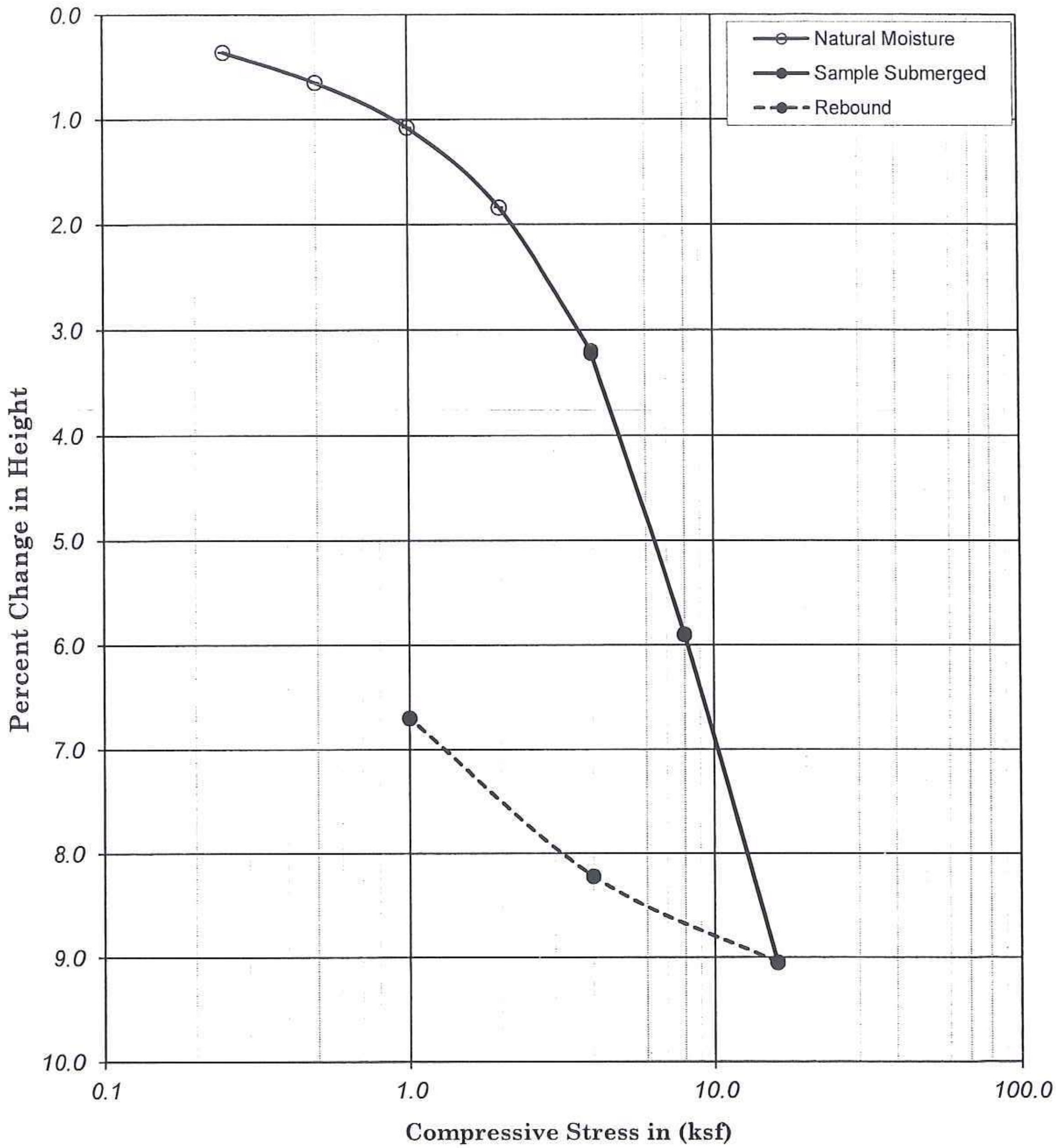
Description : Olive-brown, Lean CLAY (CL)

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

Project No. : 11-137 12/04/11

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



Boring No.	: A-11-349		Liquid Limit :	-		Moisture Content (%)	Dry Density (pcf)	Dry Density (kN/m³)	Percent Saturation	Void Ratio
Sample No.	: D-7		Plastic Limit :	-						
Depth (ft)	: 35.0	36.5	Plastic Index :	-	Initial	27.93	97.23	15.30	102.79	0.73
Depth (m)	: 10.68	11.13	Specific Gravity :	2.70	Final	26.02	104.22	16.40	113.81	0.62

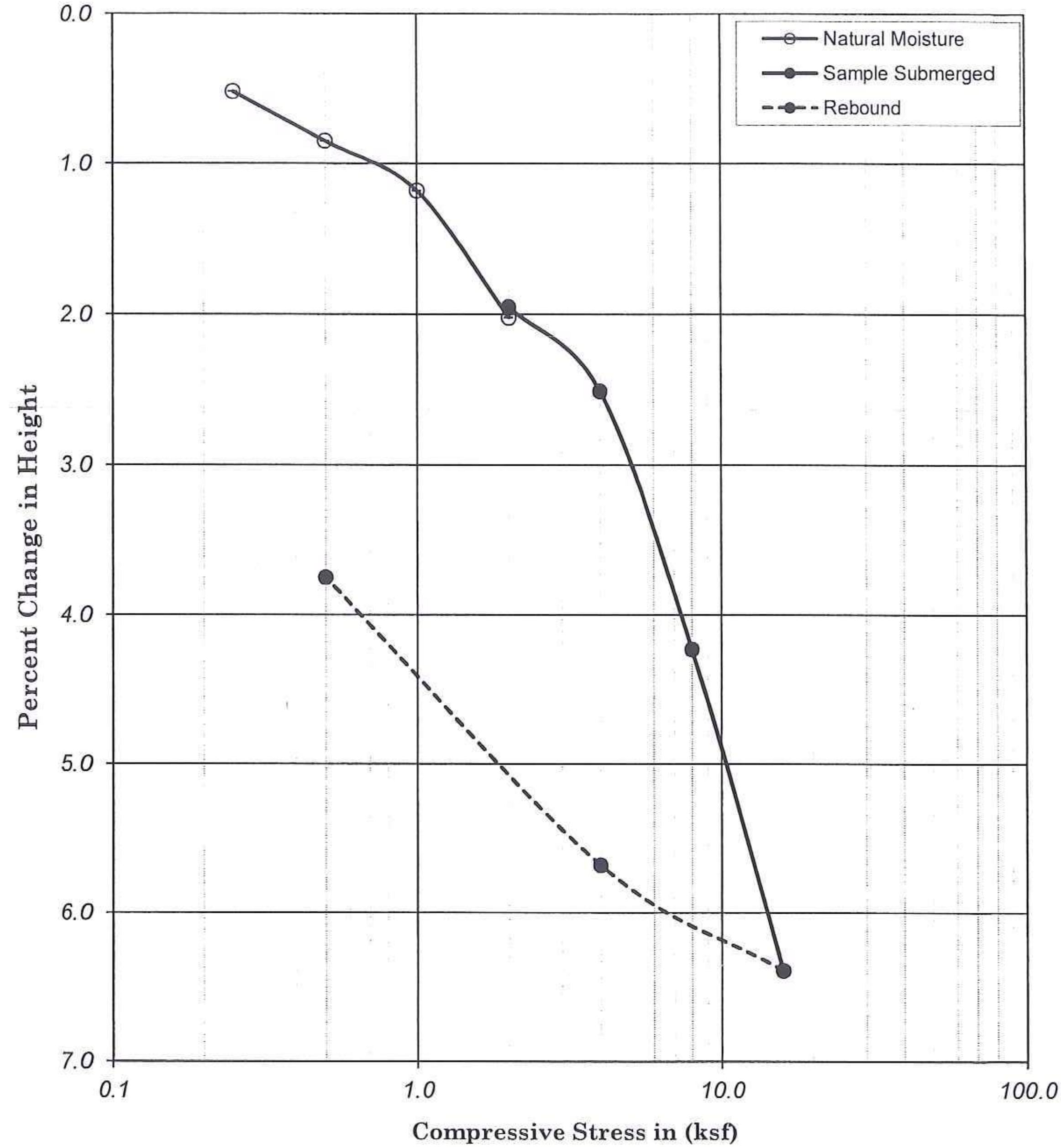
Description : *Olive-brown with yellowish brown, Lean CLAY (CL)*

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

Project No. : 11-137 12/04/11

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



								Moisture Content (%)	Dry Density (pcf)	Dry Density (kN/m³)	Percent Saturation	Void Ratio
Boring No.		:	A-11-350		Liquid Limit :	-						
Sample No.		:	D-6		Plastic Limit :	-						
Depth	(ft)	:	30.0	31.5	Plastic Index :	-	Initial	34.14	85.74	13.50	95.42	0.97
	(m)	:	9.15	9.61	Specific Gravity :	2.70	Final	36.96	89.09	14.02	111.86	0.89

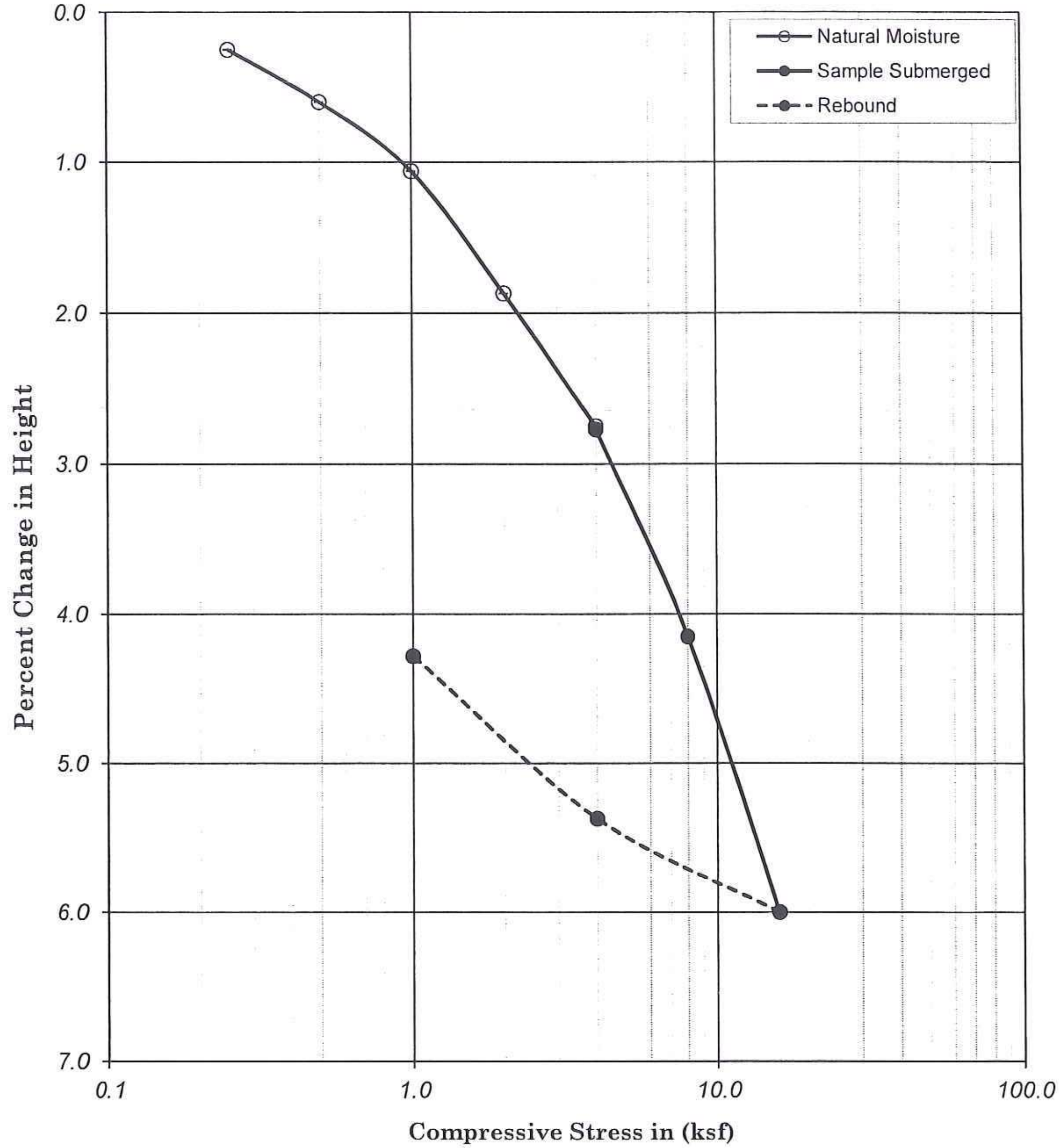
Description : *Olive-brown with yellowish brown, Lean CLAY (CL)*

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

Project No. : 11-137   12/04/11

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



Boring No.		: A-11-350		Liquid Limit :	-		Moisture Content (%)	Dry Density (pcf)	Dry Density (kN/m³)	Percent Saturation	Void Ratio
Sample No.		: D-16		Plastic Limit :	-						
Depth	(ft) :	80.0	81.5	Plastic Index :	-	Initial	31.66	93.70	14.75	107.00	0.80
	(m) :	24.40	24.86	Specific Gravity :	2.70	Final	29.97	97.90	15.41	112.12	0.72

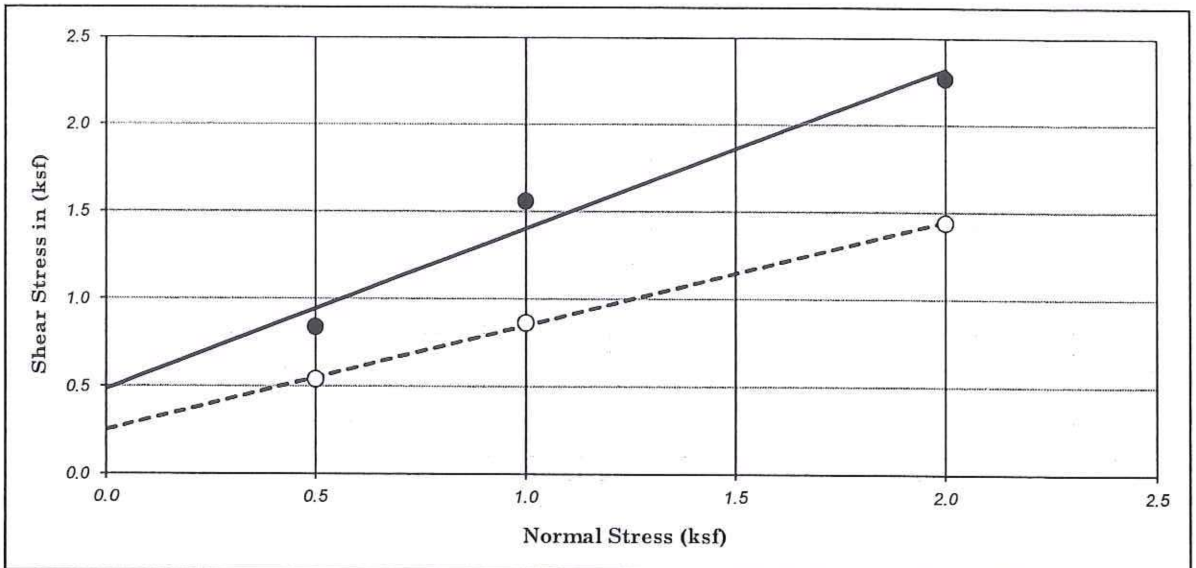
Description : *Very dark grayish brown, Elastic SILT (MH)*

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

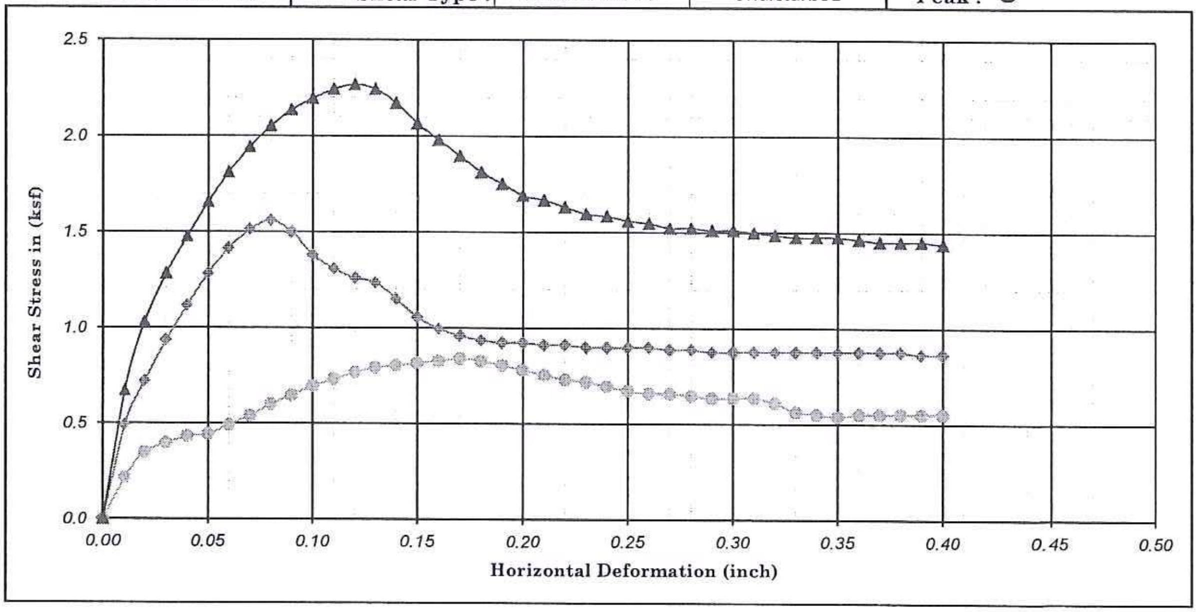
I-5 HOV Improvement Project
PCH to San Juan Creek Road

Project No. : 11-137 12/04/11

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



Ultimate : ○ | Shear Type : *Field Moisture* | *Undisturbed* | Peak : ●



Boring No. : A-11-302	Strength Intercept (C) :	0.49	(ksf)	Peak	0.25	(ksf)	Ultimate
Sample No. : D-3		23.27	(kPa)		12.07	(kPa)	
Depth (ft/m) : 10.0 | 0.00	Friction Angle (ϕ) :	42.53	Degree		30.82	Degree	

Description : Olive-brown, SANDY lean CLAY (CL) — 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)
●	14.57	109.59	17.25	0.54	0.50	23.94	0.84	40.22	0.54	25.86
◆	14.86	110.70	17.42	0.52	1.00	47.88	1.56	74.69	0.86	41.37
▲	16.42	111.89	17.61	0.51	2.00	95.76	2.27	108.59	1.44	68.95

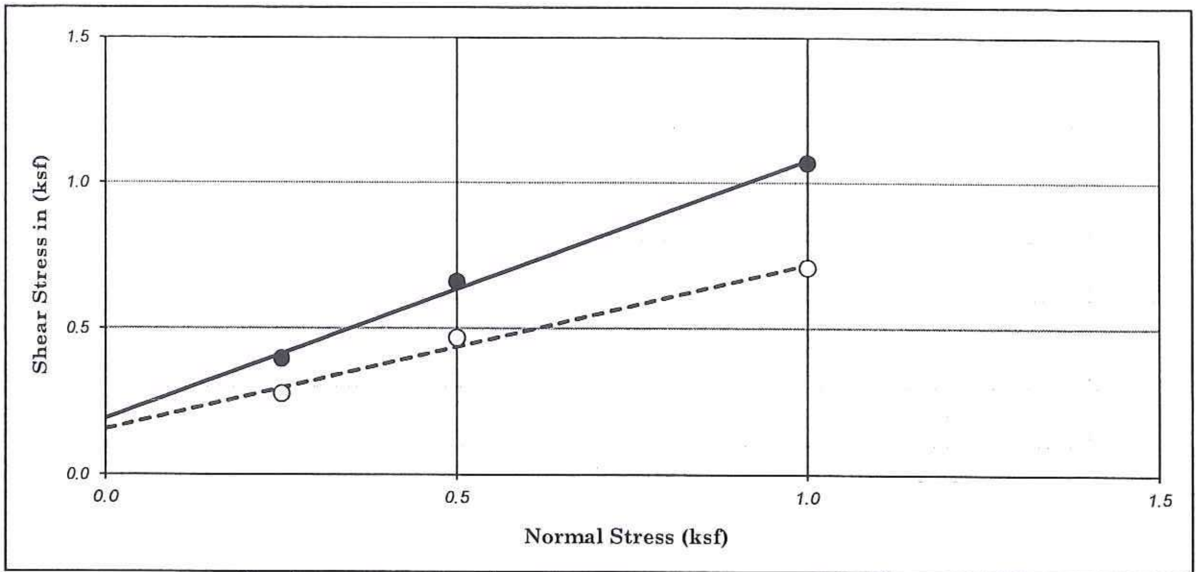
Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

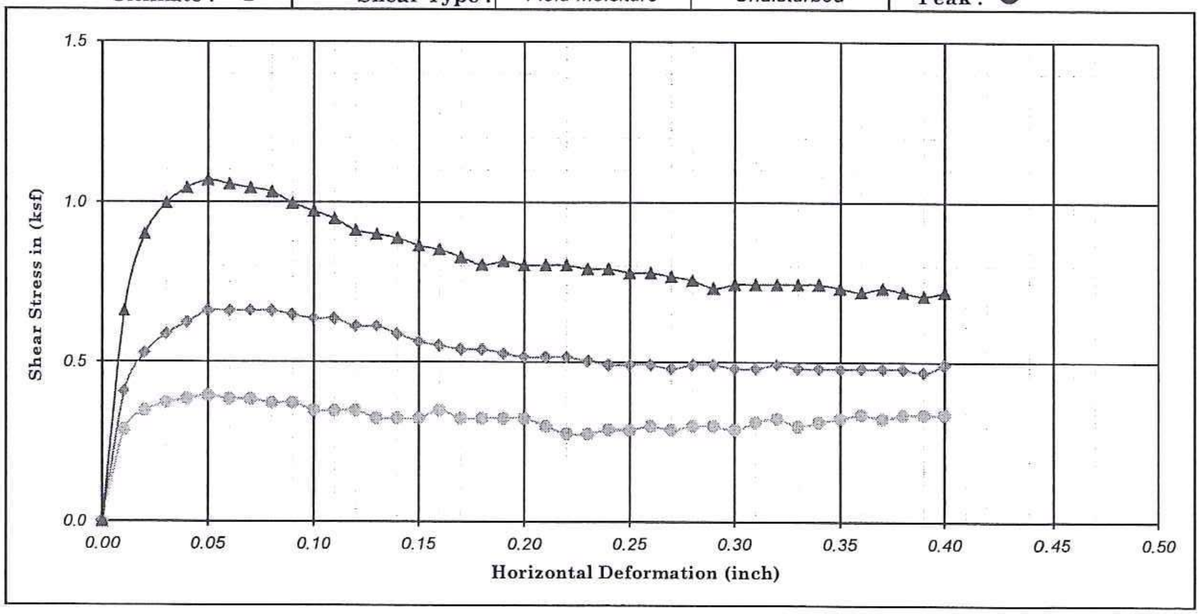
Soundwall 340

DIRECT SHEAR TEST (ASTM D-3080)

Project No. : 11-137 | Date : 12/07/11 | Figure No. :



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



Boring No.	: A-11-303		Strength Intercept (C) :		0.19	(ksf)	Peak	0.16	(ksf)	Ultimate
Sample No.	: D-1				9.19	(kPa)		7.47	(kPa)	
Depth (ft/m)	: 5.0	0.00	Friction Angle (φ) :		41.50	Degree		29.35	Degree	
Description	: Dark olive-brown, Poorly graded SAND with GRAVEL (SP)						Shear Rate (inch/minute) :		0.02	
SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m³)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	5.34	113.52	17.87	0.48	0.25	11.97	0.40	18.96	0.28	13.21
◆	7.05	108.95	17.15	0.55	0.50	23.94	0.66	31.60	0.47	22.41
▲	7.77	113.27	17.83	0.49	1.00	47.88	1.07	51.14	0.71	33.90

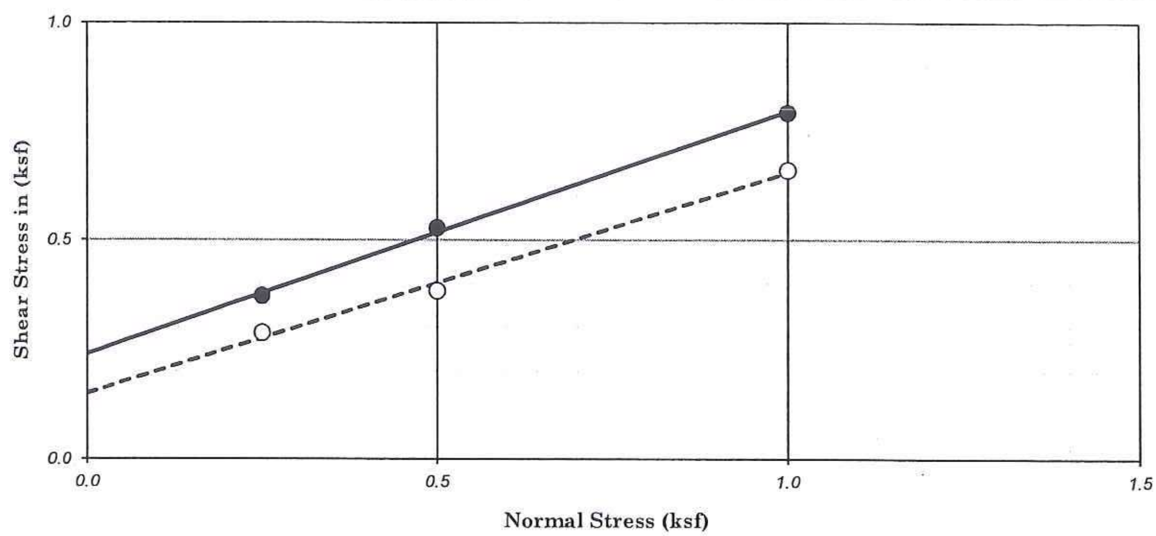
Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

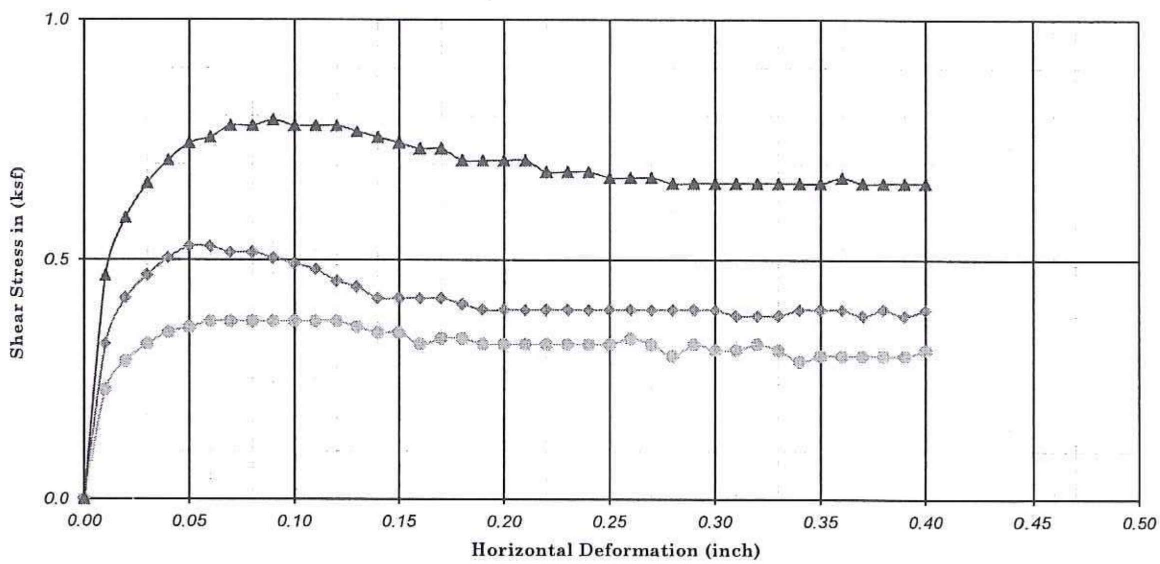
Soundwall 340

DIRECT SHEAR TEST (ASTM D-3080)

Project No. : 11-137 | Date : 11/05/11 | Figure No. :



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



Boring No. : A-11-305	Strength Intercept (C) :	0.24	(ksf)	Peak	0.15	(ksf)	Ultimate
Sample No. : D-1		11.49	(kPa)		7.18	(kPa)	
Depth (ft/m) : 5.0 | 0.00	Friction Angle (ϕ) :	29.05	Degree		26.75	Degree	

Description : Olive-brown, Poorly graded SAND (SP) — Shear Rate (inch/minute) : 0.02

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m³)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	2.41	113.32	17.84	0.49	0.25	11.97	0.37	17.81	0.29	13.79
◆	2.09	101.97	16.05	0.65	0.50	23.94	0.53	25.28	0.38	18.39
▲	1.75	90.82	14.30	0.86	1.00	47.88	0.79	37.92	0.66	31.60

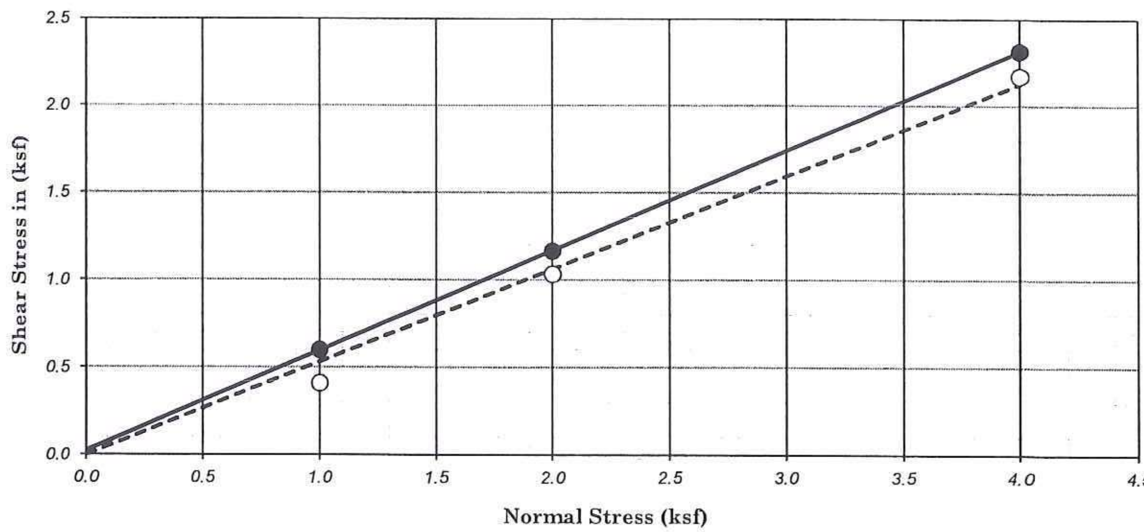
Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

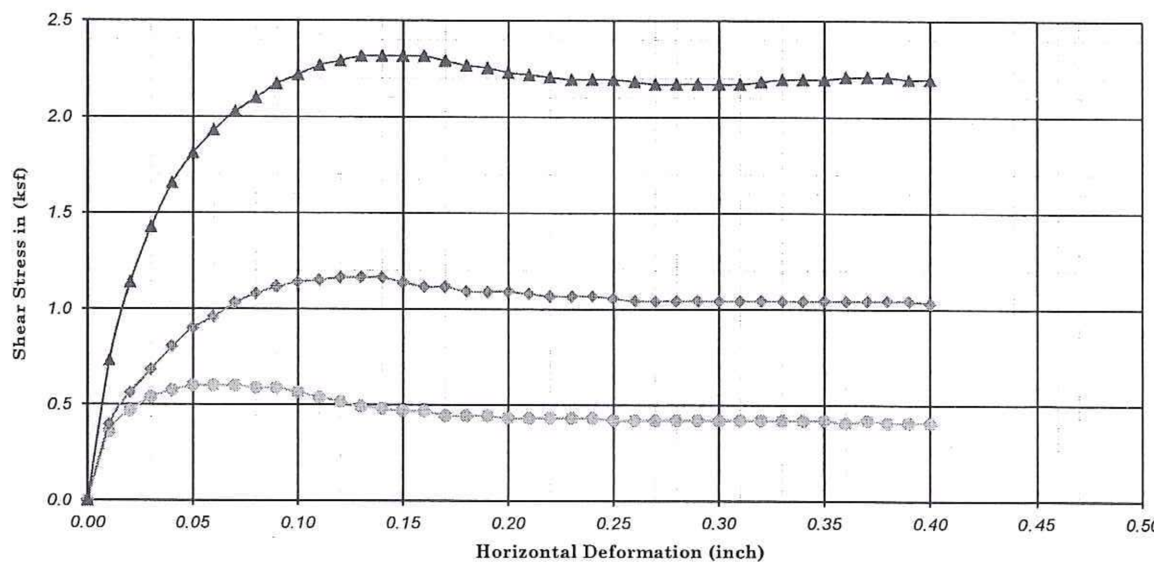
Soundwall 340

DIRECT SHEAR TEST (ASTM D-3080)

Project No. : 11-137 | Date : 11/05/11 | Figure No. :



Ultimate : ○	Shear Type :	Inundated	Undisturbed	Peak : ●



Boring No. : A-11-310	Strength Intercept (C) :	0.02	(ksf)	Peak	0.00	(ksf)	Ultimate
Sample No. : D-1		1.15	(kPa)		0.00	(kPa)	
Depth (ft/m) : 2.5 / 0.00	Friction Angle (ϕ) :	29.79	Degree		27.99	Degree	
Description : Olive-brown, Lean CLAY with SAND (CL)				Shear Rate (inch/minute) :	0.02		

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m³)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	24.10	95.60	15.05	0.76	1.00	47.88	0.60	28.73	0.41	19.54
◆	21.36	93.70	14.75	0.80	2.00	95.76	1.16	55.73	1.03	49.41
▲	24.07	93.53	14.72	0.80	4.00	191.52	2.32	110.89	2.17	104.00

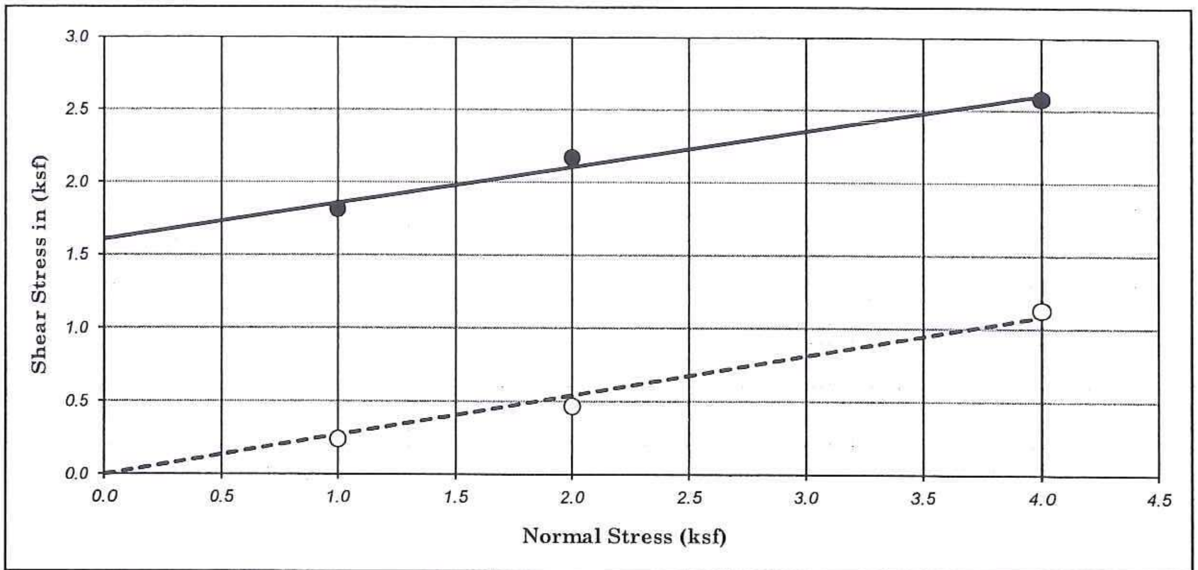
Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

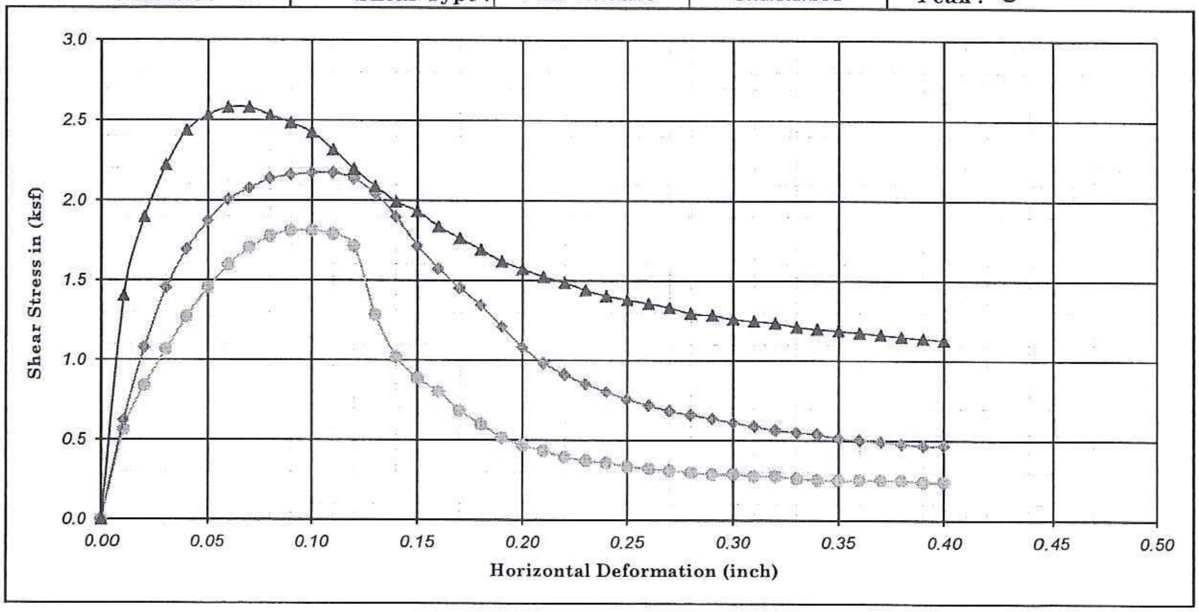
Retaining Wall 349

DIRECT SHEAR TEST (ASTM D-3080)

Project No. : 11-137 | Date : 01/18/12 | Figure No. :



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



Boring No. : A-11-310		Strength Intercept (C) :	1.61	(ksf)	Peak	0.00	(ksf)	Ultimate
Sample No. : D-5			76.99	(kPa)		0.00	(kPa)	
Depth (ft/m) : 20.0	0.00	Friction Angle (ϕ) :	13.96	Degree		15.16	Degree	
Description : Olive-brown, Lean CLAY (CL)						Shear Rate (inch/minute) :	0.02	

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m³)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	27.81	96.39	15.17	0.75	1.00	47.88	1.81	86.76	0.24	11.49
◆	25.02	99.17	15.61	0.70	2.00	95.76	2.17	104.00	0.47	22.41
▲	27.33	98.38	15.49	0.71	4.00	191.52	2.58	123.53	1.13	54.01

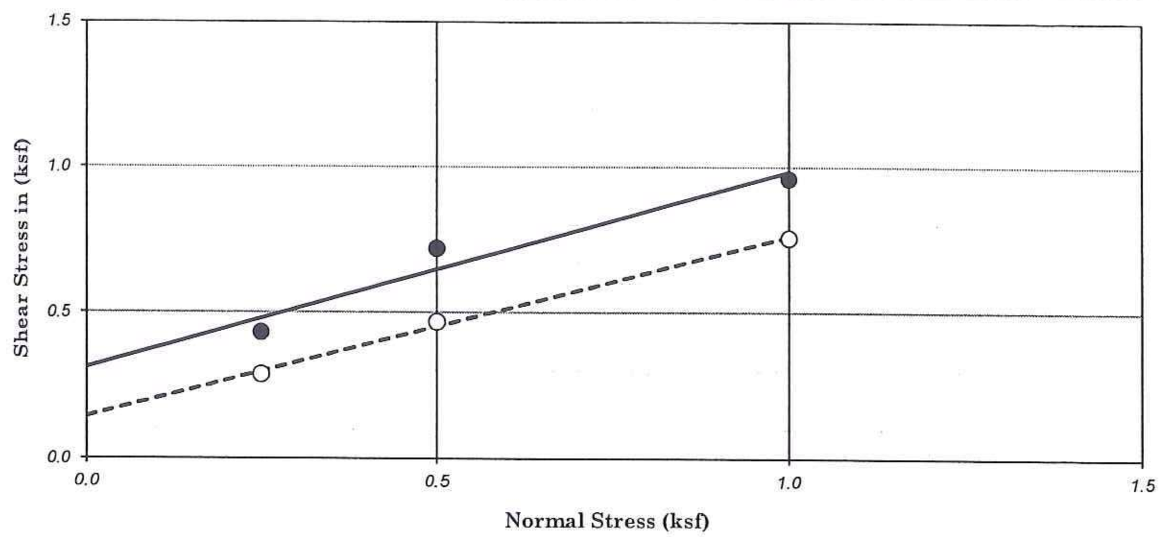
Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

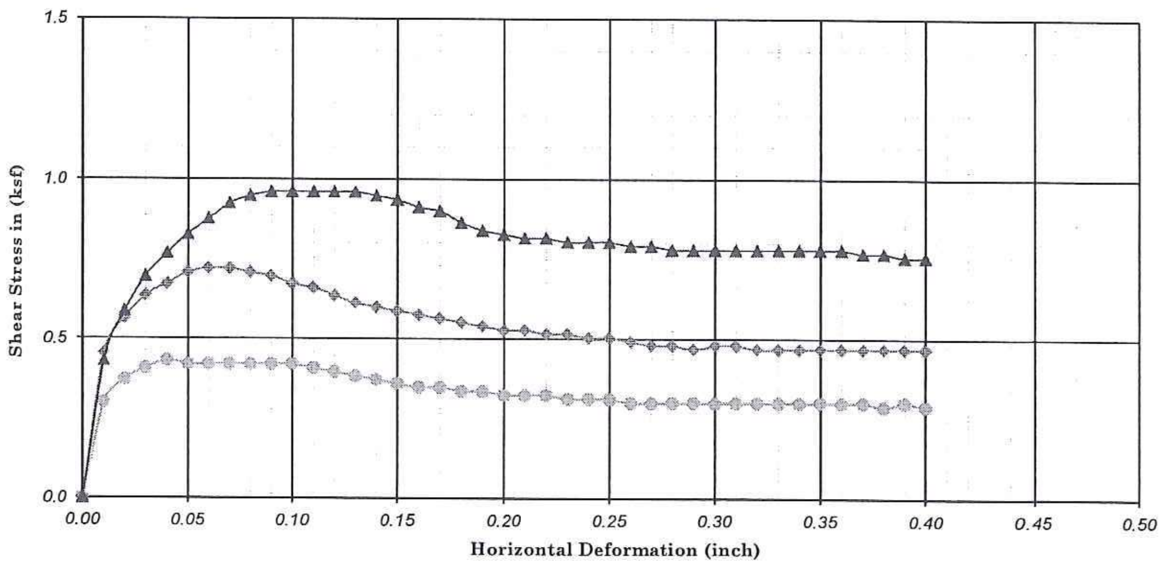
Retaining Wall 349

DIRECT SHEAR TEST (ASTM D-3080)

Project No. : 11-137 | Date : 01/13/12 | Figure No. :



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



Boring No.	: A-11-313	Strength Intercept (C) :	0.31	(ksf)	Peak	0.14	(ksf)	Ultimate	
Sample No.	: D-2		14.94	(kPa)		6.89	(kPa)		
Depth (ft/m)	: 5.0 / 0.00	Friction Angle (ϕ) :	33.90	Degree		31.68	Degree		
Description	: Olive-brown, SILTY SAND (SM)						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)
●	12.38	103.51	16.29	0.63	0.25	11.97	0.43	20.68	0.29	13.79
◆	14.33	103.65	16.32	0.63	0.50	23.94	0.72	34.47	0.47	22.41
▲	18.15	103.60	16.31	0.63	1.00	47.88	0.96	45.96	0.76	36.20

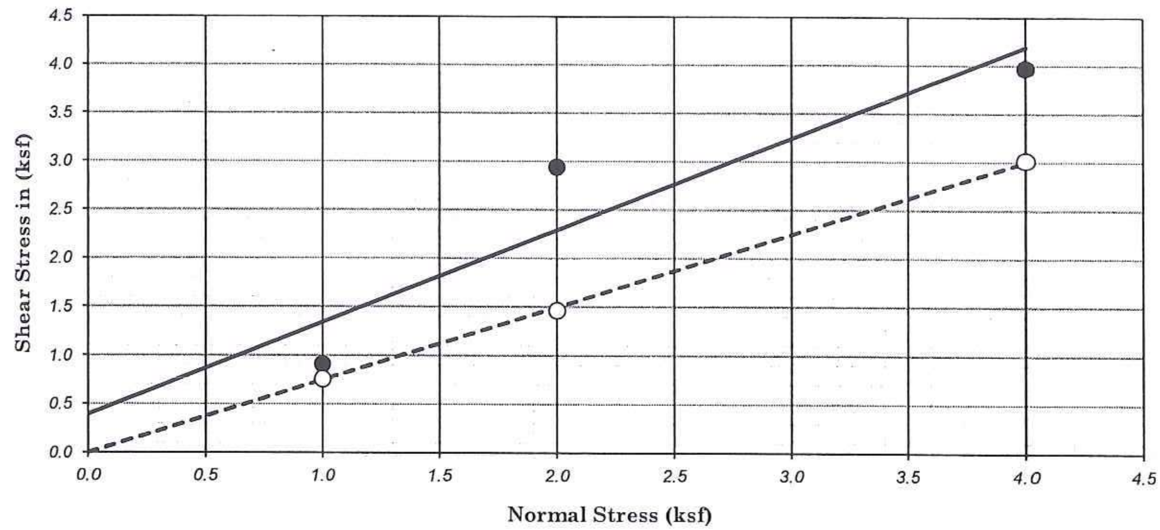
Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

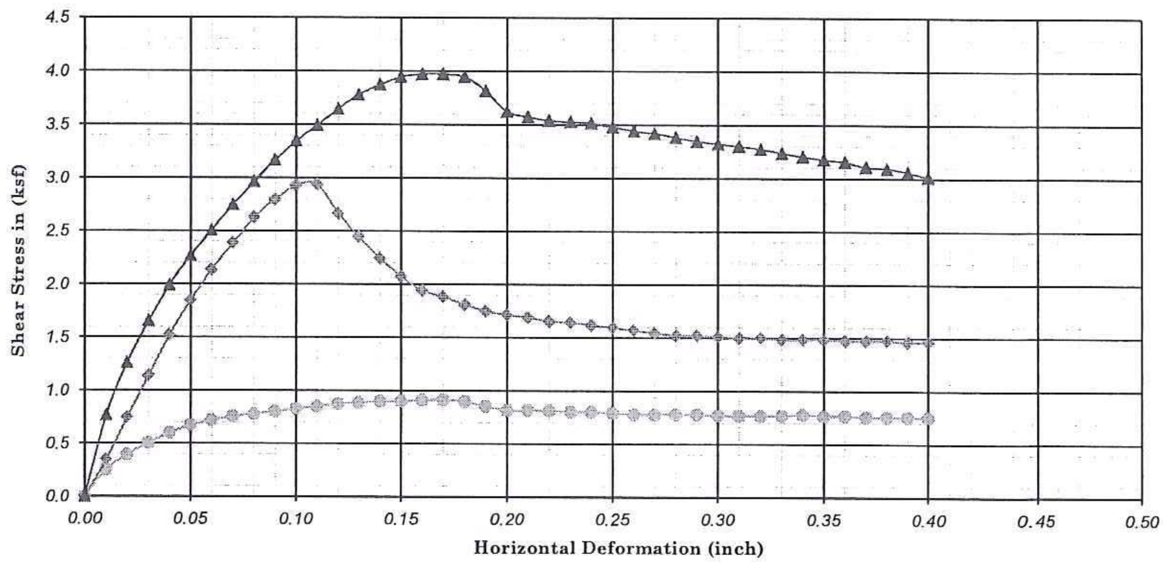
Retaining Wall 349

DIRECT SHEAR TEST (ASTM D-3080)

Project No. : 11-137 | Date : 11/05/11 | Figure No. :



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



Boring No.	: A-11-313	Strength Intercept (C) :		0.40	(ksf)	Peak	0.00	(ksf)	Ultimate	
Sample No.	: D-4			18.96	(kPa)		0.00	(kPa)		
Depth (ft/m)	: 15.0 / 0.00	Friction Angle (ϕ) :		43.47	Degree		36.84	Degree		
Description	: Olive-brown, Lean CLAY with SAND (CL)						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)
●	14.45	112.30	17.68	0.50	1.00	47.88	0.91	43.67	0.76	36.20
◆	15.10	113.51	17.87	0.49	2.00	95.76	2.94	140.77	1.46	70.10
▲	15.41	110.31	17.36	0.53	4.00	191.52	3.97	190.18	3.01	144.21

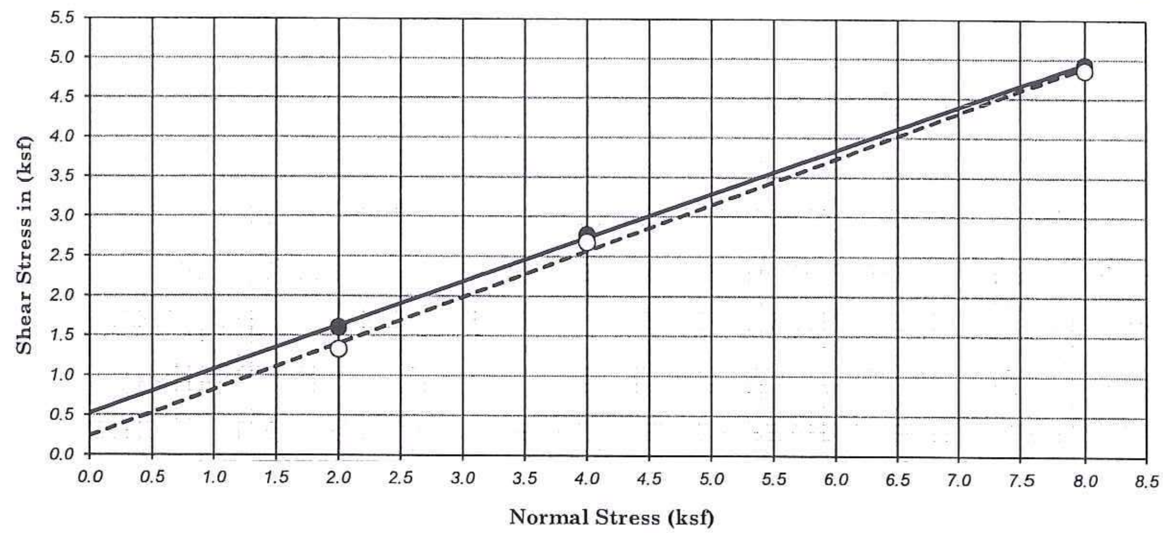
Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

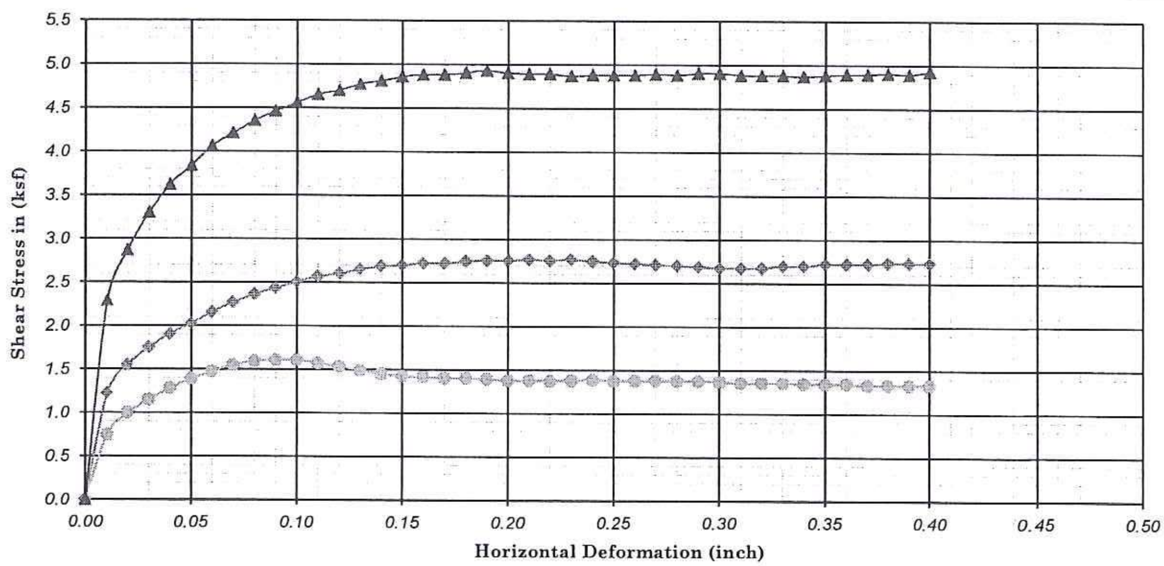
Retaining Wall 349

DIRECT SHEAR TEST (ASTM D-3080)

Project No. : 11-137 | Date : 01/13/12 | Figure No. :



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



Boring No. : A-11-313	Strength Intercept (C) :	0.53 (ksf) / 25.28 (kPa)	Peak	0.24 (ksf) / 11.49 (kPa)	Ultimate
Sample No. : D-10					
Depth (ft/m) : 45.0 / 0.00	Friction Angle (ϕ) :	28.90 Degree	Peak	30.20 Degree	Ultimate
Description : Olive-brown, Poorly graded SAND with SILT (SP-SM)			Shear Rate (inch/minute) : 0.02		

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m³)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	3.93	94.81	14.92	0.78	2.00	95.76	1.61	76.99	1.33	63.78
◆	3.67	93.94	14.79	0.79	4.00	191.52	2.77	132.72	2.68	128.13
▲	3.19	95.97	15.11	0.76	8.00	383.04	4.93	236.14	4.86	232.70

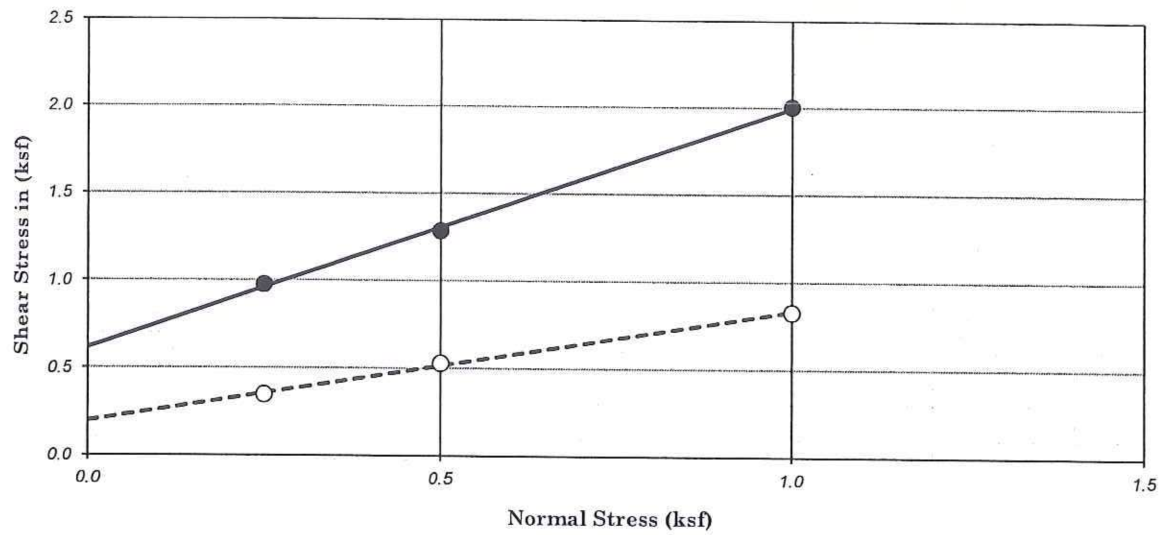
Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

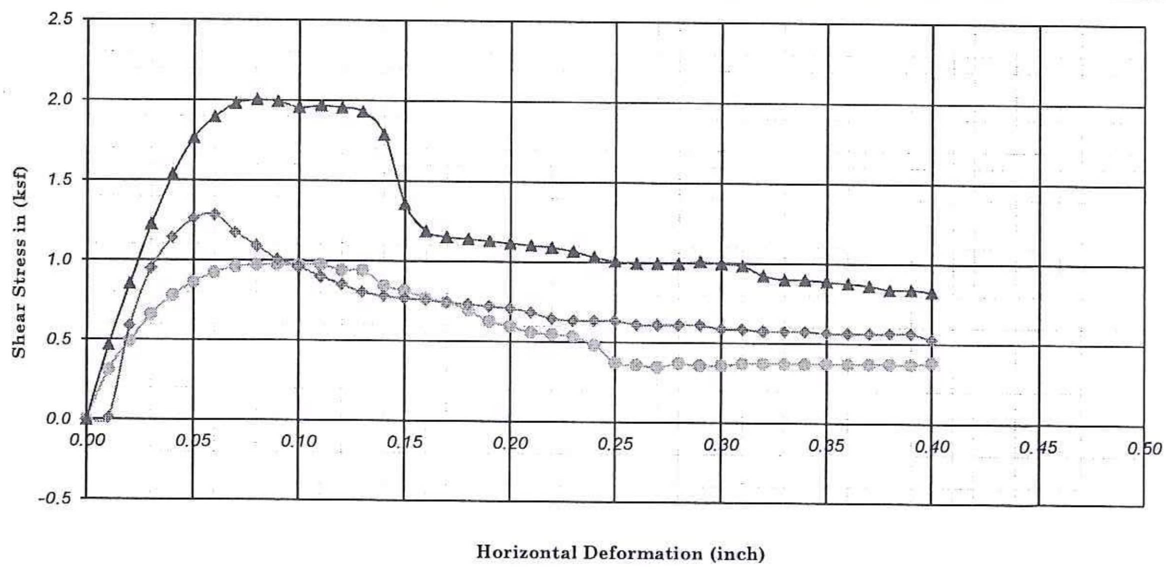
Retaining Wall 349

DIRECT SHEAR TEST (ASTM D-3080)

Project No. : 11-137 | Date : 11/05/11 | Figure No. :



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



Boring No. : A-11-314	Strength Intercept (C) :	0.62	(ksf)	Peak	0.20	(ksf)	Ultimate
Sample No. : D-1		29.49	(kPa)		9.48	(kPa)	
Depth (ft/m) : 2.5 | 0.00	Friction Angle (ϕ) :	54.08	Degree		32.39	Degree	

Description : Dark olive-brown, Lean CLAY with SAND (CL)

Shear Rate (inch/minute) : 0.02

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY		VOID RATIO	NORMAL STRESS		PEAK STRESS		ULTIMATE STRESS	
		(pcf)	(kN/m³)		(ksf)	(kPa)	(ksf)	(kPa)	(ksf)	(kPa)
●	10.29	97.89	15.41	0.72	0.25	11.97	0.98	46.73	0.35	16.66
◆	10.04	101.27	15.94	0.66	0.50	23.94	1.28	61.48	0.53	25.28
▲	9.61	101.96	16.05	0.65	1.00	47.88	2.00	95.95	0.83	39.64

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

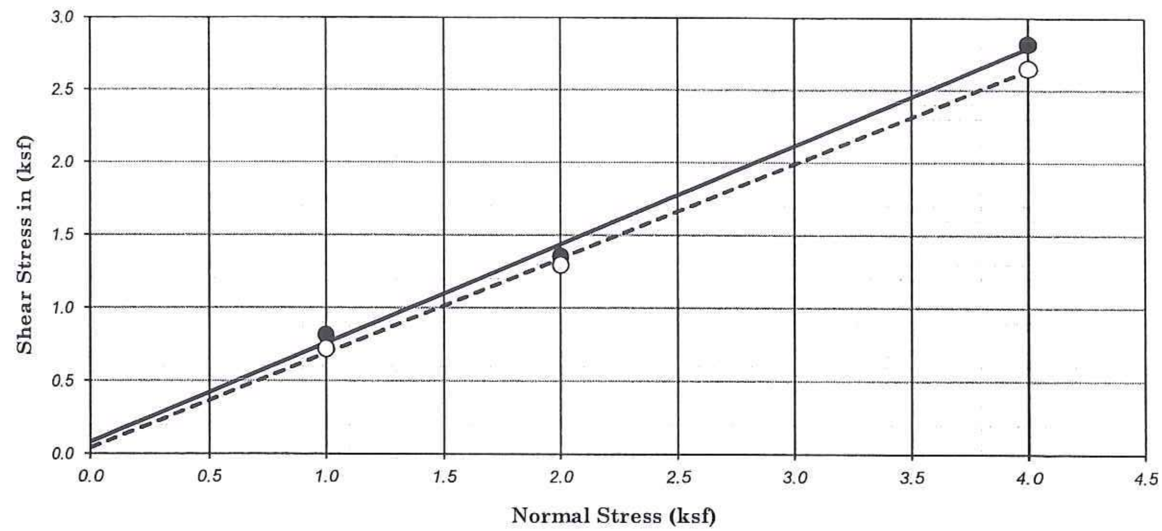
I-5 HOV Improvement Project
PCH to San Juan Creek Road

Soundwall 361

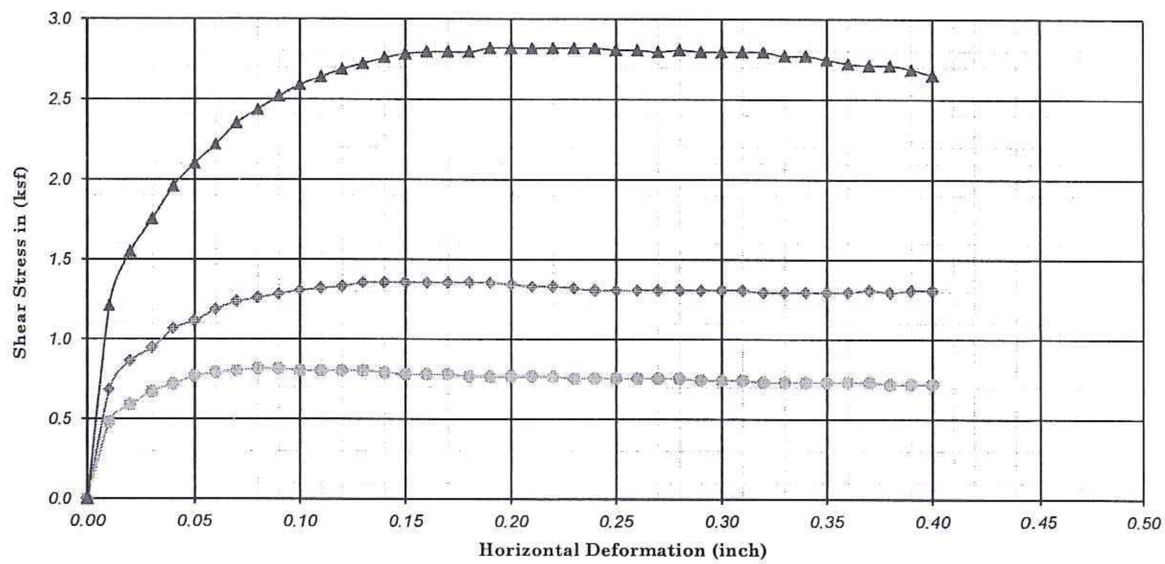
DIRECT SHEAR TEST (ASTM D-3080)

Project No. : 11-137 | Date : 11/05/11

Figure No. :



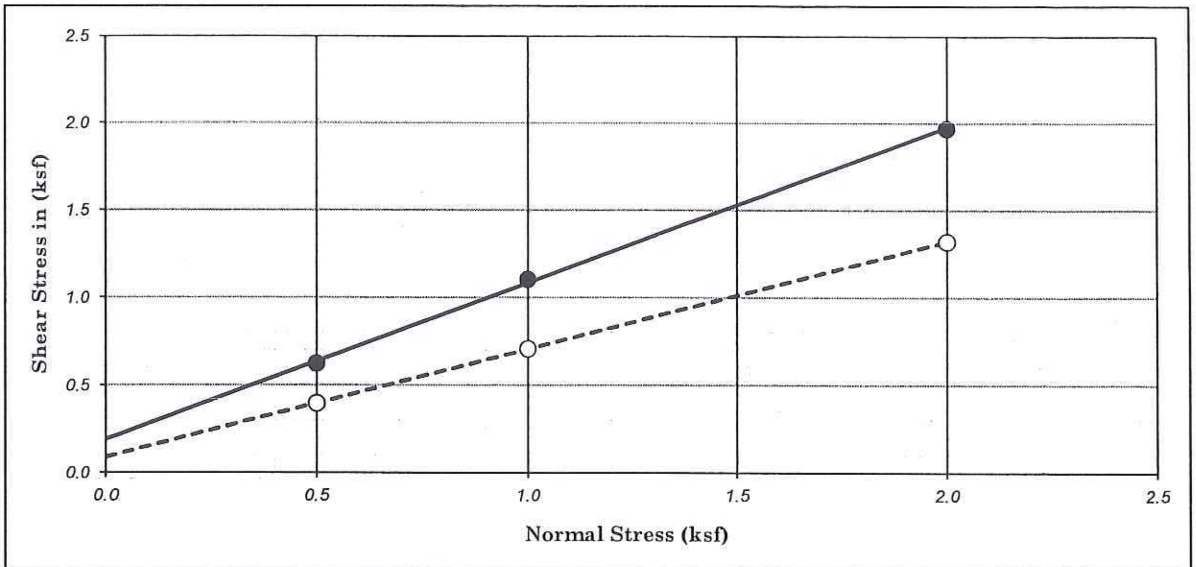
Ultimate : ○	Shear Type :	Field Moisiture	Undisturbed	Peak : ●



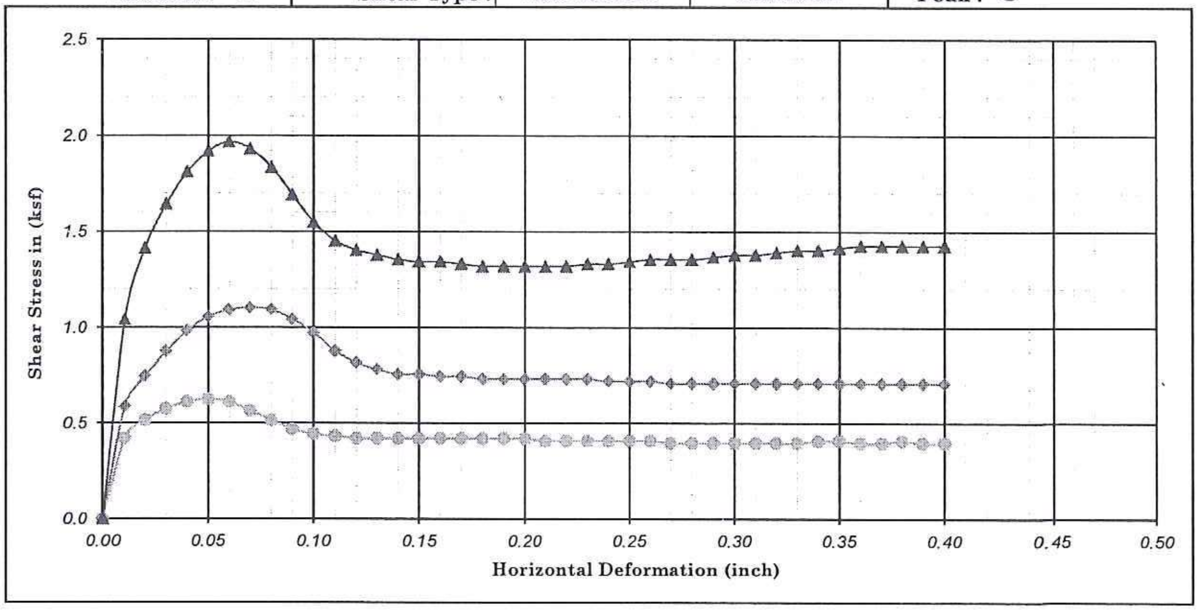
Boring No. : A-11-316	Strength Intercept (C) :	0.08	(ksf)	Peak	0.04	(ksf)	Ultimate
Sample No. : D-3		4.02	(kPa)		2.01	(kPa)	
Depth (ft/m) : 15.0	0.00	Friction Angle (ϕ) :	34.10	Degree		32.98	Degree	
Description : Olive-brown, Poorly graded SAND (SP)					Shear Rate (inch/minute) :	0.02	

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)
●	2.76	100.39	15.80	0.68	1.00	47.88	0.82	39.07	0.72	34.47
◆	2.28	98.75	15.54	0.71	2.00	95.76	1.36	64.93	1.30	62.05
▲	2.90	101.58	15.99	0.66	4.00	191.52	2.82	135.02	2.65	126.98

Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	*I-5 HOV Improvement Project* *PCH to San Juan Creek Road*
	5/N5-N1 Connector Separation
Project No. : 11-137 Date : 11/05/11	DIRECT SHEAR TEST (ASTM D-3080) Figure No. :



Ultimate : ○	Shear Type :	*Field Moisture*	*Undisturbed*	Peak : ●



Boring No.	: *A-11-317*	Strength Intercept (C) :	0.19	(ksf)	Peak	0.09	(ksf)	Ultimate
Sample No.	: *D-2*		9.19	(kPa)		4.31	(kPa)	
Depth (ft/m)	: *10.0* | *0.00*	Friction Angle (ϕ) :	41.71	Degree		31.61	Degree	

Description : *Olive-brown to olive-yellow, Poorly graded SAND with SILT (SP-SM)* Shear Rate (inch/minute) : 0.02

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m³)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	25.93	92.14	14.50	0.83	0.50	23.94	0.62	29.88	0.40	18.96
◆	23.88	94.28	14.84	0.79	1.00	47.88	1.10	52.86	0.71	33.90
▲	24.59	95.10	14.97	0.77	2.00	95.76	1.97	94.23	1.32	63.20

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

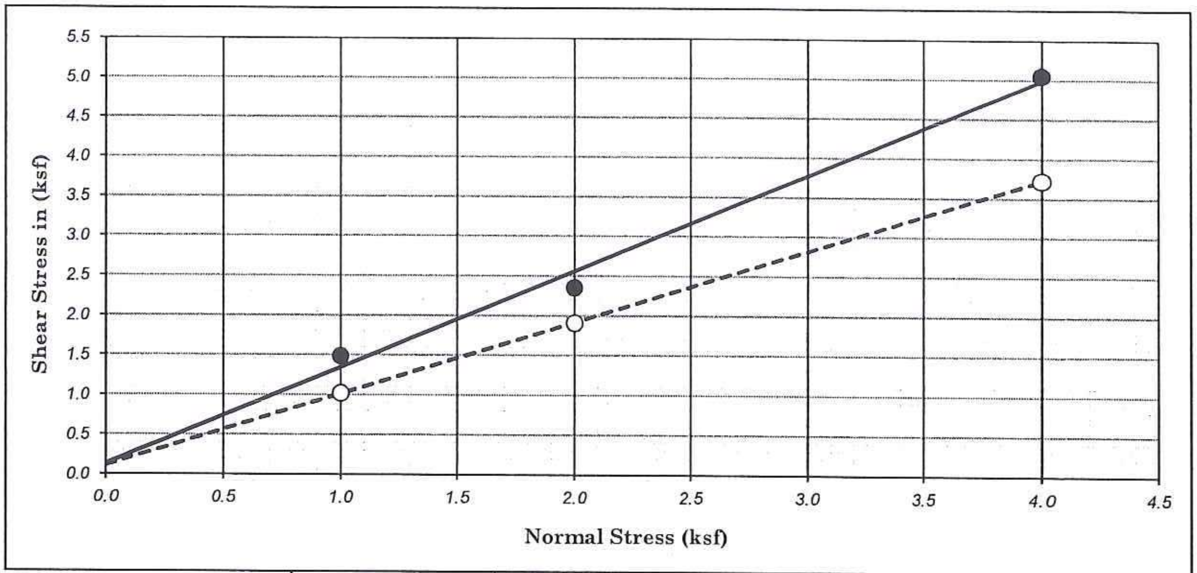
I-5 HOV Improvement Project
PCH to San Juan Creek Road

5/N5-N1 Connector Separation

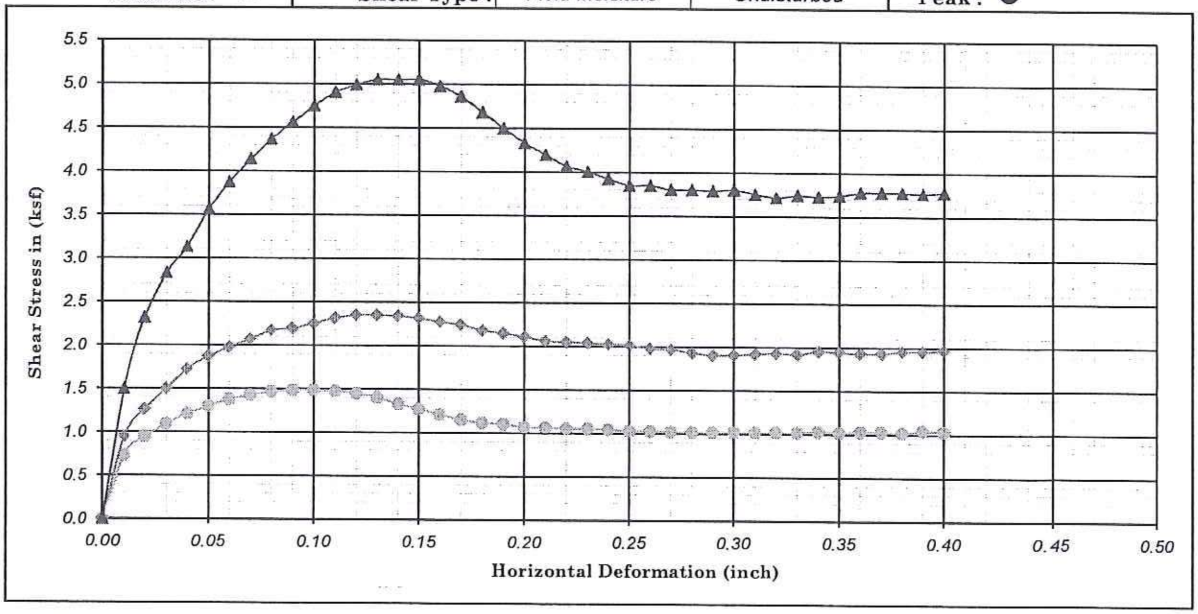
DIRECT SHEAR TEST (ASTM D-3080)

Project No. : *11-137* Date : *11/05/11*

Figure No. :



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



Boring No. : A-11-319	Strength Intercept (C) :	0.14	(ksf)	
Sample No. : D-7		6.61	(kPa)	Peak
Depth (ft/m) : 30.0 / 0.00	Friction Angle (ϕ) :	50.45	Degree	

0.11	(ksf)	
5.46	(kPa)	Ultimate
42.01	Degree	

Description : Olive-brown, Poorly graded SAND with SILT (SP-SM)

Shear Rate (inch/minute) : 0.02

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m³)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	19.10	98.09	15.44	0.72	1.00	47.88	1.49	71.25	1.02	48.84
◆	18.94	100.90	15.88	0.67	2.00	95.76	2.35	112.61	1.91	91.36
▲	18.64	104.58	16.46	0.61	4.00	191.52	5.05	241.89	3.72	178.11

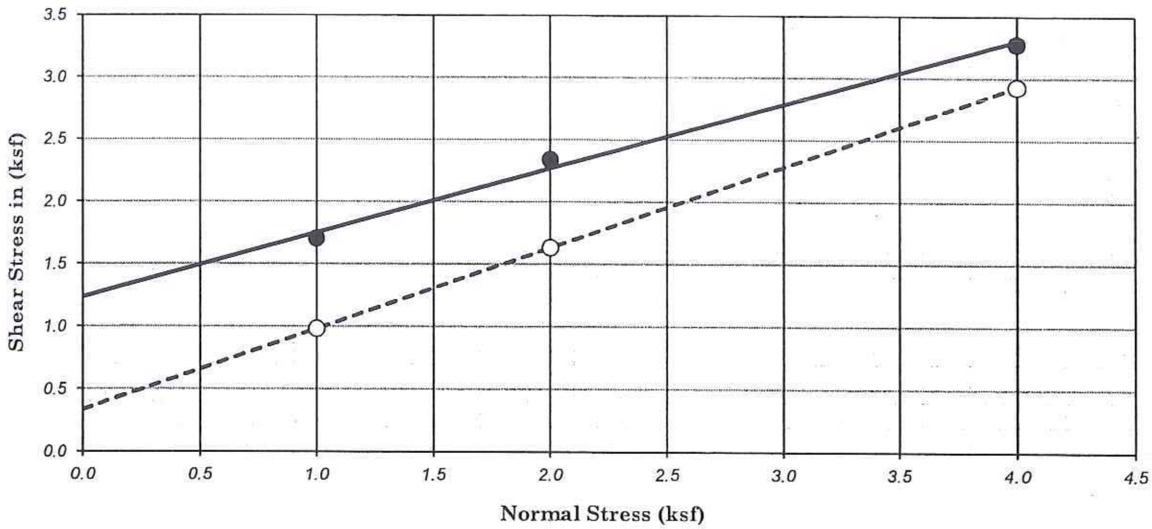
Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

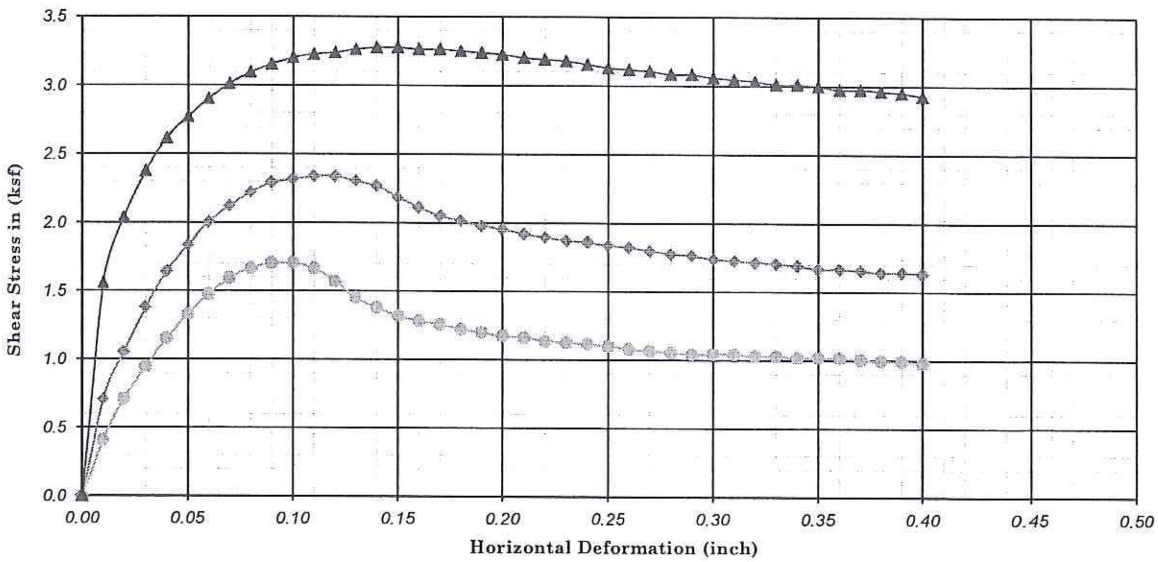
5/N5-N1 Connector Separation

DIRECT SHEAR TEST (ASTM D-3080)

Project No. : 11-137 | Date : 11/05/11 | Figure No. :



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



Boring No. : A-11-322		Strength Intercept (C) :		1.24	(ksf)	Peak		0.34	(ksf)	Ultimate	
Sample No. : D-3				59.18	(kPa)			16.09	(kPa)		
Depth (ft/m) : 15.0	0.00	Friction Angle (ϕ) :		27.29	Degree			32.94	Degree		
Description : Olive-brown, CLAYEY SAND with GRAVEL (SC)								Shear Rate (inch/minute) :		0.02	
SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m³)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)	
●	16.07	107.99	17.00	0.56	1.00	47.88	1.70	81.59	0.98	47.11	
◆	15.09	108.45	17.07	0.55	2.00	95.76	2.34	112.04	1.63	78.14	
▲	18.90	106.30	16.73	0.59	4.00	191.52	3.28	156.85	2.93	140.19	

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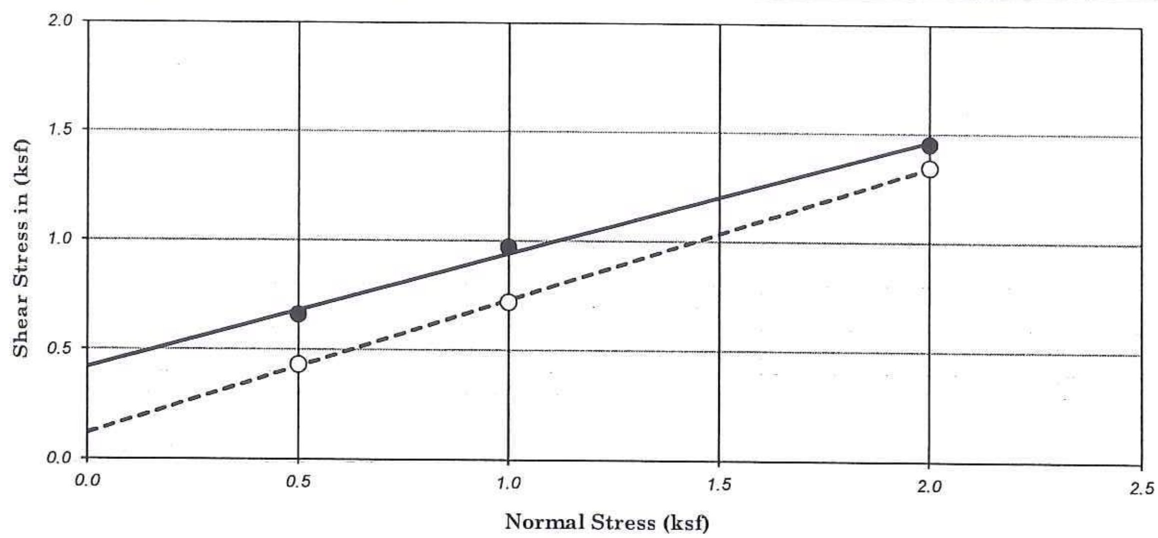
I-5 HOV Improvement Project
PCH to San Juan Creek Road

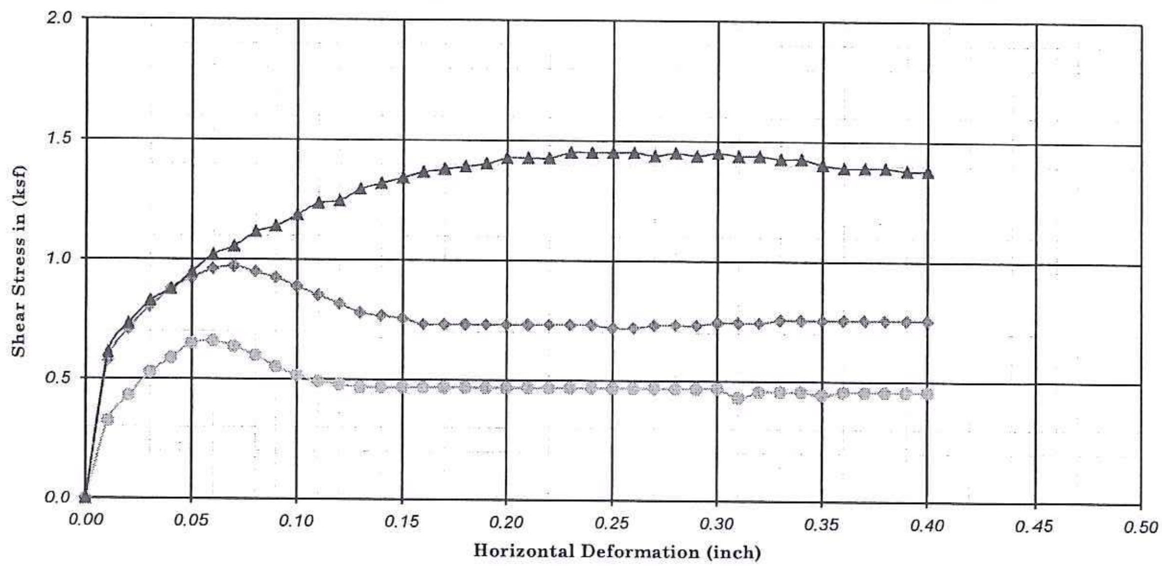
5/N5-N1 Connector Separation

DIRECT SHEAR TEST (ASTM D-3080)

Project No. : 11-137 | Date : 11/05/11 | Figure No. :



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



Boring No.	: A-11-327	Strength Intercept (C) :	0.42	(ksf)	Peak	0.12	(ksf)	Ultimate
Sample No.	: D-2		20.11	(kPa)		5.75	(kPa)	
Depth (ft/m)	: 10.0 | 0.00	Friction Angle (ϕ) :	27.53	Degree		31.40	Degree	
Description	: Yellowish brown, SILTY SAND (SM)					Shear Rate (inch/minute) :	0.02	

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m³)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	5.38	97.55	15.35	0.73	0.50	23.94	0.66	31.60	0.43	20.68
◆	3.77	98.67	15.53	0.71	1.00	47.88	0.97	46.54	0.72	34.47
▲	2.69	96.93	15.26	0.74	2.00	95.76	1.45	69.52	1.34	64.35

Earth Mechanics, Inc.
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I-5 HOV Improvement Project
PCH to San Juan Creek Road

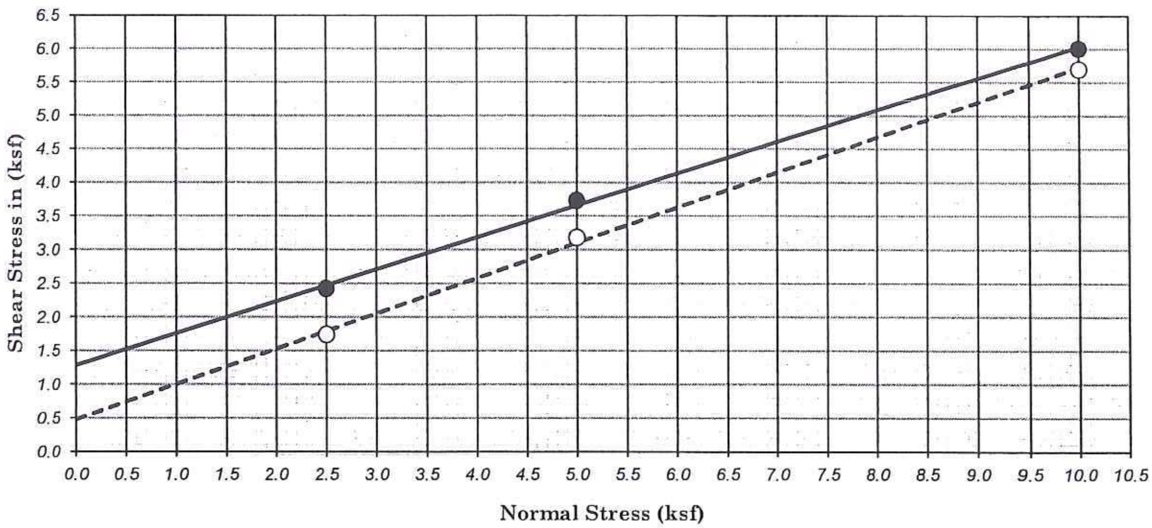
Route 5/1 Separation

DIRECT SHEAR TEST (ASTM D-3080)

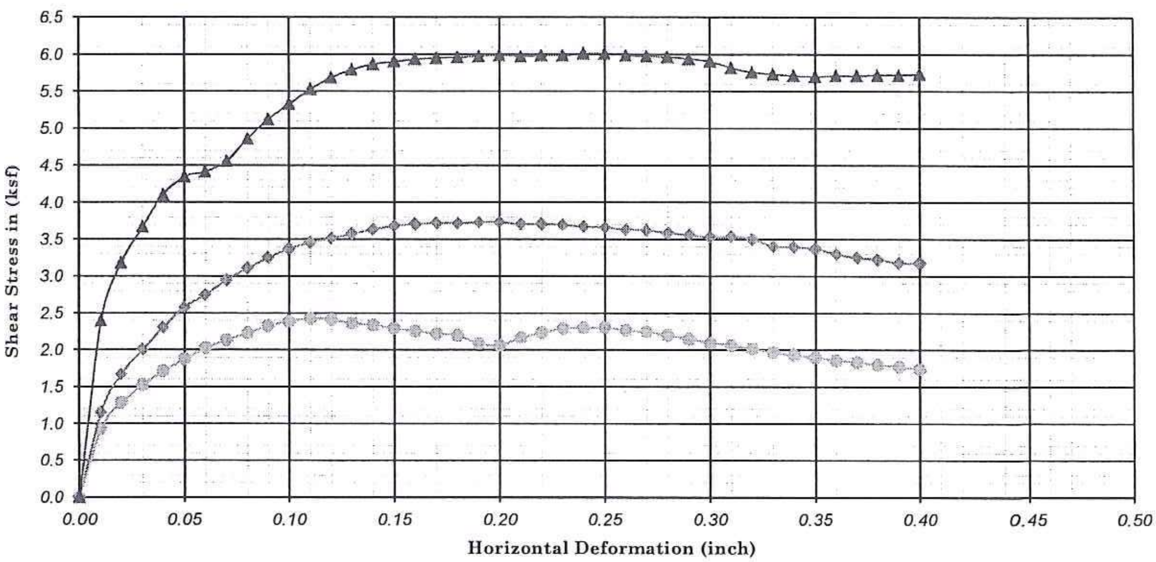
Project No. : 11-137

Date : 11/05/11

Figure No. :



Ultimate : O	Shear Type :	Field Moisture	Undisturbed	Peak : ●



Boring No. : A-11-327	Strength Intercept (C) :	1.28	(ksf)	Peak	0.48	(ksf)	Ultimate
Sample No. : D-16		61.50	(kPa)		23.01	(kPa)	
Depth (ft/m) : 30.0 / 0.00	Friction Angle (ϕ) :	25.41	Degree		27.67	Degree	
Description : Very dark grayish 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)
●	18.75	109.26	17.20	0.54	2.50	119.70	2.42	116.06	1.74	83.31
◆	18.71	105.56	16.61	0.60	5.00	239.40	3.73	178.69	3.18	152.26
▲	19.94	102.69	16.16	0.64	10.00	478.80	6.01	287.81	5.70	272.87

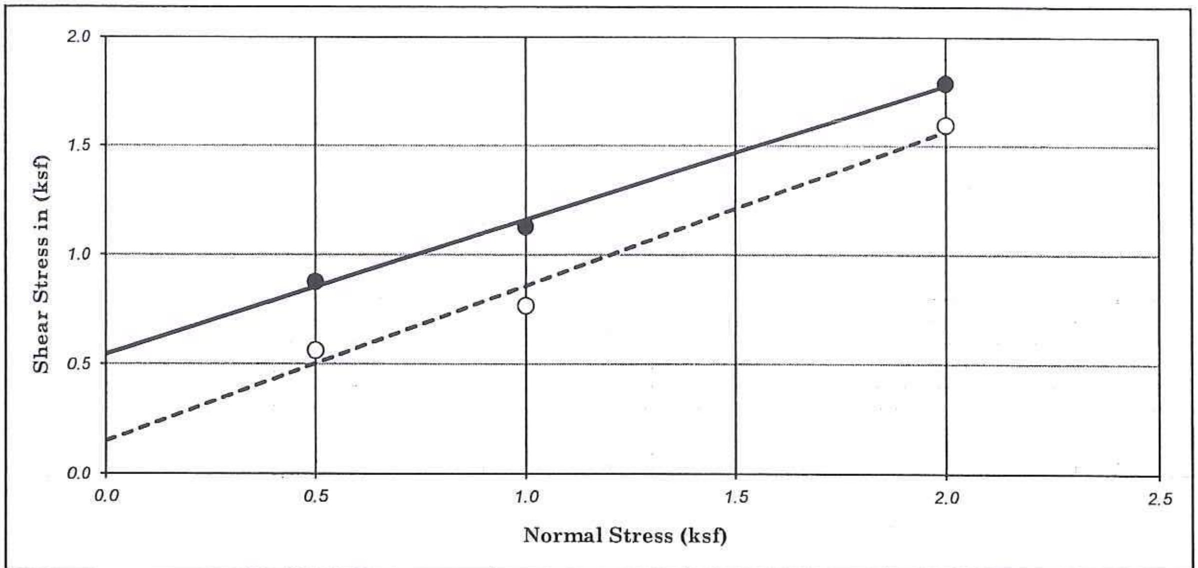
Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

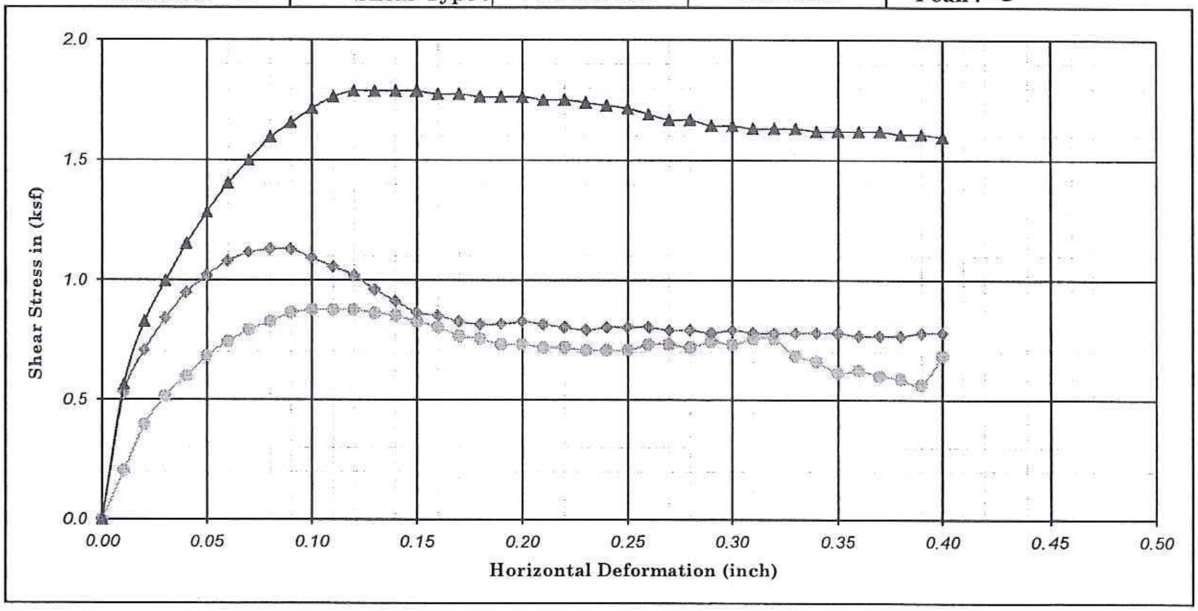
Route 5/1 Separation

DIRECT SHEAR TEST (ASTM D-3080)

Project No. : 11-137 | Date : 11/05/11 | Figure No. :



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



Boring No. : A-11-328		Strength Intercept (C) :		0.55	(ksf)	Peak		0.15	(ksf)	Ultimate
Sample No. : D-3				26.14	(kPa)			7.18	(kPa)	
Depth (ft/m) : 15.0	0.00	Friction Angle (ϕ) :		31.61	Degree			35.30	Degree	
Description : Olive-brown, CLAYEY SAND (SC)							Shear Rate (inch/minute) :			0.02

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m³)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	16.03	107.40	16.90	0.57	0.50	23.94	0.88	41.94	0.56	27.00
◆	7.79	106.11	16.70	0.59	1.00	47.88	1.13	54.01	0.77	36.77
▲	16.65	103.53	16.29	0.63	2.00	95.76	1.79	85.61	1.60	76.42

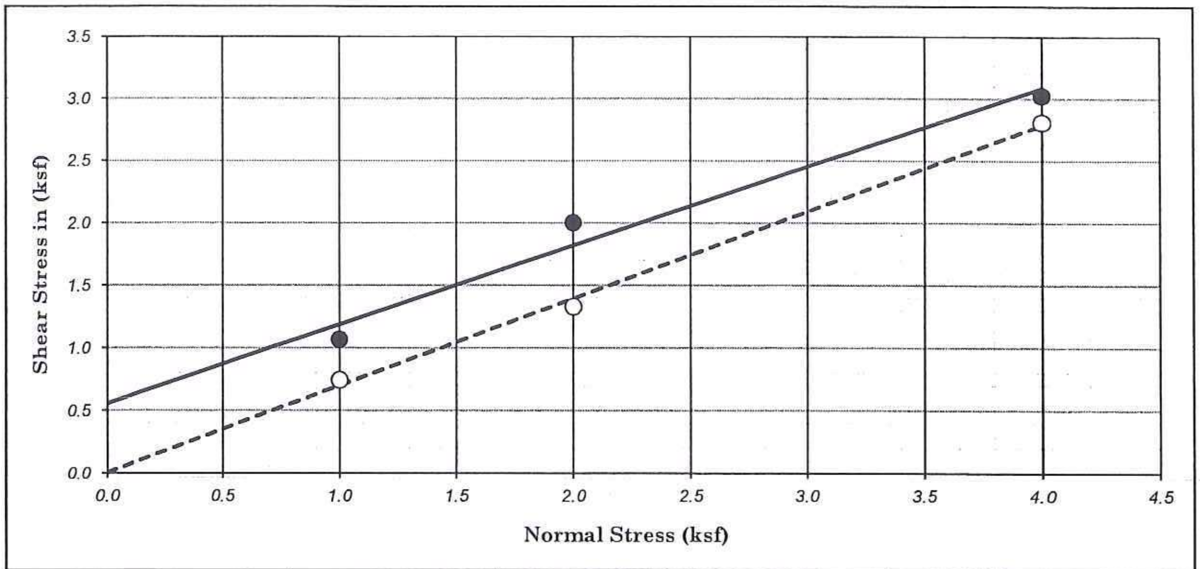
Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-5 HOV Improvement Project
PCH to San Juan Creek Road

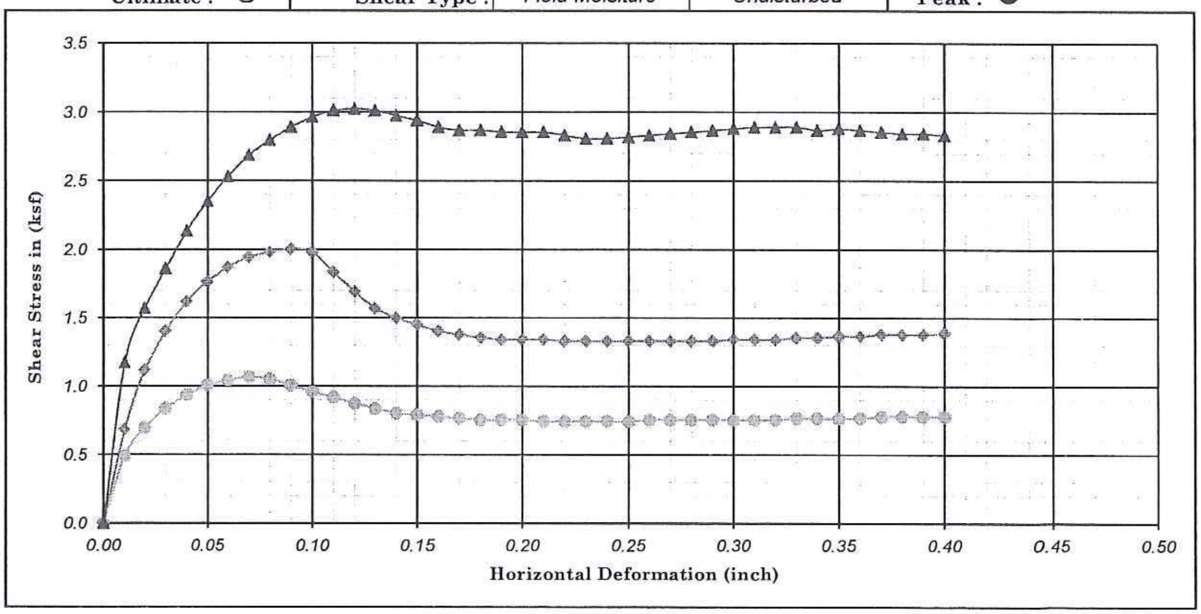
Route 5/1 Separation

DIRECT SHEAR TEST (ASTM D-3080)

Project No. : 11-137 | Date : 11/05/11 | Figure No. :



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



Boring No. : A-11-329	Strength Intercept (C) :	0.56	(ksf)	Peak	0.01	(ksf)	Ultimate
Sample No. : D-4		26.72	(kPa)		0.29	(kPa)	
Depth (ft/m) : 20.0 | 0.00	Friction Angle (ϕ) :	32.28	Degree		34.80	Degree	

Description : Light olive-brown, Poorly graded SAND with SILT (SP-SM) — 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)
●	27.09	93.34	14.69	0.81	1.00	47.88	1.07	51.14	0.74	35.62
◆	26.74	93.59	14.73	0.80	2.00	95.76	2.00	95.95	1.33	63.78
▲	27.36	92.88	14.62	0.81	4.00	191.52	3.02	144.79	2.81	134.45

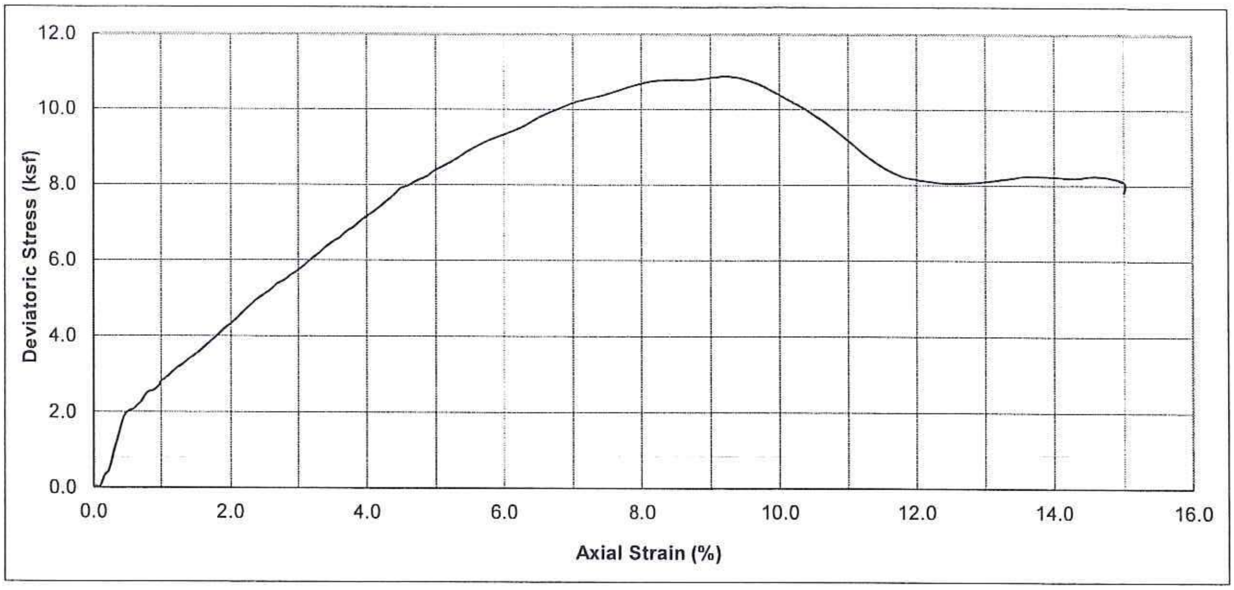
Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

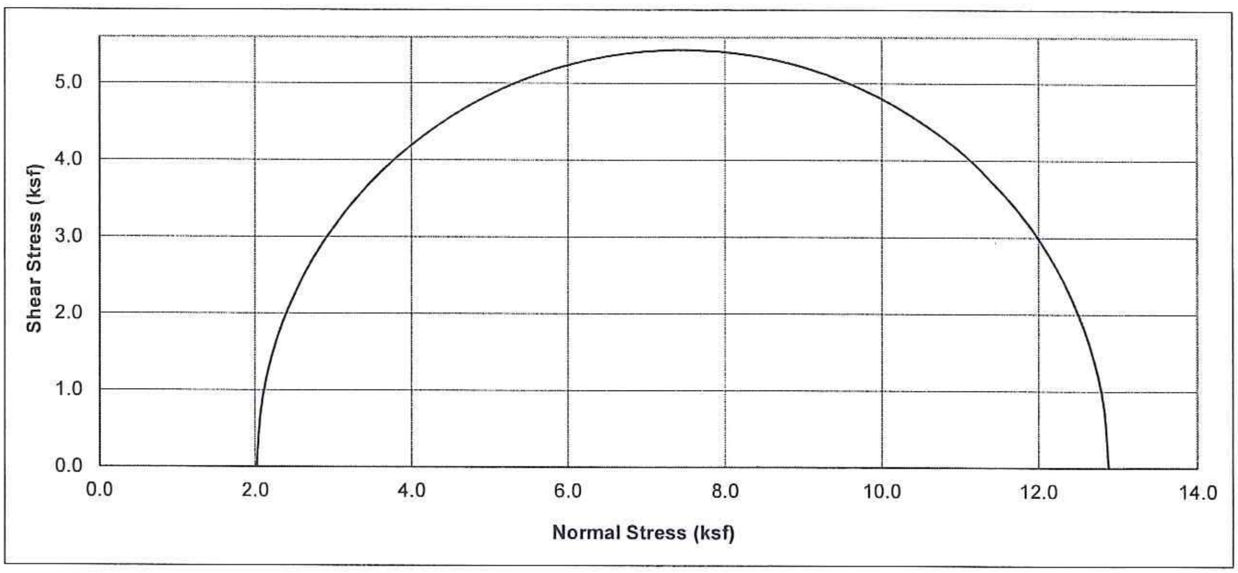
I-5 HOV Improvement Project
PCH to San Juan Creek Road

Project No. : 11-137 — Date : 11/05/11

DIRECT SHEAR TEST (ASTM D-3080)

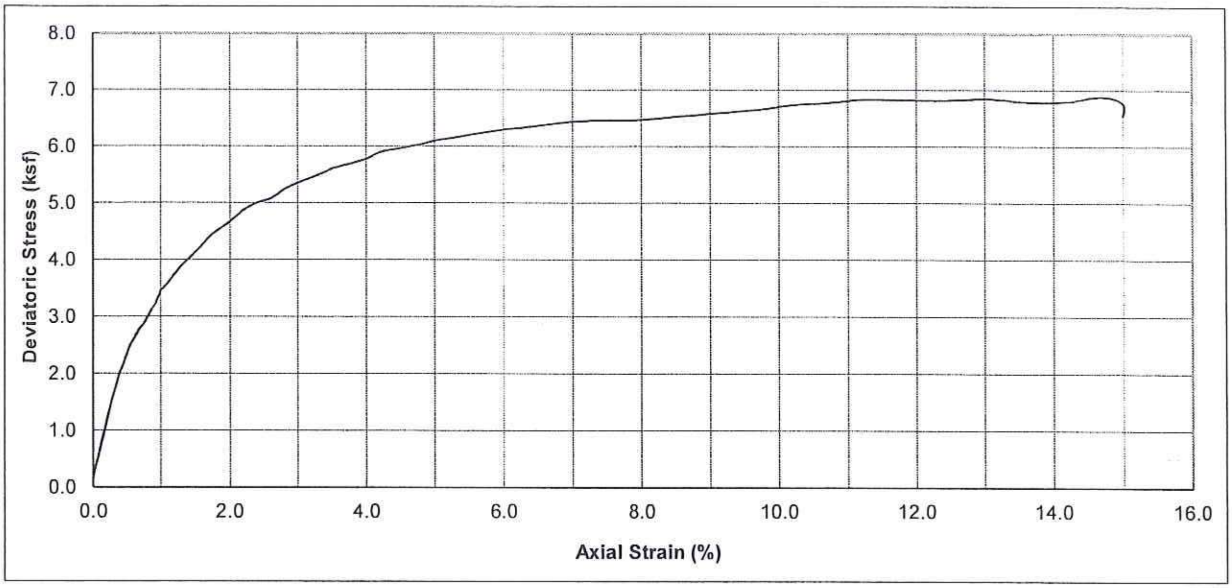
Figure No. :

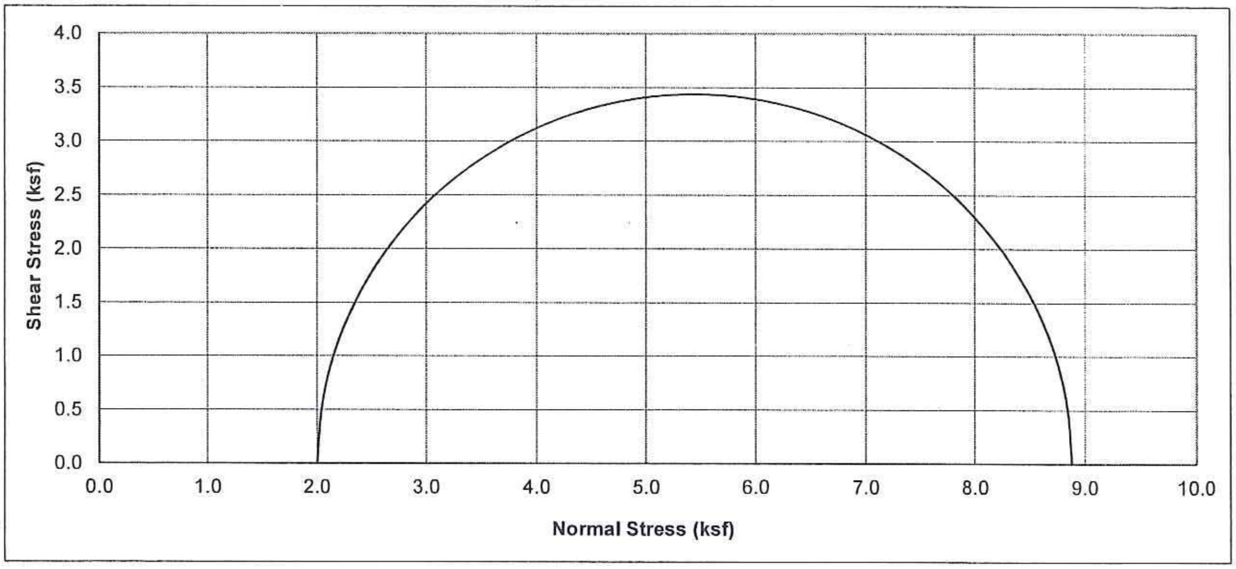




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-303	D-5	25	Olive brown , Lean CLAY with SAND (CL)	102.1	23.44	2.02	10.87	97.5

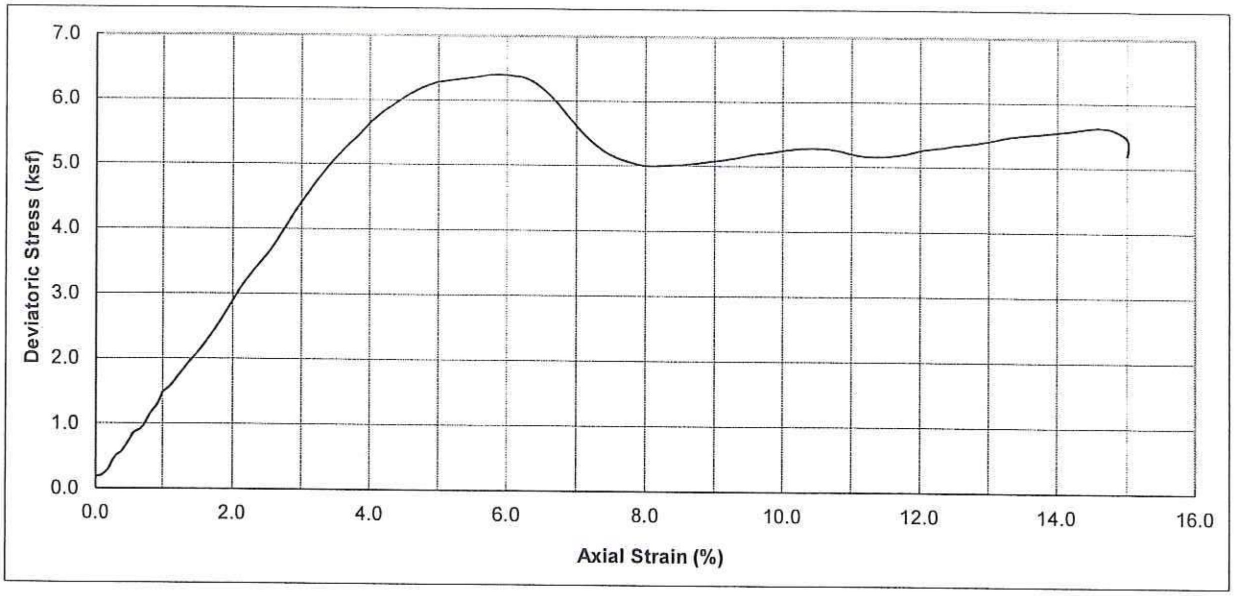
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	**I-5 HOV Improvement Project** **PCH to San Juan Creek Road**
Project No. : 11-137 **Date :** 10/27/11	**UNCONSOLIDATED UNDRAINED TEST** **(ASTM D2850)** Figure No. :

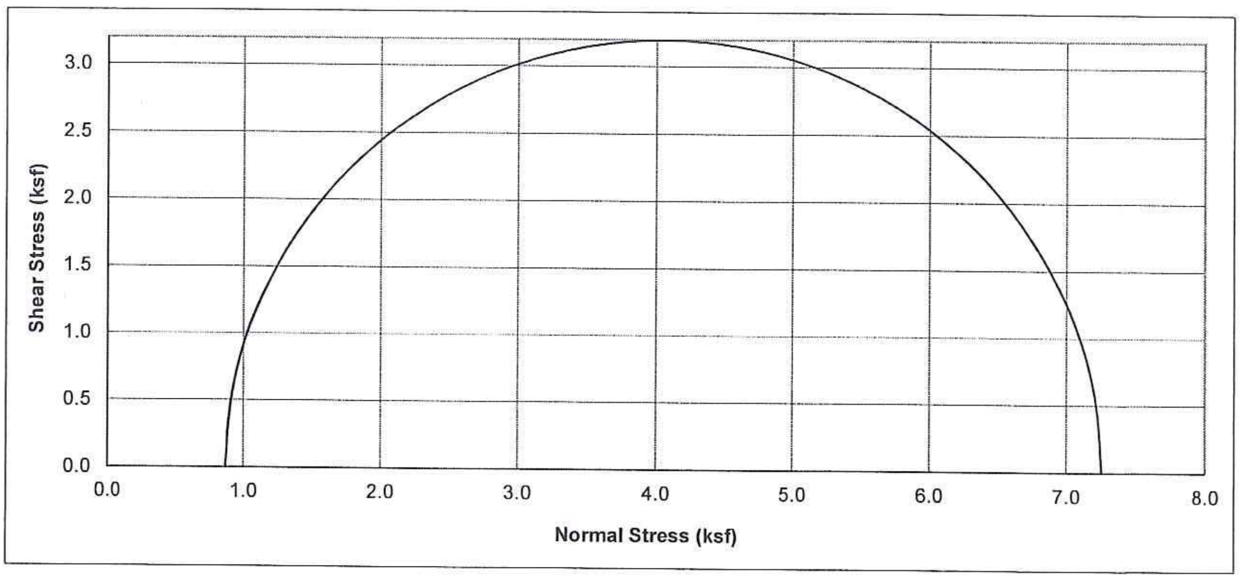




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-305	D-5	25	Olive brown , Lean CLAY (CL)	89.0	32.47	2.00	6.88	98.1

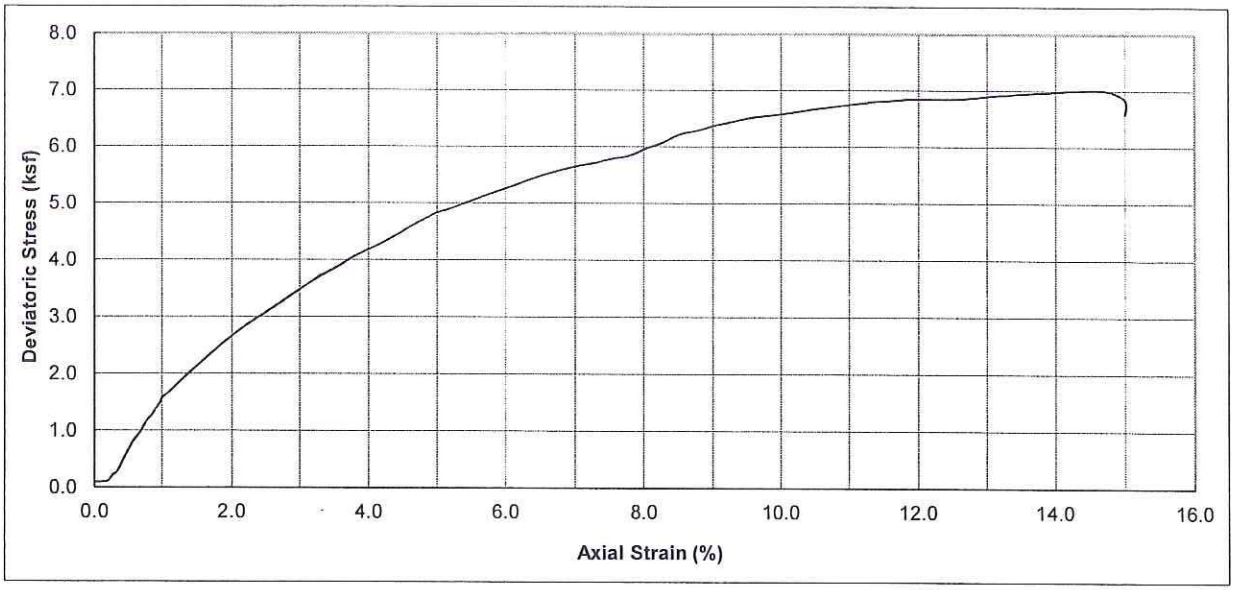
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	**I-5 HOV Improvement Project PCH to San Juan Creek Road**
Project No. : 11-137 **Date :** 10/27/11	**UNCONSOLIDATED UNDRAINED TEST** **(ASTM D2850)** Figure No. :

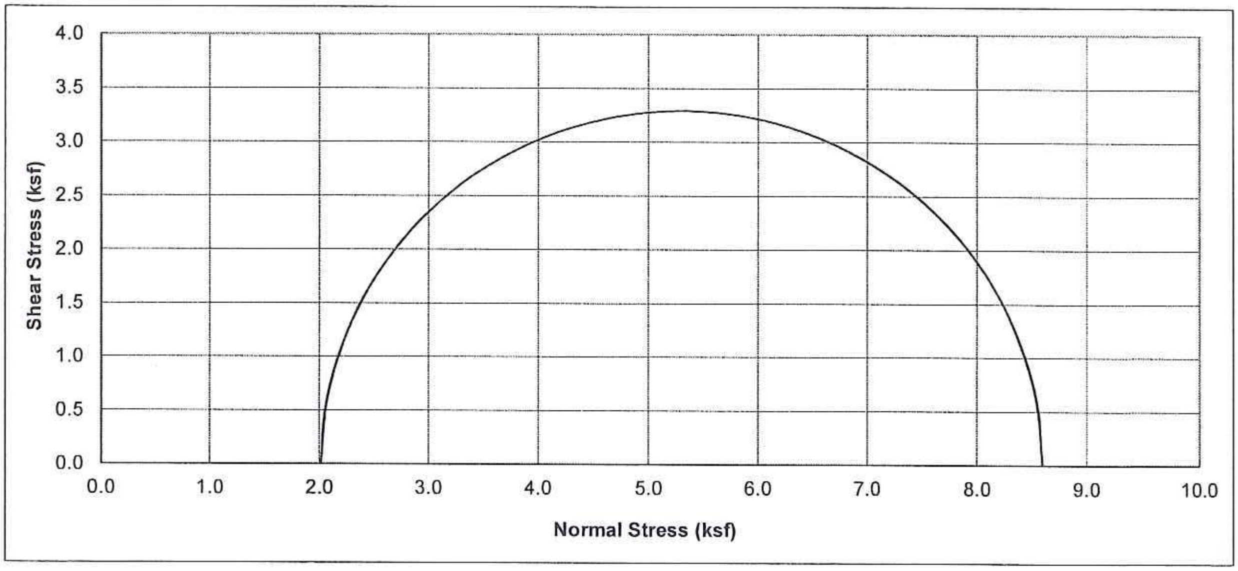




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-310	D-3	10	Olive brown , SANDY SILT (ML)	106.6	13.33	0.86	6.39	62.1

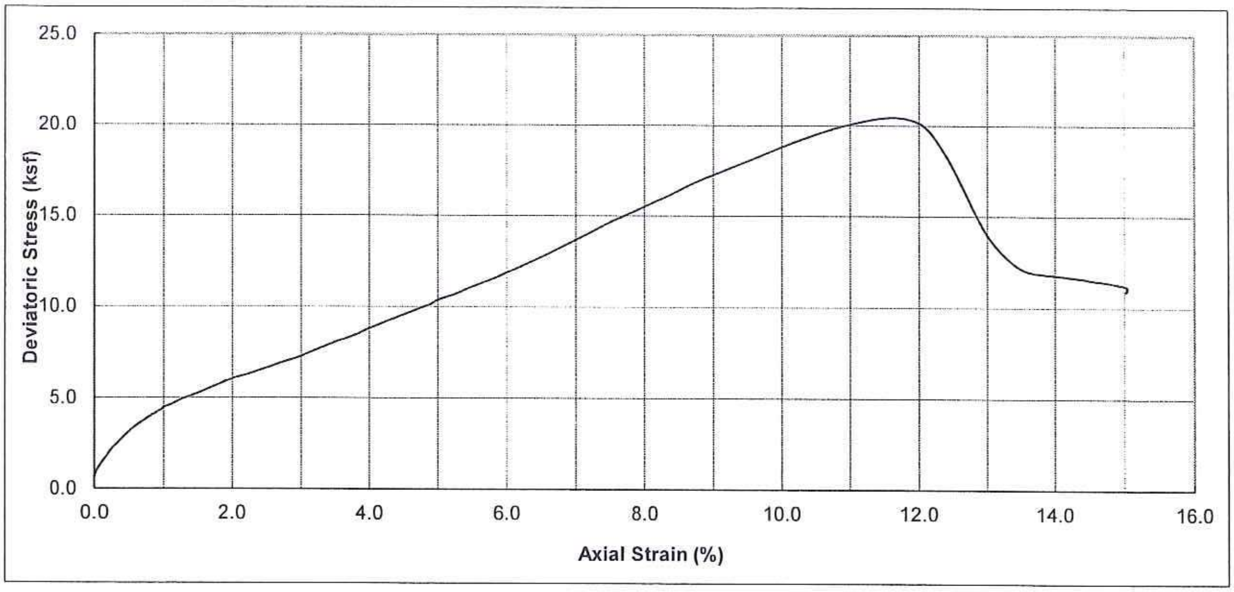
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	**I-5 HOV Improvement Project** **PCH to San Juan Creek Road**
Project No. : 11-137 — Date : 10/27/11	**UNCONSOLIDATED UNDRAINED TEST** **(ASTM D2850)** Figure No. :

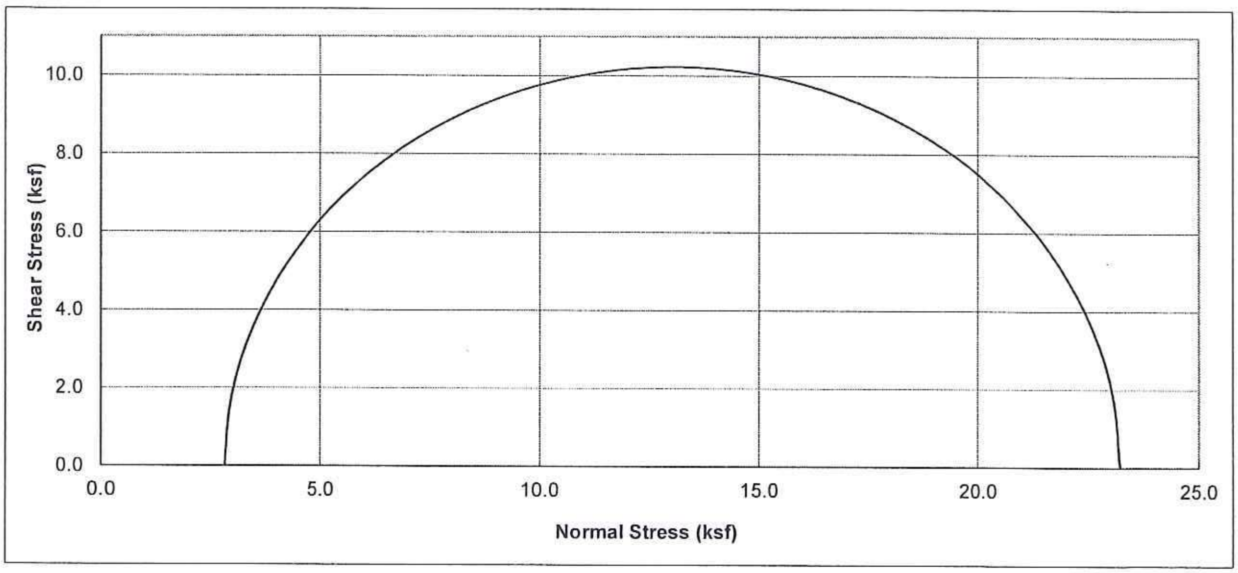




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-313	D-6	25	Olive brown , Lean CLAY with SAND (CL)	108.8	18.70	2.01	6.58	92.1

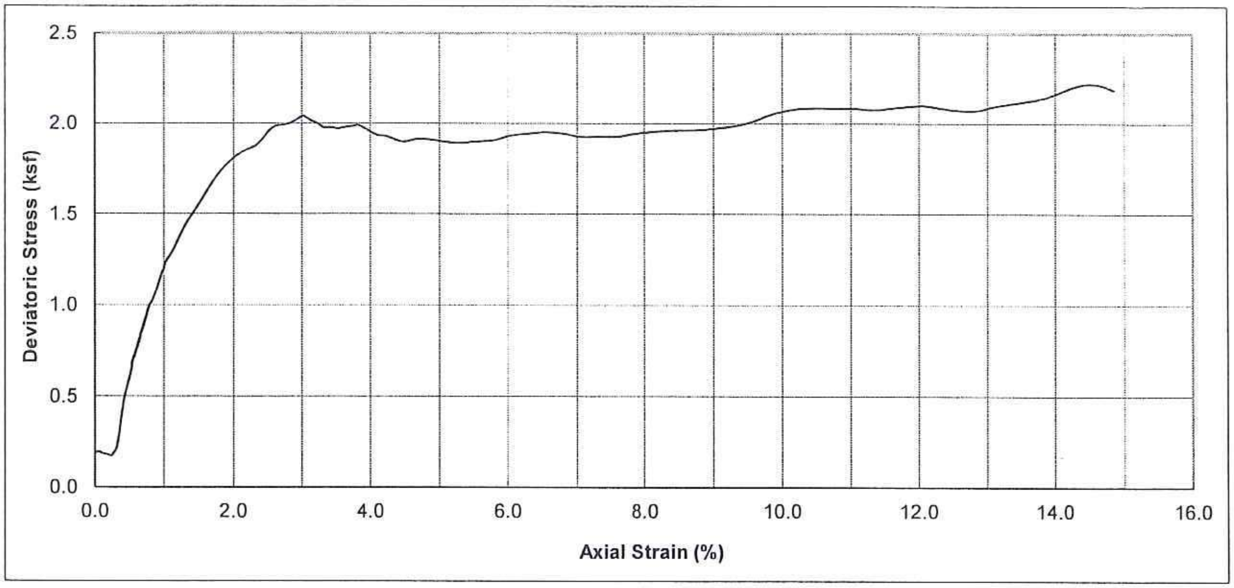
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	**I-5 HOV Improvement Project** **PCH to San Juan Creek Road**
Project No. : 11-137 **Date :** 10/27/11	**UNCONSOLIDATED UNDRAINED TEST** **(ASTM D2850)** **Figure No. :**

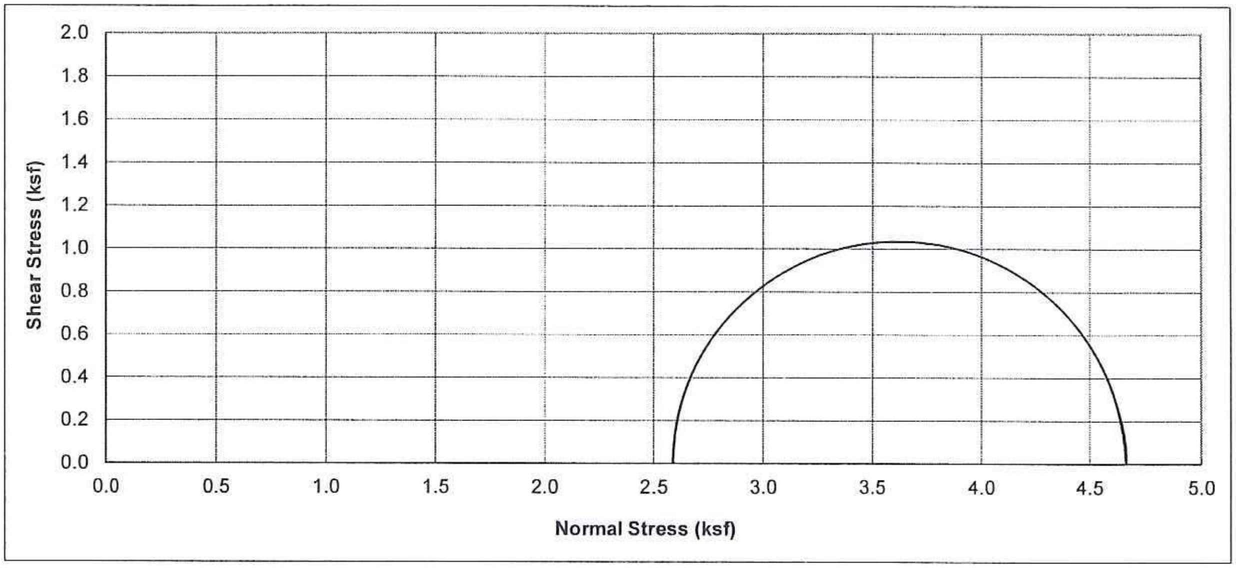




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-316	D-7	35	Dark olive gray , Elastic SILT (MH)	94.5	26.49	2.82	20.46	91.5

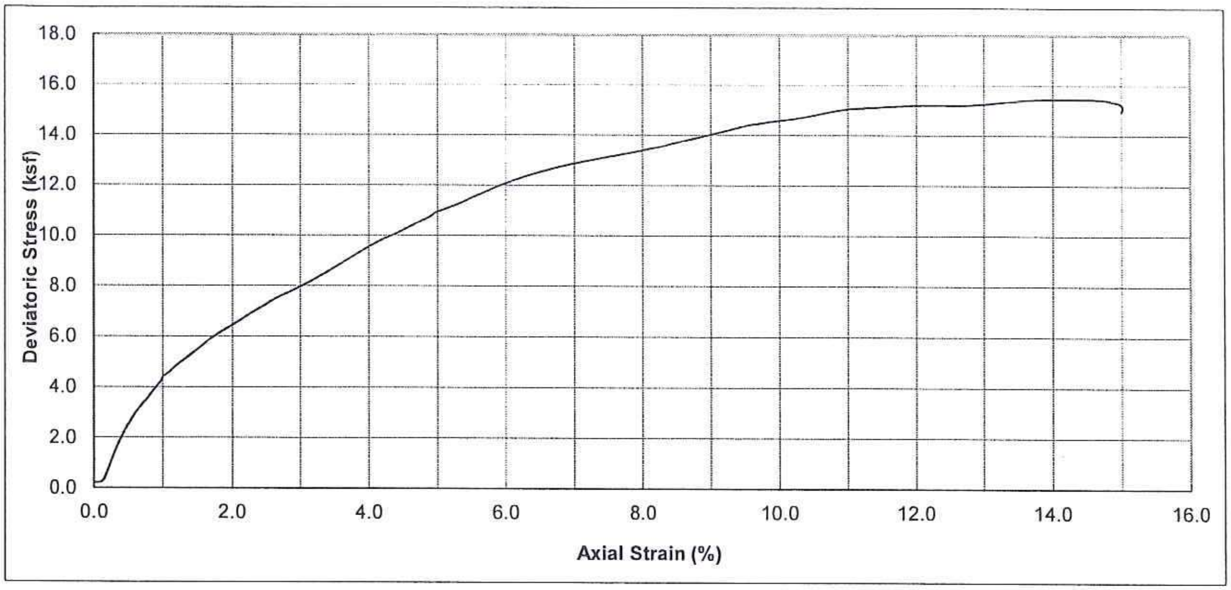
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	**I-5 HOV Improvement Project** **PCH to San Juan Creek Road**
Project No. : 11-137 **Date :** 10/28/11	**UNCONSOLIDATED UNDRAINED TEST** **(ASTM D2850)** Figure No. :

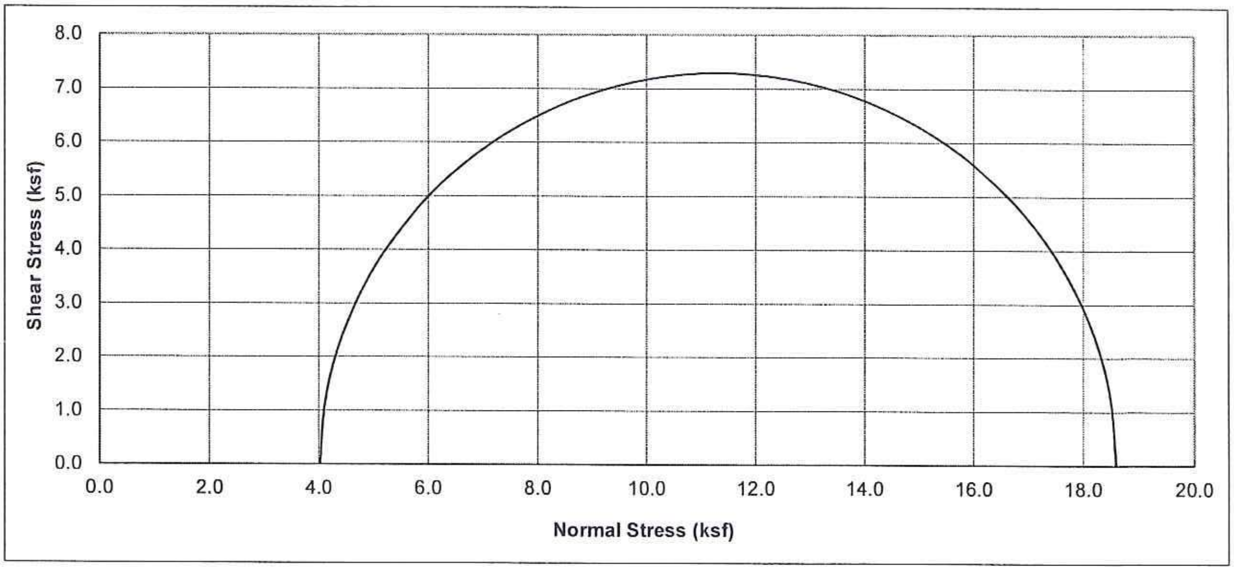




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-319	D-5	20	Olive brown , SANDY lean CLAY (CH)	95.8	25.96	2.59	2.07	92.4

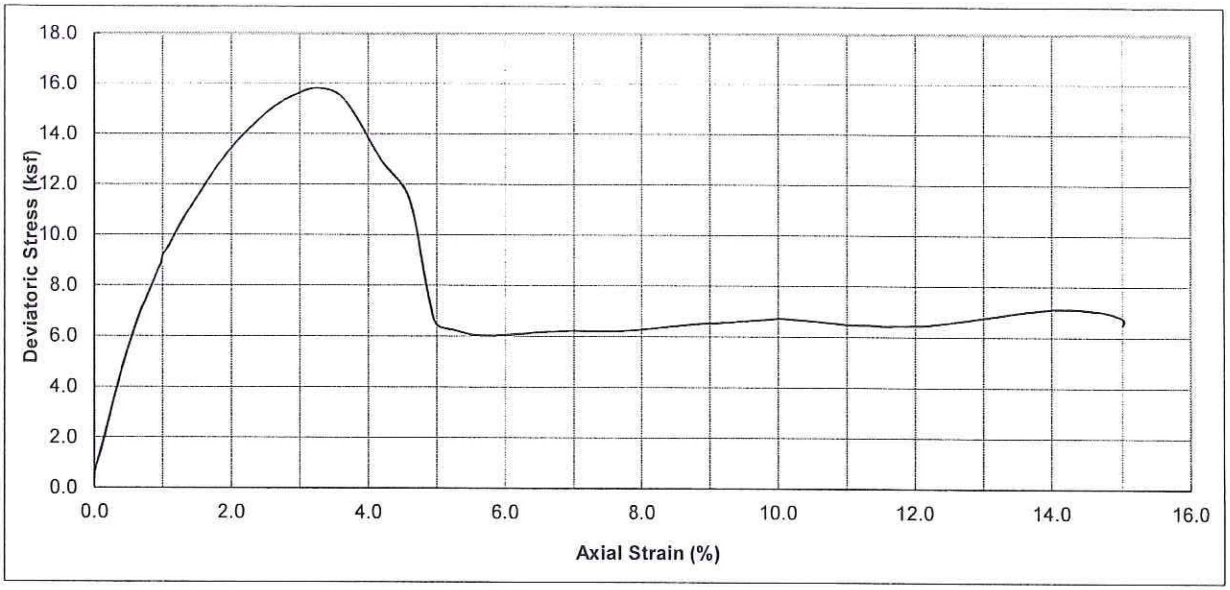
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	**I-5 HOV Improvement Project** **PCH to San Juan Creek Road**
Project No. : 11-137 **Date :** 10/28/11	**UNCONSOLIDATED UNDRAINED TEST** **(ASTM D2850)** Figure No. :

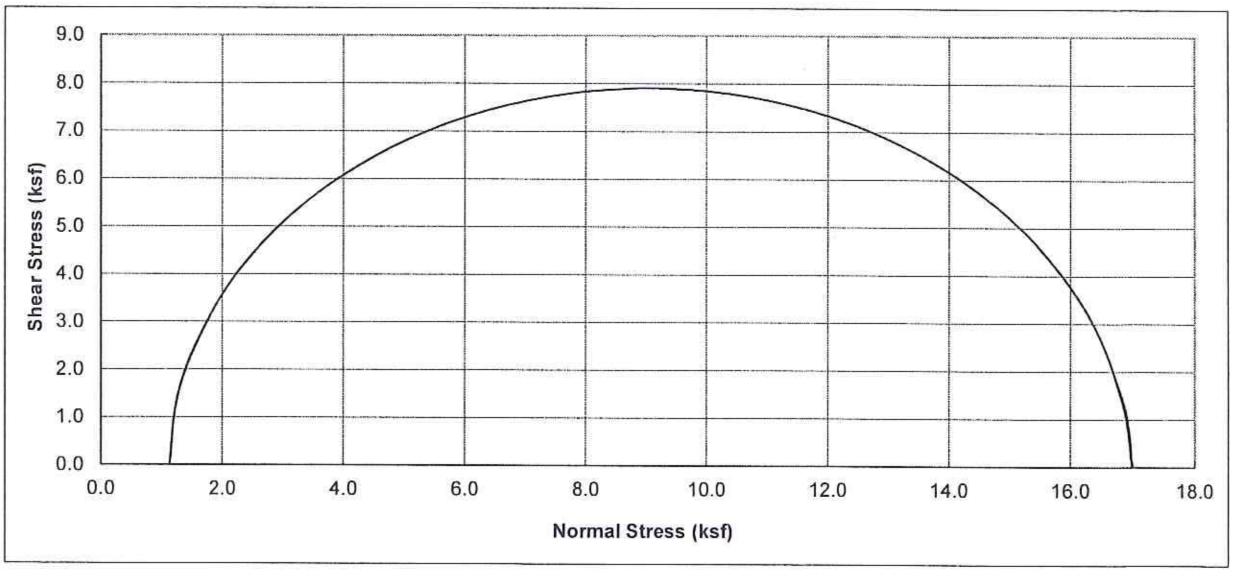




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-319	D-11	50	Dark brown , Fat CLAY trace gypsum (CH)	91.5	28.68	4.02	14.59	92.0

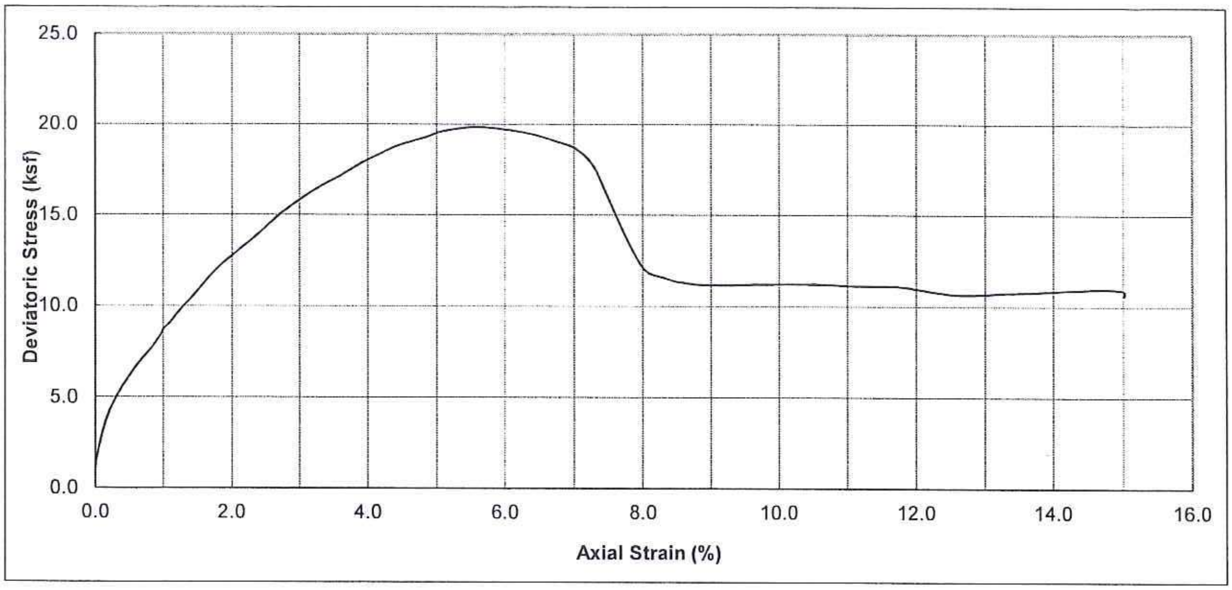
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	I-5 HOV Improvement Project PCH to San Juan Creek Road
	UNCONSOLIDATED UNDRAINED TEST
Project No. : 11-137 **Date :** 10/28/11	**(ASTM D2850)** Figure No. :

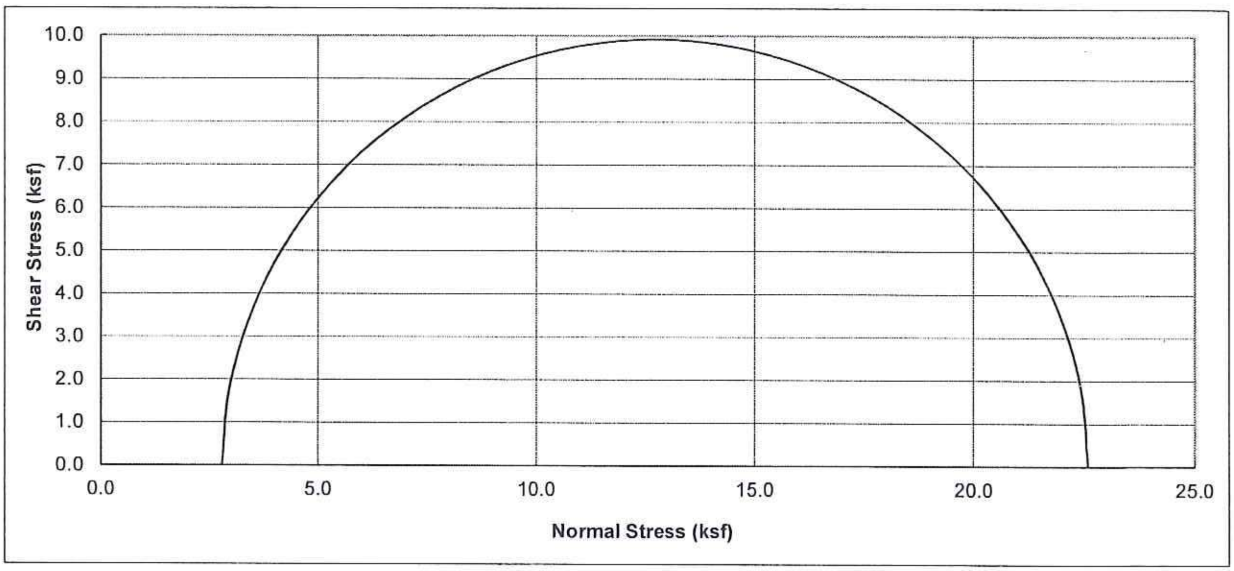




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-320	D-4	15	Dark olive gray , Elastic SILT (MH)	80.3	28.97	1.15	15.81	71.2

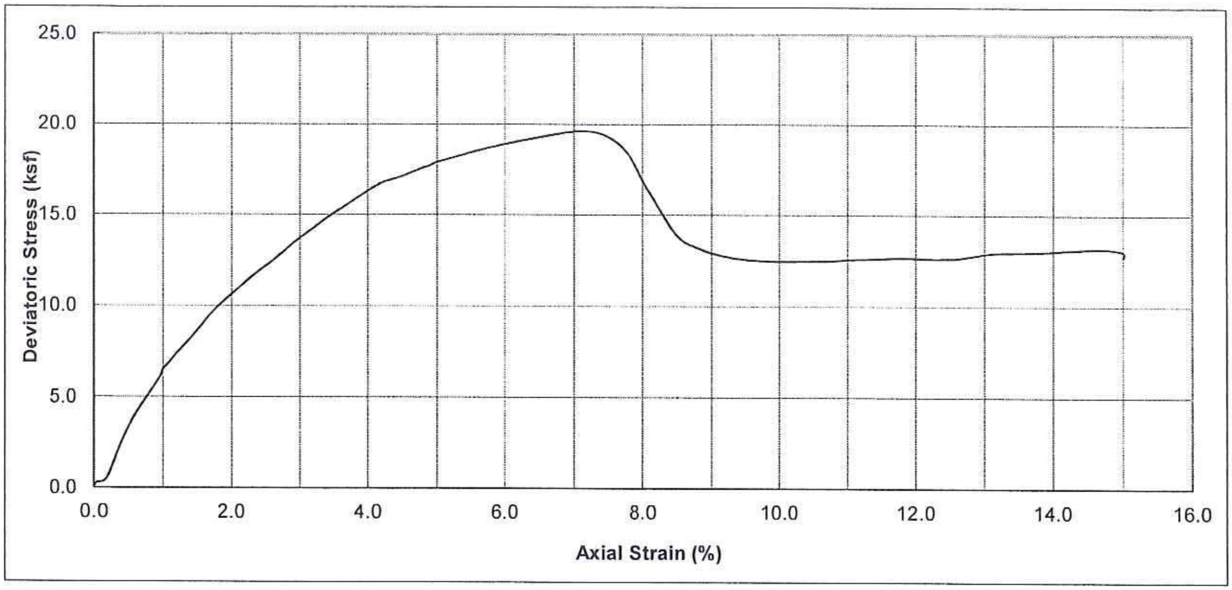
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	**I-5 HOV Improvement Project** **PCH to San Juan Creek Road**
Project No. : 11-137 **Date :** 10/28/11	**UNCONSOLIDATED UNDRAINED TEST** **(ASTM D2850)** Figure No. :

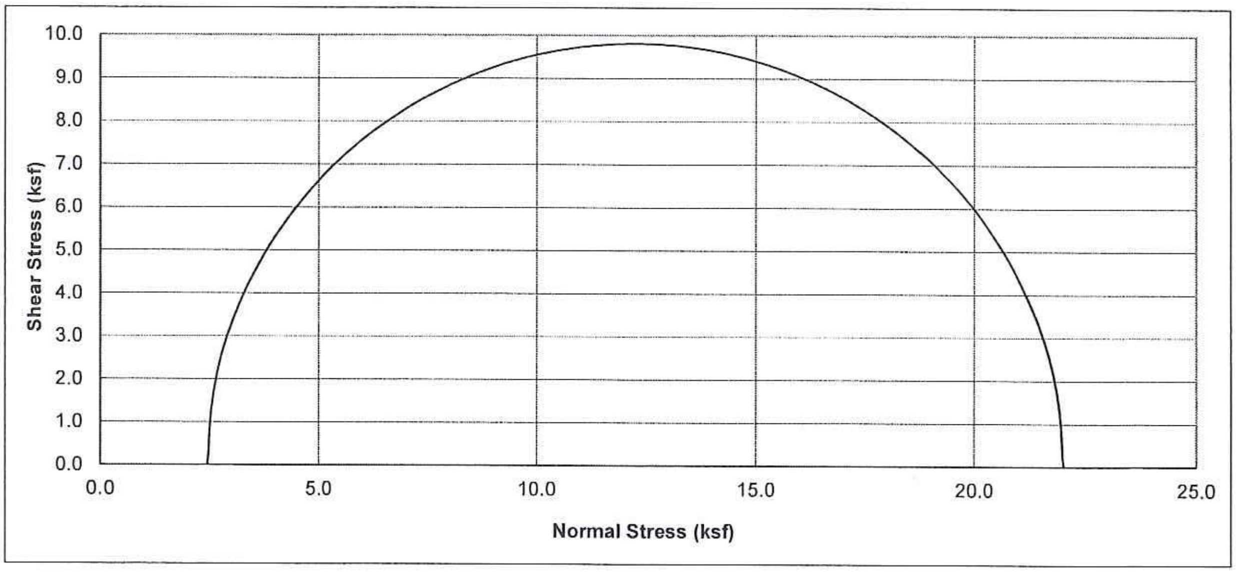




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-320	D-8	35	Dark olive gray, Elastic SILT (MH)	94.0	26.72	2.80	19.83	91.0

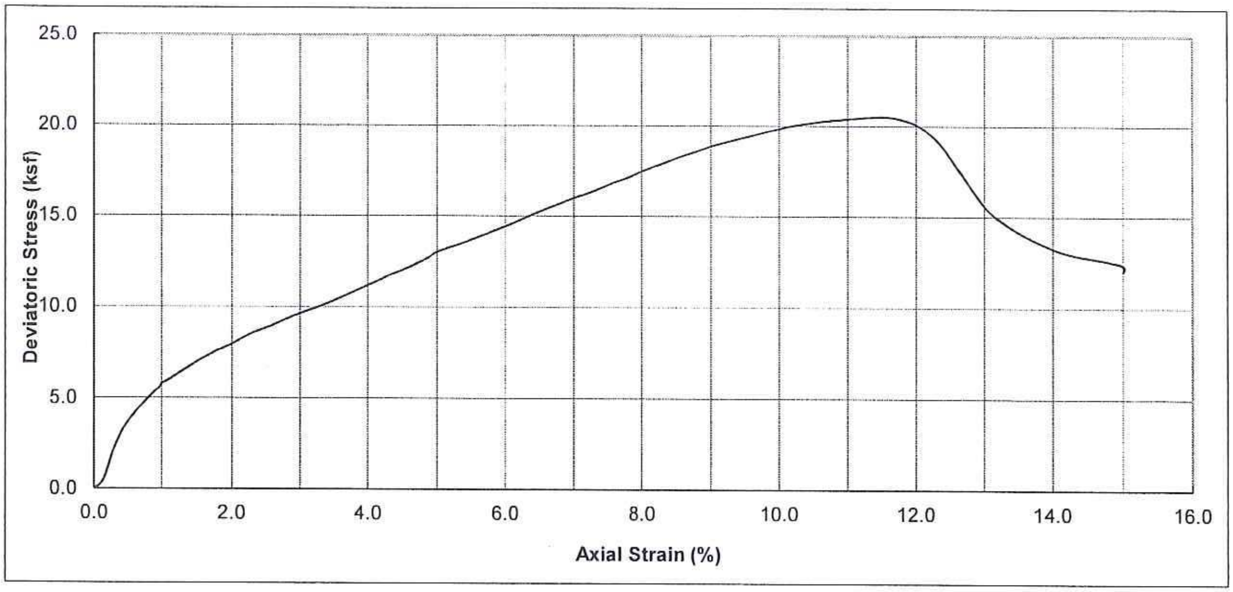
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	I-5 HOV Improvement Project PCH to San Juan Creek Road
Project No. : 11-137 / Date : 10/28/11	UNCONSOLIDATED UNDRAINED TEST (ASTM D2850) Figure No. :

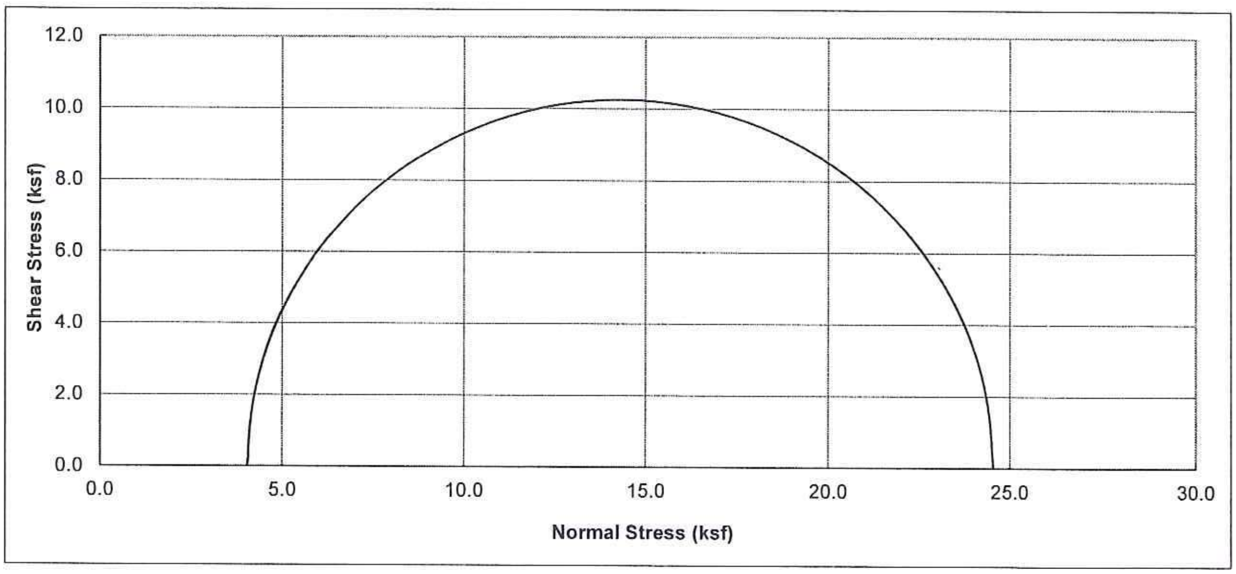




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-323	D-6	30	Olive brown , Fat CLAY (CH)	102.2	20.22	2.43	19.61	84.2

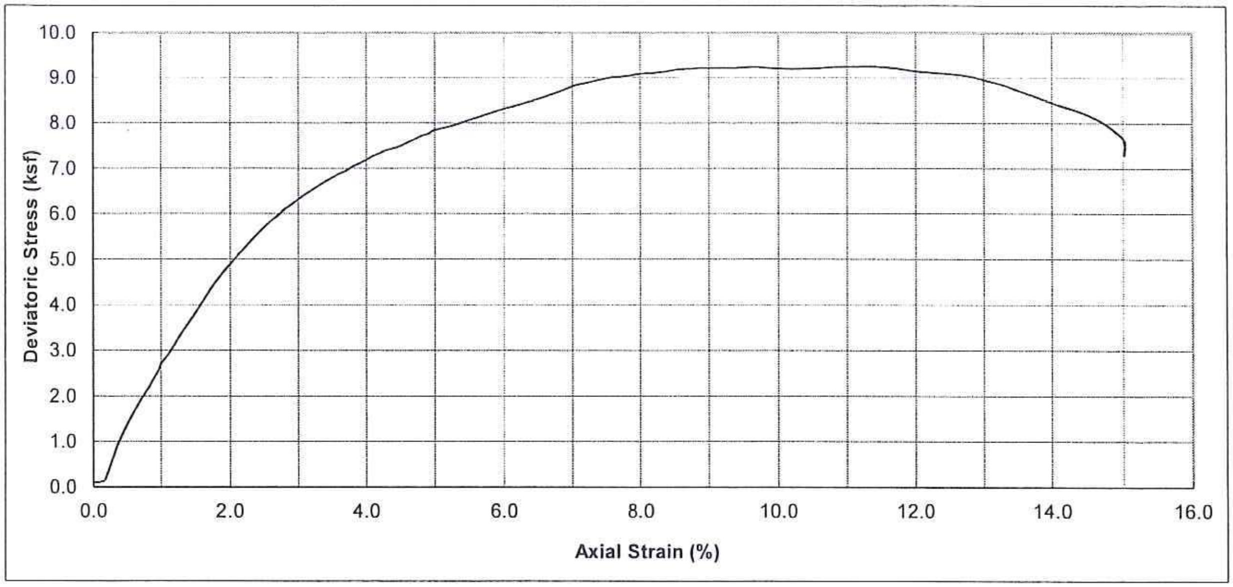
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	**I-5 HOV Improvement Project** **PCH to San Juan Creek Road**
Project No. : 11-137 **Date :** 10/28/11	**UNCONSOLIDATED UNDRAINED TEST** **(ASTM D2850)** Figure No. :

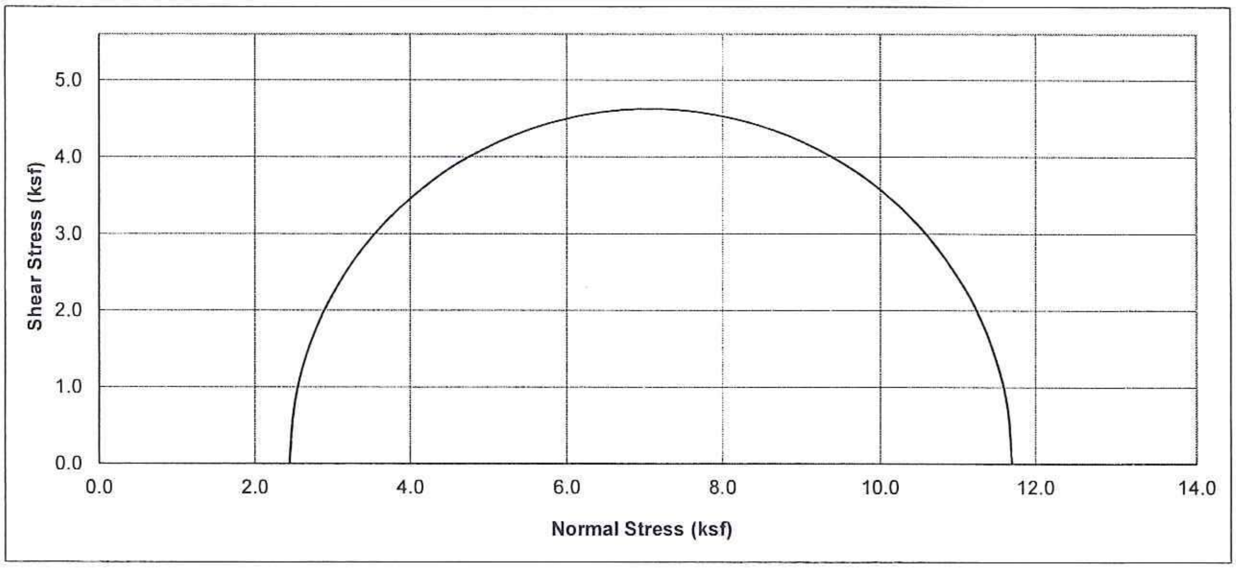




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-323	D-10	50	Very dark gray, Fat CLAY (CH)	92.5	28.14	4.03	20.52	92.4

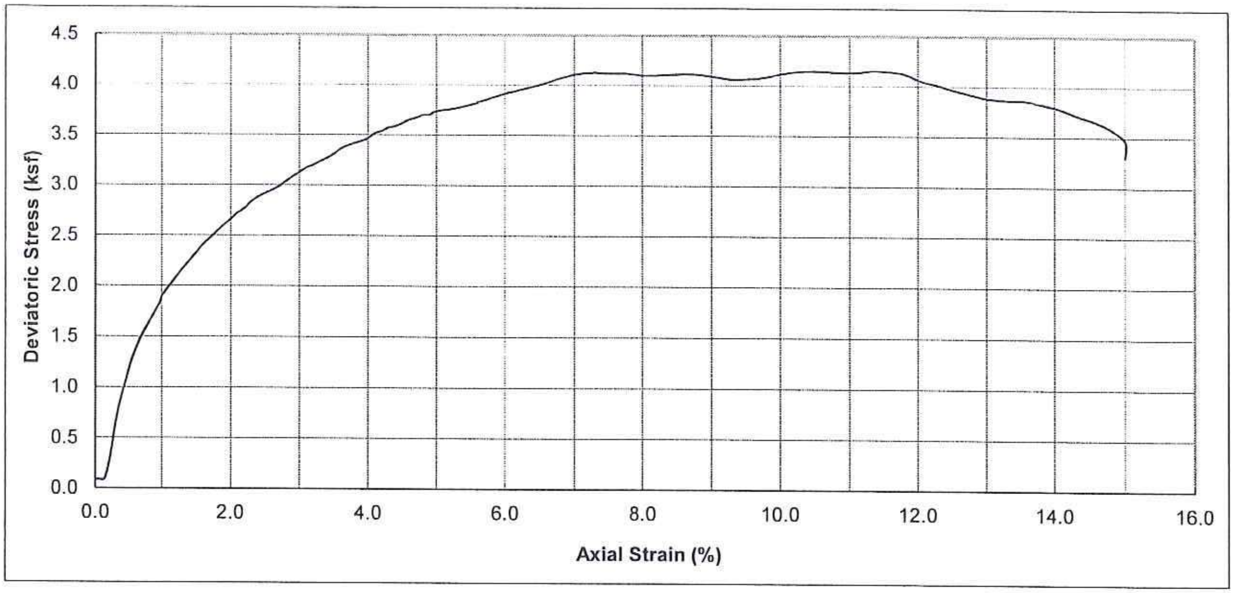
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering		I-5 HOV Improvement Project PCH to San Juan Creek Road
Project No. : 11-137	Date : 10/28/11	UNCONSOLIDATED UNDRAINED TEST (ASTM D2850) Figure No. :

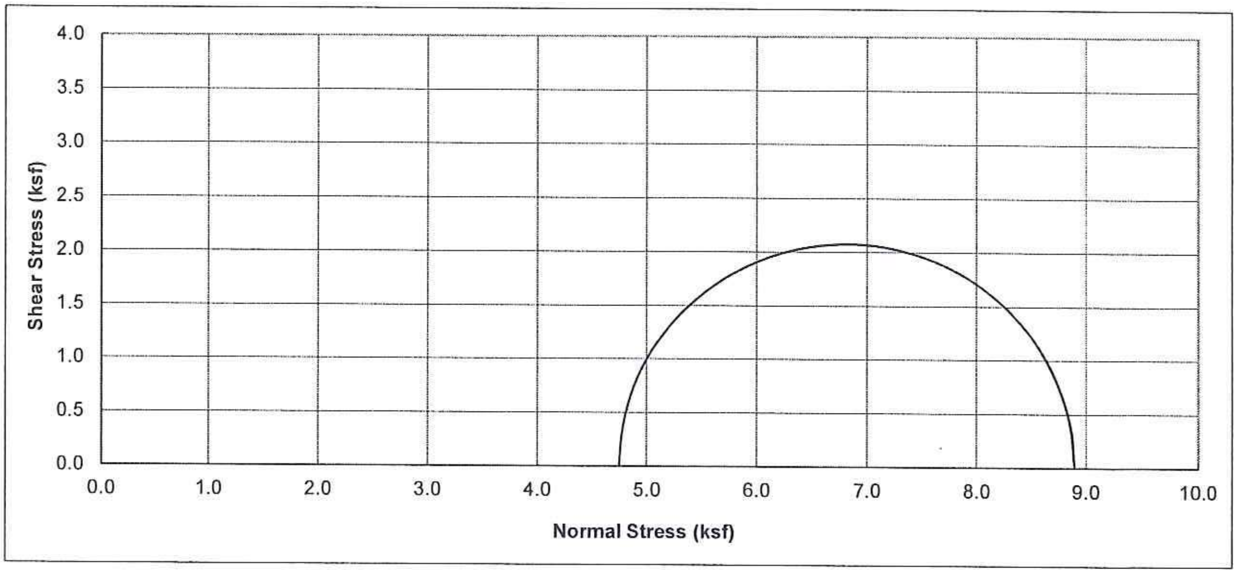




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-324	D-6	30	Olive brown ,SANDY SILT (ML)	90.5	36.82	2.44	9.25	115.5

Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	**I-5 HOV Improvement Project** **PCH to San Juan Creek Road**
Project No. : 11-137 **Date :** 10/31/11	**UNCONSOLIDATED UNDRAINED TEST** **(ASTM D2850)** Figure No. :



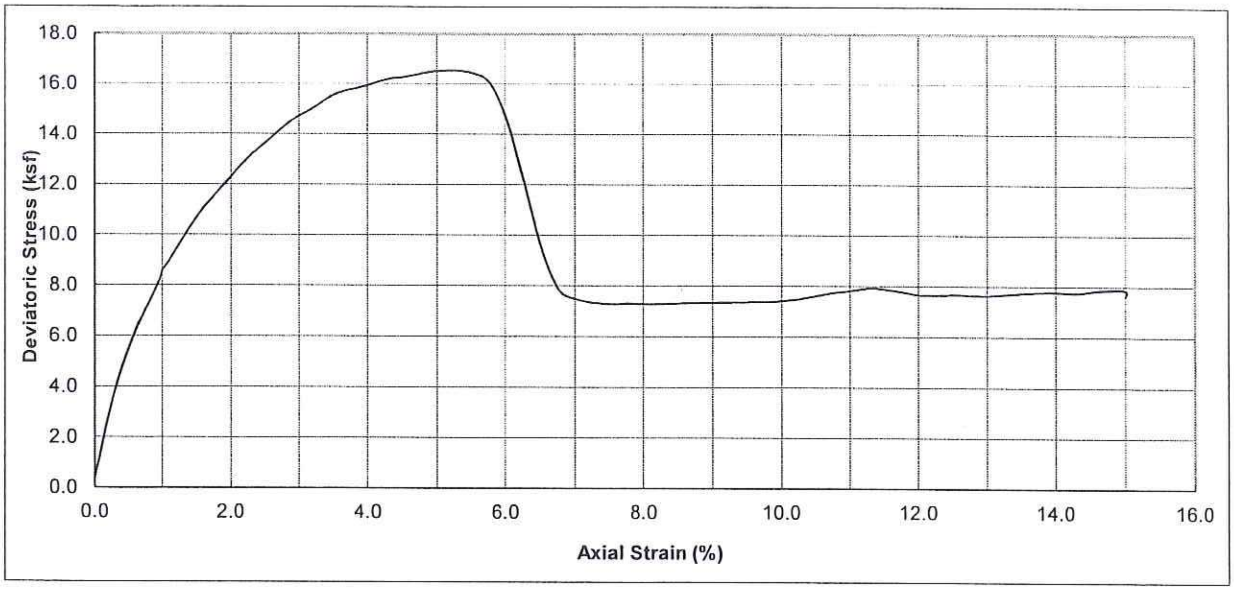


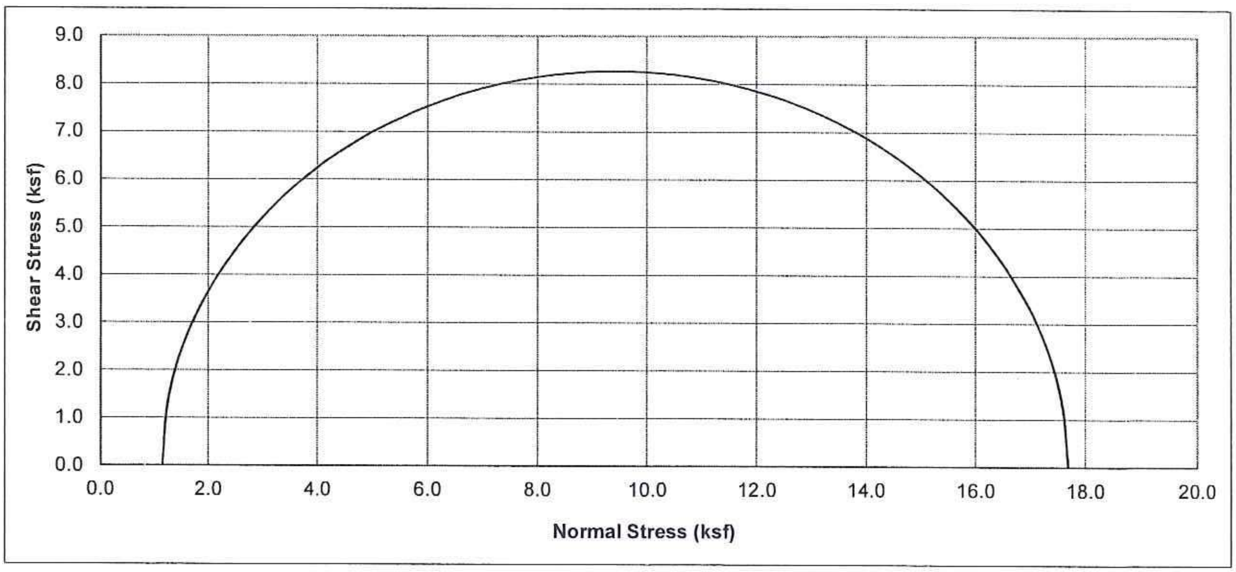
Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-324	D-12	60	Olive brown , SANDY SILT to Lean CLAY (ML/CL)	93.1	27.12	4.74	4.15	90.4

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

Project No. : 11-137 **Date :** 10/31/11

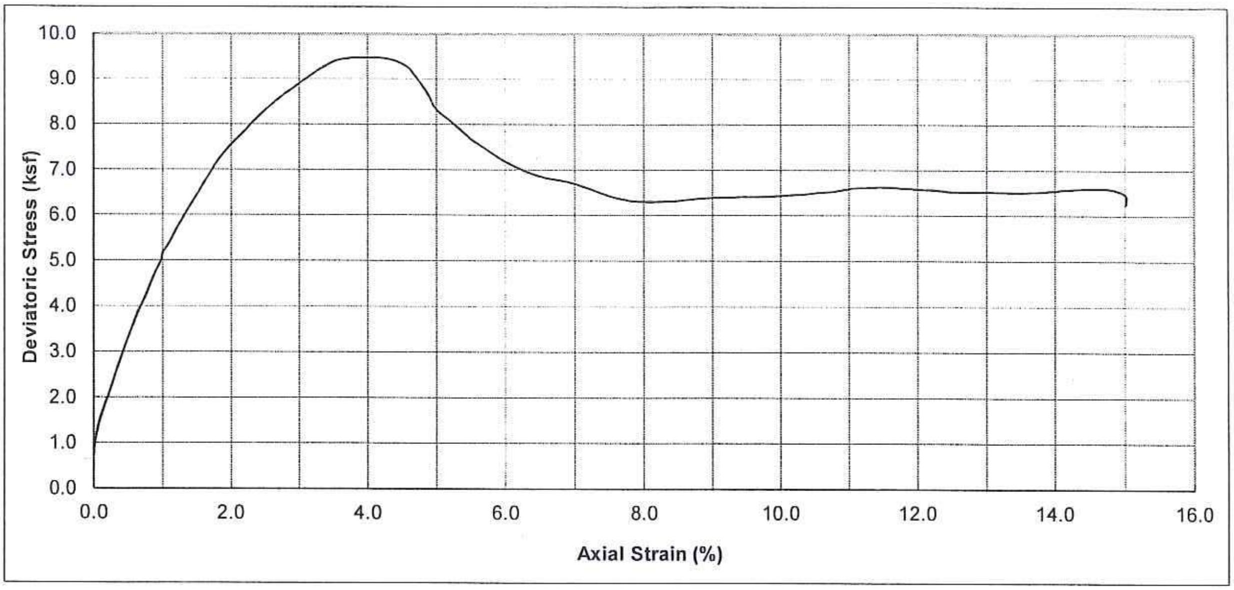
I-5 HOV Improvement Project
PCH to San Juan Creek Road
UNCONSOLIDATED UNDRAINED TEST
(ASTM D2850) Figure No. :

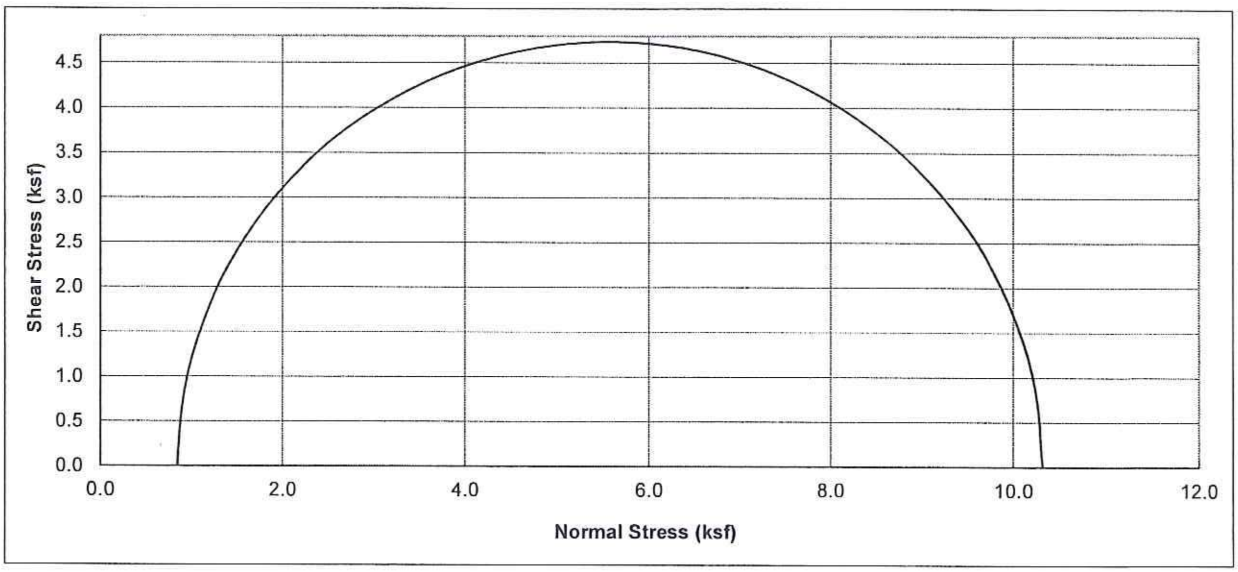




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-326	D-4	15	Dark olive brown , Elastic SILT (MH)	90.1	28.46	1.15	16.54	88.3

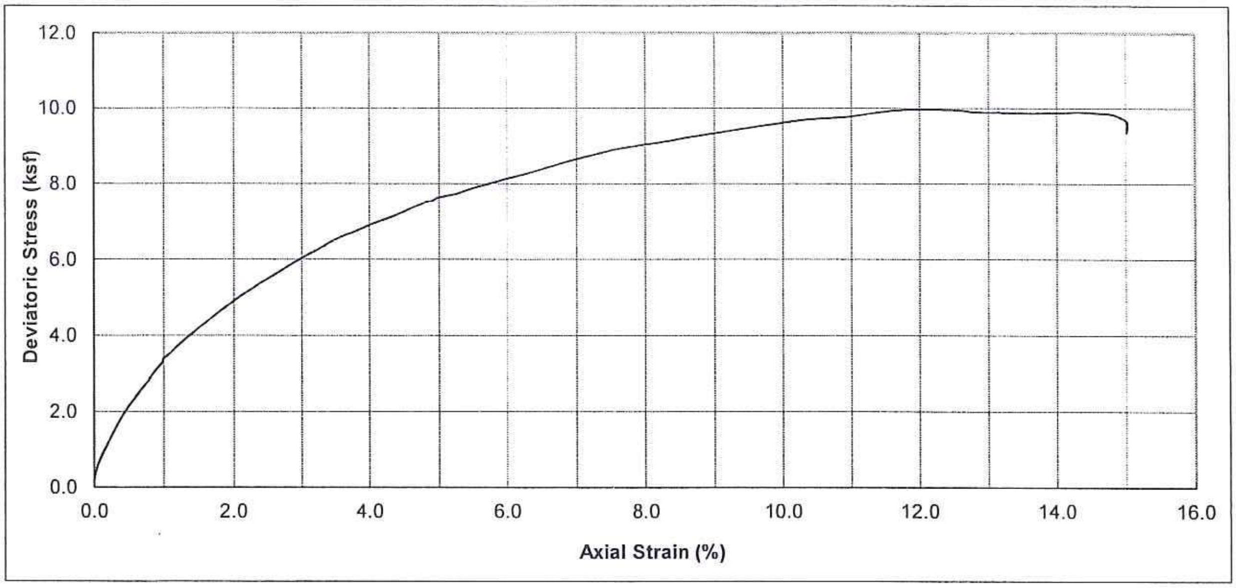
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	**I-5 HOV Improvement Project** **PCH to San Juan Creek Road**
Project No. : 11-137 **Date :** 10/31/11	**UNCONSOLIDATED UNDRAINED TEST** **(ASTM D2850)** Figure No. :

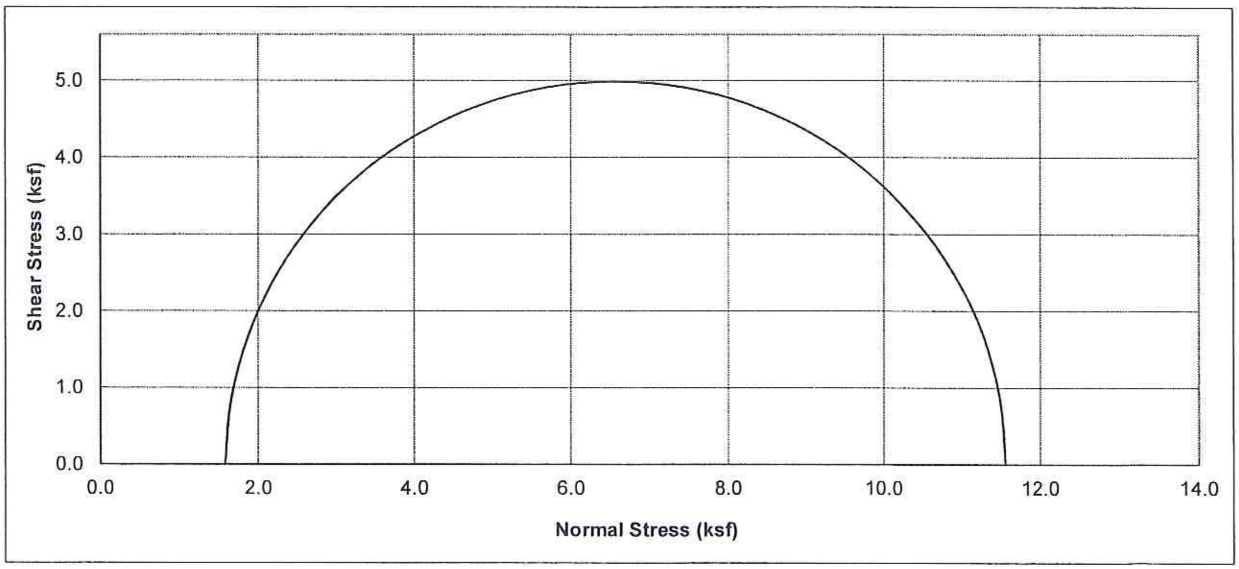




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-337	D-2	10	Olive brown , Lean CLAY (CL)	83.9	34.58	0.84	9.47	92.7

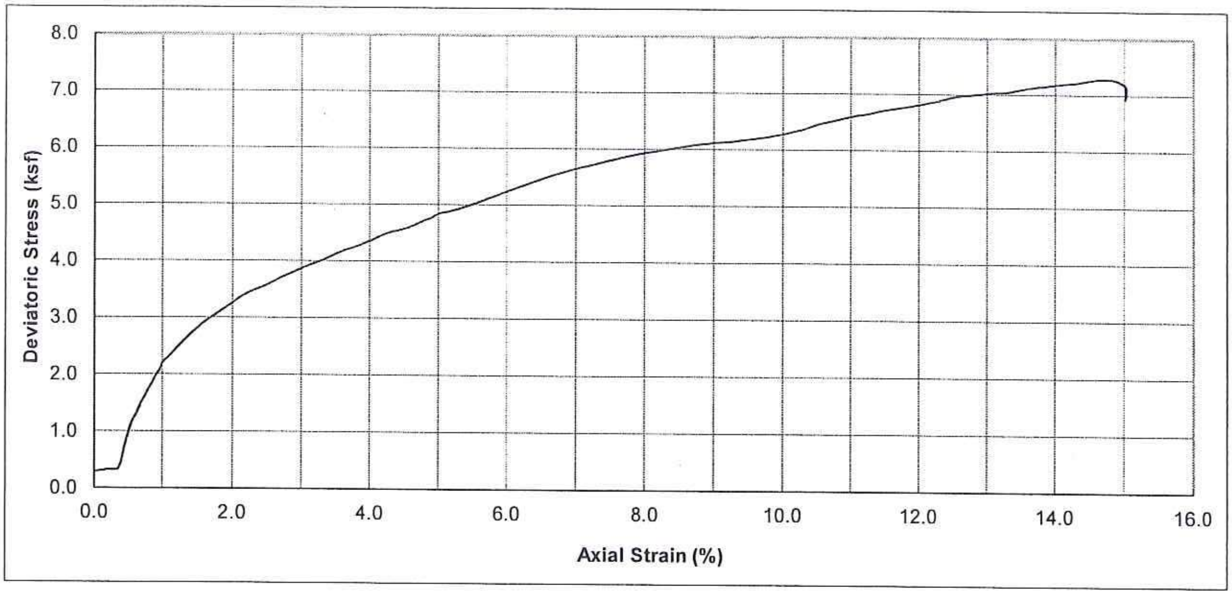
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	**I-5 HOV Improvement Project** **PCH to San Juan Creek Road**
Project No. : 11-137 **Date :** 11/01/11	**UNCONSOLIDATED UNDRAINED TEST** **(ASTM D2850)** **Figure No. :**

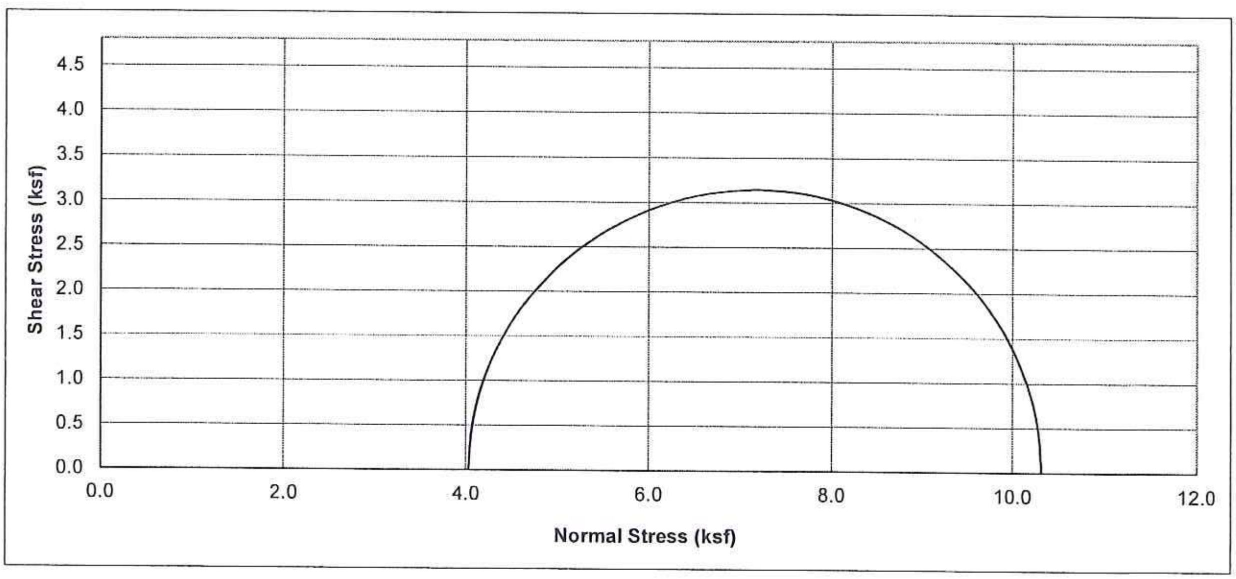




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-327	D-4	20	Olive brown , Lean CLAY (CL)	109.7	16.69	1.58	9.98	84.0

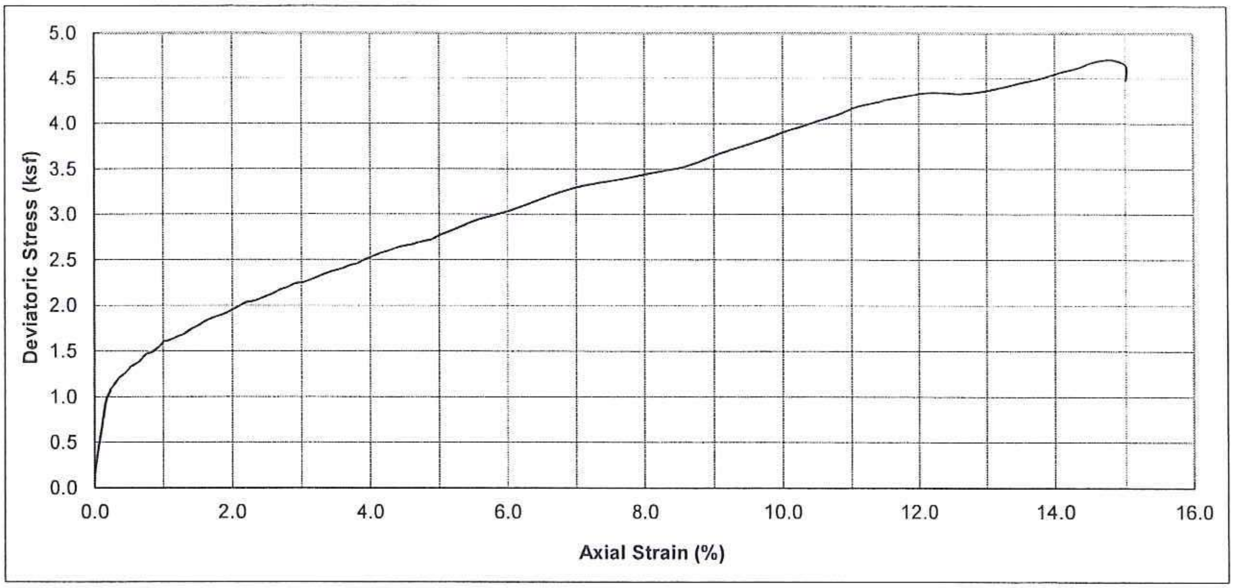
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	**I-5 HOV Improvement Project** **PCH to San Juan Creek Road**
Project No. : 11-137 **Date :** 11/01/11	**UNCONSOLIDATED UNDRAINED TEST** **(ASTM D2850)** Figure No. :

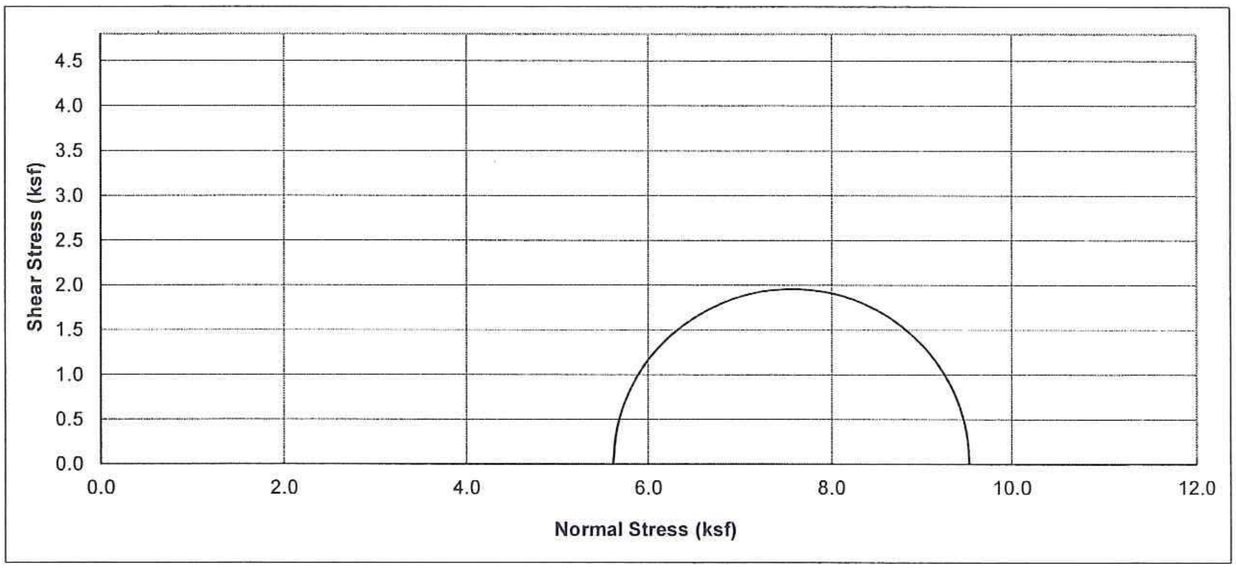




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-327	D-10	50	Olive brown , Lean CLAY with SAND (CL)	108.4	18.60	4.03	6.29	90.6

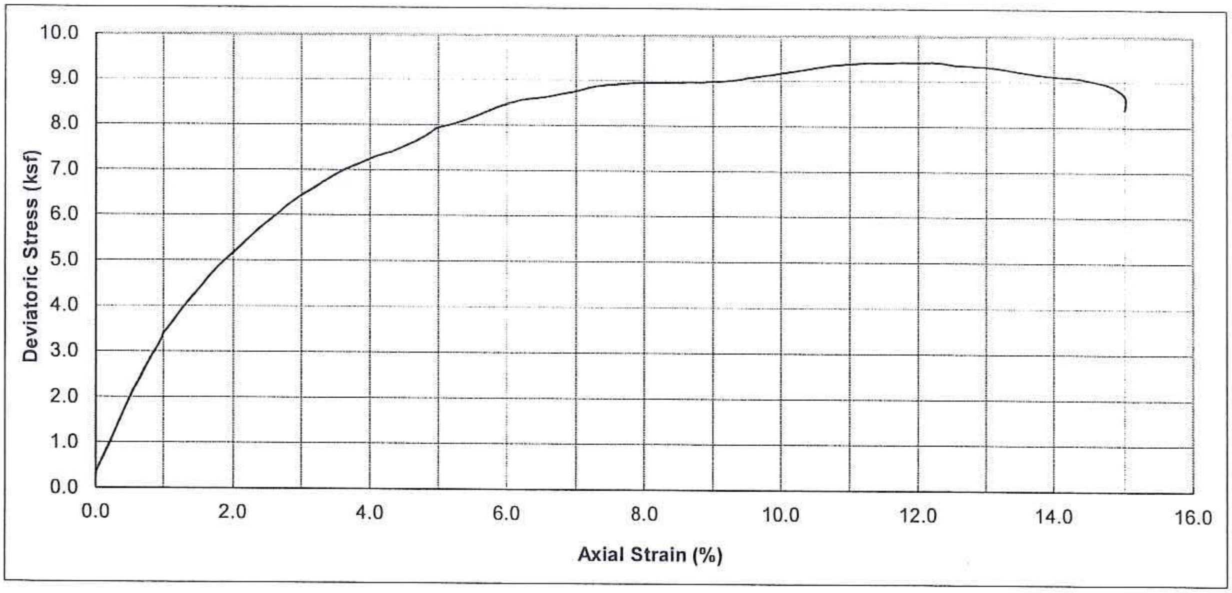
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	**I-5 HOV Improvement Project** **PCH to San Juan Creek Road**
Project No. : 11-137 / **Date :** 11/01/11	**UNCONSOLIDATED UNDRAINED TEST** **(ASTM D2850)** Figure No. :

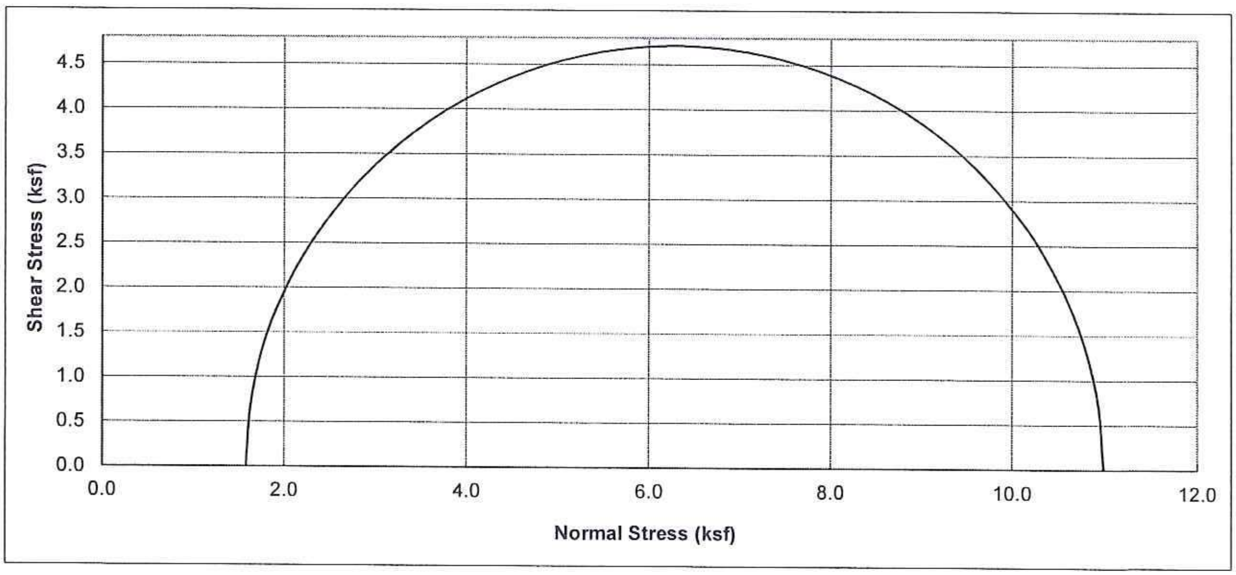




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-327	D-14	70	OLive brown , Lean CLAY with SAND (CL)	107.2	18.48	5.61	3.92	87.2

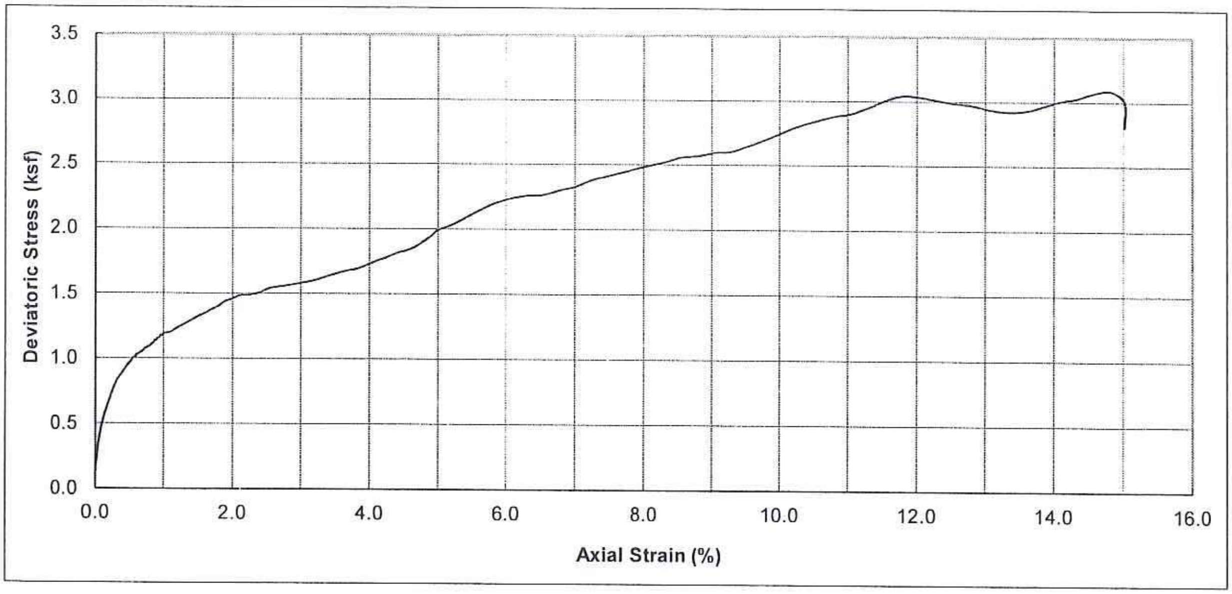
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	**I-5 HOV Improvement Project** **PCH to San Juan Creek Road**
Project No. : 11-137 **Date :** 11/01/11	**UNCONSOLIDATED UNDRAINED TEST** **(ASTM D2850)** Figure No. :

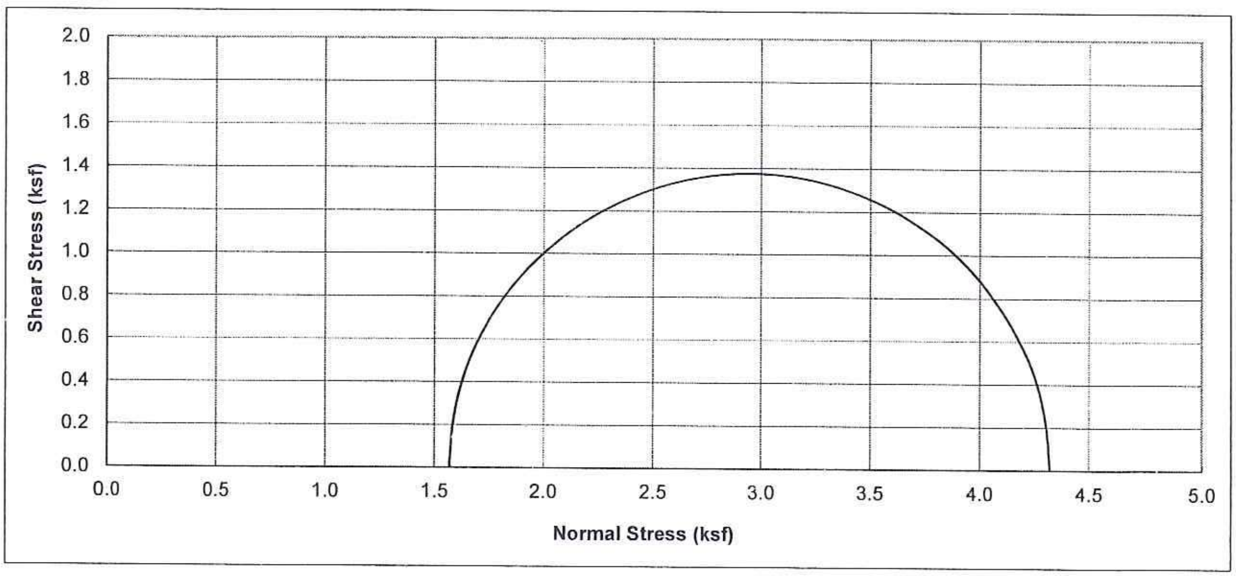




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-339	D-4	20	Olive Brown to Gray , SANDY CLAY (CL)	109.4	16.60	1.58	9.43	83.0

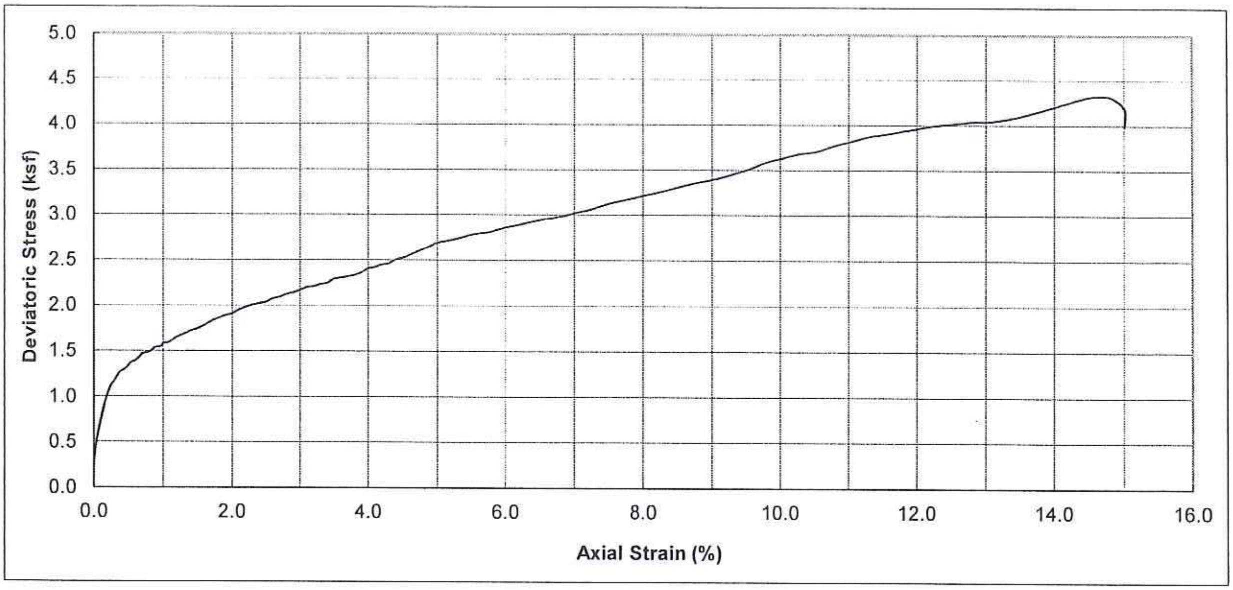
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	**I-5 HOV Improvement Project** **PCH to San Juan Creek Road**
Project No. : 11-137 **Date :** 11/01/11	**UNCONSOLIDATED UNDRAINED TEST** **(ASTM D2850)** Figure No. :

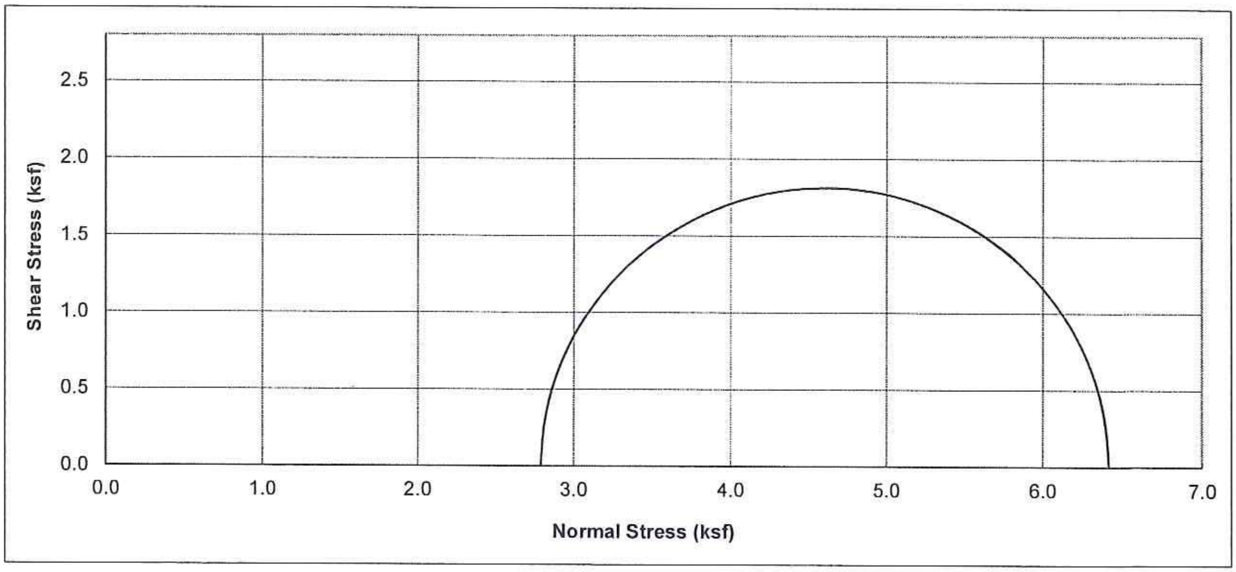




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-342	D-4	20	Olive brown , Lean CLAY with SAND (CL)	96.5	24.51	1.57	2.75	88.8

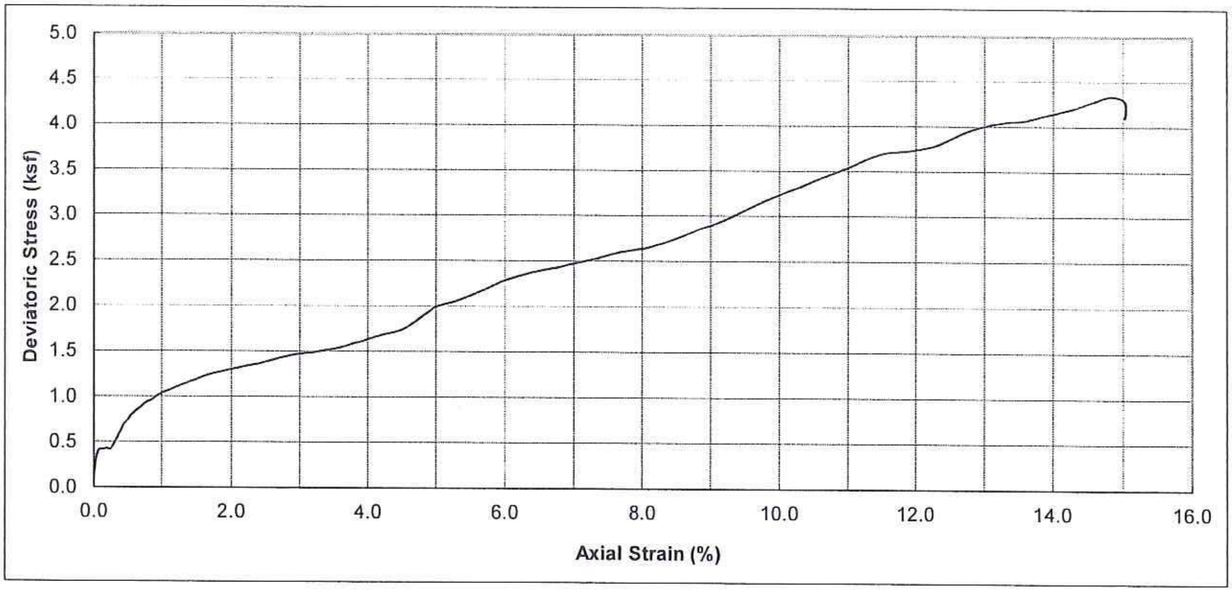
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	**I-5 HOV Improvement Project** **PCH to San Juan Creek Road**
Project No. : 11-137 **Date :** 11/01/11	**UNCONSOLIDATED UNDRAINED TEST** **(ASTM D2850)** Figure No. :

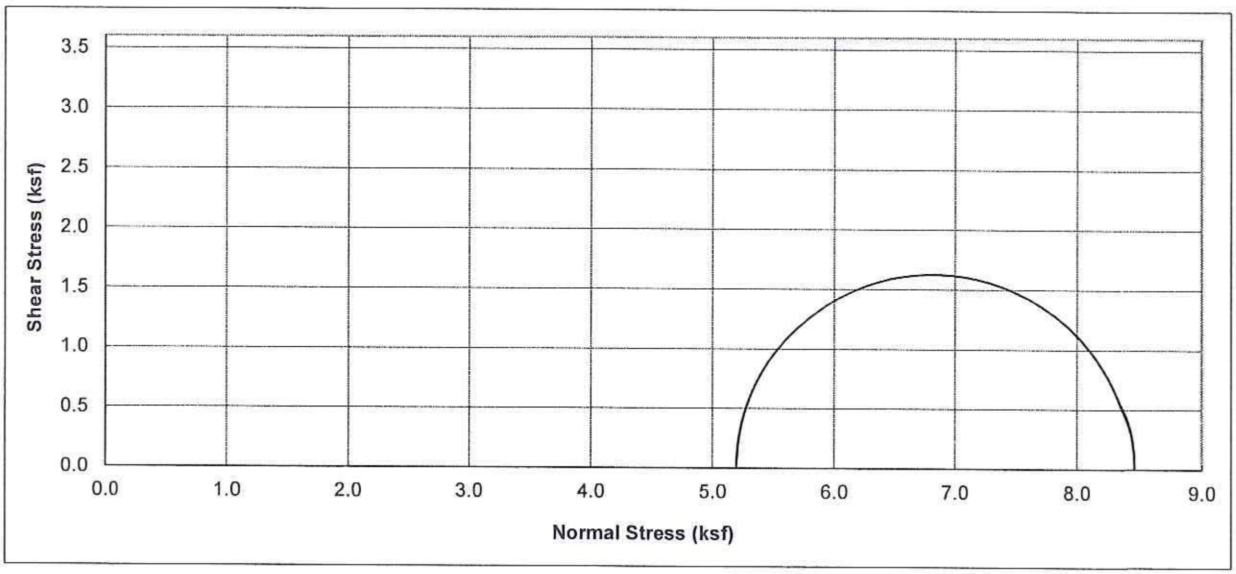




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-348	D-7	35	Olive brown , Lean CLAY with SAND (CL)	103.7	18.22	2.79	3.63	78.8

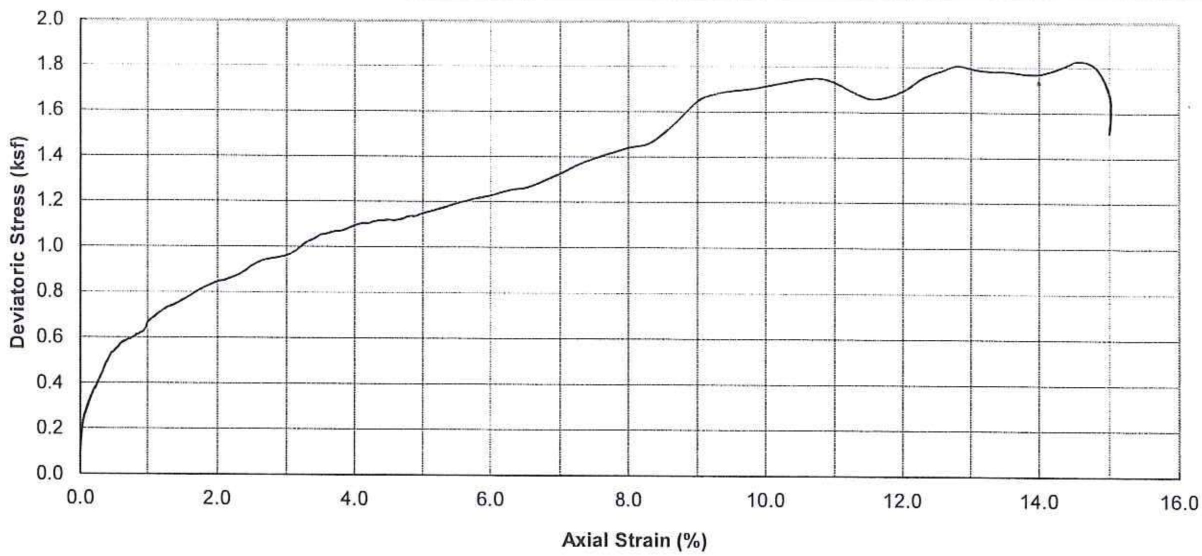
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering		I-5 HOV Improvement Project PCH to San Juan Creek Road
		UNCONSOLIDATED UNDRAINED TEST
Project No. : 11-137	Date : 11/02/11	(ASTM D2850) Figure No. :

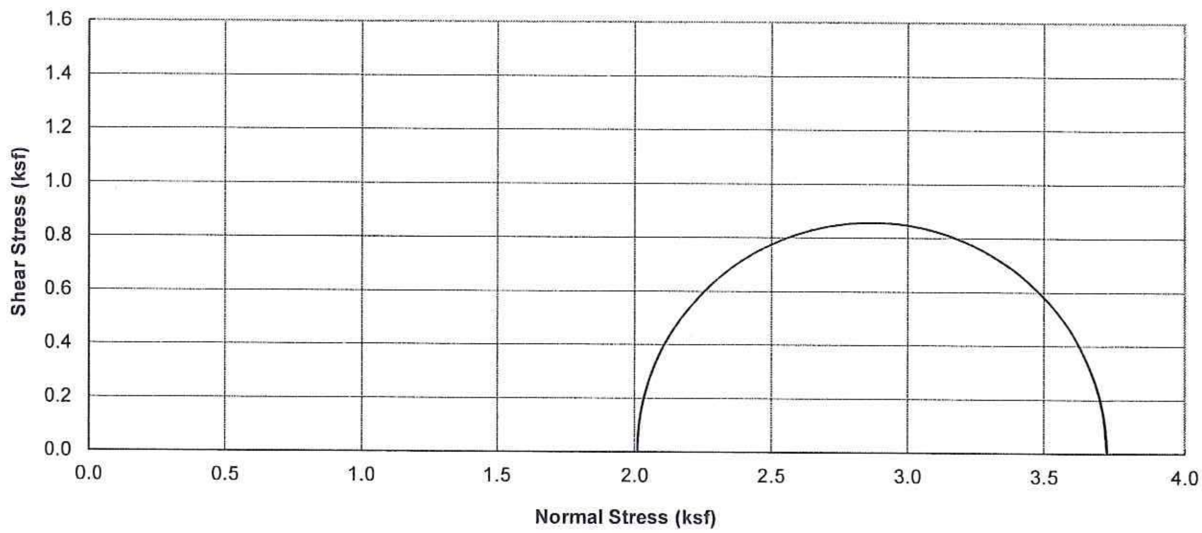




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-348	D-13	65	Olive brown , Lean CLAY with gypsum(CL)	99.6	24.33	5.19	3.25	95.0

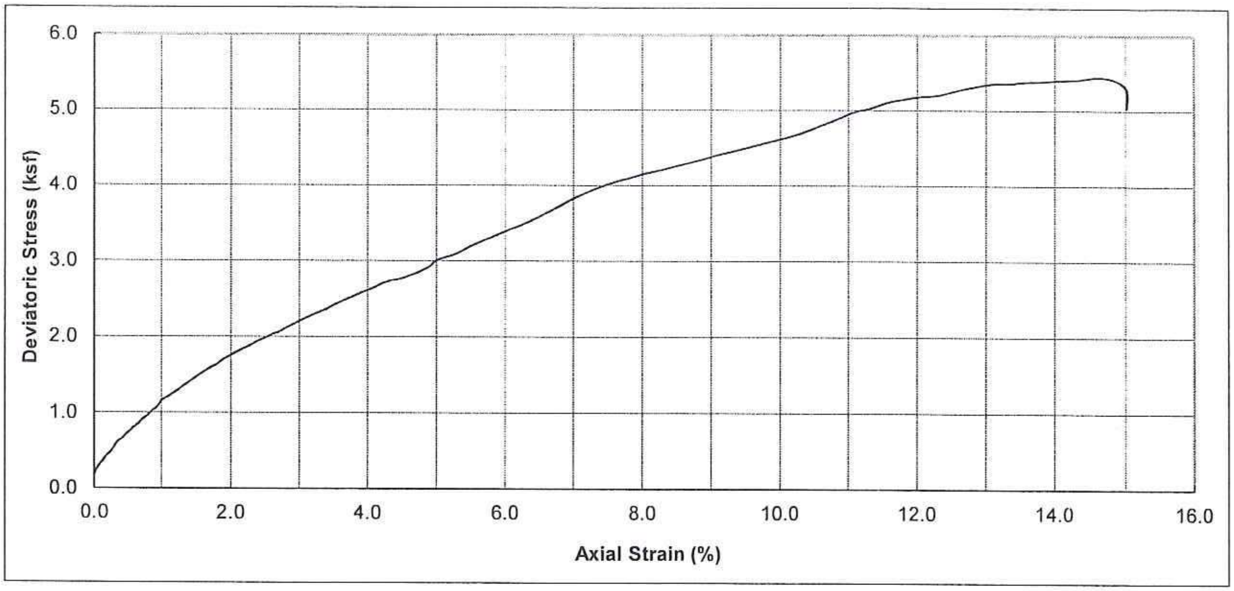
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	**I-5 HOV Improvement Project** **PCH to San Juan Creek Road**
Project No. : 11-137 **Date :** 11/02/11	**UNCONSOLIDATED UNDRAINED TEST** **(ASTM D2850)** Figure No. :

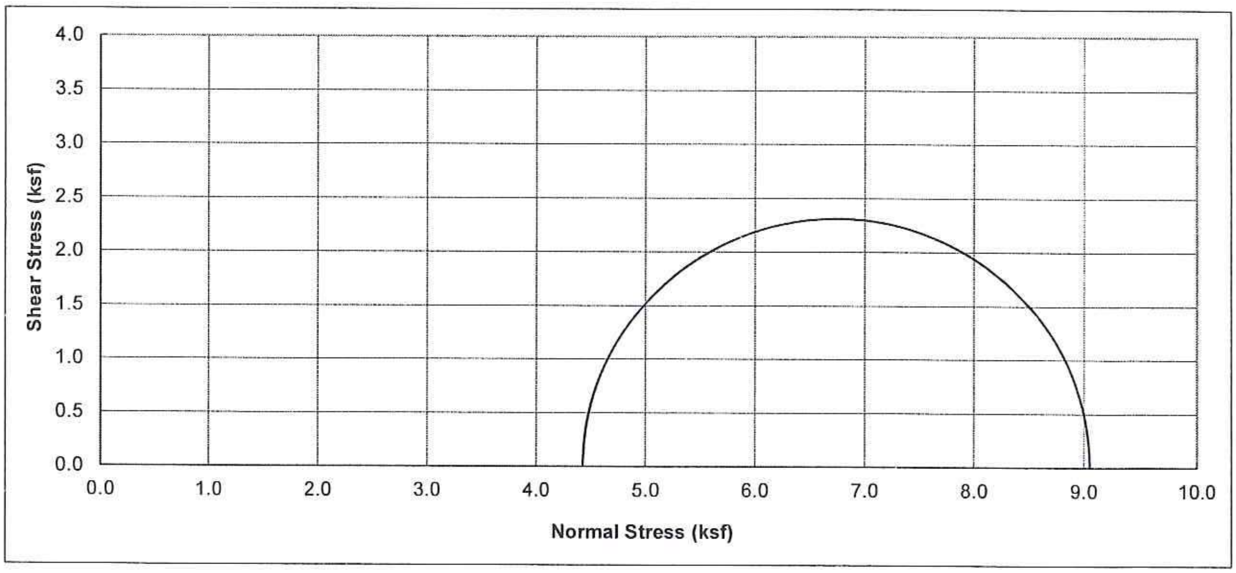




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-349	D-5	25	Olive brown , Lean CLAY (CL)	98.0	26.47	2.01	1.72	99.3

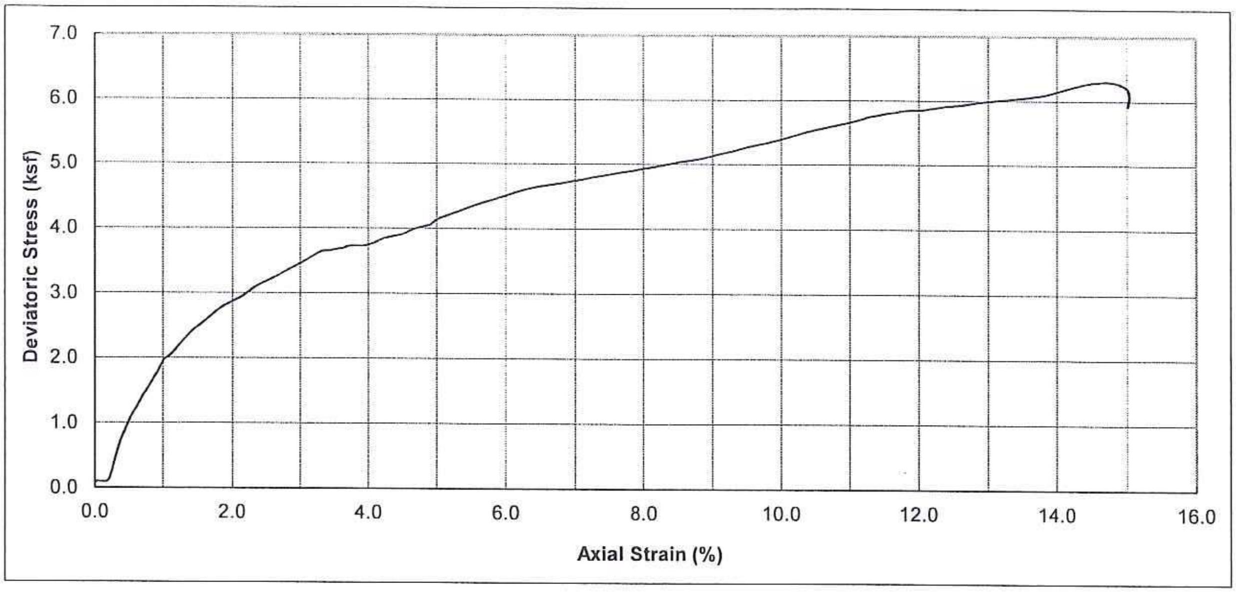
Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	**I-5 HOV Improvement Project** **PCH to San Juan Creek Road**
Project No. : 11-137 Date : 11/02/11	**UNCONSOLIDATED UNDRAINED TEST** **(ASTM D2850)** Figure No. :

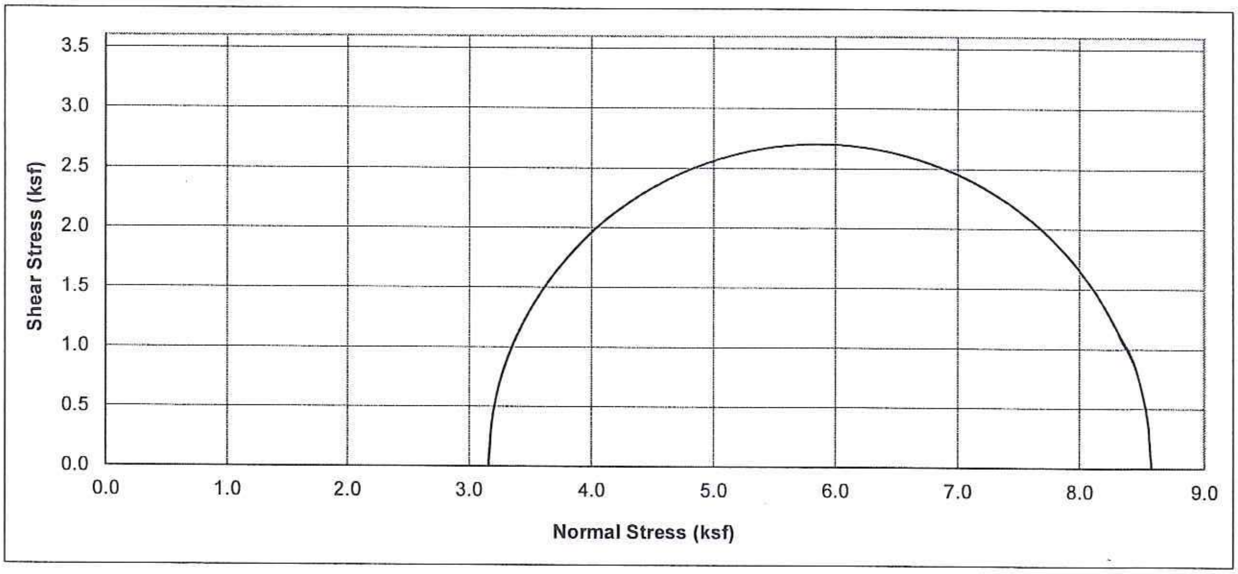




Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-349	D-11	55	Olive brown , Lean CLAY with SAND (CL)	102.5	23.12	4.43	4.63	96.9

Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	**I-5 HOV Improvement Project** **PCH to San Juan Creek Road**
	UNCONSOLIDATED UNDRAINED TEST
Project No. : 11-137 **Date :** 11/02/11	**(ASTM D2850)** Figure No. :





Boring No.	Sample No.	Depth (ft)	Soil Type	Dry Density (pcf)	Moisture Content (%)	Conf. Stress (ksf)	10% Axial Strain Dev. Stress (ksf)	Initial Saturation (%)
A-11-350	D-8	40	Dark brown , Lean CLAY (CL)	107.1	19.44	3.16	5.41	91.6

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

Project No. : 11-137 **Date :** 11/02/11

I-5 HOV Improvement Project
PCH to San Juan Creek Road
UNCONSOLIDATED UNDRAINED TEST
(ASTM D2850) Figure No. :

Appendix C

Design Calculations

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

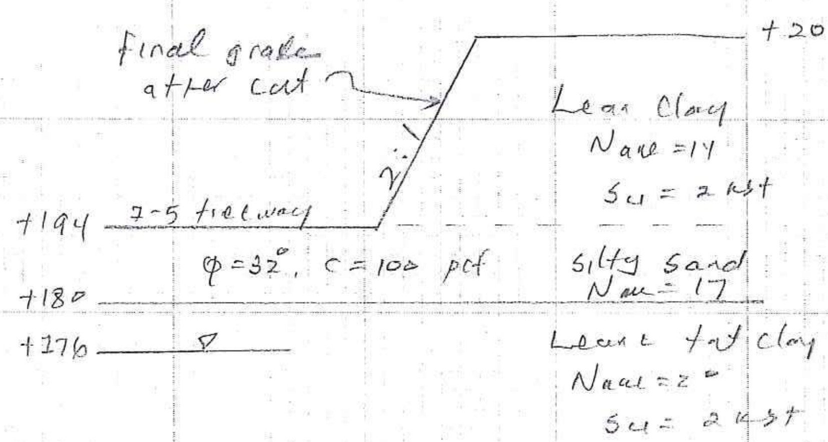
17800 Newhope Street, Suite B, Fountain Valley, CA 92708
(714) 751-3826, Fax (714) 751-3928

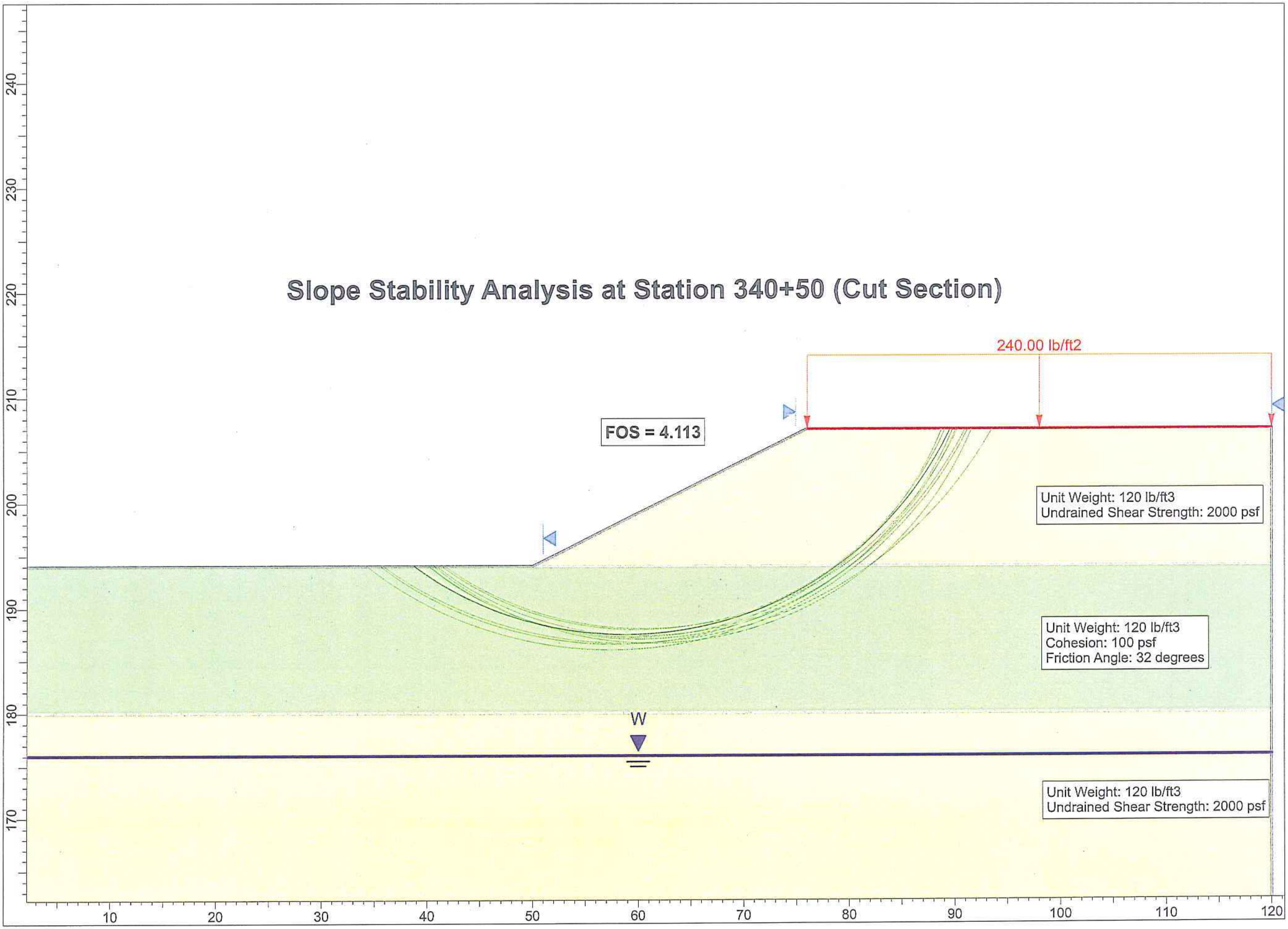
Project I-5 HOV Improvements-segment 3 GDR **Project No.** 11-137

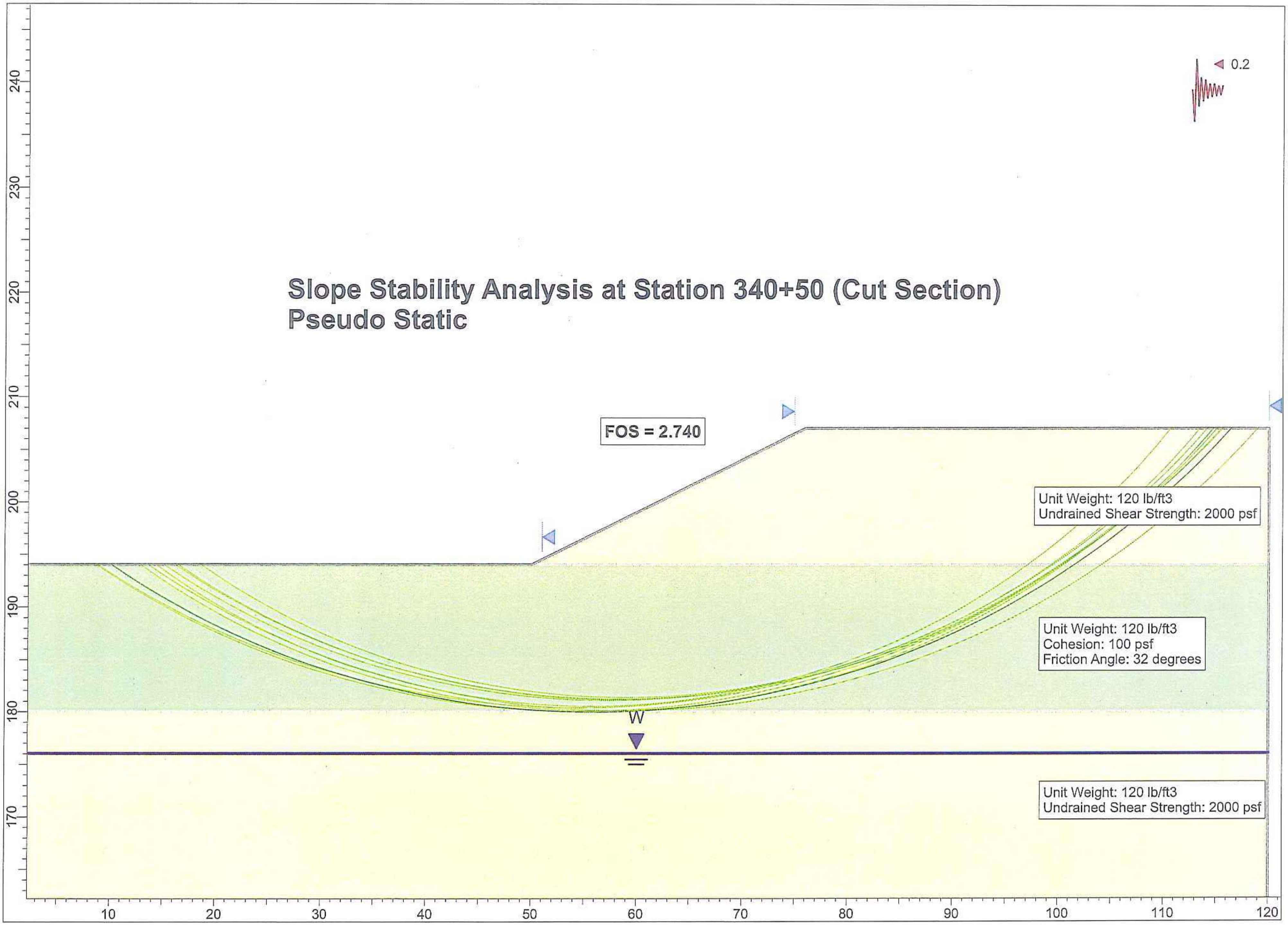
By SP **Date** 03/01/12 **Checked By** LCC **Date** 4/12/12 **Sheet** ____ **of** ____

Cuts and Excavation

at I-5 NB between 340+00 to 340+50




Slope Stability Analysis at Station 340+50 (Cut Section)
240.00 lb/ft2
FOS = 4.113
Unit Weight: 120 lb/ft3
Undrained Shear Strength: 2000 psf
Unit Weight: 120 lb/ft3
Cohesion: 100 psf
Friction Angle: 32 degrees
W
Unit Weight: 120 lb/ft3
Undrained Shear Strength: 2000 psf
240
230
220
210
200
190
180
170
10
20
30
40
50
60
70
80
90
100
110
120



Slope Stability Analysis at Station 340+50 (Cut Section)
Pseudo Static
FOS = 2.740
0.2
Unit Weight: 120 lb/ft3
Undrained Shear Strength: 2000 psf
Unit Weight: 120 lb/ft3
Cohesion: 100 psf
Friction Angle: 32 degrees
Unit Weight: 120 lb/ft3
Undrained Shear Strength: 2000 psf
W
240
230
220
210
200
190
180
170
10
20
30
40
50
60
70
80
90
100
110
120

Earth Mechanics, Inc.
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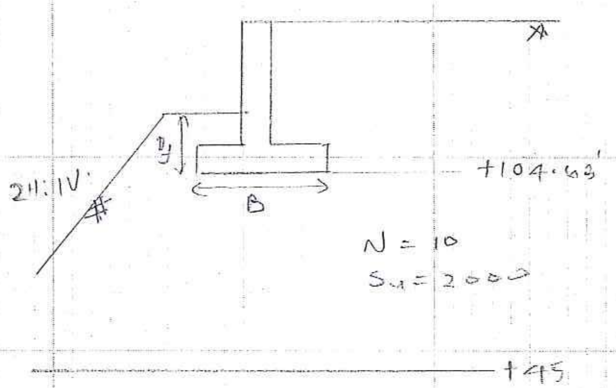
Project I-5 HOV Improvement segment 3 - GDR **Project No.** 11-137

By SP **Date** 09/05/12 **Checked By** LCC **Date** 10/5/12 **Sheet** ____ **of** ____

Retaining Wall 399



Maximum wall Ht = 10'
footing width B = 7.5'

$D_f = 1.5 + 1.33 = 2.83'$

for footing on slope

$\frac{D_f}{B} = 0.38$

stability factor $N_s = 0$

$N_{cs} = 5.4$

$N_\gamma = 0$

$N_q = 0$

$q_{ult} = cN_c$

$= 2 \times 5.4 = 10.8$ ksf

for strength limit $q_n = 0.55 \times 10.8 = 5.94$ ksf

for extreme event $q_n = 1.0 \times 10.8 = 10.8$ ksf

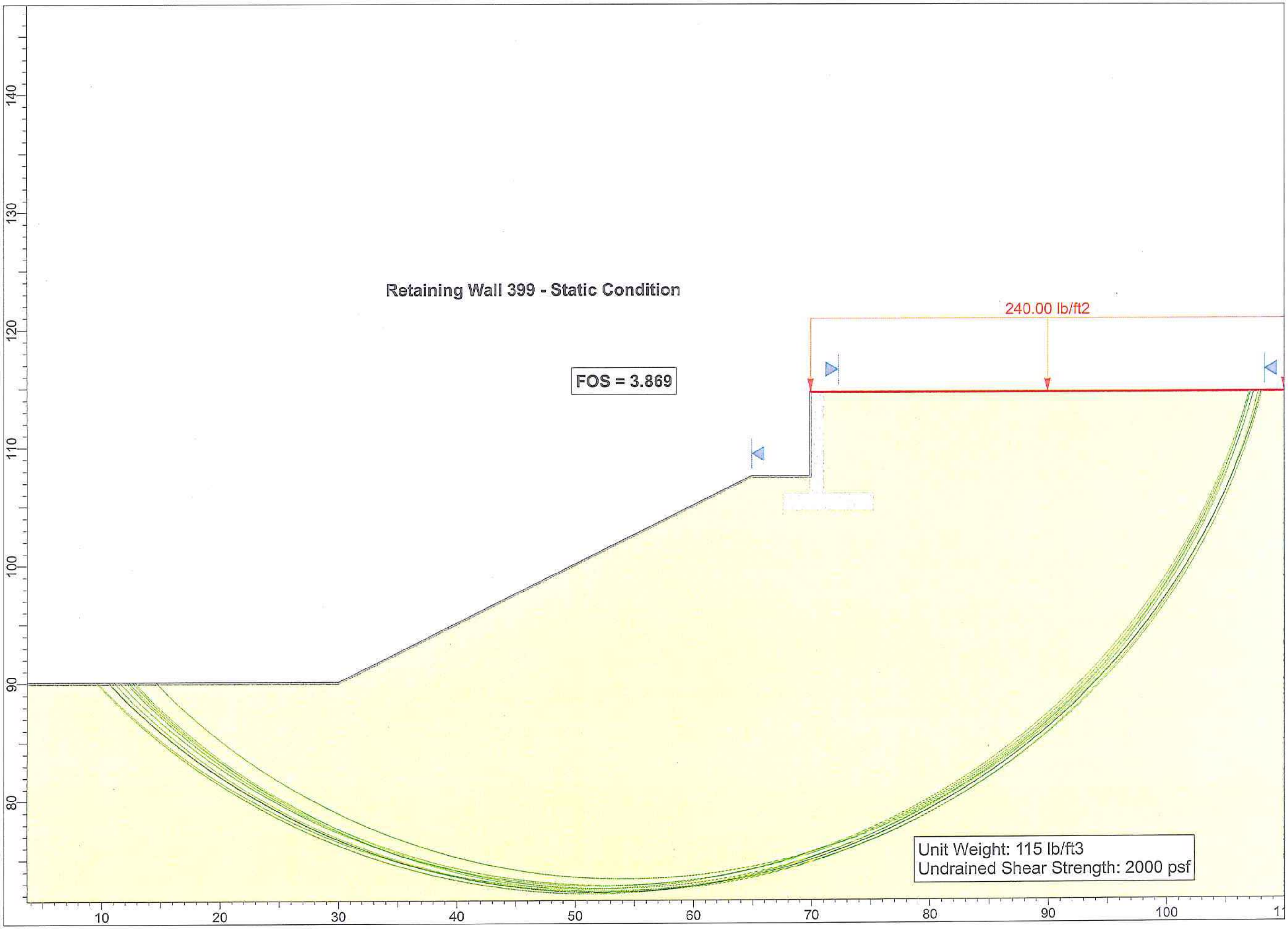
settlement

for bearing stress $\leq$ 1.4 ksf

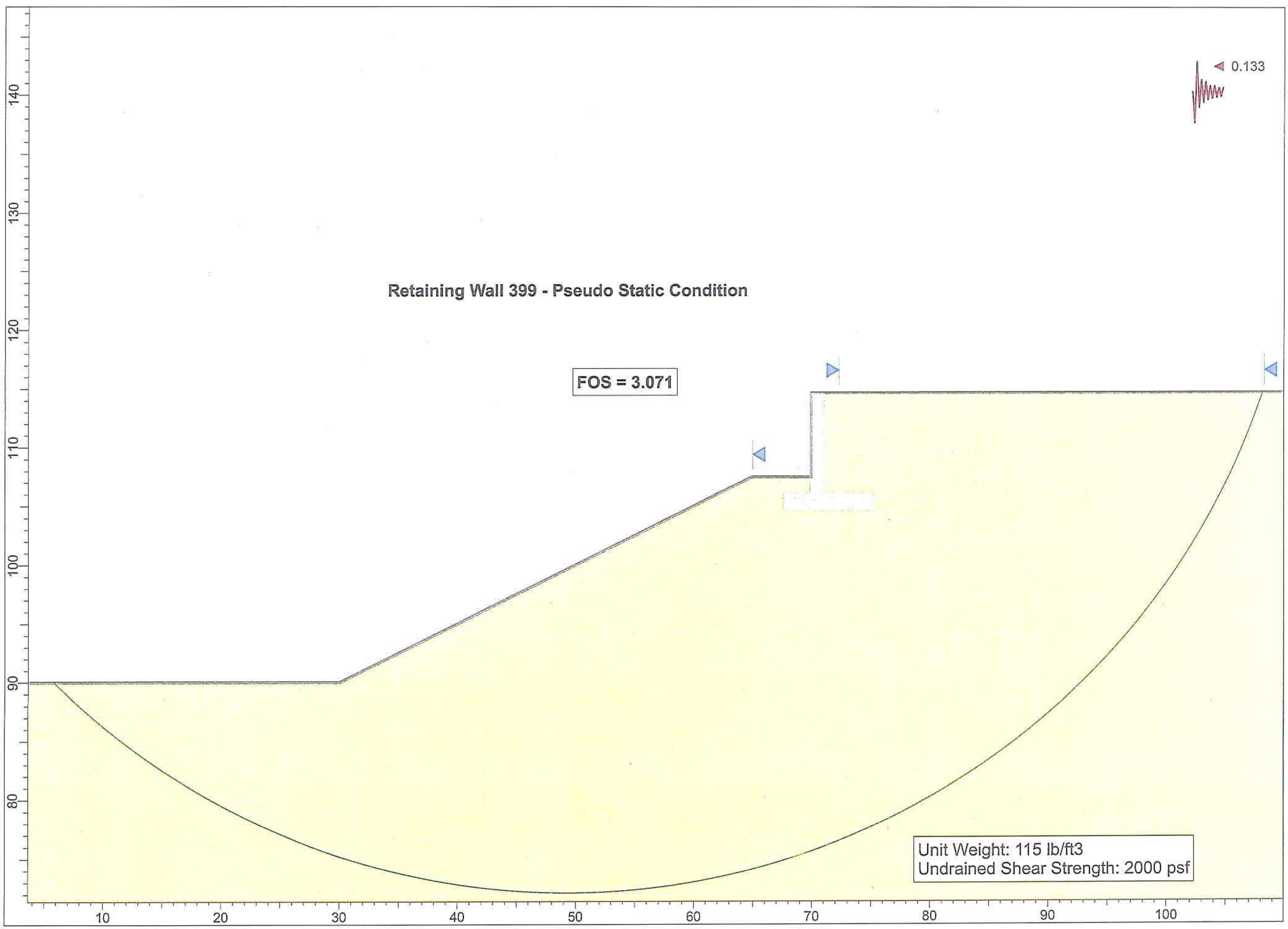
$\sigma_{v_0} = 115(2.83 + 7.5) = 1.18$ ksf ; $\Delta\sigma = 1.4 \times 0.6 = 0.84$ ksf

settlement $= 15 \times \frac{1}{50} \log\left(\frac{1.18 + 0.84}{1.18}\right) = 0.64''$

for service limit state $q_n = 1.4$ ksf



Retaining Wall 399 - Static Condition
FOS = 3.869
240.00 lb/ft2
Unit Weight: 115 lb/ft3
Undrained Shear Strength: 2000 psf
140
130
120
110
100
90
80
10
20
30
40
50
60
70
80
90
100



0.133
Retaining Wall 399 - Pseudo Static Condition
FOS = 3.071
Unit Weight: 115 lb/ft3
Undrained Shear Strength: 2000 psf
140
130
120
110
100
90
80
10
20
30
40
50
60
70
80
90
100

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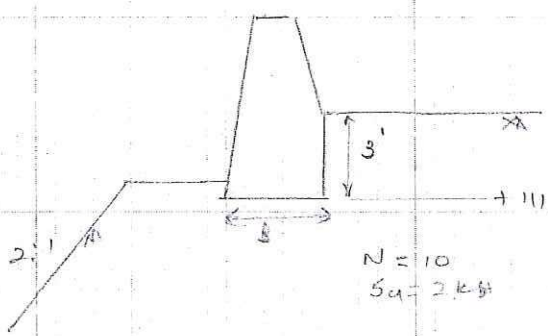
Project I-5 HOV Improvements - Segment 3 GDR **Project No.** 11-137

By SP **Date** 09-05-12 **Checked By** LCC **Date** 10/5/12 **Sheet** ____ **of** ____

Retaining Concrete Barrier



for width B = 2 ft

q_{ult} = 2 x 5.14 = 10.2 ksf for footing on slope

for strength limit q_n = 0.55 x 10.2 = 5.61 ksf

settlement

consider bearing pressure of 1 ksf

settlement = $5 \times \frac{1}{50} \log\left(\frac{0.3 + 0.5}{0.3}\right)$ = 0.5 inch

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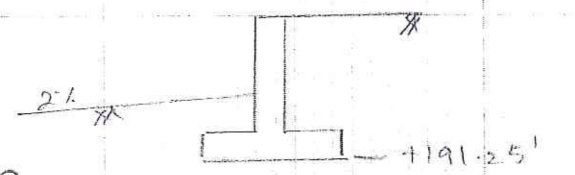
Project I-5 HOV Improvements - Segment 3 GDR Project No. 11-137

By SP Date 09-05-12 Checked By LCC Date 10/5/12 Sheet ___ of ___

Soundwall 340 on Retaining wall Type 15WB



① $N_{ave} = 23$, $\phi = 32$

+185

② $N_{ave} = 16$, $S_u = 2000$

+160

wall height = 6'
footing width = 6.75'

$q_{ult} = c N_{cm} + q N_{qm} + \frac{1}{2} \gamma B N_{\gamma m}$

$N_{cm} = N_c s_c i_c$; $N_{qm} = N_q s_q i_q d_q$; $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$

Shape factors $s_c = s_q = s_\gamma = 1$

load inclination factors $i_c = i_q = i_\gamma = 1$

depth factor $d_q = 1.2$

for $\phi = 32$ $N_c = 35.5$, $N_q = 23.2$, $N_\gamma = 30.2$

$q_{ult} = 100 \times 35.5 + 3 \times 115 \times 23.2 \times 1.2 + \frac{1}{2} \times 115 \times 6.75 \times 30.2$

$= 16.2$ ksf

for strength limit state $q_n = 0.55 \times 16.2 = 8.9$ ksf

for Extreme event limit state $q_n = 1.0 \times 16.2 = 16.2$ ksf

settlement - service limit state
consider bearing pressure of 2.5 ksf

	σ_{vo}	$\Delta\sigma$	settlement
①	$6 \times 115 = 0.69$	$2.5 \times 0.82 = 2.05$	$6 \times \frac{1}{65} \log\left(\frac{0.69 + 2.05}{0.69}\right) = 0.66$
②	$12 \times 115 = 1.38$	$2.5 \times 0.45 = 1.13$	$6 \times \frac{1}{59} \log\left(\frac{1.38 + 1.13}{1.38}\right) = 0.37$
			1.03"

Soundwall 340

Lateral Pile Analyses for Soundwall on Pile Cap

```
================================================================================
              LPile Plus for Windows, Version 6.0 (6.0.09)

            Analysis of Individual Piles and Drilled Shafts
           Subjected to Lateral Loading Using the p-y Method

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                        All Rights Reserved
================================================================================

This program is licensed to:

Earth Mechanics, Inc.
Earth Mechanics, Inc.

--------------------------------------------------------------------------------
                          Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:      X:\Projects\2011\11-137 - TRC, I-5 HOV Widening - Segment 3\Reports\06 GDR\Analyses\Lateral Capacity\
Name of input data file:     SW on Pile Cap Case 1.lp6d
Name of output file:         SW on Pile Cap Case 1.lp6o
Name of plot output file:    SW on Pile Cap Case 1.lp6p
Name of runtime file:        SW on Pile Cap Case 1.lp6r

--------------------------------------------------------------------------------
                         Date and Time of Analysis
--------------------------------------------------------------------------------

            Date:  March 8, 2012      Time:  11:59:24

--------------------------------------------------------------------------------
                               Problem Title
--------------------------------------------------------------------------------

Project Name:

Job Number:

Client:

Engineer:

Description:


--------------------------------------------------------------------------------
                              Program Options
--------------------------------------------------------------------------------

Units Used - US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes nonlinear bending stiffness and nominal Moment
  Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multiplers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output summary table of values for pile-head deflection, maximum
  bending moment, and shear force only
- Analysis assumes no soil movements acting on pile
- No p-y curves to be computed and output for user-specified depths

Solution Control Parameters:
- Number of pile increments                        =         100
- Maximum number of iterations allowed             =         100
- Deflection tolerance for convergence             =  1.0000E-05  in
- Maximum allowable deflection                     =    100.0000  in

Pile Response Output Options:
- Only summary tables of pile-head deflection, maximum bending moment,
  and maximum shear force are to be written to output report file.

--------------------------------------------------------------------------------
                    Pile Structural Properties and Geometry
--------------------------------------------------------------------------------

Total Number of Sections                           =           1
```

```
Total Pile Length                                          =     12.00 ft

Depth of ground surface below top of pile                  =     -2.00 ft

Slope angle of ground surface                              =      0.00 deg.

Pile dimensions used for p-y curve computations defined using 2 points.
p-y curves are computed using values of pile diameter interpolated over
the length of the pile.

Point        Depth          Pile
               X          Diameter
               ft            in
-----     ---------     -----------
  1         0.00000     16.0000000
  2        12.000000    16.0000000

Input Structural Properties:
----------------------------

Section No. 1:

   Section Type                                     =   Elastic Pile
   Cross-sectional Shape                            =       Circular
   Section Length                                   =        12.000 in
   Top Width                                        =        16.000 in
   Bottom Width                                     =        16.000 in
   Top Area                                         =    201.000000 sq. in
   Bottom Area                                      =    201.000000 sq. in
   Moment of Inertia at Top                         =     1.608E+03 in^4
   Moment of Inertia at Bottom                      =     1.608E+03 in^4
   Elastic Modulus                                  =   3200000.000 lbs/in


--------------------------------------------------------------------------------
                       Ground Slope and Pile Batter Angles
--------------------------------------------------------------------------------

Ground Slope Angle                                  =     0.000 degrees
                                                    =     0.000 radians

Pile Batter Angle                                   =     0.000 degrees
                                                    =     0.000 radians


--------------------------------------------------------------------------------
                        Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer           =    -2.000 ft
Distance from top of pile to bottom of layer        =     9.000 ft
p-y subgrade modulus k for top of soil layer        =    90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer          =    90.000 lbs/in**3

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer           =     9.000 ft
Distance from top of pile to bottom of layer        =    34.000 ft

Layer 3 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer           =    34.000 ft
Distance from top of pile to bottom of layer        =    59.000 ft

(Depth of lowest layer extends   47.00 ft below pile tip)

--------------------------------------------------------------------------------
                     Effective Unit Weight of Soil vs. Depth
--------------------------------------------------------------------------------

Effective unit weight of soil with depth defined using 6 points

Point       Depth X     Eff. Unit Weight
 No.          ft              pcf
-----     ----------    ----------------
  1          -2.00         115.00000
  2           9.00         115.00000
  3           9.00         115.00000
```

4	34.00	115.00000
5	34.00	120.00000
6	59.00	120.00000

Summary of Soil Properties

Layer Num.	Soil Type (p-y Curve Criteria)	Depth ft	Eff. Unit Wt., pcf	Cohesion psf	Friction Ang., deg.	qu psi	RQD percent	Epsilon 50	kpy pci	Rock Emass psi	krm	Test Type	Test Prop.	Elas. Subgr. pci
1	Sand (Reese, et al.)	-2.000	115.000	--	32.000	--	--	--	90.000	--	--	--	--	--
		9.000	115.000	--	32.000	--	--	--	90.000	--	--	--	--	--
2	Soft Clay	9.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
		34.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
3	Soft Clay	34.000	120.000	3000.000	--	--	--	0.00500	--	--	--	--	--	--
		59.000	120.000	3000.000	--	--	--	0.00500	--	--	--	--	--	--

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	1.0000	1.0000
2	12.000	1.0000	1.0000

Loading Type

p-y criteria for static loading was used for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs
1	1	V = 4920.000 lbs	M = 456480.000 in-lbs	22200.000
2	1	V = 9840.000 lbs	M = 835200.000 in-lbs	22200.000

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust values were determined from pile-head loading conditions

Number of Sections = 1

Section No. 1:

Moment-Curvature properties derived from elastic section properties

Summary of Pile Response(s)

Definitions of Pile-Head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Condition 1 V(lbs) or y(inches)	Condition 2 in-lb, rad., or in-lb/rad.	Axial Load lbs	Pile-Head Deflection inches	Maximum Moment in-lbs	Maximum Shear lbs	Pile-Head Rotation radians

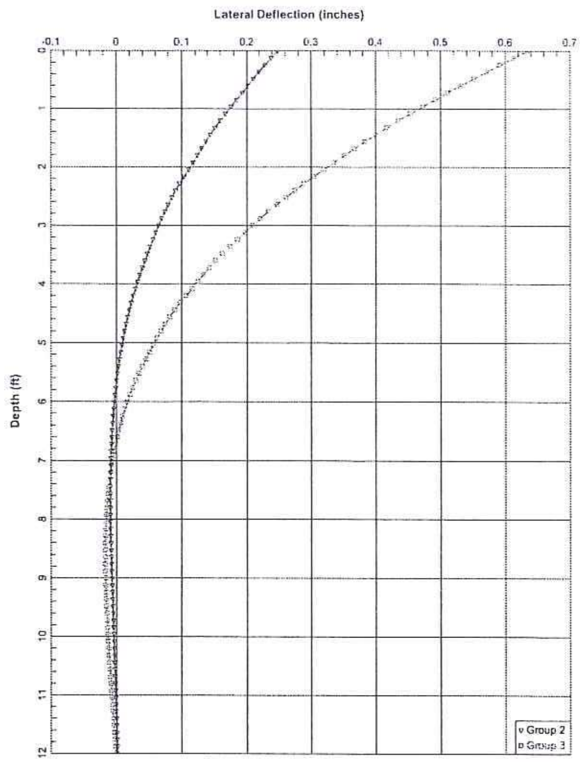
1	1	V = 4920.0000	M = 456480.	22200.	0.24835169	510650.	-7541.6701	0.00000000
2	1	V = 9840.0000	M = 835200.	22200.	0.63451721	981775.	-14316.	0.00000000

Summary of Warning Messages

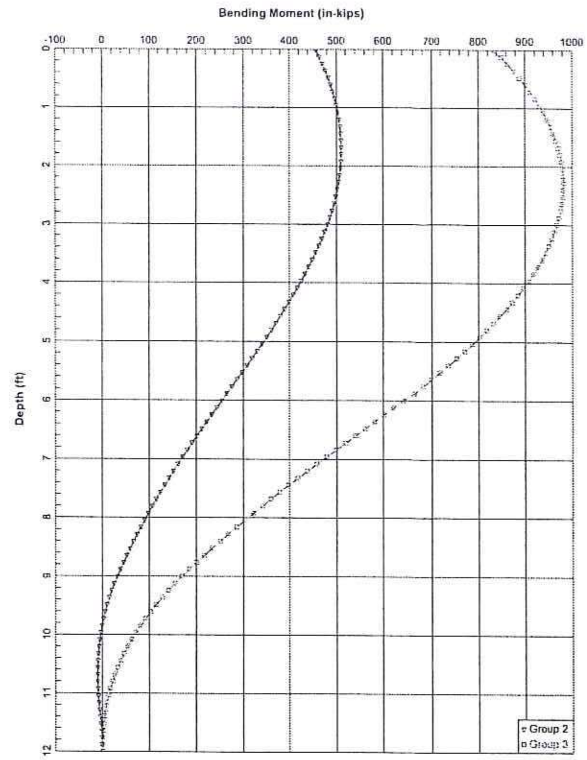
The following warning was reported 400 times

**** Warning ****

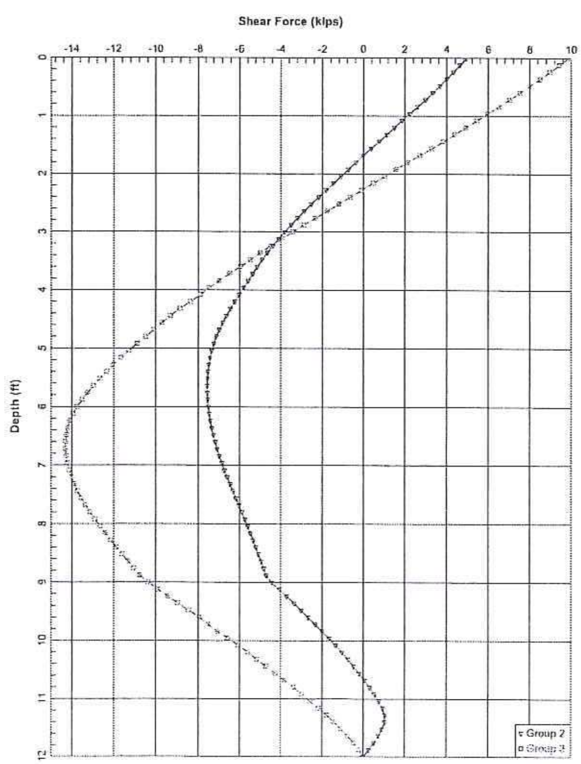
An unreasonable input value for shear strength has been specified for a soil defined using the soft clay criteria. The input value is greater than 8.68 psi (1,250 psf). You should check your input data for correctness.



Soundwall on Pile Cap, Ground Condition = Case 1



Soundwall on Pile Cap, Ground Condition = Case 1



Soundwall on Pile Cap, Ground Condition = Case 1

```
================================================================================
              LPile Plus for Windows, Version 6.0 (6.0.09)

              Analysis of Individual Piles and Drilled Shafts
             Subjected to Lateral Loading Using the p-y Method

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                         All Rights Reserved
================================================================================

This program is licensed to:

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Earth Mechanics, Inc.

--------------------------------------------------------------------------------
                          Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:     X:\Projects\2011\11-137 - TRC, I-5 HOV Widening - Segment 3\Reports\06 GDR\Analyses\Lateral Capacity\
Name of input data file:    SW on Pile Cap Case 2.lp6d
Name of output file:        SW on Pile Cap Case 2.lp6o
Name of plot output file:   SW on Pile Cap Case 2.lp6p
Name of runtime file:       SW on Pile Cap Case 2.lp6r

--------------------------------------------------------------------------------
                         Date and Time of Analysis
--------------------------------------------------------------------------------

             Date:  March 8, 2012     Time:  12:10:27

--------------------------------------------------------------------------------
                               Problem Title
--------------------------------------------------------------------------------

Project Name:

Job Number:

Client:

Engineer:

Description:


--------------------------------------------------------------------------------
                              Program Options
--------------------------------------------------------------------------------

Units Used - US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes nonlinear bending stiffness and nominal Moment
  Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multipliers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output summary table of values for pile-head deflection, maximum
  bending moment, and shear force only
- Analysis assumes no soil movements acting on pile
- No p-y curves to be computed and output for user-specified depths

Solution Control Parameters:
- Number of pile increments                         =          100
- Maximum number of iterations allowed              =          100
- Deflection tolerance for convergence              =   1.0000E-05  in
- Maximum allowable deflection                      =     100.0000  in

Pile Response Output Options:
- Only summary tables of pile-head deflection, maximum bending moment,
  and maximum shear force are to be written to output report file.

--------------------------------------------------------------------------------
                    Pile Structural Properties and Geometry
--------------------------------------------------------------------------------

Total Number of Sections                            =            1
```

```
Total Pile Length                                     =     14.00 ft

Depth of ground surface below top of pile             =     -3.00 ft

Slope angle of ground surface                         =     26.60 deg.

Pile dimensions used for p-y curve computations defined using 2 points.
p-y curves are computed using values of pile diameter interpolated over
the length of the pile.

Point        Depth          Pile
               X          Diameter
              ft             in
-----      ---------     -----------
  1          0.00000      16.0000000
  2        14.000000      16.0000000

Input Structural Properties:
----------------------------

Section No. 1:

   Section Type                                       =    Elastic Pile
   Cross-sectional Shape                              =       Circular
   Section Length                                     =        14.000 in
   Top Width                                          =        16.000 in
   Bottom Width                                       =        16.000 in
   Top Area                                           =    201.000000 sq. in
   Bottom Area                                        =    201.000000 sq. in
   Moment of Inertia at Top                           =     1.608E+03 in^4
   Moment of Inertia at Bottom                        =     1.608E+03 in^4
   Elastic Modulus                                    =   3200000.000 lbs/in


--------------------------------------------------------------------------------
                      Ground Slope and Pile Batter Angles
--------------------------------------------------------------------------------

Ground Slope Angle                                    =        26.600 degrees
                                                      =         0.464 radians

Pile Batter Angle                                     =         0.000 degrees
                                                      =         0.000 radians


--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer             =        -3.000 ft
Distance from top of pile to bottom of layer          =         9.000 ft
p-y subgrade modulus k for top of soil layer          =        90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer            =        90.000 lbs/in**3

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer             =         9.000 ft
Distance from top of pile to bottom of layer          =        34.000 ft

Layer 3 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer             =        34.000 ft
Distance from top of pile to bottom of layer          =        59.000 ft

(Depth of lowest layer extends   45.00 ft below pile tip)

--------------------------------------------------------------------------------
                    Effective Unit Weight of Soil vs. Depth
--------------------------------------------------------------------------------

Effective unit weight of soil with depth defined using 6 points

Point       Depth X     Eff. Unit Weight
 No.          ft              pcf
-----     ----------    ----------------
  1          -3.00         115.00000
  2           9.00         115.00000
  3           9.00         115.00000
```

4	34.00	115.00000
5	34.00	120.00000
6	59.00	120.00000

Summary of Soil Properties

Layer Num.	Soil Type (p-y Curve Criteria)	Depth ft	Eff. Unit Wt., pcf	Cohesion psf	Friction Ang., deg.	qu psi	RQD percent	Epsilon 50	kpy pci	Rock Emass psi	krm	Test Type	Test Prop.	Elas. Subgr. pci
1	Sand (Reese, et al.)	-3.000	115.000	--	32.000	--	--	--	90.000	--	--	--	--	--
		9.000	115.000	--	32.000	--	--	--	90.000	--	--	--	--	--
2	Soft Clay	9.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
		34.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
3	Soft Clay	34.000	120.000	3000.000	--	--	--	0.00500	--	--	--	--	--	--
		59.000	120.000	3000.000	--	--	--	0.00500	--	--	--	--	--	--

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth x ft	p-mult	y-mult
1	0.000	1.0000	1.0000
2	14.000	1.0000	1.0000

Loading Type

p-y criteria for static loading was used for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs
1	1	V = 3280.000 lbs	M = 304320.000 in-lbs	14800.000
2	1	V = 6560.000 lbs	M = 556800.000 in-lbs	14800.000

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust values were determined from pile-head loading conditions

Number of Sections = 1

Section No. 1:

Moment-Curvature properties derived from elastic section properties

Summary of Pile Response(s)

Definitions of Pile-Head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Condition 1 V(lbs) or y(inches)	Condition 2 in-lb, rad., or in-lb/rad.	Axial Load lbs	Pile-Head Deflection inches	Maximum Moment in-lbs	Maximum Shear lbs	Pile-Head Rotation radians

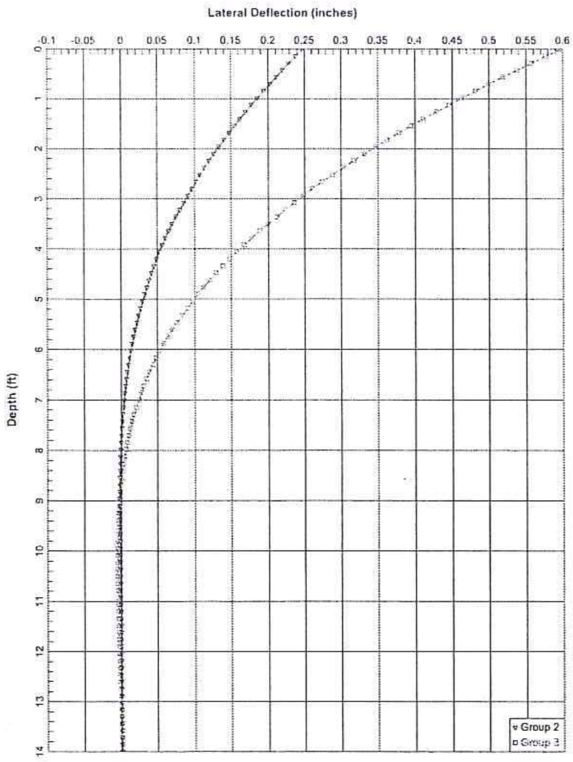
1	1	V = 3280.0000	M = 304320.	14800.	0.24691900	349695.	-5306.2003	0.00000000
2	1	V = 6560.0000	M = 556800.	14800.	0.59669244	677852.	-10204.	0.00000000

Summary of Warning Messages

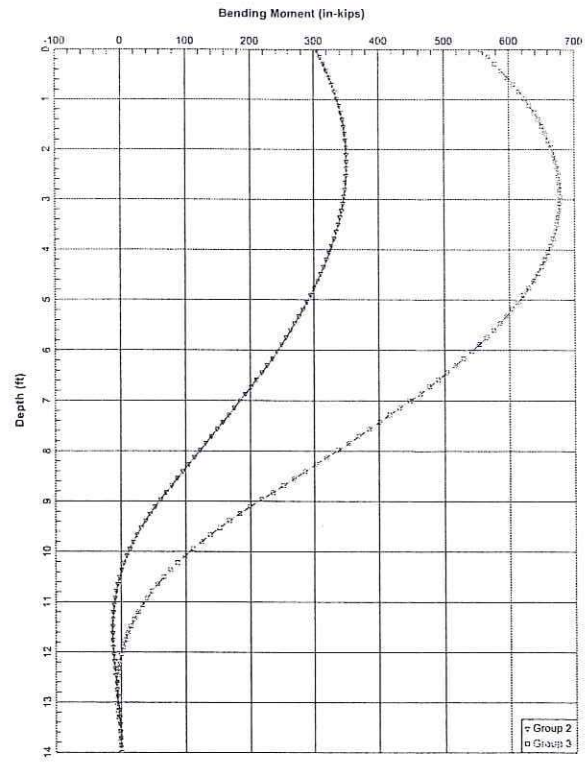
The following warning was reported 468 times

**** Warning ****

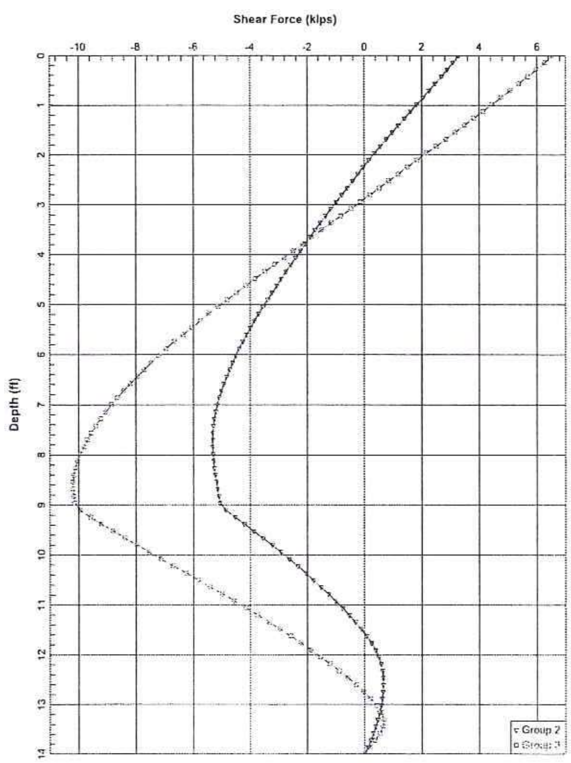
An unreasonable input value for shear strength has been specified for a soil defined using the soft clay criteria. The input value is greater than 8.68 psi (1,250 psf). You should check your input data for correctness.



Soundwall on Pile Cap, Ground Condition = Case 2



Soundwall on Pile Cap, Ground Condition = Case 2



Soundwall on Pile Cap, Ground Condition = Case 2

Soundwall 340

Lateral Pile Analyses for Soundwall on Barrier Type 736S

```
===============================================================================
               LPile Plus for Windows, Version 6.0 (6.0.09)

               Analysis of Individual Piles and Drilled Shafts
               Subjected to Lateral Loading Using the p-y Method

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                           All Rights Reserved
===============================================================================

This program is licensed to:

Earth Mechanics, Inc.
Earth Mechanics, Inc.

-------------------------------------------------------------------------------
                          Files Used for Analysis
-------------------------------------------------------------------------------

Path to file locations:      X:\Projects\2011\11-137 - TRC, I-5 HOV Widening - Segment 3\Reports\06 GDR\Analyses\Lateral Capacity\
Name of input data file:     SW on Barrier 736S Case 1.lp6d
Name of output file:         SW on Barrier 736S Case 1.lp6o
Name of plot output file:    SW on Barrier 736S Case 1.lp6p
Name of runtime file:        SW on Barrier 736S Case 1.lp6r

-------------------------------------------------------------------------------
                         Date and Time of Analysis
-------------------------------------------------------------------------------

             Date:  March 8, 2012      Time:  11:53:06

-------------------------------------------------------------------------------
                               Problem Title
-------------------------------------------------------------------------------

Project Name:

Job Number:

Client:

Engineer:

Description:


-------------------------------------------------------------------------------
                              Program Options
-------------------------------------------------------------------------------

Units Used - US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes nonlinear bending stiffness and nominal Moment
  Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multiplers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output summary table of values for pile-head deflection, maximum
  bending moment, and shear force only
- Analysis assumes no soil movements acting on pile
- No p-y curves to be computed and output for user-specified depths

Solution Control Parameters:
- Number of pile increments                      =          100
- Maximum number of iterations allowed           =          100
- Deflection tolerance for convergence           =   1.0000E-05  in
- Maximum allowable deflection                   =     100.0000  in

Pile Response Output Options:
- Only summary tables of pile-head deflection, maximum bending moment,
  and maximum shear force are to be written to output report file.

-------------------------------------------------------------------------------
                    Pile Structural Properties and Geometry
-------------------------------------------------------------------------------

Total Number of Sections                         =           1
```

```
Total Pile Length                                   =     13.00 ft

Depth of ground surface below top of pile           =     -1.50 ft

Slope angle of ground surface                       =      0.00 deg.

Pile dimensions used for p-y curve computations defined using 2 points.
p-y curves are computed using values of pile diameter interpolated over
the length of the pile.

Point        Depth            Pile
               X            Diameter
              ft               in
-----      ---------      -----------
  1          0.00000       16.0000000
  2        13.000000       16.0000000

Input Structural Properties:
----------------------------

Section No. 1:

   Section Type                                     =   Elastic Pile
   Cross-sectional Shape                            =      Circular
   Section Length                                   =        13.000 in
   Top Width                                        =        16.000 in
   Bottom Width                                     =        16.000 in
   Top Area                                         =    201.000000 sq. in
   Bottom Area                                      =    201.000000 sq. in
   Moment of Inertia at Top                         =     1.608E+03 in^4
   Moment of Inertia at Bottom                      =     1.608E+03 in^4
   Elastic Modulus                                  =  3200000.000 lbs/in


--------------------------------------------------------------------------------
                        Ground Slope and Pile Batter Angles
--------------------------------------------------------------------------------

Ground Slope Angle                                  =      0.000 degrees
                                                    =      0.000 radians

Pile Batter Angle                                   =      0.000 degrees
                                                    =      0.000 radians


--------------------------------------------------------------------------------
                         Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer           =     -1.500 ft
Distance from top of pile to bottom of layer        =      9.000 ft
p-y subgrade modulus k for top of soil layer        =     90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer          =     90.000 lbs/in**3

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer           =      9.000 ft
Distance from top of pile to bottom of layer        =     34.000 ft

Layer 3 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer           =     34.000 ft
Distance from top of pile to bottom of layer        =     59.000 ft

(Depth of lowest layer extends   46.00 ft below pile tip)

--------------------------------------------------------------------------------
                      Effective Unit Weight of Soil vs. Depth
--------------------------------------------------------------------------------

Effective unit weight of soil with depth defined using 6 points

Point        Depth X    Eff. Unit Weight
 No.           ft             pcf
-----      ---------    ----------------
  1          -1.50         115.00000
  2           9.00         115.00000
  3           9.00         115.00000
```

4	34.00	115.00000
5	34.00	120.00000
6	59.00	120.00000

Summary of Soil Properties

Layer Num.	Soil Type (p-y Curve Criteria)	Depth ft	Eff. Unit Wt., pcf	Cohesion psf	Friction Ang., deg.	qu psi	RQD percent	Epsilon 50	kpy pci	Rock Emass psi	krm	Test Type	Test Prop.	Elas. Subgr. pci
1	Sand (Reese, et al.)	-1.500	115.000	--	32.000	--	--	--	90.000	--	--	--	--	--
		9.000	115.000	--	32.000	--	--	--	90.000	--	--	--	--	--
2	Soft Clay	9.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
		34.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
3	Soft Clay	34.000	120.000	3000.000	--	--	--	0.00500	--	--	--	--	--	--
		59.000	120.000	3000.000	--	--	--	0.00500	--	--	--	--	--	--

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth x ft	p-mult	y-mult
1	0.000	1.0000	1.0000
2	13.000	1.0000	1.0000

Loading Type

p-y criteria for static loading was used for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs
1	1	V = 4600.000 lbs	M = 433200.000 in-lbs	18800.000
2	1	V = 6900.000 lbs	M = 621600.000 in-lbs	18800.000

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust values were determined from pile-head loading conditions

Number of Sections = 1

Section No. 1:

Moment-Curvature properties derived from elastic section properties

Summary of Pile Response(s)

Definitions of Pile-Head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Condition 1 V(lbs) or y(inches)	Condition 2 in-lb, rad., or in-lb/rad.	Axial Load lbs	Pile-Head Deflection inches	Maximum Moment in-lbs	Maximum Shear lbs	Pile-Head Rotation radians

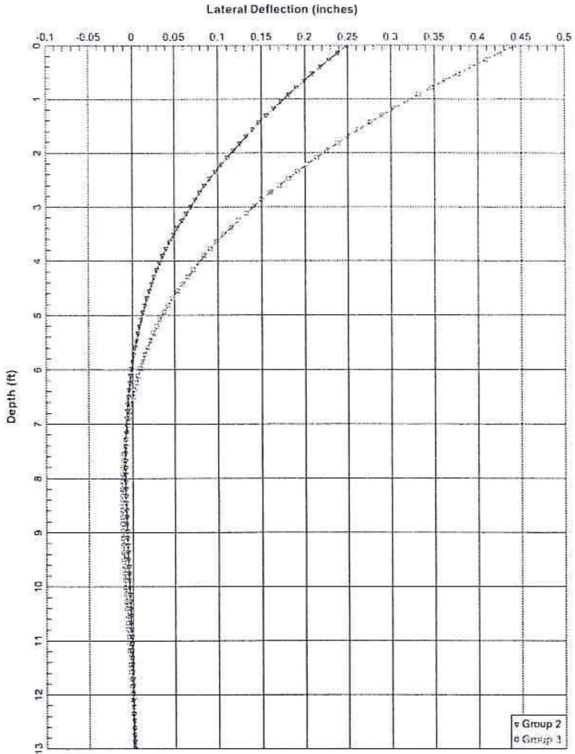
1	1	V =	4600.0000	M =	433200.	18800.	0.24862504	489336.	-7245.0643	0.00000000
2	1	V =	6900.0000	M =	621600.	18800.	0.44180524	722290.	-10553.	0.00000000

Summary of Warning Messages

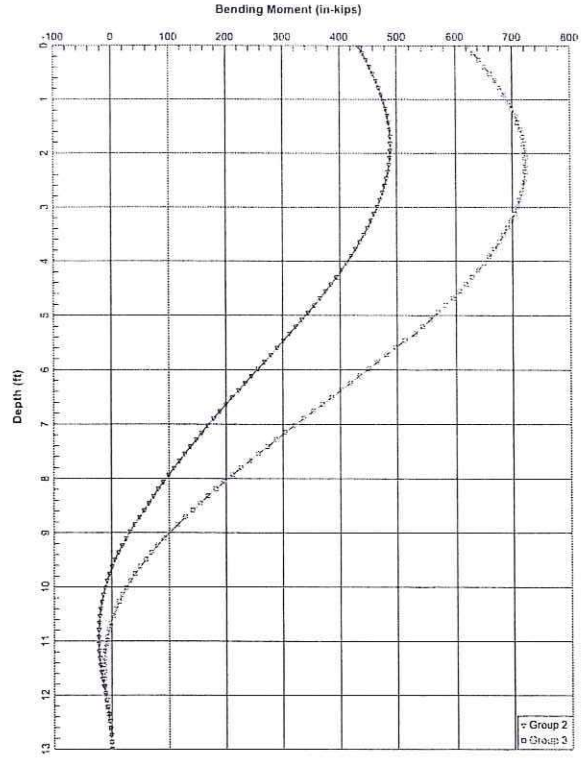
The following warning was reported 434 times

**** Warning ****

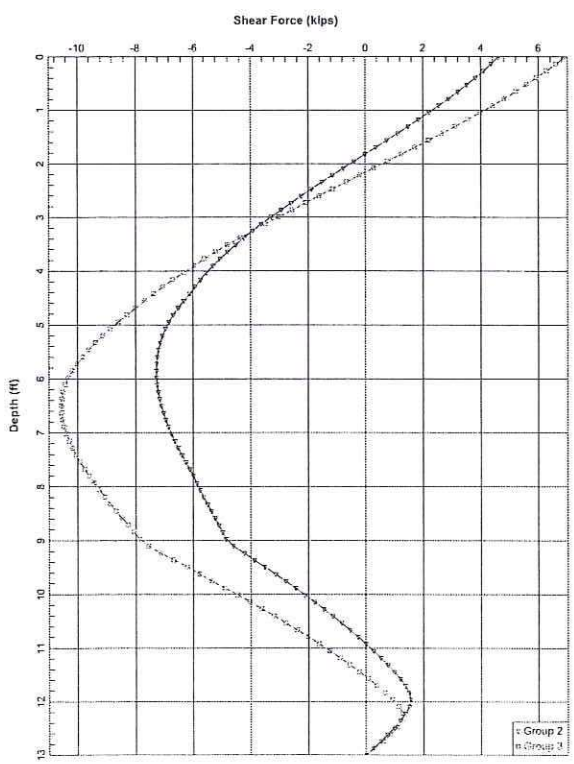
An unreasonable input value for shear strength has been specified for a soil defined using the soft clay criteria. The input value is greater than 8.68 psi (1.250 psf). You should check your input data for correctness.



Soundwall on Concrete Barrier Type 736S, Ground Condition = Case 1



Soundwall on Concrete Barrier Type 736S, Ground Condition = Case 1



Soundwall on Concrete Barrier Type 736S, Ground Condition = Case 1

```
==============================================================================

              LPile Plus for Windows, Version 6.0 (6.0.09)

               Analysis of Individual Piles and Drilled Shafts
              Subjected to Lateral Loading Using the p-y Method

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==============================================================================

This program is licensed to:

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------------------------------------------------------------------------------
                          Files Used for Analysis
------------------------------------------------------------------------------

Path to file locations:     X:\Projects\2011\11-137 - TRC, I-5 HOV Widening - Segment 3\Reports\06 GDR\Analyses\Lateral Capacity\
Name of input data file:    SW on Barrier 736S Case 2.lp6d
Name of output file:        SW on Barrier 736S Case 2.lp6o
Name of plot output file:   SW on Barrier 736S Case 2.lp6p
Name of runtime file:       SW on Barrier 736S Case 2.lp6r

------------------------------------------------------------------------------
                         Date and Time of Analysis
------------------------------------------------------------------------------

              Date:  March 8, 2012      Time:   9:50:20

------------------------------------------------------------------------------
                               Problem Title
------------------------------------------------------------------------------

Project Name:

Job Number:

Client:

Engineer:

Description:


------------------------------------------------------------------------------
                              Program Options
------------------------------------------------------------------------------

Units Used - US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes nonlinear bending stiffness and nominal Moment
  Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multiplers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output summary table of values for pile-head deflection, maximum
  bending moment, and shear force only
- Analysis assumes no soil movements acting on pile
- No p-y curves to be computed and output for user-specified depths

Solution Control Parameters:
- Number of pile increments                        =          100
- Maximum number of iterations allowed             =          100
- Deflection tolerance for convergence             =   1.0000E-05  in
- Maximum allowable deflection                     =     100.0000  in

Pile Response Output Options:
- Only summary tables of pile-head deflection, maximum bending moment,
  and maximum shear force are to be written to output report file.

------------------------------------------------------------------------------
                    Pile Structural Properties and Geometry
------------------------------------------------------------------------------

Total Number of Sections                           =           1
```

```
Total Pile Length                                        =     14.00 ft

Depth of ground surface below top of pile                =     -1.00 ft

Slope angle of ground surface                            =     26.60 deg.

Pile dimensions used for p-y curve computations defined using 2 points.
p-y curves are computed using values of pile diameter interpolated over
the length of the pile.

Point          Depth              Pile
                 X              Diameter
                 ft                in
-----        ---------         -----------
  1           0.00000          16.0000000
  2          14.000000         16.0000000

Input Structural Properties:
----------------------------

Section No. 1:

   Section Type                                          =    Elastic Pile
   Cross-sectional Shape                                 =       Circular
   Section Length                                        =         14.000 in
   Top Width                                             =         16.000 in
   Bottom Width                                          =         16.000 in
   Top Area                                              =     201.000000 sq. in
   Bottom Area                                           =     201.000000 sq. in
   Moment of Inertia at Top                              =      1.608E+03 in^4
   Moment of Inertia at Bottom                           =      1.608E+03 in^4
   Elastic Modulus                                       =    3200000.000 lbs/in

--------------------------------------------------------------------------------
                      Ground Slope and Pile Batter Angles
--------------------------------------------------------------------------------

Ground Slope Angle                                       =        26.600 degrees
                                                         =         0.464 radians

Pile Batter Angle                                        =         0.000 degrees
                                                         =         0.000 radians

--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer                =      -1.000 ft
Distance from top of pile to bottom of layer             =       9.000 ft
p-y subgrade modulus k for top of soil layer             =      90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer               =      90.000 lbs/in**3

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer                =       9.000 ft
Distance from top of pile to bottom of layer             =      34.000 ft

Layer 3 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer                =      34.000 ft
Distance from top of pile to bottom of layer             =      59.000 ft

(Depth of lowest layer extends   45.00 ft below pile tip)

--------------------------------------------------------------------------------
                     Effective Unit Weight of Soil vs. Depth
--------------------------------------------------------------------------------

Effective unit weight of soil with depth defined using 6 points

Point         Depth X     Eff. Unit Weight
 No.            ft              pcf
-----       ----------    ----------------
  1            -1.00         115.00000
  2             9.00         115.00000
  3             9.00         115.00000
```

4	34.00	115.00000
5	34.00	120.00000
6	59.00	120.00000

Summary of Soil Properties

Layer Num.	Soil Type (p-y Curve Criteria)	Depth ft	Eff. Unit Wt., pcf	Cohesion psf	Friction Ang., deg.	qu psi	RQD percent	Epsilon 50	kpy pci	Rock Emass psi	krm	Test Type	Test Prop.	Elas. Subgr. pci
1	Sand (Reese, et al.)	-1.000	115.000	--	32.000	--	--	--	90.000	--	--	--	--	--
		9.000	115.000	--	32.000	--	--	--	90.000	--	--	--	--	--
2	Soft Clay	9.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
		34.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
3	Soft Clay	34.000	120.000	3000.000	--	--	--	0.00500	--	--	--	--	--	--
		59.000	120.000	3000.000	--	--	--	0.00500	--	--	--	--	--	--

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.9000	1.0000
2	14.000	0.9000	1.0000

Loading Type

p-y criteria for static loading was used for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs
1	1	V = 2453.000 lbs	M = 231040.000 in-lbs	10027.000
2	1	V = 3680.000 lbs	M = 331520.000 in-lbs	10027.000

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust values were determined from pile-head loading conditions

Number of Sections = 1

Section No. 1:

Moment-Curvature properties derived from elastic section properties

Summary of Pile Response(s)

Definitions of Pile-Head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Condition 1 V(lbs) or y(inches)	Condition 2 in-lb, rad., or in-lb/rad.	Axial Load lbs	Pile-Head Deflection inches	Maximum Moment in-lbs	Maximum Shear lbs	Pile-Head Rotation radians

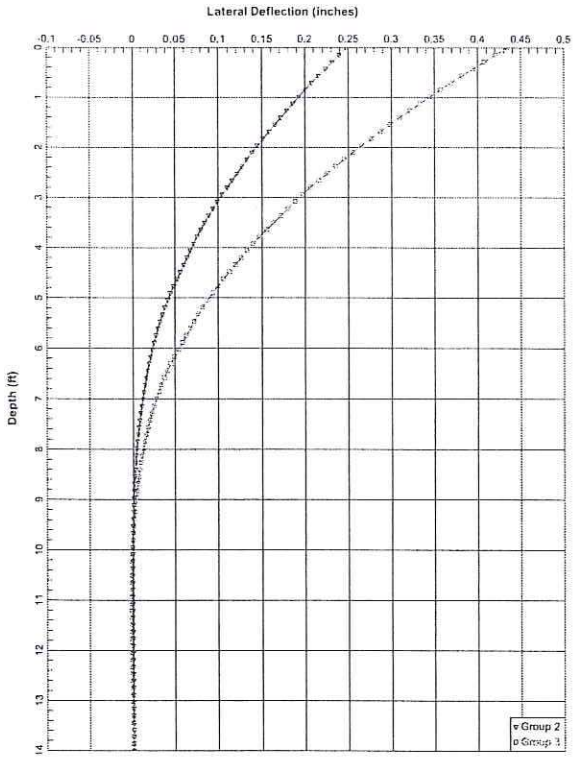
1	1	V = 2453.0000	M =	231040.	10027.	0.24743690	278506.	-4209.2948	0.00000000
2	1	V = 3680.0000	M =	331520.	10027.	0.43368176	415567.	-6421.0121	0.00000000

Summary of Warning Messages

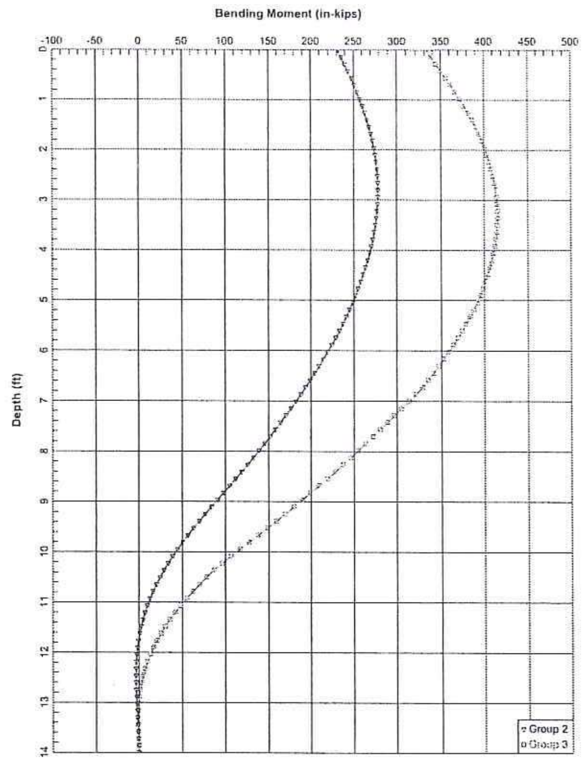
The following warning was reported 504 times

**** Warning ****

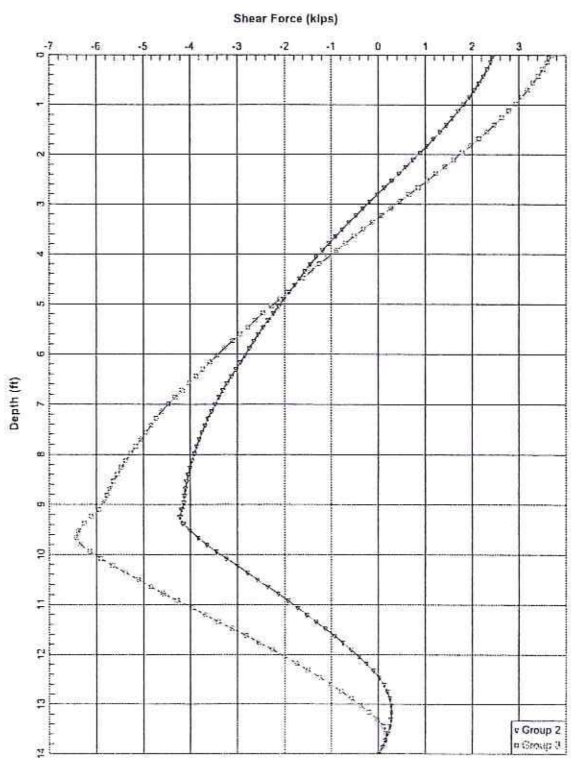
An unreasonable input value for shear strength has been specified for a soil defined using the soft clay criteria. The input value is greater than 8.68 psi (1.250 psf). You should check your input data for correctness.



Soundwall on Concrete Barrier Type 736S, Ground Condition = Case 2



Soundwall on Concrete Barrier Type 736S, Ground Condition = Case 2



Soundwall on Concrete Barrier Type 736S, Ground Condition = Case 2

```
================================================================================
               LPile Plus for Windows, Version 6.0 (6.0.09)

               Analysis of Individual Piles and Drilled Shafts
              Subjected to Lateral Loading Using the p-y Method

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================================================================================

This program is licensed to:

Earth Mechanics, Inc.
Earth Mechanics, Inc.

--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:      X:\Projects\2011\11-137 - TRC, I-5 HOV Widening - Segment 3\Reports\06 GDR\Appendix C Analyses\Lateral Capacity\SW 340\
Name of input data file:     SW on Barrier 736S Case 1 (24-inch).lp6d
Name of output file:         SW on Barrier 736S Case 1 (24-inch).lp6o
Name of plot output file:    SW on Barrier 736S Case 1 (24-inch).lp6p
Name of runtime file:        SW on Barrier 736S Case 1 (24-inch).lp6r

--------------------------------------------------------------------------------
                           Date and Time of Analysis
--------------------------------------------------------------------------------

             Date:  October 8, 2012     Time:   8:15:10

--------------------------------------------------------------------------------
                                 Problem Title
--------------------------------------------------------------------------------

Project Name:

Job Number:

Client:

Engineer:

Description:



--------------------------------------------------------------------------------
                                Program Options
--------------------------------------------------------------------------------

Units Used - US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes nonlinear bending stiffness and nominal Moment
  Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multipliers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output summary table of values for pile-head deflection, maximum
  bending moment, and shear force only
- Analysis assumes no soil movements acting on pile
- No p-y curves to be computed and output for user-specified depths

Solution Control Parameters:
- Number of pile increments                          =         100
- Maximum number of iterations allowed               =         100
- Deflection tolerance for convergence               =   1.0000E-05  in
- Maximum allowable deflection                       =    100.0000  in

Pile Response Output Options:
- Only summary tables of pile-head deflection, maximum bending moment,
  and maximum shear force are to be written to output report file.

--------------------------------------------------------------------------------
                      Pile Structural Properties and Geometry
--------------------------------------------------------------------------------

Total Number of Sections                             =           1
```

```
Total Pile Length                                       =      15.00 ft

Depth of ground surface below top of pile               =      -1.50 ft

Slope angle of ground surface                           =       0.00 deg.

Pile dimensions used for p-y curve computations defined using 2 points.
p-y curves are computed using values of pile diameter interpolated over
the length of the pile.

Point       Depth          Pile
              X          Diameter
              ft            in
-----     ---------    -----------
  1        0.00000     24.0000000
  2       15.000000    24.0000000

Input Structural Properties:
----------------------------

Section No. 1:

   Section Type                                         =   Elastic Pile
   Cross-sectional Shape                                =      Circular
   Section Length                                       =       15.000 in
   Top Width                                            =       24.000 in
   Bottom Width                                         =       24.000 in
   Top Area                                             =   452.000000 sq. in
   Bottom Area                                          =   452.000000 sq. in
   Moment of Inertia at Top                             =    8.143E+03 in^4
   Moment of Inertia at Bottom                          =    8.143E+03 in^4
   Elastic Modulus                                      =  3200000.000 lbs/in


--------------------------------------------------------------------------------
                      Ground Slope and Pile Batter Angles
--------------------------------------------------------------------------------

Ground Slope Angle                                      =       0.000 degrees
                                                        =       0.000 radians

Pile Batter Angle                                       =       0.000 degrees
                                                        =       0.000 radians


--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer               =      -1.500 ft
Distance from top of pile to bottom of layer            =       9.000 ft
p-y subgrade modulus k for top of soil layer            =      90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer              =      90.000 lbs/in**3

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer               =       9.000 ft
Distance from top of pile to bottom of layer            =      34.000 ft

Layer 3 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer               =      34.000 ft
Distance from top of pile to bottom of layer            =      59.000 ft

(Depth of lowest layer extends   44.00 ft below pile tip)

--------------------------------------------------------------------------------
                      Effective Unit Weight of Soil vs. Depth
--------------------------------------------------------------------------------

Effective unit weight of soil with depth defined using 6 points

Point       Depth X      Eff. Unit Weight
 No.          ft              pcf
-----     ----------    ----------------
  1          -1.50         115.00000
  2           9.00         115.00000
  3           9.00         115.00000
```

4	34.00	115.00000
5	34.00	120.00000
6	59.00	120.00000

Summary of Soil Properties

Layer Num.	Soil Type (p-y Curve Criteria)	Depth ft	Eff. Unit Wt., pcf	Cohesion psf	Friction Ang., deg.	qu psi	RQD percent	Epsilon 50	kpy pci	Rock Emass psi	krm	Test Type	Test Prop.	Elas. Subgr. pci
1	Sand (Reese, et al.)	-1.500	115.000	--	32.000	--	--	--	90.000	--	--	--	--	--
		9.000	115.000	--	32.000	--	--	--	90.000	--	--	--	--	--
2	Soft Clay	9.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
		34.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
3	Soft Clay	34.000	120.000	3000.000	--	--	--	0.00500	--	--	--	--	--	--
		59.000	120.000	3000.000	--	--	--	0.00500	--	--	--	--	--	--

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	1.0000	1.0000
2	13.000	1.0000	1.0000

Loading Type

p-y criteria for static loading was used for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs
1	1	V = 14800.000 lbs	M = 825600.000 in-lbs	33900.000
2	1	V = 13900.000 lbs	M = 1048800.000 in-lbs	33900.000

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust values were determined from pile-head loading conditions

Number of Sections = 1

Section No. 1:

Moment-Curvature properties derived from elastic section properties

Summary of Pile Response(s)

Definitions of Pile-Head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Condition 1 V(lbs) or y(inches)	Condition 2 in-lb, rad., or in-lb/rad.	Axial Load lbs	Pile-Head Deflection inches	Maximum Moment in-lbs	Maximum Shear lbs	Pile-Head Rotation radians

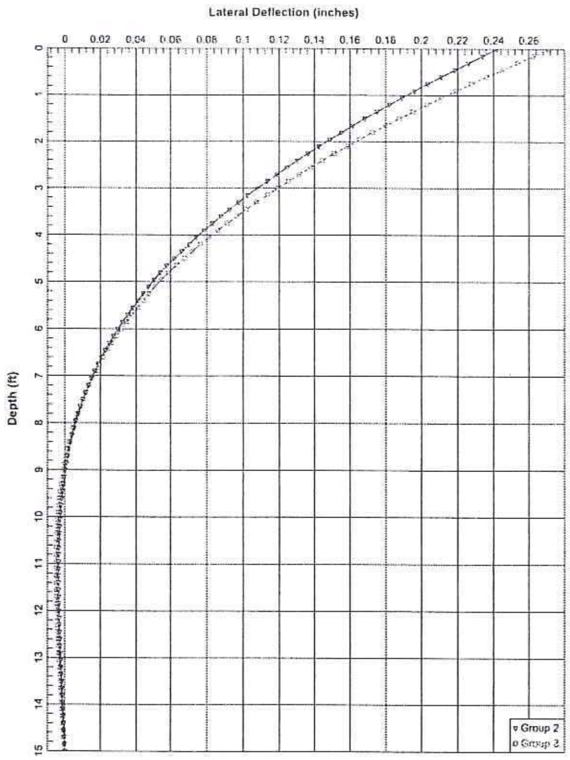
1	1	V =	14800.	M =	825600.	33900.	0.24173103	1174818.	14800.	0.00000000
2	1	V =	13900.	M =	1048800.	33900.	0.27135140	1353625.	-16480.	0.00000000

Summary of Warning Messages

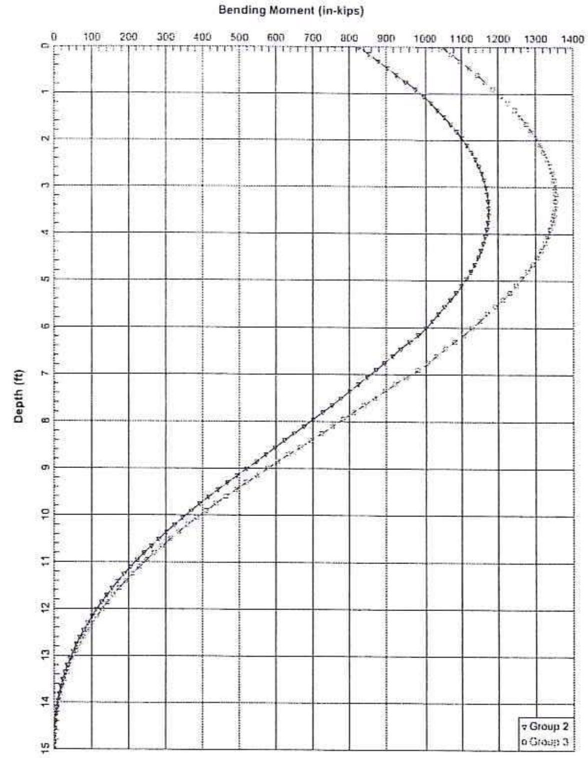
The following warning was reported 480 times

**** Warning ****

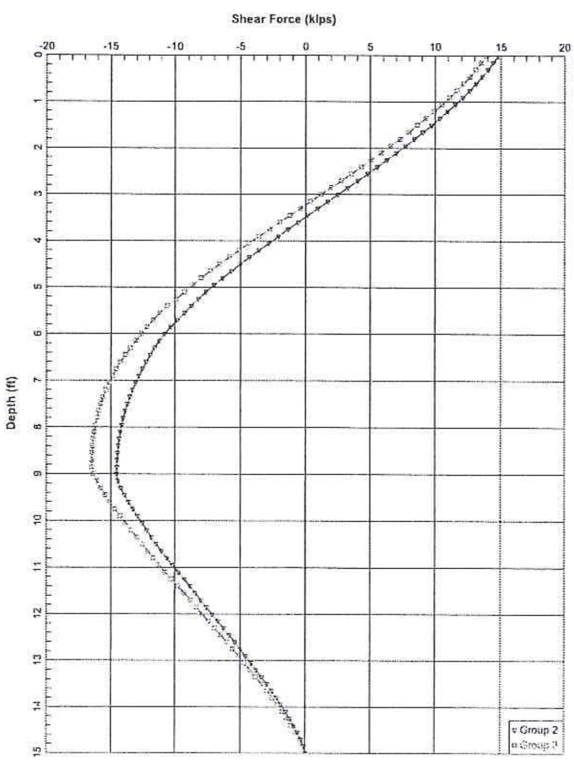
An unreasonable input value for shear strength has been specified for a soil defined using the soft clay criteria. The input value is greater than 8.68 psi (1,250 psf). You should check your input data for correctness.



Soundwall on Concrete Barrier Type 736S, Ground Condition = Case 1 (24-inch CIDH)



Soundwall on Concrete Barrier Type 736S, Ground Condition = Case 1 (24-inch CIDH)



Soundwall on Concrete Barrier Type 736S, Ground Condition = Case 1 (24-inch CIDH)

```
================================================================================
              LPile Plus for Windows, Version 6.0 (6.0.09)

              Analysis of Individual Piles and Drilled Shafts
             Subjected to Lateral Loading Using the p-y Method

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================================================================================

This program is licensed to:

Earth Mechanics, Inc.
Earth Mechanics, Inc.

--------------------------------------------------------------------------------
                          Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:      X:\Projects\2011\11-137 - TRC, I-5 HOV Widening - Segment 3\Reports\06 GDR\Appendix C Analyses\Lateral Capacity\SW 340\
Name of input data file:     SW on Barrier 736S Case 2 (24-inch).lp6d
Name of output file:         SW on Barrier 736S Case 2 (24-inch).lp6o
Name of plot output file:    SW on Barrier 736S Case 2 (24-inch).lp6p
Name of runtime file:        SW on Barrier 736S Case 2 (24-inch).lp6r

--------------------------------------------------------------------------------
                         Date and Time of Analysis
--------------------------------------------------------------------------------

              Date:  October 8, 2012     Time:   8:26:30

--------------------------------------------------------------------------------
                               Problem Title
--------------------------------------------------------------------------------

Project Name:

Job Number:

Client:

Engineer:

Description:


--------------------------------------------------------------------------------
                              Program Options
--------------------------------------------------------------------------------

Units Used - US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes nonlinear bending stiffness and nominal Moment
  Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multiplers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output summary table of values for pile-head deflection, maximum
  bending moment, and shear force only
- Analysis assumes no soil movements acting on pile
- No p-y curves to be computed and output for user-specified depths

Solution Control Parameters:
- Number of pile increments                       =          100
- Maximum number of iterations allowed            =          100
- Deflection tolerance for convergence            =   1.0000E-05  in
- Maximum allowable deflection                    =     100.0000  in

Pile Response Output Options:
- Only summary tables of pile-head deflection, maximum bending moment,
  and maximum shear force are to be written to output report file.

--------------------------------------------------------------------------------
                    Pile Structural Properties and Geometry
--------------------------------------------------------------------------------

Total Number of Sections                          =            1
```

Total Pile Length = 18.00 ft

Depth of ground surface below top of pile = -1.00 ft

Slope angle of ground surface = 26.60 deg.

Pile dimensions used for p-y curve computations defined using 2 points.
p-y curves are computed using values of pile diameter interpolated over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	24.0000000
2	18.000000	24.0000000

Input Structural Properties:

Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Circular
Section Length	=	18.000 in
Top Width	=	24.000 in
Bottom Width	=	24.000 in
Top Area	=	452.000000 sq. in
Bottom Area	=	452.000000 sq. in
Moment of Inertia at Top	=	8.143E+03 in^4
Moment of Inertia at Bottom	=	8.143E+03 in^4
Elastic Modulus	=	3200000.000 lbs/in

Ground Slope and Pile Batter Angles

Ground Slope Angle = 26.600 degrees
= 0.464 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = -1.000 ft
Distance from top of pile to bottom of layer = 9.000 ft
p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer = 9.000 ft
Distance from top of pile to bottom of layer = 34.000 ft

Layer 3 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer = 34.000 ft
Distance from top of pile to bottom of layer = 59.000 ft

(Depth of lowest layer extends 41.00 ft below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 6 points

Point No.	Depth X ft	Eff. Unit Weight pcf
1	-1.00	115.00000
2	9.00	115.00000
3	9.00	115.00000

4	34.00	115.00000
5	34.00	120.00000
6	59.00	120.00000

Summary of Soil Properties

Layer Num.	Soil Type (p-y Curve Criteria)	Depth ft	Eff. Unit Wt., pcf	Cohesion psf	Friction Ang., deg.	qu psi	RQD percent	Epsilon 50	kpy pci	Rock Emass psi	krm	Test Type	Test Prop.	Elas. Subgr. pci
1	Sand (Reese, et al.)	-1.000	115.000	--	32.000	--	--	--	90.000	--	--	--	--	--
		9.000	115.000	--	32.000	--	--	--	90.000	--	--	--	--	--
2	Soft Clay	9.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
		34.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
3	Soft Clay	34.000	120.000	3000.000	--	--	--	0.00500	--	--	--	--	--	--
		59.000	120.000	3000.000	--	--	--	0.00500	--	--	--	--	--	--

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.9000	1.0000
2	14.000	0.9000	1.0000

Loading Type

p-y criteria for static loading was used for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs
1	1	V = 11840.000 lbs	M = 660480.000 in-lbs	27120.000
2	1	V = 11120.000 lbs	M = 839040.000 in-lbs	27120.000

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust values were determined from pile-head loading conditions

Number of Sections = 1

Section No. 1:

Moment-Curvature properties derived from elastic section properties

Summary of Pile Response(s)

Definitions of Pile-Head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Condition 1 V(lbs) or y(inches)	Condition 2 in-lb, rad., or in-lb/rad.	Axial Load lbs	Pile-Head Deflection inches	Maximum Moment in-lbs	Maximum Shear lbs	Pile-Head Rotation radians

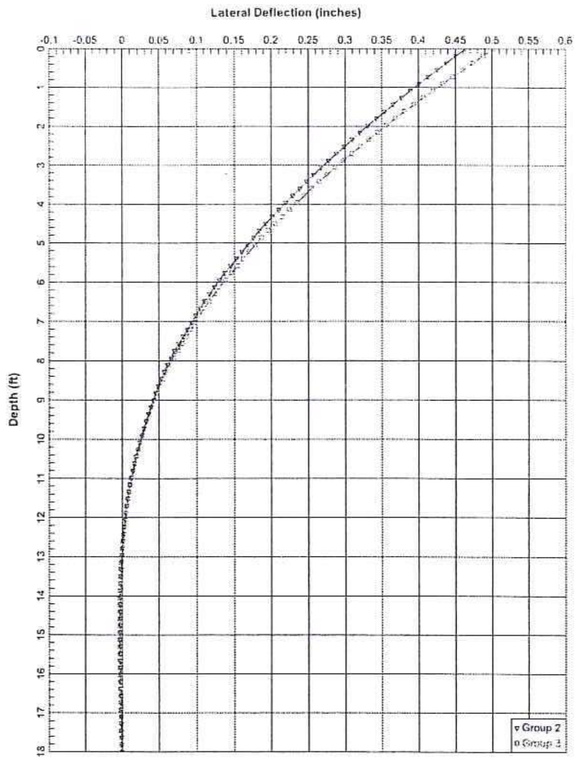
1	1	V =	11840.	M =	660480.	27120.	0.46295488	1139800.	-15314.	0.00000000
2	1	V =	11120.	M =	839040.	27120.	0.50165787	1263015.	-16356.	0.00000000

Summary of Warning Messages

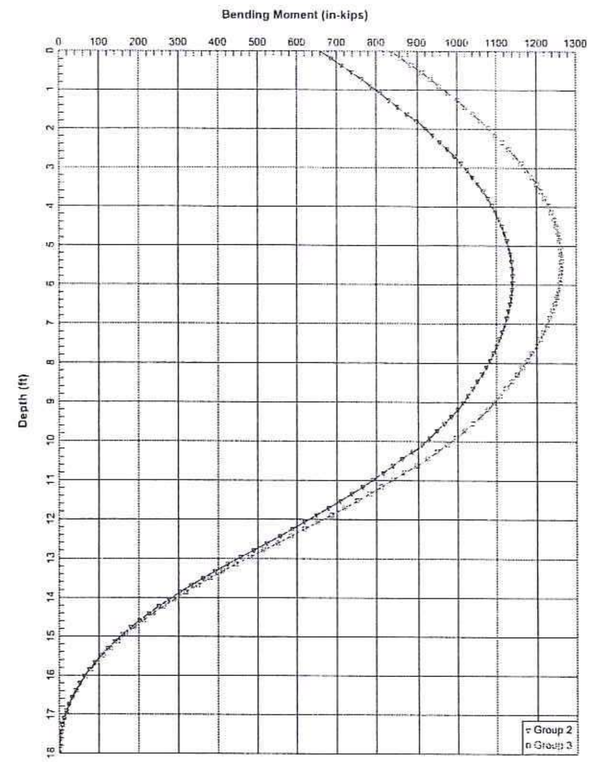
The following warning was reported 950 times

**** Warning ****

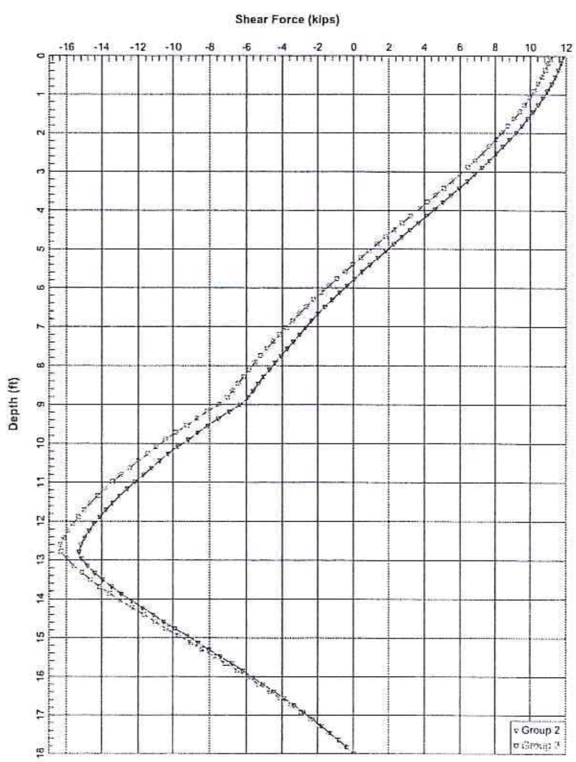
An unreasonable input value for shear strength has been specified for a soil defined using the soft clay criteria. The input value is greater than 8.68 psi (1,250 psf). You should check your input data for correctness.



Soundwall on Concrete Barrier Type 736S, Ground Condition = Case 2 (24-inch CIDH)



Soundwall on Concrete Barrier Type 736S, Ground Condition = Case 2 (24-inch CIDH)



Soundwall on Concrete Barrier Type 736S, Ground Condition = Case 2 (24-inch CIDH)

Soundwall 340

Lateral Pile Analyses for Soundwall on Barrier Type 736SV

```
================================================================================
              LPile Plus for Windows, Version 6.0 (6.0.09)

              Analysis of Individual Piles and Drilled Shafts
              Subjected to Lateral Loading Using the p-y Method

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================================================================================

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Earth Mechanics, Inc.

--------------------------------------------------------------------------------
                          Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:      X:\Projects\2011\11-137 - TRC, I-5 HOV Widening - Segment 3\Reports\06 GDR\Analyses\Lateral Capacity\
Name of input data file:     SW on Barrier 736SV Case 1.lp6d
Name of output file:         SW on Barrier 736SV Case 1.lp6o
Name of plot output file:    SW on Barrier 736SV Case 1.lp6p
Name of runtime file:        SW on Barrier 736SV Case 1.lp6r

--------------------------------------------------------------------------------
                         Date and Time of Analysis
--------------------------------------------------------------------------------

             Date:  March 8, 2012      Time:  11:35:25

--------------------------------------------------------------------------------
                               Problem Title
--------------------------------------------------------------------------------

Project Name:

Job Number:

Client:

Engineer:

Description:


--------------------------------------------------------------------------------
                              Program Options
--------------------------------------------------------------------------------

Units Used - US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes nonlinear bending stiffness and nominal Moment
  Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multipliers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output summary table of values for pile-head deflection, maximum
  bending moment, and shear force only
- Analysis assumes no soil movements acting on pile
- No p-y curves to be computed and output for user-specified depths

Solution Control Parameters:
- Number of pile increments                        =          100
- Maximum number of iterations allowed             =          100
- Deflection tolerance for convergence             =   1.0000E-05  in
- Maximum allowable deflection                     =     100.0000  in

Pile Response Output Options:
- Only summary tables of pile-head deflection, maximum bending moment,
  and maximum shear force are to be written to output report file.

--------------------------------------------------------------------------------
                    Pile Structural Properties and Geometry
--------------------------------------------------------------------------------

Total Number of Sections                           =            1
```

Total Pile Length = 14.00 ft

Depth of ground surface below top of pile = -2.50 ft

Slope angle of ground surface = 0.00 deg.

Pile dimensions used for p-y curve computations defined using 2 points. p-y curves are computed using values of pile diameter interpolated over the length of the pile.

Point	Depth x ft	Pile Diameter in
1	0.00000	16.0000000
2	14.000000	16.0000000

Input Structural Properties:

Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Circular
Section Length	=	14.000 in
Top Width	=	16.000 in
Bottom Width	=	16.000 in
Top Area	=	201.000000 sq. in
Bottom Area	=	201.000000 sq. in
Moment of Inertia at Top	=	1.608E+03 in^4
Moment of Inertia at Bottom	=	1.608E+03 in^4
Elastic Modulus	=	3200000.000 lbs/in

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	-2.500 ft
Distance from top of pile to bottom of layer	=	9.000 ft
p-y subgrade modulus k for top of soil layer	=	90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer	=	90.000 lbs/in**3

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	9.000 ft
Distance from top of pile to bottom of layer	=	34.000 ft

Layer 3 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	34.000 ft
Distance from top of pile to bottom of layer	=	59.000 ft

(Depth of lowest layer extends 45.00 ft below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 6 points

Point No.	Depth x ft	Eff. Unit Weight pcf
1	-2.50	115.00000
2	9.00	115.00000
3	9.00	115.00000

4	34.00	115.00000
5	34.00	120.00000
6	59.00	120.00000

Summary of Soil Properties

Layer Num.	Soil Type (p-y Curve Criteria)	Depth ft	Eff. Unit Wt., pcf	Cohesion psf	Friction Ang., deg.	qu psi	RQD percent	Epsilon 50	kpy pci	Rock Emass psi	krm	Test Type	Test Prop.	Elas. Subgr. pci
1	Sand (Reese, et al.)	-2.500	115.000	--	32.000	--	--	--	90.000	--	--	--	--	--
		9.000	115.000	--	32.000	--	--	--	90.000	--	--	--	--	--
2	Soft Clay	9.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
		34.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
3	Soft Clay	34.000	120.000	3000.000	--	--	--	0.00500	--	--	--	--	--	--
		59.000	120.000	3000.000	--	--	--	0.00500	--	--	--	--	--	--

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.9000	1.0000
2	14.000	0.9000	1.0000

Loading Type

p-y criteria for static loading was used for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs
1	1	V = 5440.000 lbs	M = 404480.000 in-lbs	14080.000
2	1	V = 8800.000 lbs	M = 513280.000 in-lbs	14080.000

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust values were determined from pile-head loading conditions

Number of Sections = 1

Section No. 1:

Moment-Curvature properties derived from elastic section properties

Summary of Pile Response(s)

Definitions of Pile-Head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Condition 1 V(lbs) or y(inches)	Condition 2 in-lb, rad., or in-lb/rad.	Axial Load lbs	Pile-Head Deflection inches	Maximum Moment in-lbs	Maximum Shear lbs	Pile-Head Rotation radians

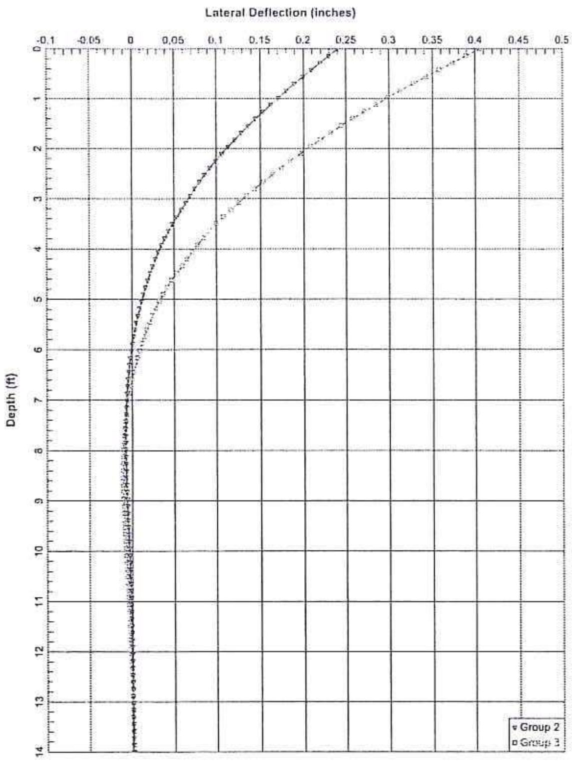
1	1	V =	5440.0000	M =	404480.	14080.	0.24029211	467463.	-6988.4569	0.00000000
2	1	V =	8800.0000	M =	513280.	14080.	0.40507342	646763.	-9809.8210	0.00000000

Summary of Warning Messages

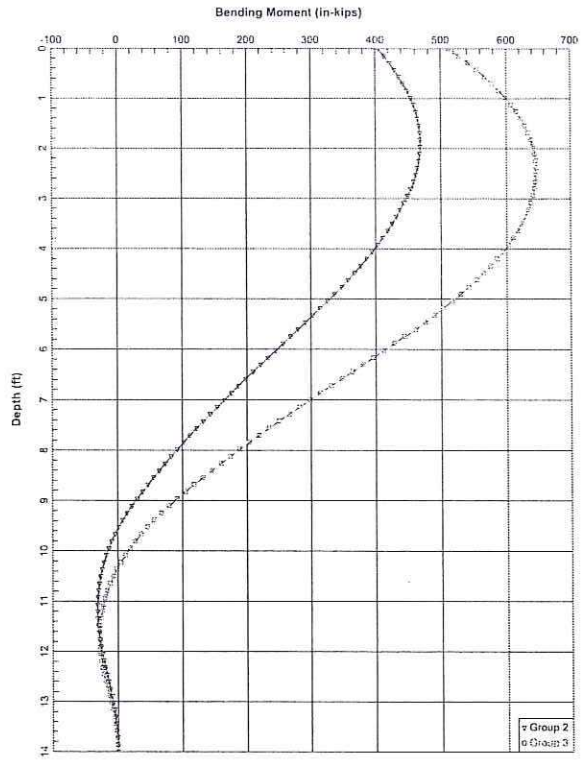
The following warning was reported 468 times

**** Warning ****

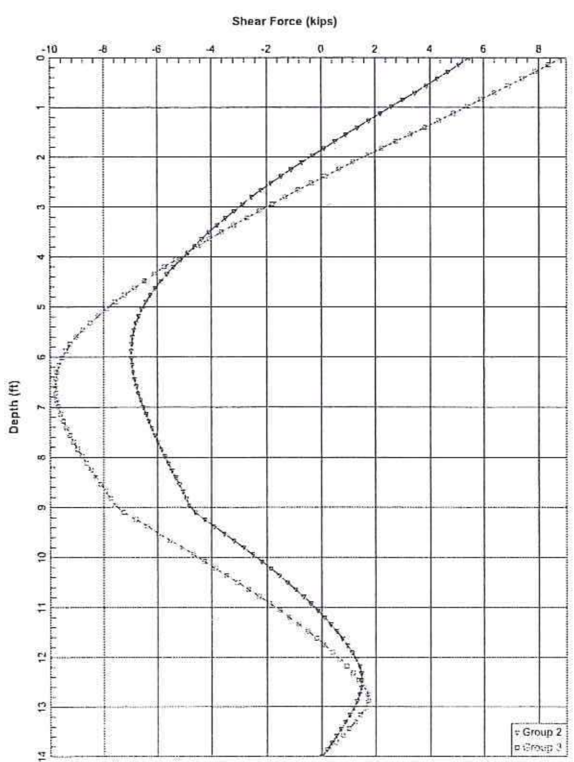
An unreasonable input value for shear strength has been specified for a soil defined using the soft clay criteria. The input value is greater than 8.68 psi (1,250 psf). You should check your input data for correctness.



Soundwall on Concrete Barrier Type 736SV, Ground Condition = Case 1



Soundwall on Concrete Barrier Type 736SV, Ground Condition = Case 1



Soundwall on Concrete Barrier Type 736SV, Ground Condition = Case 1

```
================================================================================

              LPile Plus for Windows, Version 6.0 (6.0.09)

              Analysis of Individual Piles and Drilled Shafts
             Subjected to Lateral Loading Using the p-y Method

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                          All Rights Reserved

================================================================================

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Earth Mechanics, Inc.

--------------------------------------------------------------------------------
                          Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:      X:\Projects\2011\11-137 - TRC, I-5 HOV Widening - Segment 3\Reports\06 GDR\Analyses\Lateral Capacity\
Name of input data file:     SW on Barrier 736SV Case 2.lp6d
Name of output file:         SW on Barrier 736SV Case 2.lp6o
Name of plot output file:    SW on Barrier 736SV Case 2.lp6p
Name of runtime file:        SW on Barrier 736SV Case 2.lp6r

--------------------------------------------------------------------------------
                         Date and Time of Analysis
--------------------------------------------------------------------------------

             Date:  March 8, 2012      Time:  11:41:00

--------------------------------------------------------------------------------
                               Problem Title
--------------------------------------------------------------------------------

Project Name:

Job Number:

Client:

Engineer:

Description:


--------------------------------------------------------------------------------
                              Program Options
--------------------------------------------------------------------------------

Units Used - US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes nonlinear bending stiffness and nominal Moment
  Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multipliers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output summary table of values for pile-head deflection, maximum
  bending moment, and shear force only
- Analysis assumes no soil movements acting on pile
- No p-y curves to be computed and output for user-specified depths

Solution Control Parameters:
- Number of pile increments                     =          100
- Maximum number of iterations allowed          =          100
- Deflection tolerance for convergence          =   1.0000E-05  in
- Maximum allowable deflection                  =     100.0000  in

Pile Response Output Options:
- Only summary tables of pile-head deflection, maximum bending moment,
  and maximum shear force are to be written to output report file.

--------------------------------------------------------------------------------
                   Pile Structural Properties and Geometry
--------------------------------------------------------------------------------

Total Number of Sections                        =            1
```

Total Pile Length	=	14.00 ft
Depth of ground surface below top of pile	=	-1.00 ft
Slope angle of ground surface	=	0.00 deg.

Pile dimensions used for p-y curve computations defined using 2 points.
p-y curves are computed using values of pile diameter interpolated over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	16.0000000
2	14.000000	16.0000000

Input Structural Properties:

Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Circular
Section Length	=	14.000 in
Top Width	=	16.000 in
Bottom Width	=	16.000 in
Top Area	=	201.000000 sq. in
Bottom Area	=	201.000000 sq. in
Moment of Inertia at Top	=	1.608E+03 in^4
Moment of Inertia at Bottom	=	1.608E+03 in^4
Elastic Modulus	=	3200000.000 lbs/in

Ground Slope and Pile Batter Angles

Ground Slope Angle	=	0.000 degrees
	=	0.000 radians
Pile Batter Angle	=	0.000 degrees
	=	0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	-1.000 ft
Distance from top of pile to bottom of layer	=	9.000 ft
p-y subgrade modulus k for top of soil layer	=	90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer	=	90.000 lbs/in**3

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	9.000 ft
Distance from top of pile to bottom of layer	=	34.000 ft

Layer 3 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	34.000 ft
Distance from top of pile to bottom of layer	=	59.000 ft

(Depth of lowest layer extends 45.00 ft below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 6 points

Point No.	Depth X ft	Eff. Unit Weight pcf
1	-1.00	115.00000
2	9.00	115.00000
3	9.00	115.00000

4	34.00	115.00000
5	34.00	120.00000
6	59.00	120.00000

Summary of Soil Properties

Layer Num.	Soil Type (p-y Curve Criteria)	Depth ft	Eff. Unit Wt., pcf	Cohesion psf	Friction Ang., deg.	qu psi	RQD percent	Epsilon 50	kpy pci	Rock Emass psi	krm	Test Type	Test Prop.	Elas. Subgr. pci
1	Sand (Reese, et al.)	-1.000	115.000	--	32.000	--	--	--	90.000	--	--	--	--	--
		9.000	115.000	--	32.000	--	--	--	90.000	--	--	--	--	--
2	Soft Clay	9.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
		34.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
3	Soft Clay	34.000	120.000	3000.000	--	--	--	0.00500	--	--	--	--	--	--
		59.000	120.000	3000.000	--	--	--	0.00500	--	--	--	--	--	--

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.7000	1.0000
2	14.000	0.7000	1.0000

Loading Type

p-y criteria for static loading was used for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs
1	1	V = 4080.000 lbs	M = 303360.000 in-lbs	10560.000
2	1	V = 6600.000 lbs	M = 384960.000 in-lbs	10560.000

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust values were determined from pile-head loading conditions

Number of Sections = 1

Section No. 1:

Moment-Curvature properties derived from elastic section properties

Summary of Pile Response(s)

Definitions of Pile-Head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Condition 1 V(lbs) or y(inches)	Condition 2 in-lb, rad., or in-lb/rad.	Axial Load lbs	Pile-Head Deflection inches	Maximum Moment in-lbs	Maximum Shear lbs	Pile-Head Rotation radians

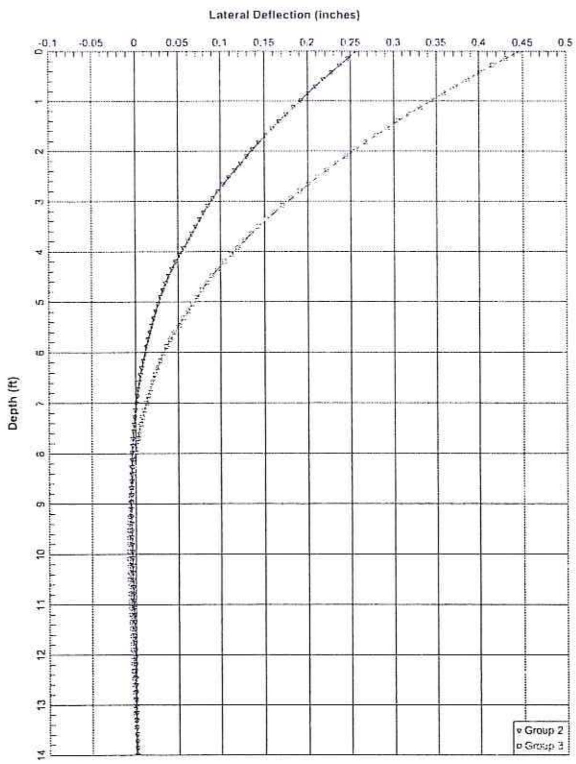
1	1	V =	4080.0000	M =	303360.	10560.	0.25612993	374492.	-5361.0942	0.00000000
2	1	V =	6600.0000	M =	384960.	10560.	0.44569640	528443.	-7683.1569	0.00000000

Summary of Warning Messages

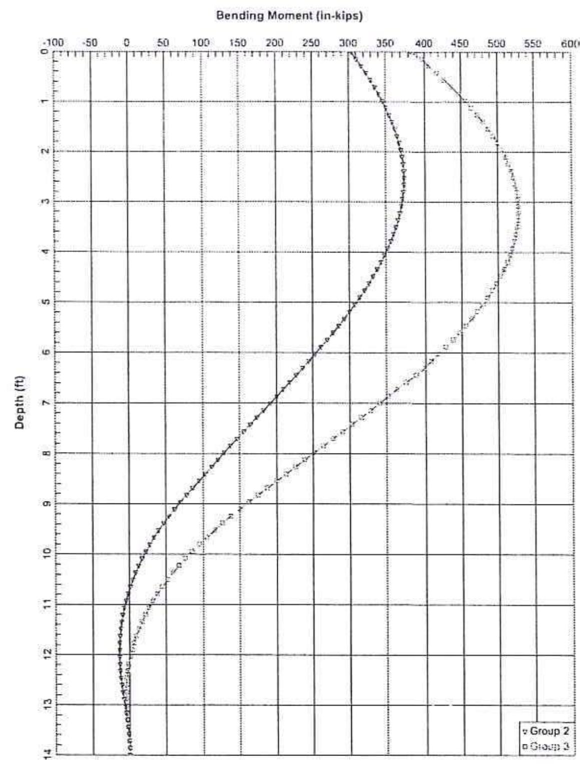
The following warning was reported 504 times

**** Warning ****

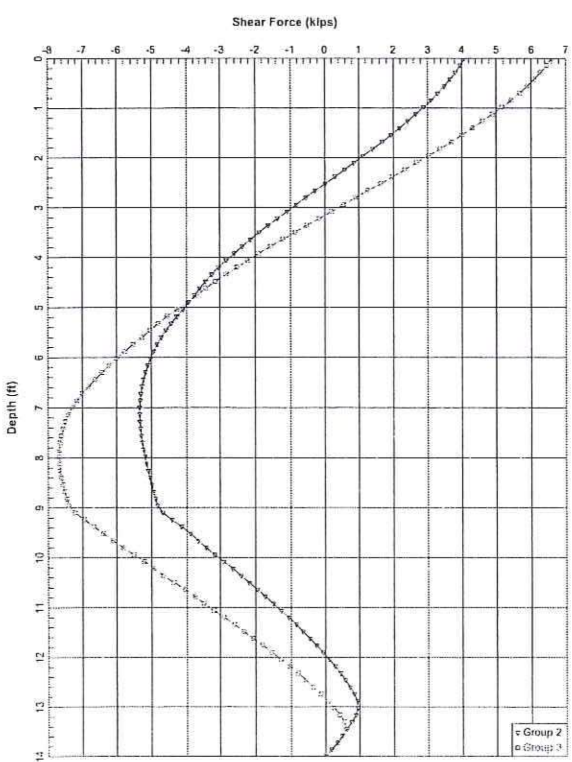
An unreasonable input value for shear strength has been specified for a soil defined using the soft clay criteria. The input value is greater than 8.68 psi (1,250 psf). You should check your input data for correctness.



Soundwall on Concrete Barrier Type 736SV, Ground Condition = Case 2



Soundwall on Concrete Barrier Type 736SV, Ground Condition = Case 2



Soundwall on Concrete Barrier Type 736SV, Ground Condition = Case 2

Soundwall 361

Lateral Pile Analyses for Soundwall on Pile Cap

```
===============================================================================

             LPile Plus for Windows, Version 6.0 (6.0.09)

              Analysis of Individual Piles and Drilled Shafts
             Subjected to Lateral Loading Using the p-y Method

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                           All Rights Reserved

===============================================================================

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-------------------------------------------------------------------------------
                          Files Used for Analysis
-------------------------------------------------------------------------------

Path to file locations:     X:\Projects\2011\11-137 - TRC, I-5 HOV Widening - Segment 3\Reports\06 GDR\Analyses\Lateral Capacity\SW 361\
Name of input data file:    SW 361 on Pile Cap Case 1.lp6d
Name of output file:        SW 361 on Pile Cap Case 1.lp6o
Name of plot output file:   SW 361 on Pile Cap Case 1.lp6p
Name of runtime file:       SW 361 on Pile Cap Case 1.lp6r

-------------------------------------------------------------------------------
                         Date and Time of Analysis
-------------------------------------------------------------------------------

             Date:  March 24, 2012     Time:  16:57:50

-------------------------------------------------------------------------------
                              Problem Title
-------------------------------------------------------------------------------

Project Name:

Job Number:

Client:

Engineer:

Description:


-------------------------------------------------------------------------------
                             Program Options
-------------------------------------------------------------------------------

Units Used - US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes nonlinear bending stiffness and nominal Moment
  Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multiplers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output summary table of values for pile-head deflection, maximum
  bending moment, and shear force only
- Analysis assumes no soil movements acting on pile
- No p-y curves to be computed and output for user-specified depths

Solution Control Parameters:
- Number of pile increments                    =          100
- Maximum number of iterations allowed         =          100
- Deflection tolerance for convergence         =   1.0000E-05  in
- Maximum allowable deflection                 =     100.0000  in

Pile Response Output Options:
- Only summary tables of pile-head deflection, maximum bending moment,
  and maximum shear force are to be written to output report file.

-------------------------------------------------------------------------------
                  Pile Structural Properties and Geometry
-------------------------------------------------------------------------------

Total Number of Sections                       =          1
```

Total Pile Length = 12.00 ft

Depth of ground surface below top of pile = -2.00 ft

Slope angle of ground surface = 0.00 deg.

Pile dimensions used for p-y curve computations defined using 2 points. p-y curves are computed using values of pile diameter interpolated over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	16.0000000
2	12.000000	16.0000000

Input Structural Properties:

Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Circular
Section Length	=	12.000 in
Top Width	=	16.000 in
Bottom Width	=	16.000 in
Top Area	=	201.000000 sq. in
Bottom Area	=	201.000000 sq. in
Moment of Inertia at Top	=	1.608E+03 in^4
Moment of Inertia at Bottom	=	1.608E+03 in^4
Elastic Modulus	=	3200000.000 lbs/in

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	-2.000 ft
Distance from top of pile to bottom of layer	=	8.000 ft
p-y subgrade modulus k for top of soil layer	=	90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer	=	90.000 lbs/in**3

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	8.000 ft
Distance from top of pile to bottom of layer	=	32.000 ft

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	32.000 ft
Distance from top of pile to bottom of layer	=	55.000 ft
p-y subgrade modulus k for top of soil layer	=	70.000 lbs/in**3
p-y subgrade modulus k for bottom of layer	=	70.000 lbs/in**3

(Depth of lowest layer extends 43.00 ft below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 6 points

Point No.	Depth X ft	Eff. Unit Weight pcf
1	-2.00	115.00000

2	8.00	115.00000
3	8.00	115.00000
4	32.00	115.00000
5	32.00	120.00000
6	55.00	120.00000

Summary of Soil Properties

Layer Num.	Soil Type (p-y Curve Criteria)	Depth ft	Eff. Unit Wt., pcf	Cohesion psf	Friction Ang., deg.	qu psi	RQD percent	Epsilon 50	kpy pci	Rock Emass psi	krm	Test Type	Test Prop.	Elas. Subgr. pci
1	Sand (Reese, et al.)	-2.000	115.000	--	32.000	--	--	--	90.000	--	--	--	--	--
		8.000	115.000	--	32.000	--	--	--	90.000	--	--	--	--	--
2	Soft Clay	8.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
		32.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
3	Sand (Reese, et al.)	32.000	120.000	--	30.000	--	--	--	70.000	--	--	--	--	--
		55.000	120.000	--	30.000	--	--	--	70.000	--	--	--	--	--

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	1.0000	1.0000
2	12.000	1.0000	1.0000

Loading Type

p-y criteria for static loading was used for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs
1	1	V = 5600.000 lbs	M = 336000.000 in-lbs	26400.000
2	1	V = 12200.000 lbs	M = 631200.000 in-lbs	26400.000

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust values were determined from pile-head loading conditions

Number of Sections = 1

Section No. 1:

Moment-Curvature properties derived from elastic section properties

Summary of Pile Response(s)

Definitions of Pile-Head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Load Condition 1 Condition 2 Axial Pile-Head Maximum Maximum Pile-Head

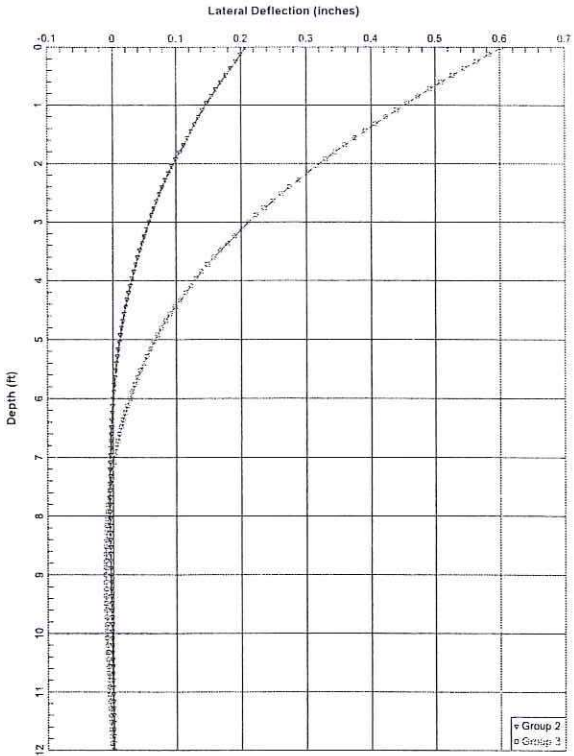
Case No.	Type No.	V(lbs) or y(inches)	in-lb, rad., or in-lb/rad.	Load lbs	Deflection inches	Moment in-lbs	Shear lbs	Rotation radians
1	1	V = 5600.0000	M = 336000.	26400.	0.20742415	408662.	-6430.6925	0.00000000
2	1	V = 12200.	M = 631200.	26400.	0.60255249	853860.	-13436.	0.00000000

Summary of Warning Messages

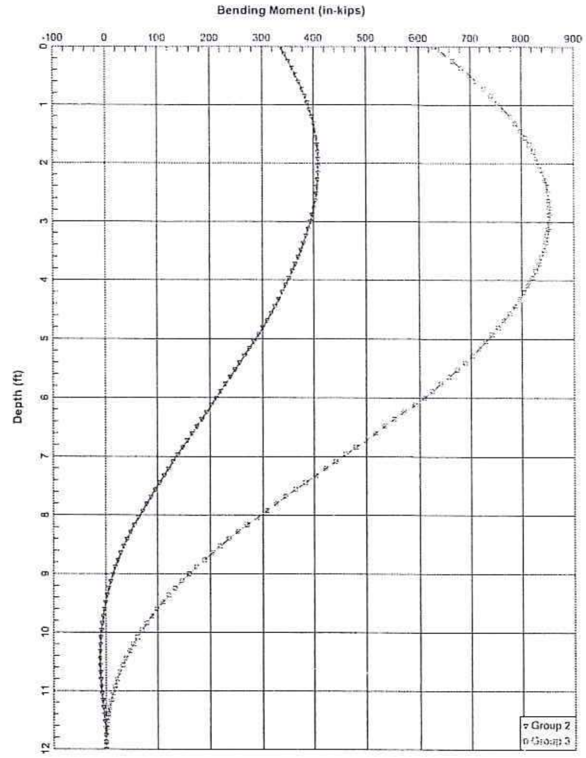
The following warning was reported 612 times

**** Warning ****

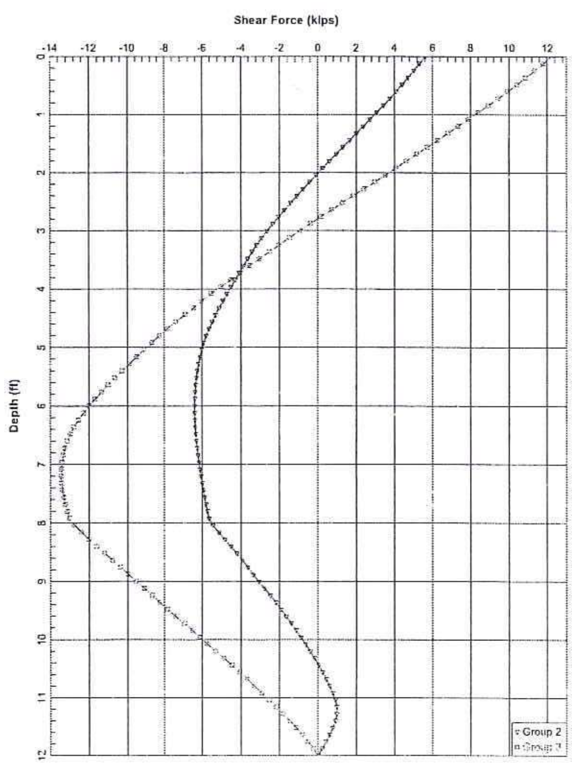
An unreasonable input value for shear strength has been specified for a soil defined using the soft clay criteria. The input value is greater than 8.68 psi (1.250 psf). You should check your input data for correctness.



Soundwall 361 on Pile Cap, Ground Condition = Case 1



Soundwall 361 on Pile Cap, Ground Condition = Case 1



Soundwall 361 on Pile Cap, Ground Condition = Case 1

```
===============================================================================
              LPile Plus for Windows, Version 6.0 (6.0.09)

              Analysis of Individual Piles and Drilled Shafts
              Subjected to Lateral Loading Using the p-y Method

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===============================================================================

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-------------------------------------------------------------------------------
                         Files Used for Analysis
-------------------------------------------------------------------------------

Path to file locations:     X:\Projects\2011\11-137 - TRC, I-5 HOV Widening - Segment 3\Reports\06 GDR\Analyses\Lateral Capacity\SW 361\
Name of input data file:    SW 361 on Pile Cap Case 2.lp6d
Name of output file:        SW 361 on Pile Cap Case 2.lp6o
Name of plot output file:   SW 361 on Pile Cap Case 2.lp6p
Name of runtime file:       SW 361 on Pile Cap Case 2.lp6r

-------------------------------------------------------------------------------
                        Date and Time of Analysis
-------------------------------------------------------------------------------

             Date:  March 24, 2012     Time:  17:08:16

-------------------------------------------------------------------------------
                             Problem Title
-------------------------------------------------------------------------------

Project Name:

Job Number:

Client:

Engineer:

Description:


-------------------------------------------------------------------------------
                            Program Options
-------------------------------------------------------------------------------

Units Used - US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes nonlinear bending stiffness and nominal Moment
  Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multiplers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output summary table of values for pile-head deflection, maximum
  bending moment, and shear force only
- Analysis assumes no soil movements acting on pile
- No p-y curves to be computed and output for user-specified depths

Solution Control Parameters:
- Number of pile increments                        =         100
- Maximum number of iterations allowed             =         100
- Deflection tolerance for convergence             =   1.0000E-05  in
- Maximum allowable deflection                     =     100.0000  in

Pile Response Output Options:
- Only summary tables of pile-head deflection, maximum bending moment,
  and maximum shear force are to be written to output report file.

-------------------------------------------------------------------------------
                  Pile Structural Properties and Geometry
-------------------------------------------------------------------------------

Total Number of Sections                           =          1
```

```
Total Pile Length                                      =      13.00 ft

Depth of ground surface below top of pile              =      -3.00 ft

Slope angle of ground surface                          =      26.60 deg.

Pile dimensions used for p-y curve computations defined using 2 points.
p-y curves are computed using values of pile diameter interpolated over
the length of the pile.

Point         Depth             Pile
                X             Diameter
               ft                in
-----       ---------        -----------
  1           0.00000         16.0000000
  2          13.000000        16.0000000

Input Structural Properties:
----------------------------

Section No. 1:

   Section Type                                        =    Elastic Pile
   Cross-sectional Shape                               =       Circular
   Section Length                                      =         13.000 in
   Top Width                                           =         16.000 in
   Bottom Width                                        =         16.000 in
   Top Area                                            =     201.000000 sq. in
   Bottom Area                                         =     201.000000 sq. in
   Moment of Inertia at Top                            =      1.608E+03 in^4
   Moment of Inertia at Bottom                         =      1.608E+03 in^4
   Elastic Modulus                                     =    3200000.000 lbs/in


--------------------------------------------------------------------------------
                    Ground Slope and Pile Batter Angles
--------------------------------------------------------------------------------

Ground Slope Angle                                     =       26.600 degrees
                                                       =        0.464 radians

Pile Batter Angle                                      =        0.000 degrees
                                                       =        0.000 radians


--------------------------------------------------------------------------------
                    Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer              =       -3.000 ft
Distance from top of pile to bottom of layer           =        8.000 ft
p-y subgrade modulus k for top of soil layer           =       90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer             =       90.000 lbs/in**3

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer              =        8.000 ft
Distance from top of pile to bottom of layer           =       32.000 ft

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer              =       32.000 ft
Distance from top of pile to bottom of layer           =       55.000 ft
p-y subgrade modulus k for top of soil layer           =       70.000 lbs/in**3
p-y subgrade modulus k for bottom of layer             =       70.000 lbs/in**3

(Depth of lowest layer extends   42.00 ft below pile tip)

--------------------------------------------------------------------------------
                  Effective Unit Weight of Soil vs. Depth
--------------------------------------------------------------------------------

Effective unit weight of soil with depth defined using 6 points

Point        Depth X      Eff. Unit Weight
 No.           ft              pcf
-----      ----------    ----------------
  1           -3.00         115.00000
```

2	8.00	115.00000
3	8.00	115.00000
4	32.00	115.00000
5	32.00	120.00000
6	55.00	120.00000

Summary of Soil Properties

Layer Num.	Soil Type (p-y Curve Criteria)	Depth ft	Eff. Unit Wt., pcf	Cohesion psf	Friction Ang., deg.	qu psi	RQD percent	Epsilon 50	kpy pci	Rock Emass psi	krm	Test Type	Test Prop.	Elas. Subgr. pci
1	Sand (Reese, et al.)	-3.000	115.000	--	32.000	--	--	--	90.000	--	--	--	--	--
		8.000	115.000	--	32.000	--	--	--	90.000	--	--	--	--	--
2	Soft Clay	8.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
		32.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
3	Sand (Reese, et al.)	32.000	120.000	--	30.000	--	--	--	70.000	--	--	--	--	--
		55.000	120.000	--	30.000	--	--	--	70.000	--	--	--	--	--

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	1.0000	1.0000
2	12.000	1.0000	1.0000

Loading Type

p-y criteria for static loading was used for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs
1	1	V = 3733.000 lbs	M = 224000.000 in-lbs	17600.000
2	1	V = 8133.000 lbs	M = 420800.000 in-lbs	17600.000

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust values were determined from pile-head loading conditions

Number of Sections = 1

Section No. 1:

Moment-Curvature properties derived from elastic section properties

Summary of Pile Response(s)

Definitions of Pile-Head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Load Condition 1 Condition 2 Axial Pile-Head Maximum Maximum Pile-Head

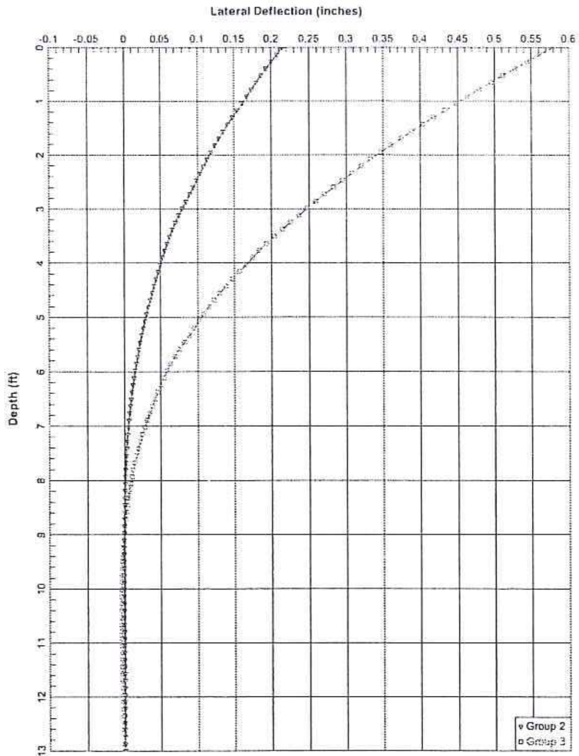
Case No.	Type No.	V(lbs) or y(inches)	in-lb, rad., or in-lb/rad.	Load lbs	Deflection inches	Moment in-lbs	Shear lbs	Rotation radians
1	1	V = 3733.0000	M = 224000.	17600.	0.21456893	285678.	-4880.9551	0.00000000
2	1	V = 8133.0000	M = 420800.	17600.	0.57838961	605185.	-10163.	0.00000000

Summary of Warning Messages

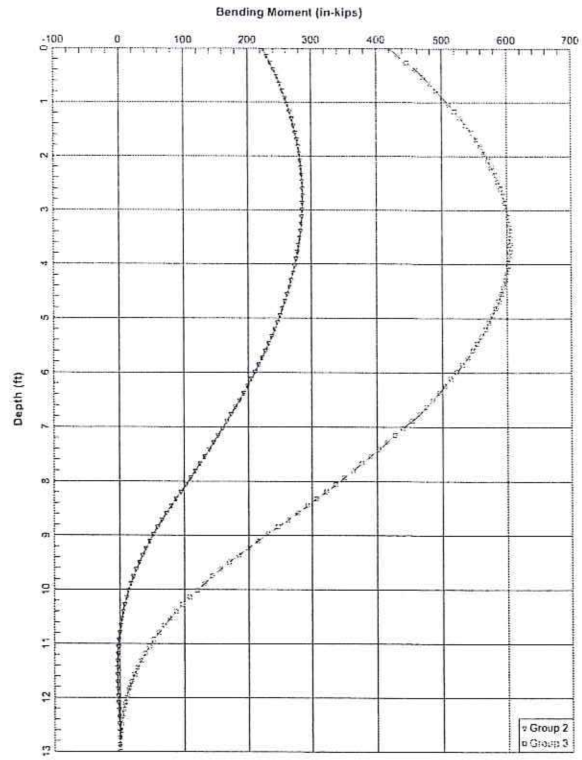
The following warning was reported 546 times

**** Warning ****

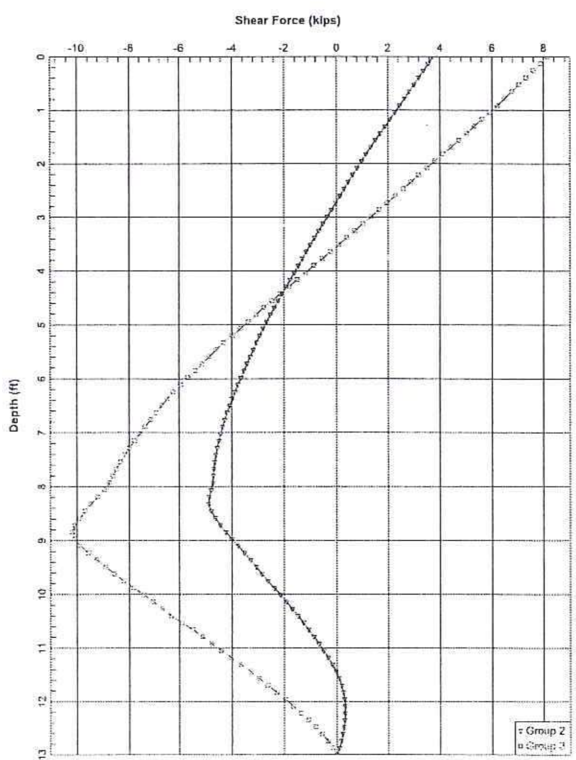
An unreasonable input value for shear strength has been specified for a soil defined using the soft clay criteria. The input value is greater than 8.68 psi (1,250 psf). You should check your input data for correctness.



Soundwall 361 on Pile Cap, Ground Condition = Case 2



Soundwall 361 on Pile Cap, Ground Condition = Case 2



Soundwall 361 on Pile Cap, Ground Condition = Case 2

Soundwall 372

Lateral Pile Analyses for Soundwall on Barrier Type 736S

```
================================================================================
              LPile Plus for Windows, Version 6.0 (6.0.09)

              Analysis of Individual Piles and Drilled Shafts
             Subjected to Lateral Loading Using the p-y Method

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================================================================================

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--------------------------------------------------------------------------------
                          Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:      X:\Projects\2011\11-137 - TRC, I-5 HOV Widening - Segment 3\Reports\06 GDR\Analyses\Lateral Capacity\SW 372\
Name of input data file:     SW 372 on Barrier 736S Case 1.lp6d
Name of output file:         SW 372 on Barrier 736S Case 1.lp6o
Name of plot output file:    SW 372 on Barrier 736S Case 1.lp6p
Name of runtime file:        SW 372 on Barrier 736S Case 1.lp6r

--------------------------------------------------------------------------------
                          Date and Time of Analysis
--------------------------------------------------------------------------------

             Date:  March 23, 2012     Time:  19:09:27

--------------------------------------------------------------------------------
                               Problem Title
--------------------------------------------------------------------------------

Project Name:

Job Number:

Client:

Engineer:

Description:

--------------------------------------------------------------------------------
                              Program Options
--------------------------------------------------------------------------------

Units Used - US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes nonlinear bending stiffness and nominal Moment
  Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multiplers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output summary table of values for pile-head deflection, maximum
  bending moment, and shear force only
- Analysis assumes no soil movements acting on pile
- No p-y curves to be computed and output for user-specified depths

Solution Control Parameters:
- Number of pile increments                       =         100
- Maximum number of iterations allowed            =         100
- Deflection tolerance for convergence            =   1.0000E-05  in
- Maximum allowable deflection                    =    100.0000  in

Pile Response Output Options:
- Only summary tables of pile-head deflection, maximum bending moment,
  and maximum shear force are to be written to output report file.

--------------------------------------------------------------------------------
                    Pile Structural Properties and Geometry
--------------------------------------------------------------------------------

Total Number of Sections                          =           1

Total Pile Length                                 =       12.00 ft

Depth of ground surface below top of pile         =       -1.50 ft
```

Slope angle of ground surface = 0.00 deg.

Pile dimensions used for p-y curve computations defined using 2 points.
p-y curves are computed using values of pile diameter interpolated over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	16.0000000
2	12.000000	16.0000000

Input Structural Properties:

Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Circular
Section Length	=	12.000 in
Top Width	=	16.000 in
Bottom Width	=	16.000 in
Top Area	=	201.000000 sq. in
Bottom Area	=	201.000000 sq. in
Moment of Inertia at Top	=	1.608E+03 in^4
Moment of Inertia at Bottom	=	1.608E+03 in^4
Elastic Modulus	=	3200000.000 lbs/in

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 2 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer = -1.500 ft
Distance from top of pile to bottom of layer = 34.000 ft

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer = 34.000 ft
Distance from top of pile to bottom of layer = 60.000 ft

(Depth of lowest layer extends 48.00 ft below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 4 points

Point No.	Depth X ft	Eff. Unit Weight pcf
1	-1.50	115.00000
2	34.00	115.00000
3	34.00	120.00000
4	60.00	120.00000

Summary of Soil Properties

Layer Num.	Soil Type (p-y Curve Criteria)	Depth ft	Eff. Unit Wt., pcf	Cohesion psf	Friction Ang., deg.	qu psi	RQD percent	Epsilon 50	kpy pci	Rock Emass psi	krm	Test Type	Test Prop.	Elas. Subgr. pci
1	Soft Clay	-1.500	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
		34.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
2	Soft Clay	34.000	120.000	3000.000	--	--	--	0.00500	--	--	--	--	--	--
		60.000	120.000	3000.000	--	--	--	0.00500	--	--	--	--	--	--

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	1.0000	1.0000
2	13.000	1.0000	1.0000

Loading Type

p-y criteria for static loading was used for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs
1	1	V = 6560.000 lbs	M = 537600.000 in-lbs	24160.000
2	1	V = 9920.000 lbs	M = 777600.000 in-lbs	24160.000

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust values were determined from pile-head loading conditions

Number of Sections = 1

Section No. 1:

Moment-Curvature properties derived from elastic section properties

Summary of Pile Response(s)

Definitions of Pile-Head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

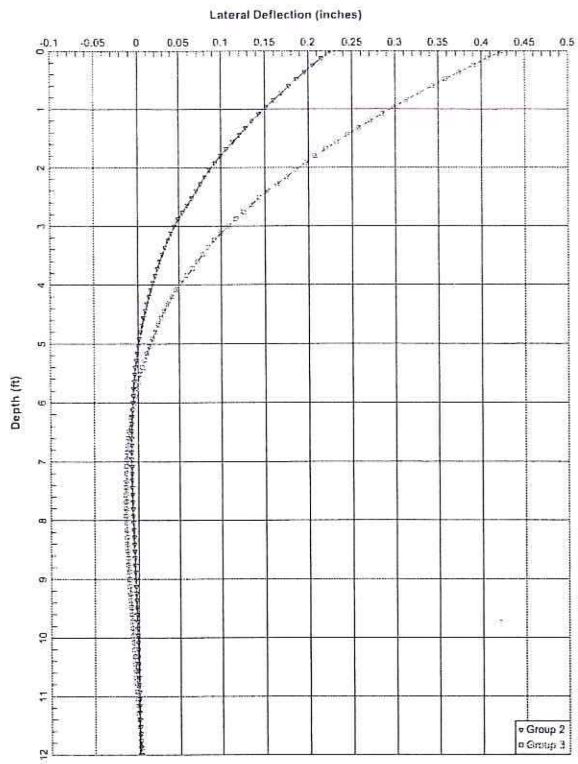
Load Case No.	Load Type No.	Condition 1 V(lbs) or y(inches)	Condition 2 in-lb, rad., or in-lb/rad.	Axial Load lbs	Pile-Head Deflection inches	Maximum Moment in-lbs	Maximum Shear lbs	Pile-Head Rotation radians
1	1	V = 6560.0000	M = 537600.	24160.	0.22487823	597819.	-11370.	0.00000000
2	1	V = 9920.0000	M = 777600.	24160.	0.42321063	889059.	-15466.	0.00000000

Summary of Warning Messages

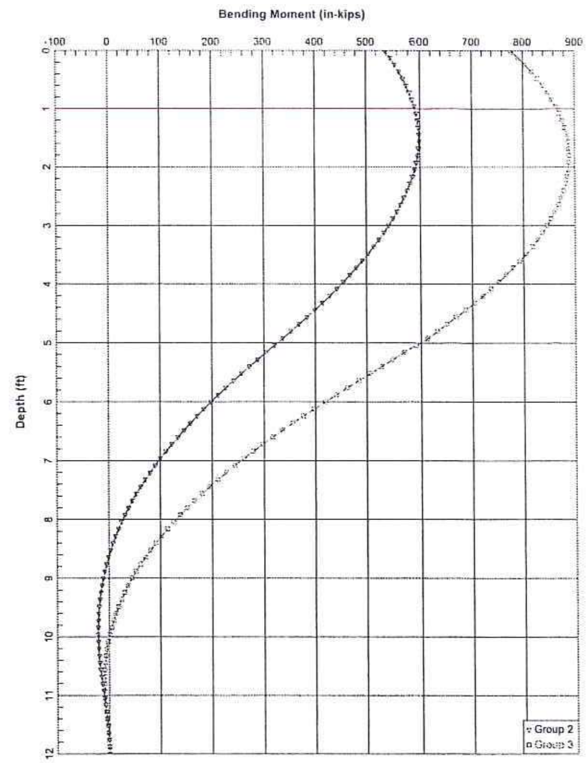
The following warning was reported 2020 times

**** Warning ****

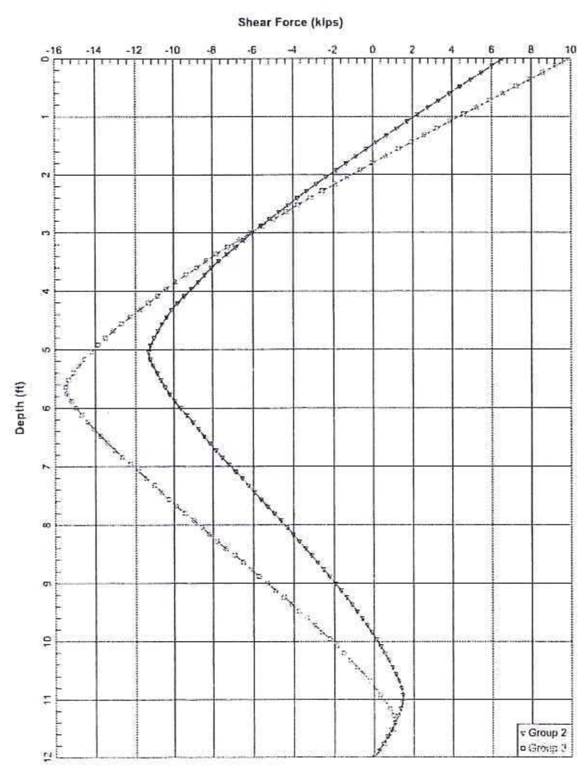
An unreasonable input value for shear strength has been specified for a soil defined using the soft clay criteria. The input value is greater than 8.68 psi (1,250 psf). You should check your input data for correctness.



Soundwall 372 on Concrete Barrier Type 736S, Ground Condition = Case 1



Soundwall 372 on Concrete Barrier Type 736S, Ground Condition = Case 1



Soundwall 372 on Concrete Barrier Type 736S, Ground Condition = Case 1

```
==============================================================================

              LPile Plus for Windows, Version 6.0 (6.0.09)

              Analysis of Individual Piles and Drilled Shafts
             Subjected to Lateral Loading Using the p-y Method

                      (c) 1985-2010 by Ensoft, Inc.
                           All Rights Reserved

==============================================================================

This program is licensed to:

Earth Mechanics, Inc.
Earth Mechanics, Inc.

------------------------------------------------------------------------------
                          Files Used for Analysis
------------------------------------------------------------------------------

Path to file locations:     X:\Projects\2011\11-137 - TRC, I-5 HOV Widening - Segment 3\Reports\06 GDR\Analyses\Lateral Capacity\SW 372\
Name of input data file:    SW 372 on Barrier 736S Case 2.lp6d
Name of output file:        SW 372 on Barrier 736S Case 2.lp6o
Name of plot output file:   SW 372 on Barrier 736S Case 2.lp6p
Name of runtime file:       SW 372 on Barrier 736S Case 2.lp6r

------------------------------------------------------------------------------
                        Date and Time of Analysis
------------------------------------------------------------------------------

               Date:  March 23, 2012      Time:  19:18:18

------------------------------------------------------------------------------
                              Problem Title
------------------------------------------------------------------------------

Project Name:

Job Number:

Client:

Engineer:

Description:

------------------------------------------------------------------------------
                             Program Options
------------------------------------------------------------------------------

Units Used - US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes nonlinear bending stiffness and nominal Moment
  Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multipliers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output summary table of values for pile-head deflection, maximum
  bending moment, and shear force only
- Analysis assumes no soil movements acting on pile
- No p-y curves to be computed and output for user-specified depths

Solution Control Parameters:
- Number of pile increments                       =          100
- Maximum number of iterations allowed            =          100
- Deflection tolerance for convergence            =   1.0000E-05  in
- Maximum allowable deflection                    =     100.0000  in

Pile Response Output Options:
- Only summary tables of pile-head deflection, maximum bending moment,
  and maximum shear force are to be written to output report file.

------------------------------------------------------------------------------
                  Pile Structural Properties and Geometry
------------------------------------------------------------------------------

Total Number of Sections                          =            1

Total Pile Length                                 =        12.00 ft

Depth of ground surface below top of pile         =        -1.00 ft

Slope angle of ground surface                     =        26.60 deg.
```

Pile dimensions used for p-y curve computations defined using 2 points.
p-y curves are computed using values of pile diameter interpolated over
the length of the pile.

Point	Depth x ft	Pile Diameter in
1	0.00000	16.0000000
2	12.000000	16.0000000

Input Structural Properties:

Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Circular
Section Length	=	12.000 in
Top Width	=	16.000 in
Bottom Width	=	16.000 in
Top Area	=	201.000000 sq. in
Bottom Area	=	201.000000 sq. in
Moment of Inertia at Top	=	1.608E+03 in^4
Moment of Inertia at Bottom	=	1.608E+03 in^4
Elastic Modulus	=	3200000.000 lbs/in

Ground Slope and Pile Batter Angles

Ground Slope Angle	=	26.600 degrees
	=	0.464 radians
Pile Batter Angle	=	0.000 degrees
	=	0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 2 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	-1.000 ft
Distance from top of pile to bottom of layer	=	34.000 ft

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	34.000 ft
Distance from top of pile to bottom of layer	=	60.000 ft

(Depth of lowest layer extends 48.00 ft below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 4 points

Point No.	Depth X ft	Eff. Unit Weight pcf
1	-1.00	115.00000
2	34.00	115.00000
3	34.00	120.00000
4	60.00	120.00000

Summary of Soil Properties

Layer Num.	Soil Type (p-y Curve Criteria)	Depth ft	Eff. Unit Wt., pcf	Cohesion psf	Friction Ang., deg.	qu psi	RQD percent	Epsilon 50	kpy pci	Rock Emass psi	krm	Test Type	Test Prop.	Elas. Subgr. pci
1	Soft Clay	-1.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
		34.000	115.000	2000.000	--	--	--	0.00700	--	--	--	--	--	--
2	Soft Clay	34.000	120.000	3000.000	--	--	--	0.00500	--	--	--	--	--	--
		60.000	120.000	3000.000	--	--	--	0.00500	--	--	--	--	--	--

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	1.0000	1.0000
2	13.000	1.0000	1.0000

Loading Type

p-y criteria for static loading was used for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs
1	1	V = 4920.000 lbs	M = 403200.000 in-lbs	18120.000
2	1	V = 7440.000 lbs	M = 583200.000 in-lbs	18120.000

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust values were determined from pile-head loading conditions

Number of Sections = 1

Section No. 1:

Moment-Curvature properties derived from elastic section properties

Summary of Pile Response(s)

Definitions of Pile-Head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

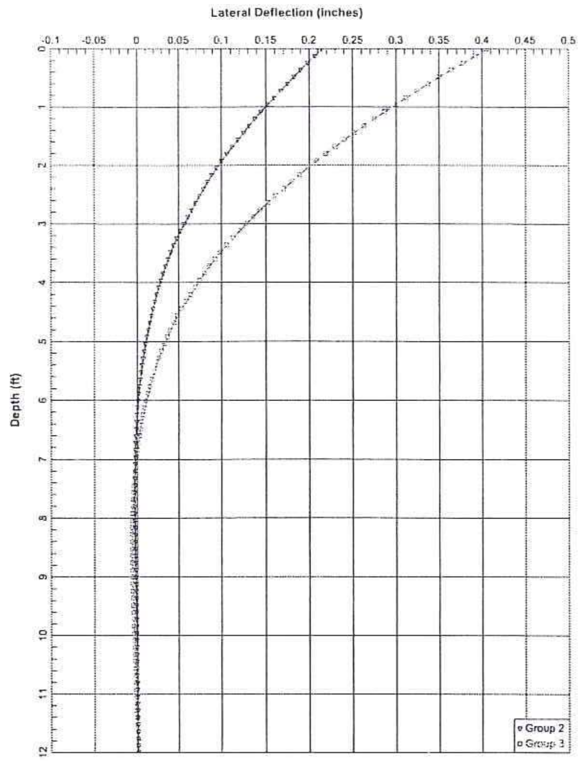
Load Case No.	Load Type No.	Condition 1 V(lbs) or y(inches)	Condition 2 in-lb, rad., or in-lb/rad.	Axial Load lbs	Pile-Head Deflection inches	Maximum Moment in-lbs	Maximum Shear lbs	Pile-Head Rotation radians
1	1	V = 4920.0000	M = 403200.	18120.	0.21501501	457180.	-8738.4623	0.00000000
2	1	V = 7440.0000	M = 583200.	18120.	0.40600772	682613.	-11898.	0.00000000

Summary of Warning Messages

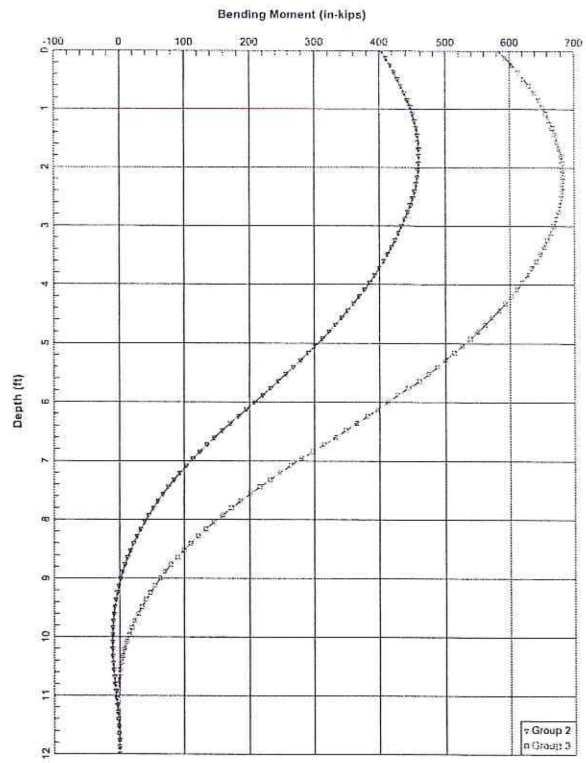
The following warning was reported 2121 times

**** Warning ****

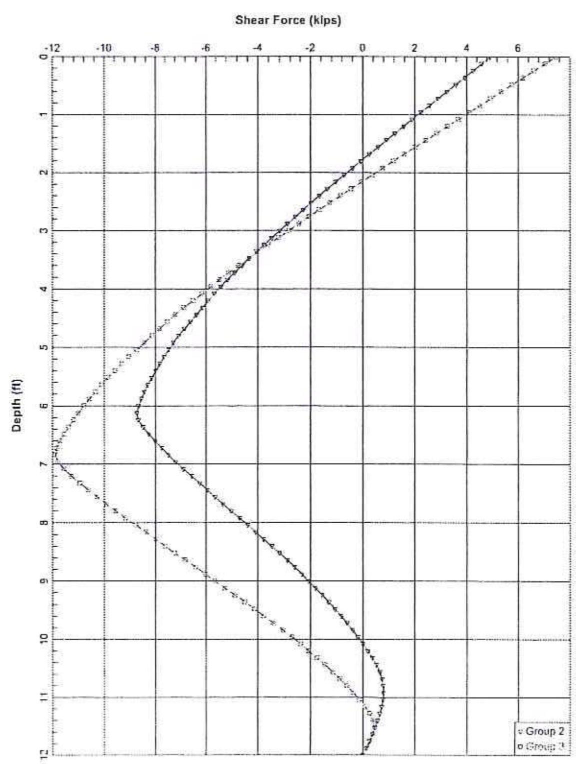
An unreasonable input value for shear strength has been specified for a soil defined using the soft clay criteria. The input value is greater than 8.68 psi (1,250 psf). You should check your input data for correctness.



Soundwall 372 on Concrete Barrier Type 736S, Ground Condition = Case 2



Soundwall 372 on Concrete Barrier Type 736S, Ground Condition = Case 2



Soundwall 372 on Concrete Barrier Type 736S, Ground Condition = Case 2

Appendix D

Caltrans Review Comments and EMI Responses

EXTERNAL SUBMITTAL REVIEW

PROJECT: INTERSTATE 5 HOV IMPROVEMENT
PROJECT No. 1200020279

EA No.: 12-0F96C1	
Agency: CalTrans	
Submittal No.	Title: GDR for PCH to San Juan Creek Rd (I-5 HOV, Segment 3), 3/29/2012

Lead:	Date: 7/20/2012
Technical Discipline: Geotechnical	

ACTION (30, 60, 85%): RL = Revise in Later Submittal RI = Revise Immediately & OTS Review

30, 60, 85% SUBMITTAL DISPOSITION (check one): ( )Approved, ( ) Approved as Noted for Correction, ( ) Rejected, Revise & Resubmit, ( ) Record Only

CODE: A - Accept/will comply, B - Agency Action, C - Clarify/Discuss, D - Delete Comment, E - Different Submittal

FINAL SUBMITTAL (100%) DISPOSITION (check one): ( ) Approved, (X) Approved as Noted for Correction, ( ) Rejected, Revise & Resubmit, ( ) Record Only

FILLED OUT BY REVIEWER						FILLED OUT BY RESPONDER		FILLED OUT AT RESOLUTION MEETING		
No.	Plan/SSP/ Page No.	Reviewer	Reviewer Comment No.	Comments	Action	Initial Code	Response	Final Code	Verify (1)	Verify (2)
1	Page 41, first paragraph	H.Liu	1	There is no "one" inch settlement control criteria for non structure-supporting retaining walls. Over-excavation and re-compaction for that purpose is not needed	RI	A	The "One" inch settlement criteria is removed from the report.			
2	Page 42, second paragraph	H.Liu	2	Same as above	RI	A	Same as above.			
3	Table 8-10, Page 47	H.Liu	3	Please varify with structure design the settlement (or differential settlement) tolerance for soundwall under service condition, and decide the permissible contact stress on a job specific basis if necessary.	RI	C	Differenctial settlement is not a concern for these soundwalls under service condition. Bearing capacity requirements can be satisfied.			
4	Appendix A LOTBS	H.Liu	4	Please put route number on all plan sheets above the boring logs.	RI	A	We will comply.			
5	Appendix A LOTBS	H.Liu	5	Please convert all boring record sheets into formal LOTBS in next submittal	RI	A	We will provide LOTB sheets of the borings for bridges, walls and sign structures, and boring records for the other borings.			
6	Appendix C RW399 Calculation	H.Liu	6	The bearing stress for RW399 under service condition is 1.4 ksf, instead of 2.5 ksf.	RI	A	We will revise the calculations using the correct bearing stress of 1.4 ksf.			
7	General Comments for Appendix C	H.Liu	7	Based on CA Amendment to AASHTO LRFD (2010), the bearing capacity resistance factor for RW footing under strength limit state is 0.55 (0.65 for MSE). Please update this factor in calculations.	RI	A	We will comply.			