Virginia’s SHRP2 R06A Project

Jeff Milton - Bridge Preservation Specialist
Virginia Department of Transportation
Structure and Bridge Division
April 2018

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

SHRP2 R06A Implementation Assistance Nondestructive Testing to Identify Concrete Bridge Deck Deterioration

- 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

SHRP2 R06A Implementation Assistance Nondestructive Testing to Identify Concrete Bridge Deck Deterioration

- 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

SHRP2 R06A Implementation Assistance Nondestructive Testing to Identify Concrete Bridge Deck Deterioration

- 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

Implementing the Technology

- 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

- 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

Implementing the Technology

- 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

Implementing the Technology

- 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)

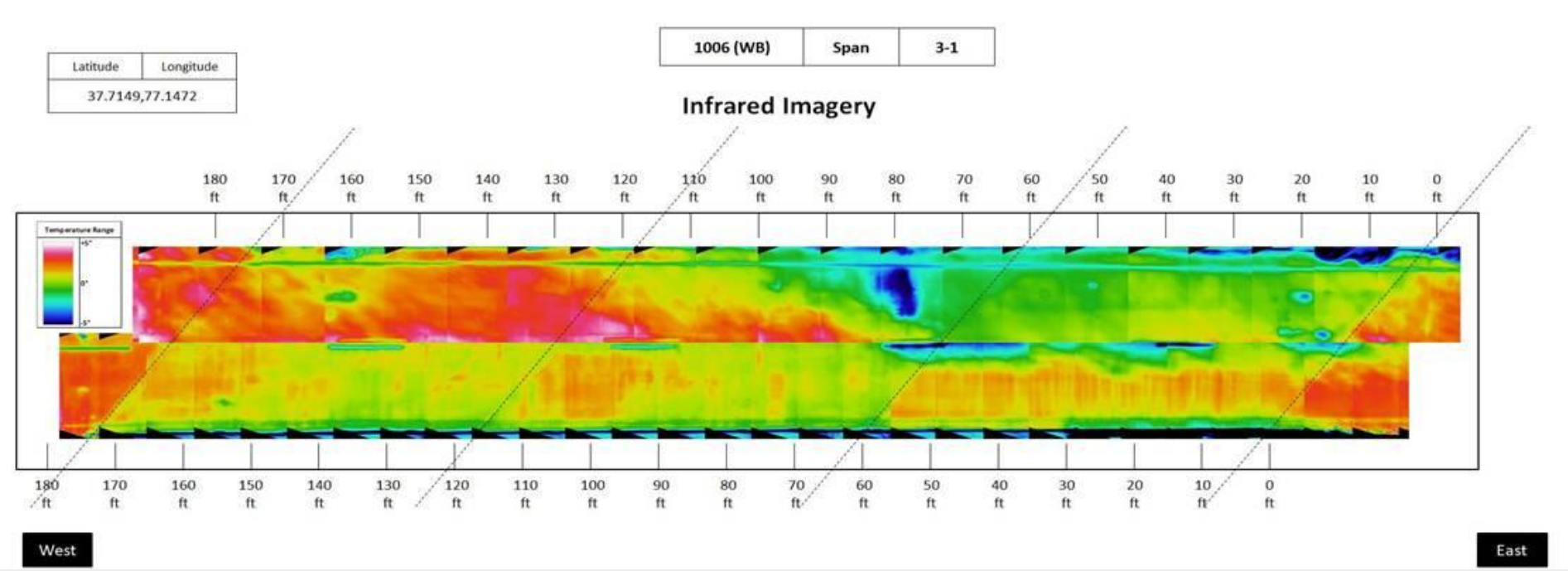
Implementing the Technology - IRT

- 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

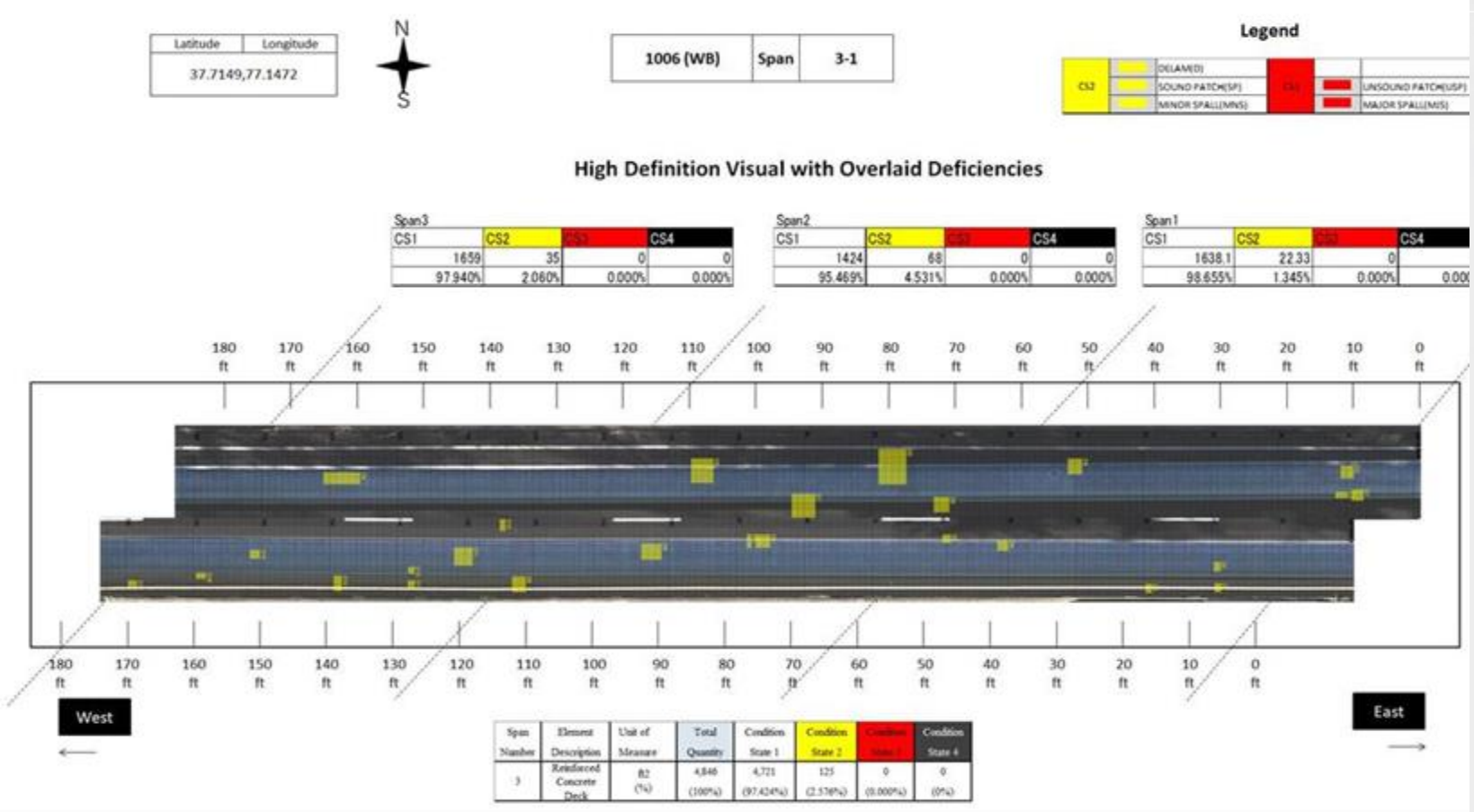
Implementing the Technology - IRT

- 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



Implementing the Technology - GPR

- 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)

Implementing the Technology - GPR

- 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

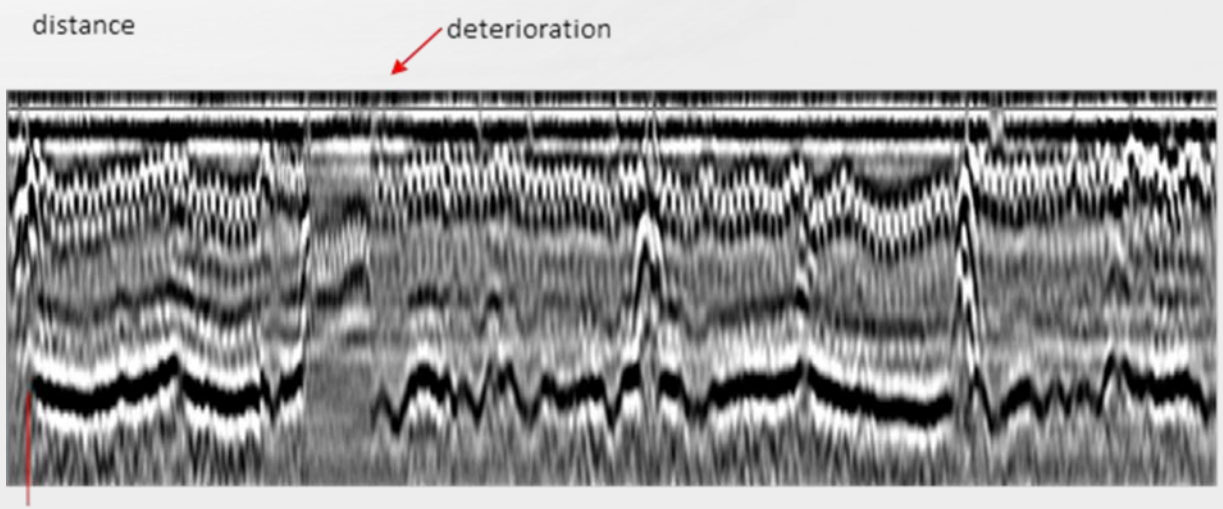
  - The results of the testing and analysis shall be presented in a written report

  - 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

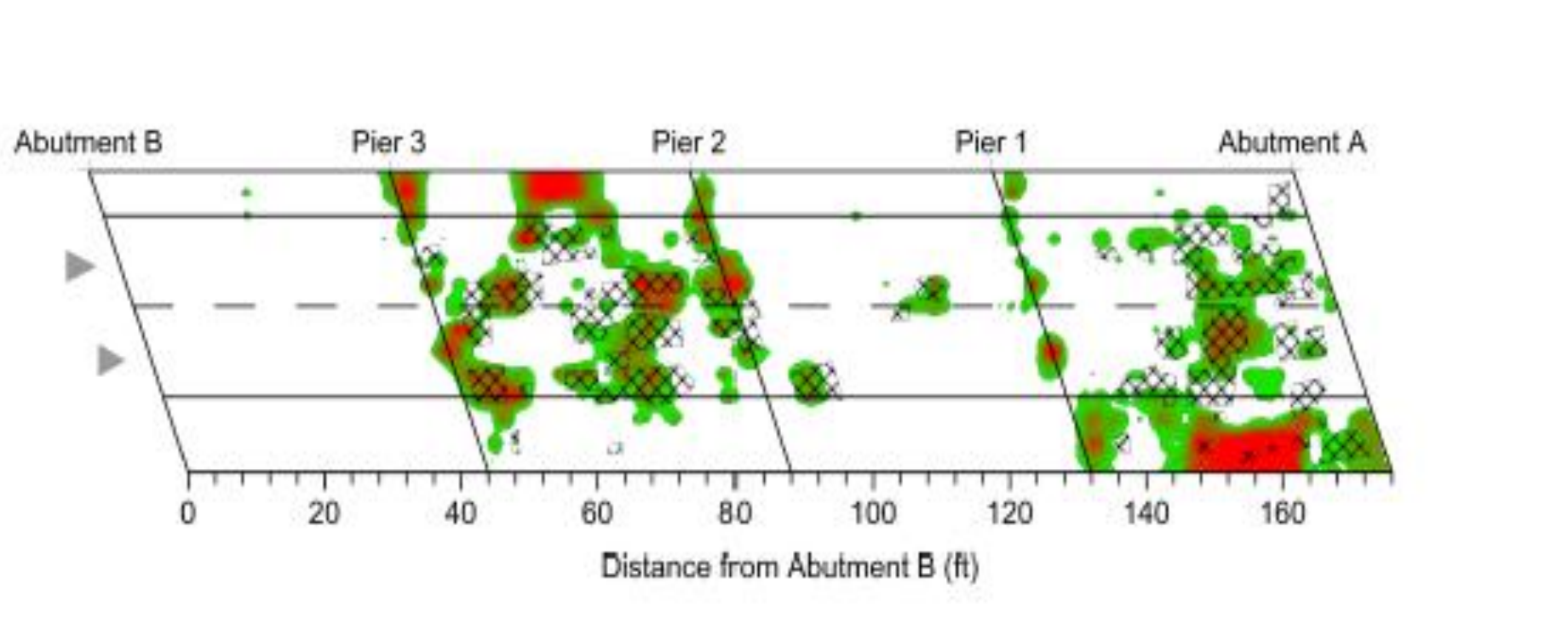
Implementing the Technology - GPR

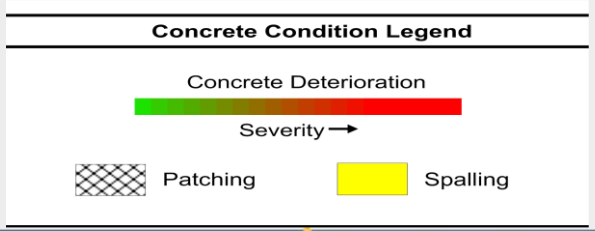
The technology used was a dual 2 GHz horn antenna system manufactured by GSSI, Inc. of Nashua, NH, The survey vehicle was equipped with an electronic distance-measuring instrument (DMI) mounted to the rear wheel of the survey van, providing continuous distance data as the GPR data was collected. The data collection and recording was controlled by the SIR-30 GPR system operated from within the survey vehicle.

Implementing the Technology - GPR

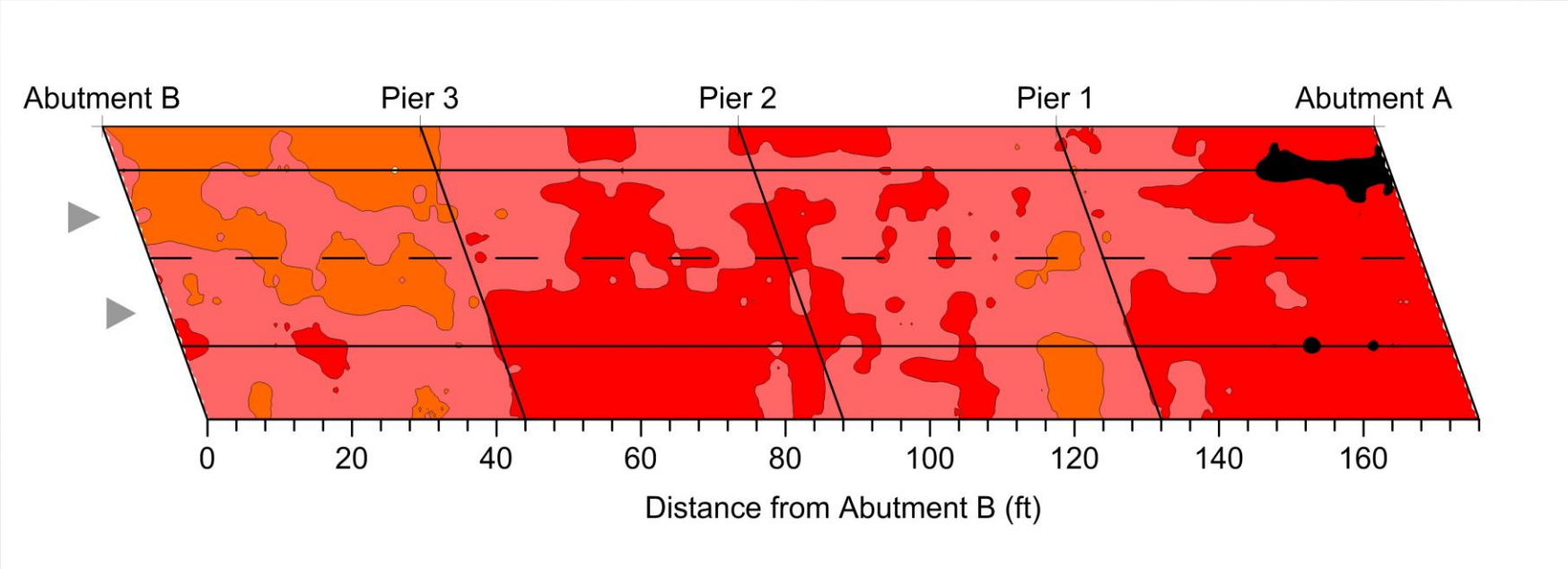


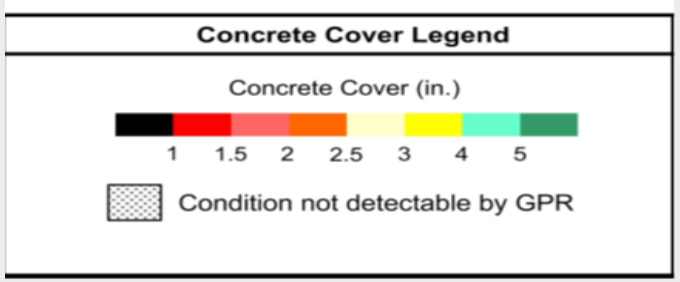
Implementing the Technology - GPR





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

Implementing the Technology – Example Results IRT

Structure ID 4583 Bridge 2012 IRT

Direction	SPAN	DELAM	SOUND PATCH	MINOR SPALL	CS2 Total	Percentage of CS2 Area	UNSOUND PATCH	MAJOR SPALL	CS3 Total	Percentage of CS3 Area	Surface Area(ft2)
Bridge information		CS2(ft2)				(%)	CS3(ft2)			(%)	
SB	1	64	118.8	0.62	184	2.116%			0	0.000%	8675.70
Total		64	119	1	184	2.116%	0	0	0	0.000%	8675.70

Implementing the Technology – Example Results GPR

Structure ID 4583 Bridge 2012 GPR

Span	Lane	Start	End	Deterioration (sf)	Patching (sf)	Spalling (sf)	Total
1	Right	Abut B	Abut A	85	8	20	113
1	Left	Abut B	Abut A	35	0	0	35
						Total	148

Implementing the Technology – Example Results Element Data

Structure ID 4583 Bridge 2012 Element Data

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

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

Thank you for your time and attention

Questions??

2018 National Bridge Preservation Partnership Conference

Virginia’s SHRP2 R06A Project