

Memorandum

To: JOSEPH PRATT - MS #5
Office of Structure Foundations
Division of Structures and Foundations

Date: August 17, 2000
File: 11-SD-5-KP R49.2
EA: 11-0301U1

From: DEPARTMENT OF TRANSPORTATION
ENGINEERING SERVICE CENTER
Division of Materials Engineering and Testing Services – MS #5
Office of Testing and Technology Services

Subject: **Corrosion Review for Retaining Wall @ Abutment 5 Left (Widen)**

We have completed our corrosion review of the Retaining Wall @ Abutment 5 Left (Widen) project outlined in a July 19, 2000 memorandum sent to Ramin Rashedi of the Office of Bridge Design C. Our review is based on corrosion test results of soil samples and groundwater samples, summarized information from the Log of test borings, and Caltrans Bridge Design Specifications 8.22 (May 2000 draft).

Project Description

The proposed Retaining Wall @ Abutment 5 Left (Widen) project is part of the Route 5/805 Freeway improvements in San Diego County. The Retaining Wall @ Abutment 5 Left (Widen) project will be located on the northwest end of the Route 5/805 Separation-Widen (Br. No. 57-0512). The Retaining Wall (Standard Type I retaining wall) will be supported either by Standard Type 1 spread footings or pile footings. The pile footings will be supported by [HP250X85 (HP10X57)] Steel H-piles. The Steel H-piles have been designed with an additional thickness of 1.8 mm (0.072 inch) per steel face exposed to soil/water as a corrosion allowance based on a May 16, 2000 conversation with Joe Pratt of the Office of Structure Foundations (OSF).

Corrosion Review

Caltrans defines a corrosive area as an area where the soil and/or water contains more than 500 ppm of chlorides, more than 2000 ppm of sulfates, has a minimum resistivity of less than 1000 ohm-cm, or a pH of 5.5 or less.

Six soil samples were taken at the Retaining Wall @ Abutment 5 Left (Widen) site, the nearby Retaining Wall No. 524 site, and at the nearby Route 5/805 Separation-Widen (Br. No. 57-0512) [Bent 2-Right Side Widen and proposed Bent 7 on the south bank of the Los Penasquitos Channel]. Groundwater at the site was found between elevation +8.84 m and elevation +7.2 m (+29.0 ft. to +23.6 ft.). No samples were taken of the groundwater. However, two samples were taken of the surface water at the Los Penasquitos Channel. The soil and water samples were tested for pH, minimum resistivity, sulfate concentration, and chloride concentration per CTM 417, CTM 422, and CTM 643. The testing results of the soil and water are listed below.

The pH level of the soil ranged from 7.48 to 7.98. The minimum resistivity of the soil ranged from 475 to 746 ohm-cm. The sulfate concentration of the soil ranged from 360 ppm to 6000 ppm, and the chloride concentration of the soil ranged from 150 ppm to 760 ppm.

The pH level of the surface water at Los Penasquitos Channel ranged from 7.4 to 7.6. The minimum resistivity of the surface water at Los Penasquitos Channel was 350 ohm-cm. The sulfate concentration of the surface water at Los Penasquitos Channel ranged from 361 ppm to

434 ppm, and the chloride concentration of the surface water at Los Penasquitos Channel ranged from 746 ppm to 760 ppm.

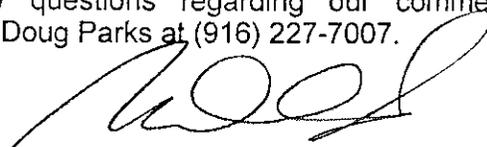
The soil and surface water on-site is corrosive based on high levels of sulfates, high levels of chlorides, and low minimum resistivity levels.

Corrosion Recommendations

In order to maintain a 75-year design life for the retaining walls, we recommend the following corrosion mitigation measures:

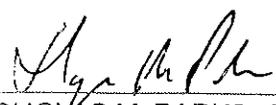
- The minimum requirements for protection of reinforced and unreinforced concrete against acid and sulfate exposure shall be in accordance with Table 8.22.2 of the BDS (May 2000 draft). For footings, pile caps, and walls, the concrete should contain a minimum cementitious material content of 400 kg per cubic meter. Cementitious material shall consist of 75% by mass Type II modified, or Type V portland cement and 25% by mass mineral admixture conforming to ASTM C618 Type F or N (flyash or natural pozzolans). Also, the water-to-cementitious material ratio shall be a maximum of 0.40.
- The minimum requirements for protection of reinforced concrete in chloride environments shall be in accordance with Table 8.22.1 of the BDS (May 2000 draft). For footings, pile caps, and walls, the steel reinforcement shall have a minimum concrete cover of 75 mm (3 inches).
- A 3.8 mm (0.150 inches) minimum sacrificial thickness shall be added to the webs and flanges of the H-piles as a corrosion allowance. The Steel H-piles have already been designed with an additional thickness of 3.6 mm (0.144 inch). The typical corrosion rate used by Caltrans for steel piles exposed to corrosive soil and/or water in the soil embedded zone is 0.0254 mm/yr (0.001 in/yr) per exposed face. The required design life of the structure is 75 years. There are two exposed faces on each of the webs and flanges of the H-piles. Therefore, the sacrificial thickness of steel on the H-piles would be 3.8 mm (0.150 inches), or an additional thickness of 0.2 mm (0.006 inches) to the original design mentioned above.

If you have any questions regarding our comments, please contact Michael Tolin at (916) 227-5297 or Doug Parks at (916) 227-7007.



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