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To: Mr. Marcelo Peinado
District 11
Design, MS#35
Attn: Mr. Tan Doan

Date: April 23, 2004

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From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 2, Branch D

Subject: Interstate 15, Managed Lanes Project, Unit 2: Foundation Recommendations for the Retaining Walls RW363L, RW363R, RW377R, RW390L, RW392R, RW394R, and 388L cut slope.

INTRODUCTION

In accordance with your request, a geotechnical investigation was performed for the purpose of providing foundation recommendations for the retaining structures and a cut slope that are required for construction of the I-15 Managed Lanes project, Unit 2. The investigation consisted of a site reconnaissance, a review of the existing as-built plans and geologic maps, limited geologic mapping, a subsurface investigation that included drilling and sampling, engineering analysis, and the writing of this report. The project information provided by the Project Engineer included wall layout sheets on a scale of 1:1000 and pertinent cross sections, which were reviewed and used in the writing of this report.

Foundation recommendation reports for the retaining structures RW364L, RW370L, RW374L, RW376R, and RW380R were provided to the Office of Structures Design, Mr. Yen-His Deng. The copies of the reports were forwarded to your office as well (Tesar and Hinman, 2004).

GEOLOGY

The project site lies within the western San Diego Peninsular Ranges Geomorphic Province of California. The project area is generally underlain by fill materials, topsoil, and/or colluvium, and locally alluvium. These surficial geologic units are underlain by the sedimentary upper Tertiary Mission Valley Formation that is underlain by the Stadium Conglomerate Formation that in turn is underlain by lower Tertiary Friars Formation.

The Friars Formation is underlain by a Mesozoic basement consisting of igneous and

metamorphic rocks. The basement, which upper layer is weathered, is composed of upper Jurassic Santiago Peak Volcanics and mid Cretaceous granitic rocks of the Southern California Batholith (Kennedy and Peterson, 1975).

The Mission Valley Formation is composed of marine, lagoonal, and nonmarine sandstone that lies conformably upon the Stadium Conglomerate. It consists of friable and soft sandstone that locally is interstratified with carbonate cemented beds (concretions). Locally it comprises cobble conglomerate zones. Locally it grades to silty sand/sandstone. Shallow and localized slipouts are known to occur in the hilly topography where the Mission Valley Formation soils were exposed on slopes.

The Stadium Conglomerate consists of cobble conglomerate with a coarse-grained sandstone matrix. The sandstone can constitute up to 50 percent of the unit. However, the cobbles, up to 0.5 m in diameter, are the most dominant ingredient of the unit. Stadium Conglomerate Formation is resistant to erosion and known not to be susceptible to sliding or slipouts.
The Friars Formation consists of siltstone and sandstone with interbeds of claystone. Landslides are common in the clay-rich part of the formation that is exposed on slopes in the hilly topography. Please refer to the section titled: “Project site geologic background and history” for more information that is pertinent.

Colluvium consists of formational materials, including topsoil that were eroded and deposited as a relatively thin mantle on the faces of slopes. Alluvium consists primarily of stream deposits of silt (often clayey), sand, and gravel derived from bedrock and residual sources that lie within or near the project area. Fill consists of compacted earth materials derived from local sources.

SEISMICITY

No known Holocene faults exists within the project area. The nearest known active fault is the Newport-Inglewood-Rose Canyon Fault Zone believed to be capable of producing an earthquake with a Maximum Credible Magnitude of 7.0 on the Richter scale. It is located about 20 km southwest and west from the project site. The La Nacion Fault is located about 20 kilometers south from the project limits, and it is capable of producing an earthquake with a Maximum Credible Magnitude of 6.75 on the Richter scale. In addition, the Elsinore Fault lies about 40 km northeast from the project limits; it is capable of producing an earthquake with a Maximum Credible Magnitude of 7.5 on the Richter scale. All three aforementioned faults are believed to be capable of generating a Peak Ground Acceleration of about 0.25 g at the project site (Mualchin, 1996).

GROUNDWATER

With the exception of one boring drilled for Wall RW377R, groundwater was not encountered during our subsurface investigations for the subject retaining structures. However, groundwater conditions, mainly perched water could potentially occur at isolated locations during the construction phase of the project. In general, the occurrence of perched water is not likely to

have a significant impact on walls construction. In the event that groundwater is encountered during construction, groundwater mitigation recommendations will be provided by this office. In Boring RW377R-B1, seepage water was encountered at an elevation of 186.35 m. However, the footings of the Wall RW377R are planned to be located at much higher elevation. Therefore, this seepage will have no impact on the Wall RW377R construction s

CORROSION

Several soil samples were collected from the location of the subject retaining structures. These samples were tested for corrosive potential and found to be non corrosive. The results of the corrosivity tests are presented in Table 1 below.

Table 1. Results of Corrosivity Tests.

BORING NO.	SAMPLE DEPTH (m)	pH	MINIMUM RESISTIVITY (ohm-cm)	SULFATE CONTENT (ppm)	CHLORIDE CONTENT (ppm)
RW363L-B2	1-5	7.3	710	260	N/A
RW363R-B1	5-10	7.8	1010	500	N/A
RW377R-B1	1-5	7.3	1005	N/A	N/A
RW390L-B1	1-5	7.8	5400	170	N/A
RW392L-B1	1-5	7.6	5000	230	N/A

Note: Caltrans defines a corrosive area as an area where the soil and/or water contains more than 500 ppm of chlorides, more than 2000 ppm sulfates, has a minimum resistivity of less than 1000 ohm-cm, or a pH of 5.5 or less.

FOUNDATION RECOMMENDATIONS

Retaining Wall RW363R

Subsurface Soils Conditions

Based on our subsurface investigation and a review of the geologic references, the alignment of the proposed retaining Wall RW363R is underlain by native soils of the Mission Valley Formation consisting of claystone and siltstone.
For Wall RW363R, LOTB RW363R-B1 was developed and submitted to the Project Engineer.

Foundation Recommendations

Based on our subsurface investigation, the review of geologic references and engineering analyses, we recommend that Wall RW363R, 4.8 m in maximum height, may be designed as standard Type 1 wall, supported on a spread footing foundation as shown on sheet B3-1 in the "Standard Plans July 1999". With Loading Case IV, the 180 kPa Gross Allowable Soil Bearing Pressure may be used for design of the Wall RW363R.
Construction Considerations

Based on the results of our subsurface investigation, our local experience, and the review of geologic references, we anticipate that excavations for Wall RW363R foundations may be accomplished with the use of standard (heavy) earthwork equipment.

Retaining Wall RW363L

Subsurface Soils Conditions

Based on our subsurface investigation and a review of the geologic references, the alignment of the proposed retaining Wall RW363L is underlain by fill materials consisting of sands, silts and clays derived most likely from the Mission Valley Formation.
For Wall RW363L, two LOTB's were developed and submitted to the Project Engineer: RW363L-B1 and RW363L-B2.

Foundation Recommendations

Based on our subsurface investigation, the review of geologic references and engineering analyses, we recommend that Wall RW363L, 6.1 m in maximum height, may be designed as standard Type 1 wall, supported on a spread footing foundation as shown on sheet B3-1 in the "Standard Plans July 1999". With Loading Case I, the 210 kPa Gross Allowable Soil Bearing Pressure may be used for design of the Wall RW363L. The minimum distance from the edge of the footing to the face of the descending slope should be no less than 1.5 m. In addition, we recommend that from Station 364+20 to 364+70 the 1.5 m thick layer of existing fill materials be removed from under the bottom of the proposed footing and replaced with structural backfill compacted to 95 % Relative Compaction in accordance with CTM 216.

Construction Considerations

Based on the results of our subsurface investigation, our local experience, and the review of geologic references, we anticipate that excavations for Wall RW363L foundations may be accomplished with the use of standard (heavy) earthwork equipment.

Retaining Wall RW377R

Subsurface Soils Conditions

Based on our subsurface investigation, the review of the geologic references, and the fact that Wall RW377R is planed to be located at the existing traveled way of the freeway, the alignment of the proposed retaining Wall RW377R is underlain by fill (subgrade) material. Subgrade is underlain by clayey and silty fill materials predominantly derived from the Friars Formation. These fill materials are in turn underlain by the native soils of the Friars Formation consisting of siltstone and claystone. In Boring RW377R-B1 the fill and Friars Formation interface was mapped at about an elevation of 185.30 m. In Boring RW377R-B3, this interface was mapped at about an elevation of 181.20 m.

For Wall RW377R, three LOTB's were developed and submitted to the Project Engineer: RW377R-B1, RW377R-B2, and RW377R-B3.

Foundation Recommendations

Based on our subsurface investigation, the review of geologic references and engineering analyses, we recommend that Wall RW377R, 4.8 m in maximum height, may be designed as standard Type 1 wall, supported on a spread footing foundation as shown on sheet B3-1 in the "Standard Plans July 1999". With Loading Case I, the 170 kPa Gross Allowable Soil Bearing Pressure may be used for design of the Wall RW377R.

Construction Considerations

Based on the results of our subsurface investigation, our local experience, and the review of geologic references, we anticipate that excavations for Wall RW377R foundations may be accomplished with the use of standard (heavy) earthwork equipment.

Retaining Wall RW390L

Subsurface Soils Conditions

Based on our subsurface investigation and a review of the geologic references, the alignment of the proposed retaining Wall RW390L is underlain by a layer of fill materials consisting of sands of the decomposed granite origin. This fill layer is underlain by the weathered bedrock of the granitic origin. In Boring RW390L-B1 the interface between fill and bedrock was mapped at about an elevation of 168.30 m
For Wall RW390L, LOTB RW390L-B1 was developed and submitted to the Project Engineer.

Foundation Recommendations

Based on our subsurface investigation, the review of geologic references and engineering analyses, we recommend that Wall RW390L, 2.4 m in maximum height, may be designed as standard Wall Type 1, supported on a spread footing foundation as shown on sheet B3-1 in the "Standard Plans July 1999". With Loading Case I, the 105 kPa Gross Allowable Soil Bearing Pressure may be used for design of the Wall RW390L. In addition, the minimum distance from the edge of the footing to the face of the descending slope should be no less than 1.5 m.

Construction Considerations

Based on the results of our subsurface investigation, our local experience, and the review of geologic references, we anticipate that excavations for Wall RW390L foundations may be accomplished with the use of standard (heavy) earthwork equipment.

Retaining Wall RW392R

Subsurface Soils Conditions

Based on our subsurface investigation and a review of the geologic references, the alignment of the proposed retaining Wall RW392R is underlain by a layer of fill materials consisting of sands of the decomposed granite origin. The fill layer is underlain by weathered bedrock of the granitic origin. In Boring RW392R-B1 the fill and bedrock interface was mapped at about an elevation of 168.00 m
For Wall RW392R, LOTB RW392R-B1 was developed and submitted to the Project Engineer.

Foundation Recommendations

Based on our subsurface investigation, the review of geologic references and engineering analyses, we recommend that Wall RW392R, 3.6 m in maximum height, may be designed as standard Type 1 wall, supported on a spread footing foundation as shown on sheet B3-1 in the "Standard Plans July 1999". With Loading Case I, the 135 kPa Gross Allowable Soil Bearing Pressure may be used for design of the Wall RW392R. In addition, the minimum distance from the edge of the footing to the face of the descending slope should be no less than 1.5 m.

Construction Considerations

Based on the results of our subsurface investigation, our local experience, and the review of geologic references, we anticipate that excavations for Wall RW392R foundations may be accomplished with the use of standard (heavy) earthwork equipment.

Retaining Wall RW394R

Subsurface Soils Conditions

Based on our local experience and a review of the geologic references we expect that the alignment of the proposed retaining Wall RW394R is underlain either by the residual soils of the granitic origin or weathered granitic bedrock. From the geotechnical engineering standpoint, both aforementioned geologic units are competent. This wall will retain a cut in the existing slope, about 4.6 m in maximum height, that is built of weathered granitic soils.

Due to the fact that the alignment of the proposed Wall RW394R is underlain by the geotechnically competent soils of the granitic origin, no LOTB's were developed for Wall RW394R

Foundation Recommendations

Based on our local experience, the review of geologic references, and engineering analyses, we recommend that Wall RW394R, 3.6 m in maximum height, may be designed as standard Type 7 wall, supported on a spread footing foundation as shown on Page XS14 in Standard Bridge Plans. From its top this wall will retain a minor fill slope (wall backfill) about 1.0 m in maximum high, and inclined at about 1:1.1 (vertical to horizontal). Therefore, the 210 kPa Gross Allowable Soil Bearing Pressure may be used for design of the Wall RW394R. We recommend

that for this wall an about 1.0 m in maximum height fill slope above the wall be protected from erosion by either paving the slope from the edge of the brow ditch to the crest of the cut or by other measures as per the Caltrans Landscape Architect recommendation.

Construction Considerations

Based on the results of our subsurface investigation, our local experience, and the review of geologic references, we anticipate that excavations for Wall RW394R foundations may be accomplished with the use of standard (heavy) earthwork equipment. Locally heavy ripping equipment may be required to excavate/rip onsite granitic soils.

Cut Slope 388L

Based on our subsurface investigation program of 2003 and 2004, local experience, and the review of geologic references, we recommend that in lieu of a retaining structure 388L the existing slope be cut no steeper than 1:0.9 (vertical to horizontal).
Slope388L will be cut into the existing slope built of weathered granitic material. Therefore, we expect hard ripping or/and excavating conditions at the location of the cut. In addition, we anticipate that blasting could potentially be required to remove hard (crystalline) sections of the existing granitic bedrock.

If you have any question regarding this report, please call Jeff Tesar at (858) 467-2716 (Calnet 734-2716).

Jeff Tesar,

Engineering Geologist,
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References:

1. L. Mualchin, California Seismic Hazard Map, 1996.

2. Michael P. Kennedy and Gary L. Peterson, Geology of the San Diego Metropolitan Area, California, Poway Quadrangle, California Division of Mines and Geology, Bulletin 200, 1975.

3. Jeff Tesar and Brian Hinman, Interstate 15, Managed Lanes Project, Unit 2: Foundation Recommendations for the Tieback Wall RW374L, Soil Nail Wall RW370L, and the Culvert Spanning for the Retaining Wall RW364L, April 15, 2004

4. Jeff Tesar and Brian Hinman, Interstate 15, Managed Lanes Project, Unit 2: Foundation Recommendations for the Retaining Walls RW364L, RW376R, and RW380R, April 21, 2004

JT

Cc:

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