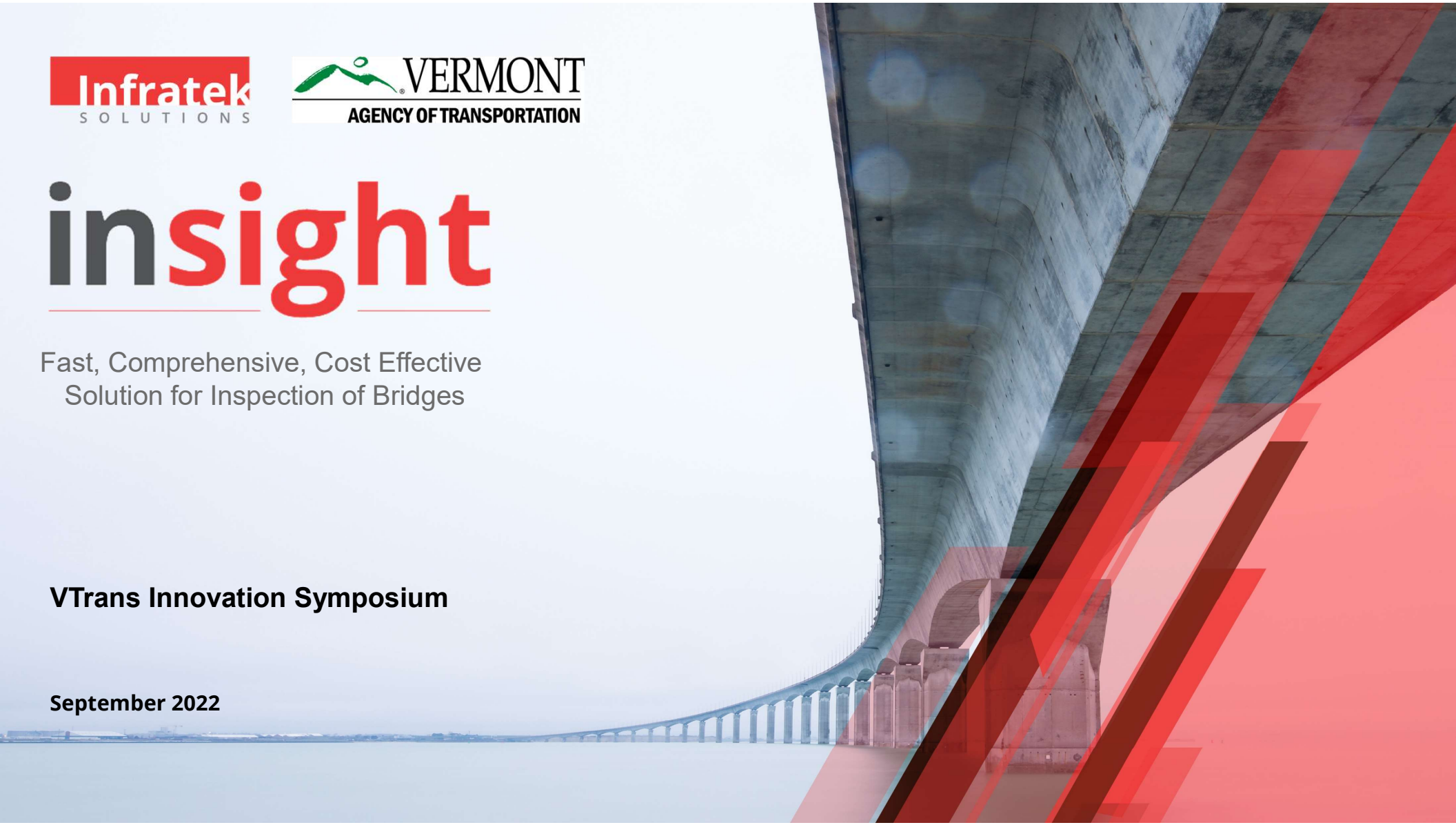
Infratek SOLUTIONS

VERMONT AGENCY OF TRANSPORTATION

insight

Fast, Comprehensive, Cost Effective Solution for Inspection of Bridges



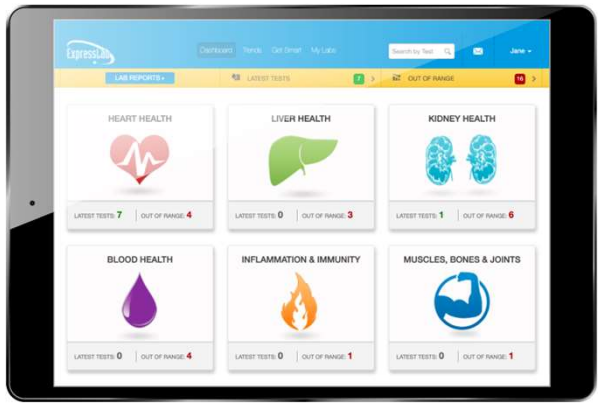
VTrans Innovation Symposium

September 2022

Our Approach to Condition Evaluation: Medical Diagnosis

Triage & Primary Diagnosis

In-Depth Diagnosis



Patient Portal

Infratek SOLUTIONS

Triage

High Speed

High-Speed Chain Drag, Crack Mapping
and Non-Destructive Evaluation
High-Speed Visual Inspection
No Lane Closure

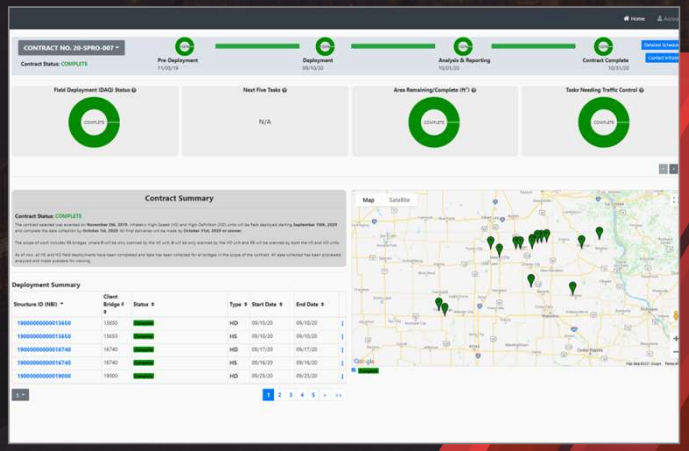
In-depth

High Definition

Fastest Ground-Coupled System
Highest Level of Accuracy & Resolution
Accurate Repair Quantities

Patient Portal

Asset Portal



Interactive
User-friendly

HS Platform

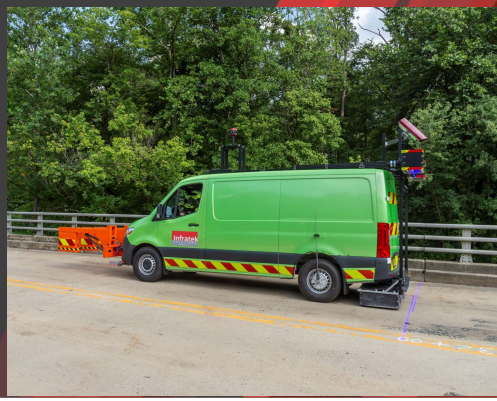
DAQ at speeds of 40 MPH or higher

Sensors:

- 360 Degree Camera for Visual Inspection
- High Speed Chain Drag
- High Resolution Surface Imaging
- Automated Crack Mapping
- InfraRed
- Surface Profiler
- GPR
- LiDAR
- High Accuracy GPS
- IMU, DMU

High-Speed System in Action

In-depth Inspection



HD Platform

As high as 5,700 sq.ft/hr. @ full deployment
with 2’ intervals // 19 ft. Coverage

High Accuracy & Repeatability

Sensors:

- Ground Penetrating Radar
- Impact Echo
- Ultrasonic Surface Wave
- Electrical Resistivity
- High Accuracy GPS
- IMU
- DMU

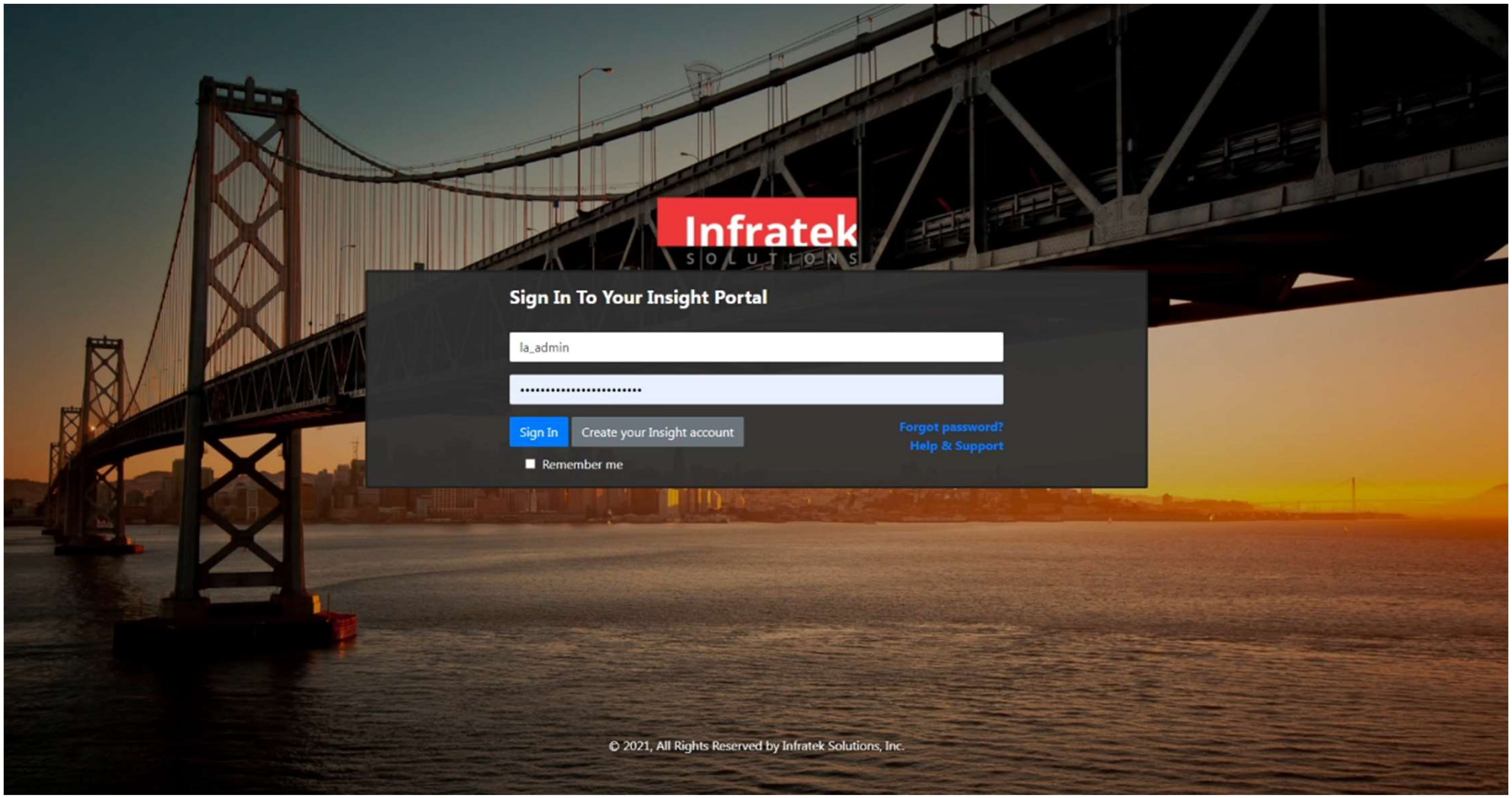
Features:

- Fully Autonomous
- Near Real Time Transparent Data Processing / QA
- Works on Decks with Asphalt Overlay
- Only Two Operators

High-Definition System in Action

High-Definition System – Ground Coupling

Two Layers of Realtime Quality Control



Login to Visual Inspection Platform

insight portal

Home | Account

Hi, Amir

- Dashboard
- My Bridges
- Calendar
- Notifications 2
- Portal Directory
- Support & FAQ

IOWA DOT

CONTRACT NO. 20-SPRO-007

Contract Status: COMPLETE

Pre-Deployment	Deployment	Analysis & Reporting	Contract Complete
100%	100%	100%	100%
11/05/19	09/10/20	10/01/20	10/31/20

Detailed Schedule | Contact Infratek

Field Deployment (DAQ) Status

Next Five Tasks

N/A

Area Remaining/Complete (ft²)

Tasks Needing Traffic Control

Contract Summary

Contract Status: COMPLETE

The contract selected was awarded on **November 5th, 2019**. Infratek's High-Speed (HS) and High-Definition (HD) units will be field deployed starting **September 10th, 2020** and complete the data collection by **October 1st, 2020**. All final deliveries will be made by **October 31st, 2020 or sooner**.

The scope of work includes **15** bridges, where **0** will be only scanned by the HS unit, **0** will be only scanned by the HD unit and **15** will be scanned by both the HS and HD units.

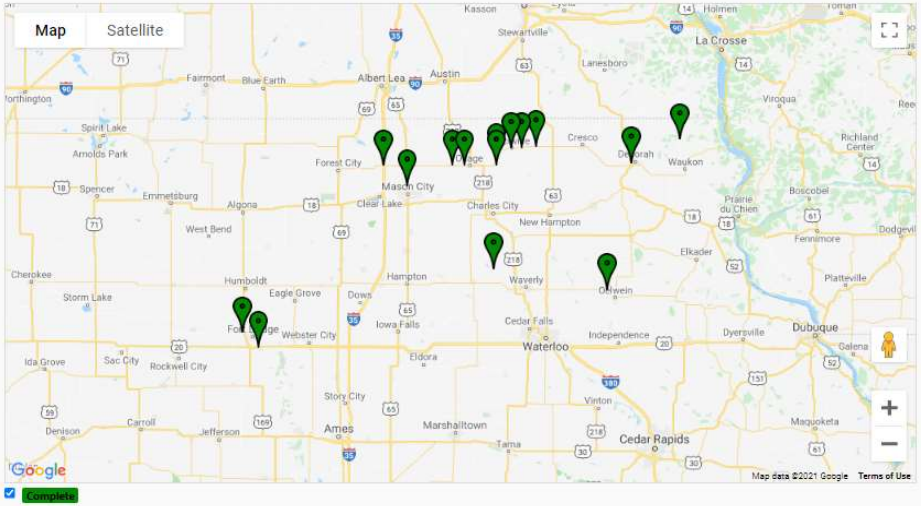
As of now, all HS and HD field deployments have been completed and data has been collected for all bridges in the scope of the contract. All data collected has been processed, analyzed and made available for viewing.

Deployment Summary

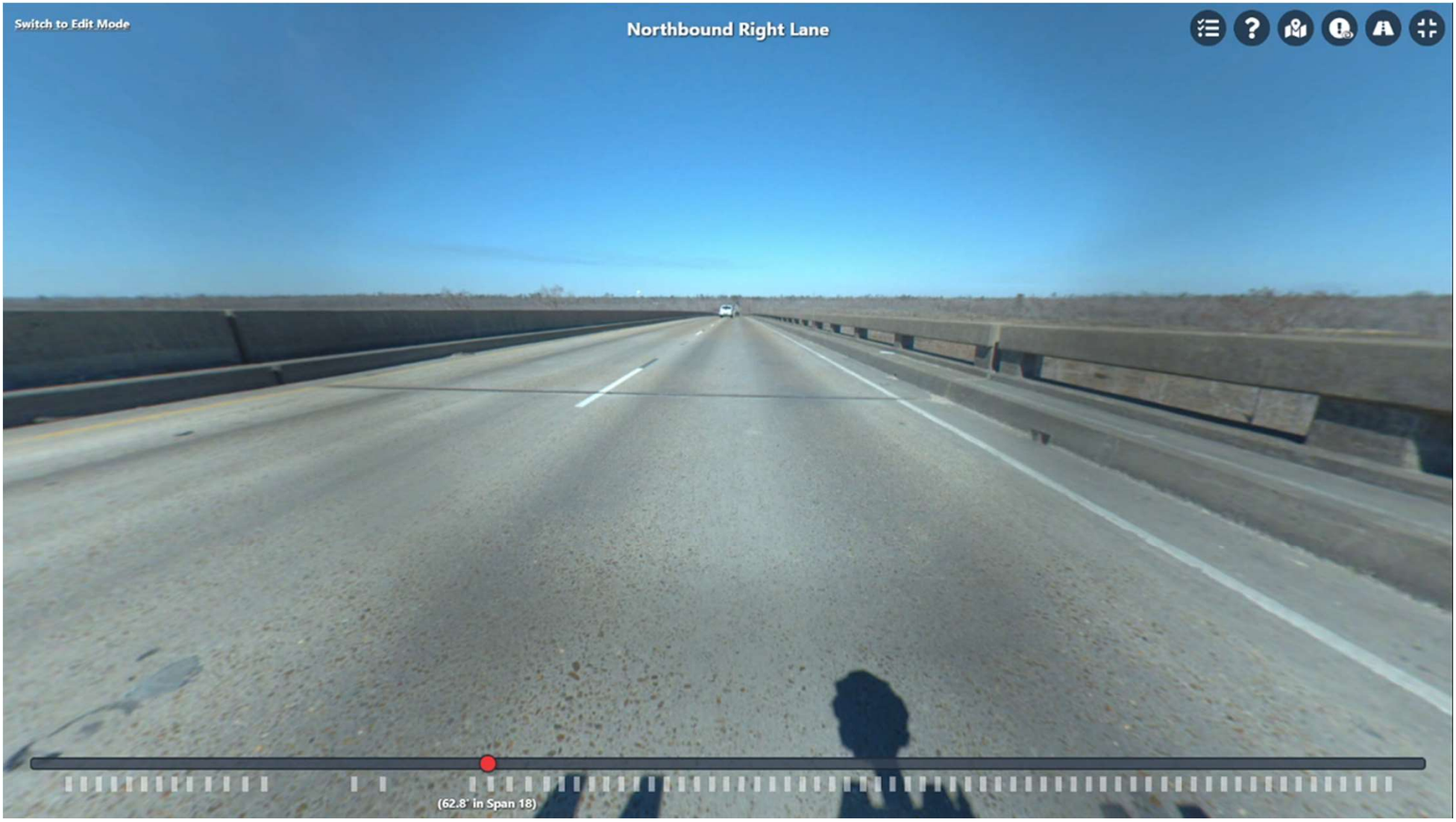
Structure ID (NBI)	Client Bridge #	Status	Type	Start Date	End Date
19000000000013650	13650	Complete	HD	09/10/20	09/10/20
19000000000013650	13650	Complete	HS	09/10/20	09/10/20
19000000000016740	16740	Complete	HD	09/17/20	09/17/20
19000000000016740	16740	Complete	HS	09/16/20	09/16/20
19000000000019000	19000	Complete	HD	09/25/20	09/25/20

5

1 2 3 4 5 > >>

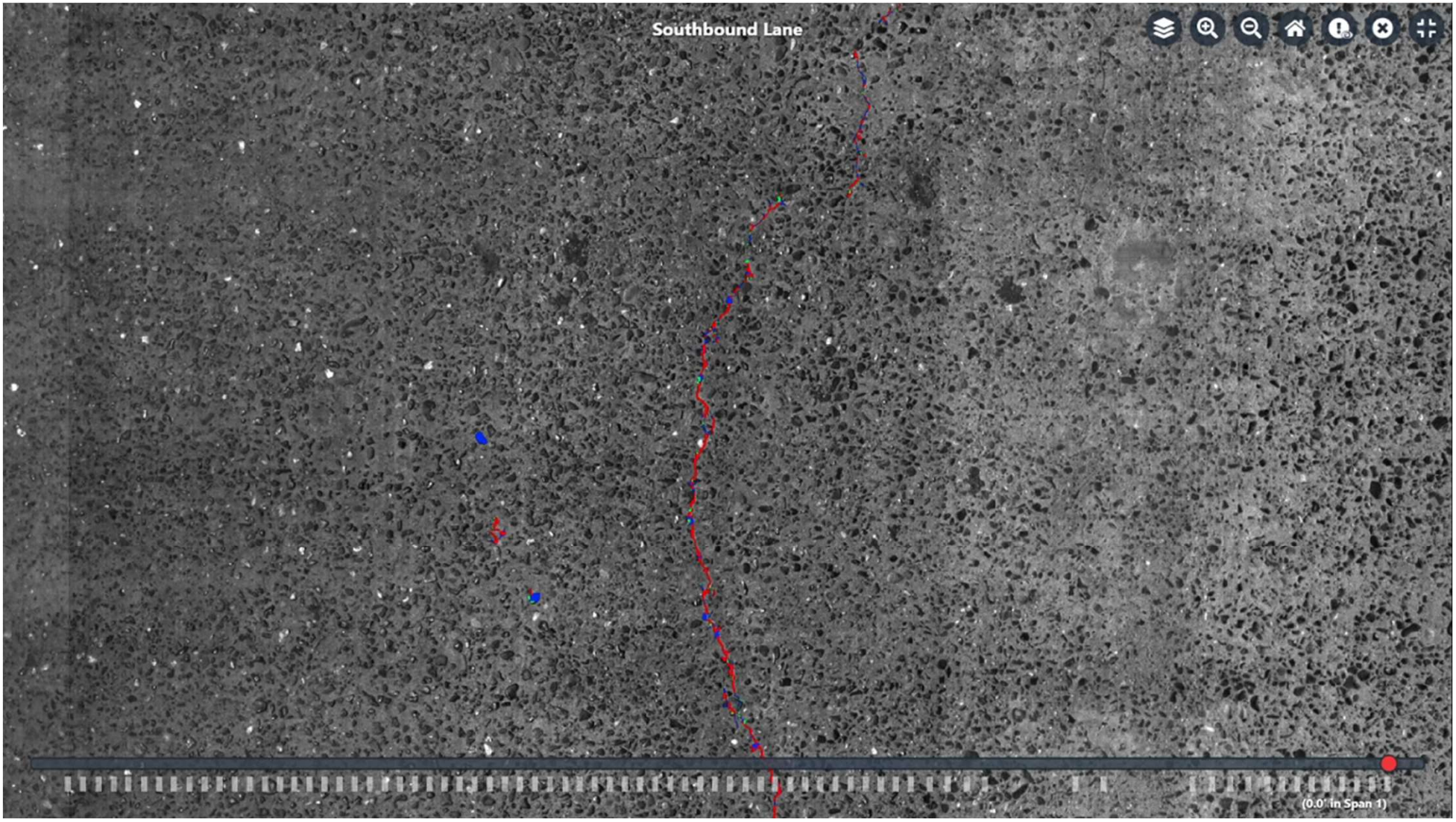


Complete



Navigation

Joint Inspection



Navigation – Crack Mapping Integration

AI Driven or Manual Annotations

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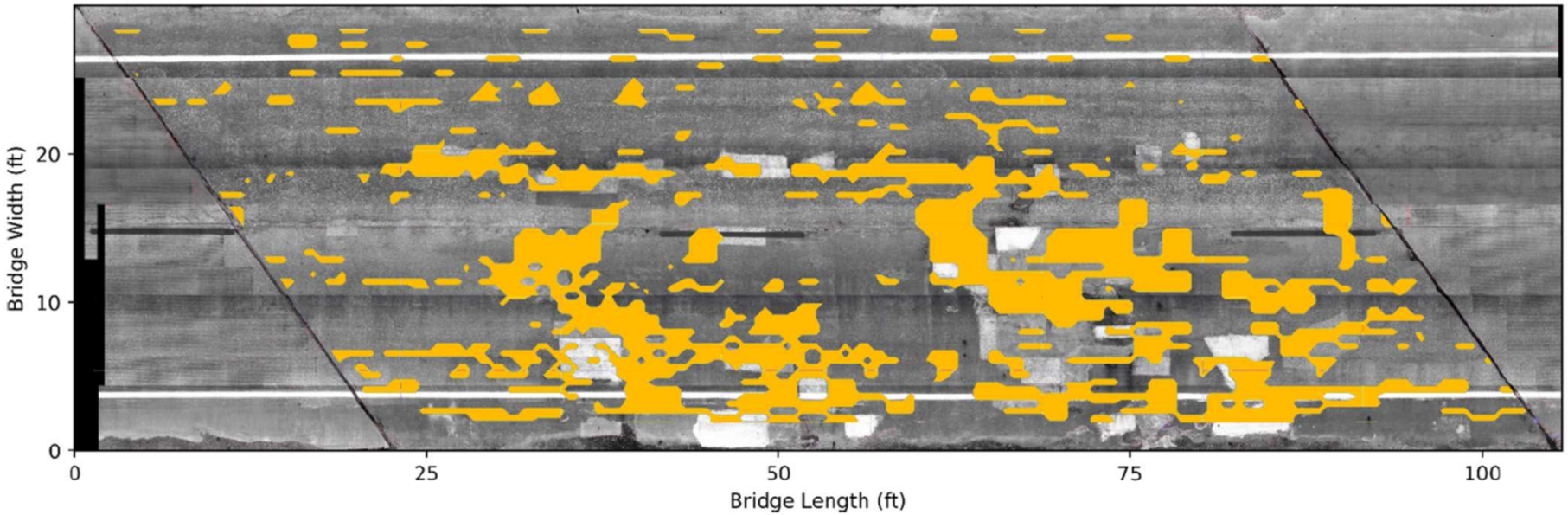
Sample Output



Delamination Index	Delaminated	Sound
	30.21 %	69.79 %
62.21	752 ft.^{2}	1,743 ft.^{2}

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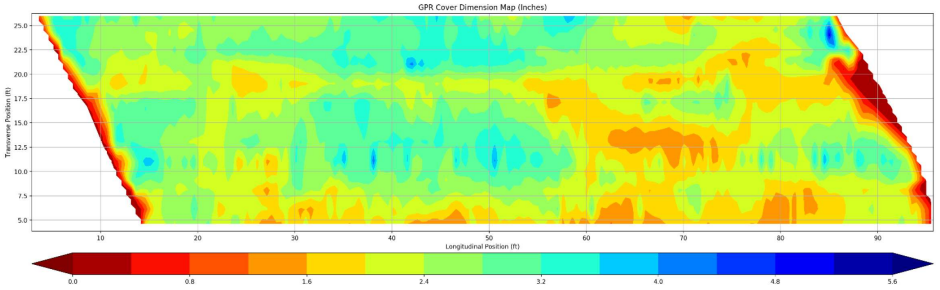
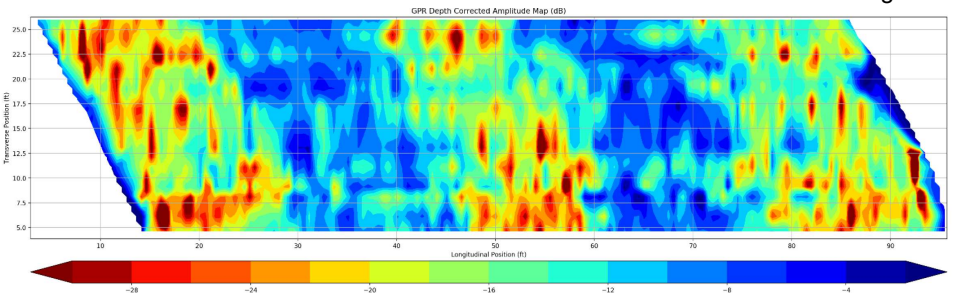
Sample Output

GPR Top Cover Dimension

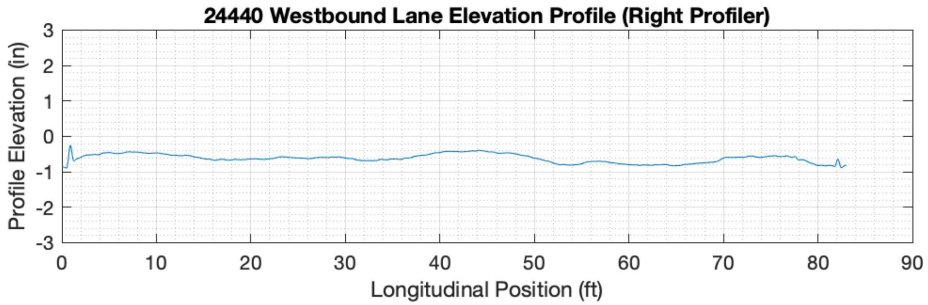


Cover Index	Insufficient	As Specified	Excessive
	[0, 1.5]	[1.5, 2.5]	2.5 +
71.53	6.05 %	49.12 %	44.84 %

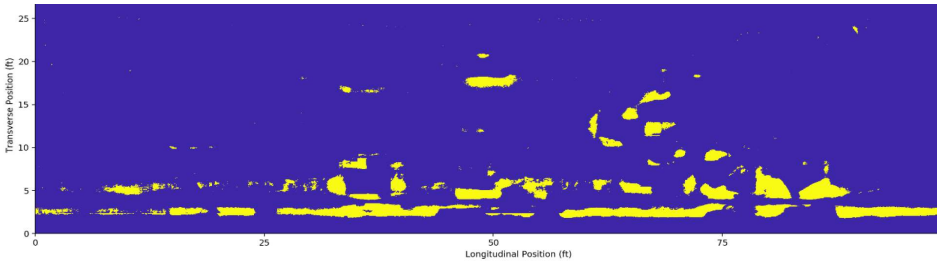
GPR Moisture Ingress



Attenuation Index	High	Moderate	Low
	[-30, -15]	[-15, -8]	-8 +
35.89	42.98 %	42.25 %	14.77 %



Surface Profile



Infra-red Thermography

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Sample Output (Static PDF Report)

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CONTRACT NO. 1234567-1234
Data Analysis Report
Bridge XXXXXXXXXXXXXXX

Latitude:		**Number of Lanes:**	2
Longitude:		**Structure Length:**	83 ft.
Deck Structure Type:	Slab	**Curb to Curb Width:**	44 ft.
Data Collection Date:	09/14/2020	**Deck Area:**	3652 sqft.
Bridge Location:			

TECHNOLOGIES DEPLOYED

HIGH SPEED UNIT (HS)		HIGH DEFINITION UNIT (HD)	
Data Acquisition Speed:	38 mph	**Data Acquisition Duration:**	1 Hr. 35 Min.
Technology		**Technology**	**Data Points**
GPR (Air Coupled)		GPR (Ground Coupled)	11 Antennas
Infrared		Acoustic (Impact Echo & USW)	5338
LiDAR		Electrical Resistivity	1631
360 Degree Imaging		Longitudinal Spacing	2.0 ft.
Surface Imaging & Crack Mapping			
Surface Profiler			


For more in-depth analysis and interactive features, visit the insight Portal at insight.infrateksolutions.com.

October 15, 2020

Infratek Solutions Inc. 50 Washington Road, Princeton Junction, NJ 08550
www.InfratekSolutions.com

Summary of Deterioration-Specific Metrics

Table 1 presents the deterioration-specific metrics extracted from the data described in the previous sections.

Table 1 - Deterioration-Specific Metrics for Bridge

Metric		Value	Notes
Surface Cracking (Total Length)	0.000 - 0.029 in.	2075 ft.	
	0.029 - 0.058 in.	2933 ft.	
	0.058+ in.	2400 ft.	
Surface Cracking (Total Length per Area)	0.000 - 0.029 in.	0.57 ft./sqft.	
	0.029 - 0.058 in.	0.80 ft./sqft.	
	0.058+ in.	0.66 ft./sqft.	
Area of Delamination		827 sqft. (22.65%)	This is the portion of the deck in the "poor" category based on IE results.
Area of Moisture Ingress		531 sqft. (14.53%)	This is the portion of the deck in the "poor" category based on ER results.
Area of Potential Deep Delamination		275 sqft. (7.55%)	This is the area of the deck graded as potential deep delamination and is assumed to be 1/3 of the highly delaminated area
Elastic Modulus		Mean = 3138.87 Ksi StDev = 1448.92 Ksi	

Non-Condition-Related Data/Information

The following provides a summary of the non-condition-related data collected for Bridge

- **Location of Drainage Grate:**
  The bridge has 2 drainage openings at/near each barrier, located in the center of the bridge, directly over the creek. The condition of these drainage openings and the debris around them is represented below.

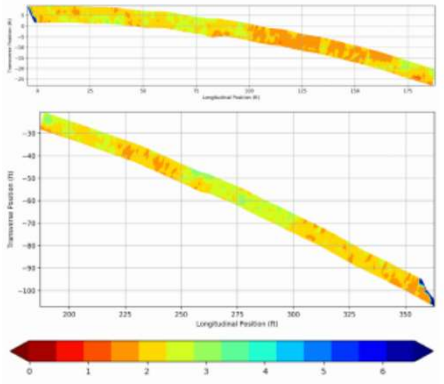
Figure 13a – Westbound Lane Drainage

Figure 13b – Eastbound Lane Drainage

17

Cover Dimension

Figure 2 provides a map of the cover depth estimated using GPR data. This data reflects the depth at which the electromagnetic waves reflect off the rebar. The specified cover depth for Bridge ##### was 1.5 in. (38 mm) and thus the scales have been adjusted to reflect that cover depths smaller than this value minus 0.5 in. are classified as "insufficient". Although none of the bridge deck showed cover less than the specified values, the cover depths do vary considerably across the bridge. This variation appears correlated with longitudinal moments with lower cover depth associated with regions of positive dead load moments.



Quality Assessment:

Cover Index	Insufficient	As Specified	Excessive
	[0. 1.0]	[1.0, 2.0]	2.0 +
69.12	0.0 %	38.25 %	61.75 %

Figure 2 – Cover depth maps derived from GPR data for Bridge ##### (length units are in feet and cover depth is in inch. Average dielectric constant of 8 was used to calculate the cover dimension using dielectric estimations generated by the High Speed GPR system)

4

Some Results & Benefits

1. Visual inspection surveys conducted faster, more accurately and safer in a collaborative manner from the comfort of personnel's desktop computers assisted by Artificial Intelligence engines.
2. Routine inspection reports can be pre-populated, edited and filed by click of a button.
3. Sounding of bridge decks can take place at traffic speed with no lane closure with higher quality and repeatability.
4. High resolution crack mapping surveys are prepared automatically and are customizable to your needs.
5. Turnaround time (time from field to insight) are fastest in the industry (Utilizing automation and standardization).
6. Several qualified NDE sensors, all deployed at traffic speed, can assist the inspection and maintenance crew with their day-to-day activities and decision makings.
7. Best available condition indices, performance metrics, plots, quantity estimates and location of surface and sub surface damage and corrosion ideal for maintenance planning, contract and project scoping
8. User-friendly customizable application with comprehensive and simple to use data management system.
9. Repair type or replacement decisions based on a comprehensive view of all available bridge information and metrics (based on owner-specified criteria)
10. Remaining service life estimation and simulation, Preservation, and maintenance recommendations
11. Online, cloud-based representation of data and information with integration capability to other bridge or asset management systems.

Thank You!

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