FOR CONTRACT NO.: 12-0H5504

INFORMATION HANDOUT

MATERIALS INFORMATION

SUPPLEMENTAL FOUNDATION RECOMMENDATION
(DATED APRIL 22, 2009)

FOUNDATION RECOMMENDATION
(DATED JANUARY 13, 2009)

ROUTE: 12-Ora-5, 57-33.2/34.0, 10.9/11.2

State of California

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. ADEL MALEK
District 12, Office of Design
Branch I/Traffic Design

Attention: Ben Ly

Date: April 22, 2009

File: 12-ORA-5-PM 33.2/34.0
12-0H5501
Overhead Sign Replacement

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

Subject: Supplemental Foundation Recommendation

As mentioned in our foundation recommendation dated January 13, 2009, site-specific subsurface exploration has been conducted to confirm or revise the previously recommended 35.0 feet cast-in-drilled-hole (CIDH) pile for supporting this overhead sign. The exploration consisted of one boring performed with truck-mounted drill rig. The boring was advanced to a depth of 45 feet below ground surface. The Standard Penetration Test (SPT) was conducted every 5.0 feet to obtain soil samples and Standard Penetration Resistance (N-value).

Artificial fill consisting of silty sand (SM) and lean clay with varying amount of sand (CL) were encountered to an approximate elevation of 126.0 feet. Below the fill, about 20 feet of native silty sand (SM) and sandy silt (ML) overlies very dense sand layer (SP) at an approximate elevation of 109 feet. Lateral and vertical pile capacity was estimated with subsurface condition revealed by this exploration. It is confirmed that the recommended 35.0 feet CIDH pile should be sufficient to support the sign replacement.

If you have any questions, please contact Chungkeun Lee at (213) 620-2148.

Prepared by: Date: 4/22/09

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c.c. OGDS-1-Los Angeles File (2)
OGDS-1-Sacramento
GS File- Sacramento

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12-0H5501
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From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design-South 1, Branch C

Subject: Foundation Recommendation

As requested by your office, the office of Geotechnical Design South1, Branch C has prepared this foundation recommendation for the construction of subject overhead sign within the HOV median adjacent to the north abutment of the Santiago Creek Bridge over Interstate 5.

SCOPE OF WORK

This foundation recommendation has been prepared with subsurface information from Log of Test Borings (LOTB) for adjacent structure, Santiago Creek Bridge (No. 55-1046, formerly 55-0114). It should be noted that site-specific subsurface exploration has not been performed to accommodate the project schedule.

PROJECT DESCRIPTIONS

It is proposed to replace an existing sign with a new single post sign on the HOV median concrete barrier between SB and NB Interstate 5 in the city of Santa Ana. Based on the project plan plotted on November 20, 2008, the existing sign will be removed and the new sign will be located approximately one hundred feet away from the north abutment of the bridge. One cast-in-drilled-hole (CIDH) pile will be installed at median barrier in order to support the sign (Type IX). The foundation depth and diameter of the pile have been pre-selected in accordance with Standard Plan dated May 2006. The pile depth has been increased by pile length above finish grade per the pile requirement at median barrier informed by the Sign & Overhead Structures Specialist, Mr. K C Liu, as follows:

Table No. 1 – Foundation Information

Type	Station	Type of Foundation	Diameter	Foundation length
Single Post (Type IX)	1004+60 (Center line of I-5 SB)	CIDH pile	5.0 (ft)	*31 feet

* Top of pile is about 3 feet above finished grade.

FIELD EXPLORATION

As mentioned earlier, this recommendation has been prepared without site-specific exploration. However, one exploratory boring will be required to verify the subsurface condition at the location of sign. Standard penetration test (SPT) and/or California modified (2 inch brass ring) samples will be collected during the exploration and sent to laboratory for testing if necessary. Also, the standard penetration test result will be recorded and used to obtain engineering properties of subsurface material at the location of pile.

PERTINENT DOCUMENTS

The following documents were reviewed for the preparation of this report:

1. Project Plans for the proposed overhead sign replacement, November 2008
2. As-built plans for I-5 widening (EA 12-005101), June 1992
3. Log of Test Borings for Santiago Creek Bridge (No. 55-0114), March 1989
4. Log of Test Borings for Santiago Creek Bridge (No. 55-0114), August 1975

SITE GEOLOGY

The proposed location of new sign is within the HOV median adjacent to the north abutment of the Santiago Creek Bridge over Interstate 5. The project is in a small fill section and the elevation of the freeway is close to the original grade of the land prior to development of this area. The project area (including the fill) is underlain by recent Holocene age alluvium. The alluvium is derived from Santiago Creek and the Santa Ana River and from the Santa Ana Mountains to the east of the project. The alluvial material present within the existing Santiago Creek channel consists of silt, sand, gravel, cobbles and boulders. The subsurface conditions represented on the 1975 and 1989 LOTB's for the bridge (No. 55-0114) are discussed in the following section, Subsurface Conditions. No bedrock was encountered in the borings for the 1975 and 1989 investigations. Depth to bedrock or bedrock like material can be expected to be greater than 100 feet (California Department of Water Resources, 1961). Groundwater was encountered in the borings completed for the 1975 and 1989 investigation and will be discussed later in this report.

SUBSURFACE CONDITIONS

Based on the above referenced LOTBs, the project site is underlain by fill and native alluvium. The fill consisting of clayey sand (SC) and loose sand with varying amounts of silt (SM/ML) is extended up to an approximate elevation of 129.0 feet. Below the fill, native sand with gravel (SP), clayey sand (SC) and sandy silt (ML) were encountered to the maximum depth of drilling during the exploration in 1989.

SEISMICITY

The closest fault to the site is the El Modeno-Peralta Hills Fault located 4.8 miles north of the site. This fault is included on the 1996 Caltrans Seismic Hazard Map and is depicted to have a potential for a 6.5 maximum credible earthquake and the site is located outside the 0.4g acceleration contour from this fault. The second closest fault to the site is the Newport-Inglewood Fault located approximately 9.0 miles southwest of the site. This fault is included on the 1996 Caltrans Seismic Hazard Map and is depicted to have a potential for a 7.0 maximum credible earthquake and the site is located outside the 0.4g acceleration contour from this fault. The third closest fault to the site is the Whittier-Elsinore Fault located approximately 11.0 miles north of the site. This fault is included on the 1996 Caltrans Seismic Hazard Map and is depicted to have a potential for a 7.5 maximum credible earthquake and the site is located outside the 0.4g acceleration contour from this fault. The closest fault zoned by the California Geologic Survey, Alquist-Priolo Earthquake Fault Zones of California, is the Newport-Inglewood Fault located approximately 9.0 miles southwest of the site. No faults have been mapped at the project site so potential for surface rupture is low.

GROUNDWATER

During the 1989 exploration, groundwater was measured at an elevation of 67 and 71 feet, respectively. Considering the top elevation of CIDH pile (Elev. 154.4 feet) and the pre-selected length of pile (31.0 feet), it is unlikely that groundwater will be encountered at the time of construction unless the sign is constructed during rainy season.

LIQUEFACTION EVALUATION

Liquefaction is defined as the phenomenon in a soil mass, because of the development of excess pore pressures, soil mass suffers a substantial reduction in its shear strength. During earthquake, excess pore pressures in saturated soil deposits may develop as a result of induced cyclic shear stresses, resulting in liquefaction.

However, since the previous drilling records indicate no shallow groundwater at the location of sign, the potential for liquefaction seems to be very low.

CORROSIVITY

Corrosion resistant design and construction materials are advised since no corrosion test results are available at this time for the location of CIDH pile. However, corrosion tests will be performed on representative soil samples prior to commencement of construction work during the forthcoming drilling program.

FOUNDATION RECOMMENDATIONS

In order to verify that the pre-selected foundation length is sufficient to support the proposed overhead sign, the vertical and lateral capacity of pile were analyzed. Service level loads at the top of pile for this sign were estimated and provided by Mr. K C Liu as follows:

Table No. 2 – Service level load & Maximum allowable pile deflection

Type	Axial Force (Kips)	Shear Force (Kips)	Bending Moment (Kips-ft)	Maximum allowable Pile-head deflection (inch)
Single Post (Type IX)	29.3	24.9	531.0	1.0

The computer software of Shaft and LPILE plus were employed to estimate the vertical and lateral capacity of CIDH pile. The properties of subsurface material at the location of pile were correlated with blow counts recorded in the LOTBs for Santiago Creek Bridge (1975 & 1989). Based on the results of analysis and degree of uncertainty due to absence of site-specific subsurface exploration at the location of pile, it is recommended that the pile length be increased to 35 feet at this time. This recommended pile length should be revised if different subsurface condition is revealed by site-specific subsurface exploration at the sign location.

Table No. 3 – Pile Data Table

Location	Pile Diameter/ Pile Type	Design Service Load (Kips)		Nominal Resistance (Kips)		Approximate Top of Pile Elev. (ft)	*Design Tip Elev. (ft)	Specified Tip Elev. (ft)
		Comp.	Tension	Comp.	Tension			
Single Post (Type IX)	5.0'/ CIDH	29.3	0	58.6	0	154.2	132.0 (1) 119.0 (2)	119.0

* Design Pile Tip Elevations are controlled by the following demands: (1) Compression (2) Lateral Loads.

CONSTRUCTION CONSIDERATOINS

1. It is recommended that construction of the CIDH pile during rainy season be avoided to eliminate the chance of encountering groundwater since the pile will be constructed nearby potential passage of water.

2. Based on the drilling records for adjacent structure, it is most likely that material at the project site contains gravel, cobbles, and/or boulders within the recommended depth of pile. Therefore, difficult drilling, caving and/or sloughing conditions should be anticipated during the excavation of pile and the CIDH pile construction.

3. The contractor shall be required to clean out the bottom of the CIDH pile prior to placing the cage and concrete.

4. Concrete placement for construction of the CIDH pile shall be completed within the same day that excavation of the drilled hole has been completed.

5. If temporary casing is used, provisions in Section 49-4.03, "Drilled Holes" of the Standard Specifications shall be followed.

6. If slurry displacement method is used, requirements in Standard Special Provisions 49-310, "Cast-In-Drilled-Hole Concrete Piles" shall be followed.

The recommendations contained in this report are based on specific project information regarding overhead sign location, type, height and base plate elevations that has been provided to our office. If any conceptual changes are made during final project design, this office should review those changes to determine if these foundation recommendations are still applicable.

REFERENCES

1. AASHTO, LRFD Bridge Design Specifications 4th Edition, 2007

2. California Geologic Survey, Digital Images of Official Maps of Alquist-Priolo Earthquake Fault Zones of California, Southern Region, 2002

3. California Department of Water Resources, Bulletin No. 104 Planned Utilization of the Ground Water Basins of the Coastal Plain of Los Angeles County, 1961

4. Caltrans, Foundation Manual, 1997

5. Caltrans, Seismic Hazard Map, 1996

6. Caltrans, Standard Plans, 2006

7. Caltrans, Standard Specifications, 2006

8. FHWA, Drilled Shafts: Construction Procedures and Design Methods, 1999