Chemical Sealers as Corrosion Inhibitors

Naselle River Bridge 101/24
WA-RD 302.1

Final Report
February 1993

Washington State Department of Transportation
Washington State Transportation Commission
Transit, Research, and Intermodal Planning (TRIP) Division
Department of Transportation in cooperation with
U.S. Department of Transportation
Federal Highway Administration
Chem-Trete Silane sealer was applied to the prestressed girders and precast piles of the newly constructed Naselle River Bridge 101/24 in Washington State in 1984. The purpose of the experiment was to gain experience with the use of the product and to measure its effectiveness over time in preventing the intrusion of chlorides into prestressed concrete girders and precast concrete piles in marine environments.

Recent rapid chloride permeability tests and chloride testing indicate that this sealer has had little or no effect on reducing the intrusion of chlorides into the concrete.
The contents of this report reflect the view of the author(s) who is (are) responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Washington State Transportation Commission, Department of Transportation, or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.
# Table Of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vicinity Map</td>
<td>1</td>
</tr>
<tr>
<td>Introduction</td>
<td>2</td>
</tr>
<tr>
<td>Study Site</td>
<td>2</td>
</tr>
<tr>
<td>Tests And Evaluations</td>
<td>3</td>
</tr>
<tr>
<td>Conclusions</td>
<td>4</td>
</tr>
<tr>
<td>Recommendations</td>
<td>4</td>
</tr>
<tr>
<td>Appendix A - Testing</td>
<td>5</td>
</tr>
<tr>
<td>Appendix B - General Layout</td>
<td>12</td>
</tr>
<tr>
<td>Appendix C - Testing Photos</td>
<td>15</td>
</tr>
</tbody>
</table>
Introduction

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. The contract specifications allowed the use of any of these three sealers. Chem-Trete was selected by the contractor.

Study Site

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).

Chem-Trete Silane sealer, manufactured by Dynanit-Nobel, Montville, NJ, was selected for this structure. This sealer was applied to the concrete in multiple
coats, as required to obtain the application rate recommended by the manufacturer.

The sealer was applied in 1984 under WSDOT Contract No. C2641. 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.


Tests and Evaluations

No control girders or piles were provided in this experimental project. Therefore, all field sampling had to be done on prestressed girders and precast piles that were treated with the silane sealer.

Core samples were taken in the field for permeability testing in the lab. The prestressed girder web of the south outside girder of Span 1 was selected because of its ease of accessibility from dry land. Four core samples were taken from the web of this girder. Also, eight chloride powder samples were taken from this girder.

It would have been desirable to take core samples from the columns of the piers for permeability testing, but the pneumatic suction devices for holding the core drill to the concrete will function only on flat surfaces. Therefore, the only field
sampling available was chloride sampling. Chloride samples were taken from the three columns of Pier 2. Two samples per column were taken, one above tide level and one below tide level, for a total of six samples at the pier.

The rapid chloride permeability test results are compatible with those for a high quality concrete exposed to a saltwater environment for eight years, but not one treated with a moisture intrusion protection system. The chloride content of the samples below the tide mark is extremely high, indicating that the protection system is not preventing the intrusion of chlorides. See Appendix A for complete test results.

Conclusions

The results of the testing indicate that the silane sealer has been ineffective at preventing the intrusion of chlorides into the concrete.

Recommendations

An attempt was made to contact the manufacturer of the product to obtain their evaluation and conclusions on the results of the Department's test data. The manufacturer could not be located at the address shown during the construction year or at any forwarding address.

Based upon the test results, it is recommended that this product not be used by WSDOT as a protective sealer on reinforced concrete structures.
Appendix A
Testing
DATE: Oct. 15, 1992

FROM: R. G. Finkle/Bob Allison
PHONE: Scan 234-4664

SUBJECT: Naselle River Bridge
Silane Sealer Testing

TO: A. H. Walley/O. R. George

Per your request we obtained 4 concrete core samples to
determine chloride permeability and 8 powder samples to
determine chloride content from Span 1 Girder E on the
subject bridge. Additionally, 6 chloride samples were
taken from the columns at pier 1. The results are at-
tached.

The samples on test report Lab #CL-4051 were taken from
the columns. The odd numbered samples being taken below
the high tide mark and the even numbered samples above
the high tide mark. The "A" designation represents a
sample taken from Ø" to 3/4" depth and the "B" repre-
sents a sample taken from 3/4" to 1-1/2" depth. Samples
on Lab #CL-4052 were taken on the girder at the ap-
proximate same locations as the permeability cores. The
"A" and "B" samples were taken on the outside of the
girder and the "C" and "D" samples were taken on the in-
side (non-exposed side) of the girder. Note that chlo-
ride content below the tide mark is extremely high.

The rapid chloride permeability test results shows num-
bers that you would typically expect of a high quality
concrete, but certainly not one treated with some sort
of moisture intrusion protection.

My conclusion is the stuff didn’t work.

REA
WASHINGT0N STATE DEPARTMENT OF TRANSPORTATION - MATERIALS LABORATORY
PO Box 167 Olympia/ 1655 S 2nd Ave Tumwater/ WA 98504

Chemistry Section

Test of: Chlorides
Date Logged In: 08/21/92
Date Logged Out: 101/24
Group: 101
Section: NASELLE R. BR.

Bridge Number: 101/24
Bridge Name: NASELLE R. BR.
Number of Samples: 12

*** Test report attached ***

Materials File X General File X Material: INFORMATIONAL
District Administrator: 4

Project Engineer: ALLISON
Chem Lab: X
Bridge: X

Rodney G. Finkle, P.E.
Materials Engineer
by: C. L. Sherrell RLS
Date: 09/25/92 Telephone 234-7064
<table>
<thead>
<tr>
<th>Sample</th>
<th>Station</th>
<th>Offset</th>
<th>Chloride</th>
<th>Asphalt</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td></td>
<td>53.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1B</td>
<td></td>
<td>22.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2A</td>
<td></td>
<td>6.21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2B</td>
<td></td>
<td>.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3A</td>
<td></td>
<td>11.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3B</td>
<td></td>
<td>3.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4A</td>
<td></td>
<td>11.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4B</td>
<td></td>
<td>2.41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5A</td>
<td></td>
<td>30.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5B</td>
<td></td>
<td>21.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6A</td>
<td></td>
<td>10.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6B</td>
<td></td>
<td>2.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Test of: Chlorides  Lab. No: CL-04052
Date Logged In: 08/21/92  Lab ID No: 0000028741
Date Logged Out:  District: 4
SR: 101
Section: NASELLE R. BR.

Bridge Number: 101/24
Bridge Name: NASELLE R. BR.
Number of samples: 8

*** Test report attached ***

<table>
<thead>
<tr>
<th>Mat. File</th>
<th>General File</th>
<th>Material: INFORMATIONAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dist Administrator: 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Project Engineer:  
  ALLION  | X(2) |
| Chem Lab: X |
| Bridge: X |

0132  T282-16
1210-  
12K9-  

Rodney G. Finkle, P.E.
Materials Engineer
by: C. L. Sherrell CLS
Date 10/08/92  Telephone 234-7064
<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>STATION</th>
<th>OFFSET</th>
<th>CHLORIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td></td>
<td>.29</td>
<td></td>
</tr>
<tr>
<td>1B</td>
<td></td>
<td>.27</td>
<td></td>
</tr>
<tr>
<td>1C</td>
<td></td>
<td>.21</td>
<td></td>
</tr>
<tr>
<td>1D</td>
<td></td>
<td>.17</td>
<td></td>
</tr>
<tr>
<td>2A</td>
<td></td>
<td>.51</td>
<td></td>
</tr>
<tr>
<td>2B</td>
<td></td>
<td>1.02</td>
<td></td>
</tr>
<tr>
<td>2C</td>
<td></td>
<td>.2</td>
<td></td>
</tr>
<tr>
<td>2D</td>
<td></td>
<td>.19</td>
<td></td>
</tr>
<tr>
<td>3A</td>
<td></td>
<td>.34</td>
<td></td>
</tr>
<tr>
<td>3B</td>
<td></td>
<td>.35</td>
<td></td>
</tr>
<tr>
<td>3C</td>
<td></td>
<td>.27</td>
<td></td>
</tr>
<tr>
<td>3D</td>
<td></td>
<td>.31</td>
<td></td>
</tr>
<tr>
<td>4A</td>
<td></td>
<td>.25</td>
<td></td>
</tr>
<tr>
<td>4B</td>
<td></td>
<td>.22</td>
<td></td>
</tr>
<tr>
<td>4C</td>
<td></td>
<td>.05</td>
<td></td>
</tr>
<tr>
<td>4D</td>
<td></td>
<td>.29</td>
<td></td>
</tr>
</tbody>
</table>

---

**Matls.**

**General**

**Proj Eng.**

**Chem Lab.**

PAGE 1 OF 1

Rodney G. Finkla, P.E.

Materials Engineer

C.L. Sherrell

DATE 10-02-1992
SAMPLE TRANSMITTAL
ACCEPTANCE/ASSURANCE/INDEPENDENT ASSURANCE

Material: PCC Cores
Contract No: MS 1654

Acceptance Sample No: 1
Assurance Sample No: 1

Brand: H-4
Heat No.:
Section: Nacelle, R. Br.
County: Pacific

Test No: H-9118, H-9119, H-9120 & H-9121

Special Projects:
Date: 8/14/92

REMARKS:
Mix Design Desired: Yes
Run Rapid Chloride Permeability on both ends of cores

TEST OF Rapid Chloride Permeability
Coulombs

M-9118
Top = 1,713
Bottom = 2,463

M-9119
Top = 2,060
Bottom = 2,014

M-9120
Top = 1,623
Bottom =

M-9121
Top = 1,908
Bottom = 2,152

Distribution of Report
Marl Files
Gen'l Files
Dist. Admin.
Proj. Engr.
Phys. Testing
Chem. Lab.

Material: Informational

ROONEY G. FINKLE, P.E.
MATERIALS ENGINEER

Date: AUG 18, 1997

By: LCH

DOT FORM 350-034
Revised 10/83
Appendix B
General Layout
Appendix C
Testing Photographs
Column Chloride Sampling
at Pier 2

Core Drilling the Web of
Span 1 South Outside Prestressed Girder