INFORMATION HANDOUT COVER sheet: Use for IH cover. Delete, replace, or add text to match the titles of the Information Handout contents. Use if supplemental project information includes an IH. Include cover if changes are made to IH due to addendum.

INFORMATION HANDOUT

INSERT: contract number ending in phase number 4. Road includes District–County–Route–Post Mile. Project ID phase number 1.

For Contract No. 12-0N3604

At 12-Ora-91-PM R1.0, 5.4

Identified by

Project ID 1214000004

GEOTECHNICAL INFORMATION

Foundation Report, Retaining Wall at Valley View Street On-Ramp to Eastbound State Route 91

State of California Business, Transportation and Housing Agency

M e m o r a n d u m

Serious Drought!
Conserve water!

To: MR. ANDREW OSHRIN
Office of Project Development, Design D
DISTRICT 12

Attention: Mr. Raju Vora

Date: July 6, 2015

File: 12-ORA-91-PM 1.0/5.4
12-0N3601 (1214000004)
Retaining Wall at Valley View Street/SR-91

From: DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design - South 1, Branch D

Subject: Foundation Report, Retaining Wall at Valley View Street On-Ramp to Eastbound State Route 91

INTRODUCTION

In response to the request of the District 12-Office of Project Development, Design D, dated May 12, 2015, the Office of Geotechnical Design South 1 (OGDS1) prepared this Foundation Report (FR) for the proposed Retaining Wall at Valley View Street On-Ramp to eastbound State Route 91 (SR-91). The proposed wall is a Type 1A Retaining Wall supporting a Type 736A concrete barrier and will be built on the descending slope on the south side of the Valley View Street On-Ramp to the eastbound State Route 91 (EB SR-91), in the City of Buena Park, Orange County. This report provides pertinent geotechnical recommendations for the design and construction of the proposed wall.

PROJECT DESCRIPTION

The current on-ramp from Valley View Street to EB SR-91 contains a curved lane on the south side for traffic from northbound Valley View Street. The proposed retaining wall will be constructed to widen the curved portion of the on-ramp and provide a standard 8-foot wide shoulder on the south side of the ramp. District 12 project plans, dated May 2015, indicate that the wall will be 146-feet long and located on the concave shaped, approximately 1.5:1 (horizontal: vertical) slope that descends from the on-ramp grade to the adjacent residential tract located about 25 feet below. The beginning and end of the wall are at offsets of 25.4 feet Rt. of Station 4+28.5 and 21.8 ft Rt. of Station 6+4.68, respectively, of the "V2 Line" located on the on-ramp.

The project plans indicate that proposed wall is 8 feet high and has a 6.5-foot wide shallow footing with the bottom being at Elevation 69.4 feet. The project plans also indicate that the current slope will be regraded in conjunction with the wall construction to have an approximate slope ratio of 2:1 (horizontal: vertical). The Caltrans Standard Plans indicate that for horizontal backfill (Load Case 1), the footing bearing stresses under Service and Strength Limit State conditions are 1.2 ksf and 2.1 ksf, respectively.

All elevations referred to in this document are based on NAVD88 datum.

GEOTECHNICAL INVESTIGATION

Explorations conducted for the seismic retrofitting of the nearby existing Valley View Overcrossing Bridge, No. 55-0302 (Caltrans, 2014) and Sound Wall 268 (EMI, 1996) contain usable information for the proposed wall. However, the elevations of these borings being lower than footing bottom elevation of the proposed wall, they did not contain information of the subsurface conditions within a part of influence zone of the wall footing. Therefore, it was decided to conduct a field investigation to supplement the data obtained in the previous investigations.

A field exploration consisting of 3 cone penetrometer tests (CPT) was conducted on June 16, 2015 using a Caltrans Foundation Testing Branch truck housing the CPT equipment. CPT system consists of an instrumented cone and a sleeve that record the soil resistance to the penetration into the subsurface. The soils types/classifications and their properties are determined from established empirical correlations for the resistances. In order to obtain a sounding, the system is advanced at a controlled rate to a predetermined depth and a continuous profile of the subsurface materials is obtained.

CPT soundings were advanced only to a depth of 20 feet from the ground surface (BGS), since information of the deeper subsurface materials were available from the previous investigations. The locations of the soundings were determined approximately from the project plans. The elevations of the soundings were estimated using precise leveling. A representative of Geotechnical Design South 1, Branch D was present during the performing of the soundings and observed geotechnical profile of the subsurface strata being investigated. Following the completion of the soundings the cone was retracted and the resulting holes were backfilled using a cement grout and capped with asphalt patches in accordance with current C-57 regulations.

Information of the soundings, including the total depths, stationing, offset and the ground surface elevations are summarized in Table 1 below.

Table 1 – Summary of CPT Soundings

CPT No.	"V2" Line Station	Offset from"V2" Line (ft)	Depth (ft)	Top Elevation (ft)
CPT-15-001	4+18	7 Rt.	20.5	78.9
CPT-15-002	4+49	8 Rt.	20.0	79.0
CPT-15-003	5+23	8 Rt.	20.5	78.3

Note: Stationing and offset were estimated based on the provided project plans. Elevations were measure through precise surveying by OGDS1 staff.

SITE AND REGIONAL GEOLOGY

SITE GEOLOGY AND SUBSURFACE CONDITIONS

Regional Geology

The site is located within the Los Angeles Basin, which lies between the Peninsular Ranges and Transverse Ranges geomorphic provinces. The Los Angeles Basin is an alluvium-filled basin that is up to several miles thick at its deepest point. The site is southwest of the Coyote Hills and east of the confluence of the Coyote Hills Creek and Fullerton Creek. The topography of the area is relatively level.

Site Geology

The site is underlain by alluvium derived from the San Gabriel River and its tributaries, such as Coyote Creek**.** The alluvium is generally composed of interlayered, very thickly bedded, medium dense to dense sands with varying amounts of silt. Man-made fills are present at the ramp locations.

Site Subsurface Conditions

The site subsurface conditions down to a depth of 20 feet below the ground surface were assessed from CPT soundings in the current investigation. The subsurface conditions below 20 feet (from an elevation of about 58 feet) were assessed from borings excavated in investigations conducted by Caltrans (Caltrans, 2014) and EMI (EMI, 1996).

The surficial materials at the site consist of about 1 ¼ -foot thick structural asphalt pavement and the underlying, approximately 3-foot thick, dense to very dense and granular subgrade (base and sub-base) materials. In the western portion of the site, the surficial materials are underlain mainly by very stiff clayey silts/silty clays to 20 feet below the ground surface (BGS), which is the maximum depth of CPT soundings (elevation of about 58 feet). These clayey silt/silty clays contain several relatively thin (less than 2 feet) clay layers and loose silty sand/sandy silt layers at elevations below the proposed footing bottom. In the eastern portion of the site, the surficial materials are underlain by very stiff clayey silts/silty clays to a depth of about 10 feet BGS. These materials are underlain by medium dense to dense silty sands to a depth of 20 feet BGS. The subsurface conditions at depths below 20 feet BGS (elevation of about 58 feet) were assessed from Boring S-301 (EMI, 1996) and CPT-13-005 and CPT-13-006 (Caltrans 2014). Boring S-301 indicates that soils at depths from 20 feet to 90 feet BGS, mainly consist of loose to medium dense silty sands with relatively thin, stiff sandy silt/silt layers and occasional dense sand layers.

In the western portion of the site, a design undrained shear strength of 3 ksf is recommended for the cohesive materials from the surface to a depth of 20 feet BGS. In the eastern portion of the site, a design undrained shear strength of 3 ksf, is recommended for the fine grained soils from the surface to a depth of 10 feet BGS. A design cohesion of 50 psf and a friction angle of 36 degrees

are recommended for the underlying granular materials from 10 feet to 17 feet BGS for the eastern portion of the side.

The subsurface soils underlying the above layers (in both eastern and western portions) to the maximum depth explored consist mainly of medium dense sands/silty sands with intermittent layers of loose and dense sand layers, and silt/clay layers. A cohesion of 100 psf and friction angle 32 degrees are recommended for these deeper sand layers.

Groundwater

The groundwater elevations at Valley View Overcrossing as observed in EMI, 1996 and Caltrans, 2014 geotechnical investigations, ranged from 33 feet 49.5 feet. Based on the above, OGDS1 is of the opinion that the depth to the groundwater at the site is over 30 feet (approximately elevation 49 ft), BGS.

CORROSION EVALUATION

Two bulk samples of the site materials were collected from the slope surface at the proposed footing elevation, for testing at the Department's Transportation Laboratory for minimum resistivity and pH (CTM 643), soluble sulfate (CTM 422), and soluble chloride contents (CTM 417). Corrosion tests results indicate that subsurface soil is non-corrosive to concrete.

Table 2 - Corrosion Test Summary

Sample No.	Approximate Elevation of Sample (feet)	pH	Minimum Resistivity (ohm-cm)	Sulfate Content (ppm)	Chloride Content (ppm)
CPT-15-001	70.0 & 73.0	8.03	1810	N/A	N/A
CPT-15-003	70.0 & 73.0	8.28	1922	N/A	N/A

Note: According to Caltrans criteria given in Corrosion Guidelines, January 1996, an area is corrosive when the soil and/or water contains more than 500 ppm of chlorides, more than 2000 ppm of sulfates, has a minimum resistivity of less than 1000 ohm-cm or has a pH of 5.5 or less.

SEISMIC DESIGN RECOMMENDATIONS

Design Ground Motion

Seismic ground motion hazard at the site was evaluated using Version 2.3.06 of the Caltrans ARS Online tool. A V_{s30} of 270 m/s was estimated for the subject site using the correlations between soil shear wave velocity and CPT tip resistance and SPT blows counts (from the previous investigations). The computations performed using Caltrans' ARS Online tool indicate that the design Peak Ground Acceleration (PGA) for the project site is 0.58g.

Based on the Caltrans ARS Online tool, the reverse faults Puente Hills (Coyote Hills), Anaheim, and Compton are the nearby significant seismic sources for the project site. The Puente Hills Fault dips 26° to the northwest with a M_{max} of 6.8, and contributes most to the seismic hazard corresponding to the design ground motion return period. The rupture distance (R_{rup}) is approximately 4.4 km (2.7 mi) from the site. The Anaheim Fault dips 71° to the northeast with a M_{max} of 6.4. The rupture distance (R_{rup}) is approximately 3.9 km (2.4 mi) from the site. The Compton Fault is Fault ID 367 in the Caltrans ARS On-line database. It dips 20° to the northeast with a M_{max} of 6.9. The rupture distance (R_{rup}) is approximately 10.8 km (6.7 mi) from the site.

Fault Surface Rupture Hazards

The project site is not located within any Alquist-Priolo Earthquake Fault Zones as established by the California Geological Survey (CGS, 1986) and fault surface rupture is not considered a design issue for the subject structure.

Liquefaction Hazards

The loose to medium dense silty sand/sand and some of the silt layers located below the groundwater table are potentially liquefiable under the design earthquake. Consequences of liquefaction include settlements and lateral movement/deformation of the embankment containing the on-ramp. Such settlements and lateral deformations could be on the order of several inches. Although the settlements/lateral deformations of the embankment is unlikely to cause catastrophic failure of the proposed retaining wall and compromise the safety of motorists, the wall could experience significant distress following a design event. However, mitigation of the liquefaction potential to reduce damages to the wall and the embankment is not considered prudent considering the cost and the benefits received. Therefore, OGDS1 is of the opinion that no mitigation of the liquefaction induced hazards is warranted for the proposed project.

GEOTECHNICAL RECOMMENDATIONS

Global Stability

The global stability of the retaining wall was evaluated under static conditions using the design soil parameters presented in the section on Site Subsurface Conditions. The analysis was performed using the Computer Program STED, which utilizes limiting equilibrium method, for a cross section at Station 5+00 (V2 Line Stationing) where the slope is approximately 25 ft. high.

The stability analysis indicated that the slope containing the retaining wall has a factor of safety in excess of 1.5 under the static condition. Analysis also indicated that under design seismic condition, the factor of safety against failure through the upper part of the slope, containing the wall, in excess of 1.1. However, under the design seismic condition, the entire slope could experience several inches of deformation due to the presence of potentially liquefiable layers at depths below the toe of the slope. OGDS1 is of the opinion that such a deformation of the slope is unlikely to cause a significant hazard to the motorists.

FOUNDATION RECOMMENDATIONS

Based on the subsurface conditions observed during the geotechnical investigations, OGDS1 is of the opinion that the wall could be constructed as proposed, provided that loose/soft materials present at the foundation subgrade is overexcavated and backfilled with compacted fill to a depth of 3 feet below the footing bottom. The backfill should consist of granular materials containing no more than 30 percent fines and be placed at a minimum relative compaction of 95 percent. The overexcavations should extend a minimum of 2 feet beyond the footing perimeter. If local sporadic loose/soft material zones are encountered at the bottom of the overexcavation, the engineer may increase the overexcavation depth by additional 1 foot at such locations.

The following Foundation Data Table provides permissible bearing stress for the Service Limit State and the bearing resistances under Strength and Extreme Event Limit States.

Table 3 – Foundation Data Table

Support Location	**Service (1), Permissible Net Contact Stress (ksf)**	**Strength/Construction Factored Gross Bearing Resistance (ksf)** ϕ= 0.45	**Extreme Event Factored Nominal Bearing Resistance (ksf)** ϕ= 1.0
Type1A- Case 1 Retaining wall (8 ft high)	1.7	6.0	13.4

Note: 1. Permissible net contact stress was estimated for a settlement of 1 inch.

CONSTRUCTION CONSIDERATIONS

1. The backfill for the overexcavations should consist of low or non-expansive, granular materials containing no more than 30 percent fines and should be free of deleterious substances or cobbles larger than 6 inches in size. Some of the onsite materials excavated for the wall construction are anticipated to be suitable for the backfill.

2. The temporary excavations for the wall construction should be cut no steeper than 1:1 (horizontal: vertical) or be shored.

3. All earthwork should be performed in accordance to Section 19 of Caltrans Standard Specification 2010.

If you have any questions or comments, please call Gamini Weeratunga at (949) 440-3427 or Shiva Karimi at (213) 620-2146.

Prepared by: Date: 7/6/2015

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Attachment: Logs of CPT Soundings

cc:

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References

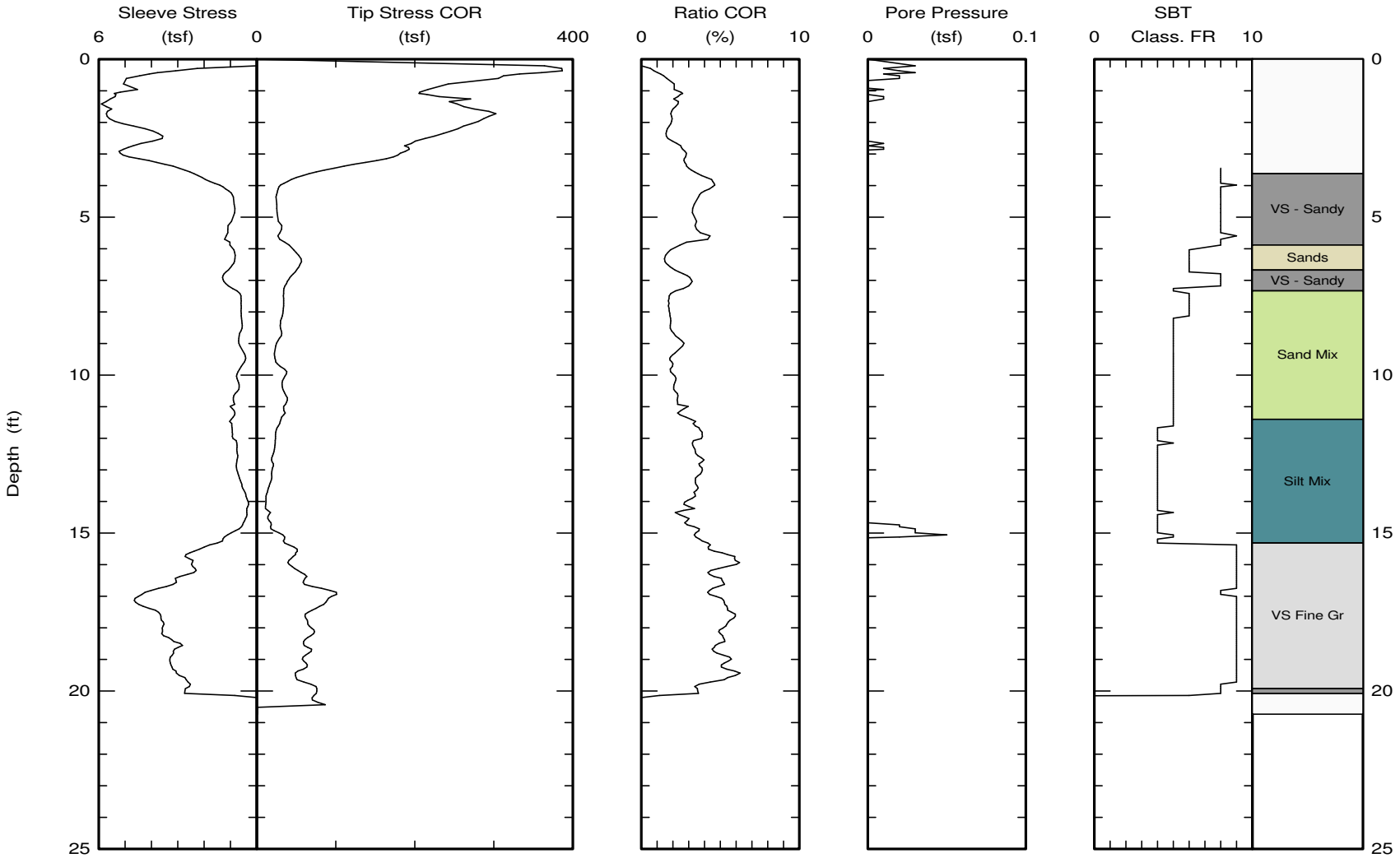
Caltrans, 2014 – "Foundation Report for Valley View Street Overcrossing (OC) Retrofit", dated March 25, 2014.

CGS, 1986 – "State of California Special Study Zones, Los Alamitos Quadrangle" dated July 1, 1986.

EMI, 1996 – "Final Structure Foundation Report, Retaining Walls 263 and 264, Widening of SR-91 at Valley View Street OC, Orange County, California" dated February 15, 1996

LOGS OF CPT SOUNDINGS

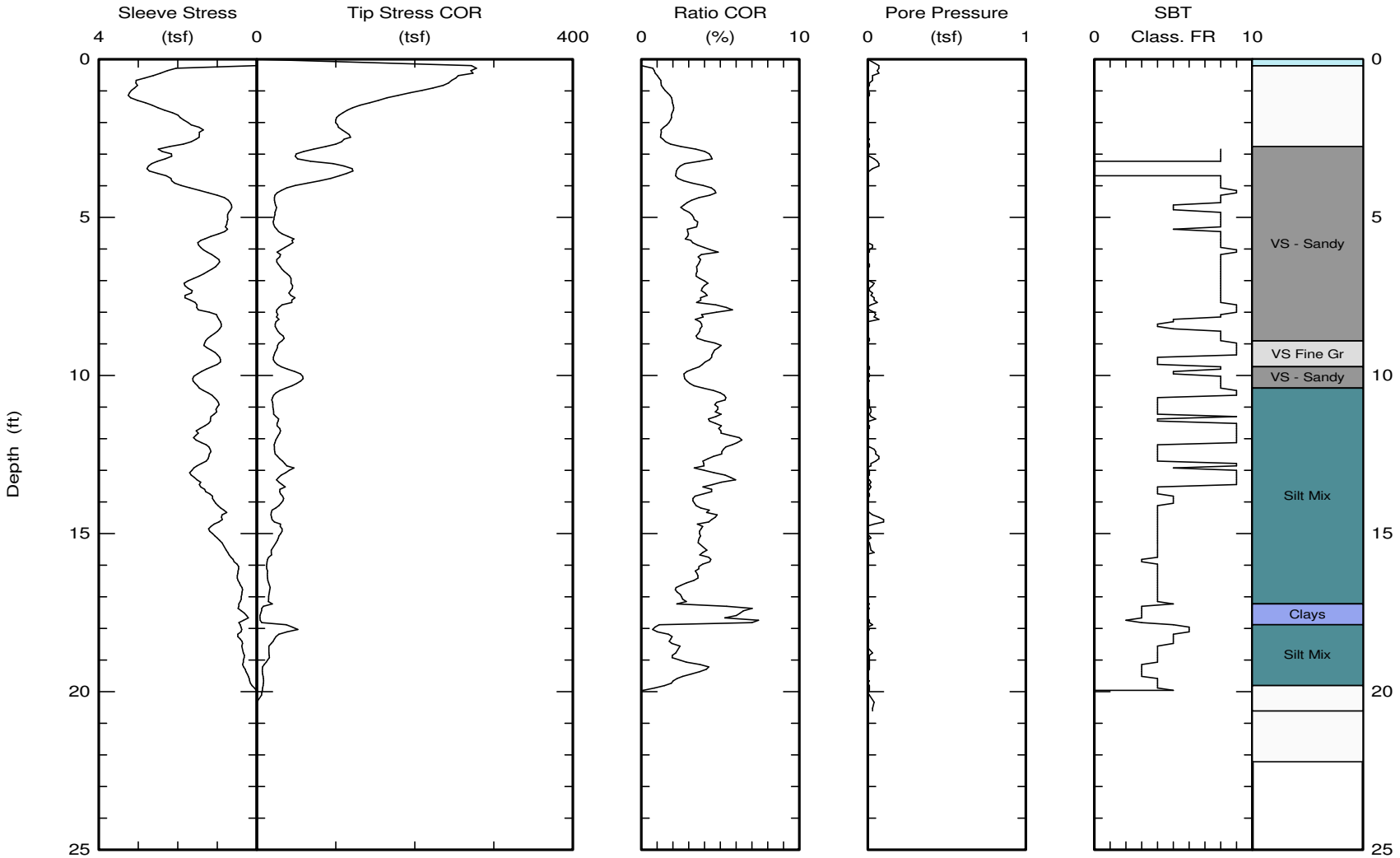
Division of Engineer Service Geotechnical Service 5900 Folsom Blvd. Sac., CA 95819 www.dot.ca.gov	Northing: Easting: Elevation:	Date: 16/Jun/2015 Test ID: 16U01-CPT1 Project: 1214000004
	Customer: Joe Pratt Job Site: ValleyView	



Maximum depth: 20.74 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

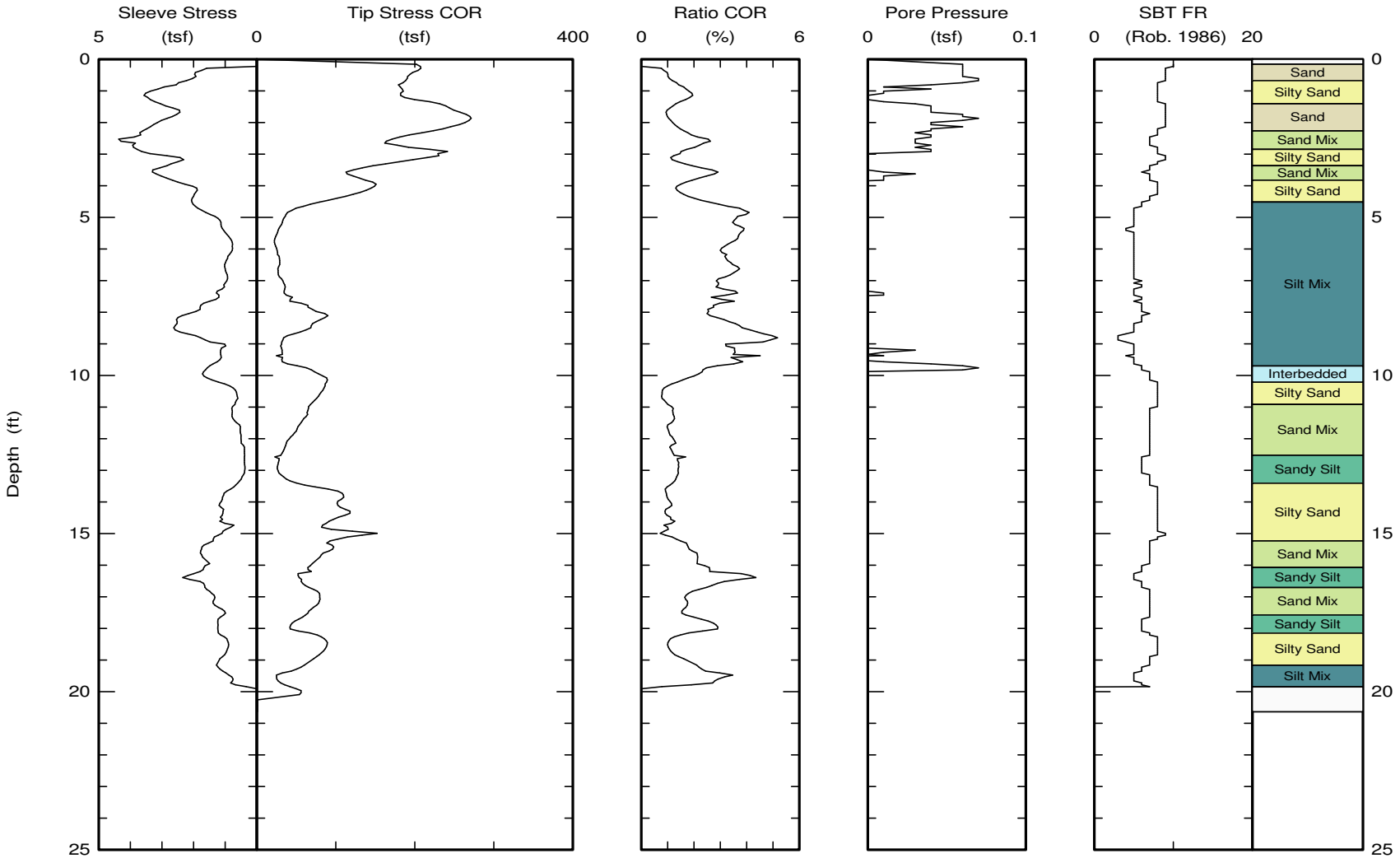
Division of Engineer Service Geotechnical Service 5900 Folsom Blvd. Sac., CA 95819 www.dot.ca.gov	Northing: Easting: Elevation:	Date: 16/Jun/2015 Test ID: 16U02-CPT2 Project: 1214000004
	Customer: Joe Pratt Job Site: ValleyView	



Maximum depth: 20.61 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Division of Engineer Service Geotechnical Service 5900 Folsom Blvd. Sac., CA 95819 www.dot.ca.gov	Northing: Easting: Elevation:	Date: 16/Jun/2015 Test ID: 16U03-CPT3 Project: 1214000004
	Customer: Joe Pratt Job Site: ValleyView	



Maximum depth: 20.64 (ft)