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NCHRP NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

FOCUS ON: NCHRP Research Report 848

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New Guidelines for NDE Bridge Inspection Methods

Image courtesy of C. Frank Starmer (CC BY-NC-SA 2.5)

Stay cable bridges like the Ravenel Bridge in Charleston, South Carolina, contain steel cables enclosed in opaque ducts and anchored in concrete. NDE technologies let inspectors examine the enclosed cables for signs of corrosion and other problems.

REAL-WORLD NEED

Transportation agencies regularly inspect bridges to ensure public safety and identify structural damage early, when it can be repaired at the lowest possible cost. However, post-tensioned (PT) girder bridges and stay cable bridges pose serious challenges to inspectors. Because the steel tendons used as the primary structural support in these bridges are typically embedded in massive concrete (internal tendons) or opaque ducts (external tendons or stay cables), the tendons are difficult to access. Consequently, both PT and stay cable bridges would benefit from non-destructive evaluation (NDE) techniques for bridge inspection that can be performed without drilling or other invasive methods. While NDE techniques have undergone significant development in recent years, they are not commonly used for PT bridges, and agencies often lack information about the techniques' strengths and limitations.

RESEARCH SOLUTION

To evaluate the effectiveness of NDE methods for detecting defects in PT and stay cable bridges, researchers invited NDE technology companies to use their products to inspect several specimens constructed with various defects, including strand corrosion, strand section loss, compromised grout, and water infiltration. Using the results of those inspections, along with factors such as cost and ease of use, the researchers developed inspection guidelines to help agencies select NDE technologies for PT tendons and cable stays based on their needs and resources.

NEXT STEPS
Put It into Practice

LEARN MORE

Review the upcoming TRB webinar on *NCHRP Research Report 848.*

EVALUATE

Use the report's flowcharts and decision matrix to help identify NDE methods that could benefit your agency.

VALIDATE

When choosing an NDE technology, use the test results in this report to help evaluate manufacturers' claims about their products' effectiveness.

PUBLICIZE

Communicate the availability and value of NDE inspection to local agencies in your state. Encourage them to use the technology in appropriate situations.

PARTNER

Apply for NCHRP implementation funding. See trb.org/nchrp.

About the Research

RESEARCH STRATEGY

Investigators began by constructing a PT girder specimen with both internal and external tendons, as well as four stay cable specimens. Each specimen was built with a different type of sheathing and corrosion protection system, and each included several kinds of defects—such as strand corrosion, strand section loss, compromised grout, and water infiltration—in a variety of locations. The investigators then invited several NDE technology companies to use their products to inspect the specimens and locate and identify the defects. From the inspection results, the researchers determined how effectively each product was able to detect the different types of defects.

WHAT WE LEARNED

This project tested 13 NDE technologies, including technologies based on electromagnetic, magnetic, mechanical wave, visual, and electrochemical methods, as well as five combinations of methods. In addition to evaluating detection performance, researchers compared factors such as ease of use and equipment and inspection costs. While no NDE technology was found to be a "silver bullet" ideal in all situations, the researchers used the test results to develop a decision matrix that can help agencies select NDE methods based on their specific needs.

WHY IT MATTERS

NDE technologies can identify deterioration in PT girder and stay cable bridges at an earlier stage than visual inspection alone. With early warning of problems, bridge owners can take timely, proactive steps to prevent further deterioration and unanticipated failure of the post-tensioning and stay cable systems, enhancing safety and minimizing the need for costly rehabilitation. By helping bridge owners select the most appropriate NDE methods, the inspection guidelines may be able to help more agencies make use of these valuable technologies.

Researchers immersed steel tendons in an electrically charged acid bath to induce corrosion, then incorporated the corroded strands into the test specimens.

RESOURCES

Images on this page from NCHRP Research Report 848

NCHRP PROJECT 14-28

FINAL PRODUCTS

NCHRP Research Report 848: Inspection Guidelines for Bridge Post-Tensioning and Stay Cable Systems Using NDE Methods
trb.org/Main/Blurbs/176001.aspx

Contractor's final report
onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP14-28_FR.pdf

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ADDITIONAL RESOURCES

TRB webinar (planned for 2017)
trb.org/ElectronicSessions/RecordedSessions.aspx

Validation of Nondestructive Testing Equipment for Concrete, Florida DOT report
fdot.gov/research/completed_proj/summary_smo/fdot_bd545-80_rpt.pdf

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