

FOR CONTRACT NO: 06-0K3901
PROJECT ID: 0600000241

INFORMATION HANDOUT

MATERIALS INFORMATION

FOUNDATION REPORT
January 13, 2012

Memorandum

*Flex your power!
Be energy efficient!*

To: MR. GARY BLAKESLEY
Chief, Design Branch 5
Office of Bridge Design North
Structure Design
Division of Engineering Services

Date: January 13, 2012

File: 06-KER-58
PM R99.3/R99.7
EA 06-0K3901
ID 0600000241
Sand Canyon Rd UC
Br. No. 50-0345L

Attention: Grant Schuster

From: DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES – MS 5

Subject: Foundation Report

Introduction

The Office of Geotechnical Design North has prepared this Foundation Report (FR) to provide foundation recommendations for replacement of the Sand Canyon Road Undercrossing (UC), Br. No. 50-0345L along State Route (SR) 58 in Kern County.

Scope of Work

The scope of our work for this FR includes review of the General Plan, Foundation Plan, foundation design loads provided by Structure Design (SD), evaluation of subsurface conditions based on the available geotechnical and geologic data, a field exploration program, and engineering and seismic analyses.

Project Description

The proposed structure type consists of a CIP RC Slab superstructure with diaphragm abutments and two bents with three pile extensions at each bent. The existing pile caps will be left in place. The bents will be supported on 36" diameter CIDH pile extensions which will be constructed outside the existing piles and pile caps. The abutments will be supported on existing 12" driven concrete piles and new 24" diameter CIDH piles.

Foundation design data and foundation design loads provided by Structure Design (SD) are presented in **Table 1** and **Table 2**.

Table 1. Foundation Design Data Sheet

Support No.	Design Method	Pile Type	Finished Grade Elev. (ft)	Cut-off Elev. (ft)	Pile Cap Size (ft)		Permissible Settlement Under Service Load (in)	Number of Piles Per Support
					B	L		
Abut 1	WSD	24" CIDH	3943.5	3940.25	Diaphragm Abut.		1	3
Bent 2	LRFD	36" CIDH	NA	NA	Pile extensions		1	3
Bent 3	LRFD	36" CIDH	NA	NA	Pile extensions		1	3
Abut 4	WSD	24" CIDH	3942.5	3939.25	Diaphragm Abut.		1	3

Table 2. Foundation Design Loads

Support No.	Service-I Limit State (kips)		Strength Limit State (kips)				Extreme Event Limit State (kips)				
	Total Load		Permanent Load	Compression		Tension		Compression		Tension	
	Per Support	Max Per Pile	Per Support	Per Support	Max Per Pile	Per Support	Max Per Pile	Per Support	Max Per Pile	Per Support	Max Per Pile
Abut 1	606	90	60	NA	NA	NA	NA	NA	NA	NA	NA
Bent 2	951	519	651	1076	678	0	0	718	369	0	0
Bent 3	951	519	651	1076	678	0	0	718	369	0	0
Abut 4	606	90	60	NA	NA	NA	NA	NA	NA	NA	NA

Field Investigation

The Office of Geotechnical Design North conducted a subsurface investigation in October and November 2011.

The subsurface investigation consisted of two rotary wash borings (No. R-11-001 and R-11-002) and two Cone Penetrometer Tests (CPT-11-001 and CPT-11-002). The borings were advanced using a self-casing wireline drilling method. The maximum depth reached by the borings and CPT was approximately 121.5 feet and 100.1 feet, respectively. Sampling was achieved in the borings utilizing a Standard Penetration Test (SPT) sampler. A summary of the borings and CPT is included in **Table 3**.

**Table 3. Subsurface Exploration Summary for Sand Canyon Rd UC
(Br. No. 50-0345)**

Boring / CPT No.	Completion Date	Drill Rig Type	Hammer Type	Hammer Efficiency (%)	Approx. Ground Surface Elevation (ft)	Boring Depth (ft)
R-11-001	10/26/2011	Acker	Auto	74	3937	81.5
R-11-002	10/25/2011	Acker	Auto	74	3940	121.5
CPT-11-001	11/1/2011	CPT	NA	NA	3920	100.0
CPT-11-002	11/1/2011	CPT	NA	NA	3920	100.1

For subsurface data and boring locations, please refer to the Log of Test Borings and the As-Built Log of Test Borings for detailed observations, information and conditions.

Full-sized Logs-of-Test-Borings (LOTB) will be prepared by Geotechnical Services, Office of Geotechnical Support, Branch D, Contracts, Graphics & Records to be incorporated in the project plans.

Site Geology and Subsurface Conditions

Information regarding the regional geology can be found on the Geologic Map of the Bakersfield Quadrangle, published by CDMG dated 1987. According to this map, the proposed bridge site is located in Recent Quaternary Alluvium, which consists of sands, silts and gravels.

The soils underlying the proposed bridge site were classified based on field classification of boring samples and CPT data. The fill embankment is about 20 feet in height and consists of dense to very dense gravelly sand. Below the fill embankment, the soil consists of about 50 feet of interbedded layers of loose to medium dense gravelly, clayey and silty sand, clean sand, and sandy to clayey silt. Below this layer, the soil consists predominantly of dense to very dense silty to gravelly sand to the maximum depth explored of 120 feet.

Topography and Drainage

Regionally, the proposed bridge site is located at the southeast corner of the Great Valley geomorphic province of California, in a transition area from flat to mountainous terrain. Locally, the proposed bridge site is generally flat with elevations ranging from 3940 feet at the top of the approach fills to 3922 feet at the bottom of the approach fills.

Ground Water

The groundwater depth was measured from the top of the approach fill at a stabilized depth of 60 feet below the ground surface (approximate elevation 3880 feet) in boring R-11-002 on November 1, 2011.

Scour

As the bridge structure is not located adjacent to any waterways, scour is not a consideration for this project.

Corrosion

Chemical tests were performed to determine the corrosion potential of the soil. The results from the corrosion testing are included in **Table 4**.

Table 4. Soil Corrosion Test Summary

Location	SIC Number	Minimum Resistivity (ohm-cm)	pH	Chloride Content (ppm)	Sulfate Content (ppm)
Sand Canyon Rd UC	C702986	1359	7.88	NA	NA

The Department currently defines a corrosive area as an area where the soil and/or water contains more than 500 PPM of chlorides, or more than 2000 PPM of sulfates, or has a minimum resistivity of less than 1000 ohm-centimeters, or has a pH of 5.5 or less. With the exception of MSE Walls, chloride and sulfate tests (CTM 422 and CTM 417) are not required (NA) if the minimum resistivity is greater than 1,000 ohm-cm.

The test results are consistent for soils present in the project area and within the non-corrosive limits established by the Department. Consequently, the soil should be considered non-corrosive with respect to pH and resistivity.

Seismic Recommendations

Based on the Caltrans 2009 Seismic Design Procedure, the nearest active fault is the Garlock Fault Zone (Western Section), Fault ID No. 349 with a Mmax of 7.8. The fault is located southeast of the proposed bridge site. The rupture distance to the fault plane from the bridge site is estimated to be about 1.5 miles. The fault is referred to as a left lateral strike slip (LLSS) fault with a dip angle of 90 degrees.

Based on the log of test borings a Vs30 (average shear wave velocity for the top 100 feet of soil column) was estimated using the SPT blow counts and the correlation formulas for both cohesive and granular soil. The estimated shear wave velocity is 236 meters per second.

Using the above shear wave velocity, the design Acceleration Response Spectrum, (ARS) curve is controlled by the USGS 5% probability of exceedance in 50 years (return period of 975 years). The design ARS curve was obtained from "USGS 2008 Interactive Deaggregation (Beta)" web site, and is attached. The estimated peak ground acceleration as shown on the ARS curve is 0.46g.

A liquefaction analysis indicates that the granular soil from elevation 3865 to 3870 feet has the potential to liquefy during a seismic event. Liquefaction analysis indicates that seismic induced settlement will be on the order of 2 to 3 inches. Lateral spreading is not anticipated.

The potential for surface rupture at the site due to fault movement is considered insignificant since there are no known faults projecting towards or passing directly through the project site.

The recommended design ARS curve with an estimated peak ground acceleration of 0.46g is attached on **Plate No. 1**.

As-Built Foundation Data

Based on the the As-Built Foundation Plan, General Plan, and Concrete Pile Details for Sand Canyon Road UC, dated August 4, 1970, the existing bridge is supported on Class II 12" driven concrete piles. The design load of the piles is 90 kips. The piles were driven to an average tip elevation of approximately 3870 feet. Pile tip elevations were based on a ground water elevation of 3841 feet.

Foundation Recommendations

Recommendations for 24 inch diameter CIDH piles at Abutments 1 and 2 are presented in **Table 5**.

Table 5. Foundation Recommendations for Abutments

Support	Pile Type	Cut-off Elevation (ft)	Service Limit State Per Support (kips)		LRFD Service-I Limit State Total Load (kips) Per Pile (Compression)	Nominal Resistance (kips)	Design Tip Elev (ft)	Spec Tip Elev (ft)
			Total	Permanent				
Abut 1	24" CIDH	3940.25	606	60	90	180	3886 (a)	3886
Abut 2	24" CIDH	3939.25	606	60	90	180	3886 (a)	3886

Notes:

1. Recommendations are based on Working Stress Design (WSD) for abutments and the loads provided by SD.
2. A factor of safety of 2.0 is used to calculate the available geotechnical resistance in Service Limit State.
3. Design tip elevations are controlled by (a) compression.
4. Design tip elevation controlled by settlement is not applicable.
5. Design tip elevation for lateral load is typically provided by SD.
6. Specified tip elevation shall not be raised if controlled by lateral load.

Recommendations for 36 inch diameter CIDH piles at Bents 2 and 3 are presented in **Table 6**.

Table 6. Foundation Recommendations for Bents

Supp Loc	Pile Type	Cut-off Elev (ft)	Service-I Limit State Load Per Support (kips)	Total Permissible Support Settlement (inches)	Required Factored Nominal Resistance (kips)				Design Tip Elev (ft)	Spec Tip Elev (ft)
					Strength Limit		Extreme Event			
					Comp $\phi=0.7$	Tension $\phi=0.7$	Comp $\phi=1.0$	Tension $\phi=1.0$		
Bent 2	36" CIDH	NA	951	1	678	0	369	0	3835 (a-II)	3835
Bent 3	36" CIDH	NA	951	1	678	0	369	0	3835 (a-II)	3835

Notes:

1. The design tip elevations recommended herein are controlled by (a-II) compression (Strength Limit State).
2. A resistance factor of 0.7 is used to calculate the available geotechnical resistance in Strength Limit State.
3. Design tip elevation controlled by settlement is not applicable.
4. Design tip elevation for lateral load is typically provided by SD.
5. Specified tip elevation shall not be raised if controlled by lateral load.

Recommendations for 24 inch CIDH piles at the Abutments and 36 inch CIDH piles at the Bents are presented in **Table 7**.

Table 7. Pile Data Table

Support Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevation (ft)	Specified Tip Elevation (ft)
		Compression	Tension		
Abut 1	24" CIDH	180	N/A	3886 (a)	3886
Bent 2	36" CIDH	969	0	3835 (a)	3835
Bent 3	36" CIDH	969	0	3835 (a)	3835
Abut 4	24" CIDH	180	N/A	3886 (a)	3886

Notes:

1. Design tip elevations for Abutments and Bents are controlled by (a) compression.

Construction Considerations

Ground water was measured at an approximate elevation of 3880 feet in boring R-11-002 on November 30, 2011. As the specified tip elevation for the 36" diameter CIDH piles are deeper than the measured ground water elevation, ground water may be encountered during pile construction. Specifications for construction of CIDH piles in wet conditions need to be included with the project.

All earthwork shall follow Section 19 of the Caltrans Standard Specifications.

Layers of loose sandy material were encountered within the borings. Temporary casing may be needed during CIDH pile construction to mitigate caving. If temporary casing is used, it shall be removed while the concrete is being placed in order to develop the required pile capacity.

Project Information

Standard Special Provision S5-280, "Project Information", discloses to bidders and contractors a list of pertinent information available for their inspection prior to bid opening. The following is an excerpt from SSP S5-280 disclosing information originating from Geotechnical Services. Items listed to be included in the Information Handout will be provided in Acrobat (.pdf) format to the addressee(s) of this report via electronic mail.

Data and information attached with the project plans are:

A. *Log-of-Test-Borings (LOTB), Sand Canyon Road UC (Replace).*

Data and Information included in the Information Handout provided to the bidders and Contractors are:

A. *Foundation Report for EA 06-0K3901, dated 1/13/2012.*

Data and Information available for inspection at the District Office:

A. *None.*

Data and Information available for inspection at the Transportation Laboratory are:

A. *None.*

Disclaimer and Contact Information

The foundation recommendations included in this report are based on specific project information regarding structure type, location, and design loads provided by SD. If any changes are made during final project design, OGDN should review the changes to determine if these foundation recommendations are still applicable. Any questions regarding this report should be directed to the attention of Ben Barnes at 916-227-1039.



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Attachment: Plate No. 1 – Final Design Response Spectrum

- c: Frank Momen (D6 Project Manager)
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Structure R.E. Pending File
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