Florida Department of Transportation Research

Corrosion Prevention of Bridge Tendons Using Flexible Filler Materials

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Current Situation

Florida's humid and coastal environments present special challenges to transportation structures which use a combination of steel and concrete, either in steel-reinforced concrete or in tensioning cables. Preventing corrosion from damaging the steel in these structures is a subject of ongoing study and innovation. For example, once in place, the ducts that contain steel tensioning cables are filled with grout, but for a few decades, flexible fillers such as greases or waxes have been used in Europe as an alternative to grout. The Florida Department of Transportation (FDOT) is implementing the use of flexible fillers, and a better understanding of their behavior in Florida environments is needed.

The sinuous Lyons Bridge in Stuart, FL, is a segmental bridges that relies on post-tensioning cables.

Research Objectives

Florida Atlantic University researchers examined the corrosion resistance of five flexible fillers under a variety of exposure conditions and when the fillers were contaminated with fungi.

Project Activities

The researchers used five waxes as flexible fillers: Fill-Flex (Trenton Corp.), Cirinject CP (Civetea SARL), Nontribos VZ Inject (Gähringer GmbH & Co.), NO-OX-ID-NG (Sanchem, Inc.), and Visconorust-2090-P (Sonneborn LLC). The first two are already on the FDOT Approved Products List; the others meet the standards for flexible filler outlined in the FDOT Structures Manual, Section 938.

The five fillers were used in a wide range of tests to determine their ability to prevent corrosion. The basic sample for all tests was seven-wire tensioning strand, tested as separated wire, as intact strand, and in multiple-strand ducts. Sample length ranged from a few inches to four feet, depending on the specific test. Samples were both cold-coated and hot coated with flexible filler. They were exposed indoors and outdoors, with partial exposure and sealed, in natural and elevated humidity, at two temperatures (22°C/72°F and 32°C/90°F). Filler-coated metal samples were also tested by exposure to three types of fungi, both separately and in a mixture of all three. Exposure periods lasted from days to a year. An electrochemical cell was also used to test the resistance of the flexible fillers to corrosion.

Wire and strand samples were examined visually after exposure. They were then cleaned to remove the wax and further cleaned with an acid solution. Samples were examined for corrosion with a stereomicroscope and with scanning electron microscopy.

The researchers carefully documented differences among the filler products' ability to prevent corrosion with respect to the many treatments. Based on their observations, they made recommendations for the installation of the flexible fillers that can help to prevent corrosion.

Project Benefits

Flexible fillers offer an important alternative in constructing post-tensioned structures. Better knowledge of the available products and proper installation techniques can help assure longer service life and lower maintenance for these structures.

For more information, please see www.fdot.gov/research/.