REVISED FINAL MATERIALS REPORT

Interstate 5 HOV Improvement Project (Segment 3)
PCH 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: January 22, 2013

EARTH MECHANICS, INC.

Geotechnical and Earthquake Engineering

Earth Mechanics, Inc.
Geotechnical & Earthquake Engineering

January 22, 2013

EMI Project No. 11-137

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

Attention: Dr. Ayman Salama, P.E.

Subject: Revised Final Materials Report
Interstate 5 HOV Improvement Project (Segment 3)
PCH 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 Revised Final Materials Report for the Interstate 5 HOV Improvement Project (Segment 3) from PCH to San Juan Creek Road. This report contains our findings, conclusions, and recommendations for the design and construction of the proposed widening. Specifically, this report addresses geotechnical and materials issues as described in Topic 114 of the California Department of Transportation (Caltrans) Highway Design Manual and Caltrans Test Method 130.

Earlier versions of this report dated March 23, 2012, July 3, 2012 and November 19, 2012 were submitted to Caltrans for review. Caltrans review comments dated June 19, 2012, July 20, 2012, and December 21, 2012, and our responses are included in Appendix C.

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

Sincerely,
EARTH MECHANICS, INC.

1-22-13

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REVISED FINAL MATERIALS REPORT

INTERSTATE 5 HOV IMPROVEMENT PROJECT (SEGMENT 3)
PCH 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.
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EMI Project No. 11-137

January 22, 2013

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1.0 GENERAL

1.1 PURPOSE AND SCOPE OF WORK

This Materials Report presents findings and conclusions of a geotechnical investigation conducted by Earth Mechanics, Inc. (EMI) for the Interstate 5 (I-5) High-Occupancy Vehicle (HOV) Lanes Improvement Project (Segment 3) from Pacific Coast Highway (PCH) to San Juan Creek Road located in the County of Orange, California. The project location is shown on the Site Location Map in Figure 1. The purpose of the geotechnical investigation was to obtain subsurface information to develop design and construction recommendations to aid TRC Solutions, Inc. (TRC) in preparing the Project Plans, Specifications, and Estimates (PS&E).

This report follows the requirements for a Materials Report in accordance with Topic 114 of the California Department of Transportation (Caltrans) Highway Design Manual (HDM, 2008a) and is organized in general accordance with California Test (CT) 130 (Caltrans, 2000). This report provides geotechnical information and recommendations for pavement structural sections, earthwork, and addresses soil corrosion issues at the site as required by the HDM.

The following geotechnical services were completed for this project:

- Geotechnical field exploration consisting of 42 exploratory borings and 11 cone-penetration test soundings.
- Laboratory testing of selected soil samples.
- Pavement structural section design.
- Soil corrosivity evaluation.
- Preparation of this report presenting our findings, conclusions, and recommendations.

1.2 PROJECT DESCRIPTION

The Orange County Transportation Authority (OCTA), in cooperation with the California Department of Transportation (Caltrans), and Cities of Dana Point and San Juan Capistrano, proposes to improve I-5 from PCH to San Juan Creek Road. The project limits on I-5 extend from approximately 0.6 mile south of PCH (I-5 Mainline Station 340+00) in the City of Dana Point to approximately 0.2 mile south of San Juan Creek Road (I-5 Mainline Station 465+00) in the City of San Juan Capistrano.

From I-5 Mainline Stations 340+00 (southern project limit) to 407+50, the proposed project will widen the I-5, and add one HOV lane in both directions, reestablish auxiliary lanes, widen three bridges, modify one bridge, realign and reestablish on- and off-ramps, and construct retaining walls, soundwalls and sign structures. 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.

1.3 CLIMATIC CONDITIONS

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.

1.4 TERRAIN, LAND USE, AND SURFACE DRAINAGE

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 Undercrossing 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.

Surrounding developments include both commercial and residential buildings. Metrolink/BNSF railway lines are located about 0.2 mile west of the I-5 centerline.

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 Undercrossing, no natural drainages actually cross this segment of the project corridor.

1.5 REGIONAL GEOLOGY

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 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 ancient landslide. The landslide is located on the west to northwest descending slope and extends about 8000 feet along the eastern edge of the I-5 southbound. Previous studies have indicated that the landslide mass extends to the northwest under the freeway by up to about 4000 feet. The landslide is postulated to have occurred during the wetter periods of the Pleistocene ice ages when the San Juan Creek valley was deeper and the streams were actively undercutting the hills at the margins of the creek. Since then, the valley has filled with alluvium which tends to form a natural buttress thereby stabilizing the slides. Alluvium overlying the McCracken Hill landslide is estimated to be on the order of 130 feet thick.

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. 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.

1.6 PERTINENT REPORTS AND INVESTIGATIONS

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

1.7 RELATED REPORTS PREPARED FOR THE PROPOSED IMPROVEMENTS

A separate Geotechnical Design Report (GDR) (EMI, 2012g) will be prepared for the current geotechnical study to address geotechnical issues not included in this report. The Geotechnical Design Report may be referred to for additional geotechnical information.

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

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

1.8 LIMITATIONS

This report is intended for the use of OCTA, TRC and Caltrans for design and construction of the I-5 HOV Improvement (Segment 3) between PCH and San Juan Creek Road. 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.

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 northern terminus of the project is in the City of San Juan Capistrano approximately 0.2 mile south of San Juan Creek Road. The project's southern terminus is approximately 0.6 mile south of PCH in the City of Dana Point. 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 and four through-lanes in each direction south of PCH, with auxiliary lanes for some of the on- and off-ramps.

There are four existing bridge structures within the project limits:

- 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)

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. The 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).

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

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

The existing pavement sections are presented in Typical Section sheets provided by TRC and summarized in Table 1.

Table 1. Existing Pavement Sections

Locations	As-Built Pavement Sections	
Stations (A Line)	I-5 Southbound Mainline	I-5 Southbound Shoulder
340+00.00 to 366+00.00	0.40' AC (Type B) 0.50' PCC 0.40' CTB (Class A) 0.25' Class 3 AB 0.85' Class 4 AS	0.40' AC (Type B) 0.50' PCC 0.40' CTB (Class A) 0.25' Class 3 AB 0.85' Class 4 AS
366+00.00 to 367+83.41		0.10' RHMA-O 0.20' RHMA-G 0.10' AC (Type B) 0.50' PCC 0.40' CTB (Class A) 0.25' Class 3 AB 0.85' Class 4 AS
367+83.41 to 369+57.22		0.40' AC (Type B) 0.50' PCC 0.40' CTB (Class A) 0.25' Class 3 AB 0.85' Class 4 AS
369+57.22 to 370+75.16	0.10' RHMA-O 0.20' RHMA-G 0.10' AC (Type B) 0.50' PCC 0.40' CTB (Class A) 0.25' Class 3 AB 0.85' Class 4 AS	0.25' AC (Type B) 0.50' CTB (Class A) 0.30' Class 3 AB 0.95' Class 4 AS
370+75.16 to 374+30.89	0.10' RHMA-O 0.20' RHMA-G 0.15' AC (Type B) 0.75' PCC 0.35' CTB (Class A) 0.50' CTB Agg 0.40' Class 4 AS	0.10' RHMA-O 0.15' RHMA-G 0.50' Class 2 AB 1.25' Class 4 AS
374+30.89 to 378+89.80	0.10' RHMA-O 0.15' RHMA-G 0.75' PCC 0.35' CTB (Class A) 0.50' CTB Agg 0.40' Class 4 AS	0.10' RHMA-O 0.15' RHMA-G 0.35' AC (Type B) 0.50' Class 2 AB 1.15' Class 4 AS
378+89.80 to 382+30.00		0.10' RHMA-O 0.15' RHMA-G 0.50' Class 2 AB 1.25' Class 4 AS
382+30.00 to 384+30.71		0.10' RHMA-O 0.15' RHMA-G 0.35' AC (Type B) 0.65' CTB (Class A) 0.30' Class 3 AB 1.10' Class 4 AS

Locations	As-Built Pavement Sections	
Stations (A Line)	I-5 Southbound Mainline	I-5 Southbound Shoulder
384+30.71 to 388+97.50	0.10' RHMA-O 0.20' RHMA-G 0.15' AC (Type B) 0.75' PCC 0.35' CTB (Class A) 0.50' CTB Agg 0.40' Class 4 AS	0.10' RHMA-O 0.15' RHMA-G 0.50' Class 2 AB 1.25' Class 4 AS
388+97.50 to 396+00.00	0.10' RHMA-O 0.15' RHMA-G 0.85' PCC 0.50' LCB 0.70' Class 2 AB	0.10' RHMA-O 0.15' RHMA-G 0.50' AC (Type B) 1.40' Class 2 AB
396+00.00 to 396+72.35	0.75' PCC 0.35' CTB (Class A) 0.50' CTB Agg 0.40' Class 4 AS	0.50' AC (Type B) 1.40' Class 2 AB
396+72.35 to 398+60.45		0.35' AC (Type B) 0.50' CTB Agg 1.15' Class 4 AS
398+60.45 to 401+08.42		0.10' RHMA-O 0.15' RHMA-G 0.50' AC (Type B) 1.40' Class 2 AB
401+08.42 to 407+60.00		0.10' RHMA-G 0.25' AC (Type B) 0.50' CTB Agg 1.15' Class 4 AS

Locations	As-Built Pavement Sections	
Stations	I-5 Northbound Mainline	I-5 Northbound Shoulder
340+00.00 to 343+50.00	0.35' AC (Type B) 0.65' CTB (Class A) 0.30' Class 3 AB 1.10' Class 4 AS	0.25' AC (Type B) 0.50' Class 3 AB 1.65' Class 4 AS
343+50.00 to 357+85.00	0.40' AC (Type B) 0.50' PCC 0.40' CTB (Class A) 0.25' Class 3 AB 0.85' Class 4 AS	0.40' AC (Type B) 0.50' PCC 0.40' CTB (Class A) 0.25' Class 3 AB 0.85' Class 4 AS
357+85.00 to 369+57.22	0.10' RHMA-O 0.20' RHMA-G 0.10' AC (Type B) 0.50' PCC 0.40' CTB (Class A) 0.25' Class 3 AB 0.85' Class 4 AS	0.10' RHMA-O 0.20' RHMA-G 0.60' Class 2 AB 1.50' Class 4 AS

Locations	As-Built Pavement Sections	
Stations	**I-5 Northbound Mainline**	**I-5 Northbound Shoulder**
369+57.22 to 375+43.87	0.10' RHMA-O 0.15' RHMA-G 0.15' AC (Type B) 0.75' PCC 0.35' CTB (Class A) 0.50' CTB Agg 0.40' Class 4 AS	0.10' RHMA-O 0.15' RHMA-G 0.50' Class 2 AB 1.25' Class 4 AS
375+43.87 to 388+97.50	0.10' RHMA-O 0.15' RHMA-G 0.75' PCC 0.35' CTB (Class A) 0.50' CTB Agg 0.40' Class 4 AS	0.10' RHMA-O 0.15' RHMA-G 0.35' AC (Type B) 0.50' Class 2 AB 1.15' Class 4 AS
388+97.50 to 394+42.58		0.10' RHMA-O 0.15' RHMA-G 0.35" AC (Type) 0.65' CTB (Class A) 0.30' Class 3 AB 1.10' Class 4 AS

Stations	I-5 Mainline Median As-Built Pavement Sections
340+00.00 to 370+99.00	No Median Improvement
370+99.00 to 375+43.87	0.70' PCC 0.35' LCB 0.50' Class 2 AB
375+43.87 to 394+42.58	0.10' RHMA-O 0.15' RHMA-G 0.70' PCC 0.35' LCB 0.50' Class 2 AB

Ramps	Stations	As-Built Pavement Sections
I-5 SB On-Ramp from PCH	"PCH-1" 360+14.66 to 364+30.00 "PCH-1" 370+61.63 to 373+00.15	0.45' AC (Type B) 0.65' CTB (Class A) 0.30' Class 3 AB 1.10' Class 4 AS
	"PCH-1" 364+30.00 to 370+61.63	0.35' AC (Type B) 0.50' Class 3 AB 1.60' Class 4 AS

Ramps	Stations	As-Built Pavement Sections
I-5 SB Loop On-Ramp from PCH	"PCH-2" 366+00.00 to 367+13.51 "PCH-2" 368+12.26 to 370+63.18	0.30' AC (Type B) 0.60' Class 2 AB 1.50' Class 4 AS
	"PCH-2" 367+13.51 to 368+12.26	0.25' AC (Type B) 0.50' CTB (Class A) 0.30' Class 3 AB 0.95' Class 4 AS
	"PCH-2" 370+63.18 to 374+92.00	0.35' AC (Type B) 0.50' CTB (Class A) 0.30' Class 3 AB 0.95' Class 4 AS
I-5 SB Off-Ramp to PCH	"PCH-3" 374+50.00 to 379+58.05	0.20' RHMA-G 0.25' AC (Type B) 0.65' CTB (Class A) 0.30' Class 3 AB 1.10' Class 4 AS
	"PCH-3" 379+58.05 to 382+30.00	0.10' RHMA-O 0.15' RHMA-G 0.45' AC (Type B) 0.65' CTB (Class A) 0.30' Class 3 AB 1.10' Class 4 AS
I-5 NB Loop On-Ramp from PCH	"PCH-4" 375+00.00 to 375+66.36	0.20' RHMA-G 0.25' AC (Type B)
	"PCH-4" 375+66.36 to 381+44.07	0.45' AC (Type B) 0.65' CTB (Class A) 0.30' Class 3 AB 1.10' Class 4 AS
	"PCH-4" 381+44.07 to 387+00.00	0.10' RHMA-O 0.15' RHMA-G 0.35' AC (Type B) 0.65' CTB (Class A) 0.30' Class 3 AB 1.10' Class 4 AS
I-5 NB Off-Ramp to PCH	"PCH-5" 343+50 to 352+80.00	0.35' AC (Type B) 0.65' CTB (Class A) 0.30' Class 3 AB 1.10' Class 4 AS
	"PCH-5" 352+80 to 356+79.82	0.45' AC (Type B) 0.65' CTB (Class A) 0.30' Class 3 AB 1.10' Class 4 AS
I-5 NB Off-Ramp to PCH	"PCH-6" 352+80.00 to 359+00.00	0.35' AC (Type B) 0.50' CTB (Class A) 0.30' Class 3 AB 0.95' Class 4 AS

Ramps	Stations	As-Built Pavement Sections
NB PCH/Camino Las Ramblas	"CLR" 33+84.20 to 40+90.00	0.35' AC (Type B) 0.65' CTB (Class A) 0.30' Class 3 AB 1.10' Class 4 AS

AC (Type B) = Asphalt Concrete – Type B; PCC = Portland Cement Concrete; CTB (Class A) = Cement Treated Base – Class A; CTB Agg = Cement Treated Base Aggregate; AB = Aggregate Base; AS = Aggregate Subbase; RHMA-O = Rubberized Hot Mix Asphalt - Open Graded; RHMA-G = Rubberized Hot Mix Asphalt - Gap Graded; LCB = Lean Concrete Base.

2.2 PROPOSED IMPROVEMENTS

According to the Project Report prepared in October 2011, the Preferred Alternative provides continuous access HOV lanes. The Preferred Alternative would include:

- Add one HOV lane per direction on I-5 throughout project limits
- Reestablish 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
- Structure widening on both the northbound and southbound side of Route 5/1 Connector (Bridge No. 55-0510)
- Structure widening on both the northbound and southbound side of 5/N5-N1 Connector Separation (Bridge No. 55-0226)
- Structure widening on southbound side of Camino Capistrano UC (Bridge No. 55-0227)
- Structure modification on south side of Via California (Bridge No. 55-0225) which includes a Retaining Wall along PCH SB to I-5 SB on-ramp
- Construct Retaining wall along southbound I-5 near Camino Capistrano UC
- Construct Sound walls at multiple locations throughout the project limits
- Construct Sign Structures at multiple locations throughout the project limits

Drainage work involves construction of various sized Reinforced Concrete Pipe (RCP) culverts and drainage inlets throughout the length of the project. The major utility lines crossing the I-5 mainline will be protected in place.

Recommended pavement structural sections for the I-5 Mainline lanes and shoulders, ramps and PCH are presented in Section 7.4 of this report.

3.0 ROADWAY AND CULVERT FOUNDATIONS

3.1 GEOTECHNICAL INVESTIGATION

A geotechnical field investigation was conducted between September 26 and October 20, 2011 for all the proposed improvements. 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 2. Approximate locations of borings and CPTs are shown on Figure 2 through Figure 8. Logs of borings and records of CPT soundings are presented in Appendix A. For deep borings, only the upper 25 feet of subsurface data are presented in the logs of borings in Appendix A.

Table 2. Soil Exploration Information

Boring	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

Boring	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-11-330	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
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.

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 and bedrock samples were obtained using a 3.25-inch outer diameter MCD sampler lined with brass rings. Each of these brass rings is 1-inch long with a 2.5-inch outside diameter. The SPT sampler (1.4-inch inside diameter) was also used to obtain soil samples. The MCD and SPT samplers were driven 18 inches into the ground or until refusal was encountered using a 140-lb hammer free falling from a height of 30 inches. The numbers of blows to advance the sampler each 6 inches of penetration were recorded. The number of blows for the final 12 inches or shorter of driving was recorded on the boring logs. 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 in² (10 cm²) and a cylindrical friction sleeve with a surface area of 23.25 in² (150 cm²). The interior of the cone penetrometer is instrumented with strain gauges that allow simultaneous measurements of cone tip and friction sleeve resistance during penetration. The cone penetrometer assembly is continuously pushed into the soil by a set of hydraulic rams at a standard rate of 0.79 inch per second (20 mm per second) while the cone tip resistance and sleeve friction resistance are recorded every 1.967 inches (50 mm) and stored in digital form. A specially designed all-wheel drive 25-ton truck provides the required reaction weight for pushing the cone assembly and is also used to transport and house the testing equipment. The computer generated graphical logs include tip resistance, friction resistance, and friction ratio. Soil behavior type interpretations are based on guidelines by Robertson and Campanella (1989).

3.2 LABORATORY SOIL TESTING

Soil samples were tested to obtain or derive relevant physical and engineering properties. To perform analyses related to the Materials Report, the following laboratory soil tests were conducted to supplement the observations recorded during the field investigation:

- In-situ Moisture Content and Unit Weight
- Percent Passing No. 200 Sieve
- Atterberg Limits
- Pocket Penetrometer
- Minimum Resistivity, pH, Sulfate Content and Chloride Content (Soil Corrosivity)
- Maximum Density and Optimum Moisture Content
- R-Value

The laboratory tests were conducted in general accordance with California Test (CT) methods or American Society for Testing and Materials (ASTM, 2008) standards. Soil corrosivity test results are presented in Section 6.2. R-value and Atterberg Limits test results for near-surface bulk samples are presented in Section 7.2. Maximum Density and Optimum Moisture Content test results are presented in Section 10.0. The remaining laboratory test results are included in the boring logs.

3.3 GROUNDWATER

As shown in Table 2, 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 borings are less than 50 feet apart, groundwater was only encountered in one of the two 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.

3.4 FOUNDATION TREATMENT FOR GENERAL FILL AREAS

Vegetation on existing ground should be removed from the site prior to fill placement. Loose, soft, dry, wet, or otherwise unsuitable materials should be removed from areas to receive fill. After clearing and grubbing, a minimum overexcavation and recompaction of 24 inches should be accomplished within all areas to receive compacted fill. The overexcavation should extend horizontally a minimum distance of 24 inches from edges of new fills. The overexcavation bottoms should be scarified to a minimum depth of 8 inches, moisture conditioned to near optimum moisture content, and compacted to at least 90 percent relative compaction. All overexcavation bottoms should be observed to be firm and unyielding prior to fill placement. No special foundation treatment is recommended for proposed drainage structures at this site. Foundation treatment for pavement subgrade is discussed in Section 0.

3.5 DRAINAGE SYSTEMS

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 downstream. 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 utilities and drainage structures that fall within a 45-degree projection below the footprint of fills.

4.0 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 (Bridge No. 55-0225).
- Up to about 15 feet of cut is required for realignment of the I-5 SB Loop On-Ramp from PCH (PCH-2 Line).
- Up to 13 feet of cut is required for widening of the I-5 NB between Stations 340+00 and 340+50.
- Up to 8 feet of excavation is required for the widening of the I-5 NB between Stations 375+00 and 376+25.

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 embankment side slopes with gradients steeper than 4H to 1V.

Stability of cut underneath Via California (Bridge No. 55-0225) will be addressed in a separate foundation report (EMI, 2012d). Stability of the other aforementioned cuts will be addressed in the Geotechnical Design Report (EMI, 2012g).

5.0 EMBANKMENTS

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

- Up to 15 feet of sliver fill will need to be placed to construct the approaches to each bridge widening.
- 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).

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.

Stability and settlement of the bridge approach fill embankments and the retaining wall backfill are addressed in the foundation reports (EMI, 2012a through 2012e). Stability and settlement of the roadway embankments are addressed in the GDR (EMI, 2012g).

6.0 CORROSION INVESTIGATIONS

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 3. 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 3. Soil Corrosion Test Results

Boring	Location		Sample Depth (feet)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Soluble Sulfate Content (ppm)	Soluble Chloride Content (ppm)
	Station (A Line) (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	SC	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	CL	500	7.5	1,574	1,200
A-11-323	367+63	91 Lt	5.0	SC-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	SM	2,070	7.3	168	180
A-11-342	382+22	114 Lt	0-5	SC	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 (2003), 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. Corrosion protection requirements for various culvert materials are presented in Section 9.5.

7.0 STRUCTURAL PAVEMENT DESIGN

7.1 EXISTING PAVEMENT SECTIONS

The as-built pavement sections along I-5 mainline and ramps have been summarized in Table 1.

7.2 SUBGRADE R-VALUES

Twenty four samples of on-site, near-surface soils were tested to determine their R-values. The R-value, and selected Plasticity Index (PI) and fine content test results along with USCS soil type are presented in Table 4.

Table 4. R-Value, Plasticity Index and Fine Content Test Results

Boring	Location		Sample Depth (feet)	USCS Soil Type	R-Value	Plasticity Index (%)	Fine Content (%)
	Station (A Line) (feet)	Offset (feet)					
A-11-301	339+88	84 Lt	0.0-2.5	SC	15	13	34
A-11-302	340+41	151 Rt	0.8-5.0	CL	4	27	-
A-11-303	340+56	92 Rt	0.0-5.0	SC	13	9	31
A-11-305	348+01	125 Rt	0.9-5.0	SC	16	18	20
HA-11-307	353+92	77 Rt	0.0-1.5	SC	33	12	38
HA-11-308	358+49	214 Rt	0.0-2.0	SC	23	15	-
A-11-316	361+81	87 Rt	0.0-5.0	CL	6	29	-
A-11-317	364+78	104 Lt	0.0-5.0	CL	10	16	74
A-11-319	366+17	98 Lt	0.0-2.5	CL	15	16	-
A-11-322	365+30	101 Rt	0.0-5.0	CL	16	20	67
A-11-327	370+20	115 Lt	0.0-5.0	CL	17	22	-
A-11-329	367+37	312 Lt	0.0-5.0	CL	33	13	51
A-11-335	370+63	6 Rt	1.5-5.0	CL	15	26	66
HA-11-336	374+49	214 Rt	0.0-5.0	CL	24	14	58
A-11-337	375+16	98 Rt	0.0-5.0	CH	14	28	96
HA-11-338	374+62	87 Lt	0.0-5.0	SM	46	NP	37
A-11-339	374+03	269 Lt	0.0-2.5	CL	12	25	67
HA-11-341	381+83	90 Rt	0.0-5.0	SM	51	8	37
A-11-342	382+22	114 Lt	0.0-5.0	SC	32	12	23
HA-11-344	390+22	99 Rt	0.0-5.0	SC	39	14	45
A-11-346	393+10	88 Rt	1.3-5.0	CL	12	18	53
A-11-348	397+27	74 Lt	0.0-5.0	SC	22	12	28
A-11-350	400+46	75 Lt	2.0-5.0	CL	22	18	50
A-11-352	398+43	80 Rt	2.1-5.0	CL	12	22	80

NP = Non-Plastic

We have the following observations based on an examination of the data in Table 4:

- R-value ranges from 4 to 51, and 14 out of the 24 samples have a R-value less than 20,
- 14 out of 24 samples tested are classified as "CL or CH", and 8 out of 24 samples tested are classified as "SC", and
- 18 out of 24 tested PI results are greater than 12%.

Soils with PI greater than 12% are considered "Expansive Soil" per Caltrans HDM Topic 614.4 (2008a). In order to mitigate the onsite expansive subgrade, a viable solution is to use a combination of underdrain, 1.0 to 1.3 feet of additional aggregate subbase (AS), 0.65 foot of lime treatment below the AS, and a design R-value of 10.

A design R-value of 20 is recommended for design of the pavement on non-expansive subgrade. Pavements for the following segments of I-5 mainline and SB On-Ramp ("PCH-1" Line) are on non-expansive subgrade and were designed with a R-value of 20:

- I-5 SB mainline between southern end of the project limit and Station 354+25,
- SB On-Ramp between "PCH-1" Line Stations 354+25 and 365+00, and
- SB On-Ramp between "PCH-1" Line Station 370+00 and "CLR" Line Station 40+90.

7.3 EXPANSIVE SUBGRADE

In order to mitigate the onsite expansive subgrade, a pavement section with underdrains, 1.0 to 1.3 feet of additional AS and lime treatment below the AS is recommended.

7.3.1 Underdrains

The purpose of the underdrains is to intercept surface water, coming from adjacent slopes or sheet flowing across the freeway, which would enter the subsurface from the unpaved areas adjacent to the pavement. Underdrains should be provided at cut area and at-grade area.

The underdrain configurations are presented in Figure 9. As shown in the Figure 9, the underdrains should consist of at least 6-inch diameter perforated plastic pipe surrounded by permeable material wrapped in filter fabric. The underdrains should be constructed in accordance with Caltrans Standard Plan D102 and requirements in Section 68-2 of the Caltrans Standard Specifications (2010), and should outlet to approved surface or subsurface drainage devices.

7.3.2 Additional Aggregate Subbase Thickness

Aggregate subbase (AS) should be provided as follows:

- For rigid pavements, provide 1.3 feet of additional AS in addition to the 0.7 foot of AS needed per Caltrans Rigid Pavement design requirements.
- For flexible pavements, provide 1.0 foot of additional AS.

The added AS thickness is recommended for the following reasons: improving the R-value of the near-surface soils; providing a filter layer between the AB (or LCB) and the native subgrade; and, providing a working table in order to improve compaction efforts for the overlying pavement materials.

7.3.3 Lime Treatment

Lime can be added to fine-grained subgrades to reduce the expansion potential. Caltrans HDM Topic 614.4 indicates a minimum treated depth of 0.65 foot. Lime treatment protocols and requirements shall conform to Caltrans Standard Specification Section 24-2 (Caltrans, 2010) and Special Provisions.

7.4 RECOMMENDED PAVEMENT STRUCTURAL SECTIONS

Rigid and flexible pavement sections were designed in accordance with Sections 620 and 630 of the Caltrans HDM (2008a), respectively. Calculations to determine the flexible pavement sections are included in Appendix B. The existing pavement structural sections are "undrained" sections; therefore, undrained pavement sections are recommended for the I-5 mainline lanes and shoulder, ramps and Camino Las Ramblas/PCH.

7.4.1 Traffic Indices and Design Life

TRC communicated with Caltrans District 12 Traffic Studies Branch regarding the Traffic Indices through emails. Based on those emails presented in Appendix B and the Pavement Life Cycle Cost Analysis (LCCA) and Preliminary Materials Report prepared by Kleinfelder West, Inc. (Kleinfelder, 2010a and 2010b), TRC prepared the following Traffic Indices for a design life of 40-years.

Table 5. Summary of Traffic Indices

Location	Traffic Index
I-5 Mainline	16.0
I-5 Mainline Shoulders	10.0
Ramps	12.0
Camino Las Ramblas/PCH	12.0

7.4.2 Pavement Life Cycle Cost Analysis (LCCA)

Pavement LCCA was performed by Kleinfelder West, Inc. (Kleinfelder, 2010a) during the PA/ED phase of the project and reviewed by Caltrans. LCCA concludes using Jointed Plain Concrete Pavement (JPCP) for the I -5 Mainline, and Hot Mix Asphalt (HMA) for the I -5 Mainline Shoulders and Ramps for 40-year design life.

7.4.3 Rigid Pavement

The recommended undrained rigid pavement sections, assuming lateral support, for the I-5 Mainline Lanes is presented in Table 6.

Table 6. Recommended Rigid Pavement Structural Sections

Location	Traffic Index (40-Year Design Life)	Subgrade Type	Undrained Rigid Pavement With Lateral Support (South Coast Climate Region)
I-5 Mainline Lanes Except I-5 SB Between Southern End of Project Limit and Station 354+25	16.0	II	0.95' JPCP / 0.35' LCB / 2.00' AS / 0.65' LSS or 0.10' HMA-O / 0.20' RHMA-G / 0.95' JPCP / 0.35' LCB / 2.00' AS / 0.65' LSS
I-5 Mainline Lanes Along I-5 SB Between Southern End of Project Limit and Station 354+25	16.0	II	0.95' JPCP / 0.35' LCB / 0.70' AS or 0.10' HMA-O / 0.20' RHMA-G / 0.95' JPCP / 0.35' LCB / 0.70' AS

JPCP = Jointed Plain Concrete Pavement; HMA-O = Hot Mix Asphalt-Open Graded; RHMA-G = Rubberized Hot Mix Asphalt - Gap Graded; LCB = Lean Concrete Base; AS = Class 2 Aggregate Subbase; LSS = Lime Stabilized Soil; Use PG 64-10 Asphalt Binder.

Where the existing pavement section has HMA or RHMA overlay, rigid pavement section with HMA-O and RHMA-G is recommended for the proposed widening along I-5 Mainline Lanes.

7.4.4 Flexible Pavement

The recommended undrained flexible pavement sections for the I-5 mainline shoulders and ramps are presented in Table 7.

Table 7. Recommended Flexible Pavement Structural Sections

Location	Traffic Index (40-Year Design Life)	Design R-Value	Undrained Section
Mainline Shoulders			
I-5 Mainline Shoulder Except I-5 SB Between Southern End of Project Limit and Station 354+25	10.0	10	1.25' HMA-A / 0.50' AB / 1.00' AS / 0.65' LSS or 0.10' HMA-O / 0.20' RHMA-G / 1.05' HMA-A / 0.50' AB / 1.00' AS / 0.65' LSS
I-5 Mainline Shoulder Along I-5 SB Between Southern End of Project Limit and Station 354+25	10.0	20	1.15' HMA-A / 0.50' AB or 0.10' HMA-O / 0.20' RHMA-G / 0.95' HMA-A / 0.50' AB
Ramps			
SB Loop On-Ramp ("PCH-2" Line) SB Off-Ramp ("PCH-3" Line) NB On-Ramp ("PCH-4" Line) NB Off-Ramp ("PCH-5" and "PCH-6" Lines)	12.0	10	0.10' HMA-O / 0.20' RHMA-G / 1.35' HMA-A / 0.50' AB / 1.00' AS / 0.65' LSS
SB On-Ramp ("PCH-1" Line) Between Stations 365+00 and 370+00			
SB On-Ramp ("PCH-1" Line) Between Stations 354+25 and 365+00	12.0	20	0.10' HMA-O / 0.20' RHMA-G / 1.20' HMA-A / 0.50' AB
SB On-Ramp ("PCH-1" Line) Between Stations 370+00 ("PCH-1" Line) and 40+90 ("CLR" Line)			

HMA-A = Hot Mix Asphalt-Type A; HMA-O = Hot Mix Asphalt-Open Graded; RHMA-G = Rubberized Hot Mix Asphalt - Gap Graded; AB = Class 2 Aggregate Base; AS = Class 2 Aggregate Subbase; LSS = Lime Stabilized Soil. Use PG 64-10 Asphalt Binder.

7.5 COMPACTION AND REMEDIAL GRADING

Compaction of the subgrade should conform to requirements described in Section 19 of the Caltrans Standard Specifications (2006). Special care is required when compaction subgrade above reinforced concrete box, buried utility lines and drainage devices, and other sensitive buried structures to avoid damaging these existing nearby facilities.

In paved area, the upper 2.5 feet of subgrade (measured from the grading plane) should possess the design R-values. The design R-values are presented in Section 7.2.

Compaction and remedial grading recommendations for unpaved areas are included in the Geotechnical Design Report (EMI, 2012a). Those recommendations are: 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. The overexcavation bottom should be scarified a minimum depth of 6 inches and compacted in-place to the required minimum relative compaction.

All overexcavation bottoms should be firm and unyielding prior to fill placement. If not, additional remedial grading may be required.

8.0 MATERIALS AVAILABLE

Construction materials can be supplied by public or private sources. Private sources of construction materials (including sand, gravel, base, concrete, and asphalt concrete) were not investigated. However, materials are available from several commercial suppliers located in Orange and Los Angeles Counties. Table 8 provides the name, location, and telephone number for several commercial sources that can supply materials for the project. The suppliers listed in Table 8 are publicly known suppliers located in the vicinity of the project site; there may be other suppliers located closer to the project site.

Prior to submitting bids and scheduling construction, contractors should verify the availability of materials from the suppliers listed in Table 8.

A current listing of mining operations eligible to sell materials to the State can be found on the Internet at: http://www.consrv.ca.gov/omr/index.htm.

Table 8. Material Sources

Operator	Location/Telephone Number
Sand and Gravel	
Chief Eagle Inc.	Santa Ana/714-540-7788
E.D.S. Sand & Gravel, Inc.	Orange/714-997-8365
El Toro Materials Company	Lake Forest/949-837-6677
McAllister Soil Service	Mission Viejo/949-364-0823
Oglebay Norton Industrial Sands	San Juan Capistrano/800-637-6258
Sierra SWPPP & Erosion Control Services	Aliso Viejo/866-500-2110
West Coast Sand & Gravel, Inc.	Buena Park/714-522-0282
Portland Cement Concrete	
Associated Ready Mix, Inc.	Fountain Valley/714-966-0231
Bison Ready Mix	Anaheim/714-936-2757
Catalina Pacific Concrete	San Juan Capistrano/949-728-0448
Cemex Concrete	Irvine/949-551-9422
K&G Concrete Pumping	Santa Ana/714-910-9473
Standard Concrete Products, Inc.	Santa Ana/800-266-2738
Standard Ready Mix Concrete	Westminster/714-901-2219
United Concrete Companies, Inc.	South Gate/323-564-1866

9.0 RECOMMENDED MATERIALS SPECIFICATIONS

9.1 REVIEW OF GRADING AND CONSTRUCTION PLANS

Recommendations contained herein are based on draft plans. Final grading and construction plans should be reviewed by EMI to confirm that geotechnical recommendations were applied to the design and that no additional recommendations are required. Recommendations contained herein may require revision or additional recommendations may be necessary based on the final design.

9.2 GENERAL EARTHWORK REQUIREMENTS

Earthwork should conform to requirements of Section 19 of the Caltrans Standard Specifications (2010). Compaction of soil should be conducted in accordance with Section 19-5 of the Standard Specifications. Fills placed against existing embankments should be properly keyed and benched into the existing side slopes as described in Section 19-6 of the Caltrans Standard Specifications.

9.3 ADJACENT STRUCTURES

No excavation should be performed below an imaginary plane inclined at 45 degrees from the edge of any existing foundation without providing adequate support for the foundation. The contractor is responsible for worker safety in the field during construction. The contractor shall conform to all applicable occupational safety and health standards, rules, regulations, and orders established by the State of California. In addition, other State, County, or Municipal regulations may supersede the recommendations presented herein. If a trench shoring design and safety plan is required, the geotechnical consultant should review the plan to confirm that recommendations presented in this report have been applied to the design.

9.4 PAVEMENT

As indicated in Section 7.5, pavement structural sections are designed based on (1) subgrade with an R-value of 10 but treated with lime to mitigate soil expansion, and (2) subgrade with an PI of less than or equal to 12% and an R-value of at least 20 without lime treatment. If the R-value and PI of subgrade exposed during construction come into question, the exposed soils should be sampled and tested during grading to verify the R-value and PI. Soils placed beneath pavement sections should be inspected, sampled, and tested to verify the minimum required relative compaction.

Construction may include pulverizing existing pavements. Any recycled materials used as aggregate base shall conform to Section 26 "Aggregate Bases" of the Caltrans Standard Specifications (2010).

9.5 CULVERT MATERIALS

Culvert material requirements along the I-5 mainline and ramps were developed using the Caltrans Alternative Pipe Culvert Selection Website (AltPipe) (Caltrans, 2008b) and the corrosion test results presented in Table 3. Using the corrosion test results of soil samples recovered above a depth equal to or shallower than 20 feet below the I-5 mainline and ramps, the

following worst-case scenario corrosion values were selected for determining minimum culvert material requirements:

- Minimum Resistivity = 250 ohm-cm
- pH = 6.7
- Soluble Sulfate = 6,400 ppm
- Soluble Chloride = 2,005 ppm

Based on the information provided by TRC, 18-, 24-, and 36-inch alternate pipe culverts are proposed at various locations along the mainline and ramps. Based on these pipe diameters, an assumed soil cover of 2 feet and a design life of 50 years, the following information is provided:

- For pipe diameters of 24 and 36 inches, steel spiral rib pipe $^{3}/_{4}$" x 1" ribs at $8^{1}/_{2}$" pitch and $11^{1}/_{2}$" pitch with minimum steel thickness of 0.109 inch and coating of polymerized asphalt invert or polymeric sheet coating should be used to attain an estimated service life of 50 years under non-abrasive conditions.
- For pipe diameters of 24 and 36 inches, steel spiral rib pipe $^{3}/_{4}$" x $^{3}/_{4}$" ribs at $7^{1}/_{2}$" pitch with minimum steel thickness of 0.109 inch and coating of polymerized asphalt invert or polymeric sheet coating should be used to attain an estimated service life of 50 years under non-abrasive conditions.
- For pipe diameter of 36-inch, corrugated steel pipe helical corrugation $2^{2}/_{3}$" x $^{1}/_{2}$" corrugations with minimum steel thickness of 0.138 inch and steel coating of polymerized asphalt invert or polymeric sheet coating should be used to attain an estimated service life of 50 years under non-abrasive conditions.
- For pipe diameter of 36-inch, corrugated steel pipe $2^{2}/_{3}$" x $^{1}/_{2}$" annular corrugations with minimum steel thickness of 0.109 inch and steel coating of polymerized asphalt invert or polymeric sheet coating should be used to attain an estimated service life of 50 years under non-abrasive conditions.
- Aluminum pipe or aluminized steel pipes are not allowed.
- Corrugated PVC plastic pipes and Type-S corrugated HDPE pipes may be used for pipe diameters of 18, 24 and 36 inches, and Type-C corrugated HDPE pipes may be used for pipe diameters of 18 and 24 inches. However, abrasion level should be evaluated by the project civil engineer.
- Reinforced concrete pipe design should be suitable for 18, 24 and 36-inch diameter pipes. The minimum concrete cover is 1-inch. The maximum water-cementitious material ratio can be either 0.35 or 0.40, but the minimum cementitious material content is 470 pounds per cubic yard.

The above recommendations are applicable to Level-1 abrasion level only as defined by the AltPipe web based application and may require additional thickness for potential abrasion, higher flow velocities, strength and overfill requirements. The termini of any plastic pipes should be protected from potential physical or fire damage such as by constructing concrete headwalls, or by concrete or metal treatment.

9.6 INSPECTION AND TESTING

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

- Grading operations, including excavations and placement of compacted fill.
- Removal of existing pavement structural sections, curb and gutter, and concrete sidewalk.
- Preparation of pavement subgrade.
- Placement of base and subbase.
- Excavations for utility trenches and drainage structures.
- Removal or support of buried utilities or structures.
- Shoring installation, if necessary.
- When any unusual conditions are encountered.

10.0 SOIL TESTING AND MATERIAL PROPERTIES SUMMARY

The summary of maximum density and optimum moisture content test results are presented in Table 9. Relevant soil exploration logs are presented in Appendix A.

Table 9. Summary of Maximum Densities and Optimum Moisture Contents

Boring	Location		Sample Depth (feet)	Soil Type	Max Wet Density (pcf)	Max Dry Density (pcf)	Opt. Moist Content (%)
	Station (A Line) (feet)	Offset (feet)					
A-11-301	339+88	84 Lt	0 to 5	SC	135.8	125.7	8.0
A-11-303	340+56	92 Rt	0 to 5	SC	129.9	120.8	7.5
A-11-316	361+81	87 Rt	0 to 5	CL	136.8	125.5	9.0
A-11-326	368+42	77 Rt	4 to 5	CL	143.2	129.0	11.0
A-11-335	370+63	6 Rt	0 to 5	CL	129.3	116.5	11.0
HA-11-341	381+83	90 Rt	0 to 5	SM	126.4	108.0	17.0
A-11-346	393+10	88 Rt	0 to 5	CL	128.6	118.5	8.5

11.0 REFERENCES

American Society for Testing and Materials (ASTM), 2008. Annual Book of Standards. Soil and Rock; Vol. 04.08.

California Department of Transportation (Caltrans), California Test Methods, various dates.

Caltrans, 2010. Standard Specifications.

Caltrans, 2008a. Highway Design Manual, July.

Caltrans, 2008b. Alternative Pipe Culvert Selection Website (AltPipe), Version 6.09, http://www. dot.ca.gov/ hq/ oppd/altpipe.htm, Web-Page last updated September 26.

Caltrans, 2003. Corrosion Guidelines, Version 1.0; Office of Materials Engineering and Testing Services, Corrosion Technology Branch, September.

Caltrans, 2000. California Test 130, Geotechnical Design Reports and Materials Reports, March.

Ehlig, P., 1989, The Late Cenozoic evolution of the Capistrano Embayment in Engineering geology along coastal Orange County, Association of Engineering Geologists, Southern California Section, Annual Field Trip guide book, p. 79-87, September 23.

EMI, 2012a, Foundation Report, 5/N5-N1 Connector Separation (Widen), Bridge No. 55-0226, Orange County, California, 12-ORA-5, PM 6.69, Caltrans Project No. 1200020279 (EA 12-0F96E1), In Progress.

EMI, 2012b, Foundation Report, Camino Capistrano UC (Widen), Bridge No. 55-0227, Orange County, California, 12-ORA-5, PM 7.3, Caltrans Project No. 1200020279 (EA 12-0F96E1), In Progress.

EMI, 2012c, Foundation Report, Route 5/1 Separation (Widen), Bridge No. 55-0510, Orange County, California, 12-ORA-5, PM 6.76, Caltrans Project No. 1200020279 (EA 12-0F96E1), In Progress.

EMI, 2012d, Foundation Report, Via California (Modify), Bridge No. 55-0225, Orange County, California, 12-ORA-5, PM 6.62, Caltrans Project No. 1200020279 (EA 12-0F96E1), In Progress.

EMI, 2012e, Foundation Report, Retaining Walls, Orange County, California, 12-ORA-5, PM 6.2/8.7, Caltrans Project No. 1200020279 (EA 12-0F96E1), In Progress.

EMI, 2012f, Foundation Report, Sign Structures, Orange County, California, 12-ORA-5, PM 6.2/8.7, Caltrans Project No. 1200020279 (EA 12-0F96E1), In Progress.

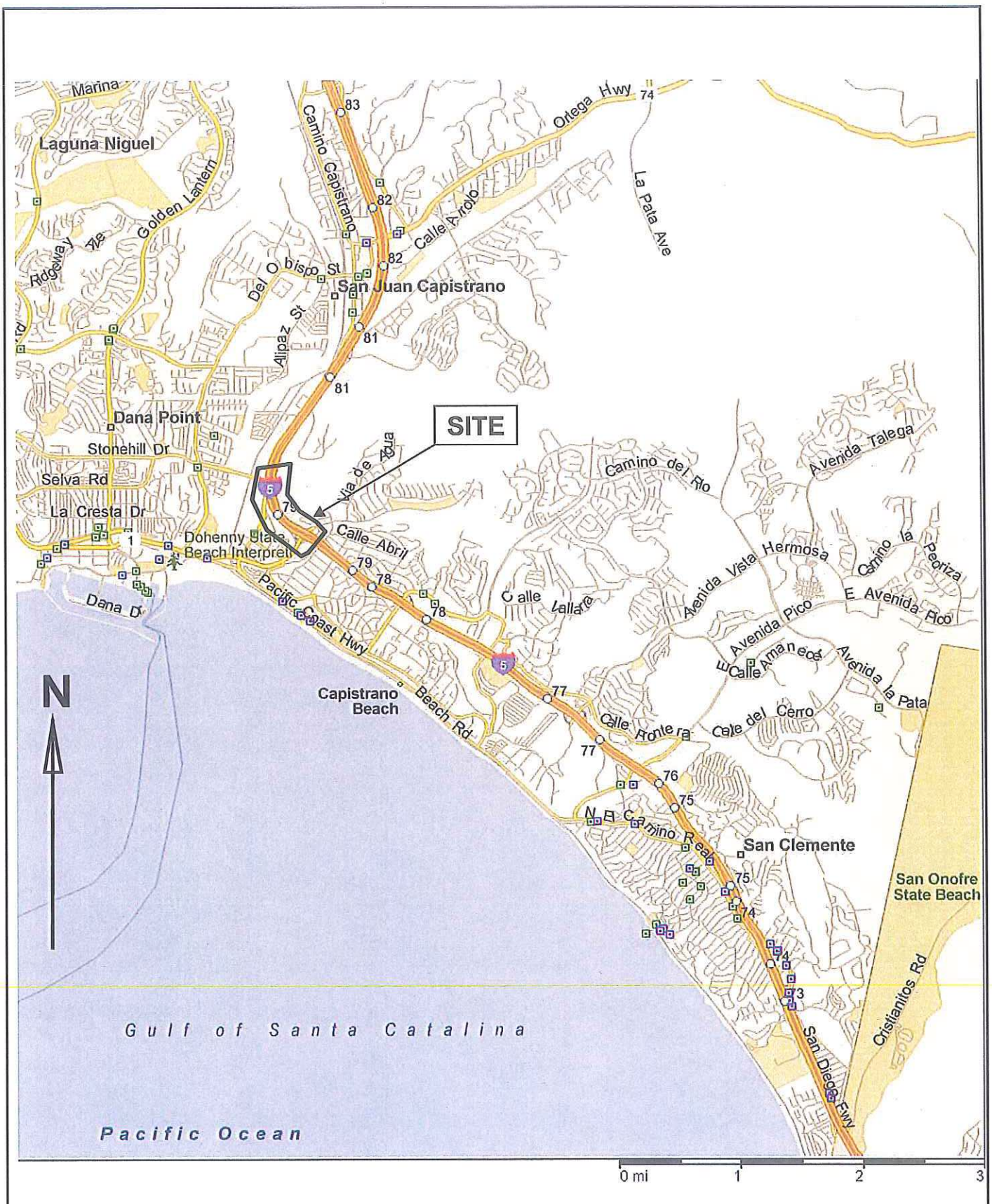
EMI, 2012g, Geotechnical Design Report, I-5 HOV Improvement Project (Segment 3), PCH to San Juan Creek Road, Orange County, California, 12-ORA-5, PM 6.2/8.7, Caltrans Project No. 1200020279 (EA 12-0F96E1), In Progress.

Kleinfelder West, Inc. (Kleinfelder), 2010a, Life Cycle Cost Analysis (LCCA) Report, Interstate 5 HOV Lane Extension PA/ED, Orange County, California, 12-ORA-5 PM 3.0/8.7, Caltrans EA No. 0F9600, Revised on August 20.

Kleinfelder, 2010b, Preliminary Materials Report, Interstate 5 HOV Lane Extension PA/ED, Orange County, California, 12-ORA-5 PM 3.0/8.7, Caltrans EA No. 0F9600, Revised on April 14.

Robertson, P.K. and Campanella, R.G., 1989, "Guidelines for Geotechnical Design Using CPT and CPTU", Civil Engineering Department, University of British Columbia, Vancouver, Canada, November.

Winterkorn, H.F. and Fang, H.Y., 1975, Foundation Design Handbook, Van Nostrand Reinhold Company, New York, NY.



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

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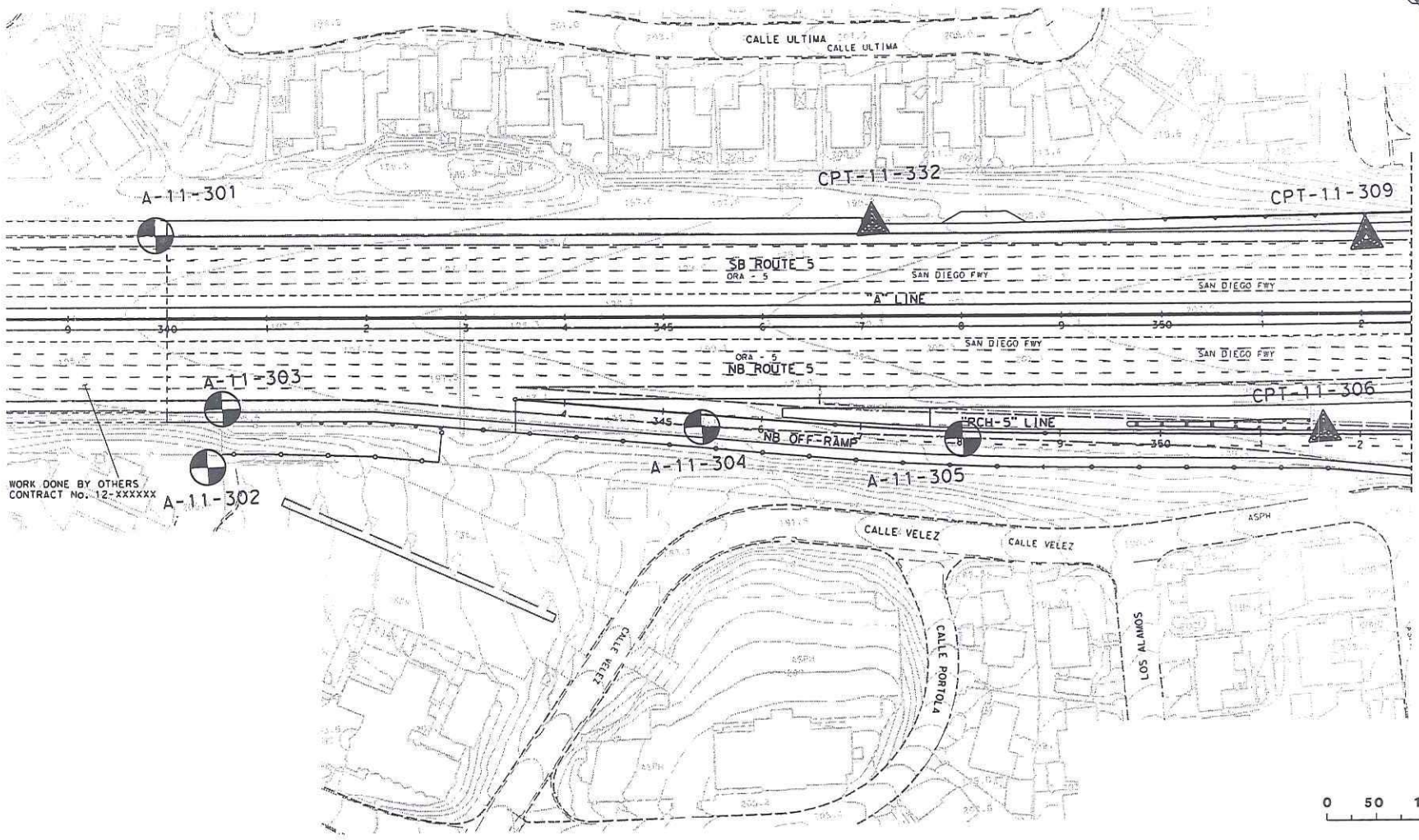
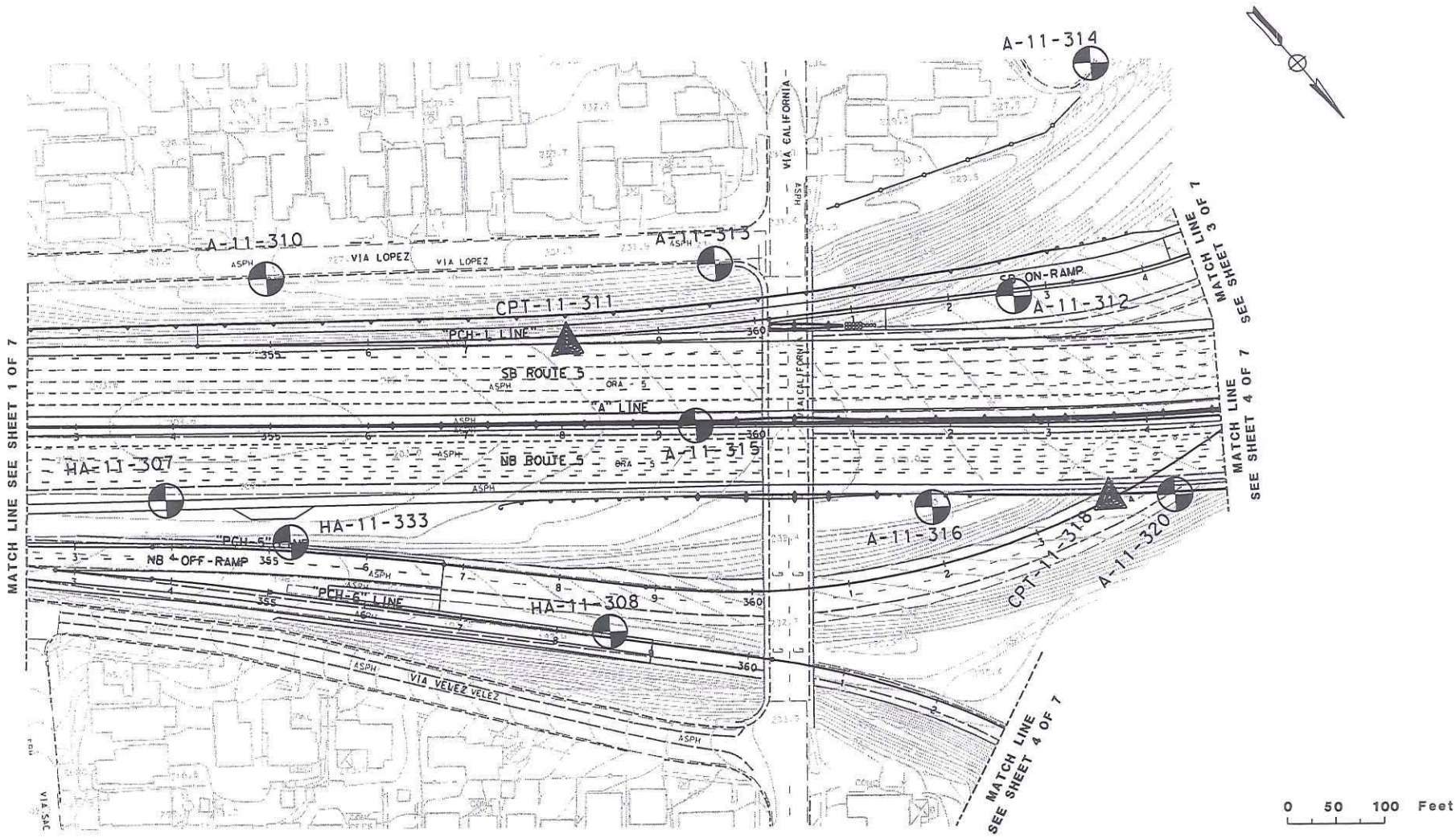
SITE LOCATION MAP

Figure 1

Project No. 11-137 | Date: 01-23-2012



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: 02-22-2012**	**Figure 2**



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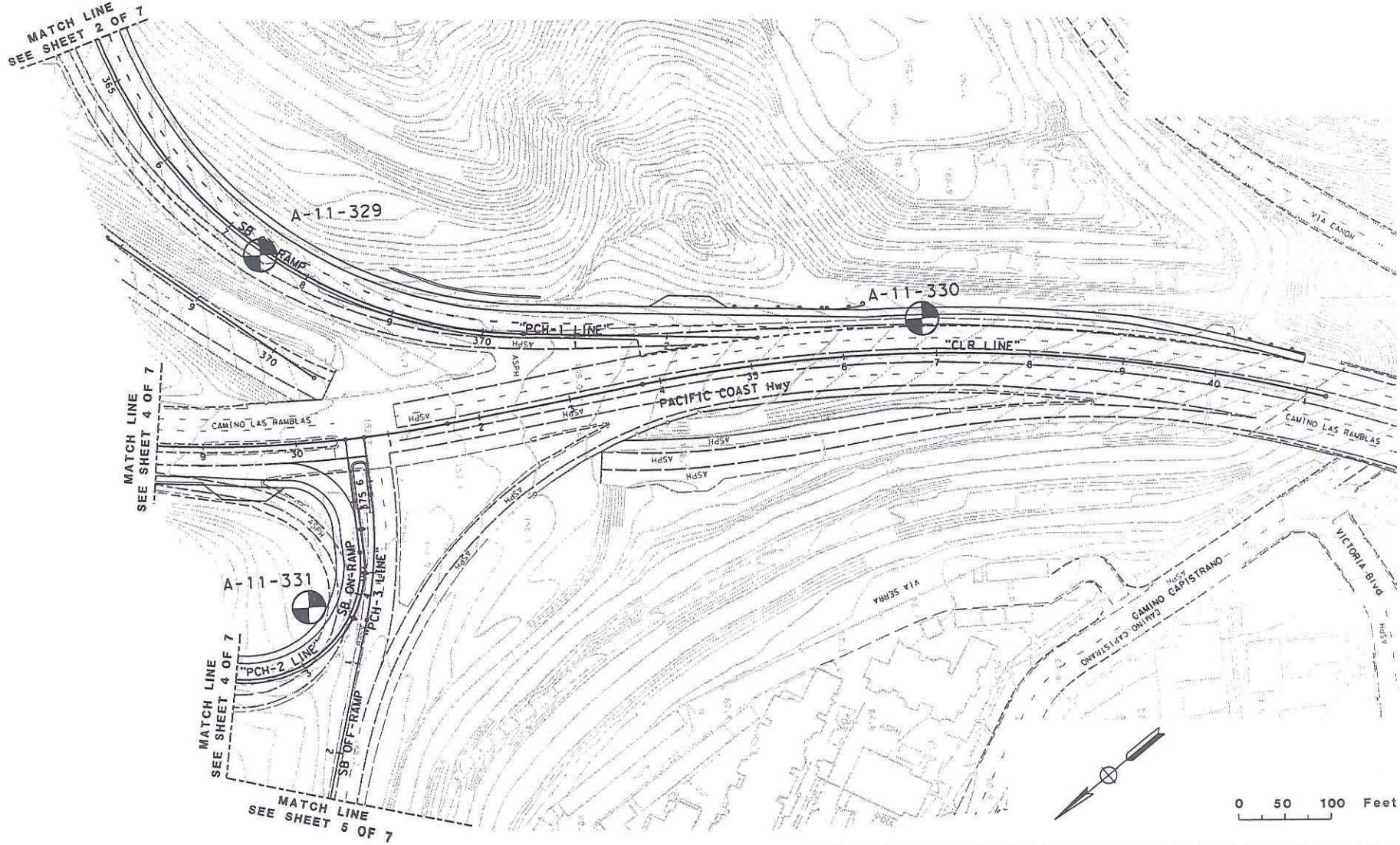
INTERSTATE 5 HOV IMPROVEMENT PROJECT (SEGMENT 3)
PCH TO SAN JUAN CREEK ROAD

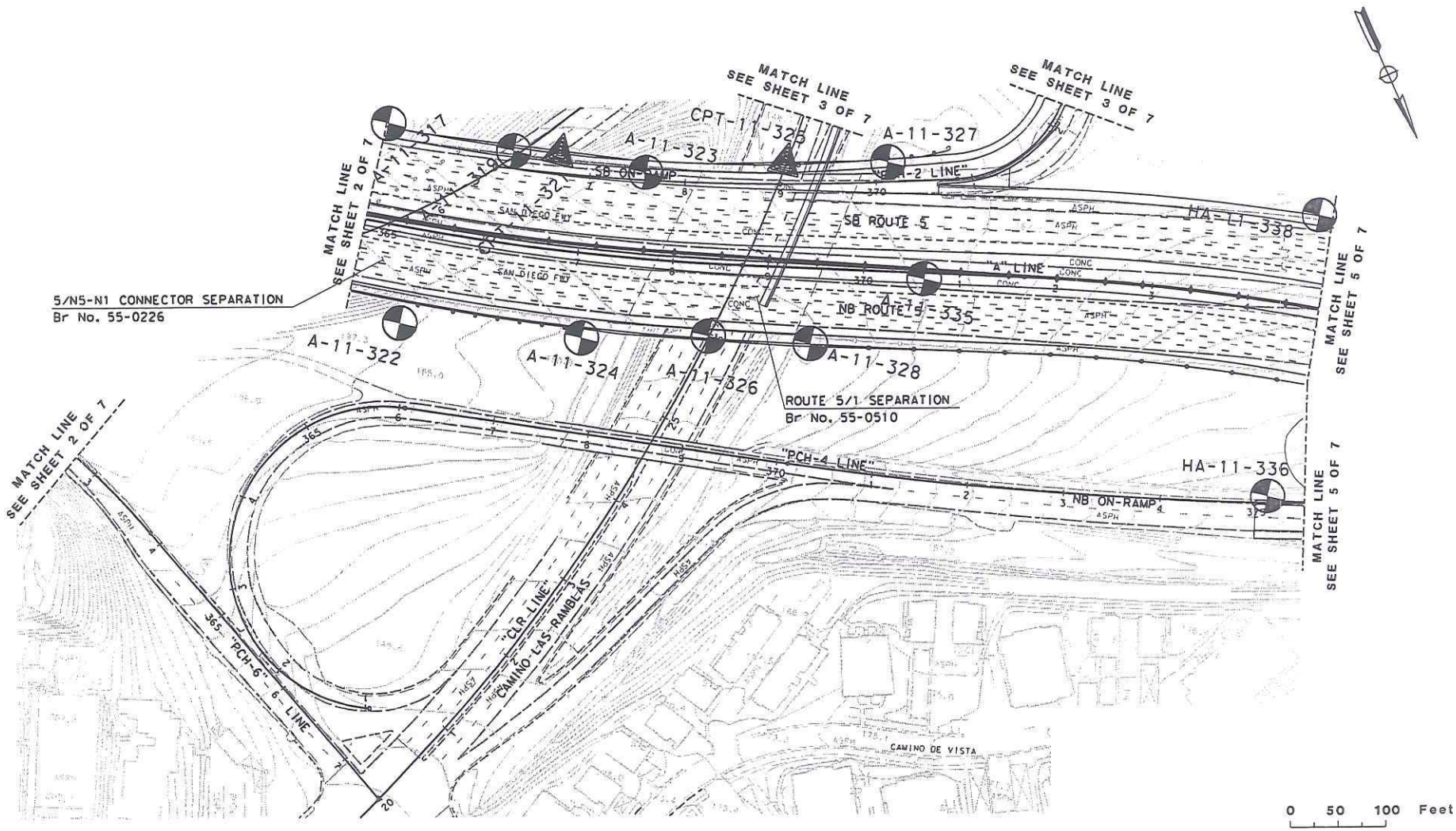
Project No.: 11-137 | Date: 02-22-2012

Exploratory Boring Location Map (2 of 7)

Figure 3



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: 02-22-2012**	Figure 4



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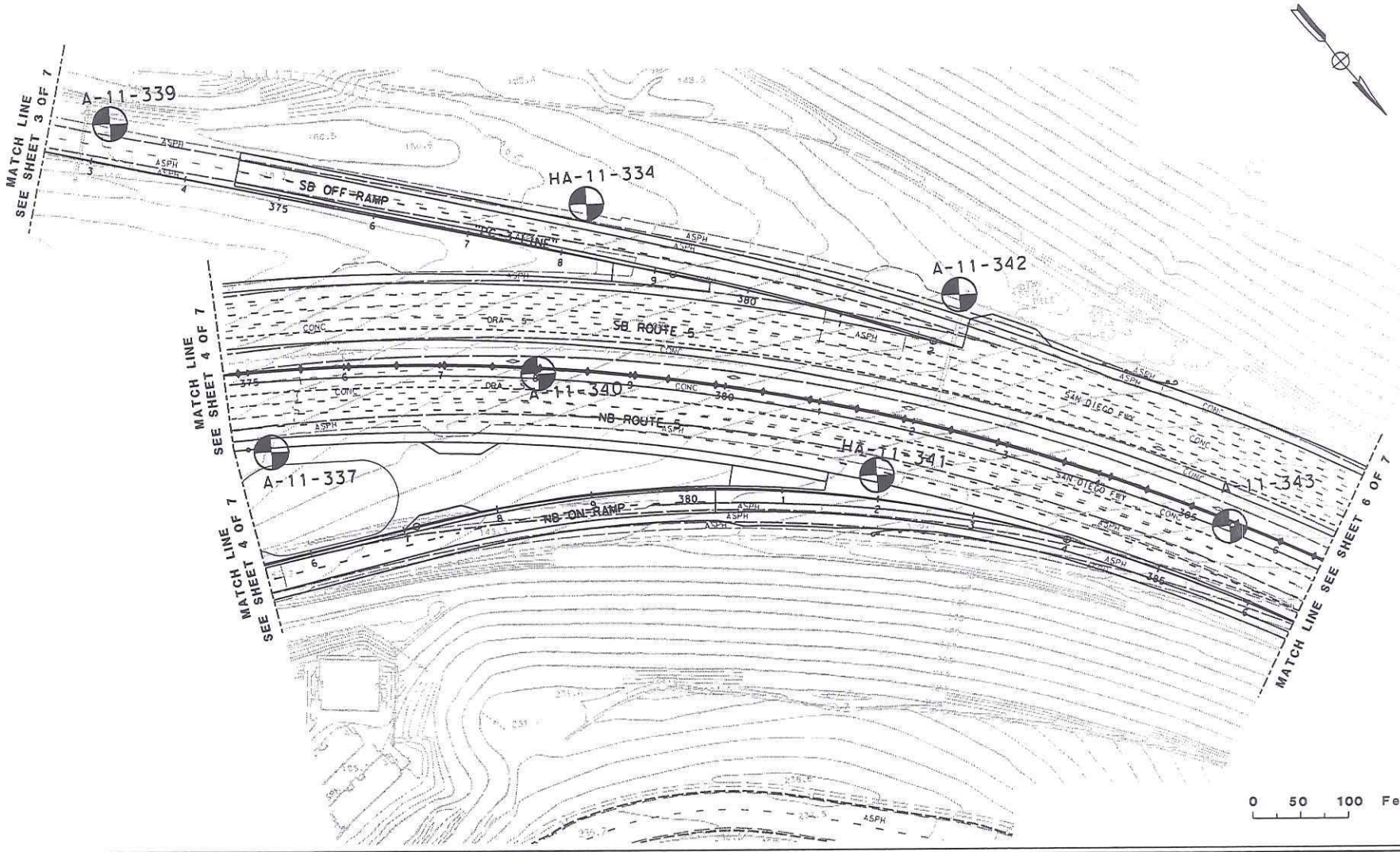
	Project No.: 11-137 / **Date: 02-22-2012**	Figure 5



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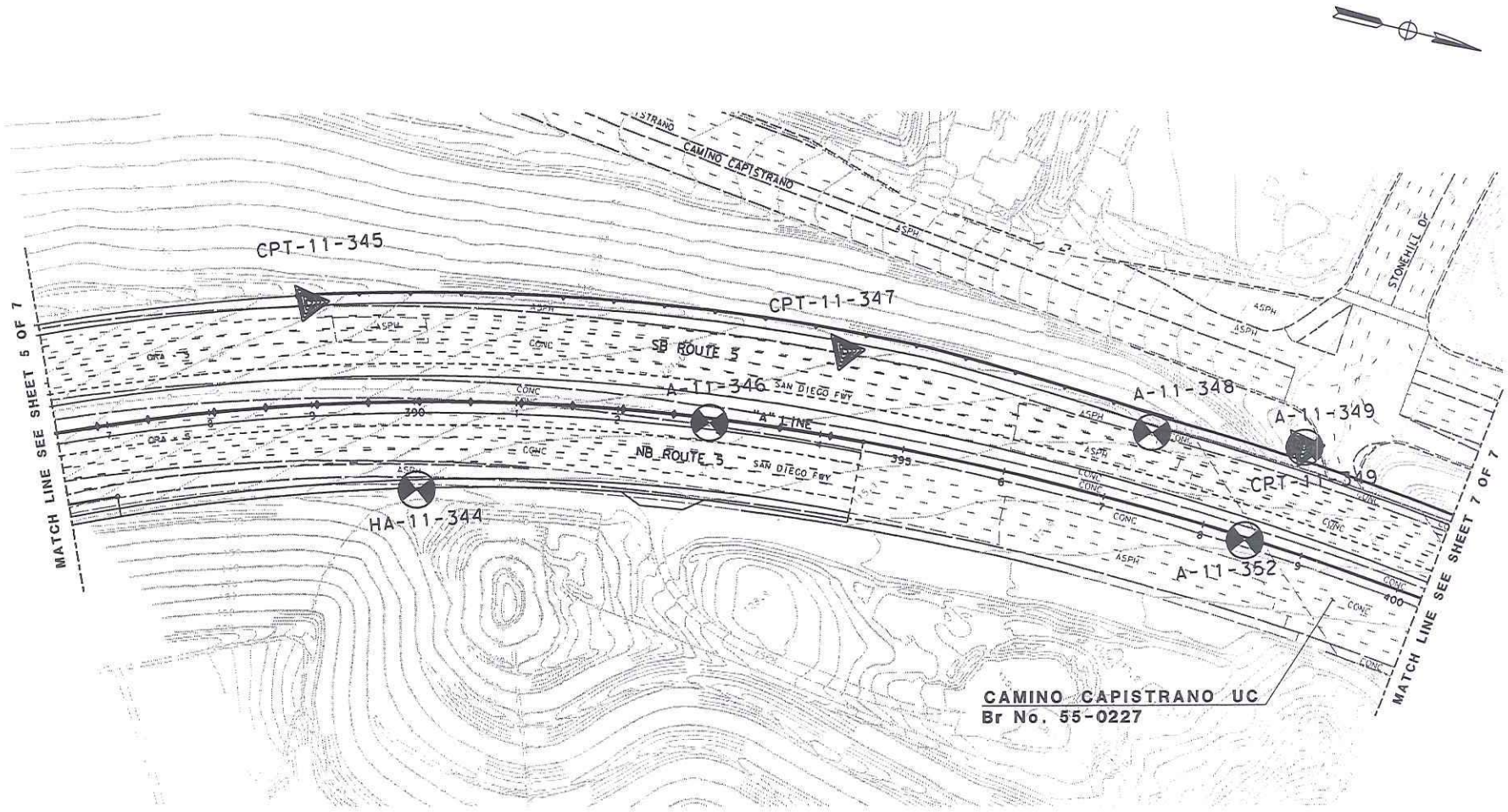
INTERSTATE 5 HOV IMPROVEMENT PROJECT (SEGMENT 3)
PCH TO SAN JUAN CREEK ROAD

Project No.: 11-137 | **Date: 02-22-2012**

Exploratory Boring Location Map (5 of 7)

Figure 6



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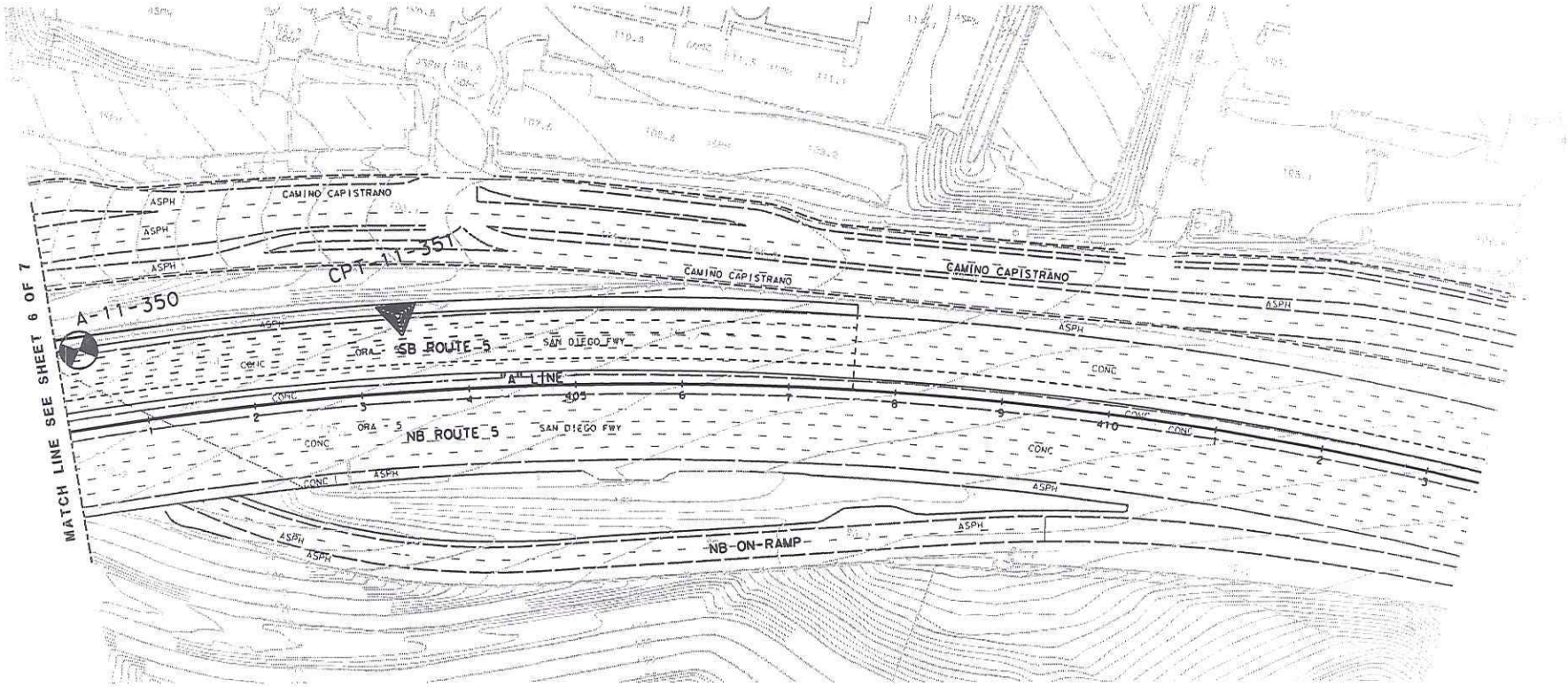
INTERSTATE 5 HOV IMPROVEMENT PROJECT (SEGMENT 3)
PCH TO SAN JUAN CREEK ROAD

Project No.: 11-137 | Date: 02-22-2012

Exploratory Boring Location Map (6 of 7)

Figure 7



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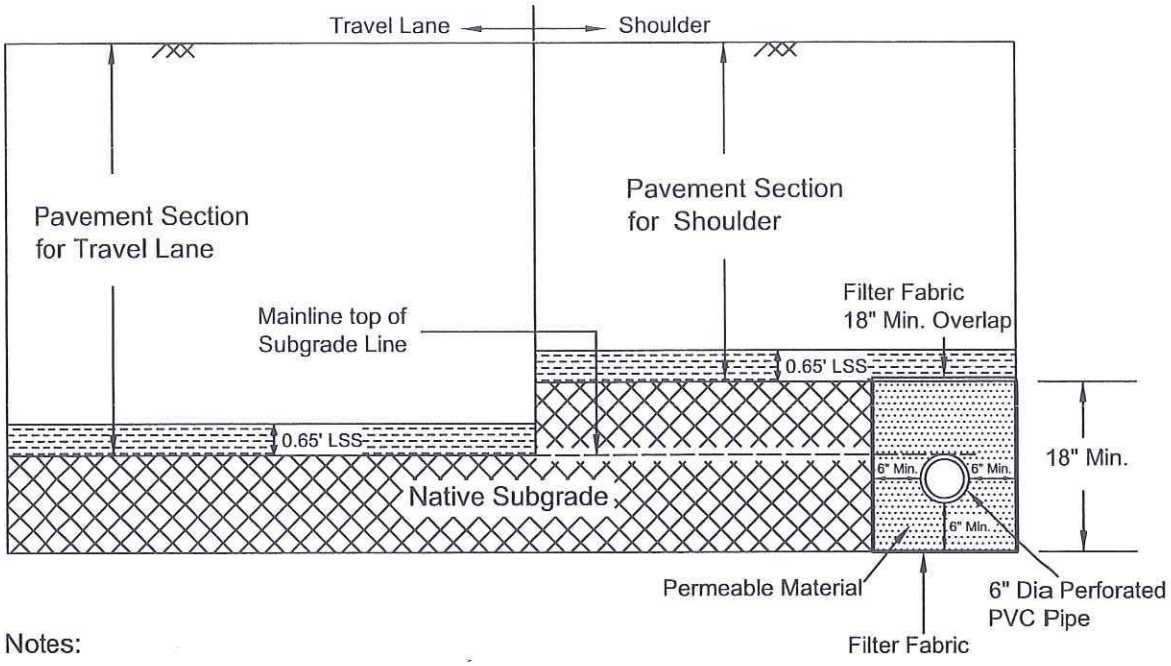
	Project No.: 11-137 / **Date: 02-22-2012**	Figure 8

Underdrain for Travel Lane with Shoulder



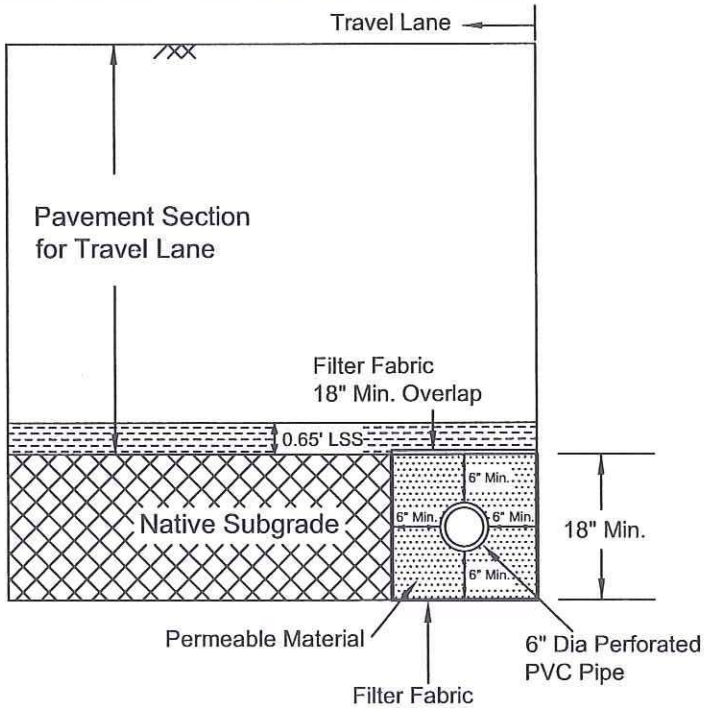
Notes:

(1) Top of 6" Diameter Perforated PVC Pipe shall be at or below the Mainline Top of Subgrade Line.

(2) 6" Diameter Perforated PVC Pipe shall be strong enough to withstand dead load and live load.

(3) LSS = Lime Stabilized Soil.

Underdrain for Travel Lane without Shoulder



Notes:

(1) 6" Diameter Perforated PVC Pipe shall be strong enough to withstand dead load and live load.

(2) LSS = Lime Stabilized Soil.

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Interstate 5 HOV Improvement Project (Segment 3)
PCH to San Juan Creek

Underdrain Configurations

Project No. 11-137 | Date: 06-22-12

Figure 9

Appendix A

BORING RECORDS AND LOGS OF CONE PENETRATION TEST SOUNDINGS

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		0			CLAYEY SAND (SC); dark olive brown; moist.			CP, PI, R, WA
		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		2	45		Very dense; coarse to fine SAND.			
					Bottom of borehole at 6.5 ft bgs			
10								
15								
20								
25								

EMI BORING LOG 11-137 I-5 HOV SEGMENT 3 1-16-2012.GPJ EMI LIBRARY CALTRANS 2010.GLB 7/2/12

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Interstate 5 HOV Improvement Project
PCH to San Juan Creek Road

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

LOG OF BORING NO. A-11-302

Grade Elevation:	205.7 ft				
Boring Depth:	16.5 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: 2,114,857 Easting: 6,130,994	
Logged By:	RJ	Groundwater Reading:	Not Encountered		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0					ASPHALT.			
		0			Lean CLAY (CL); hard; olive brown to brown; moist; trace fine GRAVEL; little fine SAND; mostly medium plasticity fines; PP = 4.5 tsf.			PI, R
		1	34			19	110	CR
5		2	14		Low plasticity fines.	16		
10		3	35		SANDY lean CLAY (CL); very stiff; olive brown, moist; some fine SAND; mostly low to medium plasticity fines; PP = 3.25 tsf.	19	108	
15		4	3		Poorly graded SAND with SILT (SP-SM); very loose; olive brown; moist; mostly coarse to fine SAND; few nonplastic fines.	6		
					Encountered existing sewer line. Drilling was terminated. Bottom of borehole at 16.5 ft bgs			
20								
25								

EM 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-11-303

Grade Elevation:	194.8 ft			
Boring Depth:	31.5 ft	Driller:	2R Drilling	SHEET 1 of 1
Borehole Diameter:	8"	Type of Rig:	CME 75	Comments: Hammer Energy Efficiency: 75%
Date Drilled:	10-11-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop	Northing: 2,114,821 Easting: 6,130,944
Logged By:	CP	Groundwater Reading:	18.5 ft on 10-11-11	

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0								
		0			CLAYEY SAND (SC); dark olive brown; moist.			CP, CR, PI, R, WA
5		1	85		Poorly graded SAND with GRAVEL (SP); very dense; dark olive brown; moist; little fine GRAVEL; mostly coarse to fine SAND; few nonplastic fines.	5	116	
10		2	16		SILTY SAND (SM); medium dense; olive brown; wet; mostly fine SAND; some nonplastic fines.	24		
15		3	36		Fat CLAY (CH); very stiff; olive gray slightly mottled with yellowish brown; moist; few fine SAND; mostly medium to high plasticity fines; trace gypsum; PP = 2.25 tsf.	26	96	PI
20		4	8		Lean CLAY (CL); very stiff; olive brown mottled with grayish brown; moist; trace fine SAND; mostly low plasticity fines.	33		
25								

(continued)

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-11-304

Grade Elevation:	196.9 ft			
Boring Depth:	51.5 ft	Driller:	2R Drilling	SHEET 1 of 1
Borehole Diameter:	8"	Type of Rig:	CME 75	Comments: Hammer Energy Efficiency: 75%
Date Drilled:	10-17-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop	Northing: 2,115,147 Easting: 6,130,588
Logged By:	KK	Groundwater Reading:	37.5 ft on 10-17-11	

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); yellowish brown; moist; little fine GRAVEL; mostly coarse to medium SAND; some nonplastic fines.			
		1	15		SANDY lean CLAY (CL); stiff; dark olive brown; moist; few fine GRAVEL; little fine SAND; mostly medium plasticity fines.	10		CR
					Poorly graded GRAVEL with SAND (GP); olive brown; moist; mostly coarse to fine GRAVEL; little fine SAND.			
5		2	60/10		SILTY SAND with GRAVEL (SM); very dense; olive brown; moist; little fine GRAVEL; mostly medium to fine SAND; little nonplastic fines. Encountered asphalt debris at 6-feet.	8	111	
10		3	9		SANDY lean CLAY (CL); stiff; olive brown; moist; trace fine GRAVEL; some fine SAND; mostly low plasticity fines.	15		
15		4	22		Lean CLAY (CL); very stiff; olive brown; moist; little fine SAND; mostly medium plasticity fines; PP = 2.5 tsf.	20	103	
20		5	9		Lean CLAY with SAND (CL); stiff; dark olive brown; moist; little fine SAND; mostly medium plasticity fines.	18		
25								

(continued)

LOG OF BORING NO. A-11-305

Grade Elevation:	198.6 ft			
Boring Depth:	51.5 ft	Driller:	2R Drilling	SHEET 1 of 1
Borehole Diameter:	8"	Type of Rig:	CME 75	Comments: Hammer Energy Efficiency: 75%
Date Drilled:	10-17-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop	Northing: 2,115,326 Easting: 6,130,395
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.			
					CLAYEY SAND (SC); yellowish brown; dry; mostly medium to fine SAND; some nonplastic fines.			
		0						PI, R, WA
5					Poorly graded SAND with GRAVEL (SP); very dense; olive brown; dry; about 30% coarse to fine GRAVEL, max. 1 in. dia.; about 66% coarse to fine SAND; about 4% nonplastic fines.	2	111	WA
		1	72		Coarse to fine GRAVEL, max. 2.5 in. dia..			
10					SILTY SAND (SM); dense; olive brown; dry to moist; mostly coarse to fine SAND; little nonplastic fines.	11		
		2	32					
15					Fat CLAY (CH); very stiff; olive brown; moist; few fine SAND; mostly high plasticity fines; PP = 3.25 tsf.	31	93	
		3	43					
20						30		
		4	16					
25								

(continued)

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. 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.			PI, R, WA
					Bottom of borehole at 1.5 ft bgs			
5								
10								
15								
20								
25								

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

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

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

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 (SC); olive brown; moist; trace coarse to fine GRAVEL, max. 1 1/2 in. dia.; mostly medium to fine SAND; little low plasticity fines.			CR, PI, R
					Bottom of borehole at 2.0 ft bgs			
5								
10								
15								
20								
25								

LOG OF BORING NO. A-11-310

Grade Elevation:	225.9 ft			
Boring Depth:	41.5 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: 2,115,561 Easting: 6,129,685
Logged By:	RJ	Groundwater Reading:	Not Encountered	

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0								
		0			Lean CLAY with SAND (CL); hard; olive brown; moist; trace coarse to fine GRAVEL, max. 2 in. dia.; little fine SAND; mostly medium plasticity fines.			
		1	28			11	107	
5					PP > 4.5 tsf.			
		2	11			18		
10								
		3	58		SANDY SILT (ML); hard; olive brown; moist; about 33% fine SAND; about 67% nonplastic to low plasticity fines; PP > 4.5 tsf.	13	105	CR, WA
15								
		4	18		Lean CLAY with SAND (CL); very stiff; olive brown; moist; little fine SAND; mostly medium plasticity fines; with 3" layer of medium to fine Poorly Graded SAND.	20		
20								
		5	38		Fat CLAY (CH); hard; olive brown; moist; little medium to fine SAND; mostly high plasticity fines; trace gypsum; PP > 4.5 tsf.	31	89	
25								

(continued)

LOG OF BORING NO. A-11-312

Grade Elevation:	184.9 ft				
Boring Depth:	51.5 ft	Driller:	2R Drilling	SHEET 1 of 1	
Borehole Diameter:	8"	Type of Rig:	CME 75	Comments: Hammer Energy Efficiency: 75%	
Date Drilled:	10-3-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop	Northing: 2,116,072 Easting: 6,129,110	
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, CLAYEY SAND (SC-SM); light yellowish brown; moist; mostly medium to fine SAND; some nonplastic to low plasticity fines.			
		0						
5		1	17		Lean CLAY (CL); stiff to very stiff; very dark grayish brown; moist; few fine SAND; mostly low plasticity fines; PP = 2.0 tsf.	20	102	CR, PI
10		2	8		Lean CLAY with SAND (CL); stiff to very stiff; olive brown; moist to wet; little fine SAND; mostly low plasticity fines.	22		
15		3	50/6 "		Elastic SILT (MH); hard; very dark gray; moist; trace fine SAND; mostly high plasticity fines; Siltstone; PP > 4.5 tsf [BEDROCK].	29	90	
20		4	39			42		
25								

(continued)

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-11-313

Grade Elevation:	225.6 ft			
Boring Depth:	51.5 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: 2,115,848 Easting: 6,129,322
Logged By:	RJ	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); loose to medium dense; olive brown; moist; trace coarse to fine GRAVEL, max. 2 in. dia.; mostly coarse to fine SAND; some nonplastic fines.			
		0			Poorly graded SAND with SILT and GRAVEL (SP-SM); loose to medium dense; olive brown; dry; little coarse to fine GRAVEL, max. 2 in. dia.; mostly fine SAND; few nonplastic fines.			
5					SILTY SAND (SM); loose; olive brown; moist; mostly fine SAND; some nonplastic fines.			
		2	12		SANDY SILT (ML); stiff to very stiff; olive brown; moist; about 45% fine SAND; about 55% nonplastic to low plasticity fines; PP = 2.0 tsf.	13	105	DS, WA
10		3	16		SILT (ML); stiff to very stiff; olive brown; moist; little fine SAND; mostly nonplastic to low plasticity fines.	11		CR
15		4	50		Lean CLAY (CL); hard; olive brown; moist; few fine SAND; mostly low plasticity fines; PP > 4.5 tsf.	12	113	
20		5	19		SILT (ML); hard; olive brown; moist; few fine SAND; mostly nonplastic to low plasticity fines.	16		
					Lean CLAY (CL); hard; olive brown; moist; few fine SAND; mostly medium plasticity fines.	18		
25								

(continued)

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-11-314

Grade Elevation:	225.1 ft			
Boring Depth:	30.9 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: 2,115,939 Easting: 6,128,895
Logged By:	RJ	Groundwater Reading:	Not Encountered	

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0					ASPHALT.			
		0			CLAYEY SAND (SC); dark olive brown; moist; trace coarse to fine GRAVEL, max. 1 in. dia.; mostly medium to fine SAND; little low to medium plasticity fines.			
		1	31		Lean CLAY with SAND (CL); very stiff; dark olive brown; moist; about 19% fine SAND; about 81% medium plasticity fines; PP = 3.5 tsf.	10	103	WA
5		2	15		SILT with SAND (ML); stiff to very stiff; light olive brown; dry to moist; little fine SAND; mostly low plasticity fines.	7		
10		3	54		Hard; about 20% fine SAND; about 80% low plasticity fines; PP > 4.5 tsf.	9	105	WA
15		4	15		Dark olive brown.	10		
					SILTY SAND (SM); medium dense; olive brown; moist; mostly fine SAND; little nonplastic fines.	6		
20		5	78		Lean CLAY (CL); hard; olive brown; moist; few fine SAND; mostly medium plasticity fines; PP > 4.5 tsf.	11	114	
25								

(continued)

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Interstate 5 HOV Improvement Project
PCH to San Juan Creek Road

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

LOG OF BORING NO. A-11-315

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%	
Date Drilled:	10-20-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop	Northing: 2,116,016 Easting: 6,129,490	
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								

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

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

EMI BORING LOG 11-137 I-5 HOV SEGMENT 3 11-19-2012.GPJ EMI LIBRARY CAL TRANS 2010.GLB 7/2/12

LOG OF BORING NO. A-11-316

Grade Elevation:	192.6 ft			
Boring Depth:	101.5 ft	Driller:	2R Drilling	SHEET 1 of 1
Borehole Diameter:	8"	Type of Rig:	CME 75	Comments: Hammer Energy Efficiency: 75%
Date Drilled:	10-6-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop	Northing: 2,116,186 Easting: 6,129,314
Logged By:	CP	Groundwater Reading:	24.0 ft on 10-6-11	

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0		0			SANDY lean CLAY with GRAVEL (CL); light yellowish brown; moist; little fine GRAVEL, max. 3/4 in. dia.; some coarse to fine SAND; mostly low plasticity fines.			CP, PI, R
5		1	37		SANDY lean CLAY (CL); hard; olive brown; moist; some fine SAND; mostly medium plasticity fines; PP > 4.5 tsf.	15	113	CR
10		2	12		Lean CLAY with SAND (CL); soft; olive brown; moist; about 22% fine SAND; about 78% medium plasticity fines.	19		WA
15		3	60		Poorly graded SAND (SP); dense; light olive brown; moist; trace fine GRAVEL; mostly fine SAND; few nonplastic fines. Trace coarse GRAVEL, max. 3 in. dia..	2	99	
20		4	64		Poorly graded SAND with SILT and GRAVEL (SP-SM); very dense; olive brown; moist; little fine GRAVEL; mostly medium to fine SAND; few nonplastic fines.	3		
25								

(continued)

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Interstate 5 HOV Improvement Project
PCH to San Juan Creek Road

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

LOG OF BORING NO. A-11-317

Grade Elevation:	179.3 ft				
Boring Depth:	100.5 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: 2,116,220 Easting: 6,128,966	
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					Lean CLAY (CL); very stiff; olive brown; moist; few fine SAND; mostly medium plasticity fines.			
		0						PI, R, WA
5		1	25		Poorly graded SAND with SILT (SP-SM); dense; light olive brown; dry to moist; trace fine GRAVEL, max. 3/8 in. dia.; mostly fine SAND; few nonplastic fines.	11		CR
10		2	43		Poorly graded SAND (SP); medium dense; olive brown to yellowish brown; moist; mostly fine SAND; trace nonplastic fines.	27	91	WA
15		3	29		Elastic SILT (MH); hard; very dark gray; moist; few fine SAND; mostly high plasticity fines; Siltstone [BEDROCK].	27		
20		4	50/5 "		PP > 4.5 tsf.	27	91	
25								

(continued)

LOG OF BORING NO. A-11-319

Grade Elevation:	152.4 ft			
Boring Depth:	81.5 ft	Driller:	2R Drilling	SHEET 1 of 1
Borehole Diameter:	8"	Type of Rig:	CME 75	Comments: Hammer Energy Efficiency: 75%
Date Drilled:	10-4-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop	Northing: 2,116,300 Easting: 6,128,859
Logged By:	CP	Groundwater Reading:	15.0 ft on 10-4-11	

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0		0			SANDY lean CLAY (CL); yellowish brown to olive brown; moist; some medium to fine SAND; mostly low plasticity fines.			PI, R
		1	28		SILTY SAND (SM); medium dense; yellowish brown to olive brown; moist; trace fine GRAVEL, max. 3/4 in. dia.; mostly medium to fine SAND; little nonplastic fines.	9	115	
5		2	8		Lean CLAY (CL); stiff; olive brown; moist; few fine SAND; mostly medium plasticity fines.	25		
10		3	13		SANDY lean CLAY (CL); stiff; olive brown; moist; some fine SAND; mostly medium plasticity fines; PP = 1.75 tsf.	23	98	CR
15		4	4		Dark olive brown; wet; mostly low plasticity fines.	26		
20		5	12		SANDY fat CLAY (CH); medium stiff to stiff; olive brown; wet; some fine SAND; mostly high plasticity fines; PP = 1.0 tsf.	26	95	PI
25								

(continued)

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

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

LOG OF BORING NO. A-11-320

Grade Elevation:	166.6 ft			
Boring Depth:	81.5 ft	Driller:	2R Drilling	SHEET 1 of 1
Borehole Diameter:	8"	Type of Rig:	CME 75	Comments: Hammer Energy Efficiency: 75%
Date Drilled:	10-4-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop	Northing: 2,116,336 Easting: 6,129,117
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			Lean CLAY (CL); very soft; very dark brown; moist; few fine SAND; mostly medium plasticity fines.			
		1	2			27		
5		2	39		Elastic SILT (MH); hard; dark olive brown; moist; few fine SAND; mostly high plasticity fines; Siltstone; PP > 4.5 tsf [BEDROCK].	34	83	CR
10		3	25		About 1% fine SAND; about 99% high plasticity fines.	36		WA
15		4	63			29	89	PI
20		5	32			31		
25								

(continued)

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

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

LOG OF BORING NO. A-11-322

Grade Elevation:	186.7 ft				
Boring Depth:	101.5 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: 2,116,418 Easting: 6,129,042	
Logged By:	RJ	Groundwater Reading:	Not Encountered		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0					SANDY lean CLAY (CL); olive brown; moist; trace coarse to fine GRAVEL, max. 1 in. dia.; some medium to fine SAND; mostly medium plasticity fines.			
		0						CR, PI, R, WA
5		1	55		Lean CLAY with SAND (CL); hard; olive brown; moist; little medium to fine SAND; mostly medium plasticity fines.	21	98	
10		2	15			14		
15		3	50/5 "		CLAYEY SAND with GRAVEL (SC); very dense; olive brown; moist; about 21% coarse to fine GRAVEL, max. 1 in. dia.; about 30% coarse to fine SAND; about 49% medium plasticity fines.	9	119	WA
20		4	31		SILTY SAND (SM); dense; light olive brown; moist; mostly fine SAND; some nonplastic fines.	5		
					Lean CLAY with SAND (CL); medium stiff to stiff; olive brown; moist; little fine SAND; mostly medium plasticity fines.	27		
25								

(continued)

LOG OF BORING NO. A-11-323

Grade Elevation:	173.0 ft			
Boring Depth:	100.8 ft	Driller:	2R Drilling	SHEET 1 of 1
Borehole Diameter:	8"	Type of Rig:	CME 75	Comments: Hammer Energy Efficiency: 75%
Date Drilled:	10-3-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop	Northing: 2,116,378 Easting: 6,128,742
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.			
					Lean CLAY (CL); yellowish brown; dry to moist; few fine SAND; mostly low to medium plasticity fines.			
5		1	26		SILTY, CLAYEY SAND (SC-SM); dense; yellowish brown; dry to moist; mostly medium to fine SAND; some nonplastic to low plasticity fines.	9		CR
10		2	25		Lean CLAY with SAND (CL); hard; olive brown mottled with white; moist; little fine SAND; mostly medium plasticity fines; PP > 4.5 tsf.	12	114	
					Trace coarse to fine GRAVEL, max. 2 in. dia.; rig chattered.			
15		3	20		SILTY SAND (SM); very dense; olive brown; dry to moist; about 13% fine GRAVEL, max. 3/4 in. dia.; about 72% fine SAND; about 15% nonplastic fines.	4		WA
20		4	95		Fat CLAY (CH); olive brown mottled with brown; moist; few fine SAND; mostly high plasticity fines; Claystone; PP > 4.5 tsf [BEDROCK].	24	98	
25								

(continued)

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

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

LOG OF BORING NO. A-11-324

Grade Elevation:	180.6 ft			
Boring Depth:	111.5 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: 2,116,510 Easting: 6,128,875
Logged By:	RJ	Groundwater Reading:	98.0 ft on 9-28-11	

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 coarse to fine GRAVEL, max. 2 in. dia.; mostly coarse to fine SAND; little low plasticity fines.			
5		1	16		SANDY lean CLAY (CL); hard; yellowish brown; moist; trace fine GRAVEL, max. 3/4 in. dia.; some medium to fine SAND; mostly medium plasticity fines.	13		
					Trace coarse to fine GRAVEL, max. 3 in. dia..			
10		2	79		Olive brown mottled with white; PP > 4.5 tsf.	14	102	CR
15		3	13		Olive brown.	22		
20		4	36			25	104	
25								

(continued)

LOG OF BORING NO. A-11-326

Grade Elevation:	150.8 ft			
Boring Depth:	81.5 ft	Driller:	2R Drilling	SHEET 1 of 1
Borehole Diameter:	8"	Type of Rig:	CME 75	Comments: Hammer Energy Efficiency: 75%
Date Drilled:	10-10-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop	Northing: 2,116,563 Easting: 6,128,753
Logged By:	KK	Groundwater Reading:	24.0 ft on 10-10-11	

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0					ASPHALT.			
		1	6		Poorly graded SAND with SILT and GRAVEL (SP-SM); loose; olive brown; moist; little fine GRAVEL, max. 3/4 in. dia.; mostly coarse to fine SAND; few nonplastic fines.	4		
5		2	7		Lean CLAY with SAND (CL); stiff; olive brown mottled with brown; moist to wet; little fine SAND; mostly medium plasticity fines; PP = 1.75 tsf.	20	102	CP CR
10		3	4			22		
15		4	57		Elastic SILT (MH); hard; dark olive brown; moist; few fine SAND; mostly high plasticity fines; Siltstone; trace gypsum; PP > 4.5 tsf [BEDROCK].	28	92	PI
20		5	28		Lean CLAY (CL); hard; gray mottled with brown; moist; few fine SAND; mostly high plasticity fines; Claystone; trace gypsum [BEDROCK].	28		
25								

(continued)

LOG OF BORING NO. A-11-327

Grade Elevation:	168.5 ft				
Boring Depth:	101.5 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: 2,116,472 Easting: 6,128,507	
Logged By:	KK	Groundwater Reading:	77.5 ft on 9-26-11		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0					SANDY lean CLAY (CL); medium stiff to stiff; olive brown; moist; trace coarse to fine GRAVEL; some fine SAND; mostly medium plasticity fines.			
		0						CR, PI, R
5		1	14			12		
10		2	27		SILTY SAND (SM); medium dense; yellowish brown; moist; trace fine GRAVEL, max. 1/2 in. dia.; mostly medium to fine SAND; some nonplastic fines.	10	105	
					Lean CLAY with SAND (CL); hard; olive brown; moist; trace fine GRAVEL, max. 1/2 in. dia.; little fine SAND; mostly low plasticity fines; PP > 4.5 tsf.			
15		3	12		Olive brown mottled with grayish brown; mostly medium plasticity fines.	14		
20		4	26		Lean CLAY (CL); hard; olive brown; moist; few fine SAND; mostly medium plasticity fines; PP > 4.5 tsf.	17	110	
25								

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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-11-328

Grade Elevation:	174.5 ft		
Boring Depth:	101.5 ft	Driller: 2R Drilling	SHEET 1 of 1
Borehole Diameter:	8"	Type of Rig: CME 75	Comments: Hammer Energy Efficiency: 75%
Date Drilled:	9-29-11	Hammer Data: Automatic hammer 140-lbs/30-inch drop	Northing: 2,116,615 Easting: 6,128,658
Logged By:	RJ	Groundwater Reading: Not Encountered	

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. 1/2 in. dia.; mostly coarse to fine SAND; some low plasticity fines.			
5		1	45		SANDY lean CLAY (CL); hard; olive brown mottled with yellow; moist; trace fine GRAVEL, max. 3/4 in. dia.; some medium to fine SAND; mostly medium plasticity fines; PP > 4.5 tsf.	14	98	
10		2	21		Olive brown; some fine SAND; mostly medium plasticity fines.	13		
15		3	45		CLAYEY SAND with GRAVEL (SC); medium dense; olive brown; moist; about 21% coarse to fine GRAVEL, max. 1 in. dia.; about 49% coarse to fine SAND; about 30% medium plasticity fines.	6	119	
					Poorly graded SAND with SILT (SP-SM); medium dense; olive brown; moist; mostly coarse to fine SAND; few nonplastic fines.			
					Trace coarse GRAVEL.			
20		4	24		SANDY lean CLAY (CL); very stiff; olive brown; moist; some fine SAND; mostly medium plasticity fines.	23		
					SILTY SAND (SM); medium dense; olive brown; moist to wet; mostly medium to fine SAND; some nonplastic fines.	18		
25								

(continued)

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-11-329

Grade Elevation:	156.4 ft			
Boring Depth:	31.5 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: 2,116,174 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								
		0			SANDY lean CLAY (CL); olive brown; moist; trace fine GRAVEL, max. 3/4 in. dia.; some coarse to fine SAND; mostly low to medium plasticity fines.			PI, R, WA
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	
25								

(continued)

EMI BORING LOG 11-137 I-5 HOV SEGMENT 3 1-16-2012.GPJ EMI LIBRARY CALTRANS 2010.GLB 7/2/12

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

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

LOG OF BORING NO. A-11-330

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								

EMI BORING LOG 11-137 I-5 HOV SEGMENT 3 1-IN-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-11-331

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		0			SILTY SAND (SM); brown; dry; mostly coarse to fine SAND; some nonplastic fines.			
		1	21		Lean CLAY with SAND (CL); very stiff; olive brown; moist; little fine SAND; mostly medium plasticity fines. Trace coarse to fine GRAVEL, max. 1 in. dia..			
5		2	57		Encounter roots.			
					Bottom of borehole at 6.5 ft bgs			
10								
15								
20								
25								

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								

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		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.			
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%
Date Drilled:	10-20-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop	Northing: 2,116,601 Easting: 6,128,522
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); brown; moist; little fine GRAVEL, max. 1/2 in. dia.; some coarse to fine SAND; mostly low to medium plasticity fines.			CP, PI, R, WA
		1	6					
5		2	27		Lean CLAY with SAND (CL); stiff to very stiff; gray to olive gray; moist; little fine SAND; mostly medium plasticity fines.			
					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 7/2/12

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Interstate 5 HOV Improvement Project
PCH to San Juan Creek Road

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

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		0			SANDY lean CLAY (CL); light yellowish brown; moist; trace fine GRAVEL, max. 1/2 in. dia.; little coarse to fine SAND; mostly low to medium plasticity fines.			PI, R, WA
5					Bottom of borehole at 5.0 ft bgs			
10								
15								
20								
25								

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

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

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

LOG OF BORING NO. A-11-337

Grade Elevation:	154.0 ft			
Boring Depth:	30.5 ft	Driller:	2R Drilling	SHEET 1 of 1
Borehole Diameter:	8"	Type of Rig:	CME 75	Comments: Hammer Energy Efficiency: 75%
Date Drilled:	9-29-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop	Northing: 2,116,893 Easting: 6,128,177
Logged By:	RJ	Groundwater Reading:	Not Encountered	

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0					Fat CLAY (CH); olive brown; moist; trace fine SAND; mostly medium to high plasticity fines.			
		0						PI, R, WA
5		1	17		Very stiff; dark yellowish brown.	30		
10		2	47		Hard; olive brown; few fine SAND; mostly medium plasticity fines; trace mica; PP > 4.5 tsf.	35	84	
15		3	11		Dark yellowish brown; few fine SAND; mostly low plasticity fines.	38		
20		4	50/5 "		Elastic SILT (MH); hard; dark gray; moist; trace fine SAND; mostly high plasticity fines; Siltstone; trace mica; PP > 4.5 tsf [BEDROCK].	29	89	
25								

(continued)

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		0			SILTY SAND with GRAVEL (SM); light yellowish brown; moist; little fine GRAVEL, max. 1/2 in. dia.; mostly fine SAND; little nonplastic fines.			R, WA
5					Bottom of borehole at 5.0 ft bgs			
10								
15								
20								
25								

Earth Mechanics, Inc.
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PCH to San Juan Creek Road

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

LOG OF BORING NO. A-11-339

Grade Elevation:	157.8 ft				
Boring Depth:	31.5 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: 2,116,519 Easting: 6,128,082	
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			SANDY lean CLAY (CL); brown; dry; little fine GRAVEL, max. 3/4 in. dia.; some coarse to fine SAND; mostly low to medium plasticity fines.			PI, R, WA
5		1	27		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.	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	
25								

(continued)

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Interstate 5 HOV Improvement Project
PCH to San Juan Creek Road

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

LOG OF BORING NO. A-11-340

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%
Date Drilled:	10-20-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop	Northing: 2,117,048 Easting: 6,127,948
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								

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		0			SILTY SAND with GRAVEL (SM); yellowish brown; moist; little fine GRAVEL, max. 1/2 in. dia.; mostly fine SAND; some nonplastic to low plasticity fines.			CP, CR, 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.
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Interstate 5 HOV Improvement Project
PCH to San Juan Creek Road

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

LOG OF BORING NO. A-11-342

Grade Elevation:	147.6 ft			
Boring Depth:	41.5 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: 2,117,230 Easting: 6,127,523
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					CLAYEY SAND with GRAVEL (SC); olive brown; dry; little fine GRAVEL, max. 3/4 in. dia.; mostly coarse to fine SAND; some low plasticity fines.			
		0						CR, PI, R, WA
5		1	13		SANDY lean CLAY (CL); very stiff; yellowish brown; moist; trace fine GRAVEL, max. 3/4 in. dia.; some fine SAND; mostly low plasticity fines.	23		
10		2	42		Lean CLAY (CL); hard; dark yellowish brown; moist; trace fine GRAVEL, max. 3/8 in. dia.; few medium to fine SAND; mostly low plasticity fines; PP > 4.5 tsf.	20	107	
15		3	27		Lean CLAY with SAND (CL); hard; dark yellowish brown; moist; about 2% fine GRAVEL, max. 1/2 in. dia.; about 19% fine SAND; about 79% low plasticity fines.	18		WA
					SILTY SAND with GRAVEL (SM); medium dense to dense; dark gray; moist; little fine GRAVEL, max. 3/4 in. dia.; mostly medium to fine SAND; little low plasticity fines.			
20		4	42		Lean CLAY with SAND (CL); stiff; olive brown; moist; few medium to fine SAND; mostly medium plasticity fines; PP = 1.5 tsf.	25	98	
					CLAYEY SAND (SC); medium dense; yellowish brown; moist; few fine GRAVEL, max. 3/8 in. dia.; mostly medium to fine SAND; little low plasticity fines.	7	121	
25								

(continued)

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Interstate 5 HOV Improvement Project
PCH to San Juan Creek Road

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

LOG OF BORING NO. A-11-343

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%	
Date Drilled:	10-20-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop	Northing: 2,117,621 Easting: 6,127,511	
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								

EM BORING LOG 11-137 I-5 HOV SEGMENT 3 1-18-2012.GPJ EM 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. 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		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.			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.
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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%
Date Drilled:	10-20-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop	Northing: 2,118,314 Easting: 6,127,323
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			Lean CLAY (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, WA
		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								

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

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

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

LOG OF BORING NO. A-11-348

Grade Elevation:	116.9 ft				
Boring Depth:	101.5 ft	Driller:	2R Drilling	SHEET 1 of 1	
Borehole Diameter:	8"	Type of Rig:	CME 75	Comments: Hammer Energy Efficiency: 75%	
Date Drilled:	10-2-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop	Northing: 2,118,721 Easting: 6,127,141	
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); medium dense; dark olive brown; moist; little fine GRAVEL, max. 3/8 in. dia.; mostly fine SAND; some low plasticity fines.			
		0						PI, R, WA
5		1	28			4	122	
10		2	16			5		
15		3	12		Lean CLAY with SAND (CL); very stiff; olive brown mottled with dark olive brown; moist; little fine SAND; mostly medium plasticity fines; PP = 2.25 tsf.	26	93	
20		4	8		Dark olive brown.	25		CR
25								

(continued)

Earth Mechanics, Inc.
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PCH to San Juan Creek Road

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

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

LOG OF BORING NO. A-11-349

Grade Elevation:	81.7 ft			
Boring Depth:	81.5 ft	Driller:	2R Drilling	SHEET 1 of 1
Borehole Diameter:	8"	Type of Rig:	CME 75	Comments: Hammer Energy Efficiency: 75%
Date Drilled:	10-11-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop	Northing: 2,118,868 Easting: 6,127,118
Logged By:	CP	Groundwater Reading:	18.0 ft on 10-11-11	

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. 3/8 in. dia.; mostly medium to fine SAND; some nonplastic fines.			
		0			Lean CLAY with SAND (CL); very stiff; very dark brown; moist; little fine SAND; mostly medium plasticity fines.			
5		1	12		PP = 2.25 tsf.	26	92	CR
10		2	11		Lean CLAY (CL); very stiff; black; moist; few fine SAND; mostly medium plasticity fines.	20		
15		3	23		PP = 3.0 tsf.	21	104	
20		4	4		Dark olive brown.	28		
25								

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Interstate 5 HOV Improvement Project
PCH to San Juan Creek Road

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

LOG OF BORING NO. A-11-350

Grade Elevation:	113.1 ft				
Boring Depth:	100.6 ft	Driller:	2R Drilling	SHEET 1 of 1	
Borehole Diameter:	8"	Type of Rig:	CME 75	Comments: Hammer Energy Efficiency: 75%	
Date Drilled:	10-2-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop	Northing: 2,119,046 Easting: 6,127,160	
Logged By:	KK	Groundwater Reading:	70.8 ft on 10-2-11		

Depth (ft)	Sample Type	Sample	Blows/foot	Graphic Log	GEOTECHNICAL DESCRIPTION	Moisture (%)	Dry Density (pcf)	Test/ Results
0					ASPHALT.			
		0			SANDY lean CLAY (CL); medium stiff to stiff; olive brown; moist; some fine SAND; mostly medium plasticity fines.			PI, R, WA
5		1	6			21		
10		2	27		Lean CLAY with SAND (CL); very stiff to hard; olive brown; moist; little fine SAND; mostly medium plasticity fines; PP = 4.0 tsf.	22	102	
15		3	9			22		
20		4	18		Very stiff; PP = 2.5 tsf.	25	94	
25								

(continued)

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-11-352

Grade Elevation:	109.3 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:	10-20-11	Hammer Data:	Automatic hammer 140-lbs/30-inch drop	Northing: 2,118,832 Easting: 6,127,298
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			Lean CLAY (CL); medium stiff; olive brown; moist; little fine GRAVEL, max. 3/8 in. dia.; some medium to fine SAND; mostly medium plasticity fines.			PI, R, WA
		1	8					
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 1-16-2012.GPJ EMI LIBRARY CALTRANS 2010.GLB 7/2/12

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

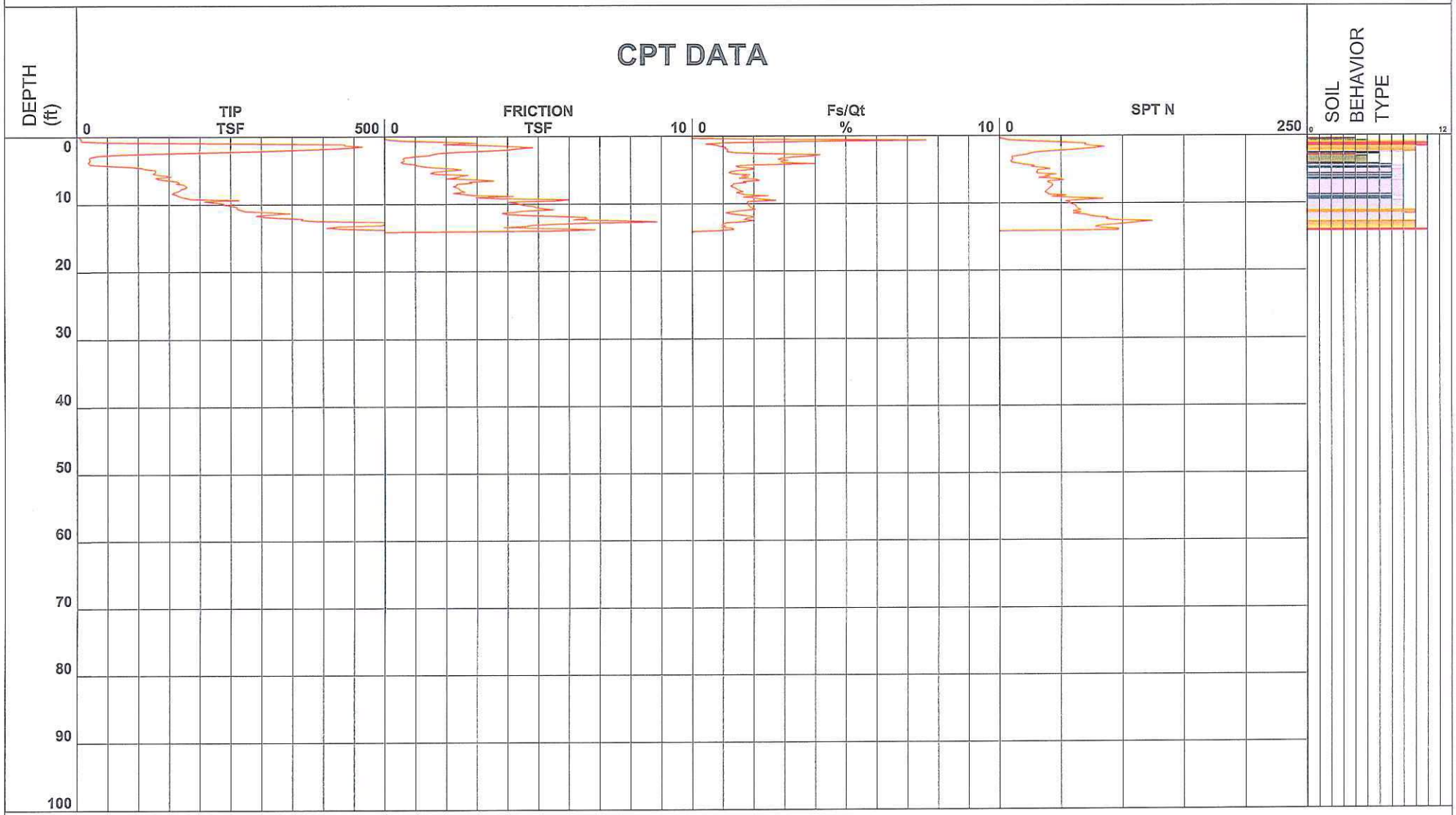
Interstate 5 HOV Improvement Project
PCH to San Juan Creek Road

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

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
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 (*)

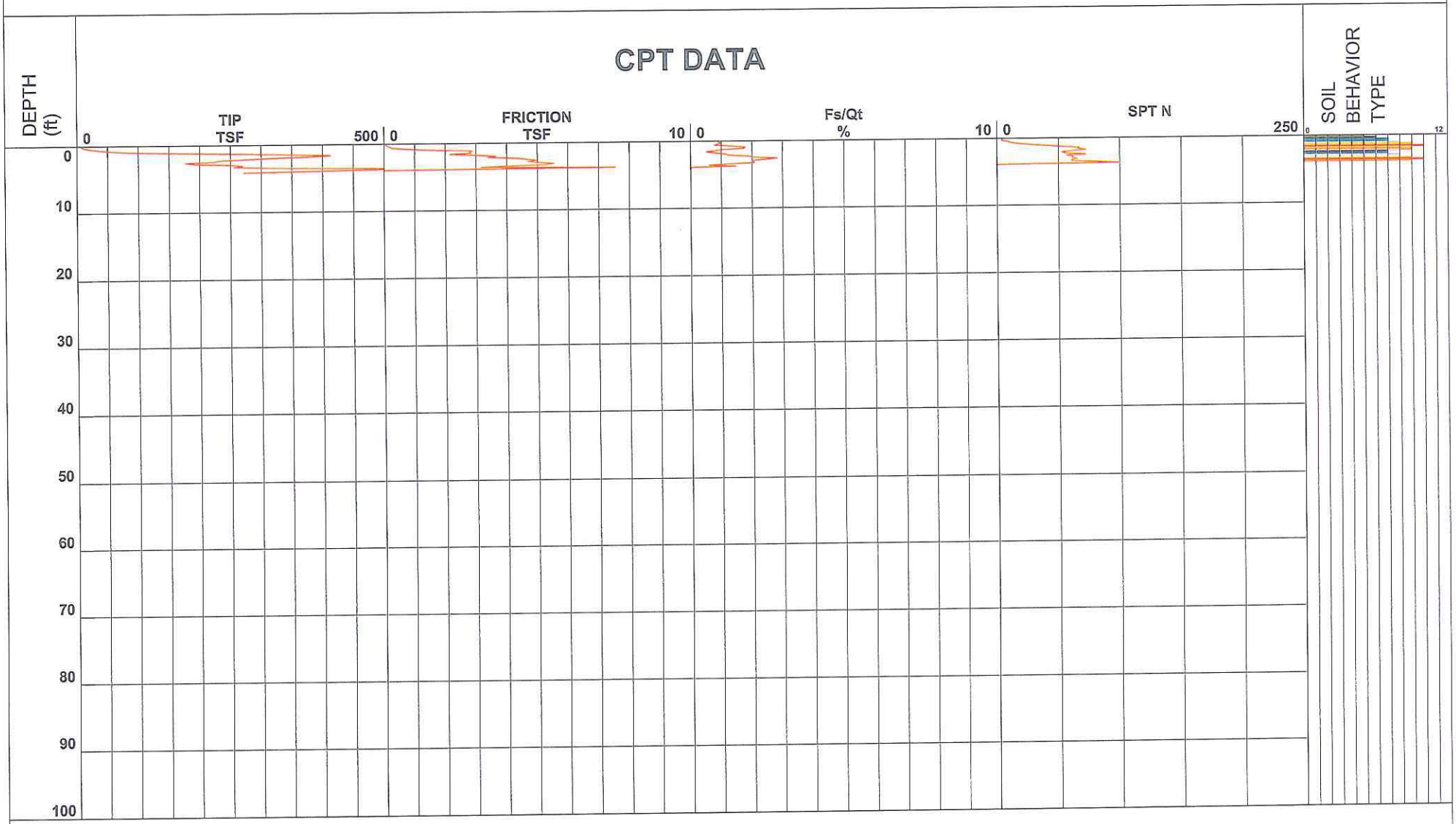
Depth Increment

*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(521).cpt
Job Number	11-137	Cone Number	DSG1104	GPS	
Hole Number	CPT-11-309	Date and Time	10/4/2011 1:28:23 AM	Maximum Depth	4.10 ft
Water Table Depth		>4.10 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 (*)

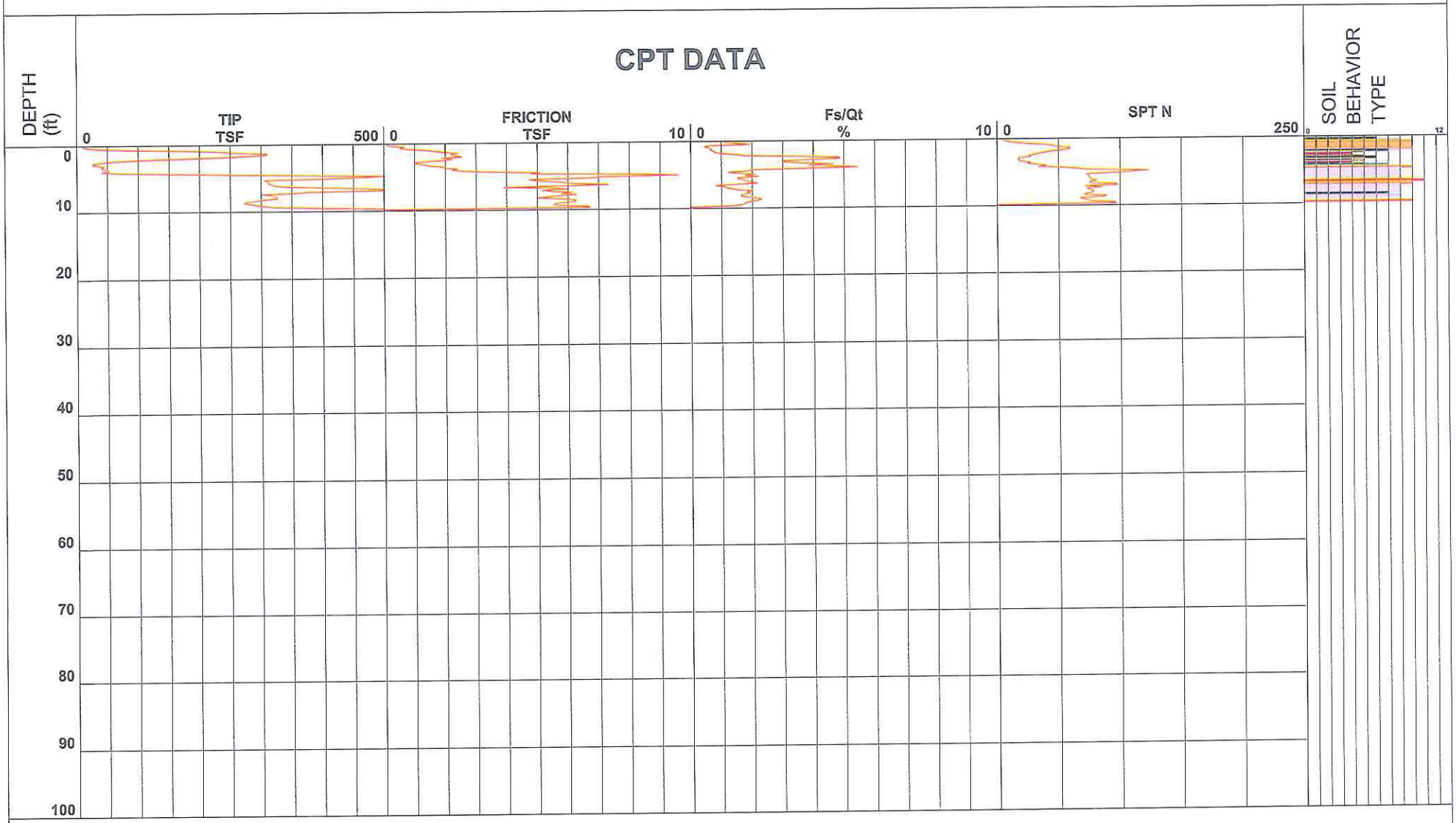
Depth Increment

*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(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
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 (*)

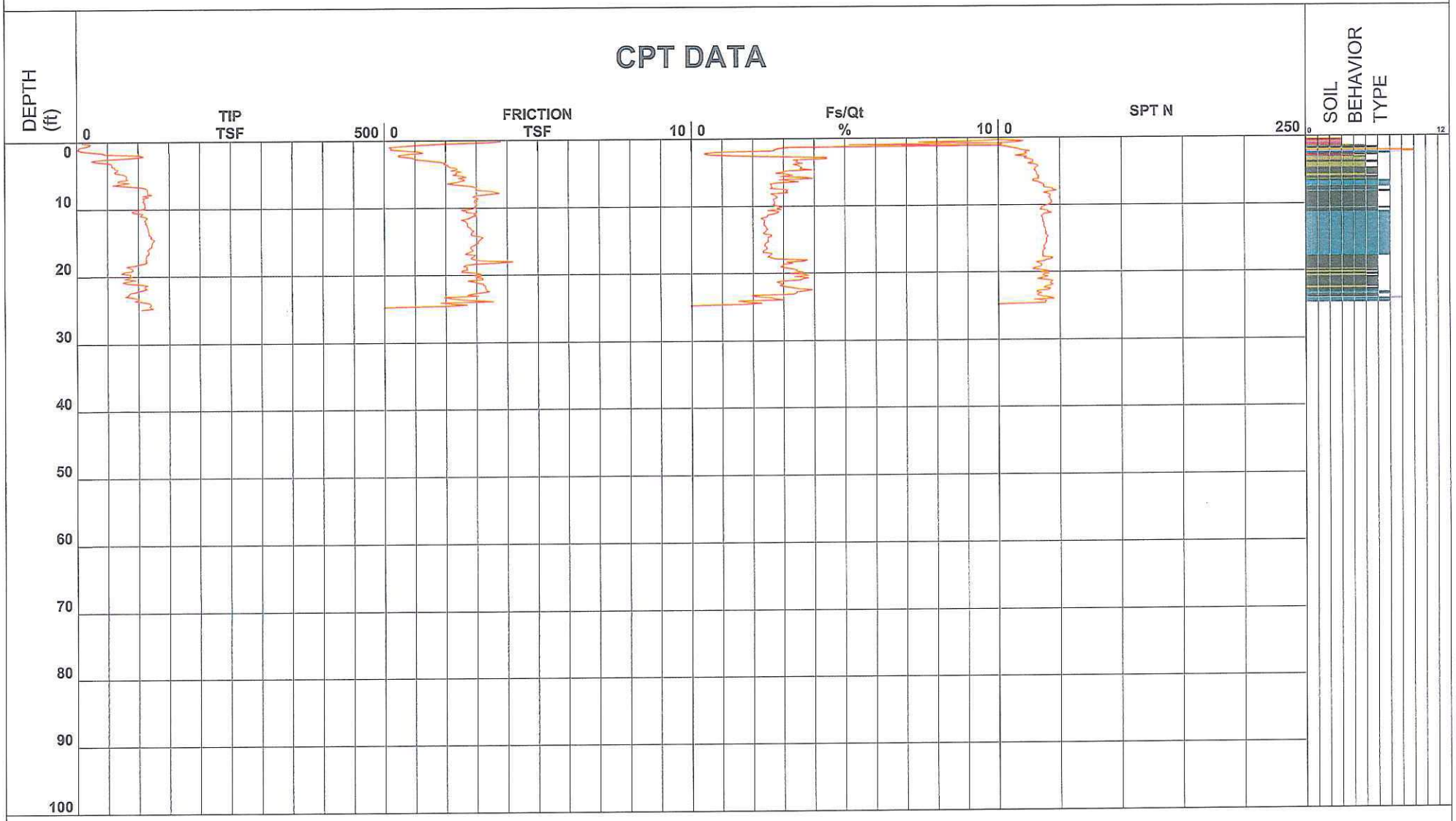
Depth Increment

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

Earth Mechanics

Location	I-5 HOV Widening Segment 3	Operator	BH-DM	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
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 (*)

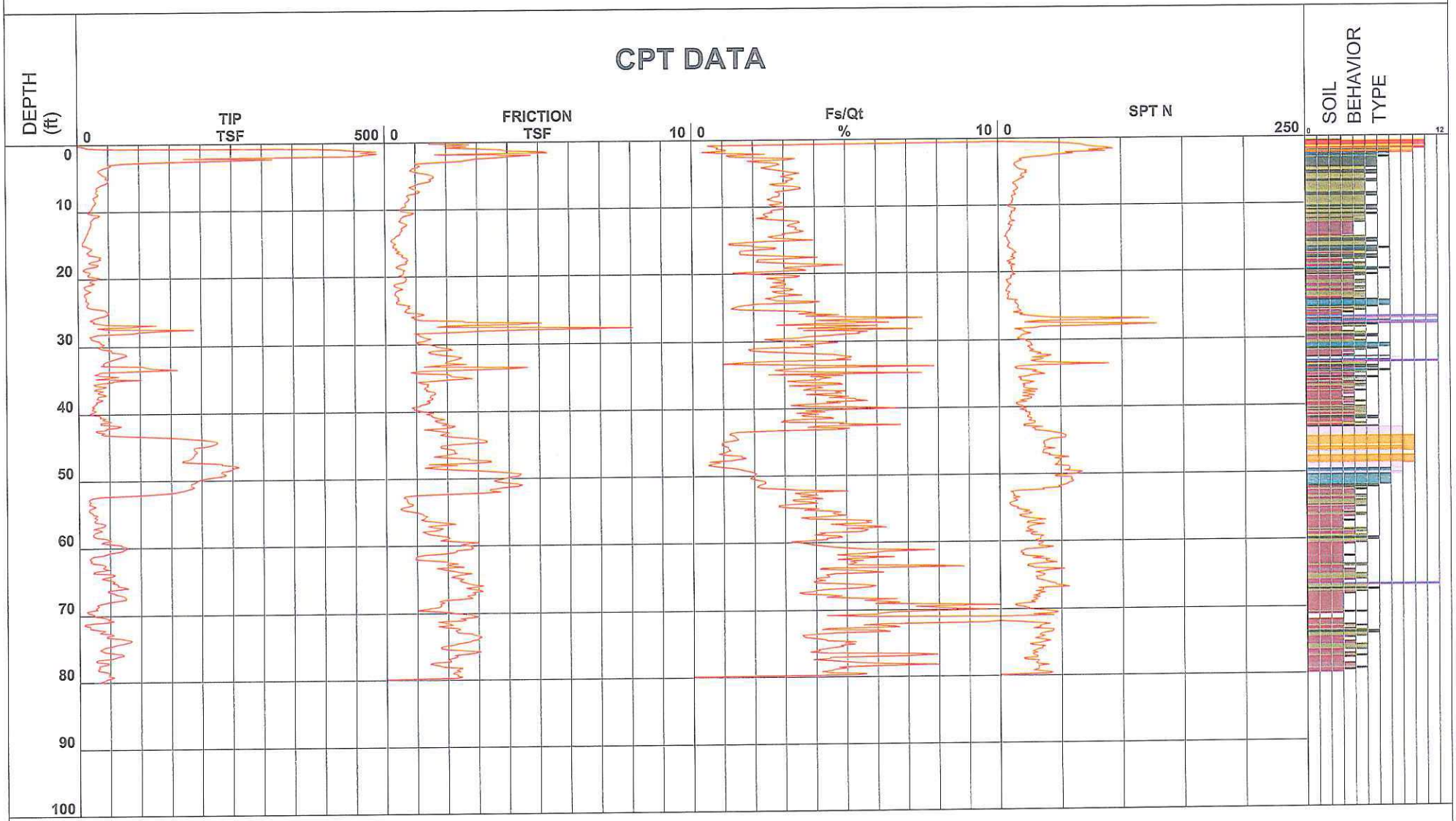
Depth Increment

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

Earth Mechanics

Location	I-5 HOV Widening Segment 3	Operator	BH-DM	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



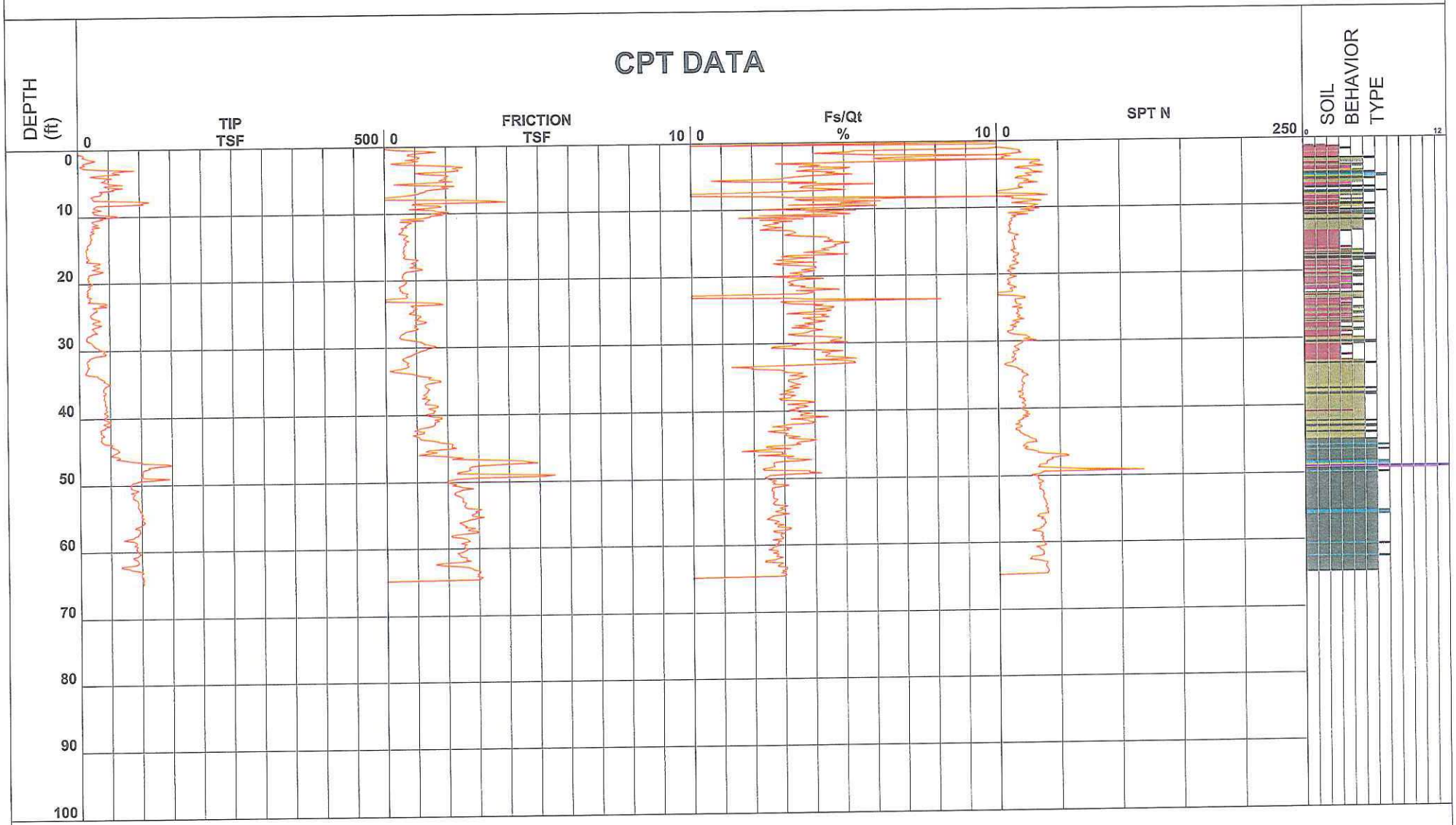
1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Depth Increment

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

Earth Mechanics

Location	I-5 HOV Widening Segment 3	Operator	BH-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				



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 (*)

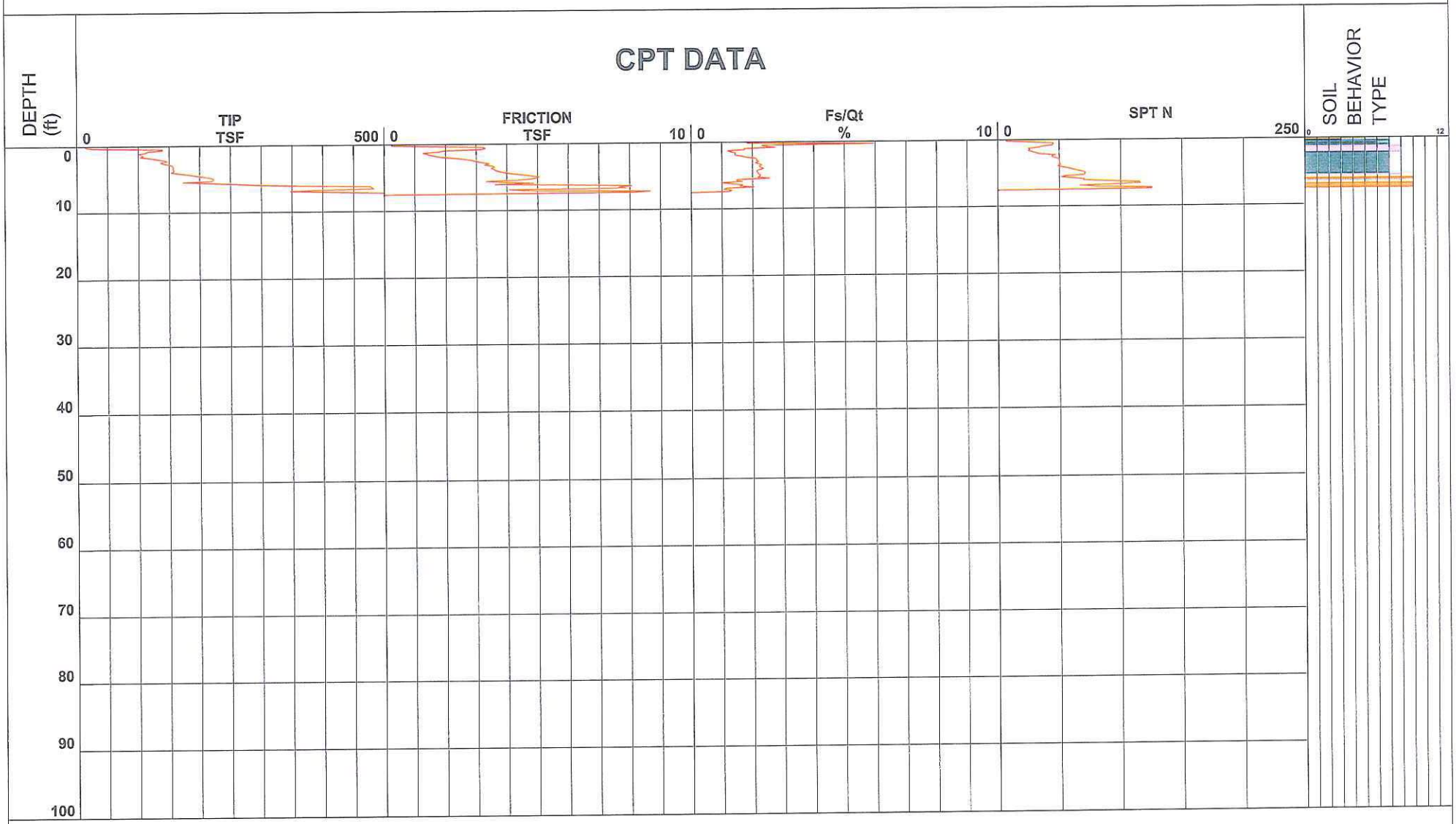
Depth Increment

(*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(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
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 (*)

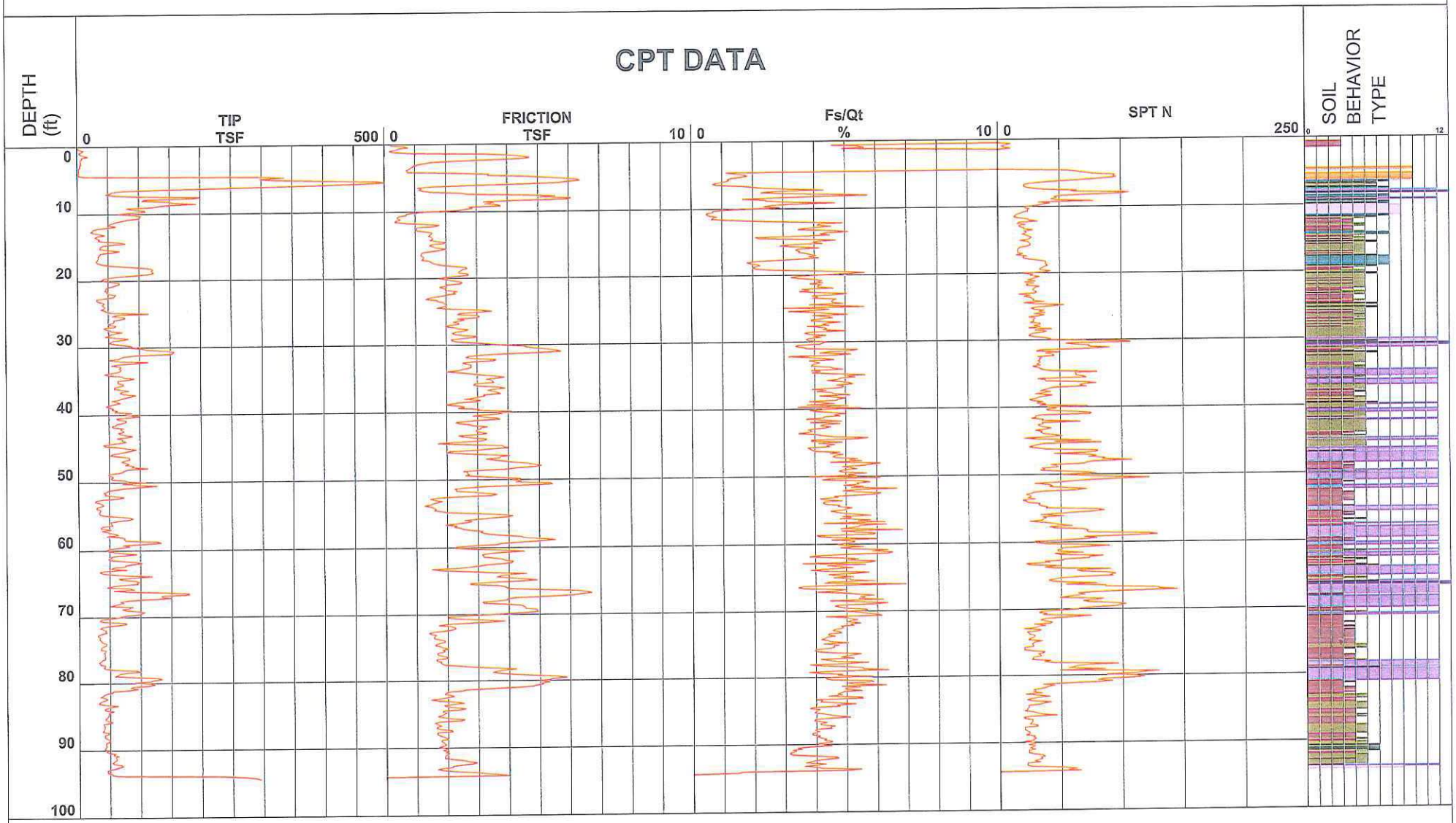
Depth Increment

*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(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 (*)

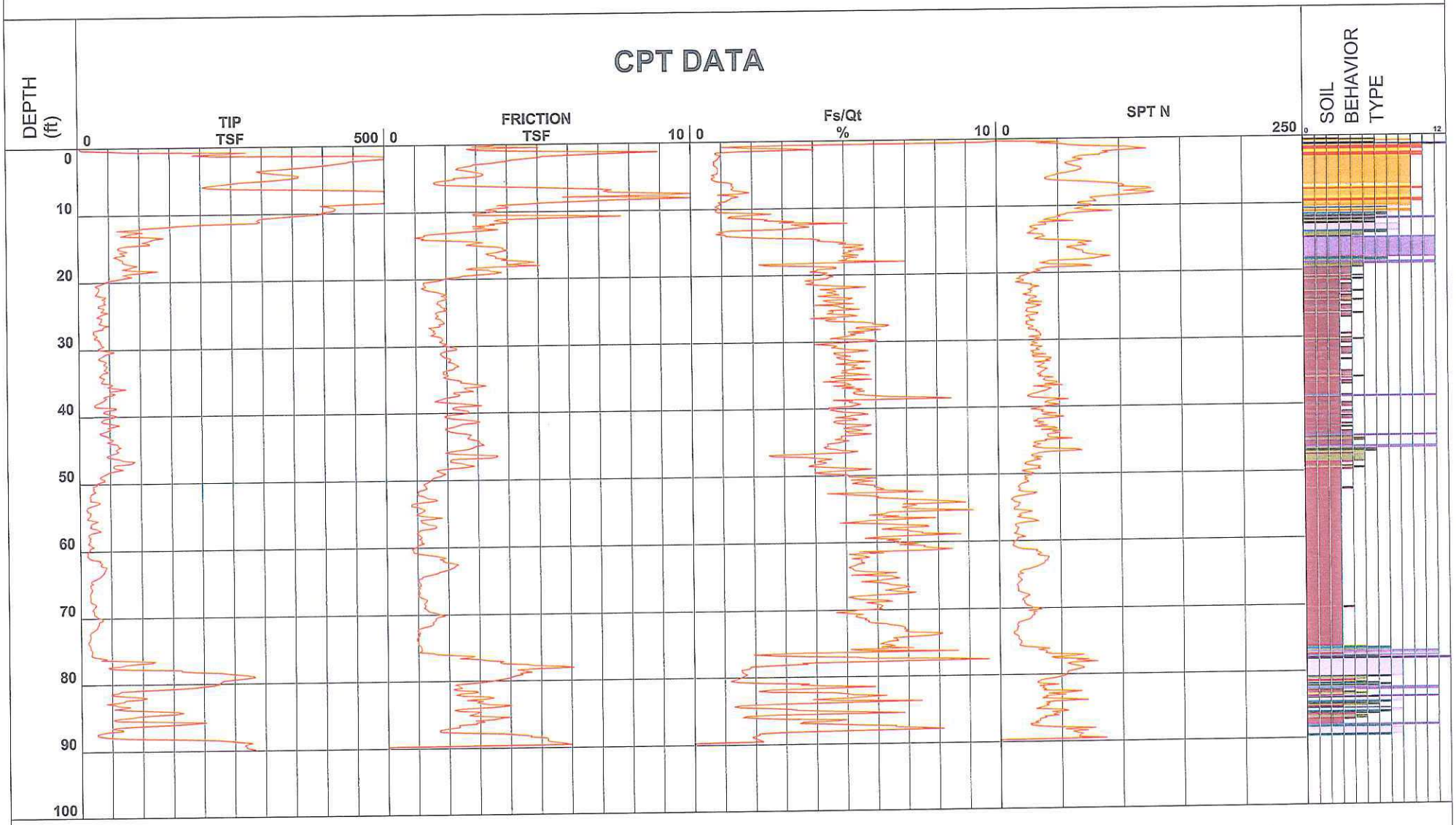
Depth Increment

*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 (*)

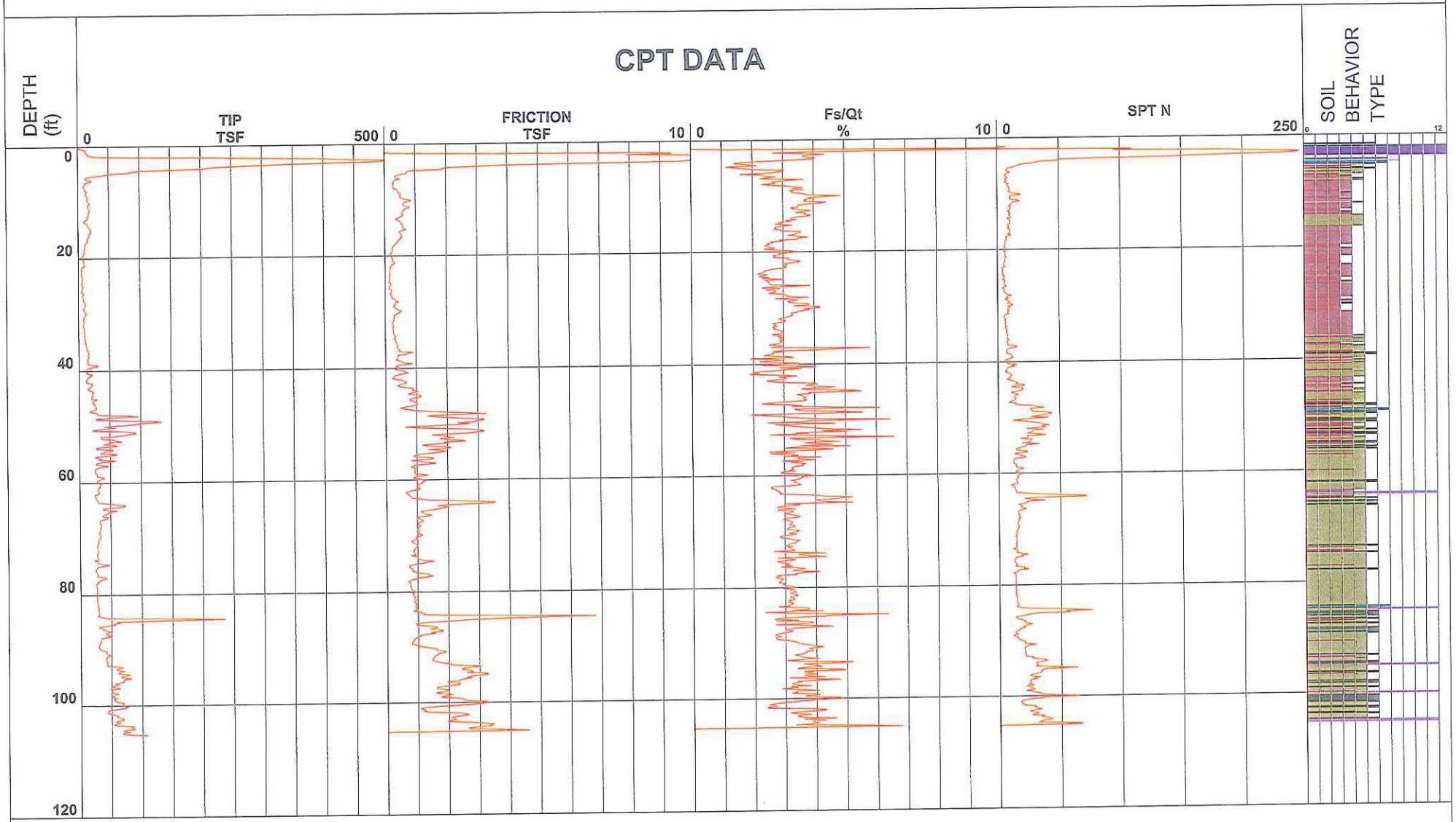
Depth Increment

*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 (*)

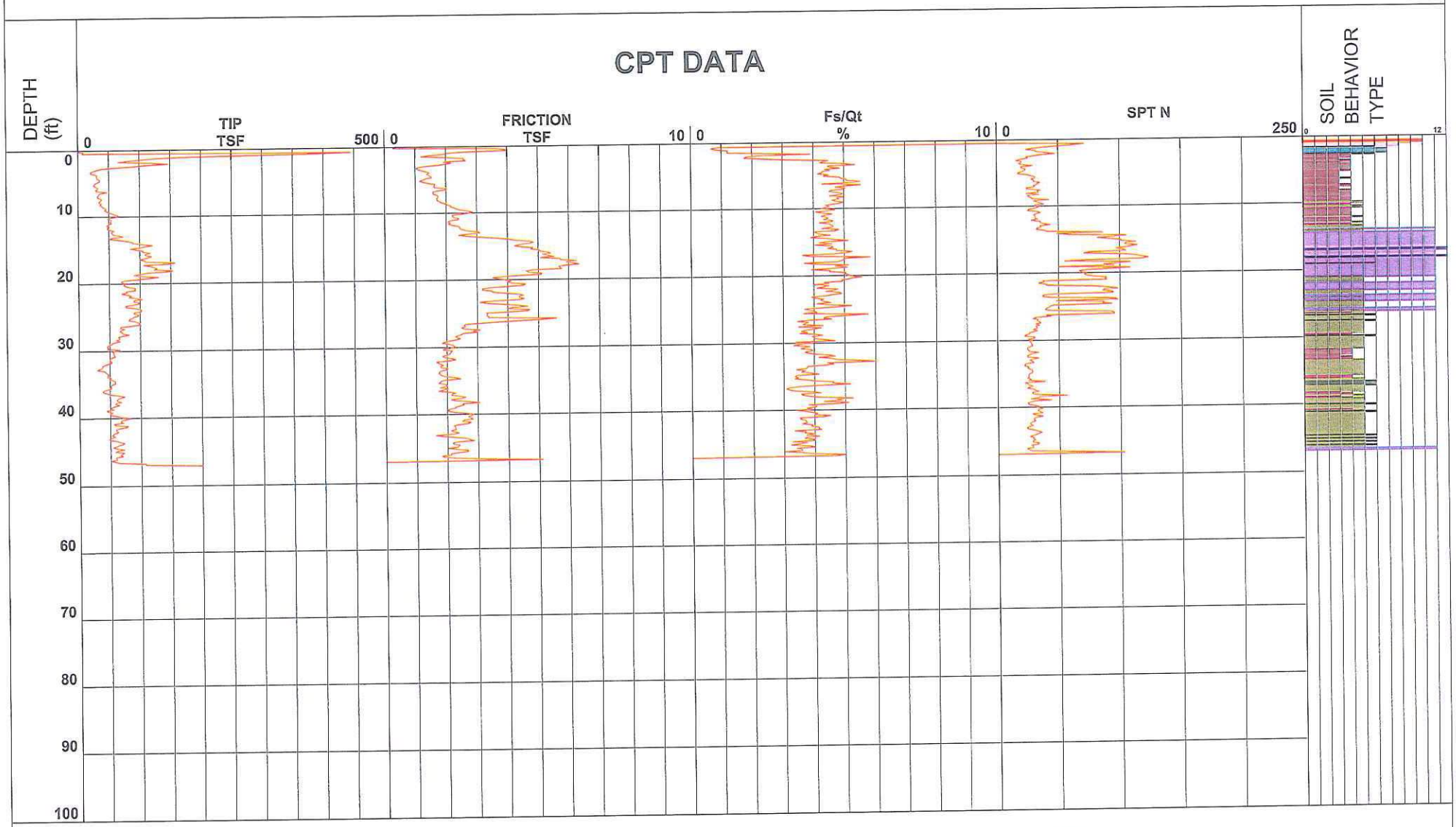
Depth Increment

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

Earth Mechanics

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

DESIGN CALCULATIONS

CALFP Ver. 1.1

Unit System = E

Title: I-5 Improvement Segment 3
Traffic Index (TI) = 10.0
R.Value of Subgrade (Native Soil) = 10
Required GE = 0002.88 ft

Depth (ft)	GF	GE (ft)	Depth (ft)	GF	GE (ft)
00.10	01.79	00.18	00.15	01.79	00.27
00.20	01.79	00.36	00.25	01.79	00.45
00.30	01.79	00.54	00.35	01.79	00.63
00.40	01.79	00.72	00.45	01.79	00.81
00.50	01.79	00.90	00.55	01.81	01.00
00.60	01.87	01.12	00.65	01.92	01.25
00.70	01.97	01.38	00.75	02.01	01.51
00.80	02.05	01.64	00.85	02.10	01.79
00.90	02.14	01.93	00.95	02.18	02.07
01.00	02.21	02.21	01.05	02.25	02.36
01.10	02.29	02.52	01.15	02.32	02.67
01.20	02.35	02.82	01.25	02.38	02.98
01.30	02.42	03.15	01.35	02.45	03.31

HMA Safety Factor (GE) = 0000.10 ft
HMA Ultimate Depth = 0001.35 ft
(HMA MAX. Depth shown in Table)

HMA MIN. Depth (selected) = 0000.30 ft

Note: Positive Residual GE indicates over-design.
Note: Negative Safety Factor in Native Soil

HMA ft	TPB	T-Base ft	B-Base ft	Subbase ft	Res-GE ft	Cost	HMA-GF ft	ft	$/y^2
01.25	00.00	00.00	00.00	00.00	00.09	0000.00	02.38		
01.30	00.00	00.00	00.00	00.00	00.27	0000.00	02.42		
01.35	00.00	00.00	00.00	00.00	00.43	0000.00	02.45		

Note: This design requires a safety Factor for GE. This requires that a design be selected that has a value as close as possible to 0.1 in the 'Res-GE' column. Such a design is generally shown in the first row of the above table.

***** FINISH *****

CALFP Ver. 1.1

Unit System = E

Title: I-5 Improvement Segment 3
Traffic Index (TI) = 10.0
R.Value of Subgrade (Native Soil) = 20
Required GE = 0002.56 ft

Depth (ft)	GF	GE (ft)	Depth (ft)	GF	GE (ft)
00.10	01.79	00.18	00.15	01.79	00.27
00.20	01.79	00.36	00.25	01.79	00.45
00.30	01.79	00.54	00.35	01.79	00.63
00.40	01.79	00.72	00.45	01.79	00.81
00.50	01.79	00.90	00.55	01.81	01.00
00.60	01.87	01.12	00.65	01.92	01.25
00.70	01.97	01.38	00.75	02.01	01.51
00.80	02.05	01.64	00.85	02.10	01.79
00.90	02.14	01.93	00.95	02.18	02.07
01.00	02.21	02.21	01.05	02.25	02.36
01.10	02.29	02.52	01.15	02.32	02.67
01.20	02.35	02.82	01.25	02.38	02.98
01.30	02.42	03.15	01.35	02.45	03.31

HMA Safety Factor (GE) = 0000.10 ft
HMA Ultimate Depth = 0001.35 ft
(HMA MAX. Depth shown in Table)

HMA MIN. Depth (selected) = 0000.30 ft

Note: Positive Residual GE indicates over-design.
Note: Negative Safety Factor in Native Soil

HMA ft	TPB	T-Base ft	B-Base ft	Subbase ft	Res-GE ft	Cost	HMA-GF ft	ft	$/y^2
01.15	00.00	00.00	00.00	00.00	00.11	0000.00	02.32		
01.20	00.00	00.00	00.00	00.00	00.26	0000.00	02.35		
01.25	00.00	00.00	00.00	00.00	00.42	0000.00	02.38		
01.30	00.00	00.00	00.00	00.00	00.59	0000.00	02.42		

Note: This design requires a safety factor for GE. This requires that a design be selected that has a value as close as possible to 0.1 in the 'Res-GE' column. Such a design is generally shown in the first row of the above table.

***** FINISH *****

CALFP Ver. 1.1

Unit System = E

Title: I-5 Improvement Segment 3
Traffic Index (TI) = 12.0
R.Value of Subgrade (Native Soil) = 10
Required GE = 0003.46 ft

Depth (ft)	GF	GE (ft)	Depth (ft)	GF	GE (ft)
00.10	01.64	00.16	00.15	01.64	00.25
00.20	01.64	00.33	00.25	01.64	00.41
00.30	01.64	00.49	00.35	01.64	00.57
00.40	01.64	00.66	00.45	01.64	00.74
00.50	01.64	00.82	00.55	01.66	00.91
00.60	01.70	01.02	00.65	01.75	01.14
00.70	01.79	01.25	00.75	01.84	01.38
00.80	01.88	01.50	00.85	01.91	01.62
00.90	01.95	01.76	00.95	01.99	01.89
01.00	02.02	02.02	01.05	02.05	02.15
01.10	02.09	02.30	01.15	02.12	02.44
01.20	02.15	02.58	01.25	02.18	02.73
01.30	02.21	02.87	01.35	02.23	03.01
01.40	02.26	03.16	01.45	02.29	03.32
01.50	02.31	03.47	01.55	02.34	03.63
01.60	02.36	03.78	01.65	02.39	03.94

HMA Safety Factor (GE) = 0000.10 ft
HMA Ultimate Depth = 0001.65 ft
(HMA MAX. Depth shown in Table)

HMA MIN. Depth (selected) = 0000.30 ft

Note: Positive Residual GE indicates over-design.
Note: Negative Safety Factor in Native Soil

HMA ft	TPB ft	T-Base ft	B-Base ft	Subbase ft	Res-GE ft	Cost	HMA-GF ft	ft	$/y^2
01.55	00.00	00.00	00.00	00.00	00.17	0000.00	02.34		
01.60	00.00	00.00	00.00	00.00	00.32	0000.00	02.36		
01.65	00.00	00.00	00.00	00.00	00.49	0000.00	02.39		

Note: This design requires a safety Factor for GE. This requires that a design be selected that has a value as close as possible to 0.1 in the 'Res-GE' column. Such a design is generally shown in the first row of the above table.

***** FINISH *****

CALFP Ver. 1.1

Unit System = E

Title: I-5 Improvement Segment 3
Traffic Index (TI) = 12.0
R.Value of Subgrade (Native Soil) = 20
Required GE = 0003.07 ft

Depth (ft)	GF	GE (ft)	Depth (ft)	GF	GE (ft)
00.10	01.64	00.16	00.15	01.64	00.25
00.20	01.64	00.33	00.25	01.64	00.41
00.30	01.64	00.49	00.35	01.64	00.57
00.40	01.64	00.66	00.45	01.64	00.74
00.50	01.64	00.82	00.55	01.66	00.91
00.60	01.70	01.02	00.65	01.75	01.14
00.70	01.79	01.25	00.75	01.84	01.38
00.80	01.88	01.50	00.85	01.91	01.62
00.90	01.95	01.76	00.95	01.99	01.89
01.00	02.02	02.02	01.05	02.05	02.15
01.10	02.09	02.30	01.15	02.12	02.44
01.20	02.15	02.58	01.25	02.18	02.73
01.30	02.21	02.87	01.35	02.23	03.01
01.40	02.26	03.16	01.45	02.29	03.32
01.50	02.31	03.47	01.55	02.34	03.63
01.60	02.36	03.78	01.65	02.39	03.94

HMA Safety Factor (GE) = 0000.10 ft
HMA Ultimate Depth = 0001.65 ft
(HMA MAX. Depth shown in Table)

HMA MIN. Depth (selected) = 0000.30 ft

Note: Positive Residual GE indicates over-design.
Note: Negative Safety Factor in Native Soil

HMA ft	TPB ft	T-Base ft	B-Base ft	Subbase ft	Res-GE ft	Cost	HMA-GF ft	ft	$/y^2
01.40	00.00	00.00	00.00	00.00	00.09	0000.00	02.26		
01.45	00.00	00.00	00.00	00.00	00.25	0000.00	02.29		
01.50	00.00	00.00	00.00	00.00	00.39	0000.00	02.31		
01.55	00.00	00.00	00.00	00.00	00.56	0000.00	02.34		

Note: This design requires a safety factor for GE. This requires that a design be selected that has a value as close as possible to 0.1 in the 'Res-GE' column. Such a design is generally shown in the first row of the above table.

***** FINISH *****

Raja Pirathiviraj

From:	Bahman Panah <bahman_panah@dot.ca.gov>
Sent:	Tuesday, February 07, 2012 11:11 AM
To:	Lew, Ross (Irvine,CA-US)
Cc:	Habib Temori; Alma Olguin (alma_olguin@dot.ca.gov); Behdad Baseghi; Kamran Mazhar
Subject:	Re: 0F96E1: I-5 HOV Segment 3 - Information needed for Pavement Design
Attachments:	Pavement Design Comment from Materials & Research Branch, 3-29-10.pdf

We have already discussed the minmum TI requirements for ramps at the PR stage. We generally use TI=12 for our ramps in district 12 due to heavy truck traffic..

Bahman J. Panah, M.S., P.E.
Materials Branch
(949) 724-2180

"Lew, Ross (Irvine,CA-US)" <RLew@trcsolutions.com>
02/06/2012 09:43 AM

To: Habib Temori <habib_temori@dot.ca.gov>, "Alma Olguin (alma_olguin@dot.ca.gov)" <alma_olguin@dot.ca.gov>, "Bahman Panah (bahman_panah@dot.ca.gov)" <bahman_panah@dot.ca.gov>

cc: "Kamran Mazhar (kamran_mazhar@dot.ca.gov)" <kamran_mazhar@dot.ca.gov>

Subject: 0F96E1: I-5 HOV Segment 3 - Information needed for Pavement Design

Hi Habib, Bahman and Alma,

Your assistance is requested. Based on the HDM Table 613.5A, the corresponding Medium Classification Ramp TIs are:

TI = 10 for 20 yrs
TI = 11 for 40 yrs

However, over a year ago Bahman provided a comment stating that it is more conservative to use TIs of 11 for 20 yrs and 12 for 40 yrs. See attached memo from Bahman.

Please confirm that we should use the more conservative TIs.

Thanks,
Ross

(See attached file: Pavement Design Comment from Materials & Research Branch, 3-29-10.pdf)

Raja Pirathiviraj

From: Habib Temori <habib_temori@dot.ca.gov>
Sent: Monday, February 06, 2012 11:41 AM
To: Lew, Ross (Irvine,CA-US)
Cc: Alma Olguin (alma_olguin@dot.ca.gov); Bahman Panah (bahman_panah@dot.ca.gov); Kamran Mazhar (kamran_mazhar@dot.ca.gov)
Subject: Re: 0F96E1: I-5 HOV Segment 3 - Information needed for Pavement Design
Attachments: Pavement Design Comment from Materials & Research Branch, 3-29-10.pdf

Hi,

It is the Material Branch's call to decide on this issue. Thanks.

Habib Temori
Traffic Studies Branch
Toll Road Operations
District Safety Devices Coordinator
(949) 724-2360

"Lew, Ross (Irvine,CA-US)" <RLew@trcsolutions.com>
02/06/2012 09:43 AM

To: Habib Temori <habib_temori@dot.ca.gov>, "Alma Olguin (alma_olguin@dot.ca.gov)" <alma_olguin@dot.ca.gov>, "Bahman Panah (bahman_panah@dot.ca.gov)" <bahman_panah@dot.ca.gov>

cc: "Kamran Mazhar (kamran_mazhar@dot.ca.gov)" <kamran_mazhar@dot.ca.gov>

Subject: 0F96E1: I-5 HOV Segment 3 - Information needed for Pavement Design

Hi Habib, Bahman and Alma,

Your assistance is requested. Based on the HDM Table 613.5A, the corresponding Medium Classification Ramp TIs are:

TI = 10 for 20 yrs
TI = 11 for 40 yrs

However, over a year ago Bahman provided a comment stating that it is more conservative to use TIs of 11 for 20 yrs and 12 for 40 yrs. See attached memo from Bahman.

Please confirm that we should use the more conservative TIs.

Thanks,
Ross

(See attached file: Pavement Design Comment from Materials & Research Branch, 3-29-10.pdf)

State of California — Business, Transportation and Housing Agency

Memorandum

To: Kamran Mazhar, Chief
Branch 'F'

Date: March 29, 2010

File: Ora-5, PM 3.30/8.30
EA: 0F9600

From: DEPARTMENT OF TRANSPORTATION
District 12
Materials and Research Branch

Cat: 441.01

Subject: **Review of Response to Caltrans Comments on Draft Pavement Design for I-5 HOV lane extension between Avenia Pico UC and San Juan Creek Rd.**

Materials and Research (M&R) Branch has received respond comments prepared by KLEINFELDER for the above-referenced project.

Our comments and responses are based on Preliminary Material Report prepared based on existing records. Consultant has acknowledged all the previous comments dated February 28,2010.

Comment no. 6, it is proposed to overlay the existing or new pavement with 0.25 RHMA. HDM limits RHMA thickness to 0.2 ft.

It is stated that the soils generally consist of clayey to silty sand, or sandy to clayey silt and this type of soils may have high potential for expansion and settlement. All this will be addressed on MR at early stages of PS&E.

As for the ramp, estimating ramp truck traffic is more difficult than mainline. It is of much greater impact of commercial and industrial development. Design shall concur with selection type, we generally recommend at minimum TI=11 for 20 years and TI=12 for 40 years design.

Please submit the final MR including all soils data and PS&E at all stages of completion for our review.

If you have any questions, please call Bahman Panah at (949) 724-2180.

Prepared by:

Bahman J. Panah, P.E.
Materials & Research Branch
Division of Project Delivery

Concurred by:

Behdad Bagheri, Ph.D, PE, GE, PMP
Chief, Materials & Research Branch
Division of Project Delivery

Cc: Frank Lin, Sidney Dadras, File

Raja Pirathiviraj

From: Habib Temori <habib_temori@dot.ca.gov>
Sent: Tuesday, January 31, 2012 11:00 AM
To: Lew, Ross (Irvine,CA-US)
Cc: Alma Olguin; Tavassoli, Ehsan (Irvine,CA-US); Kamran Mazhar; Jason Osman
Subject: RE: 0F96E1 Fw: I-5 HOV Segment 3 - Information needed for Pavement Design
Attachments: I-5 HOV Prelim Materials Report (Body Only), 4-2010.pdf

Ross,

Per your request, we have calculated the 20-year and 40-year design mainline TI values for the above listed projects as follow:

Route	Postmile	20-Year TI (100%)	40-Yeay TI (100%)
005	6.20-8.70	14.5	16.0

Please be advised that the Highway Design Manual procedures and 2010 traffic data were used to determine these values. Should you have any questions, please me.

Habib Temori
Traffic Studies Branch
Toll Road Operations
District Safety Devices Coordinator
(949) 724-2360

"Lew, Ross (Irvine,CA-US)" <RLew@trcsolutions.com>
01/25/2012 05:21 PM

To: "Habib Temori (habib_temori@dot.ca.gov)" <habib_temori@dot.ca.gov>
cc: Kamran Mazhar <kamran_mazhar@dot.ca.gov>, Alma Olguin <alma_olguin@dot.ca.gov>, "Tavassoli, Ehsan (Irvine,CA-US)" <ETavassoli@trcsolutions.com>
Subject: RE: 0F96E1 Fw: I-5 HOV Segment 3 - Information needed for Pavement Design

Hi Habib,

Per our discussion, please review the attached Materials Report that was prepared on April 2010 and notify me if the TI's in the report are still valid or not. Due to the size of the report, I attached only the body of the report. Thank you for your assistance.

Ross

-----Original Message-----
From: Alma Olguin [mailto:alma_olguin@dot.ca.gov]
Sent: Wednesday, January 25, 2012 8:51 AM
To: Lew, Ross (Irvine,CA-US)
Cc: Kamran Mazhar
Subject: RE: 0F96E1 Fw: I-5 HOV Segment 3 - Information needed for Pavement Design

Ross,
You can contact him directly, please cc me.
Thank you,
Alma

"Lew, Ross (Irvine,CA-US)" <RLew@trcsolutions.com> 01/24/2012 04:11 PM

To: Alma Olguin <alma_olguin@dot.ca.gov>
cc:
Subject: RE: 0F96E1 Fw: I-5 HOV Segment 3 - Information needed for Pavement Design Should I contact Habib for the TI or will you do it?

Thanks,
Ross

-----Original Message-----
From: Alma Olguin [mailto:alma_olguin@dot.ca.gov]
Sent: Tuesday, January 24, 2012 1:34 PM
To: Lew, Ross (Irvine,CA-US); Tavassoli, Ehsan (Irvine,CA-US)
Cc: Kamran Mazhar; Bahman Panah; Majid Movahed; Bryan Sorensen; Habib Temori
Subject: Fw: 0F96E1 Fw: I-5 HOV Segment 3 - Information needed for Pavement Design

Ross and Ehsan,
Please see Bahman's email attached.
Thank you,

Alma

----- Forwarded by Alma Olguin/D12/Caltrans/CAGov on 01/24/2012 01:29 PM

Bahman Panah/D12/Caltrans/CAGov
01/24/2012 10:10 AM

To: Alma Olguin/D12/Caltrans/CAGov@DOT
cc: Behdad Baseghi/D12/Caltrans/CAGov@DOT, Kamran Mazhar/D12/Caltrans/CAGov@DOT
Subject: Re: 0F96E1 Fw: I-5 HOV Segment 3 - Information needed for Pavement Design(Document link: Alma Olguin)

The TI was provided by our traffic branch for in house use at PSR stage.
Habib is in charge of traffic data.
As for part 2, deflection study will be required to determine the condition of existing AC ramps and determine the required mill/replace option for HMA or HMAR (RuberizedAC).

Bahman J. Panah, M.S., P.E.
Materials Branch
(949) 724-2180

Alma Olguin/D12/Caltrans/CAGov
01/23/2012 01:43 PM

To: Bahman Panah/D12/Caltrans/CAGov@DOT, Majid Movahed/D12/Caltrans/CAGov@DOT, Bryan Sorensen/D12/Caltrans/CAGov@DOT, Habib Temori/D12/Caltrans/CAGov@DOT
cc:
Subject: 0F96E1 Fw: I-5 HOV Segment 3 - Information needed for Pavement

Design

I am forwarding the following requests from the Consultant regarding Segment 3 of the I-5 HOV. Please advise.
Thank you,
Alma

----- Forwarded by Alma Olguin/D12/Caltrans/CAGov on 01/23/2012 01:36 PM

"Lew, Ross (Irvine,CA-US)" <RLew@trcsolutions.com>
01/23/2012 07:45 AM

To
"Kamran Mazhar (kamran_mazhar@dot.ca.gov)" <kamran_mazhar@dot.ca.gov>, "Alma Olguin (alma_olguin@dot.ca.gov)" <alma_olguin@dot.ca.gov>

cc
"Tavassoli, Ehsan (Irvine,CA-US)" <ETavassoli@trcsolutions.com>

Subject
I-5 HOV Segment 3 - Information needed for Pavement Design

(Embedded image moved to file: pic03468.gif) Good Morning Kamran and Alma,

I hope the both of you had a good weekend and your assistance is requested on the following items.

Kamran, were you able to determine the correct interpretation of HDM 613.5 and the first 2 foot of the shoulder criteria?

Alma,

(1) The TIs for the preliminary pavement design were provided by the District during the PA/ED phase. For this PS&E phase, we need written Caltrans approval on Design Life and TI's from their Traffic Unit (not Materials). We have to include this approval sheet in our Materials Report. Please also have the Traffic Unit provide the TI for the mainline inside shoulder.

(2) Materials Unit requires rigid pavement for the exit ramp termini; so we will have flexible for the ramps and then rigid at the exit ramp termini only. Please confirm that this design is acceptable to the District.

Thank you for your assistance and we'll follow up with you later this week to see if you have any questions or require additional information.

Ross
(See attached file: I-5 HOV Prelim Materials Report (Body Only), 4-2010.pdf)

Appendix C

CALTRANS REVIEW COMMENTS AND EMI RESPONSES

DESIGN REVIEW
COMMENT, RESPONSE and RESOLUTION LOG

Project: I-5 HOV Improvement Project - PCH to San Juan Creek Road | Project No. EA 12-0F96E1 | Discipline: Materials & Research

REVIEWING AGENCY'S INFORMATION

Reviewing Agency: Caltrans

Reviewer Name and Contact Info: Bahman Panah

DESIGNER'S INFORMATION

Discipline Leader/Firm and Contact Info.: Ehsan Tavassoli (TRC) (949) 727-7301

PM Approval: Ayman Salama Date: 1/21/2013

MILESTONE: [ ] Technical Studies [ ] Draft PA/ED [ ] Draft PA/ED [ ] 35% Design [ ] 65% PS&E [ ] 95% PS&E [X] 100% PS&E [ ] Final Design [ ] Post Design

COMMENT and RESOLUTION CODES: DC=Design Criteria; DS=Design Standards; DD=Directive; Sp=Specifications; CAD=Drafting Standard; S=Suggested; G=General

ACTION CODES: A=Will Incorporate; B=Disagree, not incorporated; C=Continue Resolution; D=Adjudication Required; N/A = Not Applicable

REVIEW COMMENT SECTION						RESPONSE SECTION			RESOLUTION				Implementation	
No.	Dwg/SSP/ Page No., etc	Comment	Comment Code	Name	Date	Response to Reviewer's Comments	Name	Date	Resolution Code	Action Code	Responder's Initials/Date	Agency Reviewer's Initials/Date	Updated by Initial/Date	Verified by Initial/Date
1	MR Report	The final MR dated November 19,2012 was submitted along with the 100% PS&E. It appears that only some corrections have been made.	G	Bahman Panah	12/21/2012	Only correction was in Table 7. The pavement section for SB Loop On-Ramp (PCH-2 Line) has been revised to include lime treatment.	Lino Cheang	1/21/2013	N/A					
2	X-2, X-5	On typical cross section X-2 and X-5 at Gore area and PCH-2, PCH-4, and PCH-5 lines, per HDM either use tied shoulder or widened slab.	DS	Bahman Panah	12/21/2012	Will comply and revise to show 2' of widened slab through these gore areas per our dicussion.	LL	1/21/2013	A	LL 1/21/13				
3	X-1, SSP	RHMA-O is provided for OGFC, please change to HMA-O. Delete the provided RHMA-O SSP and place HMA-O SSP instead. Asphalt Binder for HMA-O shall be PG 64-10.	DS	Bahman Panah	12/21/2012	Will comply.	LL	1/3/2013	A	LL 1/3/13				
4	SSP	For QC/QA Spec. we need a minimum quantity of 10,000 tons. Therefore only HMA Type A qualifies for QC/QA spec. The quantity provided for RHMA-G and HMA-O, is less than 10,000 tons. RHMA-G should be under Standard spec and HMA-O is under Method spec.	DS	Bahman Panah	12/21/2012	Will comply and revise SSP 39-1.01 accordingly to reflect this.	LL	1/3/2013	A	LL 1/3/13				
5	SSP	Provide SSP for lime stabilized soil.	G	Bahman Panah	12/21/2012	Lime Stabilized Soil is covered under Section 24-2 of the 2010 Standard Specs. NSSP 24-2.03E was provided in 100% submittal to allow LSS compaction of 0.67' layer. Per disucssion, SSP 24-2.03C is added to specify lime application rate and unconfined compressive strength.	LL	1/21/2013	A	LL 1/21/13				
6	SSP	Provide SSP for Asphalt Treated Base.	G	Bahman Panah	12/21/2012	Asphalt Treated Base is not used for this project.	LL	1/3/2013	N/A	LL 1/3/13				

DESIGN REVIEW
COMMENT, RESPONSE and RESOLUTION LOG

No.	Dwg/SSP/ Page No., etc	Comment	Comment Code	Name	Date	Response to Reviewer's Comments	Name	Date	Resolution Code	Action Code	Responder's Initials/Date	Agency Reviewer's Initials/Date	Updated by Initial/Date	Verified by Initial/Date
7	SSP	With the provided SSP 39-1.20 for liquid anti strip, also provide SSP 39-1.18 and SSP 39-1.19 for treating aggregate where test show low tensile strength ratio.	G	Bahman Panah	12/21/2012	Will comply.	LL	1/21/2013	A	LL 1/21/13				
8	SSP	Provide SSP 39-1.15C with self-propelled spreader and vibratory rollers.	G	Bahman Panah	12/21/2012	Will comply.	LL	1/21/2013	A	LL 1/21/13				

DESIGN REVIEW
COMMENT, RESPONSE and RESOLUTION LOG

Project: I-5 HOV Improvement Project - PCH to San Juan Creek Road | Project No. EA 12-0F96E1 | Discipline: Materials

REVIEWING AGENCY'S INFORMATION

Reviewing Agency: Caltrans

Reviewer Name and Contact Info: Bahman Panah 949-724-2180

DESIGNER'S INFORMATION

Discipline Leader/Firm and Contact Info.: Ehsan Tavassoli (TRC) (949) 727-7301

PM Approval: Ayman Salama Date: 11/14/2012

MILESTONE: [ ] Technical Studies [ ] Draft PA/ED [ ] Draft PA/ED [ ] 35% Design [ ] 65% PS&E [X] 95% PS&E [ ] Final Design [ ] Post Design

COMMENT and RESOLUTION CODES: DC=Design Criteria; DS=Design Standards; DD=Directive; Sp=Specifications; CAD=Drafting Standard; S=Suggested; G=General

ACTION CODES: A=Will Incorporate; B=Disagree, not incorporated; C=Continue Resolution; D=Adjudication Required; N/A = Not Applicable

REVIEW COMMENT SECTION						RESPONSE SECTION			RESOLUTION				Implementation	
No.	Dwg/SSP/ Page No., etc	Comment	Comment Code	Name	Date	Response to Reviewer's Comments	Name	Date	Resolution Code	Action Code	Responder's Initials/Date	Agency Reviewer's Initials/Date	Updated by Initial/Date	Verified by Initial/Date
1	MR	The revised MR dated July 3, 2012 prepared by Earth Mechanics for this segment has offered an alternative of a combination of 0.64 ft of Lime treatment and provided under-drains in cut and at grade areas and provided an additional 1.0 to 1.3 ft of additional aggregate subbase (AS) in lieu of the required 4.0 ft over-excavation at the grading level. Please on plans show the locations of proposed under-drains	CAD	Bahman Panah	7/20/2012	Under-drains are shown on "Subsurface Drainage Plan" Sheet SB-1 to SB-6, details shown on SBD-1 and quantity shown on SBQ-1. The typical cross sections on X sheets also reflects locations of the underdrains.	LL	9/14/2012		N/A	LL 9/14/12			
2		Typical cross section show Class 3 used as imported borrow with R=40 and PI<12. Please show the over excavation limits on all typical sections.		Bahman Panah	7/20/2012	There is not need for the over excavation. The pavement structure includes lime stabilized soil where there is an expansive soil.	LL	9/14/2012		N/A	LL 9/14/12			
3		On typical Pavement sections, some show lime treatment and some do not, with no lime treatment, additional excavation is required and shall be shown on the typical cross sections.	CAD	Bahman Panah	7/20/2012	Per Section 7.2 of Materials Report dated 7/3/2012 , the existing soil condition in areas along I-5 SB mainline from southern end limits to Sta 354+25, between PCH-1 354+25 to 365+00, and between PCH-1 370+00 to CLR 40+90 are considered as "non-expansive" subgrade. Lime treatment and overexcavation are not necessary for these areas. The proposed pavement section for these areas are shown as Type 10 and 11 in the 95% plans, which does not have LSS or Overexcavation. For the PCH-2 SB Loop on-ramp, the pavement section will be revised to Type 5 with the LSS as discussed during coordination. A NSSP will be prepared to require the contractor to complete the 0.65' LSS in one layer in order to complete the pavement construction within the 7-day window allowed for the closure of this ramp.	LL	9/14/2012		A	LL 10/22/12		LL 10/22/12	ETH 11/12/12

DESIGN REVIEW
COMMENT, RESPONSE and RESOLUTION LOG

No.	Dwg/SSP/ Page No., etc	Comment	Comment Code	Name	Date	Response to Reviewer's Comments	Name	Date	Resolution Code	Action Code	Responder's Initials/Date	Agency Reviewer's Initials/Date	Updated by Initial/Date	Verified by Initial/Date
4		On reconstructed ramps, please provide a note on plans for the existing pavement to be removed entirely.	CAD	Bahman Panah	7/20/2012	Will comply.	LL	9/14/2012		A	LL 9/14/12		LL 10/22/12	ETH 11/12/13
5	MR	In the MR it is stated that per restriction specified in the environmental documents, the SB Loop on-ramp (PCH-2 line) can not be closed for more than 9 days during construction. And, Lime treatment can not be completed within this time frame. Therefore an alternative pavement section by replacing 0.65 fr of LSS with 0.65 ft of AS. In the report it is stated that 15 ft of cut is required at PCH-2 line. This alternative shall be approved by the Geotechnical/pavement Engineer.	G	Bahman Panah	7/20/2012	Pavement section for SB Loop On-Ramp (PCH-2 Line) has been revised to inlcude lime treatment.	LL	9/14/2012		A	LL 9/14/12			
						Up to about 15 feet of cut is required for realignment of the I-5 SB Loop On-Ramp from PCH (PCH-2 Line). This is not a vertical excavation. This is the maximum height of a proposed cut slope with an approximate gradient of 4H:1V. The evaluation of this 15 feet cut slope is presented in Geotechnical Design Report (GDR) dated March 29, 2012, and the GDR will need to be reviewed and approved by Caltrans Geotechnical Engineer.	LL	9/14/2012		N/A	LL 9/14/12			
6		If RSC is recommended as an alternative to JPCP pavement due to working window closure restriction imposed by TMC, it shall be quantified and shown on the plans. Be advised that JPCP will be a minimum of 10 days for cure time. Type 3 Portland cement (with accelerators) can be sed with a minimum 3 days cure time	G	Bahman Panah	7/20/2012	Noted. Will revise if RSC is determined necessary.	LL	9/14/2012		N/A	LL 9/14/12			

Earth Mechanics, Inc.
Geotechnical & Earthquake Engineering

July 3, 2012

EMI Project No. 11-137

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

Attention: Mr. Ross Lew, P.E.

Subject: Response to Caltrans Review Comments
Materials Report, Interstate 5 HOV Improvement Project (Segment 3),
PCH to San Juan Creek Road, Orange County, California
12-ORA-5, PM 6.2/8.7
Caltrans Project No. 1200020279 (EA 12-0F96E1)

Dear Mr. Lew:

Earth Mechanics, Inc. (EMI) submitted a Materials report dated March 23, 2012 for the subject project. Caltrans prepared a memorandum dated June 19, 2012 presenting their review comments. A copy of this memorandum is attached.

There are six Caltrans review comments. EMI prepared the response for the first review comment and TRC prepared the responses for the other five review comments. All six review comments and the responses are presented below:

1) The MR prepared by Earth Mechanics for this segment indicates that the subgrade soil is expansive and requires removal to 4 ft below the grading plane. The soils need to be classified per Unified Soil Classification. The results for gradation and swell test should be provided in the report. The soil Boring No's and soil Boring locations should correspond to each other. some Boring No's are missing.

Response: The 4 feet of removal from the grading plane documented in the March 23, 2012 Materials Report has been replaced by using a combination of underdrains and lime treatment to mitigate expansive subgrade.

Plasticity Index, Passing No. 200 Sieve and R-value tests have been added and the subgrade will be classified using the Unified Soil Classification System. Swell tests were not performed because the underdrains will intercept water migrating towards the subgrade.

We double checked the boring numbers and the borings locations and there are no missing boring numbers.

2) Typical cross section show Class 3 used as imported borrow with R= 40 and PI< 12. Please show the over excavation limits on all typical sections.

Response: The project does not recommend over excavation anymore.

3) If Lime treatment of subgrade is considered in lieu of deeper excavation, it should be shown on the plans.

Response: Will comply.

4) On reconstructed ramps, the existing pavement shall be removed entirely.

Response: The existing pavement will be removed within construction limits as shown on removal sheets, C-1 to C-7.

5) If RSC is recommended as an alternative to JPCP pavement due to working window closure restriction imposed by TMC, it shall be quantified and shown on the plans. Be advised that JPCP will require a minimum of 10 days for cure time. Type 3 Portland cement (with accelerators) can be used with a minimum 3 days cure time.

Response: RSC is not recommended in our project.

6) Please be advised that at 65% of PS&E phase, we assume grading shown on plans are final.

Response: That is correct.

Sincerely,
EARTH MECHANICS, INC.

Lino Cheang

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

Lino Cheang, GE 2345
Project Manager

Attachment
Caltrans Review Memorandum dated June 19, 2012

State of California

Business, Transportation and Housing Agency

Memorandum

To: Kamran Mazhar, Chief
Design Branch F

Date: June 19, 2012

File: Ora-5, PM 6.2/8.7
Segment 3
EA: 12-0F96E1

From: DEPARTMENT OF TRANSPORTATION
District 12
Materials and Research Branch

Subject: **Review of 65% PS&E submittals- Segment 3**

The District Materials & Research (M&R) Branch has received the 65% PS&E submittals prepared by TRC for Orange County Transportation Authority.

The project scope for the entire project is to widen the mainline and reconstruct ramps along the interstate 5 between PM 3.0 /8.7. The project is divided into three segments. This review is for segment 3 from PM 6.2/8.7.

Our comments:

1) The MR prepared by Earth Mechanics for this segment indicates that the subgrade soil is expansive and requires removal to 4 ft below the grading plane. The soils need to be classified per Unified Soil Classification. The results for gradation and swell test should be provided in the report. The soil Boring No's and soil Boring locations should correspond to each other. some Boring No's are missing.

2) Typical cross section show Class 3 used as imported borrow with R= 40 and PI< 12. Please show the over excavation limits on all typical sections.

3) If Lime treatment of subgrade is considered in lieu of deeper excavation, it should be shown on the plans.

4) On reconstructed ramps, the existing pavement shall be removed entirely.

5) If RSC is recommended as an alternative to JPCP pavement due to working window closure restriction imposed by TMC, it shall be quantified and shown on the plans. Be advised that JPCP will require a minimum of 10 days for cure time. Type 3 Portland cement (with accelerators) can be used with a minimum 3 days cure time.

6) Please be advised that at 65% of PS&E phase, we assume grading shown on plans are final.

If you have any questions, please call Bahman J. Panah at 724-2180.

Prepared by:

Bahman J. Panah, P.E.
Materials & Research Branch
Division of Project Delivery

Concurred by:

Behdad Baseghi, Ph.D., P.E., G.E., PMP
Chief, Materials & Research Branch
Division of Project Delivery

Cc: Frank Lin, Alma Olguin, File