State of California

Business, Transportation and Housing Agency

# Memorandum

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To: MR. ROBIN ROGERSON
Division of Structure Design
Office of Structure Design C, Branch 12

Attention: Dan Texler

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Vehicular U.C.
Bridge No. 57-1081 R/L

From: **DEPARTMENT OF TRANSPORTATION**
ENGINEERING SERVICE CENTER
Division of Structural Foundations - MS 5
Office of Structure Foundations

Subject Foundation Recommendations

This report presents the foundation recommendations for the proposed Vehicular Undercrossing Bridges (Bridge No's. 57-1081 R/L). The Foundations Investigations Branch C of the Office of Structure Foundations (OSF) completed a foundation investigation pursuant to the July 24, 2000 request by the Division of Structure Design (DSD) for a foundation investigation and recommendations for the two proposed structures.

The following foundation recommendations are based on subsurface information gathered during the recent foundation investigation (July 2000) performed by Caltrans along with a review of subsurface information used to develop the Draft Type Selection Report for the proposed structures, prepared by Boyle Engineering Corporation (BEC), dated January 22, 1999. With regards to the current foundation recommendations, all elevations referenced within this report and shown on the Log of Test Boring Sheets are based on the NAVD 88 vertical datum.

**Project and Site Description**

The project site is located just north of the McGonigle Canyon area within San Diego County. The site is approximately 0.4 km south of the intersection of Black Mountain Road and Clarkview Lane, where the proposed State Route 56 will intersect the proposed Vehicular Road. Presently, the land at the proposed structure site is undeveloped and used for agricultural purposes. The terrain around the project site generally consists of undeveloped, low hills that are dissected by natural drainage paths.

The proposed new bridges are to consist of single span, cast-in-place box, pre-stressed girder type structures. The proposed bridges will span the proposed Vehicular Road, which will pass underneath and perpendicular to the bridges.

**Geology**

The foundation investigation performed in July 2000 consisted of two 152mm diameter hollow-stem auger borings and one 25mm diameter dynamic-displacement (wacker) boring. The

investigation revealed that the soils encountered at the proposed bridge site can be generally separated into two units. The upper unit soils are described as a thin layer of cultivated top soil consisting of medium dense to very dense, silty sand to a depth of about 0.76 meters (elev. 83.1 m) in boring B-00-1 and to a depth of about 0.70 m (elev. 77.1 m) in boring B-00-2. The upper unit soils at the site are underlain by poorly indurated sandstone (La Jolla Group) consisting of a dense to very dense, silty sand with silt, gravel and localized lenses of weak to moderate cementation. The two borings B-00-1 and B-00-2 were drilled with a Christensen CS 2000 drill rig and advanced to maximum explored depths of 18.4 m (elev. 66.5 m) and 13.9 m (elev. 63.8 m), respectively.

The subsurface exploration completed by BEC, revealed similar soil conditions as described above with minor differences. The upper unit is described by BEC as a thin layer of alluvium, slopewash, and man-placed fills consisting of loose to medium dense silty, and clayey sand and hard clay to a depth of about 1.8 meters (elev. 83.1 m) in boring UAR-HSA-1 and to a depth of about 0.6 m (elev. 77.1 m) in boring UAR-HSA-2. The upper unit soils at the site are underlain by sandstone decomposed to a very dense, silty sand with gravel and localized lenses of weak to moderate cementation. The two borings UAR-HSA-1 and UAR-HSA-2 were drilled to maximum explored depth of 18.4 m (elev. 66.5 m) and 13.9 m (elev. 63.8 m), respectively.

Groundwater was encountered during the Caltrans July 2000 subsurface investigation in both borings B-00-1 and B-00-2. The groundwater was interpreted as a minor perched water zone and was identified in boring B-00-1 at a depth of 13.3 m (elev. 69.0 m) and in Boring B-00-2 at a depth of 13.6 m (elev. 63.5 m). Groundwater was also identified in one of two exploratory borings performed by BEC. The groundwater was also interpreted as a minor perched water zone and was identified in boring UAR-HSA-1 at a depth of 18.2 m (elev. 66.7m).

**Corrosion**

Samples retrieved from the July 2000 foundation investigation (boring B-00-1) were combined to make composite samples of earth materials at intervals from 0 to 0.76m depth, 0.76 to 3.81m depth and 3.81 to 6.10m depth. The Office of Testing and Technology Services, Corrosive Technology Branch (CTB) tested the three composite samples for corrosive potential. The results of the laboratory tests determined that the composite samples were not corrosive. Refer to Table 1 below for specific test results.

**Table 1: Corrosion Test Summary-Composite Samples**

| Boring Number/ Corrosion Number | Sample Depth (m) | pH | Minimum Resistivity (Ohm-Cm) | Sulfate Content (PPM)* | Chloride Content (PPM)* | Years To Perforation 18 ga. Galv. Steel Culvert |
|---|---|---|---|---|---|---|
| B-00-1 / 00-0750 | 0 to 0.76 | 6.6 | 1300 | N/A | N/A | 17 |
| B-00-1 / 00-0751 | 0.76 to 3.8 | 8.0 | 1500 | N/A | N/A | 29 |
| B-00-1 / 00-0752 | 3.8 to 6.1 | 8.7 | 1400 | N/A | N/A | 29 |

*The Corrosion Technology Branch policy states that if the minimum resistivity is greater than 1000ohm-cm the sample is considered to be non-corrosive and testing to determine sulfate and chloride contents are not performed.

## Fault and Seismic Data

The proposed structure site is potentially subject to strong ground motions from nearby earthquake sources during the design life of the new structure. The Newport-Inglewood-Rose Canyon (Strike Slip) fault, located approximately 12.2 km southwest of the site, is the controlling fault for this site with a maximum credible earthquake of Mw=7.0. The Peak Bedrock Acceleration at this site, based on the Caltrans California Seismic Hazard Map, is estimated to be 0.3g. At this site, the liquefaction potential is considered very minimal.

For site specific seismic data and design recommendations, refer to the memorandum concerning final seismic design recommendations dated December 11, 2000, by Mr. Hossain Salimi of the Office of Geotechnical Earthquake Engineering.

## Foundation Recommendations

The following recommendations are for the proposed Vehicular Undercrossings, Bridges No. 57-1081 R/L, as shown on the preliminary "General Plan" (dated July 18, 2000). Spread footings may be used for support of the proposed structures. It is anticipated that both the right and left Abutment No. 2 and the right bridge Abutment No. 1 footings will be located on engineered fill constructed for the roadway approach to the bridge structures. However, the left bridge Abutment No. 1 bottom of footing elevation is partially situated on the top of the formational earth materials (La Jolla Group) described earlier. To eliminate the potential for differential settlement to occur across the left bridge Abutment No. 1 support location, subexcavation of formational earth materials and replacement with engineered fill compacted to 95% relative compaction is recommended. The Gross Allowable Soil Bearing Pressures to be used for design are listed below in Table 2.

**Table 2: Spread Footing Data (Bridge No. 57-1081 Left/Right)**

| Support Location | Minimum Footing Width (m) | Bottom of Footing Elevation (m) | Bearing Pressures To Be Used For Design | |
|---|---|---|---|---|
| | | | WSD[1] | LFD[2] |
| | | | Gross Allowable Soil Bearing Pressure | Ultimate Soil Bearing Pressure |
| Abutment 1 (Left Bridge) | 3.6 | 84.71 | 192 kPa (4.0 ksf) | N/A |
| Abutment 2 (Left Bridge) | 3.6 | 84.44 | 192 kPa (4.0 ksf) | N/A |
| Abutment 1 (Right Bridge) | 3.6 | 83.84 | 192 kPa (4.0 ksf) | N/A |
| Abutment 2 (Right Bridge) | 3.6 | 83.58 | 192 kPa (4.0 ksf) | N/A |

Notes: 1) For Working Stress Design, the Maximum Applied Pressure, ($q_{applied}$), is not to exceed the specified Gross Allowable Soil Bearing Pressure, ($q_{all}$). The Ultimate Soil Bearing Capacity, ($q_{ult}$), will equal or exceed 3 times the specified Gross Allowable Soil Bearing Pressure, ($q_{all}$).
2) For Load Factor Design, The Maximum Applied Pressure, ($q_{applied}$), is not to exceed the Ultimate Soil Bearing Pressure, ($q_u$) times the Strength Reduction Factor, ($\phi$). The Ultimate Soil Bearing Capacity, ($q_{ult}$), will equal or exceed the specified Ultimate Soil Bearing Pressure, ($q_u$).

The recommended gross allowable soil bearing pressures to be used for design, listed in Table 2, are based upon the following design criteria:

(1) All abutment footings have a minimum footing width of 3.6 meters,
(2) All abutment footings are positioned such that there will be a minimum horizontal distance of 1.22 meters from the near face/top of the footing to the face of the finished slope (Bridge Design Specifications 4.4.2.1) and
(3) At the Left Bridge Abutment No. 1, the footing shall be supported on 0.61 meter of engineered fill compacted to 95% relative compaction. The limits of sub-excavation and replacement with structure shall conform to the limits required for relative compaction under retaining wall footings without piles as defined in section 19-5.03 of the Standard Specifications.

If any of the above minimum footing widths or horizontal embedment depth are reduced, the OSF is to be contacted for reevaluation.

**General Notes**

1. All support locations are to be plotted in both plan and elevation views on the Log of Test Borings as stated in "Memo to Designers" 4-2. The plotting of support locations should be made prior to requesting a final foundation review.

**Construction Considerations**

1. Due to granular nature of the soils, primary settlement is expected to occur immediately and concurrent with fill placement; therefore, no waiting period is required prior to installing spread footings.

2. Concrete for all structure support footings shall be placed neat against the undisturbed engineered fill on the bottom of the footing excavation. Should the bottom of the footing excavation be disturbed, then the disturbed soils shall be recompacted to 95% relative compaction prior to placement of concrete for the structure support footings.

The recommendations contained in this report are based on specific project information regarding structure type and structure location that has been provided by the Division of Structure Design. Any questions regarding the above recommendations should be directed to the attention of Hector Valencia (916) 227-7081 (CALNET 498-7081) or Mark DeSalvatore (916) 227-7056 (CALNET 498-7056), Division of Structural Foundations, Office of Structure Foundations.

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