Naselle River Bridge 101/24

Chemical Sealers As Corrosion Inhibitors

WA-RD 105.1

Post-Construction Report
March 1987

Washington State Department of Transportation
Planning, Research and Public Transportation Division
in cooperation with the
United States Department of Transportation
Federal Highway Administration

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16. ABSTRACT

This Post Construction Report provides an overview of the selection of a chemical sealer and its use as a method of protecting the girders and piles of the Nasell River Bridge from the intrusion of chloride ions. The structure treated is located in a marine environment. Chem-Trete Silane sealer was used for this structure and applied as specified by the manufacture. After 1½ years exposure to a salt environment no deteriation of the concrete has been detected. Monitoring of the structure will continue under Washington State Department of Transportation's Bridge Inspection program.

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CHEMICAL SEALERS AS CORROSION INHIBITORS

Naselle River Bridge 101/24

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Post-Construction Report

Experimental Feature WA 82-02

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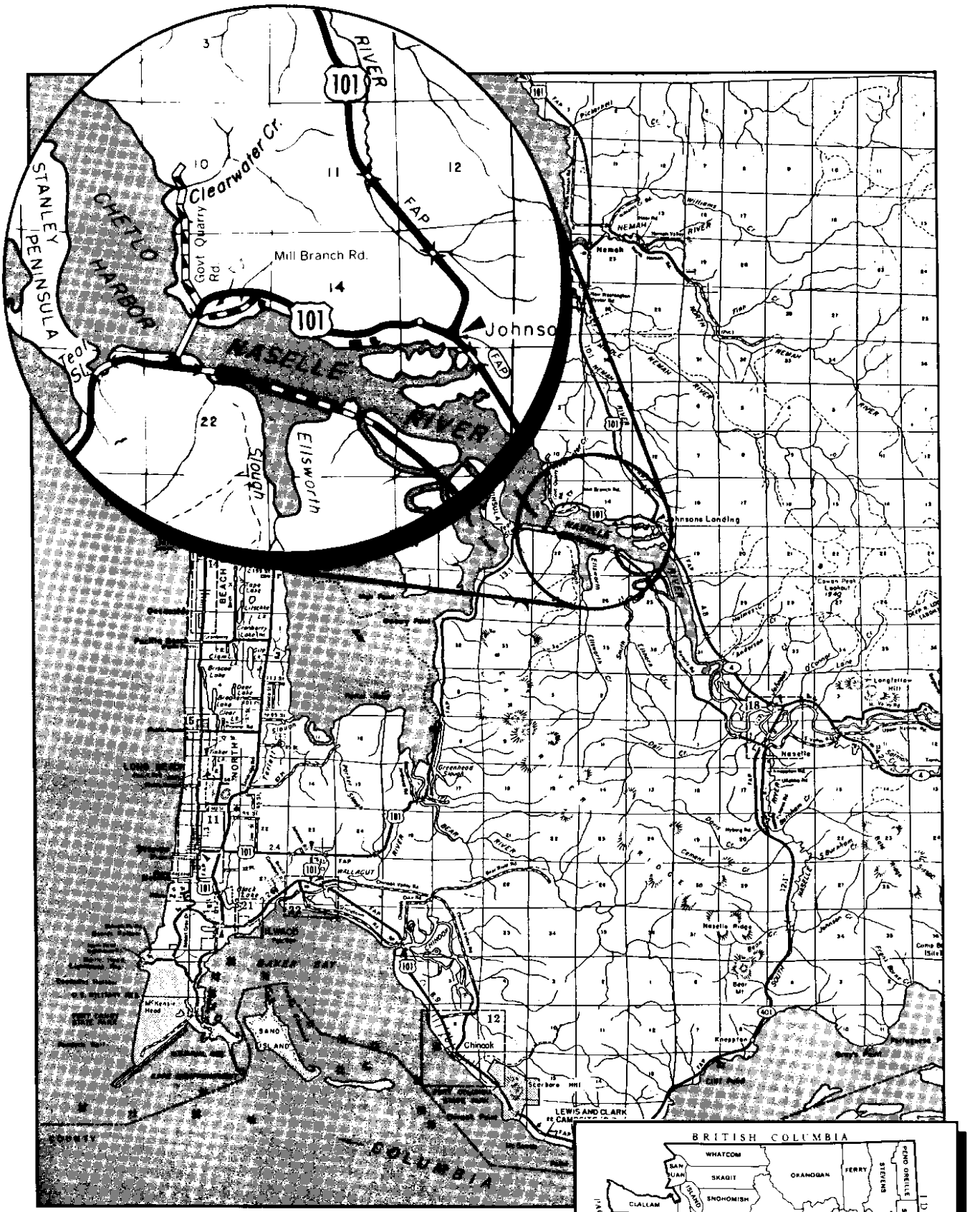

Vicinity Map

Naselle River Bridge 101/24

Purpose:

The Washington State Department of Transportation (WSDOT), in search of a method for protecting concrete structures from the intrusion of chloride ions, identified the following chemical sealers from laboratory tested sealers reported in NCHRP Publication No. 244 as being the most effective in providing a chloride ion barrier:

- Chem-Trete Silane
- EA Sealer
- Penetrating Sealer 1854

This experimental project was designed to provide field experience and an evaluation of the method of application and the effectiveness of one of the above sealers on newly constructed bridge girders and piles. Chem-Trete Silane was selected based on its excellent penetration and superior chloride ion barrier characteristics as reported in the NCHRP report.

Description:

The Naselle River Bridge (101/24) was selected as an appropriate structure for the chemical seal experiment due to its marine environment location. The bridge is located on

State Route 101, five miles north of the town of Naselle (see vicinity map).

In addition to specified corrosion protection measures of expoy coating all the reinforcing steel in both cast-in-place (CIP) concrete members and the prestressed girders and piles, all units were to receive a chemical seal surface treatment. The surface treatment was to be placed after the removal of the surface laitance by light sandblasting. Manufacture's specifications and rates of application were to be followed during the placement of the sealer. The sealer was to be applied down to elevation -15.0' on the precast prestressed piles and only to exposed areas of the girder and piles that were not encased in CIP concrete.

Chem-Trete Silane, (Alkyl-Alkoxy Silane) sealer, manufactured by Dynait-Nobel, Moutville, N.J., was selected for this structure. This sealer was to be applied in one coat as specified by the manufacture, following proper caring of the concrete, and the removal of the surface laitance.

The preparation of the concrete surface, application method and rate of application, workability of the sealer, uniformity of appearance and problems were monitored for post construction reporting.

Construction Summary

The precast components of the structure were constructed by Concrete Technology, Tacoma, Washington. The Chem-Trete Silane was applied by Global Spraying at the Concrete Technology construction site after the concrete was properly cured. Prior to the sand blasting to remove surface laitance, the WSDOT Bridge Construction Engineer directed the prime contractor to conduct a test application of the Chem-Trete Silane, without surface preparation, to determine the rate of application and sealer penetration. As a result of this test, it was determined that the manufacture's specified coverage and penetration could be achieved without sandblasting by applying multiple coats of the sealer. A change order was issued to delete sandblasting from the contract specifications. Based on the test results the contractor applied two coats of sealer at a rate of 150 sq. ft. per gallon. This coverage was equal to that specified by the manufacture (125 - 175 sq. ft./2 gal.). The sealer was sprayed on the girders and piles during dry and light misty rain conditions. The spraying was discontinued during heavier showers. Due to weather conditions it took over two months to complete the spraying.

The Chem-Trete Silane Sealer appeared to be applied uniformly on all girders and piles. This was difficult to determine as the sealer is clear and cannot be seen after it

drys. The addition of colored pigment would make the sealer more visible and provide for easier inspection.

The unit cost for the sealer and the spraying in place was $4.50/square yard. There were approximately 22,450 square yards covered.

Tests and Evaluations

The spraying of the Chem-Trete Silane Sealer was inspected to ensure that manufacture's specifications were met. The WSDOT Materials Laboratory conducted electrical resistivity tests on the treated beams. Numerous tests were performed and each revealed that there was no apparent barrier between the reinforcing steel and the copper plate used in the resistivity test. It was noted that the low range of the readings, 600 to 1500 ohms, seemed to indicate that the passage of electricity was enhanced by the Chem-Trete Silane.

The electrical resistivity test did not indicate that the Chem-Trete coating provided a waterproof membrane, but this does not necessarily mean that the coating will not prevent the ingress of chloride salts. As the manufacture's literature points out, the Chem-Trete coating is not a barrier to water vapor. The electrical resistivity test, in

this case, was not a good test method to measure the effectiveness of this type of sealer.

To date, there has been no noticeable signs of deterioration due to the penetration of chloride ions. The structure has been exposed to the marine environment for over one and a half years. Continued evaluation will be done as part of WSDOT's bridge inspection program.

Conclusions

1. Chem-Trete Silance can be applied by spraying, to comply with manufacture's specification by using two coats.

2. Removal of surface laitance is not required prior to applying the silane sealer, provided two or more coats are applied.

3. This sealer is clear when applied and drys to the same color as the concrete.

4. The unit cost for placement of the sealer was $4.50/square yard.

5. Electrical resistivity test does not provide information on the sealer's ability to ward off chloride ions.

6. After one and a half years in a marine environment, the Naselle River Bridge (10/24) showed no sign of deterioration caused by chloride ion penetration to the reinforcing steel.

Recommendations

1. A colored pigment added to the Chem-Trete Silane Sealer would make it easier to inspect for proper coverage.

2. The electrical resistivity test should not be used as a test method for Chem-Trete Silane.

3. A field test method should be developed for measuring the ability of sealants to prevent the intrusion of chloride ions into concrete.

4. Naselle River Bridge should be inspected annually and reported to the Washington State Department of Transportation Materials Laboratory for follow up analysis.

5. Future application of Chem-Trete Silane Sealer or other similar sealers should be monitored as experimental features to provide additional data on their effectiveness.