

Memorandum

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

Date: August 18, 2000

File: 11-SD-5-KP 49.2/49.3

EA: 11-0301U1

Retaining Wall Nos. 524 and 525

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 Nos. 524 and 525**

We have completed our corrosion review of the Retaining Wall Nos. 524 and 525 project outlined in a May 8, 2000 memorandum sent to Doug Parks of the Corrosion Technology Branch. Our review is based on corrosion test results of soil 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 Nos. 524 and 525 project is part of the Route 5/805 Freeway improvements in San Diego County. The Wall footprint(s) 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.

Five soil samples were taken at the Retaining Wall Nos. 524 and 525 site and tested for pH, minimum resistivity, sulfate concentration, and chloride concentration per CTM 417, CTM 422, and CTM 643. Groundwater at Retaining Wall No. 524 was found at elevation +8.84 m (+29.0 ft.). Groundwater at Retaining Wall No. 525 was found at elevation +7.77 m (+25.5 ft.). No samples were taken of the groundwater. The corrosiveness of the site is based solely upon soil test results. The results of the soil testing are listed below.

The pH level ranged from 7.48 to 8.27. The minimum resistivity ranged from 475 to 746 ohm-cm. The sulfate concentration ranged from 360 ppm to 6000 ppm, and the chloride concentration ranged from 150 ppm to 760 ppm.

The soil 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.



MICHAEL TOLIN
Transportation Engineer (Civil)
Corrosion Technology Branch

Reviewed By:



DOUGLAS M. PARKS, Chief
Corrosion Technology Branch

c: Rob Reis, Corrosion Technology Branch
Arron Rambach, Corrosion Technology Branch