# Florida Department of Transportation Research

Improved Inspection Techniques for Steel Prestressing/Post Tensioning Strand
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Post-tensioned concrete has been widely used for over 50 years. The first Sunshine Skyway Bridge, built in 1954, was one of the earliest structures in the U.S. to incorporate post-tensioned elements; its replacement also uses the technology. Post-tensioning has many advantages; for example, it allows longer, lighter spans. But this technique also has vulnerabilities, especially corrosion of cables or anchors, exacerbated by Florida's hot, humid, often salty environment. Though failed tensioning components have never led to significant public safety concerns, the Florida Department of Transportation (FDOT), through its research program, continually seeks better methods of installation, inspection, and maintenance of post-tensioned structures.

*In this cross-section of a post-tensioning duct, clusters of tensioning strands can be seen scattered throughout, surrounded by grout. Grout condition varies from intact (left), to decaying (outlined gray areas; middle), to decayed (right), where voids and corroded tendons are visible.*

Transportation structures in Florida are inspected regularly, but post-tensioned structures can present some special challenges to inspectors. Internal tensioning components are hidden by solid concrete while external components are often obscured by structural elements. Structures, by their nature, can be difficult to inspect. For example, the undersides of highly elevated and lengthy concrete spans are difficult to access. As new technologies for inspection become available, they offer new opportunities for inspection and evaluation.

In this project, researchers from Florida International University surveyed all available means for nondestructive testing and evaluation of post-tensioned concrete, with the goal of producing a guide for condition assessment.

The researchers grouped methods into several categories by component issues. For tendon and cable, these included detecting breaks and cross-sectional loss, detecting active corrosion, and characterizing in situ tension force; for ducts, detecting improper grout condition and characterizing duct location or condition. Specific methods employed a wide variety of techniques, such as acoustic emission, ultrasonic imaging, x-ray diffraction, electrochemical noise, thermography, and others. Each method was characterized, and applications were presented.

Having identified nondestructive methods and their properties, the next step for the researchers was to assess advantages and disadvantages of each method and to develop a protocol for determining the most appropriate method depending on specific evaluation tasks. For example, tensioning systems may be categorized by several features, such as whether the system was installed before 2000, when different construction materials and practices were used than in more recent bridges, or the system's duct material or specific geometry.

Based on their findings, the researchers drafted a guide for evaluating post-tensioned bridge elements. With this guide, bridge inspections can be more efficient and more effective, helping to ensure better maintenance and more timely repair of some of the most heavily used and safety-critical structures in the state.

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