Florida Department of Transportation Research

Inspection of Flexible Filler Tendons

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Project Number
BE932

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Current Situation

Historically, the Florida Department of Transportation (FDOT) used cementitious grouts (CG) in post-tensioning (PT) duct systems to provide corrosion protection and bond tendons to the surrounding concrete. However, CG systems often encountered issues like voids or bleed water segregation, leading to corrosion. Although FDOT now also uses flexible filler systems, which provide a protective barrier without bonding, detecting corrosion early on remains a challenge.

If FDOT had effective tools to monitor the condition of bridge tendons, it could save costs towards corrosion mitigation and extend the service life of PT bridges.

Testing setup for small-scale 50-kHz and 500-kHz testing on block specimens.

Research Objectives

The objective of this research was to develop an inspection protocol for post-tensioning (PT) ducts that rely on flexible filler materials for corrosion protection in bridge applications. Key priorities for this project also included identifying non-destructive evaluation (NDE) methods for identifying micro-cracking and assessing stress levels in concrete, and non-invasive NDE methods for identifying corrosion in tendons and anchorages.

Project Activities

The Embry-Riddle Aeronautical research team thoroughly reviewed existing inspection protocols for bonded systems with CG, focusing on non-invasive NDE methods like ultrasound coda-wave interferometry, thermoelasticity, and radiography for anchorage cap imaging. The team then performed proof-of-concept testing at the university's laboratory to evaluate the techniques on small-scale specimens.

The project also included large-scale testing at FDOT's Structures Lab in Tallahassee to further evaluate ultrasound interferometry during post-tensioning and four-point bending tests.

Project Conclusions and Benefits

This project concluded that ultrasound coda-wave interferometry was a promising method for inspecting PT systems with flexible fillers. This method can detect early signs of damage, including stress changes and micro-cracking, well before they become visible. Radiography was also effective in identifying specific issues at anchorages and tendons. These findings will help FDOT improve its inspection protocols, allowing for earlier detection of tendon issues, which could prevent costly repairs and extend the lifespan of bridges. By adopting these advanced NDE methods, FDOT can enhance the safety and durability of PT structures.

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