INFORMATION HANDOUT

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MATERIALS INFORMATION

Foundation Report for Retaining Wall No. 9 at Westbound Route 118/ Tampa Ave. Off Ramp, dated October 4, 2013

State of California Business, Transportation and Housing Agency

M e m o r a n d u m

Flex your power!
Be energy efficient!

To: MR. JINRONG WANG
Structures Design South
Design Branch 12

Date: October 4, 2013

File**:** 07-LA-118-PM R4.70/4.78
0712000001
Retaining Wall No. 9

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

Subject: Foundation Report for Retaining Wall No. 9 at Westbound Route 118/Tampa Ave Off-Ramp

INTRODUCTION

In a memo dated March 12, 2013, Mr. Matt Holm (Chief Bridge Design Branch 12), requested a Foundation Report for proposed Retaining Wall No. 9 at Westbound Route 118/Tampa Avenue Off-Ramp. The proposed retaining wall would accommodate widening of the north side of the Off-Ramp and retain existing fill and alluvial soils plus probable additional fill. This report describes the geotechnical conditions at the site as evaluated from the recently completed field investigation and laboratory testing program. It also provides geotechnical foundation design and construction recommendations for proposed Retaining Wall No. 9.

PROJECT DESCRIPTION

Proposed Retaining Wall No. 9 will be constructed above Westbound Route 118 and will retain soil on the north side of the Tampa Ave Off-Ramp in the city of Porter Ranch, within Los Angeles County.

According to the Wall Plans (checked sheets) provided by Mr. Jinrong Wang of Structures Design, last revised on May 23, 2013, the proposed Retaining Wall No. 9 will be a Special Design Type 7 Wall (L-shaped) supported on spread footings with wall height ranging from 8 to 16 feet. Vertical ground anchors, attached through the footing, are provided for the 16 ft high wall segment. A concrete barrier will be placed on the Off-Ramp side of the retaining wall at roadway grade. The maximum retaining wall height is 16 ft, with a length of 422.85 ft located from RW LOL Station 7+22.09 to Station 11+44.94. Refer to the current Wall Plans for location and geometric layout data for the wall.

GEOTECHNICAL INVESTIGATION

A field investigation was first conducted on September 29, 2011 followed by additional field work during May 14 and 15, 2013. The field investigation included drilling/sampling one – 3 inch diameter rotary boring and two - 7 inch diameter hollow stem auger (HSA) borings. Soil samples were predominantly taken utilizing the Standard Penetration Test (SPT) with minor sampling

utilizing the modified California Sampler (2.0 inch I.D.). The borings were drilled utilizing a Caltrans operated drill rig model CME 75 (1- 3 inch diameter rotary wash boring) and a CS 2000 drill rig (2- 7 inch diameter hollow stem auger borings). SPT N Values were recorded at 5 foot intervals during drilling. The SPT's were performed in accordance with ASTM Test Method D1586-84 using a standard 1.4 inch I.D. sampler with a 140 lb hammer dropped 30 inches. A modified California Sampler was used to collect 2 inch diameter brass-lined samples for laboratory analysis. All the samples were sealed in the field and transported to Caltrans laboratories.

District 7 Surveys located and surveyed Boring R-11-001 and provided the current Bench Mark (PRHV521) location and elevation for OGDS1 to level Borings A-13-003 and A-13-002. In addition, all three borings below were located based on the current Retaining Wall No. 9 Foundation Plans (checked sheets received June 6, 2013). The Office of Geotechnical Design South 1 (OGDS1) Branch D determined the location and elevation of borings. Boring information including boring number, boring stationing and offset, boring depth, ground surface elevation, and date drilled are summarized in Table 1, below. All elevations provided in the report are based on NAVD 88 datum.

Table 1 – Summary of Borings

Boring No.	Centerline Sta. Rte 118	Offset from Centerline Route 118 (ft)	Depth of Boring (ft)	Top of Boring Elevation (ft)	Date Drilled
A-13-003	246+82	163 Lt.	66.5	1127.9	5/15/13
A-13-002	247+63	159 Lt.	66.5	1122.7	5/14/13
R-11-001	250+36	118 Lt.	51.5	1106.7	9/29/11

LABORATORY TESTING

Selected soil samples were sent to Caltrans Transportation Laboratory in Sacramento for testing. All laboratory tests were performed in accordance with ASTM standard procedures and California Test Methods. The summarized laboratory test data are shown in Table 2, below.

Table 2 – Summary of Laboratory Tests

Test	Standard	No. of Test Performed
Particle Size and Mechanical Analysis	ASTM D422, CTM 202 and 203	9
Atterberg Limits (Plasticity Index)	CTM 204	7
Corrosion	CTM 417, 422, 532, 643	10
Direct Shear	ASTM D3080	1
Moisture	ASTM D2216	9
Unit Weight	ASTM D4767	1

SITE GEOLOGY AND SUBSURFACE CONDITIONS

The subject site at the westbound Route 118 Tampa Avenue Off-Ramp is located at the south end of the Mission Hills/north end of the San Fernando Valley. The site is on the northern limb (gently southward dipping beds estimated at about 6 degree dip within borings) of an east-west trending syncline. The site is adjacent to a cut slope through undifferentiated alluvium. Borings logged on the existing off-ramp show fill underlain by undifferentiated Holocene (Qa) and older Quaternary alluvium (Qoa) which are in turn underlain by the Pleistocene/Pliocene Saugus Formation (QTs) as shown on the Geologic Map of the Oat Mountain and Canoga Park (North ½) 7.5 minute Quadrangles, Los Angeles County, California (Dibblee, T.W. Jr., June 1992, CDMG and USGS, Dibblee Geological Foundation Map #DF-36). Fill ranges from 5 to 6 ft thick and consists of medium dense, silty sand with gravel sporadically interlayered with hard sandy lean clay (Pocket Penetrometer readings range from PP=4.0 to >4.5 tsf). Fill contains trace asphalt fragments. Top of fill ranges from +1127.9 to +1106.7 ft elevation and extends down to +1122.6 to +1100.7 ft elevation along the proposed wall length. The undifferentiated Holocene and older Quaternary alluvium (about 60 to 55 ft thick) ranges from elevations +1122.6 to +1100.7 ft down to elevations +1062.5, +1062.2, and below 1055.2 ft (within Boring R-11-001) and is composed of medium dense to very dense, silty sand to minor dense clayey sand, poorly graded sand with silt, and sandy silt interbedded with very stiff to hard, sandy lean clay (PP=3.0 to >4.5 tsf). Undifferentiated alluvium shows sporadic gravel, iron oxide staining, trace gyspsum, calcite filaments, and charcoal fragments. Within Borings A-13-003 and A-13-002 the Pleistocene/Pliocene Saugus Formation (QTs) was encountered ranging from 1.1 to 6.0 ft sampled thickness which ranges from elevations +1062.5 to 1062.2 ft down to +1061.4 to 1056.2 ft. Again, Boring R-11-001 terminated within undifferentiated alluvium at elevation +1055.2 ft (51.5 ft depth). The Saugus Formation consisted of poorly indurated, very soft, moderately to thickly interbedded, sandy claystone (hard, sandy lean clay with sporadic gravel, PP>4.5 tsf) and poorly indurated, very soft, silty sandstone (very dense, silty sand with gravel). Bedding planes show traces of iron oxide staining and gravel is composed of very soft angular mudstone, sandstone, and moderately hard chert rock fragments. The borings extended down to 66.5 to 51.5 ft depth (down to elevations +1056.2 and +1055.2 ft).

Groundwater

Groundwater was not encountered during the recent field exploration for this project. The two auger borings were dry down to a maximum depth of 66.5 ft (dry down to elevation +1056.2 ft, measured within the 2 borings on May 14 and 15, 2013).

Scour

There is no possibility of scour at the site due to the distance from stream channels.

SEISMICITY

The site is located in a seismically active area. Proposed Retaining Wall No. 9 is located approximately 1.7 km (1.0 mi) northeast of the Northridge Hills fault (Maximum Magnitude -

MMax 6.4, Caltrans Fault Identification No. FID 307), 3.2 km (2.0 mi) southwest of the Sierra Madre Fault Zone (Santa Susana section, MMax 6.8, FID 298), and 0.11 km (0.07 mi) south of the Mission Hills 2011 fault (MMax 6.0, FID 305). All are reverse faults dipping either 55 degrees north (Sierra Madre Fault Zone, Santa Susana section and the Mission Hills 2011 fault) or 31 degrees northeast (Northridge Hills fault). For the deterministic approach, seismic events that are likely to produce the greatest ground accelerations at the site could be a large event on the active Northridge Hills fault or a large event on another more distant active fault. The Peak Ground Acceleration (design PGA to be used for the retaining wall) at the site is estimated to be about 0.77g.

Surface Fault Rupture Hazard Evaluation

The project site is not located within any California Geological Survey (CGS) designated Earthquake Fault Zone (EFZ) or directly underlain by any fault considered active for wall design. The closest active zoned fault (EFZ) is a segment of the Santa Susana Fault Zone (Special Studies Zones, Oat Mountain 7.5 minute Quadrangle, Gay, T.E., January 1, 1976, California Division of Mines and Geology) which is approximately 3.2 km (2.0 mi) NE of the site. This fault trends in a mostly east-west direction. The proposed wall is not located within the confines of an EFZ and no well-defined fault traces have been mapped within the project limits. Therefore, the possibility of surface fault rupture is considered to be low.

CORROSIVITY

Representative soil samples (4 specific and 6 composite samples) were tested for minimum resistivity and pH (CTM 643), soluble sulfate (CTM 422), and soluble chloride contents (CTM 417). Test results of the soil corrosivity are presented in Table 3, below. Test results show that subsurface soils at project site are considered non-corrosive to structural elements.

Table 3 - Corrosion Test Summary

Boring No.	Sample Depth (ft)	Minimum Resistivity (ohm-cm)	pH	Chloride Content (ppm)	Sulfate Content (ppm)
A-13-003	2.0-3.5	2405	7.62	3	27
A-13-003	10-31.5	2520	6.51	0	25
A-13-003	40.0-56.5	1708	7.63	6	23
A-13-003	60.0-65.4	1808	8.1	11	33
A-13-003	65.4-66.5	2313	7.68	12	25
A-13-002	5.5-15.3	1642	7.51	58	61
A-13-002	15.3-31.5	2574	7.8	30	35
A-13-002	55.0-66.5	2975	7.84	4	5
R-11-001	5.0 – 6.5	1815	8.06	N/A	N/A
R-11-001	25.0 – 26.5	2275	7.54	N/A	N/A

Note: According to Caltrans Corrosion Guidelines (September 2003), for Structural Elements a site is considered corrosive if one or more of the following conditions exist: pH is $\leq$5.5, chloride

concentration is ≥500 ppm, sulfate concentration is ≥2000 ppm. Resistivity is not considered for Structural Elements. For Boring R-11-001 (drilled in 2011), Caltrans Corrosion Technology Section's practice was that if the minimum resistivity of the sample was >1000 ohm-cm and the pH was >5.5, the sample was considered to be noncorrosive and no chloride or sulfate contents were measured.

LIQUEFACTION POTENTIAL

The liquefaction potential is considered to be low, as no ground water was encountered down to a depth of at least 66.5 ft below the surface elevation which ranges from 69 to 43 ft below the proposed bottom of footing elevations for the wall. Auger borings were dry to the above depths (66.5 ft) at bottom of hole. Soils are dominantly medium dense to very dense granular material and very stiff to hard clays.

SLOPE STABILITY

A cross section at Retaining Wall LOL Stationing 8+17 to 8+41, where the planned wall height is 16 ft, was used to analyze slope stability. Due to the absence of weak failure planes in the retained or underlying soils, a circular failure mode was considered in OGDS1's analysis. The soil parameters for the analysis were estimated from established correlations using field data such as SPT N values.

The stability analysis was conducted using the computer program PC STBL6, that utilizes the limit equilibrium method, which indicated the minimum factors of safety of the retained soils are greater than 1.5 and 1.1, under static and design seismic conditions, respectively.

FOUNDATION RECOMMENDATIONS

Proposed Retaining Wall No. 9 is a Type 7 Retaining Wall with concrete barrier (Type 60D) at the traffic side of the wall placed at road grade. The retaining wall will be approximately 422.85 ft length and ranges from 8 to 16 ft height. The retaining wall can be supported by spread footing foundations with vertical tiedowns added for portions of the wall at 16 ft height as shown on the Retaining Wall Plans (checked sheets, received June 6, 2013).

General Foundation Information, Permissible Settlement Under Service Load, Effective Spread Footing Widths, and Design Loads for various Limit States utilizing Load Resistance Factor Design (LRFD) Method are presented in Tables 4, 5, and 6 and were provided by Structures Design South.

Table 7 provides Foundation Design Recommendations for Retaining Wall No. 9 Spread Footings and is provided by OGDS1.

Existing poor quality soils beneath a portion of the wall footprint will be replaced with structure backfill compacted to 95% R.C. (relative compaction). Remedial treatment consists of overexcavating existing soils within the specified limits below footing grade and replacing these

soils with structure backfill compacted to 95% R.C. (relative compaction) up to footing grade.

OGDS1 was requested by Structures Design to limit the extent of sub-excavations and compacted structure backfill prism beneath the wall spread footings if geotechnically feasible. After critical geotechnical review, OGDS1 determined that the sideslopes of the compacted backfill prism could be steepened to 1H (horizontal):1V (vertical). Also, to further reduce the Sub-excavation and replacement with structure backfill compacted to 95% R.C. beneath the wall, the one foot horizontal setback requirement of the wall spread footing heel from the top slope of the backfill prism is not required on the north side of the wall. However, on the south side of the wall the one foot horizontal setback of the wall spread footing toe from the top slope of the backfill prism is required. The above are specific earthwork modifications for the subject wall site. Refer to the Caltrans Standard Specifications (2010), section 19-5.03A and B for details (although section 19-5.03B- item 2 footing setback and slope of the structure backfill prism is modified as provided above). A representative of OGDS1 is required to inspect and verify suitability of the exposed materials at the Bottom of Sub-excavations. After inspection of the Sub-excavations, possible additional Sub-excavation may be required locally to reduce total and differential settlement to tolerable levels. Inspection of Wall Sub-excavations by a representative of OGDS1 needs to be included in the Special Provisions for this project. With the reduction in extent of recommended Sub-excavations some localized unsuitable material may be left in place, however, inspections/verifications by OGDS1's representative and possible local modifications will reduce settlement to tolerable levels. For the purpose of estimating reasonable quantities for engineering work, Sub-excavations have been included below in Table 7 for all Wall spread footing sections.

Table 4 - Foundation Design Data Sheet

Approximate RWLOL Stationing	Retaining Wall Height (ft)	Design Method	Minimum Finished Grade Elevation (ft)	Bottom of Footing Elevation (ft)	Footing Size (ft)		Permissible Settlement Under Service Load * (in)
					B	L (Approx.)	
7+22.09 to 7+37	8	LRFD	1128.9	1125.15	8.25	15	1.0
7+37 to 7+53	12	LRFD	1125.9	1122.15	8.25	16	1.0
7+53 to 7+69	12	LRFD	1124.2	1120.45	8.25	16	1.0
7+69 to 7+85	14	LRFD	1122.0	1118.00	10.0	16	1.0
7+85 to 8+01	16	LRFD	1120.08	1115.75	8.25	16	1.0
8+01 to 8+17	16	LRFD	1118.43	1114.10	8.25	16	1.0
8+17 to 8+41	16	LRFD	1116.33	1112.00	8.25	24	1.0
8+41 to 8+65	16	LRFD	1114.23	1109.90	8.25	24	1.0
8+65 to 8+89	14	LRFD	1113.35	1109.35	10.0	24	1.0
8+89 to 9+13	14	LRFD	1111.4	1107.40	10.0	24	1.0
9+13 to 9+45	14	LRFD	1110.25	1106.25	10.0	32	1.0
9+45 to 9+77	14	LRFD	1107.23	1103.23	10.0	32	1.0
9+77 to 10+09	14	LRFD	1105.8	1101.80	10.0	32	1.0
10+09 to 10+25	16	LRFD	1103.83	1099.50	8.25	16	1.0
10+25 to 10+49	16	LRFD	1102.63	1098.30	8.25	24	1.0
10+49 to 10+74	16	LRFD	1101.5	1097.17	8.25	25	1.0
10+74 to 10+98	14	LRFD	1101.5	1097.50	10.0	24	1.0
10+98 to 11+23	14	LRFD	1101.5	1097.50	10.0	25	1.0
11+23 to 11+44.94	12	LRFD	1103.25	1099.50	8.25	22	1.0

* Based on CALTRANS' current practice, the total permissible settlement is one inch under Service Load. Differential settlement of the foundations will be acceptable and within tolerance (1V:500H for CIP concrete retaining walls). Different permissible settlement under service loads may be allowed if a structural analysis verifies that required level of serviceability is met. Minimum Finished Grade Elevation is based on minimum 2 foot cover over footings.

Table 5 – LRFD Service Limit State I

Approximate RWLOL Stationing	Retaining Wall Height (ft)	Effective Spread Footing Width - B' (ft)	Net Bearing Stress q'o (ksf)
7+22.09 to 7+37	8	8.1	0.4
7+37 to 7+53	12	7.1	0.8
7+53 to 7+69	12	7.1	0.8
7+69 to 7+85	14	8.9	0.7
7+85 to 8+01	16	5.8	1.9
8+01 to 8+17	16	5.8	1.9
8+17 to 8+41	16	5.8	1.9
8+41 to 8+65	16	5.8	1.9
8+65 to 8+89	14	8.9	0.7
8+89 to 9+13	14	8.9	0.7
9+13 to 9+45	14	8.9	0.7
9+45 to 9+77	14	8.9	0.7
9+77 to 10+09	14	8.9	0.7
10+09 to 10+25	16	5.8	1.9
10+25 to 10+49	16	5.8	1.9
10+49 to 10+74	16	5.8	1.9
10+74 to 10+98	14	8.9	0.7
10+98 to 11+23	14	8.9	0.7
11+23 to 11+44.94	12	7.1	0.8

Table 6 – LRFD Strength and Extreme Event Limit States

Approximate RWLOL Stationing	Retaining Wall Height (ft)	Strength Limit State (Controlling Group)		Extreme Event Limit State (Controlling Group)	
		Effective Spread Footing Width - B' (ft)	Gross Uniform Bearing Stress qo (ksf)	Effective Spread Footing Width - B' (ft)	Gross Uniform Bearing Stress qo (ksf)
7+22.09 to 7+37	8	7.6 (Str Ia) 6.9 (Str Ib)	1.2 (Str Ia) 1.0 (Str Ib)	7.1 (Ext I) 2.9 (Ext II)	0.9 (Ext I) 2.3 (Ext II)
7+37 to 7+53	12	6.2 (Str Ia) 5.0 (Str Ib)	1.8 (Str Ia) 1.8 (Str Ib)	5.0 (Ext I) 3.3 (Ext II)	1.7 (Ext I) 2.7 (Ext II)
7+53 to 7+69	12	6.2 (Str Ia) 5.0 (Str Ib)	1.8 (Str Ia) 1.8 (Str Ib)	5.0 (Ext I) 3.3 (Ext II)	1.7 (Ext I) 2.7 (Ext II)
7+69 to 7+85	14	8.0 (Str Ia) 6.6 (Str Ib)	1.8 (Str Ia) 1.7 (Str Ib)	6.3 (Ext I) 6.0 (Ext II)	1.8 (Ext I) 1.7 (Ext II)
7+85 to 8+01	16	4.7 (Str Ia) 3.4 (Str Ib)	3.8 (Str Ia) 4.4 (Str Ib)	2.8 (Ext I) 3.8 (Ext II)	5.2 (Ext I) 3.6 (Ext II)
8+01 to 8+17	16	4.7 (Str Ia) 3.4 (Str Ib)	3.8 (Str Ia) 4.4 (Str Ib)	2.8 (Ext I) 3.8 (Ext II)	5.2 (Ext I) 3.6 (Ext II)
8+17 to 8+41	16	4.7 (Str Ia) 3.4 (Str Ib)	3.8 (Str Ia) 4.4 (Str Ib)	2.8 (Ext I) 3.8 (Ext II)	5.2 (Ext I) 3.6 (Ext II)
8+41 to 8+65	16	4.7 (Str Ia) 3.4 (Str Ib)	3.8 (Str Ia) 4.4 (Str Ib)	2.8 (Ext I) 3.8 (Ext II)	5.2 (Ext I) 3.6 (Ext II)
8+65 to 8+89	14	8.0 (Str Ia) 6.6 (Str Ib)	1.8 (Str Ia) 1.7 (Str Ib)	6.3 (Ext I) 6.0 (Ext II)	1.8 (Ext I) 1.7 (Ext II)
8+89 to 9+13	14	8.0 (Str Ia) 6.6 (Str Ib)	1.8 (Str Ia) 1.7 (Str Ib)	6.3 (Ext I) 6.0 (Ext II)	1.8 (Ext I) 1.7 (Ext II)
9+13 to 9+45	14	8.0 (Str Ia) 6.6 (Str Ib)	1.8 (Str Ia) 1.7 (Str Ib)	6.3 (Ext I) 6.0 (Ext II)	1.8 (Ext I) 1.7 (Ext II)
9+45 to 9+77	14	8.0 (Str Ia) 6.6 (Str Ib)	1.8 (Str Ia) 1.7 (Str Ib)	6.3 (Ext I) 6.0 (Ext II)	1.8 (Ext I) 1.7 (Ext II)
9+77 to 10+09	14	8.0 (Str Ia) 6.6 (Str Ib)	1.8 (Str Ia) 1.7 (Str Ib)	6.3 (Ext I) 6.0 (Ext II)	1.8 (Ext I) 1.7 (Ext II)
10+09 to 10+25	16	4.7 (Str Ia) 3.4 (Str Ib)	3.8 (Str Ia) 4.4 (Str Ib)	2.8 (Ext I) 3.8 (Ext II)	5.2 (Ext I) 3.6 (Ext II)
10+25 to 10+49	16	4.7 (Str Ia) 3.4 (Str Ib)	3.8 (Str Ia) 4.4 (Str Ib)	2.8 (Ext I) 3.8 (Ext II)	5.2 (Ext I) 3.6 (Ext II)
10+49 to 10+74	16	4.7 (Str Ia) 3.4 (Str Ib)	3.8 (Str Ia) 4.4 (Str Ib)	2.8 (Ext I) 3.8 (Ext II)	5.2 (Ext I) 3.6 (Ext II)
10+74 to 10+98	14	8.0 (Str Ia) 6.6 (Str Ib)	1.8 (Str Ia) 1.7 (Str Ib)	6.3 (Ext I) 6.0 (Ext II)	1.8 (Ext I) 1.7 (Ext II)
10+98 to 11+23	14	8.0 (Str Ia) 6.6 (Str Ib)	1.8 (Str Ia) 1.7 (Str Ib)	6.3 (Ext I) 6.0 (Ext II)	1.8 (Ext I) 1.7 (Ext II)
11+23 to 11+44.94	12	6.2 (Str Ia) 5.0 (Str Ib)	1.8 (Str Ia) 1.8 (Str Ib)	5.0 (Ext I) 3.3 (Ext II)	1.7 (Ext I) 2.7 (Ext II)

Table 7 – Foundation Design Recommendations For Spread Footings

Approximate RWLOL Stationing	Footing Size (ft)		Bottom of Footing Elevation (ft)	Minimum Footing Embedment Depth (ft)	Bottom of Sub-excavation Elevation (ft)	LRFD		
	B	L (Approx.)				Service (q'o/1.0)	Strength $\Phi_b = 0.45$ (qo/0.45)	Extreme Event $\Phi_b = 1.00$
						Permissible Net Contact Stress (ksf)*	Factored Gross Nominal Bearing Resistance (ksf)	Factored Gross Nominal Bearing Resistance (ksf)
7+22.09 to 7+37	8.25	15	1125.15	3.75	1121.15	2.5	2.67 (Str Ia)	2.3 (Ext II)
7+37 to 7+53	8.25	16	1122.15	3.75	1119.15	2.5	4.0 (Str Ib)	2.7 (Ext II)
7+53 to 7+69	8.25	16	1120.45	3.75	1117.45	2.5	4.0 (Str Ib)	2.7 (Ext II)
7+69 to 7+85	10.0	16	1118.00	4.0	1115.00	2.3	3.78 (Str Ib)	1.8 (Ext I)
7+85 to 8+01	8.25	16	1115.75	4.33	1113.75	3	9.78 (Str Ib)	5.2 (Ext I)
8+01 to 8+17	8.25	16	1114.10	4.33	1112.10	3	9.78 (Str Ib)	5.2 (Ext I)
8+17 to 8+41	8.25	24	1112.00	4.33	1110.0	3	9.78 (Str Ib)	5.2 (Ext I)
8+41 to 8+65	8.25	24	1109.90	4.33	1107.90	3	9.78 (Str Ib)	5.2 (Ext I)
8+65 to 8+89	10.0	24	1109.35	4.0	1107.35	2.5	3.78 (Str Ib)	1.8 (Ext I)
8+89 to 9+13	10.0	24	1107.40	4.0	1104.40	2.5	3.78 (Str Ib)	1.8 (Ext I)
9+13 to 9+45	10.0	32	1106.25	4.0	1103.25	2.5	3.78 (Str Ib)	1.8 (Ext I)
9+45 to 9+77	10.0	32	1103.23	4.0	1099.23	2.5	3.78 (Str Ib)	1.8 (Ext I)
9+77 to 10+09	10.0	32	1101.80	4.0	1098.80	2.5	3.78 (Str Ib)	1.8 (Ext I)
10+09 to 10+25	8.25	16	1099.50	4.33	1096.50	3.5	9.78 (Str Ib)	5.2 (Ext I)
10+25 to 10+49	8.25	24	1098.30	4.33	1095.30	3.5	9.78 (Str Ib)	5.2 (Ext I)
10+49 to 10+74	8.25	25	1097.17	4.33	1095.17	3.5	9.78 (Str Ib)	5.2 (Ext I)
10+74 to 10+98	10.0	24	1097.50	4.0	1095.50	2.5	3.78 (Str Ib)	1.8 (Ext I)
10+98 to 11+23	10.0	25	1097.50	4.0	1095.50	2.5	3.78 (Str Ib)	1.8 (Ext I)
11+23 to 11+44.94	8.25	22	1099.50	3.75	1096.50	2.8	4.0 (Str Ib)	2.7 (Ext II)

* Generally the permissible net contact stresses were computed for footings either directly founded on competent native materials or compacted fill overlying competent native soils. See the foundation recommendations for recommended sub-excavation and replacement with structure backfill compacted to 95% R.C. (relative compaction). Sub-excavations were reduced which may result with some localized unsuitable material being left in place, but recommended improvements and verification of suitability of exposed materials at bottom of Sub-excavations by OGDS1 (meaning some additional local Sub-excavation may be required) will reduce total and differential settlement to tolerable levels. See the foundation recommendations for recommended Sub-excavation and replacement with structure backfill compacted to 95% R.C. (relative compaction).

Foundation Settlement

The anticipated settlement is less than 1.0 inch for total settlement, which satisfies the acceptable tolerance criteria after recommended remedial treatment of soils is completed. Differential settlement will also be acceptable and within tolerance for the retaining wall (1V:500H). The settlement period will be short term and will be completed during construction.

Vertical Tiedown Ground Anchors

All anchors should be either proof tested or performance tested per Caltrans Standard Specifications (2010), section 46, and per Memo To Designers (MTD) 5-12 or as directed by the Structure Construction Representative.

Minimum unbonded length of anchors should be 15 ft.

CONSTRUCTION CONSIDERATIONS

1. A minimum soil cover of 2 ft is required over the retaining wall footings.
2. No groundwater is anticipated at the bottom of footing or Sub-excavation elevations or within the tiedown vertical range.
3. Some materials left in place may not be able to obtain 95% R.C. (Relative Compaction). After inspection of the Sub-excavations by a representative of OGDS1 and verification of suitability of the exposed materials (if no additional excavation required), contractor should compact the bottom of the Sub-excavation before placing additional structure backfill to 95% R.C. Some additional local Sub-excavation may be required if exposed material is considered unsuitable by the OGDS1 representative. Excavations and Sub-excavations should be cleaned of any loose soils and debris.
4. Free water shall not be allowed to stand in any excavations. If excavations become flooded, at least the bottom 0.5 ft of soil shall be removed and replaced or re-compacted per Caltrans specifications.
5. The backfill areas should be cleaned of any loose soils and debris before receiving backfill.
6. Moderate caving may be anticipated during drilling for tiedowns due to scattered gravel within silty sand interbeds and poorly indurated silty sandstone interbeds below (if tiedowns extend to formation).
7. Based on soil types encountered during the recent investigation, a backcut slope of 1H:1.25V maximum would be temporarily stable to enable construction. If there are constraints due to lack of right-of-way space or construction concerns, temporary or permanent shoring may be utilized to accommodate steeper excavations for the proposed spread footings. The Right-of-Way Line is very close to the proposed retaining wall and precautions need to be observed near the large water lines located north of the proposed wall.

If significant future design changes are made in wall type, wall heights, bottom of footing or profile grade elevations, and design loading from that shown on referenced plans within this

report, OGDS1 should be notified. OGDS1 should review the changes to verify that the foundation recommendations provided within this report remain applicable.

If you have any questions or comments, please call Joe Pratt at (213) 620-2313 or Shiva Karimi at (213) 620-2146.

Prepared by: Date: 10/04/2013

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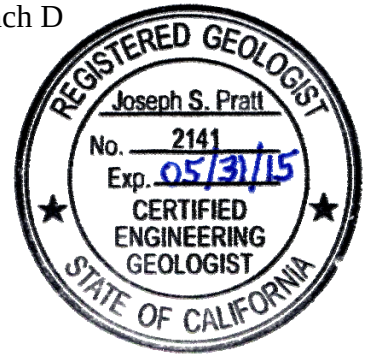

Supervised by: Date: 10/04/2013

E Shiva Karimi

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