**FOR CONTRACT NO.: 07-4Y3901**

# INFORMATION HANDOUT

## MATERIALS INFORMATION

SUMMARY OF FOUNDATION RECOMMENDATION REPORT Oct 21, 2009
SOIL PROFILE/LOG OF TEST BORINGS

**ROUTE: 07-Ven-101 PM 12.5**

State of California

Business, Transportation and Housing Agency

# Memorandum

*Flex your power!*
*Be energy efficient!*

**To:** MR. SHAFIQUL ISLAM– DISTRICT 07
Senior Transportation Engineer

**Date:** October 21, 2009

**File:** 07-VEN-101-PM 12.5
EA 07-4Y3901
Overhead Sign Replacement
Sign No. 12451

Attention: Paul Fok

**From:** **DEPARTMENT OF TRANSPORTATION**
**DIVISION OF ENGINEERING SERVICES**
**Geotechnical Services**
**Office of Geotechnical Design – South 1**
**Branch B**

**Subject:** Foundation Recommendation for Overhead Sign Replacement (FINAL)

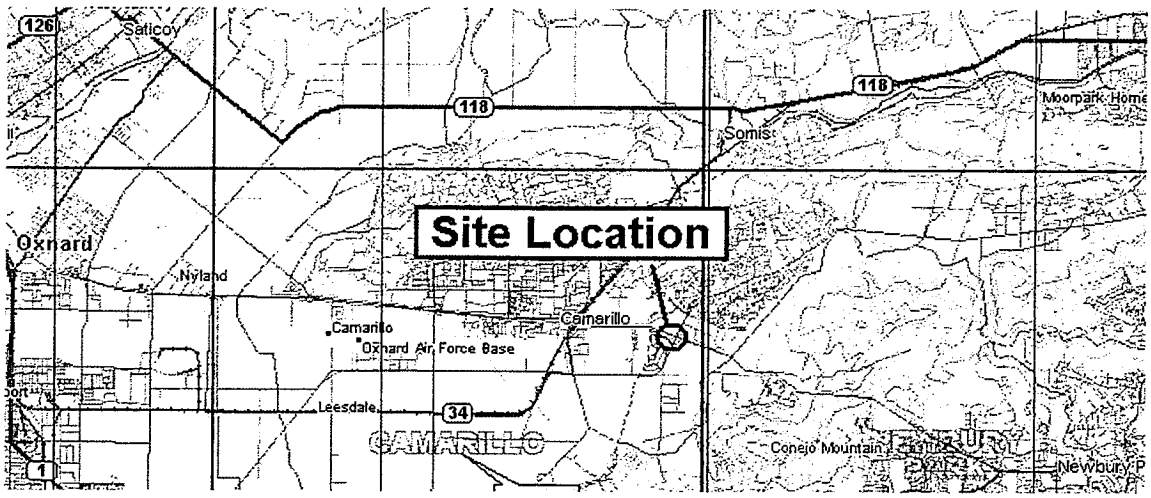
## 1.0 INTRODUCTION

The Office of Geotechnical Design South 1 (OGDS-1), Branch B has conducted a foundation investigation pursuant to the request by your office on June 15, 2009 for a foundation investigation and recommendations for the proposed overhead sign replacement to be supported on Cast in Drilled Hole (CIDH) pile foundations. The sign is single post type sign at VEN-101 Southbound right shoulder STA 658+37.00. Mr. K.C. Liu of the Office of Design and Technical Services provided the pile head loading conditions for the subject overhead signs via e-mail dated September 23, 2008. A site map of the project site map is shown on Figure 1.

## 2.0 SITE DESCRIPTION

The proposed overhead sign is located at intersection of VEN-101 and Pleasant Valley Road the City of Camarillo, in Ventura County. Site is bounded by residential development to the north and a commercial nursery to south of the freeway.

Site Map Figure 1.




## 3.0 GEOTECHNICAL INVESTIGATION

Our geotechnical investigation consisted of drilling one exploratory borings R-08-001 at the location of the proposed overhead sign on August 11, 2009. The boring was advanced utilizing a mud rotary method with a CS 2000 drill rig equipped with an automatic hammer. Table 1 summarizes details of the boring information. The boring location was determined based upon the location shown on the overhead sign shown on the design plan dated June 25, 2009. The orientation and elevation of the boring location is based on the survey results provided by the Office of D07 Design on July 17, 2009. LOTB (Log of Test Borings) is being prepared by the Office of Geotechnical Support and will be submitted to District Office upon completion.

**Table 1 - Summary of Boring Information**

| Boring No. | Station | Offset (m) | Reference Line | Surface Elevation (ft) (1) (2) | Depth (ft) | Date |
|---|---|---|---|---|---|---|
| R-09-001 | 324+65.00 | 75.00 LT | VEN-101 Alignment | 139.00 | 501.50 | 08/11/09 |

(1) Elevations are above mean sea level (MSL) (1988 NAVD Datum)
(2) Reference Layout Plan L-1 dated September 9, 2009

## 4.0 LABORATORY TESTING

Selected undisturbed samples, SPT soils samples and bulk samples obtained from Borings were tested for following laboratory testing:

- Mechanical Analysis
- Plasticity Index
- Corrosion

Testing was performed in accordance with California Test Methods (see Table 2 below). Laboratory tests were performed at the Material Laboratory in Los Angeles. The corrosion test results are presented in Table No. 3 in this report. A summary of the laboratory results are presented in the Appendix A.

**Table 2 – Laboratory Test Methods**

| Test | Standard |
|---|---|
| Mechanical Analysis of Soils | CTM 202, 203 |
| Atterberg Limits of Soils | CTM 204 |
| Corrosion – Resistivity, pH | CTM 643 |
| Corrosion – Chloride content | CTM 422 |
| Corrosion – Sulfate content | CTM 417 |

## 5.0 GEOLOGY

### 5.1 Regional Geology

The site is located in the Ventura Basin within the Transverse Ranges Geomorphic Province. East-west trending mountain ranges and valleys characterize the Transverse Ranges Province, which contrasts with the adjacent Peninsular and Coast Ranges. The Ventura Basin is to the west of the Santa Monica Mountains and Santa Susana Hills, and to the east and north of the Pacific Ocean. The project is underlain by the Holocene-aged alluvium, which overlies crystalline basement rocks at great depth. The nearest waterway is the Calleguas Creek, approximately ¼ mile to the west..

### 5.2 Site Geology

The subsurface soil encountered at the location of the proposed overhead signs is alluvium composed of alternating layers of loose to medium dense sand, and silt/sand mixtures, and soft to medium stiff silts. The soils are soft/loose down to about 25' below grade. The sign foundation will be placed at approximate native ground elevation.

### 5.3 Groundwater

Ground water was not encountered during the original investigation for nearby Santa Rosa Road Overcrossing (Calleguas Rd. Overcrossing) in 1956, but perched water was encountered during the investigation for the widening in 1986 at about 50 feet below grade. Ground water measurements from monitoring wells installed by the nearby Mobil Gas Station show a depth to ground water of about 40-45 feet.

### 5.4 Seismicity

At a distance of approximately 1.80 miles (2.9 km), the controlling fault for the site is the Simi-Santa Rosa (Camarillo-Santa Rosa Section. It is a reverse thrust fault with a maximum moment magnitude $M_w$ of 7.00. Recommended ARS Curve and data are provided in Appendix B.

## 6.0 GEOTECHNICAL ENGINEERING ANALYSIS

### 6.1 Liquefaction Potential

Based on the depth to ground water and the increasing density of the soils with depth, liquefaction is not considered to affect the subject pile foundation.

### 6.2 Corrosion

Composite soil sample from the exploratory boring was tested at the District 7 Transportation Laboratory in Los Angeles for corrosion potential. The test results summarized in Table No. 3 indicate that the soil at the site is generally not corrosive to metal and reinforced concrete (Corrosion Guidelines, 2003). Caltrans currently defines a corrosive area as an area where the soil and/or water contains more than 500 PPM of chlorides, more than 2000 PPM of sulfates, and a minimum resistivity of less than 1000 ohm-centimeters or has a pH of 5.5 or less.

**Table 3- Corrosion Test Summary-Composite Sample**

| Boring No. | Sample Depth (ft) | pH | Minimum Resistivity (Ohm-cm) | Sulfate Content (PPM)* | Chloride Content (PPM)* |
|---|---|---|---|---|---|
| R-09-001 | 0-5 | 7.8 | 2300 | N/A | N/A |

* The Corrosion Technology Section policy states that if the minimum resistivity is greater than 1000 Ohm-Cm the sample is considered to be non-corrosive and testing to determine sulfate and chloride is not performed.

## 7.0 FOUNDATION RECOMMENDATIONS

### 7.1 Axial and Lateral Pile Capacity Analysis

The axial pile capacity evaluation for the proposed CIDH piles was performed using SHAFT for Windows, V5.0 by ENSOFT Inc. The lateral load-deformation response of single pile was analyzed utilizing the LPILE plus for Windows, V5.0m by ENSOFT Inc. The depth of sign foundation was computed based on the boundary conditions shown in Table 4. The allowable axial resistance of the pile which exceeds the nominal compression resistance was based on skin friction only. Unfactored loads provided to our office are shown in Table 4. The pile data table is provided in Table 5. The recommended pile diameter and depth is given in Table 6.

**Table 4 – Unfactored Load**

| Sign Post No. | Bending Moment at Pile Head (Kip-ft) | Shear Force at Pile Head (Kips) | Design Axial Load (Kips) |
|---|---|---|---|
| 1 | 344 | 12.2 | 18.7 |

**Table 5- Pile Data**

| Sign Post No. | Pile Type | Design Loading (Kips) | Nominal Resistance | | Design Tip Elevation (ft)* | Specified Tip Elevation (ft)* |
|---|---|---|---|---|---|---|
| | | | Compression (Kips) | Tension (Kips) | | |
| 1 | 5.0' CIDH | 18.7 | 37.4 | N/A | 118 (1)<br>89(2) | 89.00 |

* Assume top of pile is at Elev. 139.0'
(1) Compression Load
(2) Lateral Loads

**Table 6 - Recommended Pile Depths**

| Sign Post No. | Pile Diameter/ Pile Type | Pile Depth (Length from pile head to pile tip) (feet) |
|---|---|---|
| 1 | 5.0'/ CIDH | 50 |

Maximum bending moments and maximum shear forces computed are presented in Table 7 below.

**Table 7-Maximum Bending Moments and Maximum Shear Forces**

| Sign Post No. | Max. BM (Kip-ft) | Depth of Max BM below the pile head (feet) | Max. Shear (Kips) | Depth of Max Shear below the pile head (feet) | Maximum lateral pile head deflection (inches) |
|---|---|---|---|---|---|
| 1 | 1100 | 12.5 | 12.2 | 0 | 0.04 |

Based upon the lateral pile axial pile analysis results, lateral pile resistance controls the design length of the pile as shown in table 5. Therefore, the recommended pile length is 50 ft. as shown in table 6.

## 8.0 CONSTRUCTION CONSIDERATIONS

The following recommendations are made for CIDH piles installation and construction and are recommended to be incorporated in the Special Provisions of the project.

- The contractor shall be required to clean out the bottom of the shaft prior to placing the cage and the concrete.
- Concrete placement for construction of the CIDH piling shall be completed within the same day that excavation of the drilled hole has been completed.
- Caving may be anticipated during excavation of the pile boring and during CIDH pile construction. The contractor should advise method to control caving, such as use of temporary steel casings.
- Groundwater or perched water should be anticipated in the proposed pile location at a depth of 40 to 50 ft. below freeway grade (approximated elevation 103 to 93 ft.). If groundwater is encountered in the drilled hole, a method to remove the water should be employed before placing concrete such as dewatering. A temporary casing may be needed to further control water infiltration.

If you have any questions or comments, please call Mushtaq Ahmed at 213-620-2132 or Sam Sukiasian at or 213-620-2135.

Prepared by: Date: 10.21.09

Mushtaq Ahmed P.E.
Transportation Engineer - Civil
Office of Geotechnical Design – South 1
Branch B

Reviewed by: Date: 10/21/09

Sam Sukiasian G.E.,
Senior Transportation Engineer
Office of Geotechnical Design – South 1
Branch B

REGISTERED PROFESSIONAL ENGINEER
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Exp. 6-30-11
STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER
SAMUEL G. SUKIASIAN
No. GE2681
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10-21-09

Kristopher Barker, C.E.G.
Engineering Geologist
Office of Geotechnical Design – South 1
Branch B

PROFESSIONAL GEOLOGIST
KRISTOPHER BARKER
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CERTIFIED
ENGINEERING
GEOLOGIST
8-31-11
STATE OF CALIFORNIA

cc: OGDS1- LA File
OGDS1- Sac. File
GS- Sac. File

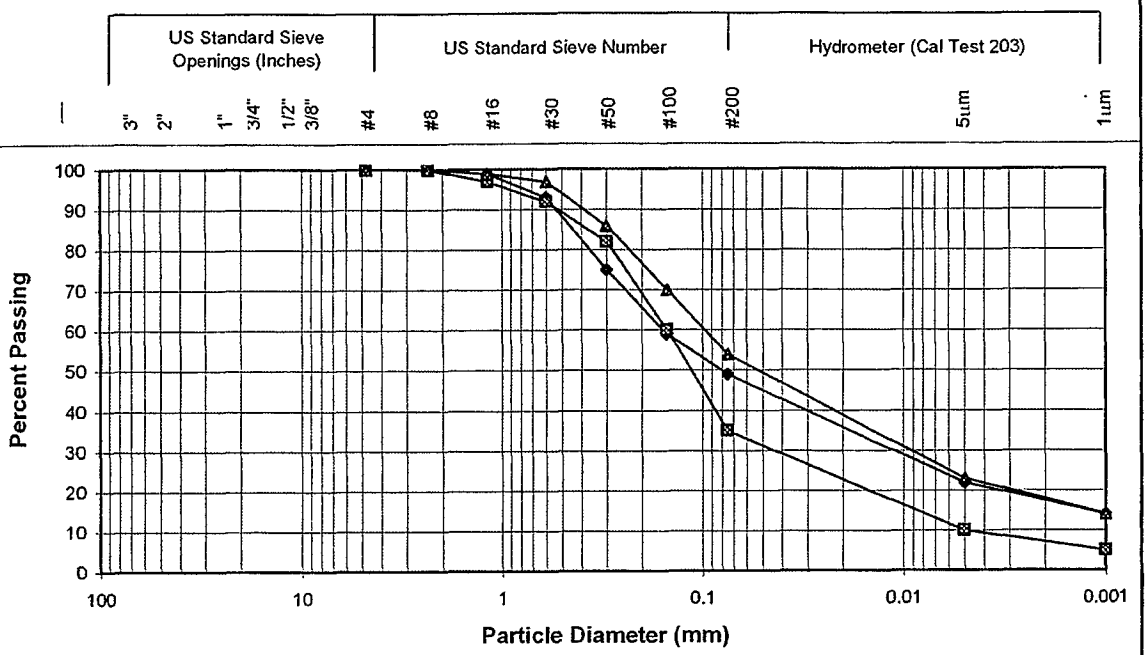
## 9.0 REFERENCES

Mualchin, "Caltrans California Seismic Hazard Map", 1996.

Morton, P.K. and Miller, R.V., "Geologic Map of Orange County California", 1981.

# APPENDIX A

# Gradation Analysis Test Results




**Sample ID:** B-1@20' B-1@25' B-1@35'

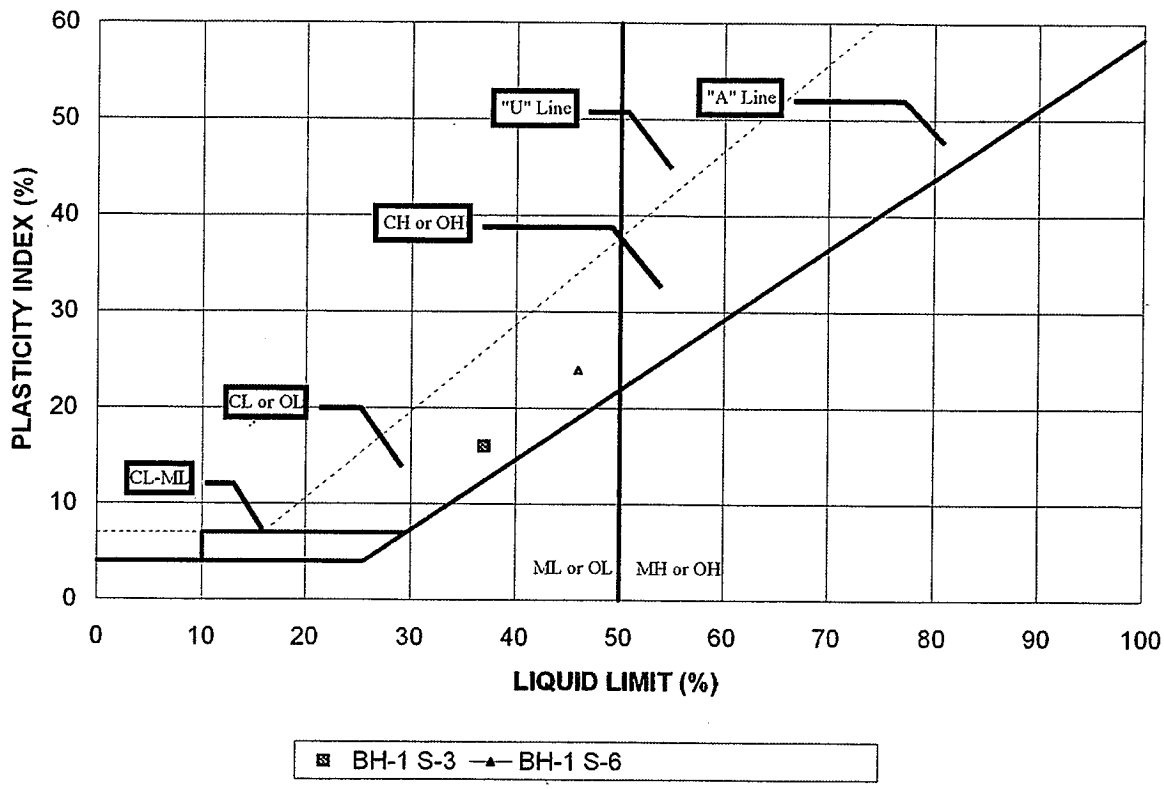
| COBBLES | GRAVELS | | SANDS | | | SILT | CLAY |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Crse. | Medium | Fine | | |

Caltrans

Engineering Services
Division of Geotechnical Services
Office of Geotechnical
Design - South 1

| | |
|---|---|
| Project: | Overhead Sign |
| EA: | 07-4Y3901 |
| Dist-Co-Rte-PM: | 07-VEN 101-PM 0.10 |

# Atterberg Limits Test Results




| Boring No. | Sample No. | Depth (m) | LL | PL | PI | Classification |
|---|---|---|---|---|---|---|
| BH-1 | S-3 | 15 | 37 | 16 | 21 | CL |
| BH-1 | S-6 | 30 | 46 | 24 | 22 | CL |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Caltrans

Engineering Services
Division of Geotechnical Services
Office of Geotechnical
Design - South 1

| | |
|---|---|
| Project: | OH Sign |
| EA: | 07-4Y3901 |
| Dist-Co-Rte-KP: | 07-VEN-101-PM 16.5 |

# APPENDIX B

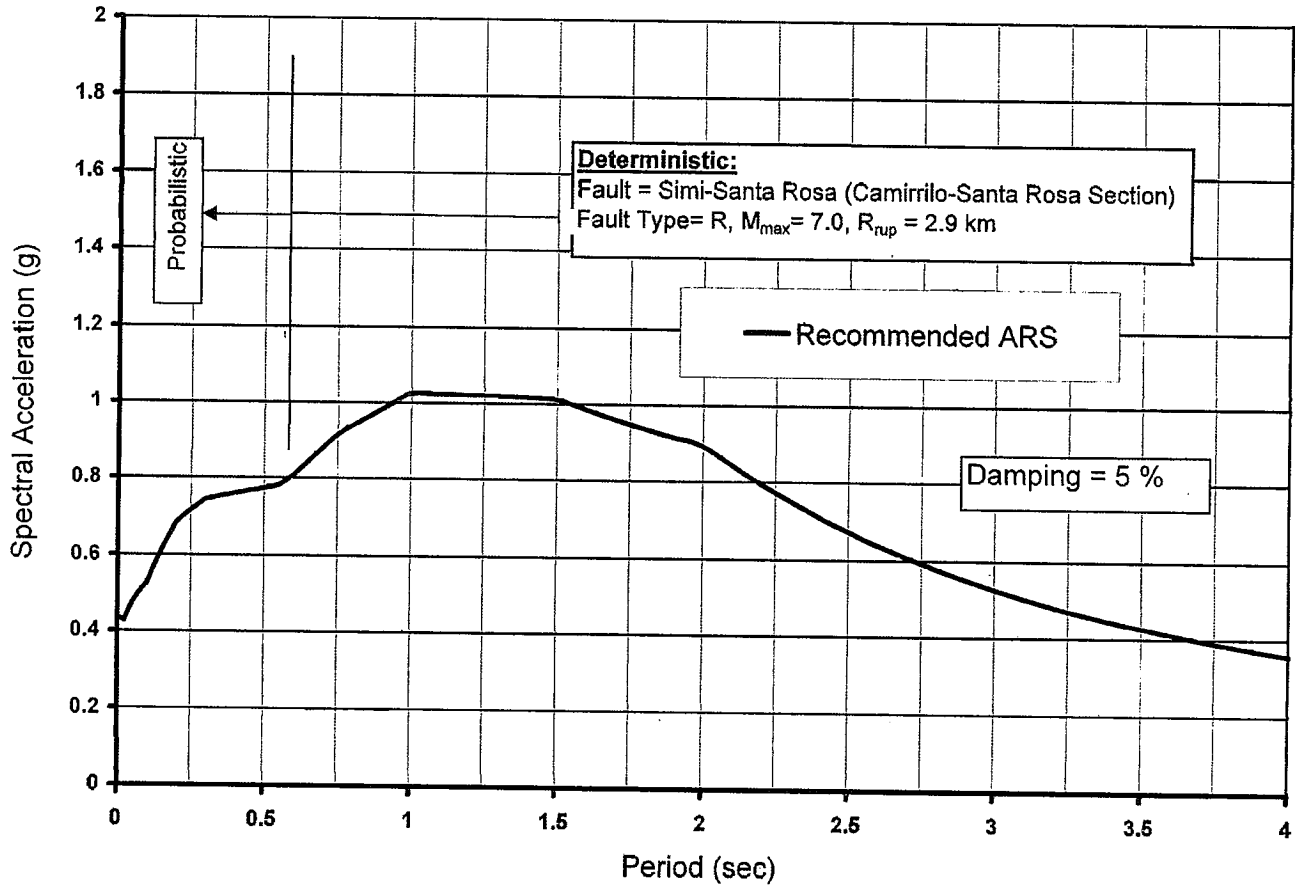



Figure 1. Recommended Design ARS Curve for the OH Sign at VEN-101-PM 12.5 (EA: 07-4Y3901)

OH SIGN, 07-VEN-101-PM 12.5
EA: 4Y3901

**Data for the Recommended ARS**

| Period (Sec.) | Spectral Acceleration, g | Period (Sec.) | Spectral Acceleration, g | Period (Sec.) | Spectral Acceleration, g |
|---|---|---|---|---|---|
| 0.01 | 0.433 | 0.24 | 0.71 | 2.20 | 0.80 |
| 0.02 | 0.429 | 0.25 | 0.72 | 2.40 | 0.71 |
| 0.02 | 0.429 | 0.26 | 0.72 | 2.50 | 0.68 |
| 0.03 | 0.427 | 0.28 | 0.73 | 2.60 | 0.64 |
| 0.03 | 0.436 | 0.29 | 0.74 | 2.80 | 0.58 |
| 0.03 | 0.438 | 0.30 | 0.74 | 3.00 | 0.53 |
| 0.03 | 0.443 | 0.32 | 0.75 | 3.20 | 0.48 |
| 0.04 | 0.449 | 0.34 | 0.75 | 3.40 | 0.44 |
| 0.04 | 0.450 | 0.35 | 0.75 | 3.50 | 0.43 |
| 0.04 | 0.457 | 0.36 | 0.75 | 3.60 | 0.41 |
| 0.04 | 0.461 | 0.38 | 0.76 | 3.80 | 0.38 |
| 0.04 | 0.464 | 0.40 | 0.76 | 4.00 | 0.36 |
| 0.05 | 0.466 | 0.42 | 0.76 | 4.20 | 0.34 |
| 0.05 | 0.467 | 0.44 | 0.77 | 4.40 | 0.32 |
| 0.05 | 0.470 | 0.45 | 0.77 | 4.60 | 0.30 |
| 0.05 | 0.473 | 0.46 | 0.77 | 4.80 | 0.28 |
| 0.06 | 0.480 | 0.48 | 0.77 | 5.00 | 0.27 |
| 0.06 | 0.486 | 0.50 | 0.77 | | |
| 0.07 | 0.492 | 0.55 | 0.78 | | |
| 0.07 | 0.494 | 0.60 | 0.81 | | |
| 0.07 | 0.497 | 0.65 | 0.85 | | |
| 0.08 | 0.502 | 0.67 | 0.86 | | |
| 0.08 | 0.507 | 0.70 | 0.88 | | |
| 0.09 | 0.512 | 0.75 | 0.92 | | |
| 0.09 | 0.516 | 0.80 | 0.94 | | |
| 0.10 | 0.520 | 0.85 | 0.96 | | |
| 0.10 | 0.524 | 0.90 | 0.98 | | |
| 0.11 | 0.543 | 0.95 | 1.01 | | |
| 0.12 | 0.562 | 1.00 | 1.03 | | |
| 0.13 | 0.579 | 1.10 | 1.02 | | |
| 0.13 | 0.585 | 1.20 | 1.02 | | |
| 0.14 | 0.596 | 1.30 | 1.02 | | |
| 0.15 | 0.612 | 1.40 | 1.02 | | |
| 0.16 | 0.627 | 1.50 | 1.01 | | |
| 0.17 | 0.642 | 1.60 | 0.99 | | |
| 0.18 | 0.656 | 1.70 | 0.96 | | |
| 0.19 | 0.670 | 1.80 | 0.94 | | |
| 0.20 | 0.684 | 1.90 | 0.92 | | |
| 0.22 | 0.697 | 2.00 | 0.89 | | |

| DIST | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No | TOTAL SHEETS |
|---|---|---|---|---|---|
| 07 | Ven | 101 | 12.5 | 1 | 3 |

M. Mushtaq Ahmed 01-05-10
REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
M. Mushtaq Ahmed
No. C56390
Exp. 6-30-11
CIVIL
STATE OF CALIFORNIA

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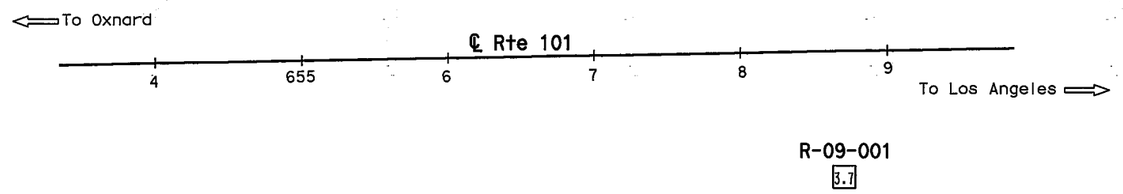
This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, & Presentation Manual (June 2007).

## BENCH MARK

SURVEY CONTROL

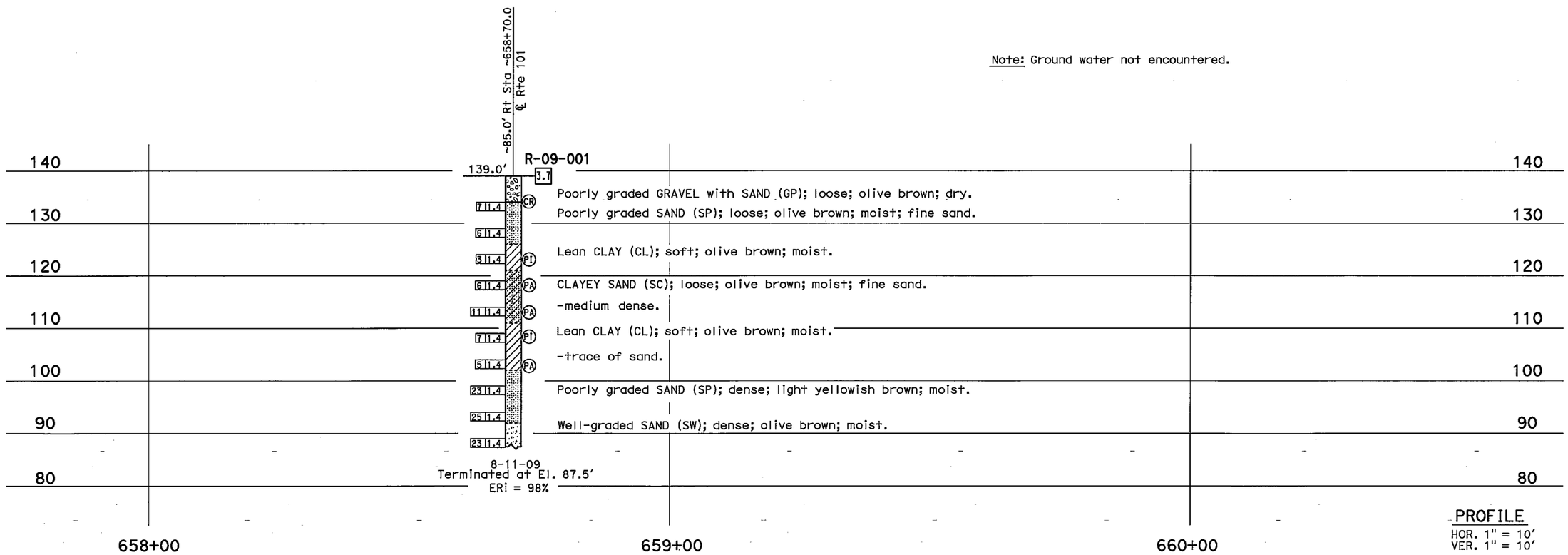
Horizontal Datum: NAD 83 (1991.35) Zone 5 per SR-99-276
Vertical Datum: NGVD 29 (1980) per SR-99-276
Point 8: PK & Wshr NB Gore
N 1901936.272
E 6256548.520
Elev 137.080
Point 9: PK & Wshr SB Sld
N 1901929.772
E 6256215.840
Elev 141.325




## PLAN

1" = 50'

Note: Ground water not encountered.




## PROFILE

HOR. 1" = 10'
VER. 1" = 10'

| ENGINEERING SERVICES | GEOTECHNICAL SERVICES | STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION | DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH | BRIDGE NO. XX-XXXX POST MILES 12.5 | OVERHEAD SIGN LOG OF TEST BORINGS 1 OF 3 |
|---|---|---|---|---|---|
| FUNCTIONAL SUPERVISOR NAME: S. Sukiasian | DRAWN BY: C. Christian/ F. Nguyen CHECKED BY: N. Srour | FIELD INVESTIGATION BY: K. BARKER | | | |

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 07
EA 4Y3901

DISREGARD PRINTS BEARING EARLIER REVISION DATES 12-15-09 12-30-09

REVISION DATES | SHEET | OF

FILE => ohsign1of3.dgn

USERNAME => s128268 DATE PLOTTED => 21-JAN-2010 TIME PLOTTED => 08:52

| DIST | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No | TOTAL SHEETS |
|---|---|---|---|---|---|
| 07 | Ven | 101 | 12.5 | 2 | 3 |

REGISTERED CIVIL ENGINEER 01-05-10

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER M. Mushtaq Ahmed No. C56390 Exp. 6-30-11 CIVIL STATE OF CALIFORNIA

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

## CEMENTATION

| Description | 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. |

## CONSISTENCY OF COHESIVE SOILS

| Description | Unconfined Compressive Strength (tsf) | Pocket Penetrometer Measurement (tsf) | Torvane Measurement (tsf) | Field Approximation |
|---|---|---|---|---|
| Very Soft | < 0.25 | < 0.25 | < 0.12 | Easily penetrated several inches by fist |
| Soft | 0.25 to 0.50 | 0.25 to 0.50 | 0.12 to 0.25 | Easily penetrated several inches by thumb |
| Medium Stiff | 0.50 to 1.0 | 0.50 to 1.0 | 0.25 to 0.50 | Penetrated several inches by thumb with moderate effort |
| Stiff | 1 to 2 | 1 to 2 | 0.50 to 1.0 | Readily indented by thumb but penetrated only with great effort |
| Very Stiff | 2 to 4 | 2 to 4 | 1.0 to 2.0 | Readily indented by thumbnail |
| Hard | > 4.0 | > 4.0 | > 2.0 | Indented by thumbnail with difficulty |

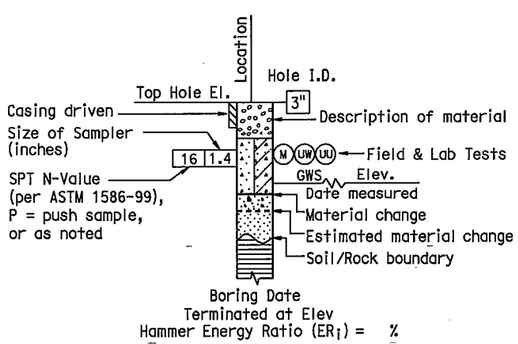
## BOREHOLE IDENTIFICATION

| Symbol | Hole Type | Description |
|---|---|---|
| Size | A | Auger Boring |
| Size | R<br>P | Rotary drilled boring<br>Rotary percussion boring (air) |
| Size | R | Rotary drilled diamond core |
| Size | HD<br>HA | Hand driven (1-inch soil tube)<br>Hand Auger |
| ● | D | Dynamic Cone Penetration Boring |
| ▲ | CPT | Cone Penetration Test (ASTM D 5778-95) |
| ⬚ | O | Other |

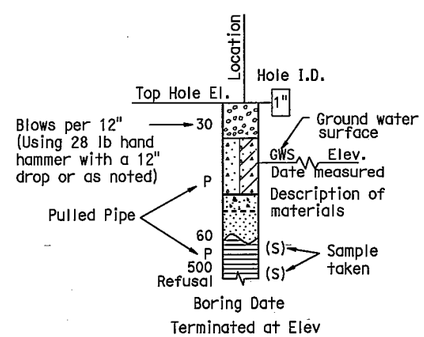
**Note: Size in inches.**

## PLASTICITY OF FINE-GRAINED SOILS

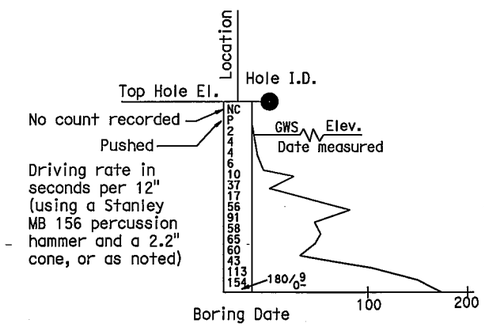
| Description | Criteria |
|---|---|
| Nonplastic | A 1/8-inch thread cannot be rolled at any water content. |
| Low | The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit. |
| Medium | The thread is easy to roll and not much time is required to reach the plastic limit. The thread 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. |



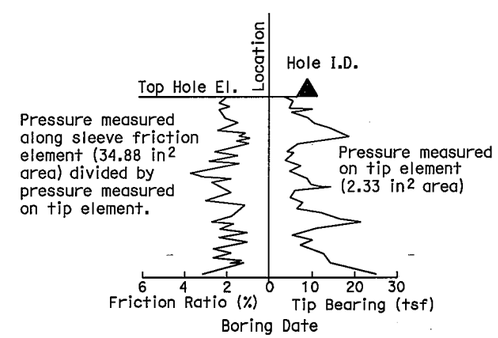

**ROTARY BORING**




**HAND BORING**




**DYNAMIC CONE PENETRATION BORING**




**CONE PENETRATION TEST (CPT) SOUNDING**

| ENGINEERING SERVICES | GEOTECHNICAL SERVICES | STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION | DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH | BRIDGE NO. XX / POST MILE 12.5 | OVERHEAD SIGN LOG OF TEST BORINGS 2 OF 3 |
|---|---|---|---|---|---|
| | PREPARED BY: F. Nguyen | | | | |

GS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 07 EA 4Y3901

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES SHEET OF

FILE => ohsign2of3.dgn

USERNAME => s128268 DATE PLOTTED => 21-JAN-2010 TIME PLOTTED => 08:50

| DIST | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No | TOTAL SHEETS |
|---|---|---|---|---|---|
| 07 | Ven | 101 | 12.5 | 3 | 3 |

REGISTERED CIVIL ENGINEER 01-05-10

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER M. Mushtaq Ahmed No. C56390 Exp. 6-30-11 CIVIL STATE OF CALIFORNIA

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REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

## GROUP SYMBOLS AND NAMES

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

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

## FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (TV) Pocket Torvane
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

## APPARENT DENSITY OF COHESIONLESS SOILS

| Description | SPT $N_{60}$ (Blows / 12 inches) |
|---|---|
| Very loose | 0 - 4 |
| Loose | 5 - 10 |
| Medium Dense | 11 - 30 |
| Dense | 31 - 50 |
| Very Dense | > 50 |

## MOISTURE

| Description | 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

| Description | 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% |

## PARTICLE SIZE

| Description | | Size |
|---|---|---|
| Boulder | | > 12" |
| Cobble | | 3" to 12" |
| Gravel | Coarse | 3/4" to 3" |
| | Fine | No. 4 to 3/4" |
| Sand | Coarse | No. 10 to No. 4 |
| | Medium | No. 40 to No. 10 |
| | Fine | No. 200 to No. 40 |

ENGINEERING SERVICES

GEOTECHNICAL SERVICES

PREPARED BY: F. Nguyen

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN

DESIGN BRANCH

BRIDGE NO. XX

POST MILE 12.5

# OVERHEAD SIGN

# LOG OF TEST BORINGS 3 OF 3

GS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 07
EA 4Y3901

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET OF

FILE => ohsign3of3.dgn

USERNAME => s128268 DATE PLOTTED => 21-JAN-2010 TIME PLOTTED => 08:49