Florida Department of Transportation Research

Early Warning Corrosion Detection in Post Tensioned Tendons

BD544-08

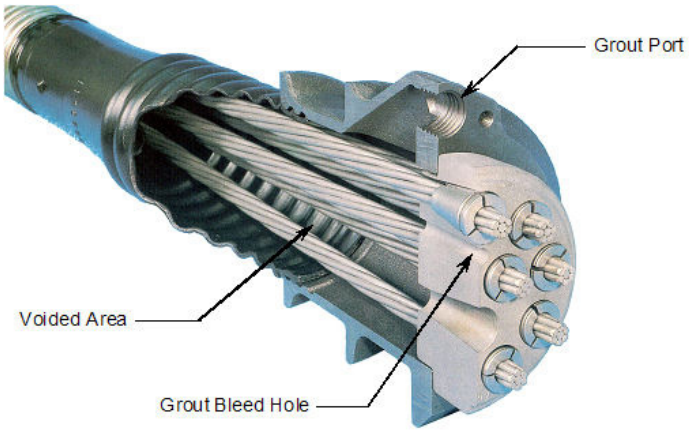
Steel post-tensioned tendons provide strength and stability to bridges constructed of pre-cast segments. The tendons in bridges built over salt water areas sometimes develop corrosion. Corrosion can cause the tendons to fail, thereby weakening the bridges and shortening their service life. FDOT has a tendon inspection program, but examining the thousands of tendons on each bridge is costly and time-consuming. To improve the inspection process, researchers at the University of South Florida studied several non-intrusive corrosion detection methods that have potential to provide reliable, cost-effective remote evaluation of multiple tendon locations within a bridge.

Post-tensioned tendons are constructed of bundled steel strands that are placed inside a conduit and encased in grout that is pumped into the conduit. The grout is intended to protect the strands from their environment. However, cement and water in the grout can separate, resulting in voids at or near the tendon anchors. When these voids occur, they initially contain water, and eventually air. Corrosion can begin in both the water- and air-filled voids, and in the grout around them.

The researchers studied the ability of several detection methods to identify probable corrosion at voids in the tendons. They evaluated electrochemical noise (EN) monitoring and electric resistance (ER) probes, and linear polarization resistance (LPR) and electrochemical impedance spectroscopy (EIS) techniques.

The study results showed that the EN probe was able to detect corrosion only in one of two types of grout examined. In contrast, the EIS and LPR methods reliably detected corrosion in both grouts. The LPR method, in particular, showed good potential for practical implementation. The ER probe proved to be a promising method for detecting air-space corrosion.

The researchers developed nine conceptual designs for field implementation of the EIS,LPR and ER methods. The two designs that appear to possess the best combination of features and ease of operation are being further developed.



Cutaway view of a post tension anchor
Image credit: DYWIDAG-Systems International

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For more information, visit: http://www.dot.state.fl.us/research-center.