Advanced Methods to Identify Asphalt Pavement Delamination--R06D

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What is SHRP2?

• The Second Strategic Highway Research Program (SHRP2): a large scale research program designed to make significant advances in some of the most challenging areas in the highway industry

• 9-year, $232 million research program

• TRB: managed over 100 research projects, involving more than 300 research contractors

• Implementation budget of just over $170 million
Quick SHRP2 Overview

- **SHRP2 Solutions** – 63 products
- **Solution Development** – processes, software, testing procedures, and specifications
- **Field Testing** – refined in the field
- **Implementation** – 430 transportation projects; adopt as standard practice
- **SHRP2 Education Connection** – connecting next-generation professionals with next-generation innovations
Focus Areas

**Safety**: fostering safer driving through analysis of driver, roadway, and vehicle factors in crashes, near crashes, and ordinary driving

**Reliability**: reducing congestion and creating more predictable travel times through better operations

**Capacity**: planning and designing a highway system that offers minimum disruption and meets the environmental and economic needs of the community

**Renewal**: rapid maintenance and repair of the deteriorating infrastructure using already-available resources, innovations, and technologies
• Designed to help State DOTs, MPOs, local agencies, and other interested organizations deploy SHRP2 Solutions.

<table>
<thead>
<tr>
<th>Proof of Concept Pilot</th>
<th>Lead Adopter Incentive</th>
<th>User Incentive</th>
</tr>
</thead>
<tbody>
<tr>
<td>To evaluate product readiness.</td>
<td>To help offset costs associated with product implementation and risk mitigation.</td>
<td>To support implementation activities, such as conducting internal assessments, changing processes, and organizing peer exchanges.</td>
</tr>
</tbody>
</table>
SHRP2 Implementation:
INNOVATE. IMPLEMENT. IMPROVE.

$130 million
FUNDING ASSISTANCE

63
SHRP2 SOLUTIONS

430+
PROJECTS IMPLEMENTED

DOT
52 Recipients
MPO/LOCAL
30 Recipients
UNIVERSITY
10 Recipients
FEDERAL/TRIBAL
7 Recipients

REENEWAL
230+
CAPACITY
100+
RELIABILITY
90+
SAFETY
11

SHRP2 SOLUTIONS
SHRP2 Implementation:
INNOVATE. IMPLEMENT. IMPROVE.

- 224,761 Participants Engaged
- 8,939 Outreach Activities
- 14,961 Hours Technical Assistance
  - Training: 8,286 hours
  - Workshops: 463 hours
  - Peer Exchanges: 81 hours
  - Demos: 62 hours
  - Showcases: 47 hours
Advanced Methods to Identify Pavement Delamination (R06D)

Challenge

• Asphalt is typically laid in multiple layers of thickness. If those layers don’t bond together, pavement problems begin to show at the surface.

• Delamination between asphalt layers causes surface distresses like cracking and tearing.

• Pavement performance drastically drops, creating safety and cost issues.

Solution

• Technology that detect delamination under the surface of pavement before it becomes a larger issue.

• Measure at reasonable traveling speed.

• Cover full-lane width.
## R06D Test Sections at NCAT Test Track

<table>
<thead>
<tr>
<th>Section</th>
<th>Top 2-inch lift</th>
<th>Bottom 3-inch lift</th>
<th>Existing surface</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Full bond</td>
<td>no bond</td>
<td>PCC</td>
</tr>
<tr>
<td></td>
<td>Full bond</td>
<td>Full bond</td>
<td>PCC</td>
</tr>
<tr>
<td></td>
<td>Full bond</td>
<td>Full bond</td>
<td>HMA</td>
</tr>
<tr>
<td>Section 1</td>
<td>Partial No bond</td>
<td>Full bond</td>
<td>HMA</td>
</tr>
<tr>
<td>Section 2</td>
<td>No bond</td>
<td>Full bonding</td>
<td>HMA</td>
</tr>
<tr>
<td>Section 3</td>
<td>partial stripping</td>
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<tr>
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</tr>
<tr>
<td>Section 5</td>
<td>Full bond</td>
<td>partial No bond</td>
<td>HMA</td>
</tr>
<tr>
<td>Section 6</td>
<td>Full bond</td>
<td>No bond</td>
<td>HMA</td>
</tr>
<tr>
<td>Section 7</td>
<td>Full bond</td>
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<td>HMA</td>
</tr>
<tr>
<td>Section 10</td>
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</tbody>
</table>
Solutions

• Ground Penetrating Radar (GPR) antenna array with frequency sweep

• Impact echo (IE) and seismic analysis of surface waves (SASW) rolling wheel scanning system
GPR Technology

Advantages
- Can be used at highway speeds
- Covers large areas
- Can fine other subsurface features (utilities)
- Can be used in live traffic

Limitations
- Cannot distinguish delamination where the bond of the asphalt lifts is weak or missing
- Must have moderate change in material with air or water present
GPR
GPR at NCAT Test Track
GPR on Florida DOT Research Lane

Lane 5 - depth slice at 1.5”

Temperature profile map
IE & SASW Technology

Advantages

• Can distinguish debonding (delamination)
• Covers large areas compared to point testing
• Can find concrete delamination and cracking

Limitations

• Requires a lane closure
• Cannot be used at highway speed
• Technology works best on stiff materials
IE & SASW
IE / SASW at NCAT Test Track

IE Report

SASW Report
Real-time IE Output During Test
Real-time IE Output During Test
Real-time IE Output During Test
Benefits

• GPR with frequency sweep antenna array
  ➢ Can identify variations in the pavement, and provide a relative degree of severity.
  ➢ Operates at reasonable speed and up to full-lane width in a single pass.

• IE/SASW scanner
  ➢ Can identify variations in the pavement; isolate the depth of discontinuity.
  ➢ Can identify debonding between asphalt layers

• Both Technologies
  ➢ Excellent forensic tool for project level analysis
  ➢ Multi-functional NDT (pavement, bridge decks, etc…)
<table>
<thead>
<tr>
<th>States</th>
<th>Round 7</th>
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</thead>
<tbody>
<tr>
<td>California</td>
<td>Minnesota</td>
</tr>
<tr>
<td>Florida</td>
<td>New Mexico</td>
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<tr>
<td>Kentucky</td>
<td>Texas</td>
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**Save Lives**
Single-pass and full-lane coverage improve safety by minimizing the time technicians are exposed to traffic.

**Save Money**
Single-pass operation minimizes data collection costs. Full-lane coverage increases testing efficiency and reduces data-collection costs.

**Save Time**
Full-lane coverage and single-pass operations reduce the time to collect field data.
IAP State Activities

Mounting the GPR Antenna
IAP State Activities

Calibrating the Antenna
Automated Data Analysis
What’s Next for R06D

The Future

Product demand will drive software development to make data analysis more efficient and effective.

• Real-time display detail
• Automated signal identification in distressed areas
For More Information on R06D

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Additional Resources:
GoSHRP2 Website: fhwa.dot.gov/GoSHRP2
AASHTO SHRP2 Website: http://shrp2.transportation.org
R06D Product Page Coming soon