State of California
DEPARTMENT OF TRANSPORTATION

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. ABBAS TOURZANI
Senior Bridge Engineer
Office of Bridge Design West
Division of Engineering Services

Date: February 19, 2008

File: 04-SF-101-KP 13.4/15.1
(PM 8.3/9.4)
04-163701
High Viaduct NB & SB
(Bridges No. 34-0157 L/R)
Veterans Off - Ramp
(Bridge No. 34-0159)
Veterans On – Ramp
(SB-101, Bridge No. 34-0160)

From: CAROLINE CHEN CC
Transportation Engineer
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

TUNG NGUYEN TN
Transportation Engineer
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

Subject: Preliminary Foundation Recommendations

INTRODUCTION

This memorandum provides preliminary foundation recommendations for the High Viaduct NB & SB (Bridges No. 34-0157 L/R), Veterans Off – Ramp (Bridge No. 34-0159), and Veterans On – Ramp (SB-101, Bridge No. 34-0160) structures in the City of San Francisco, San Francisco County, based on the advance planning study plan dated December 6, 2006. Bridges number 34-0157 L/R will replace bridge number 34-0019. The proposed High Viaduct NB & SB and Veterans Off - Ramp are six-span bridges, while Veterans On – Ramp (SB-101) is four-span bridge. The proposed structures are part of the project to replace Doyle Drive, a stretch of Highway 101 extending to the southern approach of the Golden Gate Bridge. The existing stretch includes an approximately 1520 foot long high viaduct near the western end, and an approximately 3730 foot long low viaduct at the eastern end.

SITE GEOLOGY AND SUBSURFACE CONDITIONS

General Site Geology

Shallow bedrock of the Franciscan Formation generally underlies the more elevated western areas of the project site. This Formation consists of heavily folded and sheared assemblage of Greywacke Shale Sandstone, Chert, and Serpentine. The overburden soil are made up of artificial fill, slope debris, and ravine fill and or the Colma Formation, which is a unconsolidated fine to medium-grained sand unit with clay beds. The lower elevations on the eastern side reflect an estuarine deposition environment where the bedrock is located at a significant depth. The surficial soil in the eastern side consists of dune and beach sands and soft clayey silt layers. These soils are generally underlain by Colma Formation, which overlies the Franciscan bedrock. The bedrock is exclusively serpentinite west of Station 90+00± and Sandstone/Shale is found east of Stations 90+00±.

In the past, the project site consisted of extensive tidal marsh separated from the Bay by a beach and dunes. The area that extends from the Crissy Field in southerly direction towards Lombard Street and underlies Doyle Drive east of Post Commissary building was filled with hydraulic fill in 1912. The hydraulic fill consists of loose sands with variable amount of silt and clay.

Site Specific Subsurface Conditions

The useful existing information available for the proposed site consists of 27 borings (Borings 2 through 3, Borings 5 through 15, and Borings 17 through 30) conducted in 1933 for the original Presidio Road construction as part of the construction of the Golden Gate Bridge, for the Golden Gate Bridge and Highway District of California. These borings are within the distance of approximately 30 ft north to the proposed northbound High Viaduct. Boring diagram of these borings did not show blow counts or indication of relative density for granular soils or the strength and consistency for cohesive soils. Groundwater was not measured.

Based on Borings 15, 17, and 18, which reached elevations ranging from 68.9 to 9.6 ft, subsurface between proposed Abutment 1 and Bent 2 consists of clay and sand, underlain by shale in the western end and sandstone in the eastern end. Elevation of bedrock surface

slopes up eastward from elevation 9.6 to 72.9 ft. Ground surface slopes up eastward at a slope of about 10%.

Based on Borings 2 and 3, and Borings 5 through 9, which reached elevations ranging from -10 ft to –60 ft, subsurface between proposed Bents 2 and 3 consists of interbedded sand and clay layers. No bedrock was encountered. Groundwater noted by wet or water bearing sand or seepage was indicated in Borings 2, 3, 5, and 7 through 9, at elevations ranging from -7 to 1 ft, or about 20 ft to 40 ft below ground surface. Ground surface in this zone is relatively flat.

Based on borings 10 through 14, and 19 through 30, subsurface between proposed Bent 3 and Abutment 7 consists of clay, sand, and sandy clay, with thickness increasing toward east from approximately 8 ft to 55 ft, underlain by predominantly serpentine bedrock. The serpentine is typically weathered and decomposed near the top, becoming harder with depth. There is some evidence of sandstone and shale underlying the serpentine layer between proposed Bents 4 and 5. The ground surface in this zone slopes down deeply toward east at a slope of approximately 20%. The top of serpentine bedrock slopes down eastward from approximate elevation 140 ft near Abutment 7 to approximate elevation -13 ft near Bent 3.

SCOUR

Scour is not anticipated to be an issue for this site since there is no watercourse running through the site.

CORROSIVITY

The site is anticipated to be corrosive due to its proximity to the San Francisco Bay and the past existence of a tidal marsh. Corrosion samples will be collected from this site during future field investigation, and tested. Sampling and testing of site soils and groundwater shall be in conformance with the Corrosion Guidelines for Foundation Investigations (Caltrans, 2003).

SEISMICITY/LIQUEFACTION POTENTIAL

Hossain Salimi from Office of Geotechnical Design West will provide preliminary seismic recommendations for this structure.

FOUNDATION TYPE RECOMMENDATIONS

Cast-In-Steel-Shell (CISS) piles are feasible choices for the proposed structures, based on the available subsurface information. Driving these types of piles may generate vibration and noise, but may fall within acceptable levels. Suitable corrosion mitigation measures need to be recommended and/or accounted for during final design.

Cast-In-Drilled-Hole (CIDH) piles with diameter 24 inches or larger are another feasible alternative. However, casing may be needed because of the caving potential due to the presence of granular materials at the site located between proposed Bents 2 and 4 and groundwater. Difficulties in construction and anomalies within piles may be anticipated with CIDH piles under such site conditions. But if noise and vibration are of extreme concern, CIDH piles may be considered instead of the CISS.

Concrete driven piles and close-ended pipe piles are not recommended, due to anticipated hard driving/refusal, and the impact on the nearby existing structures and environment caused by potentially excessive noise and vibration during pile driving.

ADDITIONAL FIELD WORK AND LABORATORY TESTING

Further field exploration is needed, specifically rotary wash borings and cone penetration tests. One rotary boring at every support in each direction with exploration depth ranging from 50 to 150 ft is recommended for the bridges. Three of these borings (at least one at the area between Bent 2 and Bent 4) are proposed to install piezometers for groundwater monitoring purpose. Four cone penetration tests to the depth of 100 ft in the median area between northbound and southbound 101 at Bents 2 through 5 are also recommended.

The number, locations, and depth of borings will be adjusted depending on the locations of supports, load demands, and pile/foundation type used in the final design. Soil samples will be collected for corrosion tests and other laboratory tests to obtain soil parameters necessary for foundation design.

The recommendations contained in this report are not final. A request for final recommendations should be made during final project design, and sent to the Office of Geotechnical Design West. Any questions regarding the above recommendations should be directed to the attention of Tung Nguyen at 510-622-1775 or Caroline Chen at 916-227-5386.

c: TPokrywka, WNyaz, CChen, TNguyen, JStayton (4), R.E. Pending File, Route File

CChen/TNguyen/mm