Nondestructive Condition Evaluation of 14 Bridge Decks – Florida DOT, District 2

FINAL REPORT

Submitted to

RS&H
10748 Deerwood Park Blvd South
Jacksonville, FL 32256

by

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July 22, 2016

1. Introduction

The objective of this project is to evaluate the condition of the 14 bridge decks listed in Attachment A, which are located in the Jacksonville area. The deck condition evaluations were carried out using infrared thermography (IR), ground penetrating radar (GPR), and high resolution video imaging. Impact echo and hammer sounding were also used to augment the IR and GPR results. The deck condition information will be utilized by RS&H and FDOT (District 2) to plan future maintenance and rehabilitation efforts.

2. Data Collection

The IR and GPR survey work took place on May 2nd and 3rd. The weather conditions were sunny to partly cloudy with temperatures in the mid-80's to low-90's (°F). The impact-echo (IE) testing and hammer sounding was completed on June 6th, using the preliminary results of the IR and GPR analyses to target a minimum of 10 locations per bridge deck. Infrared data was collected for 11 decks, and GPR and IE data was collected for select lanes of 9 decks as prescribed by Florida DOT (see Attachment A for details). The IR, GPR, and IE equipment used for this project is shown in Attachment B.

2.1 Infrared Thermography (IR)

The infrared thermography survey was carried out according to ASTM D 4788 – 03 (2013) using a 320 x 240 pixel FLIR Systems Model A-40 infrared camera and a Garmin 1080p VIRB video camera, both mounted to an elevated platform on top of the survey vehicle and operated remotely from within the vehicle. Data was collected from 10 AM to 5 PM, ensuring maximum temperature differentials caused by delamination.

The infrared data was collected in a series of passes across each deck, moving at approximately 50 mph. For a typical interstate deck with 2 lanes and left and right shoulders, the survey requires four passes—one in each lane and one in each shoulder. Each pass covers a deck width of 12 to 15 feet. The IR camera is connected to an electronic distance measuring instrument (DMI) and set to record an image for every foot of travel.

2.2 Ground Penetrating Radar (GPR)

The GPR surveys were carried out according to ASTM D 6087-08 using a dual 1 GHz horn antenna system manufactured by GSSI, Inc. of Nashua, NH. The GPR data was collected in a series of lines spaced 3 feet transversely across the width of each deck at speeds up to 55 mph. A typical 40-foot-wide deck would have 13 lines of data, each representing a cross sectional slice of the deck at a particular offset. The DMI distance data is continuously recorded into each GPR record, so that each GPR data scan has an associated distance.

2.3 Impact-Echo (IE)

The impact-echo testing was carried out according to ASTM C1383-15 using an Olson Instruments NDE-360 unit. A total of 114 locations were tested, with a minimum of 10 locations for each of the 9

prescribed decks to confirm the infrared and GPR results. Test locations were selected using the preliminary results of the GPR and IR analyses.

3. Data Processing and Analysis

3.1 Infrared Thermography (IR)

The infrared data is reviewed simultaneously with the video data to differentiate delaminated areas from surface features (discoloration, oil stains, sand and rust deposits, etc.) that appear in the infrared, but are unrelated to subsurface conditions. Figure 1 shows an example of delaminated areas as they appear in a single image of infrared data and in the corresponding visual data. For analyzing this data, a horizontal slice is taken from each image, calibrated so that it captures an area that is 1 foot in the direction of travel. Sequential slices are then stitched together to create a single strip image for each pass. The strip image for each pass is placed next to those of adjacent passes to produce a composite thermal image of the entire deck as shown in Figure 2 (bridge 720079).

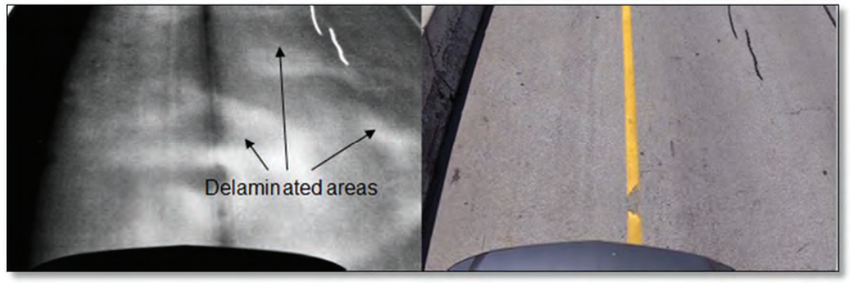


Figure 1. Sample Infrared and Visual images

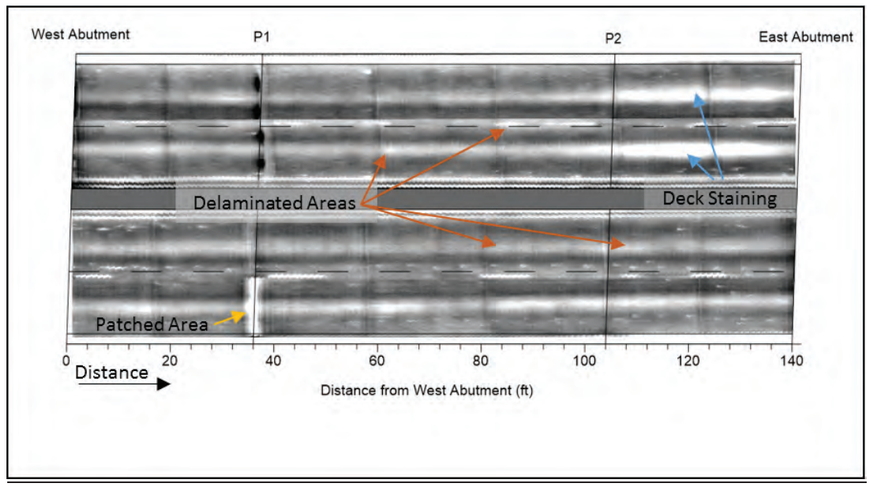


Figure 2. Sample IR image from bridge 720079 showing delaminations, deck staining and patching.

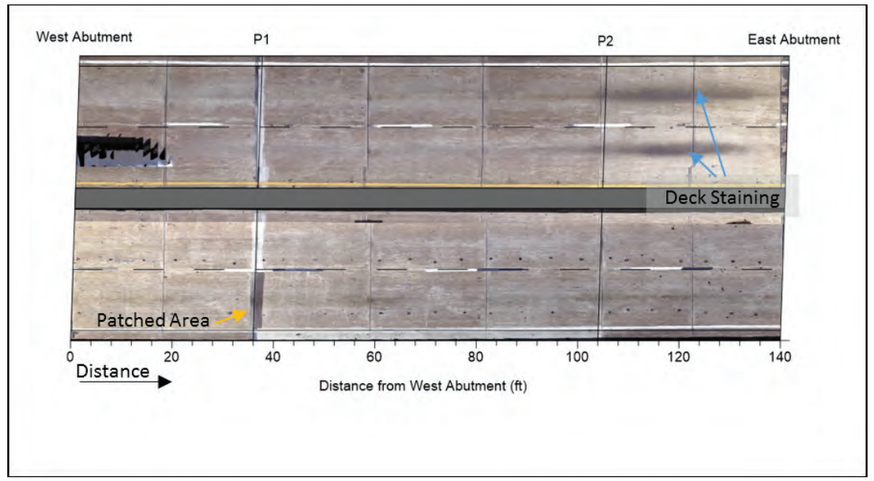


Figure 3. Sample High Resolution Video image from bridge 720079 showing deck staining and patching.

The white blotchy areas on the IR image of Figure 2 indicate delaminations. These are "hot spots" where the surface temperatures are higher due to the thermal barrier produced by the delaminations. Surface staining/discoloration can also produce “hotspots" unrelated to subsurface conditions. The darker the color of the deck surface, the higher the emissivity and corresponding surface temperature. Figure 3 shows the stained areas highlighted in Figure 2 as they appear in the visual data.

Thermal images such as those shown in Figure 2 have been created for each bridge surveyed under this project. For the analysis, the delaminated and debonded areas that appear in each image are delineated and quantified. Areas where the IR data was obscured (by shadows, staining, water, debris, etc.) were also mapped and quantified. When calculating the delamination percentage for each deck, the obscured area was first subtracted from the total area to account for the reduction in useful data.

3.2 Ground Penetrating Radar (GPR)

The GPR analysis is carried out with Infrasense's proprietary software *win*DECAR® using the following steps:

(1) Identification of the beginning and the end of the deck in each radar file, and check of the radar distance measurement against the known length and other features within the deck;

(2) Identification of features (top rebar, bottom of deck) that appear as dielectric discontinuities in the GPR data (see example data, Figure 4);

(3) Setup of the analysis for all of the passes for a given deck, computation of concrete dielectric constant, rebar depth, and concrete attenuation;

The analyzed GPR data is presented in the form of contour plots. The potential areas of delaminated and scaled concrete are identified by a threshold, which is calculated from statistics of the analyzed

data. Figures 4 and 5 show samples of GPR data used for the condition assessment. Figure 4 is a sample of GPR data recorded along the left wheel-path of the inside lane of bridge 720174. Note that the reflections from the rebar and deck bottom are both strong (relatively high amplitude) and uniform throughout the length of the pass.

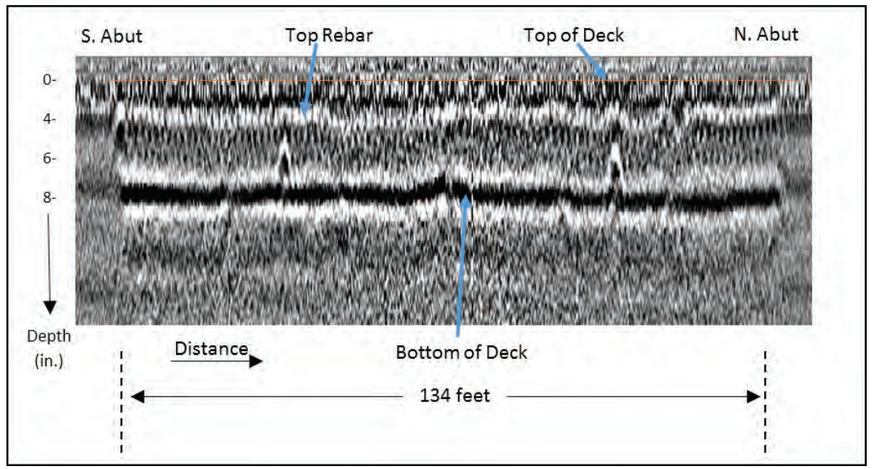


Figure 4. Sample GPR data from bridge 720174 (left lane).

Figure 5 provides a sample of GPR data recorded in the shoulder of the southbound direction of bridge 720323, showing typical signs of deterioration. The weakening of the reflection (attenuation) from the top rebar layer and the bottom of the deck is an indication of corrosion, chloride contamination, and possible delamination.

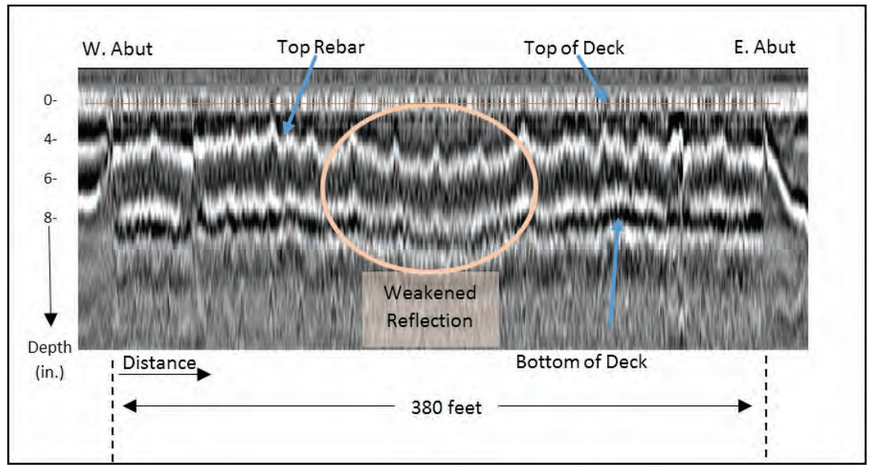


Figure 5. GPR data from Bridge 720323 showing typical signs of deterioration.

3.3 Impact-Echo (IE)

Impact-echo testing was carried out at 114 locations to validate the IR and GPR results. Test locations were selected using the preliminary condition maps. The impact-echo test provides a resonant frequency associated with the thickness of the deck slab. If the slab is intact, the thickness data is clear, and should correspond with the expected slab thickness. If the slab is delaminated, the thickness data is unclear and generally does not correspond to the thickness of the slab. Figure 6 provides example data from both a sound and delaminated location. Note that the thickness scale on these plots is in feet. The thickness in plot (a) corresponds to the expected thickness (sound), where the thickness in plot (b) is very different (delaminated). The impact-echo results were subsequently used to calibrate the preliminary IR and GPR results and produce the final version of the condition maps presented in Attachment C.

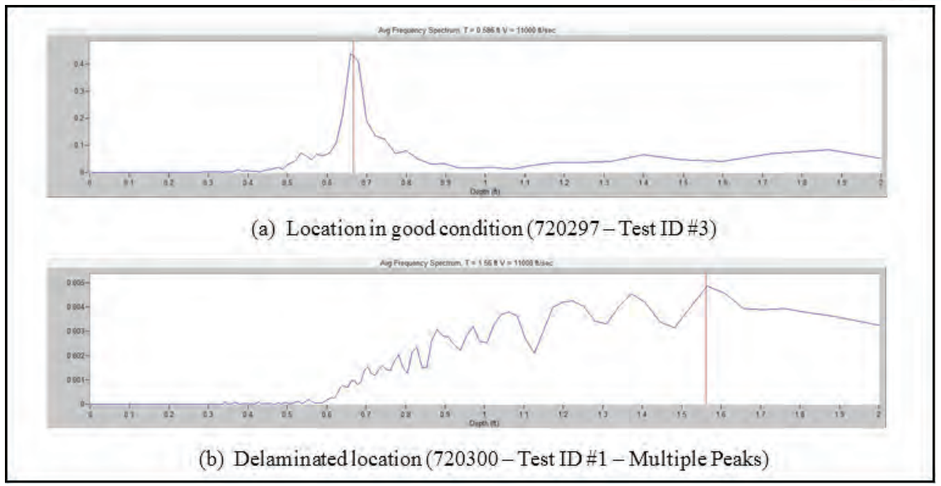


Figure 6. Impact-Echo data samples showing a non-delaminated (a) and delaminated location (b)

4. Results

The results of the nondestructive deck evaluations include the summary table in Attachment A, and the condition and rebar-depth maps provided as Attachment C. These results were obtained using the combination of infrared thermography (IR), ground penetrating radar (GPR), and impact-echo (IE) prescribed by Florida DOT, District 2. Of the 14 bridges, 6 were surveyed using IR, GPR and IE, 5 were surveyed using IR only, and the remaining 3 were surveyed using GPR and IE. The GPR and IE testing were limited to select lanes for 7 of the decks (see Attachment A for details). Note that the quantities provided in Attachment A are reported as a percentage of the surveyed area, accounting for the presence of physical obstructions (lane closures) and thermal obstructions (staining, shadows, debris).

The final condition maps (Attachment C) show the combined results of the IR, GPR and IE surveys. The mapped conditions include: delaminations detected by IR and shown as red hatched polygons; deterioration detected by GPR and shown as blue to magenta areas; and patching detected in the IR and visual data and shown as green hatched polygons. Diamond icons are used to define the impact-echo test locations; with green diamonds designating IE results that show the deck in good condition, and red diamonds designating IE results indicative of delamination. The IE results correlate with the final IR and GPR results at 87 of the 114 IE test locations (76%). A majority of the IE results that don't correlate with the final condition maps (22 of 27) are GPR "false positives". These are areas where the GPR is likely detecting precursor conditions, such as chloride contamination and corrosion activity, that have not yet manifested into delaminations detectable by IE testing (or sounding). Given that IR detects existing delaminations, whereas GPR detects a mix of precursor conditions and delaminations, the correlation between the results of the two methods varies. To quantify the level of correlation between the GPR and IR results for each bridge, we used the following definitions:

- Good Correlation: GPR and IR generally detect the same areas of distress (>80% correlation).
- Reasonable Correlation: GPR and IR generally detect some common distress areas (>50% correlation).
- Limited Correlation: GPR and IR generally detect very few common distress areas (>25% correlation).

Table 1 shows the correlation between the IR and GPR results for the 6 bridges where both methods were used to evaluate the deck conditions. The table shows 3 of the decks to have "good" correlation, 2 "reasonable" correlation, and 1 "limited" correlation.

Table 1. Correlation between IR and GPR Results

Bridge #	IR delams (>10sf) within GPR survey area	IR delams that overlap GPR deterioration areas	IR delams adjacent to a GPR deterioration area (i.e. within 5')	IR delams that correlate with GPR deterioration areas	Correlation Percentage
720200	7	6	1	7	Good (7/7=100%)
720071	6	4	1	5	Good (5/6=83%)
720072	6	1	0	1	Limited (1/6=17%)
720036	7	1	6	7	Good (7/7=100%)
720132	5	1	2	3	Reasonable (3/5=60%)
720323	8	5	1	6	Reasonable (6/8=75%)

Based on the data collection and analysis efforts carried out for this project, we can draw the following conclusions regarding the ability of IR and GPR to provide an indication of bridge deck deterioration:

- The IR and GPR results correlated with impact-echo results at 76% of the test locations.
- Of the 6 bridges where both IR and GPR testing were conducted on the same deck area, the two methods correlated reasonably well with each other.

5. References

ASTM, “Standard Test Method for Evaluating Asphalt-Covered Concrete Bridge Decks Using Ground Penetrating Radar”, ASTM, Annual Book of ASTM Standards, Vol 04.03, Designation: D6087-08 (2015).

ASTM, “Standard Test Method for Detecting Delamination in Bridge Decks Using Infrared Thermography,” ASTM, Annual Book of ASTM Standards, Vol 04.03, Designation: D4788-03 (2013), 2013.

ASTM, “Standard Test Method for Measuring the P-Wave Speed and the Thickness of Concrete Plates Using the Impact-Echo Method,” ASTM, Annual Book of ASTM Standards, Vol 04.02, Designation: C1383-15.

Maser, K.R., and Roddis, W.M.K., “Principles of Radar and Thermography for Bridge Deck Assessment”, ASCE Journal of Transportation Engineering, Vol. 116, No. 5, Sept/Oct, 1990.

SHRP C-101, “Condition Evaluation of Concrete Bridges Relative to Reinforcement Corrosion – Volume 3: Method of Evaluating the Condition of Asphalt-Covered Decks”, Strategic Highway Research Program Report SHRP-S-325, Washington, DC, 1993.

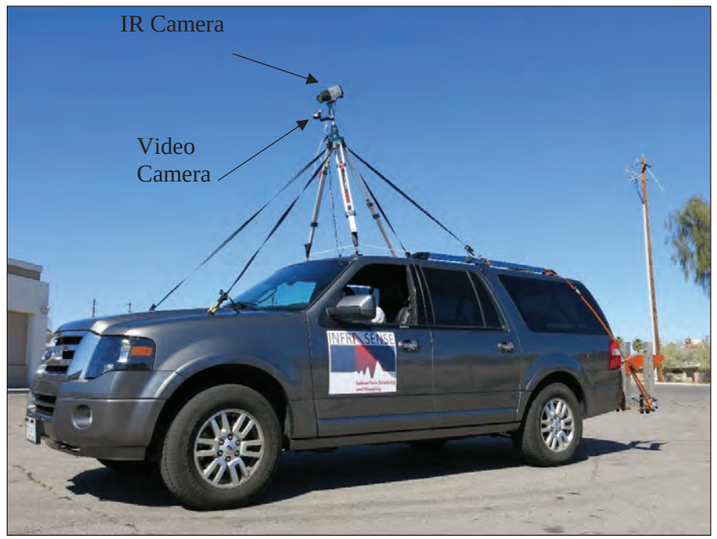
ATTACHMENT A
Bridge Deck Survey Results Summary

Bridge ID	Feature On	Feature Under	Roadway Area (sf)	IR Target Lanes	GPR Target Lanes	Delamination Quantity with Infrared (%)	Deterioration Quantity with GPR (%)	Avg. Rebar Depth (in.)	IE Correlation with Final GPR/IR
720200	I-10 WB (SR-8)	CSXRR	16226	ALL	Outside Lane Only	2.9%	15.00%	2.9	10 of 12
720071	SR-105	Myrtle Creek	2890	ALL	ALL	5.1%	10.6%	3.0	14 of 15
720072	SR-105	Simpson Creek	2893	ALL	ALL	3.8%	6.2%	4.5	13 of 16
720097	US-ALT-1 (SR-115)	8th St. & CSXRR	58503	All West Bound Lanes	N/A	3.6%	N/A	N/A	N/A
720055	US-ALT-1 (SR-115)	CSX RR	46924	All East Bound Lanes	N/A	5.4%	N/A	N/A	N/A
720036	US-ALT-1 (SR-115)	US-17 (SR-5)	15363	All West Bound Lanes	Outside Lane and Shoulder	3.0%	6.30%	2.9	8 of 14
720132	US-ALT-1 (SR-115)	11th St.	12848	All East Bound Lanes	Inside Lane and Shoulder	2.7%	4.40%	2.5	8 of 10
720488	SR-228 (Leg E)	Adams St. from Hart Ramp	53383	ALL	N/A	4.1%	N/A	N/A	N/A
720033	SR-115	Trout River	41860	All South Bound Lanes	N/A	3.4%	N/A	N/A	N/A
720079	SR-10A	Palmetto St.	9786	ALL	N/A	5.4%	N/A	N/A	N/A
720323	I-10 EB (SR-8)	CSX RR	19190	ALL	Inside Lane Only	3.6%	18.30%	3.1	12 of 14
720297	I-95 NB	Church St.	7250	N/A	Outside NB Lane and Inside Ramp	N/A	28.00%	2.1	11 of 13
720300	I-95 NB	Union St.	9660	N/A	NB Exit Ramp	N/A	12.20%	2.3	6 of 10
720174	I-95 NB	8th St.	14646	N/A	Outside NB Lane and Shoulder	N/A	3.70%	1.9	5 of 10

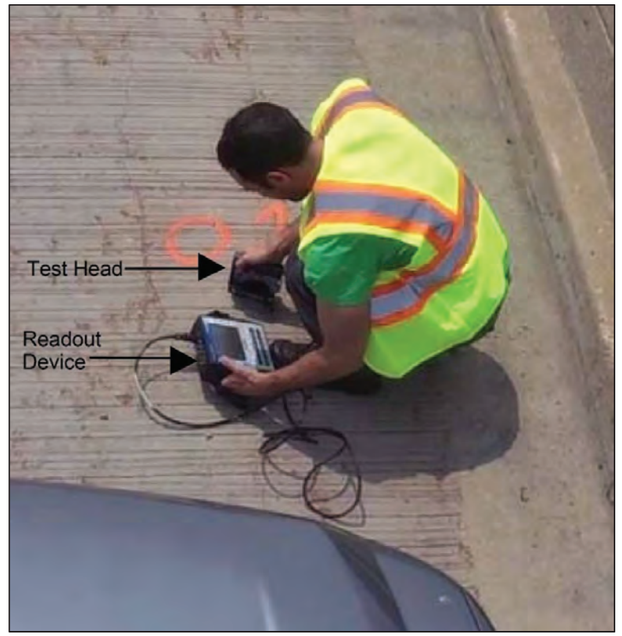
ATTACHMENT B

Equipment used for Deck Evaluations

GPR Equipment



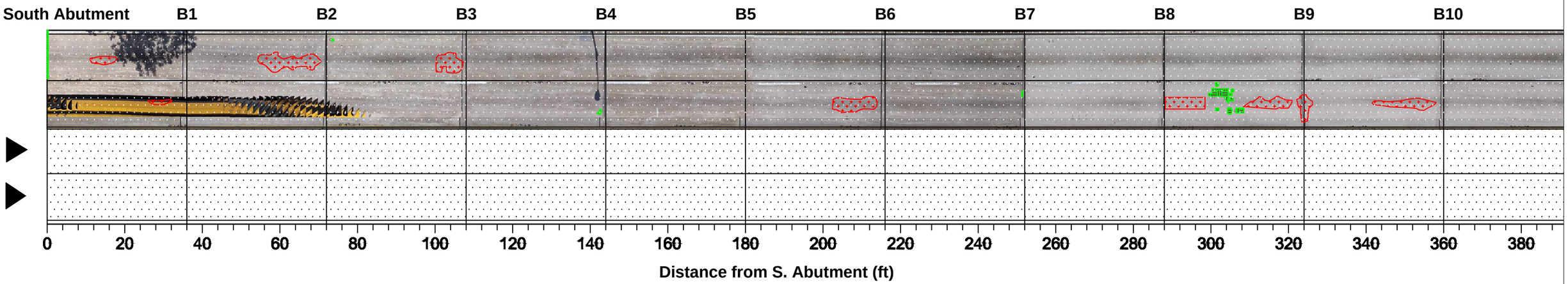
IR Equipment



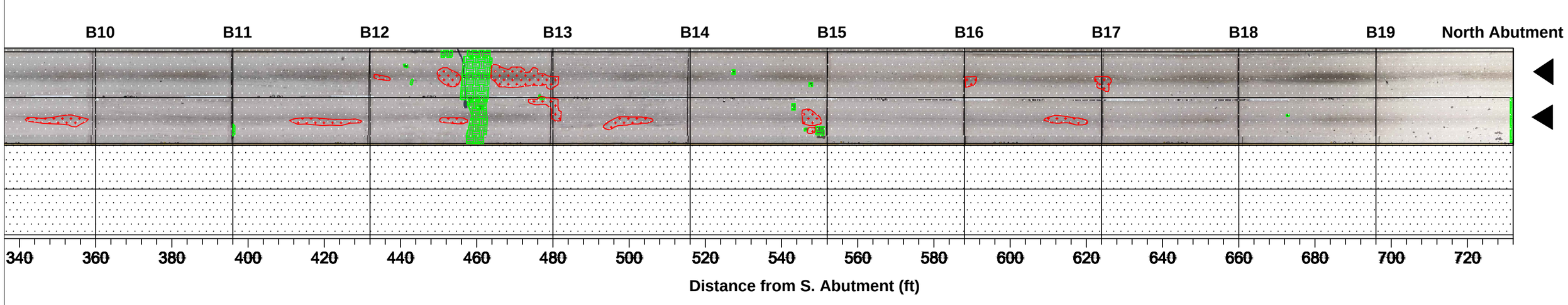
Impact-Echo Testing Equipment

ATTACHMENT C
Deck Condition Maps

IR Results



IR Results



INFRASENSE
Subsurface Scanning and Mapping

GPR Evaluated - Concrete Deterioration

Increasing Severity

Rebar Depth (Inches)

1 2 3 4 5 6 7

N

Direction of Travel

Scale: 1 inch = 25 feet

0 25 50

Delamination Detected with Infrared

Patching

Area Not Surveyed with GPR and Impact Echo

Impact Echo Test - Good Condition

Impact Echo Test - Delamination/Deterioration

Deck Condition Evaluation

SR-115

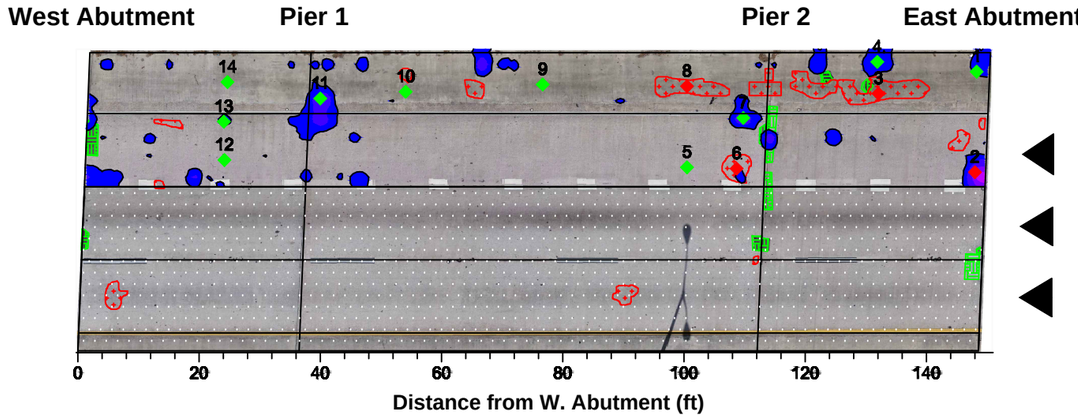
Bridge ID: 720033

RS&H Florida Scanning Project, Project No. 101-3098-012

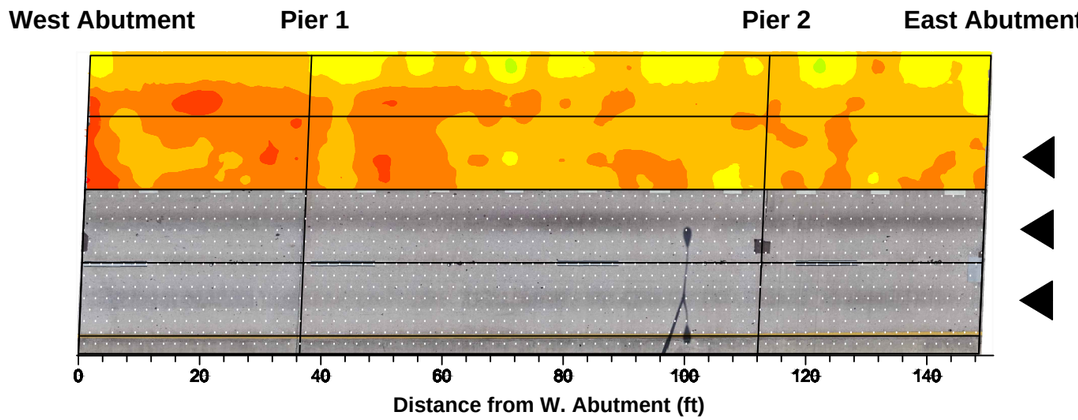
Infrasense, Inc.
21-G Olympia Avenue, Suite 45, Woburn, Massachusetts 01801

Analyzed by: KJS
Reviewed by: AJC
Completed: 06/6/2016

GPR Results



Rebar Depth



Subsurface Scanning and Mapping

GPR Evaluated - Concrete Deterioration

Increasing Severity

Rebar Depth (Inches)

1 2 3 4 5 6 7

N

Direction of Travel

Scale: 1 inch = 25 feet

0 25 50

Delamination Detected with Infrared

Patching

Area Not Surveyed with GPR and Impact Echo

Impact Echo Test - Good Condition

Impact Echo Test - Delamination/Deterioration

Deck Condition Evaluation

US-ALT-1 (SR-115)

Bridge ID: 720036

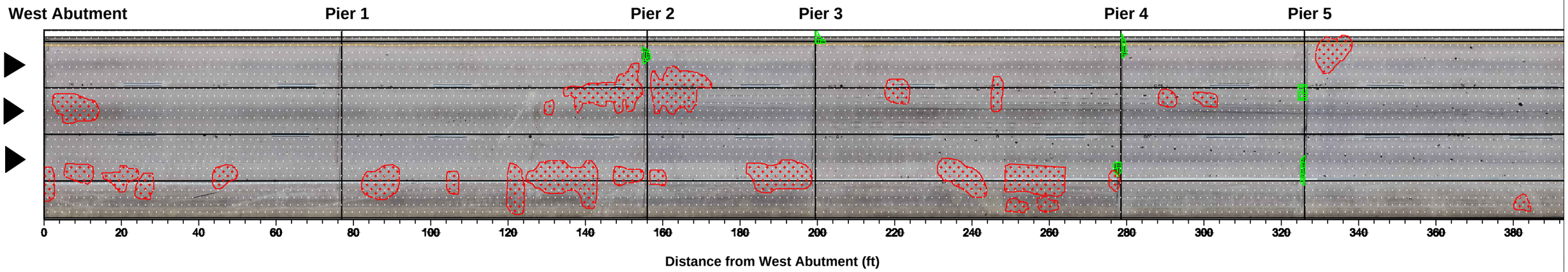
RS&H Florida Scanning Project, Project No. 101-3098-012

Infrasense, Inc.

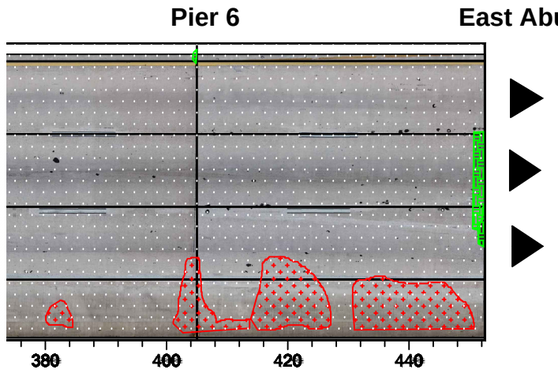
Analyzed by: KJS
Reviewed by: AJC
Completed: 06/6/2016

21-G Olympia Avenue, Suite 45, Woburn, Massachusetts 01801

IR Results



IR Results



Subsurface Scanning and Mapping

GPR Evaluated - Concrete Deterioration

Increasing Severity

Rebar Depth (Inches)

1 2 3 4 5 6 7

N

Direction of Travel

Scale: 1 inch = 25 feet

0 25 50

Delamination Detected with Infrared

Patching

Area Not Surveyed with GPR and Impact Echo

Impact Echo Test - Good Condition

Impact Echo Test - Delamination/Deterioration

Deck Condition Evaluation

US-ALT-1 (SR-115)

Bridge ID: 720055

RS&H Florida Scanning Project, Project No. 101-3098-012

Infrasense, Inc.

Analyzed by: KJS

Reviewed by: AJC

Completed: 06/6/2016

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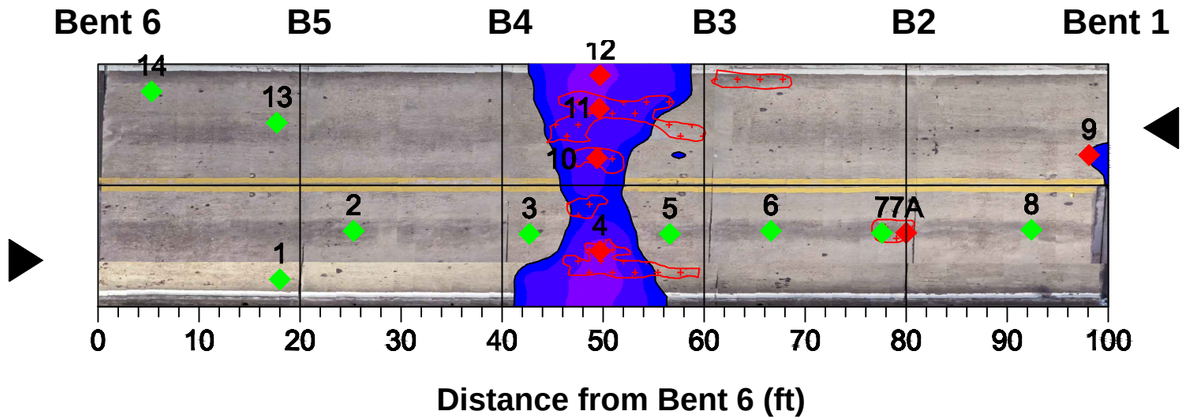
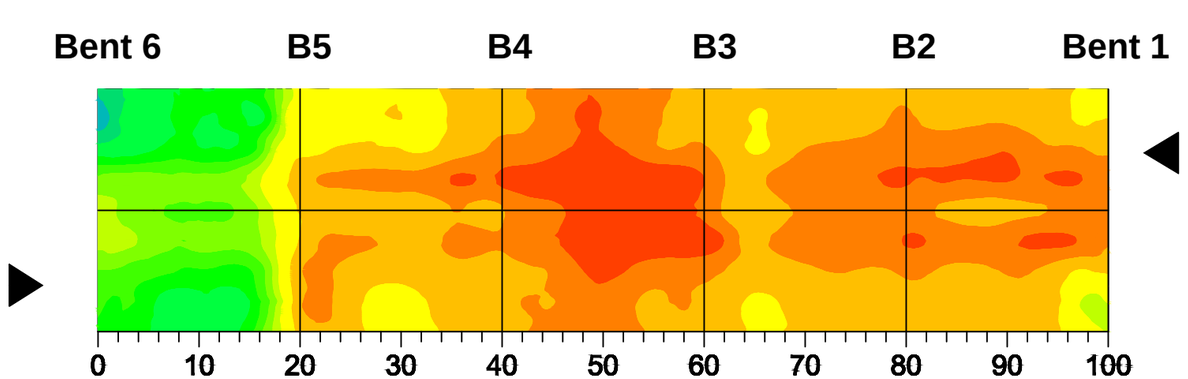
GPR Results



Rebar Depth



INFRASENSE
Subsurface Scanning and Mapping

GPR Evaluated - Concrete Deterioration

Increasing Severity

Rebar Depth (Inches)

1 2 3 4 5 6 7

N

Direction of Travel

Scale: 1 inch = 15 feet

0 15 30

Delamination Detected with Infrared

Patching

Area Not Surveyed with GPR and Impact Echo

Impact Echo Test - Good Condition

Impact Echo Test - Delamination/Deterioration

Deck Condition Evaluation

SR-105

Bridge ID: 720071

RS&H Florida Scanning Project, Project No. 101-3098-012

Infrasense, Inc.

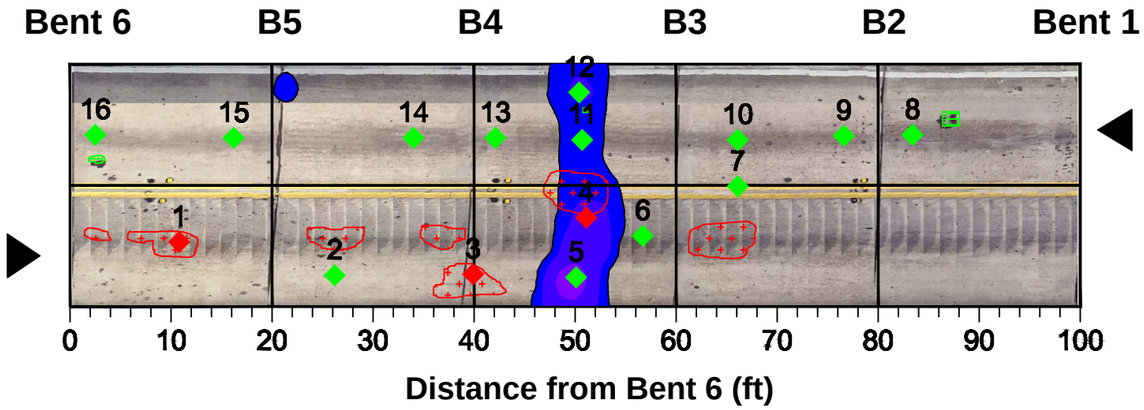
Analyzed by: KJS

Reviewed by: AJC

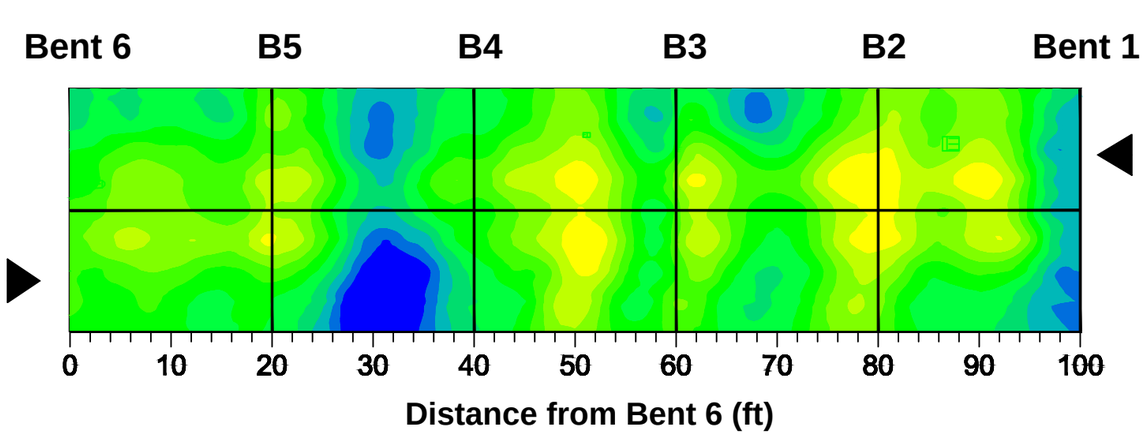
Completed: 06/6/2016

21-G Olympia Avenue, Suite 45, Woburn, Massachusetts 01801

GPR Results



Rebar Depth



INFRASENSE
Subsurface Scanning and Mapping

GPR Evaluated - Concrete Deterioration

Increasing Severity

Rebar Depth (Inches)

1 2 3 4 5 6 7

Direction of Travel

Scale: 1 inch = 15 feet

0 15 30

Delamination Detected with Infrared

Patching

Area Not Surveyed with GPR and Impact Echo

Impact Echo Test - Good Condition

Impact Echo Test - Delamination/Deterioration

Deck Condition Evaluation

SR-105

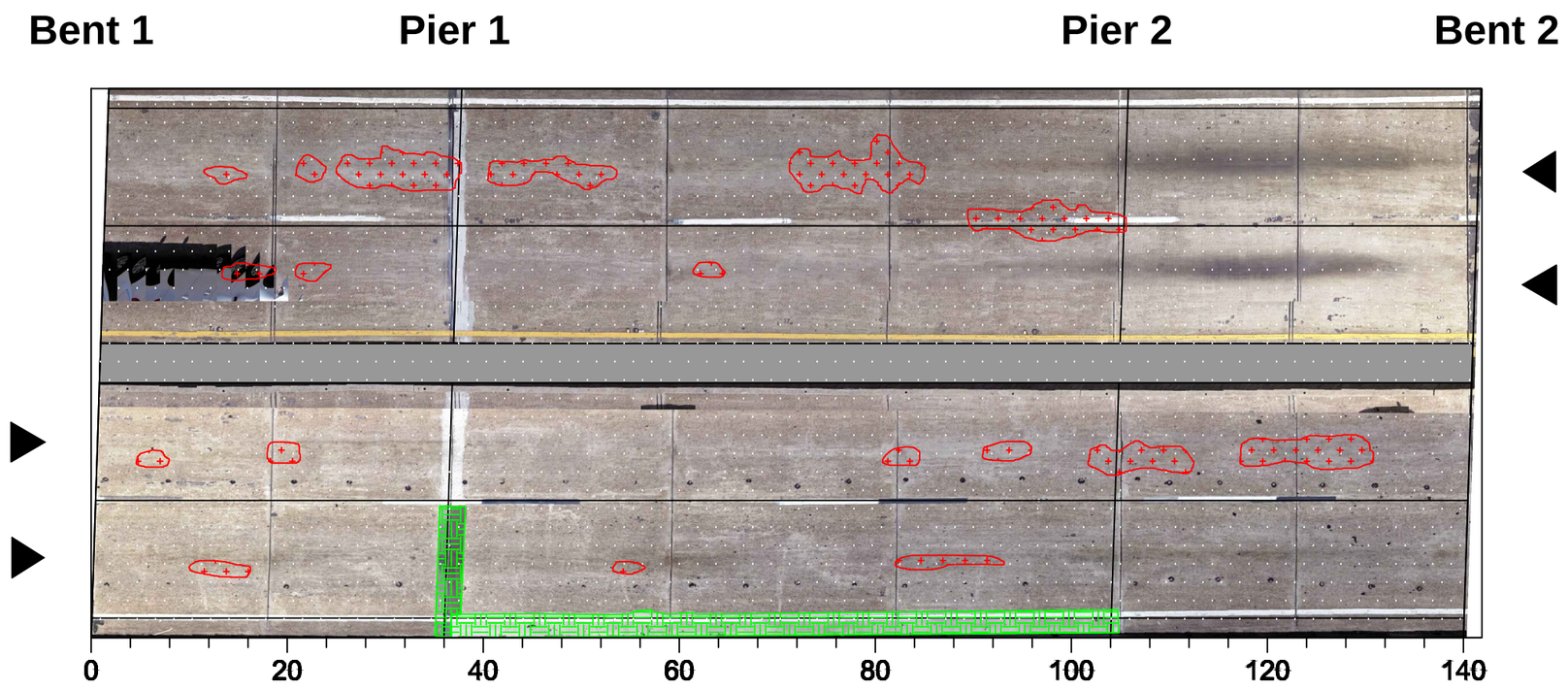
Bridge ID: 720072

RS&H Florida Scanning Project, Project No. 101-3098-012

Infrasense, Inc.

Analyzed by: KJS
Reviewed by: AJC
Completed: 06/6/2016

21-G Olympia Avenue, Suite 45, Woburn, Massachusetts 01801



Subsurface Scanning and Mapping

GPR Evaluated - Concrete Deterioration

Increasing Severity

Rebar Depth (Inches)

1 2 3 4 5 6 7

N

Direction of Travel

Scale: 1 inch = 15 feet

0 15 30

Delamination Detected with Infrared

Patching

Area Not Surveyed with GPR and Impact Echo

Impact Echo Test - Good Condition

Impact Echo Test - Delamination/Deterioration

Deck Condition Evaluation

SR-10A

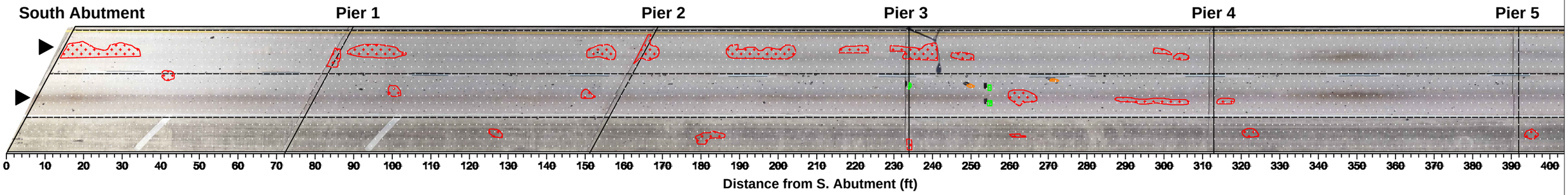
Bridge ID: 720079

RS&H Florida Scanning Project, Project No. 101-3098-012

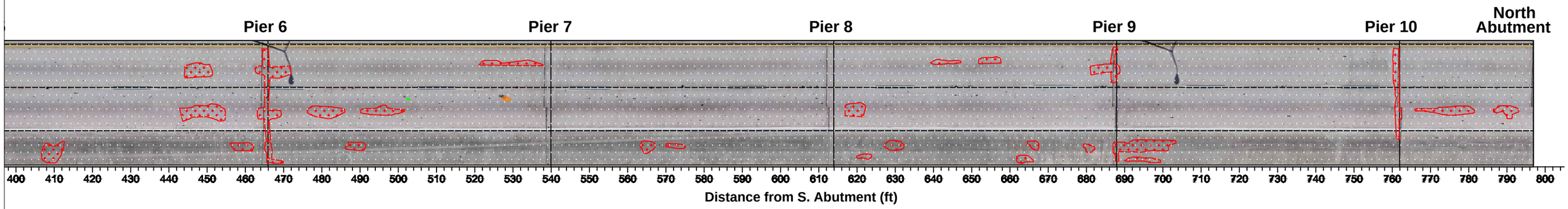
Infrasense, Inc.
21-G Olympia Avenue, Suite 45, Woburn, Massachusetts 01801

Analyzed by: KJS
Reviewed by: AJC
Completed: 06/6/2016

IR Results



IR Results



INFRASENSE
Subsurface Scanning and Mapping

GPR Evaluated - Concrete Deterioration

Increasing Severity

Rebar Depth (Inches)

1 2 3 4 5 6 7

N

Direction of Travel

Scale: 1 inch = 25 feet

0 25 50

Delamination Detected with Infrared

Patching

Area Not Surveyed with GPR and Impact Echo

Impact Echo Test - Good Condition

Impact Echo Test - Delamination/Deterioration

Deck Condition Evaluation

US-ALT-1 (SR-115)

Bridge ID: 720097

RS&H Florida Scanning Project, Project No. 101-3098-012

Infrasense, Inc.

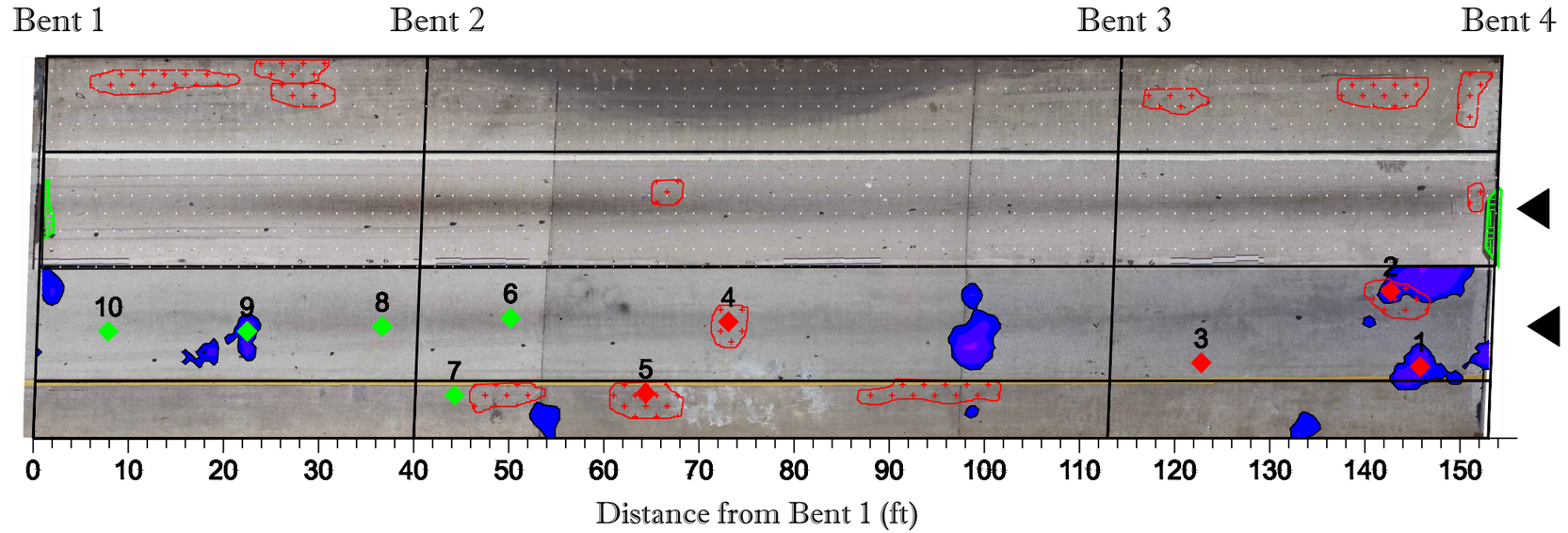
Analyzed by: KJS

Reviewed by: AJC

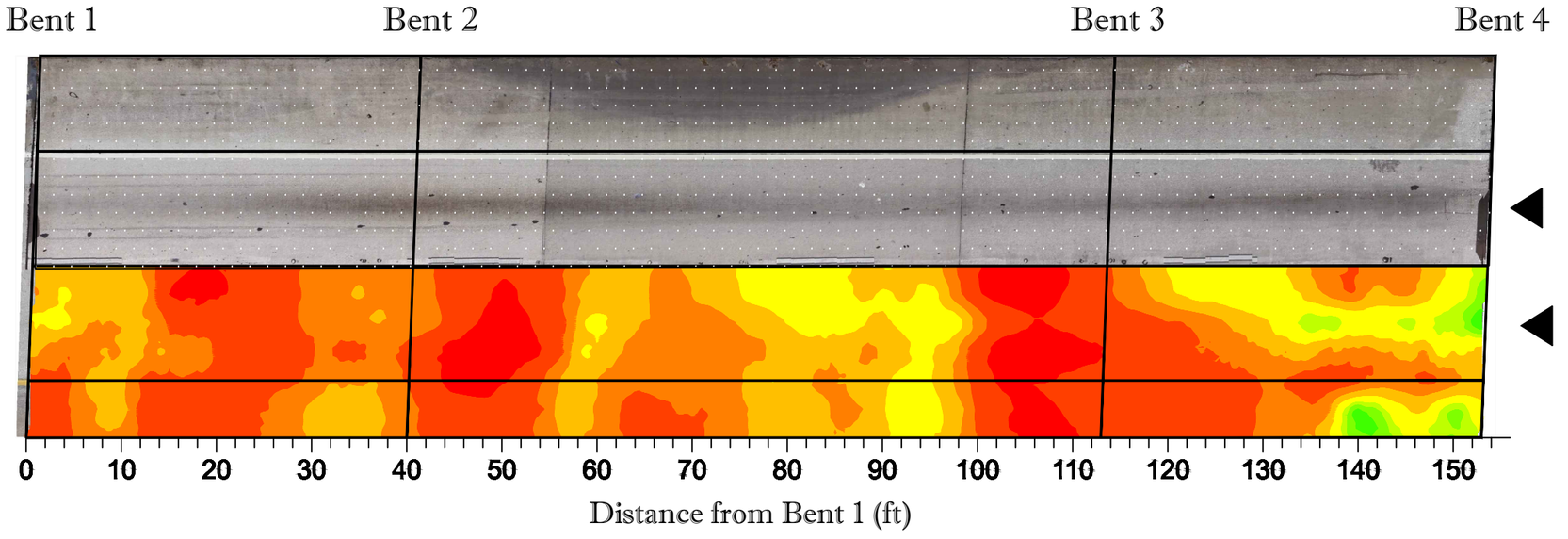
Completed: 06/6/2016

21-G Olympia Avenue, Suite 45, Woburn, Massachusetts 01801

GPR Results



Rebar Depth



Subsurface Scanning and Mapping

GPR Evaluated - Concrete Deterioration

Increasing Severity

Rebar Depth (Inches)

1 2 3 4 5 6 7

N

Direction of Travel

Scale: 1 inch = 15 feet

0 15 30

Delamination Detected with Infrared

Patching

Area Not Surveyed with GPR and Impact Echo

Impact Echo Test - Good Condition

Impact Echo Test - Delamination/Deterioration

Deck Condition Evaluation

US-ALT-1 (SR-115)

Bridge ID: 720132

RS&H Florida Scanning Project, Project No. 101-3098-012

Infrasense, Inc.

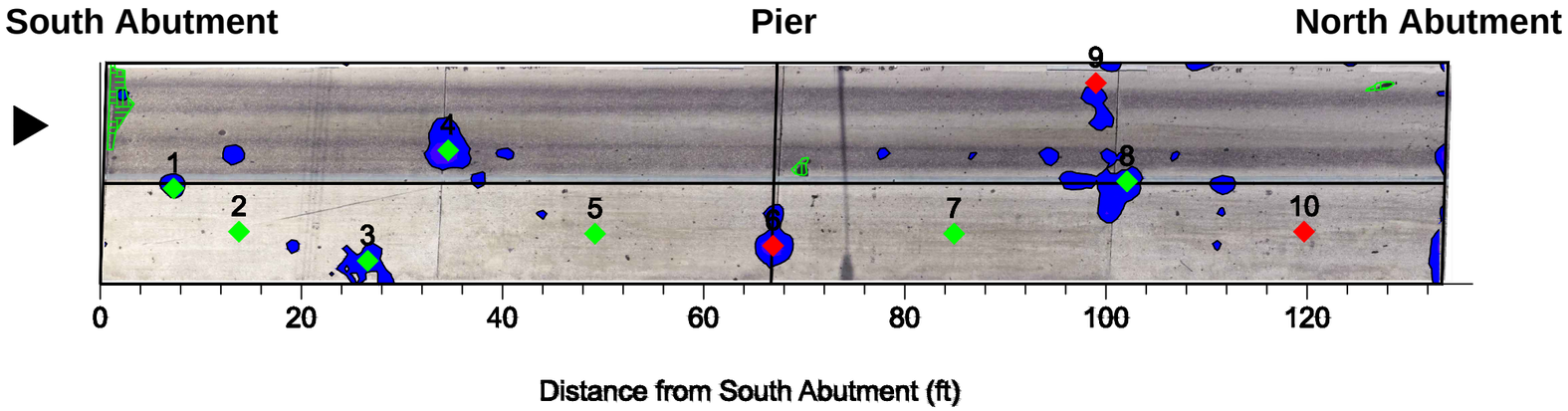
Analyzed by: KJS

Reviewed by: AJC

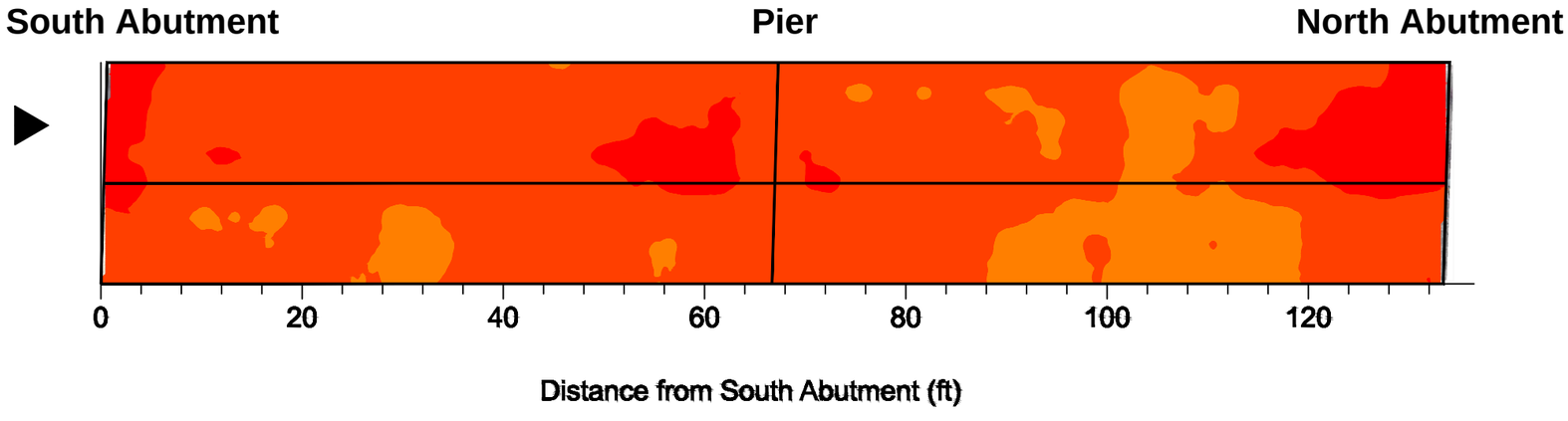
Completed: 06/6/2016

21-G Olympia Avenue, Suite 45, Woburn, Massachusetts 01801

GPR Results



Rebar Depth



INFRASENSE
Subsurface Scanning and Mapping

GPR Evaluated - Concrete Deterioration

Increasing Severity

Rebar Depth (Inches)

1 2 3 4 5 6 7

N

Direction of Travel

Scale: 1 inch = 15 feet

0 15 30

Delamination Detected with Infrared

Patching

Area Not Surveyed with GPR and Impact Echo

Impact Echo Test - Good Condition

Impact Echo Test - Delamination/Deterioration

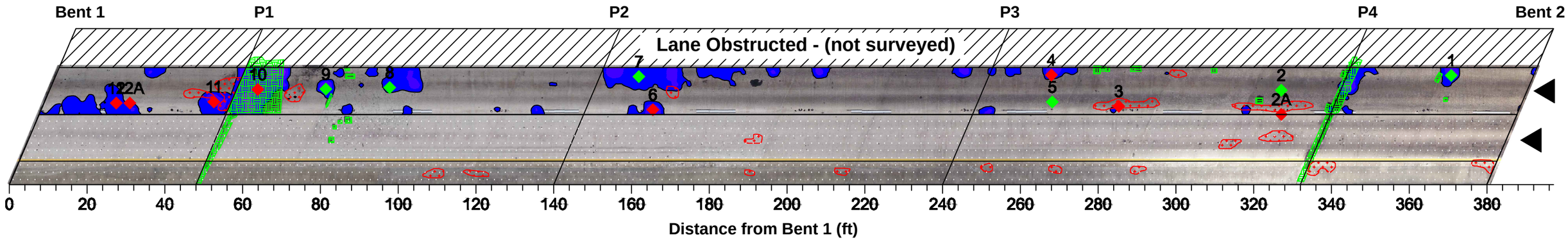
Deck Condition Evaluation

I-95 Northbound
Bridge ID: 720174
RS&H Florida Scanning Project, Project No. 101-3098-012

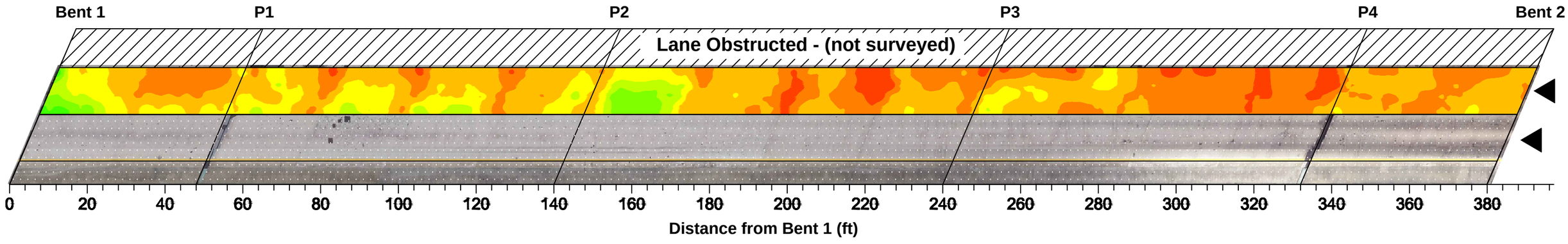
Analyzed by: KJS
Reviewed by: AJC
Completed: 06/6/2016

Infrasense, Inc.
21-G Olympia Avenue, Suite 45, Woburn, Massachusetts 01801

GPR Results



Rebar Depth



INFRASENSE
Subsurface Scanning and Mapping

GPR Evaluated - Concrete Deterioration

Increasing Severity

Rebar Depth (Inches)

1 2 3 4 5 6 7

N

Direction of Travel

Scale: 1 inch = 25 feet

0 25 50

Delamination Detected with Infrared

Patching

Area Not Surveyed with GPR and Impact Echo

Impact Echo Test - Good Condition

Impact Echo Test - Delamination/Deterioration

Deck Condition Evaluation

I-10 Westbound (SR-8)

Bridge ID: 720200

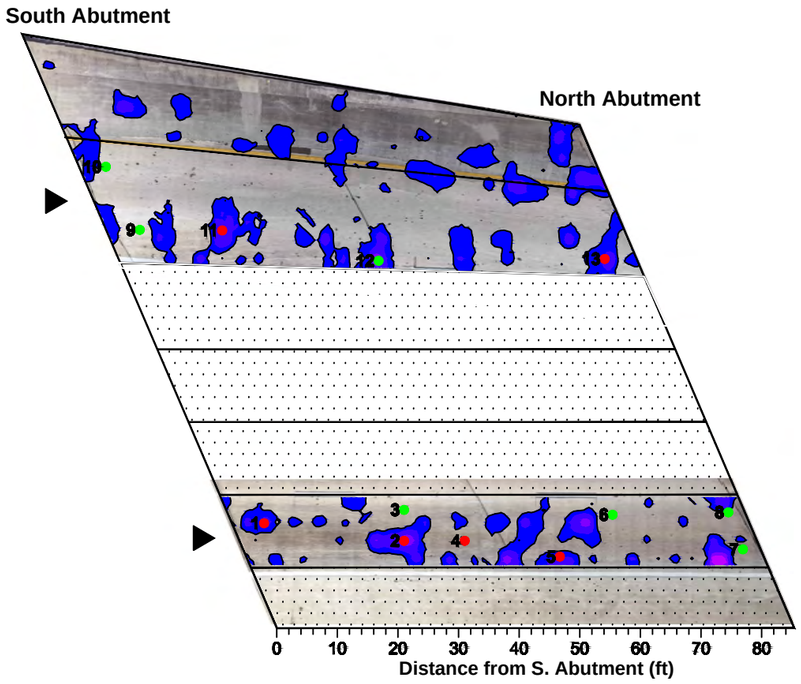
RS&H Florida Scanning Project, Project No. 101-3098-012

Infrasense, Inc.

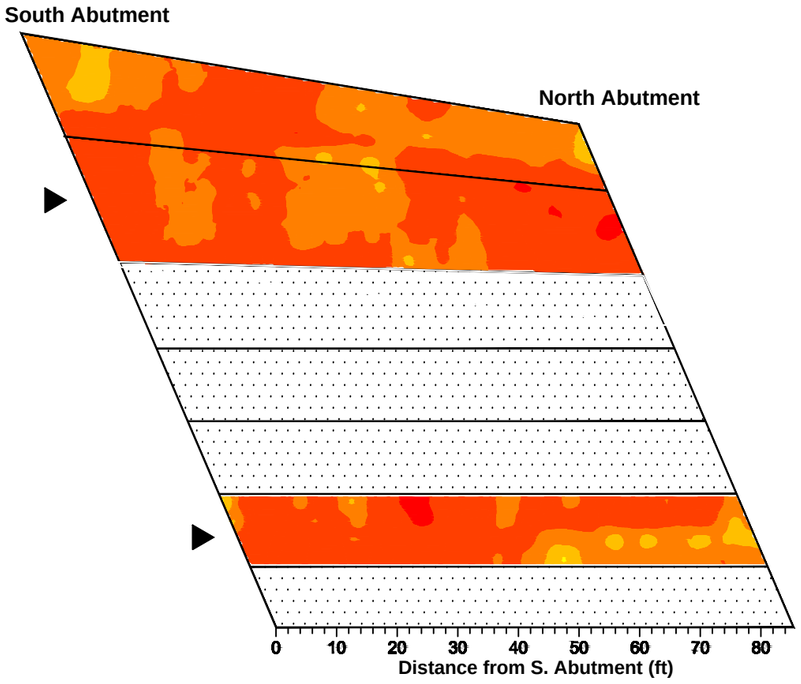
Analyzed by: KJS
Reviewed by: AJC
Completed: 06/6/2016

21-G Olympia Avenue, Suite 45, Woburn, Massachusetts 01801

GPR Results



Rebar Depth



INFRASENSE
Subsurface Scanning and Mapping

GPR Evaluated - Concrete Deterioration

Increasing Severity

Rebar Depth (Inches)

1 2 3 4 5 6 7

N

Direction of Travel

Scale: 1 inch = 25 feet

0 25 50

Delamination Detected with Infrared

Patching

Area Not Surveyed with GPR and Impact Echo

Impact Echo Test - Good Condition

Impact Echo Test - Delamination/Deterioration

Deck Condition Evaluation

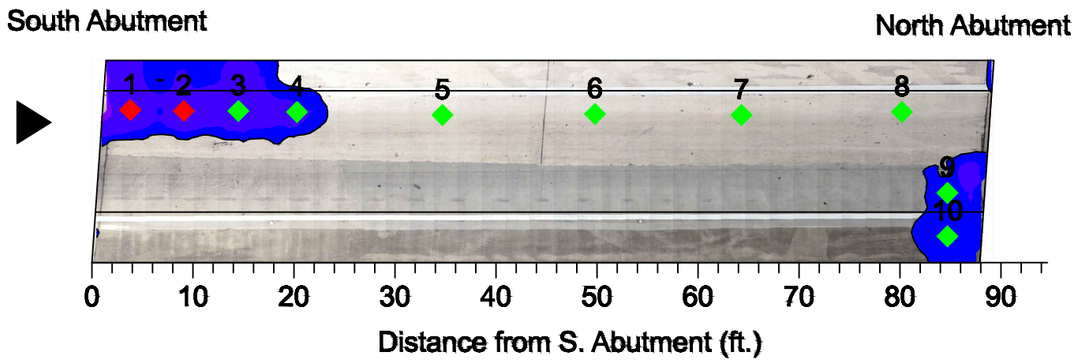
I-95 Northbound

Bridge ID: 720297

RS&H Florida Scanning Project, Project No. 101-3098-012

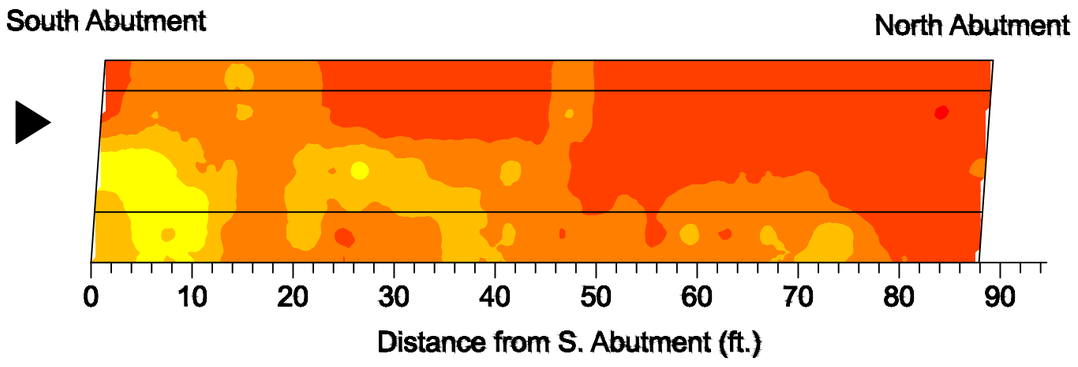
		Infrasense, Inc.
Analyzed by:	KJS	21-G Olympia Avenue,
Reviewed by:	AJC	Suite 45, Woburn,
Completed:	06/6/2016	Massachusetts 01801

GPR Results



Survey limit to exit ramp

Rebar Depth



Survey limit to exit ramp

INFRASENSE
Subsurface Scanning and Mapping

GPR Evaluated - Concrete Deterioration

Increasing Severity

Rebar Depth (Inches)

1 2 3 4 5 6 7

N

Direction of Travel

Scale: 1 inch = 15 feet

0 15 30

Delamination Detected with Infrared

Patching

Area Not Surveyed with GPR and Impact Echo

Impact Echo Test - Good Condition

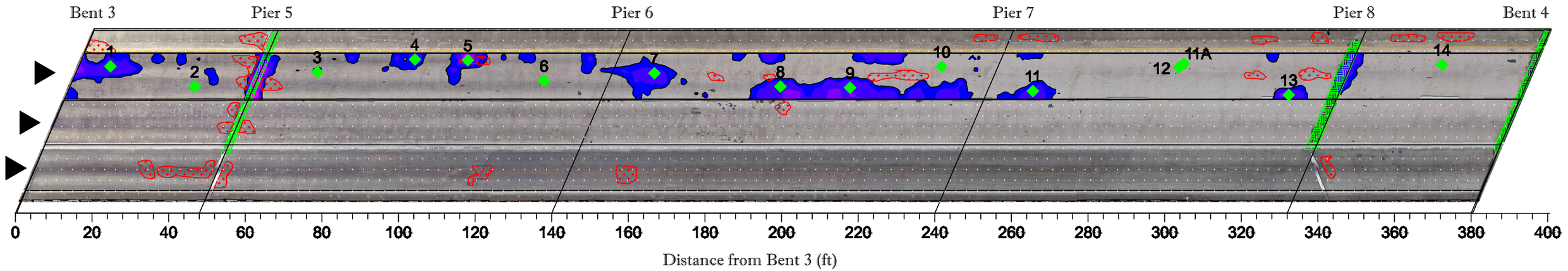
Impact Echo Test - Delamination/Deterioration

Deck Condition Evaluation

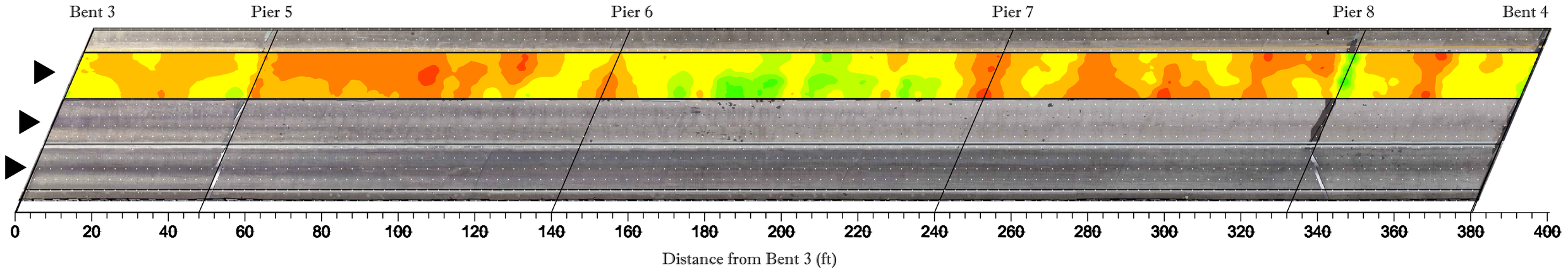
I-95 Northbound
Bridge ID: 720300
RS&H Florida Scanning Project, Project No. 101-3098-012

Infrasense, Inc.
Analyzed by: KJS
Reviewed by: AJC
Completed: 06/6/2016
21-G Olympia Avenue, Suite 45, Woburn, Massachusetts 01801

GPR Results



Rebar Depth



INFRASENSE
Subsurface Scanning and Mapping

GPR Evaluated - Concrete Deterioration

Increasing Severity

Rebar Depth (Inches)

1 2 3 4 5 6 7

N

Direction of Travel

Scale: 1 inch = 25 feet

0 25 50

Delamination Detected with Infrared

Patching

Area Not Surveyed with GPR and Impact Echo

Impact Echo Test - Good Condition

Impact Echo Test - Delamination/Deterioration

Deck Condition Evaluation

I-10 Eastbound (SR-8)

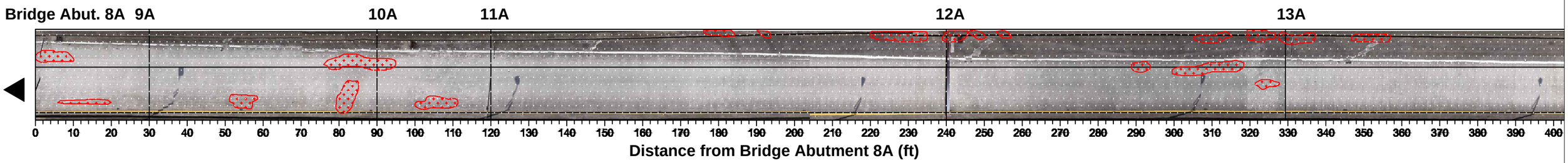
Bridge ID: 720323

RS&H Florida Scanning Project, Project No. 101-3098-012

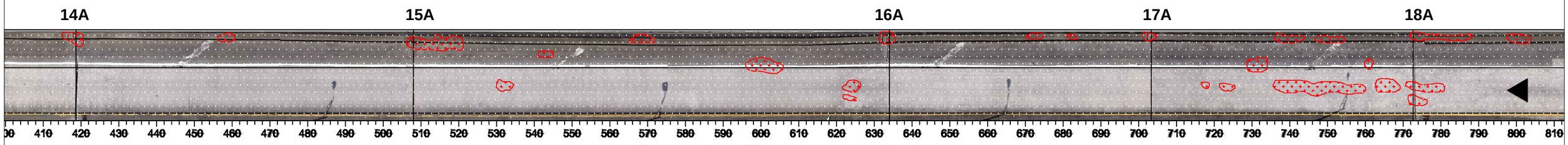
Infrasense, Inc.
21-G Olympia Avenue, Suite 45, Woburn, Massachusetts 01801

Analyzed by: KJS
Reviewed by: AJC
Completed: 06/6/2016

IR Results



IR Results



INFRASENSE
Subsurface Scanning and Mapping

GPR Evaluated - Concrete Deterioration

Increasing Severity

Rebar Depth (Inches)

1 2 3 4 5 6 7

N

Direction of Travel

Scale: 1 inch = 25 feet

0 25 50

- Delamination Detected with Infrared
- Patching
- Area Not Surveyed with GPR and Impact Echo
- Impact Echo Test - Good Condition
- Impact Echo Test - Delamination/Deterioration

Deck Condition Evaluation

SR-228 (Leg E)

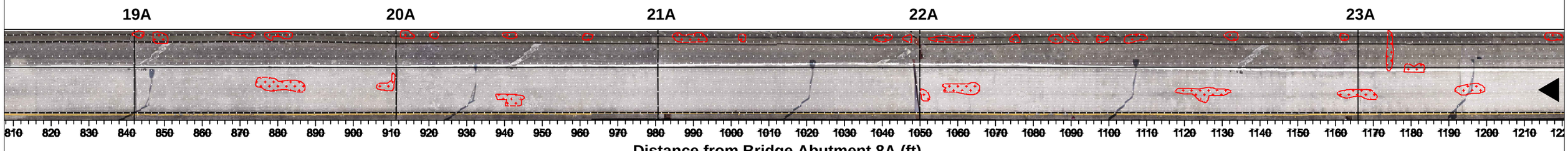
Bridge ID: 720488

RS&H Florida Scanning Project, Project No. 101-3098-012

Infrasense, Inc.
21-G Olympia Avenue, Suite 45, Woburn, Massachusetts 01801

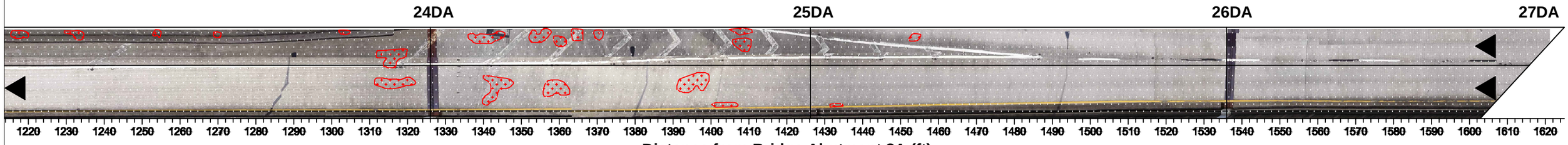
Analyzed by: KJS
Reviewed by: AJC
Completed: 06/6/2016

IR Results



Distance from Bridge Abutment 8A (ft)

IR Results



Distance from Bridge Abutment 8A (ft)

INFRASENSE
Subsurface Scanning and Mapping

GPR Evaluated - Concrete Deterioration

Increasing Severity

Rebar Depth (Inches)

1 2 3 4 5 6 7

N

Direction of Travel

Scale: 1 inch = 25 feet

0 25 50

Delamination Detected with Infrared

Patching

Area Not Surveyed with GPR and Impact Echo

Impact Echo Test - Good Condition

Impact Echo Test - Delamination/Deterioration

Deck Condition Evaluation

SR-228 (Leg E)

Bridge ID: 720488

RS&H Florida Scanning Project, Project No. 101-3098-012

Infrasense, Inc.
21-G Olympia Avenue, Suite 45, Woburn, Massachusetts 01801

Analyzed by: KJS
Reviewed by: AJC
Completed: 06/6/2016