



SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

PennDOT's Use of Nondestructive Testing Solutions

2016 NASTO Conference
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June 6, 2016




 U.S. Department of Transportation
Federal Highway Administration

 AMERICAN ASSOCIATION
OF STATE HIGHWAY AND
TRANSPORTATION OFFICIALS
AASHIO

PennDOT Overview

PennDOT's 11 engineering districts are directly responsible for nearly 40,000 miles of roadway and roughly 25,000 bridges.

- 12,000 employees
- Annual budget of more than \$7 billion in state/federal funds
- Also oversees public transportation, airports, railroads, ports and waterways



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PennDOT and SHRP2

Of the 15 SHRP2 solutions employed by PennDOT, three focus on Nondestructive Testing (NDT):

1. NDT for Tunnel Linings (R06G)
2. Tools to Improve PCC Pavement Smoothness during Construction (R06E)
3. NDT for Concrete Bridge Decks (R06A)

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How Does NDT Relate to Safety?

- Safer testing methods for inspectors.
- Safer roads for drivers due to fewer lane closures.
- Safer (and in many cases shorter) work zones for PennDOT employee/contractors.
- Ultimately safer bridges and tunnels due to better detection devices.
- Issues and concerns can be identified earlier and repairs made more quickly.

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NDT for Tunnel Linings (R06G)

- PennDOT is one of two states participating in the FHWA/AASHTO Implementation Assistance Program.
- PennDOT owns 5 tunnels; Turnpike Authority has 5; local municipalities own 9; many on major interstates and commuter roadways.
- As part of the early SHRP2 research, helped evaluate multiple NDT methods to detect deterioration in concrete tunnel linings.
- Looked at air-coupled ground-penetrating radar (GPR), Infrared Thermography (IRT), laser scanning, and video recording; compared and contrasted with traditional methods

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NDT for Tunnel Linings (R06G)

Liberty and Armstrong Tunnels, downtown Pittsburgh, PA



Images courtesy of Google and Wikipedia

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NDT for Tunnel Linings (R06G)

Outcomes/Lessons Learned:

- Limitations include cost, accuracy of information, and need for suitable types of tunnel.
- NDT methods were at least 25-50% more expensive than traditional inspection.
- NDT corresponded reasonably well vs. hand sounding, discrepancies were found in delamination and spall quantities. Some level of physical inspection is required regardless of method.
- GPR cannot be used on steel liners or on tunnels with steel fiber-reinforced repairs. IRT is not effective on long tunnels in good condition due to lack of temperature variation.

Showcase of findings planned for September 2016.

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Tools To Improve PCC Pavement Smoothness During Construction (R06E)

- PennDOT is testing technology that measures International Roughness Index (IRI) of concrete during paving.
- Trial conducted in October 2015 on an unbonded concrete overlay construction project on Interstate 81 near Pine Grove, PA.
- SHRP2 provided a PennDOT contractor with equipment, expertise and labor.
- Results showed a strong correlation between measured IRI at back of paver to finished IRI.

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Tools To Improve PCC Pavement Smoothness During Construction (R06E)

Gomaco GSI and Paver-Mounted Monitoring System:



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Tools To Improve PCC Pavement Smoothness During Construction (R06E)

Lessons Learned/Next Steps:

- “Trouble spots” can be identified during paving using real-time data, so they can be immediately improved by hand-finishing, minimizing more costly corrections later.
- Contractor determines whether or not to use this technology on paving projects. Some contractors in PA have already adopted the technology.
- Beginning in Fall 2016, PennDOT will begin conducting a workshop for contractors to help expand use.

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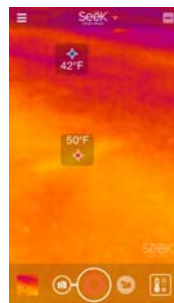
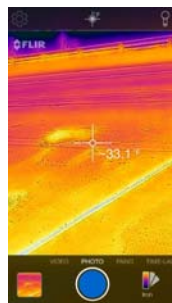
NDT for Concrete Bridge Decks (R06A)

- PennDOT is a lead adopter to deploy NDT on concrete bridge decks.
- Southwestern PA district is deploying several technologies with an evaluation of each:
 - Testing two different models of new infrared (IR) camera for iPhone
 - Fabrication of a rig to attach PennDOT's existing, more sophisticated IR camera to a van for more practical and mobile use on bridge decks
 - Purchase of a cart-mounted, ground-coupled GPR unit

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NDT for Concrete Bridge Decks (R06A)

Examples of NDT technology:



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NDT for Bridge Decks (R06A)

Current Evaluations/Next Steps:

- IR technology shows delaminations, but iPhone technology is limited, with pros and cons for each camera.
- Deployment of mobile rig will enhance utility of existing high-end IR camera. Can be operated from ground or within van by any Bluetooth device.
- All study findings will be shared with AASHTO and FHWA. Implementation will continue through 2016.

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For More Information

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Additional Resources:

Fhwa.dot.gov/GoSHRP2

SHRP2.transportation.org