

Memorandum

To: MR. KEVIN ROSS
Structure Design MS-9
Office of Bridge Design - South
Bridge Design Branch 12

Attention: Mr. Dan Texler

Date: August 29, 2001

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Rancho Santa Fe Farms O.C.
Bridge No. 57-1080

From: DEPARTMENT OF TRANSPORTATION
Division of Engineering Services
Geotechnical Services - MS 5
Office of Geotechnical Design - South
Structure Foundations - South Branch

Subject: Foundation Recommendations

This report presents the foundation recommendations for the proposed Rancho Santa Fe Farms O.C. (Bridge No. 57-1080). The Office of Geotechnical Design - South, Structure Foundations - South Branch completed a foundation investigation pursuant to the July 24, 2000 request by Structure Design, Office of Bridge Design - South for a foundation investigation and recommendations for the proposed structure.

The following foundation recommendations are based on subsurface information gathered during the recent foundation investigation (Sep./Oct. 2000) performed by Caltrans along with a review of subsurface information used to develop the Draft Type Selection Report for the proposed structure, 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 Description

The project site is located within the Carmel Valley area within San Diego County. The project site is located near the intersection of Black Mountain Road and Rancho Santa Fe Farms Rd. The proposed structure site is located on property that is currently a nursery.

The proposed new bridge is to consist of a double span, cast-in-place, pre-stressed, concrete box girder type structure. The proposed bridge will span the proposed State Route 56, which will pass underneath and nearly perpendicular to the bridge.

Geology

The foundation investigation performed in September/October 2000 consisted of four mud rotary borings and one boring advanced utilizing a one-inch soil tube. 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 top soil consisting of a medium dense silty sand to a depth of about .61 meters in borings B-00-1 and B-00-2, (elev. 93.0 m and elev. 93.1 m, respectively),

and a 150 mm sandy gravel road base layer underlain by firm to stiff sandy clay to a depth of 1.1 m (elev. 95.7 m) in Boring B-00-4, and to a depth of .91 m (elev. 95.7 m) in boring B-00-5. The upper unit soils at the site are underlain by poorly indurated sandstone (Poway and La Jolla Groups) consisting of a dense to very dense silty sand, silt and occasional gravel layers, and localized lenses of weak to strong cementation. Borings B-00-1 through B-00-4 were drilled with a Christensen CS 2000 drill rig and advanced to a maximum explored depths of 30.5 m (elev. 63.2 m), 30.8 m (elev. 63.0 m), 30.8 m (elev. 60.4 m), and 12.7 m (elev. 84.1 m), respectively. Boring B-00-5 was advanced utilizing a one-inch soil tube to a maximum depth of 1.22 m (elev. 95.4 m). Refer to the Log of Test Borings for site-specific soils data.

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 medium dense to dense clayey sand with trace gravel fill material to a depth of 1.7 m (elev. 95.1 m) in boring RSF-HSA-1, to 3.2 m (elev. 92.8 m) in boring RSF-HSA-2, and to 1.7 m (elev. 93.8 m) in boring RSF-HSA-3. The upper unit soils at the site are underlain by a weakly cemented sandstone characterized as a very dense clayey sand with interbedded hard silt and clay layers with localized lenses of strong cementation. The three borings RSF-HSA-1, RSF-HSA-2, and RSF-HSA-3, were drilled to a maximum explored depth of 9.4 m (elev. 87.4 m), 16.9 m (elev. 79.1 m), and 11.0 m (elev. 84.5 m), respectively.

Ground Water

Ground water was encountered during the Caltrans subsurface investigation in boring B-00-2; at a depth of 21.5 m (elev. 72.3 m) and is interpreted to be a minor perched water zone. Groundwater was not identified in any of the three exploratory borings performed by BEC.

Corrosion

Corrosion test results for soil samples collected from Boring B-00-1 are shown in Table 1, and indicate that soil samples tested from depths of 5.1 m and 6.2 m (elev. 88.6 m and 87.5 m, respectively) have a minimum resistivity less than 1000 ohm-cm which indicates that they are corrosive, whereas the remaining soil samples, tested from depths below 87.5 m elevation, did not meet Caltrans current specifications as being corrosive. The most recent corrosion recommendations for this structure have been issued by memorandum, dated July 19, 2001, by the Office of Testing and Technology Services, Corrosion Technology Branch. A copy of this memorandum has been sent to Structure Design. For specific corrosion recommendations, refer to the above-mentioned memorandum.

**Table 1
 Corrosion Test Summary**

Location	Corrosion Test Number	pH	Minimum Resistivity (Ohm-Cm)	Sulfate Content (PPM)*	Chloride Content (PPM)*
Boring 00-1 (Elev. 88.6 m)	00-0960	7.3	460	141	468
Boring 00-1 (Elev. 87.5 m)	00-0952	7.7	695	79	302
Boring 00-1 (Elev. 71.2 m)	00-0961	7.1	1000	26	91
Boring 00-1 (Elev. 65.4 m)	00-0962	7.4	1700	N/A	N/A

Note: Caltrans currently defines a corrosive environment as an area where the soil contains more than 500 ppm of chlorides, or more than 2000 ppm of sulfates, or has a minimum resistivity of less than 1000 ohm-cm, or has a pH of 5.5 or less. *If the minimum resistivity is greater than 1000 ohm-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 Office of Geotechnical Earthquake Engineering has provided Final Seismic Design Recommendations for this site in the memorandum dated August 8, 2001. The controlling fault for the site is the Newport-Inglewood-Rose Canyon fault with a maximum credible earthquake $M_w=7.0$ located approximately 11.7 kilometers southwest of the site. The corresponding Peak Bedrock Acceleration is estimated to be 0.3g. For site-specific ARS recommendations, refer to the above-mentioned memorandum. The above-mentioned memorandum also states that the site is not considered susceptible to liquefaction.

Foundation Recommendations

The following recommendations are for the proposed Rancho Santa Fe Farms O.C. (Br. No. 57-1080), as shown on the General Plan dated July 24, 2001. Spread footings may be used at all structure support locations. It is anticipated that the proposed Abutment 1 footing will be located on engineered fill constructed for the roadway approach to the bridge structure. The proposed Bent 2 right and left column footings, as well as the Abutment 3 footing are anticipated to be on formational material. The Gross Allowable Soil Bearing Pressures and bottom of footing elevations to be used for design are listed below in Table 2.

Table 2: Spread Footing Data (Br. No. 57-1080)

Support Location	Minimum Footing Width	Bottom of Footing Elevation	Recommended Soil Bearing Pressures	
			ASD ¹	LFD ²
			Gross Allowable Soil Bearing Pressure (q_{all})	Ultimate Soil Bearing Pressure (q_{ult})
Abutment 1	3.66 m	91.84 m	225 kPa (4.7 ksf)	N/A
Bent 2 Left & Right Columns	5.30 m	87.47 m		859 kPa (17.9 ksf)
Abutment 3	3.66 m	93.87 m	225 kPa (4.7 ksf)	N/A

Notes: 1) Allowable Stress Design, (ASD). The Maximum Contact Pressure, (q_{max}), is not to exceed the recommended Gross Allowable Soil Bearing Pressure, (q_{all}). The Ultimate Soil Bearing Capacity, (q_u), will equal or exceed 3 times the recommended Gross Allowable Soil Bearing Pressure, (q_{all}). 2) Load Factor Design, (LFD). The Maximum Contact Pressure, (q_{max}), divided by the Strength Reduction Factor, (ϕ), is not to exceed the recommended Ultimate Soil Bearing Pressure, (q_{ult}). The Ultimate Soil Bearing Capacity, (q_u), will equal or exceed the recommended Ultimate Soil Bearing Pressure, (q_{ult}).

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

- (1) The abutment footings shall have a minimum footing width of 3.66 meters.
- (2) The 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 if it is a seat abutment (Bridge Design Specifications 4.4.2.1), and 1.52 meters if it is an end-diaphragm abutment (Bridge Design Details 6-21).

If any of the above minimum footing widths or horizontal embedment depth are reduced, the Office of Geotechnical Design - South, Structure Foundations - South Branch is to be contacted for reevaluation.

General Notes:

All support locations are to be plotted in plan view 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. At the Abutment 1 support location, the contractor shall subexcavate into formational material to elevation 89.3 meters from the left edge of the footing to the center of the footing, and then shall step the bottom of the subexcavation down to elevation 87.5 meters from the center of the footing to the right edge of the footing. The excavation shall then be backfilled with engineered fill, compacted to 95% relative compaction, up to the bottom of footing elevation. The limits of subexcavation and replacement with engineered fill 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.
2. A 30-day waiting period is required at Abutment 1 support location where new fill material is being placed.
3. At the proposed Abutment 1 support location, concrete for the abutment support footing 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.
4. At the proposed Bent 2 and Abutment 3 support locations, all concrete shall be placed neat against the undisturbed formational materials at the bottom of the excavation. Should the bottom of the footing excavation be disturbed, the bottom of footing excavation shall be extended down by 0.15 meter intervals until undisturbed formational materials are observed and approved by the Engineer.
5. At the Bent 2 location, the structure support footing excavations are to be inspected and approved by a representative of the Office of Geotechnical Design - South, Structure Foundations - South Branch, after the excavation has been completed to the final grade and prior to placing any steel or concrete in the excavation.

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The recommendations contained in this report are based on specific project information regarding structure type, location, and design loads that have been provided by Structure Design, Office of Bridge Design - South. If any conceptual changes are made during final project design, the Office of Geotechnical Design - South, Structure Foundations - South Branch should review those changes to determine if these foundation recommendations are still applicable. Any questions regarding the above recommendations should be directed to the attention of Erich Neupert (916) 227-7145 (CALNET 498-7145) or Mark DeSalvatore (916) 227-7056 (CALNET 498-7056).

Report by:

Erich Neupert

Erich Neupert
Engineering Geologist
Office of Geotechnical Design - South
Structure Foundations - South Branch

Supervised by:

Date:

8/29/01

Mark DeSalvatore

Mark DeSalvatore, R.C.E., No. 039499
Senior Materials and Research Engineer
Office of Geotechnical Design - South
Structure Foundations - South Branch



- c: R.E. Pending File
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