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RESEARCH UPDATE

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Field Evaluation Of A Corrosion Inhibiting Deicer
(Final Report)

REFERENCE: Initial Report 90-1

HISTORY:

In 1988, an 8.5 mile section of Vermont Route 14 near Irasburg was selected for experimental application of a corrosion inhibiting deicer. This product, DOMTAR TCI, was added to conventional rock salt used in winter road maintenance. The product is supposed to inhibit the corrosion-causing chemical reaction between chlorides in the road salt and reinforcing steel in the bridge deck.

From the three bridges located within the test area, Bridge 124 was selected for study because it had a bare concrete deck which facilitated testing. Baseline rates of corrosion and corrosion potential measurements were taken in November 1988.

The DOMTAR TCI treated salt was applied during the winter and spring of 1988-89. Corrosion testing in the spring of 1989 indicated much higher rates of corrosion (double the baseline values). As testing continued through the summer, corrosion rates on the southbound lane began decreasing and by fall, had dropped below the baseline value. In the northbound lane, corrosion rates showed a slight decrease from the spring readings.

The preliminary report contained an initial conclusion indicating that the product seemed to be working in the southbound lane, and that further study was required to determine the cause of the differing results between the two lanes. Possible factors included difference in rebar depth, concrete permeability and cement content.

The key difference between the results in the two lanes was thought to be due to the depth of concrete over the reinforcing steel; in the northbound lane it was 1-3/4", and in the southbound lane it was 2-1/2". Chloride concentration decreases with depth, and presumably the shallower rebar would be more susceptible to corrosion. The DOMTAR TCI probably was not present in high enough concentration to make up for the increase in free chloride ions, according to the manufacturer.

STATUS:

The treated salt was applied again during the winter and spring of 1989-90. Tests in April, 1990 indicated that the corrosion rates in the northbound lane had risen to almost triple the baseline values, while the southbound rates still measured below the baseline.

Increasing concern about the validity of the test results led to a check of the test circuit. Measurements taken in June 1990, revealed a problem

with the ground pin in the southbound lane. Oxidation of the pin had created added resistance in the circuit and had affected previous corrosion measurements. When a new ground connection was used, the values were found to be similar to those in the northbound lane. Thus, the sharp drop in corrosion rate values between the spring and fall of 1989 was probably due to the faulty connection and not to the success of the product.

Core sample tests showed little difference between the concrete in the north and southbound lanes. High chloride contents were found above and below the rebar level in both lanes, while tests for phosphorus content indicated that the DOMTAR TCI had not penetrated below 3/8 of an inch.

It was still assumed that low concentration of the product was the reason for the lack of success in the winter applications. It was then suggested that a section of the bridge be sprayed with a saturated solution of monofluorophosphate (MFP), the corrosion inhibiting agent found in DOMTAR TCI.

In July 1990, a saturated (+/-30%) MFP solution was applied to a section of the southbound lane. The deck had received no rain for 48 hours, and should have been dry enough to soak up the solution. Approximately 9 gallons were sprayed over the 25' by 13.5' section. The solution formed a slippery film on the surface, which was still wet after three hours. Plain water dried in 10 minutes. The section was then sanded and reopened to traffic.

In laboratory tests conducted in August 1990, a 30% MFP solution took about five hours to dry, but left the concrete surface coated with a white powder, which was assumed to be MFP.

Following the laboratory testing, an application of 10% MFP solution was tried on the bridge, again with no apparent saturation.

Due to the apparent lack of success, the testing program was discontinued and treated salt was not used during the 1990-1991 winter season.

CONCLUSION:

Initial indications that the product was working on a portion of the bridge have been attributed to a faulty ground connection.

In order to inhibit corrosion, the product must penetrate the concrete and interact with the chloride ions in the vicinity of the reinforcing steel. While DOMTAR TCI may inhibit corrosion in some laboratory settings, it did not effectively penetrate the concrete bridge deck in this test, and therefore did not inhibit corrosion in the reinforcing steel.

This product is not recommended for use as a corrosion inhibiting deicer.

FOLLOW UP:

The bridge under study in this field trial was rehabilitated during the 1991 construction season. No further testing is expected.

Distribution A,B,C,D,E,F,G