Virginia’s SHRP2 R06A Project

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Introduction

- This presentation will provide an overview of Virginia’s work under the SHRP2 R06A program
What is SHRP2?

- The second Strategic Highway Research Program
What is SHRP2?

- National partnership Sponsored by
  - FHWA
  - AASHTO
  - TRB

- SHRP 2 was created to find strategic solutions to three national transportation challenges:
  - Improving highway safety
  - Reducing congestion
  - Improving methods for renewing roads and bridges
What is SHRP2?

- SHRP 2 Renewal research filled gaps in research and development to produce user-friendly tools so that innovative design and construction methods can be applied more broadly.

- It tested and objectively evaluated alternative methods to provide transportation agencies with information they need to deliver projects faster.

- Renewal research products simplified access to information on successful practices in performance specs, utilities, and interaction with railroads, which can speed project delivery and address causes of delay.
What is R06A? (Nondestructive Testing to Identify Concrete Bridge Deck Deterioration)

- Identifies nondestructive testing technologies for detecting deterioration in concrete bridge decks

- The first phase created a report documenting and validating promising technologies
  - Report graded and ranked the technologies based on results of the validations
The SHRP2 Implementation Assistance Program (IAP) was launched in 2013, and through seven rounds SHRP2 provided more than $130 million in financial support and technical assistance to transportation agencies across the country.
Virginia is involved in the following structure related implementation assistance programs:

- Nondestructive Testing for Concrete Bridge Decks - IAP R06A Lead Adopter
- Service Life Design for Bridges - IAP R19A Lead Adopter
- Nondestructive Testing for Tunnel Linings - IAP R06G User Incentive
SHRP2 R06A Implementation Assistance Nondestructive Testing to Identify Concrete Bridge Deck Deterioration

- Lead Adopter Incentive - Available to help offset costs associated with product implementation and risk mitigation

- Virginia is a lead adopter in the R06A Implementation Assistance Program
Virginia received a $100,000 grant under the Round 4 Implementation Assistance Program for R06A.

Virginia is utilizing the grant to apply NDT technology for the assessment of a series of concrete bridge decks.
Implementing the Technology

• Virginia is implementing the technology in two ways

1. Rapid screening of deck condition for many structures (Network Level)
   • Assess conditions
   • Help with prioritization and planning (repair and preservation)

2. Development of detailed damage quantities on individual bridges
   • Assist in making appropriate repair selections for interventions
   • Assess deck condition deterioration rates for bridge management applications
   • It may also be applied to monitor the condition and performance of preservation methods over time, for example comparative performance of different overlay types
Implementing the Technology

- Virginia developed contracts for Nondestructive Testing Technologies for Concrete Bridge Decks

- The technologies included Infrared Thermography (IRT) and Ground Penetrating Radar (GPR)

- Two rounds of contracts were advertised
The contract documents contained the following qualification requirements for performing the work:

- Firms - minimum of five (5) years’ experience performing the services requested
- Project managers - minimum of five (5) years’ experience managing the services requested
- Resume for all project managers

Implementing the Technology
Implementing the Technology

- The first contract included both Infrared Thermography and Ground Penetrating Radar
- The contract was awarded to one contractor on February 27, 2017
Implementing the Technology

The unit prices for the first contract were as follows:
- Infrared Thermography Testing - $0.079/SF
- Ground Penetrating Radar Testing - $0.079/SF
- Traffic Control - $300/Bridge
- Mobilization - $133.33/Bridge

The first contract included six bridge decks in two districts totaling 76,488 square feet.
Implementing the Technology

• The second contract was advertised to include two lots - one lot for Infrared Thermography (IRT) and one lot for Ground Penetrating Radar (GPR)

• Based on the bids received, the lots were awarded to separate contractors
Lot 1 - Infrared Thermography (IRT) - This contract was awarded on September 12, 2017 – Deck area scanned was 251,953 square feet for 19 bridges in seven districts. The total contract amount was $17,992.22

- Bid Prices
  - IRT scans - $0.06/SF
  - Traffic Control - $218.86/District
  - Mobilization - $192.86/District
Lot 2 - Ground Penetrating Radar (GPR) - This contract was awarded on September 12, 2017 – Deck area scanned was 251,953 square feet for 19 bridges in seven districts. Total contract amount was $20,459.98

- Bid Prices
  - GPR scans - $0.065/SF
  - Traffic Control - $130.29/District
  - Mobilization - $453.00/District
Implementing the Technology - IRT

The contract for Lot 1 included the following technical requirements

- The work shall be conducted in accordance with American Society for Testing and Materials (ASTM) D4788-03 (2013), except as amended herein, using a host vehicle that is capable of collecting real-time infrared images of the deck surface at, or near, highway speeds (i.e., 45 mph or greater).

- The host vehicle shall be equipped with a high-resolution (Thermal sensitivity/Noise Equivalent Temperature Difference (NETD) of < 0.05°C @ 30°C (86°F) / 50 mK or less) infrared camera capable of producing thermal images with a 320×240 pixel or greater resolution at suitable field of view and frame rate to achieve complete coverage of the length of the deck.

- The host vehicle shall also be capable of collecting high-resolution video/photographic images of the deck surface, at or near, highway speeds (i.e., 45 mph or greater).
The contract for Lot 1 included the following technical requirements (Continued)

- The test data shall be analyzed for defect features in the deck. Defect features are defined as anomalous regions, spalling, previous patching, delaminated and deteriorated concrete occurring at the top layer of reinforcement and above.

- The results of the testing and analysis shall be presented in a written report.

- The report shall include a plan view of the bridge showing areas and quantities for each of the defect features.
• The technology used was the Deck Top Scanning System (DTSS) which is a mobile platform that can be loaded/mounted onto a vehicle. It consists of an infrared thermography (IR) camera, two line-scanning cameras, a GPS unit, and a speedometer unit that, combined, locate surface and sub-surface defects in bridge decks or roadways.
Implementing the Technology - IRT
Implementing the Technology - IRT
The contract for Lot 2 included the following technical requirements:

- The work shall be conducted in accordance with American Society for Testing and Materials (ASTM) D6087-08 (2015) using a host vehicle that is capable of collecting data from the deck surface at, or near, highway speeds (i.e., 45 mph or greater).

- The host vehicle shall be equipped with a multi-channel array of air coupled (non-contacting) horn antennas or a multi-channel array of ground-coupled antennas within close proximity to the deck surface; antennae shall have center frequencies of 1.0 GHz minimum, with 1.5 GHz to 3.0 GHz preferred, or the system may employ step frequency radar that covers at least this range.

- The host vehicle shall also be capable of collecting high resolution video/photographic images of the deck surface at, or near, highway speeds (i.e., 45 mph or greater).
The contract for Lot 2 included the following technical requirements (Continued)

• The test data shall be analyzed for defect features in the deck. Defect features are defined as anomalous regions, spalling, previous patching, and deteriorated concrete occurring at the top layer of reinforcement and above and for the cover over the top mat of deck reinforcing steel

• The results of the testing and analysis shall be presented in a written report

• The report shall include a plan view of the bridge showing areas and quantities for each of the defect features and apparent cover depths over the top mat of reinforcing steel
The technology used was a dual 2 GHz horn antenna system manufactured by GSSI, Inc. of Nashua, NH. The survey vehicle was equipped with an electronic distance-measuring instrument (DMI) mounted to the rear wheel of the survey van, providing continuous distance data as the GPR data was collected. The data collection and recording was controlled by the SIR-30 GPR system operated from within the survey vehicle.
Implementing the Technology - GPR
Implementing the Technology - GPR
Implementing the Technology - GPR
Implementing the Technology

- The results from the IRT scans and the GPR scans are currently being reviewed and compared to each other and to the Element Data
### Structure ID 4583 Bridge 2012 IRT

<table>
<thead>
<tr>
<th>Direction</th>
<th>SPAN</th>
<th>DELAM</th>
<th>SOUND PATCH</th>
<th>MINOR SPALL</th>
<th>CS2 Total</th>
<th>Percentage of CS2 Area</th>
<th>UNSOUND PATCH</th>
<th>MAJOR SPALL</th>
<th>CS3 Total</th>
<th>Percentage of CS3 Area</th>
<th>Surface Area(ft²)</th>
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</thead>
<tbody>
<tr>
<td>Bridge information</td>
<td></td>
<td>CS2(ft²)</td>
<td>(%)</td>
<td>CS3(ft²)</td>
<td>(%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>SB</td>
<td>1</td>
<td>64</td>
<td>118.8</td>
<td>0.62</td>
<td>184</td>
<td>2.116%</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0.000%</td>
</tr>
<tr>
<td>Total</td>
<td>64</td>
<td>119</td>
<td>1</td>
<td>184</td>
<td>2.116%</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.000%</td>
<td>8675.70</td>
</tr>
<tr>
<td>Span</td>
<td>Lane</td>
<td>Start</td>
<td>End</td>
<td>Deterioration (sf)</td>
<td>Patching (sf)</td>
<td>Spalling (sf)</td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Right</td>
<td>Abut B</td>
<td>Abut A</td>
<td>85</td>
<td>8</td>
<td>20</td>
<td>113</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>1</td>
<td>Left</td>
<td>Abut B</td>
<td>Abut A</td>
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<td>35</td>
<td></td>
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## Implementing the Technology – Example Results Element Data

### Structure ID 4583 Bridge 2012 Element Data

<table>
<thead>
<tr>
<th>Element #</th>
<th>Element Name</th>
<th>Units</th>
<th>Qty (State 1)</th>
<th>Qty (State 2)</th>
<th>Qty (State 3)</th>
<th>Qty (State 4)</th>
<th>Total Qty</th>
<th>% (State 1)</th>
<th>% (State 2)</th>
<th>% (State 3)</th>
<th>% (State 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Re Concrete Deck</td>
<td>sq.ft</td>
<td>0</td>
<td>9,120.00</td>
<td>203</td>
<td>0</td>
<td>9,323.00</td>
<td>0%</td>
<td>97.80%</td>
<td>2.10%</td>
<td>0%</td>
</tr>
<tr>
<td>1080</td>
<td>Delamination/Spall/Patched Area</td>
<td>sq.ft</td>
<td>0</td>
<td>167</td>
<td>3</td>
<td>0</td>
<td>170</td>
<td>0%</td>
<td>98.20%</td>
<td>1.70%</td>
<td>0%</td>
</tr>
<tr>
<td>1120</td>
<td>Efflorescence/Rust Staining</td>
<td>sq.ft</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>1130</td>
<td>Cracking (RC and Other)</td>
<td>sq.ft</td>
<td>0</td>
<td>0</td>
<td>200</td>
<td>0</td>
<td>200</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>1190</td>
<td>Abrasion(PSC/RC)</td>
<td>sq.ft</td>
<td>0</td>
<td>8,949.00</td>
<td>0</td>
<td>0</td>
<td>8,949.00</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>510</td>
<td>Wearing Surfaces</td>
<td>sq.ft</td>
<td>953</td>
<td>2</td>
<td>0</td>
<td>5</td>
<td>960</td>
<td>99.20%</td>
<td>0.20%</td>
<td>0%</td>
<td>0.50%</td>
</tr>
</tbody>
</table>
Implementing the Technology

- The next phase of the work will involve comparing the results of the NDT scans with the results of conventional deck investigations for selected bridges.
Implementing the Technology

• We would like to use the lessons learned from the SHRP2 R06A project to develop a standing on-call contract for the districts to use in evaluating bridge decks
Virginia’s SHRP2 R06A Project

Thank you for your time and attention

Questions??

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