SHRP2 R06A - Nebraska Experience

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NEBRASKA
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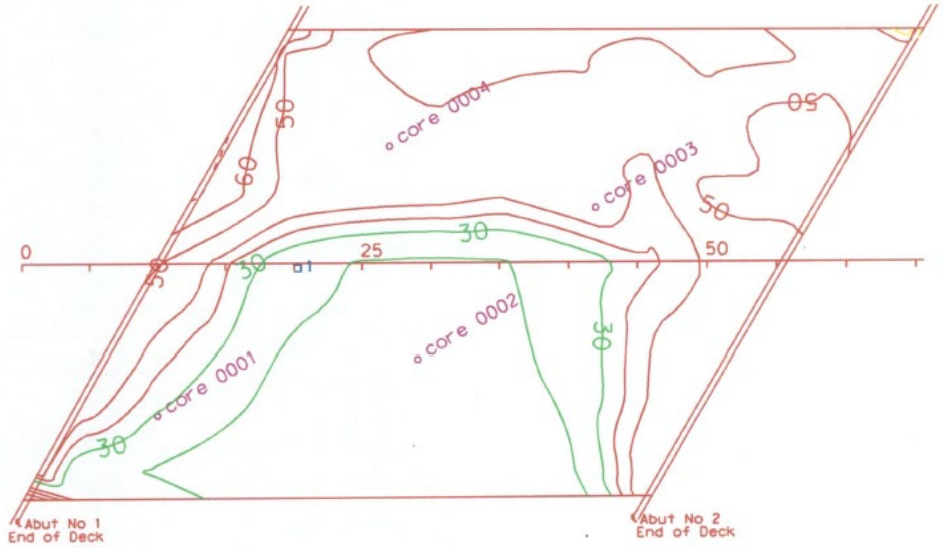
DEPARTMENT OF TRANSPORTATION

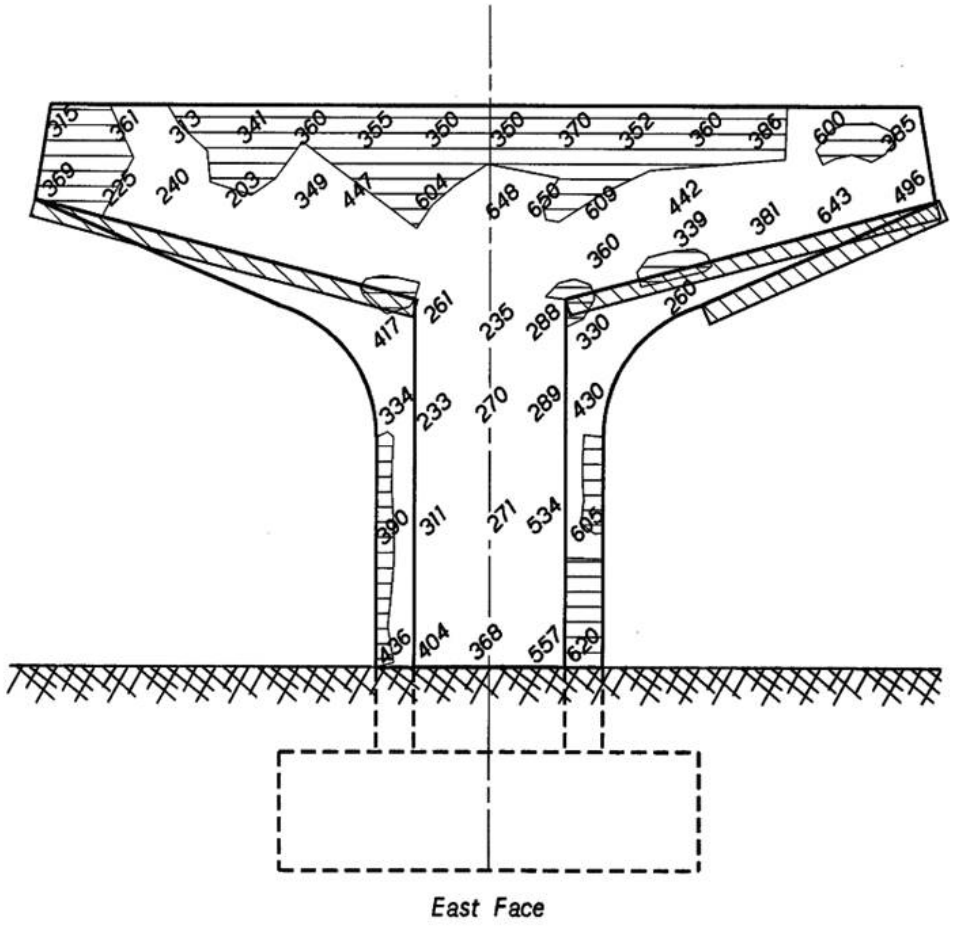
Nebraska NDT Background – Bridge Management

BRIDGE DECK SURVEY

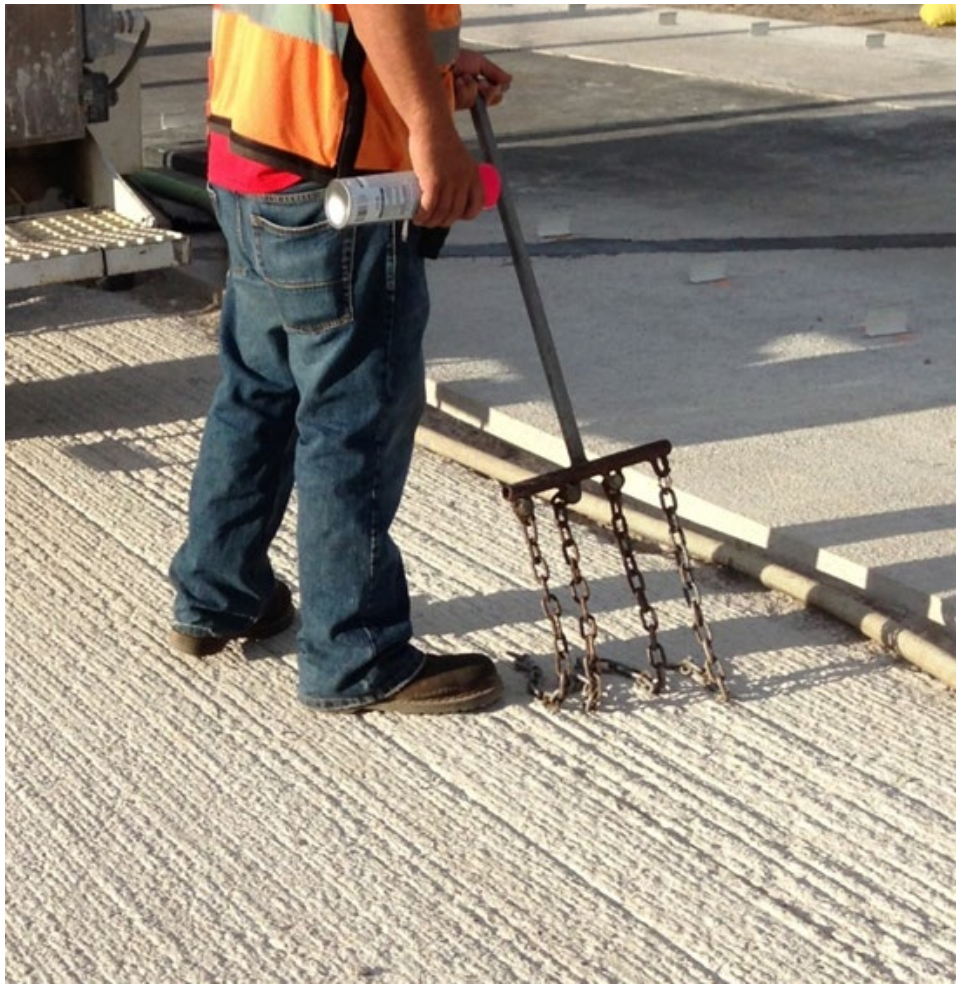
Project No= 35-4(111) Hwy No= N-35 Ref Post= 21.19
Location= Winside North
Spans= One Date Tested= 8/1/00 Roadway Width= 34 FT
Reamrks= Cast-in-Place Concrete Girders
DELAMINATED AREAS
0.25 SQ FT OF 1562.64 SQ FT = 0 PERCENT
CHLORIDE ANALYSIS:

CORE	REINFORCING DEPTH(IN.)	CHLORIDES (LB./CU.YD.)
0001	2.50	0.13
0002	2.50	0.27
0003	2.50	0.27
0004	2.50	0.40
AVERAGE	2.50	0.27





Nebraska NDT Background – Active Construction



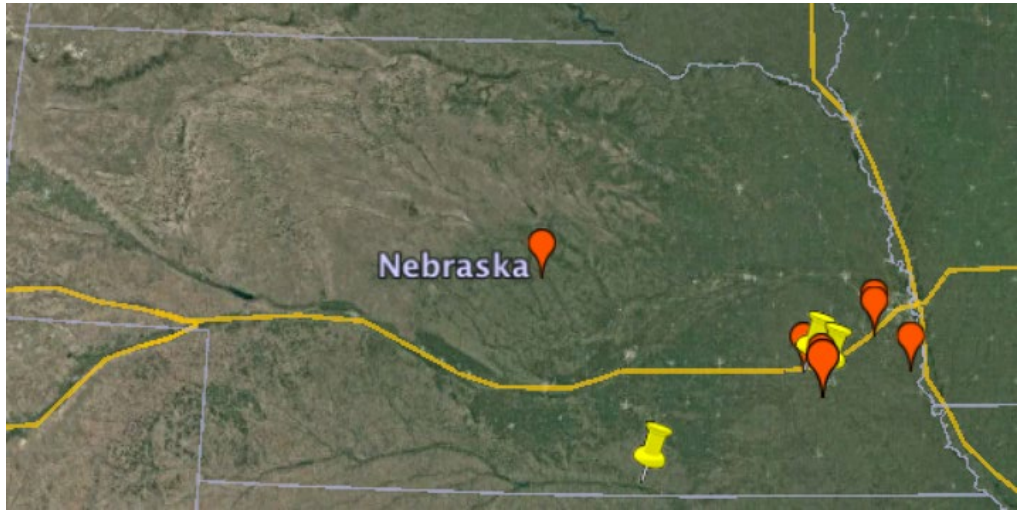
Nebraska NDT Background – Research

Nebraska's SHRP2 R06A Project:

JOINT EFFORT

Nebraska's SHRP2 R06A Project:

- Initial Discussions
  - SHRP2 R07 IAP Recipient
  - NDOT seeks to implement a process of strategically programming their bridge deck assets for repair, maintenance and preservation.
  - This process could include NDE as it provides quantitative information to make data driven decisions.
  - A process that could be implemented in a phased approach would be preferred.
- Scope
  - Perform NDE with a phased approach to quickly assess a large population of bridge decks and identify those decks needing higher resolution inspection.
  - Perform high resolution inspection to determine more quantitative information.

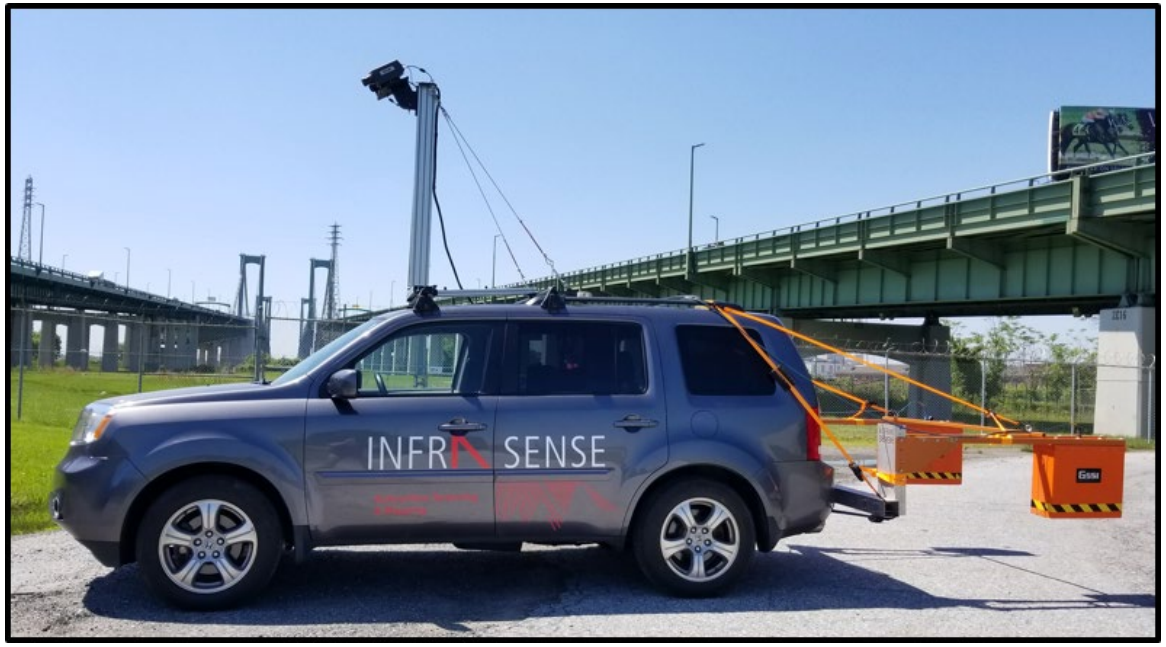


Structure ID	Location	Length (ft)	Width (ft)
S006 30531	US 6 over South Branch of Middle Creek	122	42.7
S006 30574	US 6 over Burlington Northern Santa Fe Railroad	325	45.6
S031 00805	SR 31 over Platte River Tributary	153	34.5
S034 36465	US 34 over unknown creek	125	46.5
S070 10107	SR 70 over unknown creek	36	39
S077 05024L	US 77 SB over Salt Creek	140	39
S077 05693L	US 77 SB over Rock Island & Pacific Railroad	162	42.2
S077 05693R	US 77 NB over Rock Island & Pacific Railroad	180	39.6
S080 43297	SR 31 over I-80	211	88.3
S136 08987	US 136 over Beaver Creek	163	30.4

- 10 Bridges
- Primarily bare concrete deck
- 2 with asphalt overlays

Phase I – Network Level/High Speed Scanning

- October 2017
- 45 mph – Minimal traffic disruption
- 10 Bridges
  - Infrared Thermography
  - Ground Penetrating Radar
  - High Resolution Video

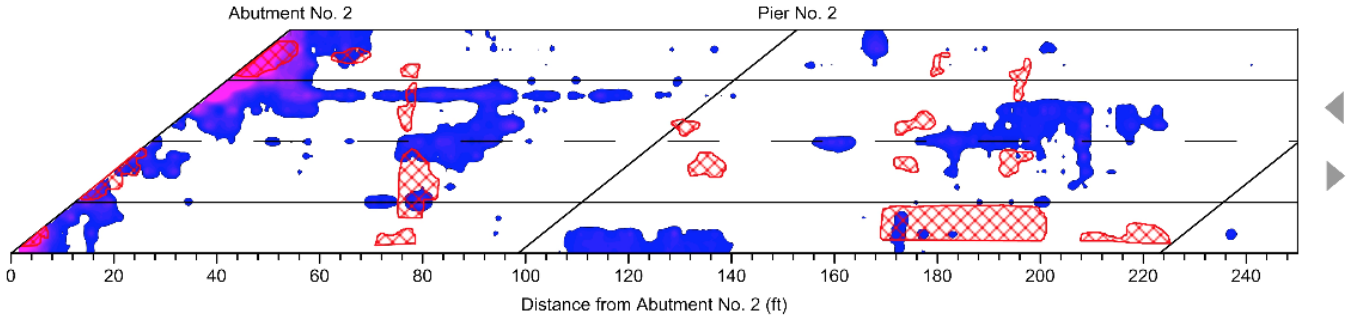


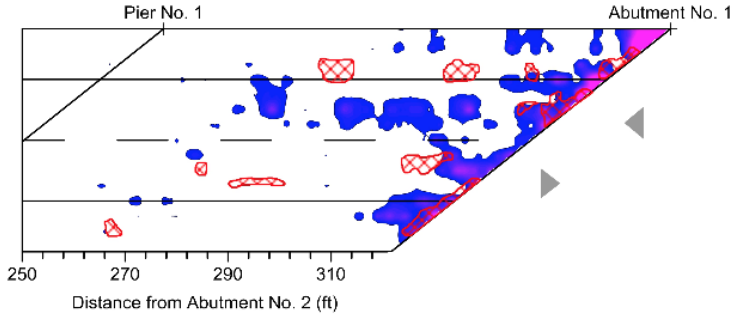
Phase II – Project Level/Validation Testing

- January 2018
- Done under lane closures
- 3 Bridges selected/ 2 tested
  - Manual Chain Drag
  - Deck Acoustic Response
  - SounDAR
  - Electrical Resistivity Testing
    - Originally half-cell

STRUCTURE 006 30574

PHASE I RESULTS S006 30574





Concrete Condition Legend	Orientation	Quantity Summary			General Information
Deterioration detected by GPR severity →	N	Condition	sq. ft.	%	Bridge ID: S006 30574 US 6 Over BNSF RR
Delamination detected by IR		Delamination (IR)	758.1	5.7	
Patching		Deterioration (GPR)	2059.5	14.6	Analyzed by: SB, RG Reviewed by: AC Completed: 11/20/17
Spalling		Patching	0.0	0.0	
*combined quantity accounting for overlap		Spalling	0.0	0.0	**Sheet 1 of 1**
Not Surveyed	▶ Direction of traffic	Combined Defects*	2586.6	18.3	

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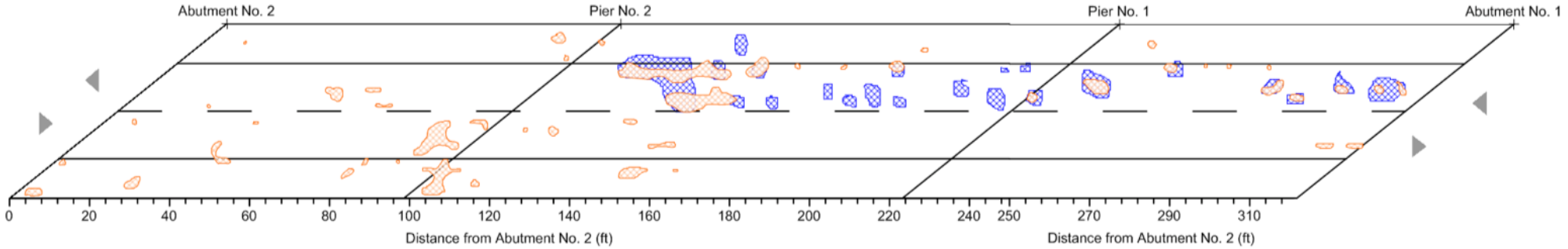
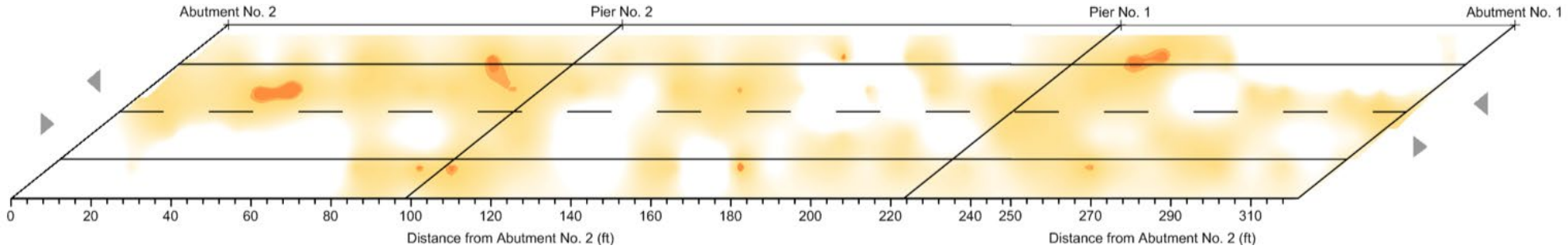
PHASE II RESULTS S006 30574



Concrete Condition Legend	Orientation	Quantity Summary			General Information
Only the east bound lane and shoulder between were surveyed via manual chain drag. The entire roadway was surveyed with SounDAR. The lanes were closed during the survey.	N	Condition	sq. ft.	%	Bridge ID: S006 30574 US 6 Over BNSF RR
Delamination detected by Chain		Delamination (Chain)	436.6	3.1	Analyzed by: JC Reviewed by: SB Completed: 3/2/18
Delamination detected by SounDAR.	Direction of traffic	Deterioration (SounDAR)	402.8	2.9	
		Combined Defects*	839.5*	6.0	**Sheet 1 of 1**
		Defects have overlapping areas			

BRI RAW DATA. REFINED RESULTS.

PHASE II RESULTS S006 30574



Electrical Resistivity (R) Color Scale	Orientation	Quantity Summary		General Information
R > 20 | 10 < R < 20 | 5 < R < 10 | R < 5	N Direction of traffic	Corrosion Likelihood	%	Bridge ID: S006 30574 US 6 Over BNSF RR
		Very High (R < 5)	0	
		High (5 < R < 10)	0	Analyzed by: LM Reviewed by: SB Completed: 3/2/18
		Moderate Low (10 < R < 20)	2	
		Low (R > 20)	98	Sheet 1 of 1

RAW DATA. REFINED RESULTS.

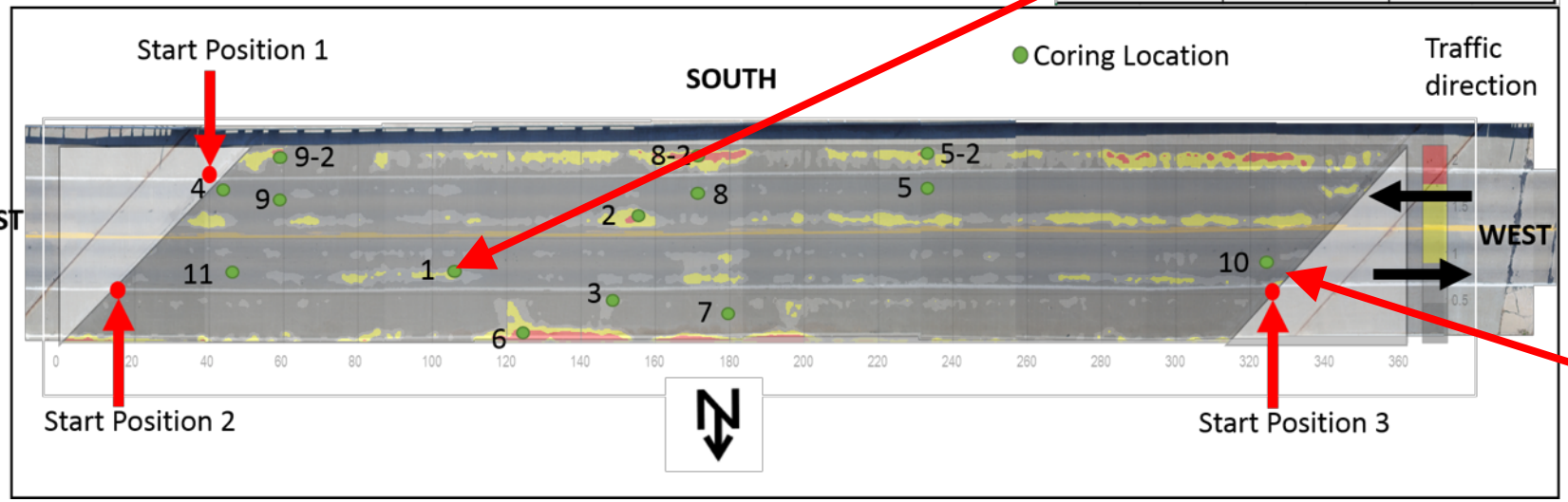
CORE RESULTS S006 30574

Core ID	From Start Position 1	From Edge Line
	ft in	ft in
2	118'	8'5"
4	1'7"	1'11"
5(5-2)	198'7"	3'5"
8(8-2)	134'6"	3'11"
9(9-2)	17'8"	4'1"

Core ID	From Start Position 2	From Edge Line
	ft in	ft in
1	96'2"	3'4"
3	140'1"	2'1"
6	115'5"	8'11"
11(ref.)	34'5"	3'6"

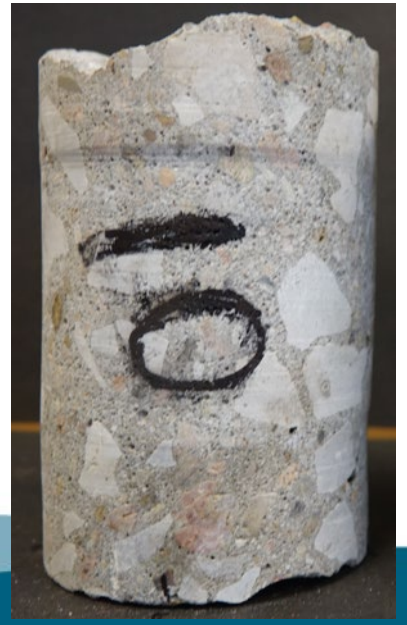
Bridge S006 30574
US 6 OVER BNSF RR

Core ID	From Start Position 3	From Edge Line
	ft in	ft in
7	150'11"	5'1"
10	1'5"	4'11"

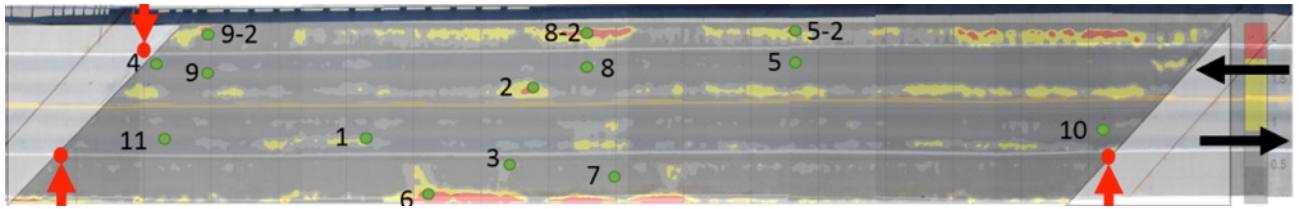


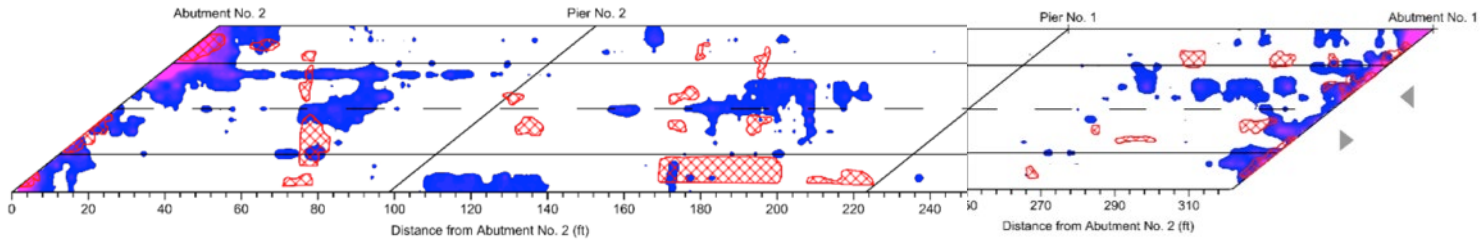
Chlorides:
3.11 lb/cuyd

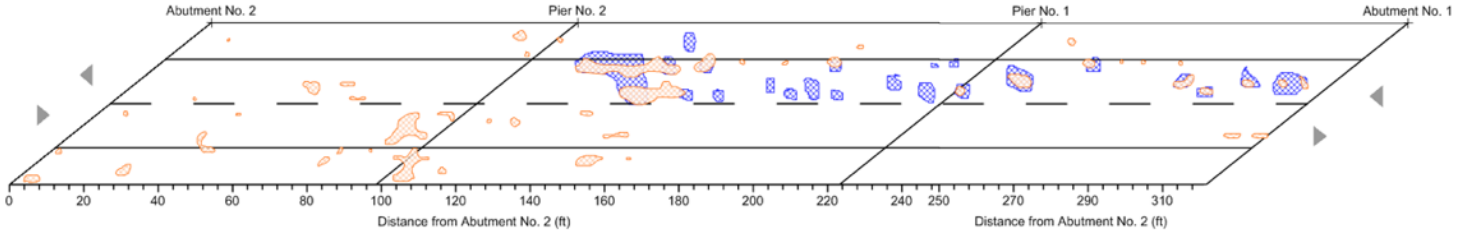
Chlorides:
4.12 lb/cuyd

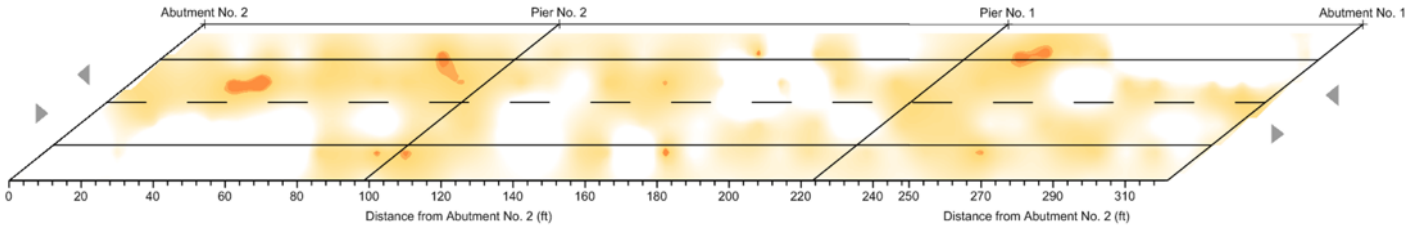


ALL RESULTS S006 30574



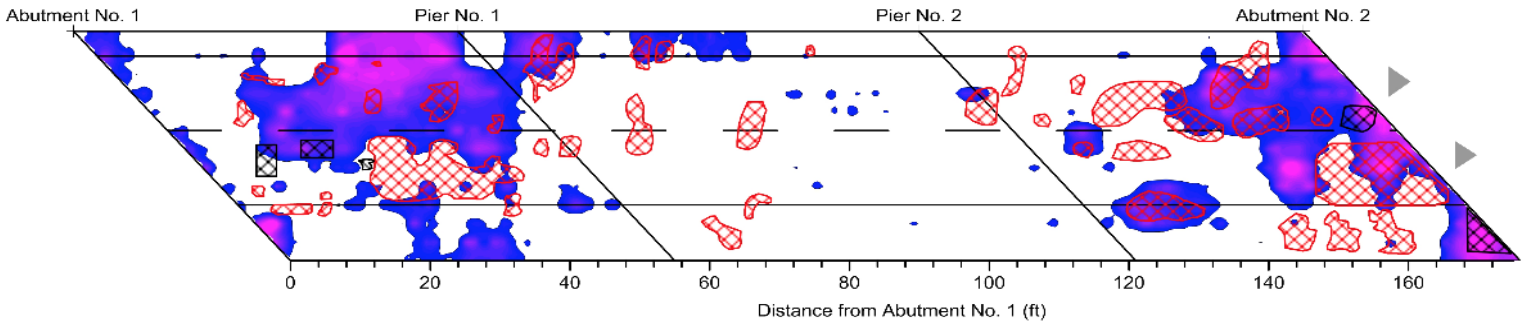






STRUCTURE S077 05693R

PHASE I RESULTS S077 05693R



Concrete Condition Legend	Orientation	Quantity Summary			General Information
Deterioration detected by GPR severity →	Delamination detected by IR Patching Spalling Not Surveyed		N	Condition / sq. ft. / %	Bridge ID: S077 05693R US 77 NB over RI & P RR
*combined quantity accounting for overlap	▶ Direction of traffic			Delamination (IR) 870.4 20.1	Analyzed by: SB, RG Reviewed by: AC Completed: 11/20/17
				Deterioration (GPR) 1789.3 27.6	
				Patching 68.4 1.5	
				Spalling 0.0 0.0	**Sheet 1 of 1**
				Combined Defects* 2247.6 34.6	

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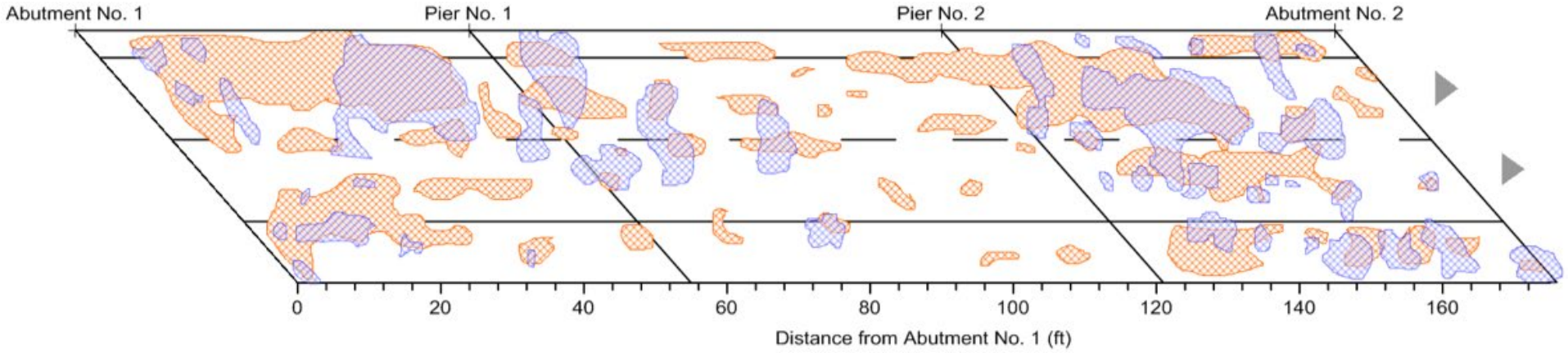
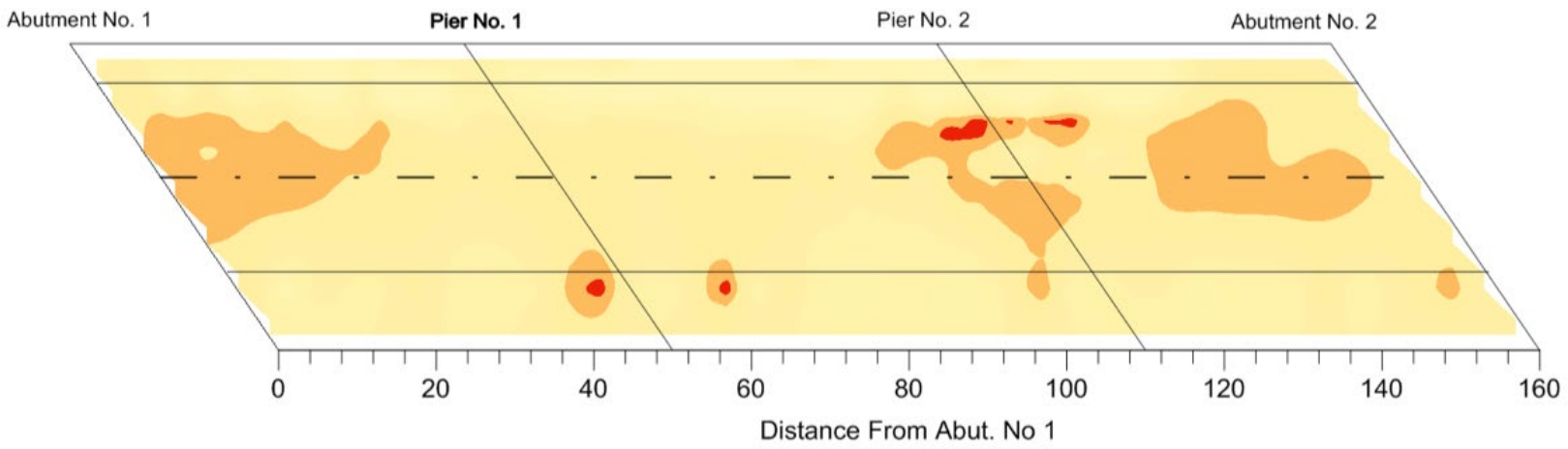
PHASE II RESULTS S077 05693R



Concrete Condition Legend	Orientation	Quantity Summary			General Information
The entire roadway were surveyed with manual chain drag and SounDAR. The lanes were closed during the survey.	N	Condition	sq. ft.	%	Bridge ID: S077 05693R US 77 NB over RI & P RR
Delamination detected by Chain		Delamination (Chain)	1173.9	18.2	
Delamination detected by SounDAR.	▶ Direction of traffic	Deterioration (SounDAR)	1800.0	27.6	Analyzed by: JC Reviewed by: SB Completed: 3/2/18
		Combined Defects*	2973.9*	**45.7**	
		Defects have overlapping areas			**Sheet 1 of 1**

BQI RAW DATA. REFINED RESULTS.

PHASE II RESULTS S077 05693R



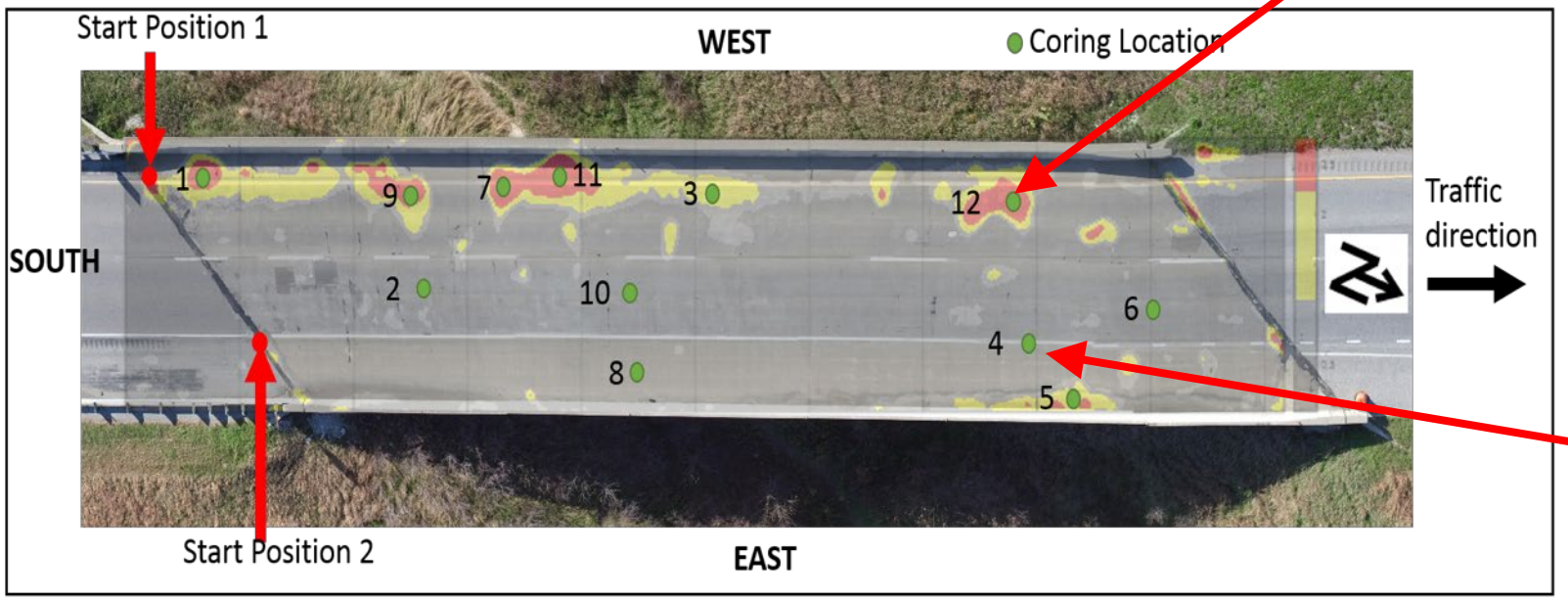
Electrical Resistivity (R) Color Scale	Orientation	Quantity Summary		General Information
R > 20 | 10 < R < 20 | 5 < R < 10 | R < 5	Direction of traffic	Corrosion Likelihood	%	Bridge ID: S077 05693R US 77 NB over RI & P RR
		Very High (R < 5)	0	
		High (5 < R < 10)	2.5	Analyzed by: LM Reviewed by: SB Completed: 02/07/18
		Moderate Low (10 < R < 20)	4.6	
		Low (R > 20)	92.9	Sheet 1 of 1

BGI RAW DATA. REFINED RESULTS.

CORE RESULTS S077 05693R

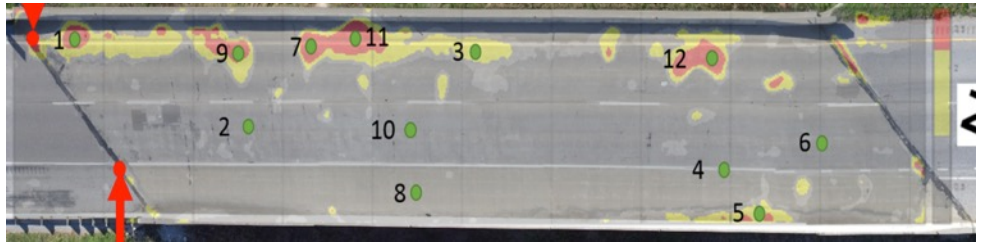
Core ID	From Start Position 1	From Edge Line
	ft in	ft in
1	9'5"	6"
3	99'11"	1'10"
7	62'10"	6"
9	46'5"	1'8"
11	72'10"	6"
12	153'6"	2'7"

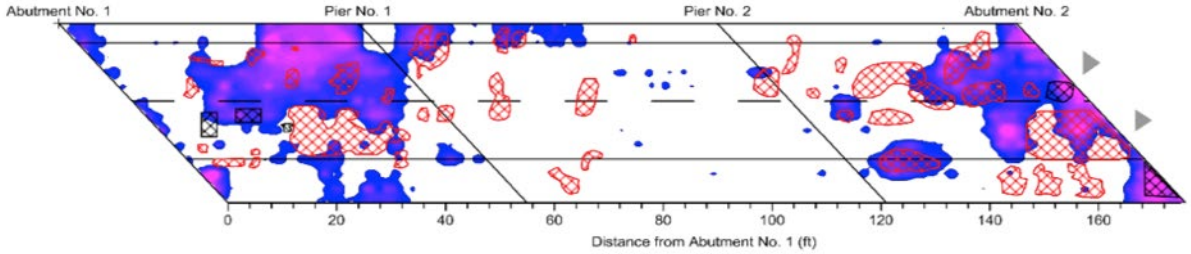
Core ID	From Start Position 2	From Edge Line
	ft in	ft in
2	28'11"	7'2"
4	134'5"	0"
5	142'	8'1"
6	155'11"	5'1"
8	66'2"	5'2"
10(ref.)	64'11"	6'5"

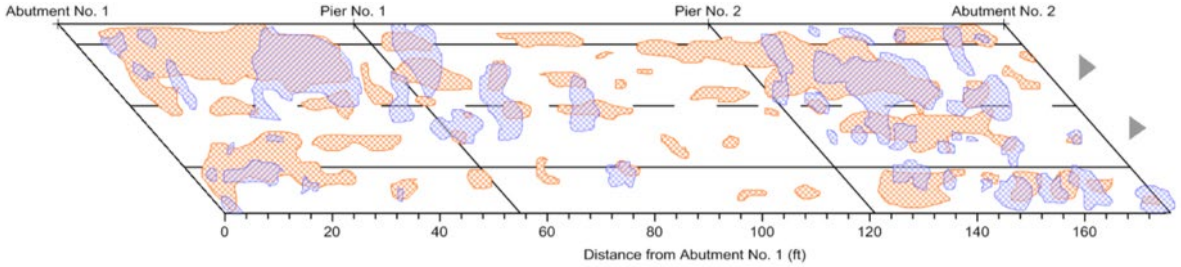


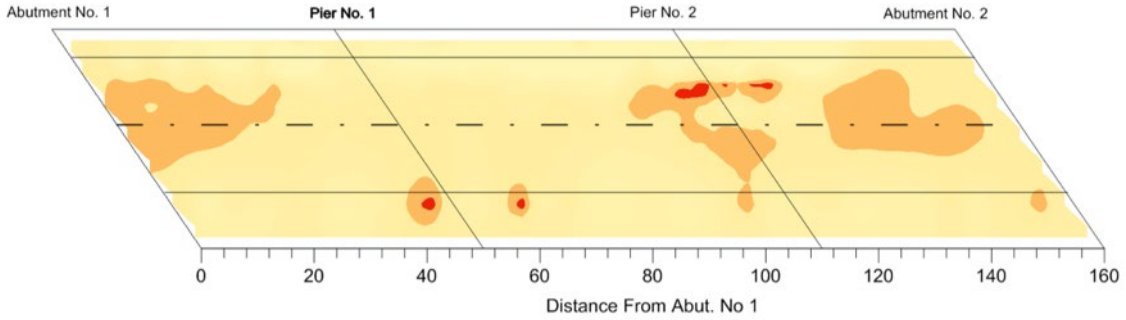
Bridge S077 05693R

ALL RESULTS S077 05693R



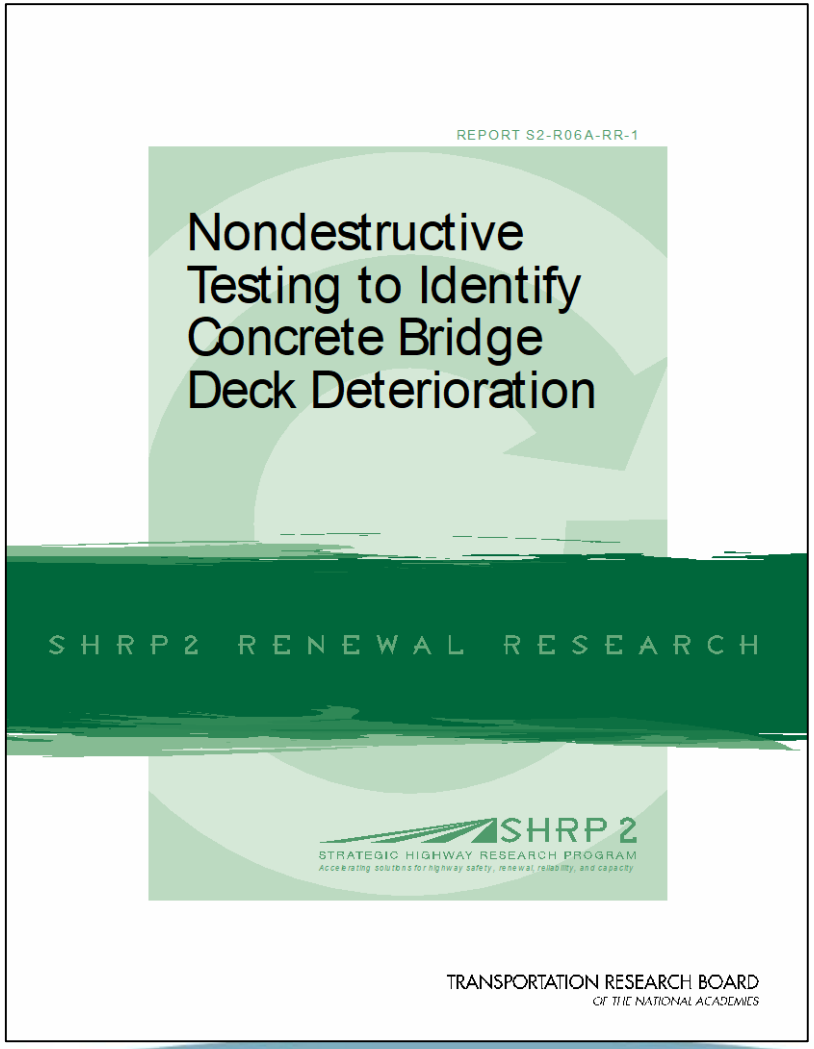






Conclusions

- Phase I inspection can provide data for:
  - Long term degradation potential
  - Approximate quantities for repair
  - Identification of bridges for further inspection
- Phase II inspection can provide data for:
  - High resolution information on bridge deck condition
  - Quantities for immediate repair



Moving Forward

- Looking into doing program level NDE of high asset corridors
- Need for evaluation performance of decks with overlays
- Identifying bridges that can benefit from NDE
- Correlate NDE data to actual construction information

On Going Research

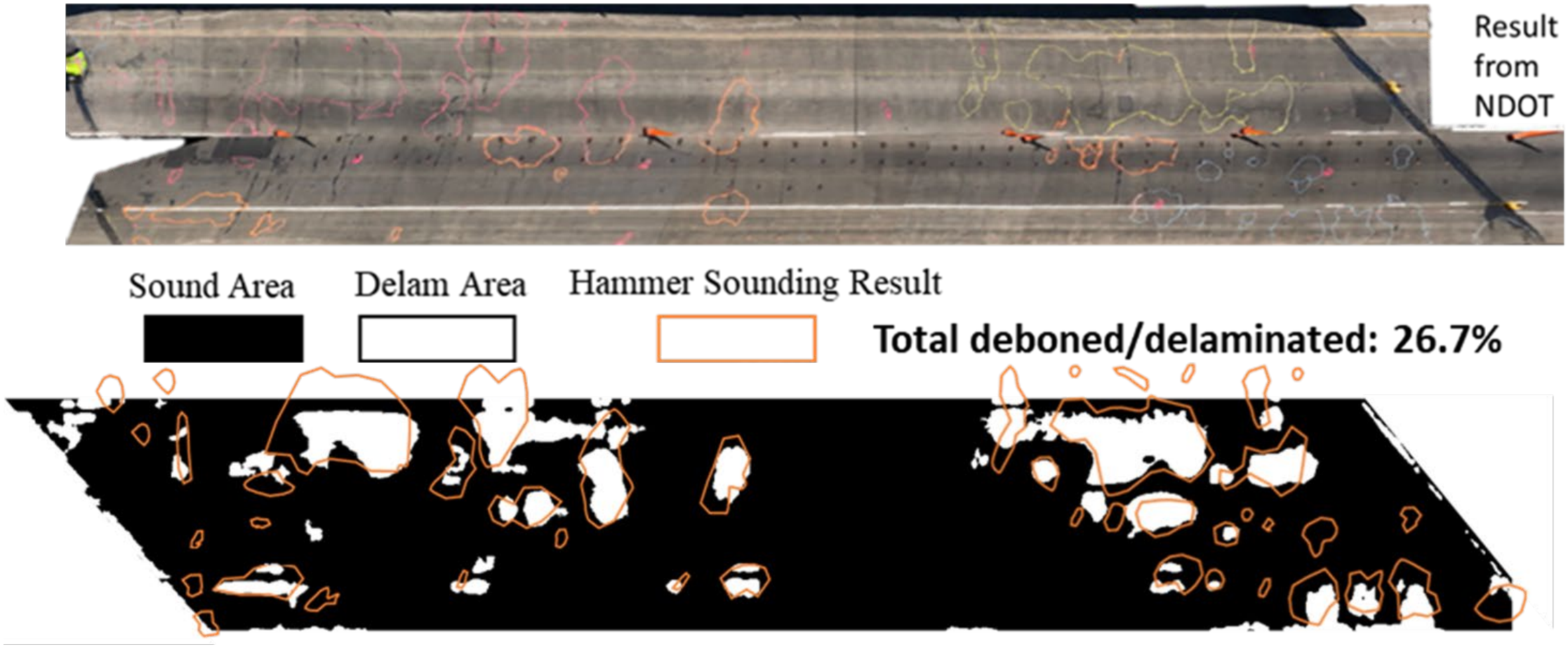


Fig. 3. The preliminary result of Bridge-S0770 5693R: 3” concrete overlay debonding

On Going Research

- I-680 Mormon Bridge:
  - Asphalt over existing deck
  - Plan quantity over ran on first half of first bridge
  - GPR scan prior to membrane being removed predicted high potential for deterioration.

	Quantity Summary		General Information
Cover Condition	Conc. Deterioration (%)	29.5	Bridge ID: S680 01343R I-680 WB over Missouri River
	Conc. Deterioration (s.f)	17120	Analyzed by: EG Reviewed by: AC Completed: 1/10/19
	Concrete Cover (in)	1.8	
	Asphalt Cover (in)	2.7	Sheet 1 of 4

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