

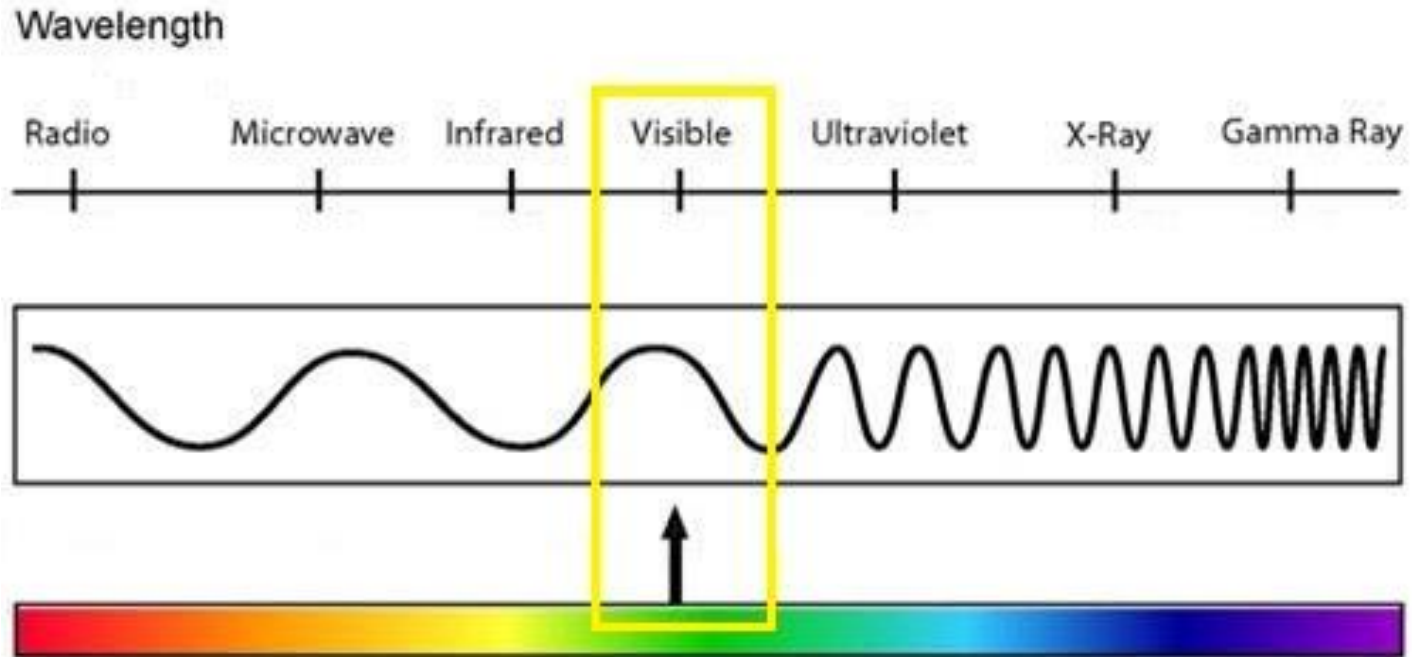


2012 Michigan Bridge Conference



Infrared Deck and Substructure Case Studies

What is infrared energy?



Visible is reflected light
Infrared is emitted energy

Emitted vs Reflected

Infrared

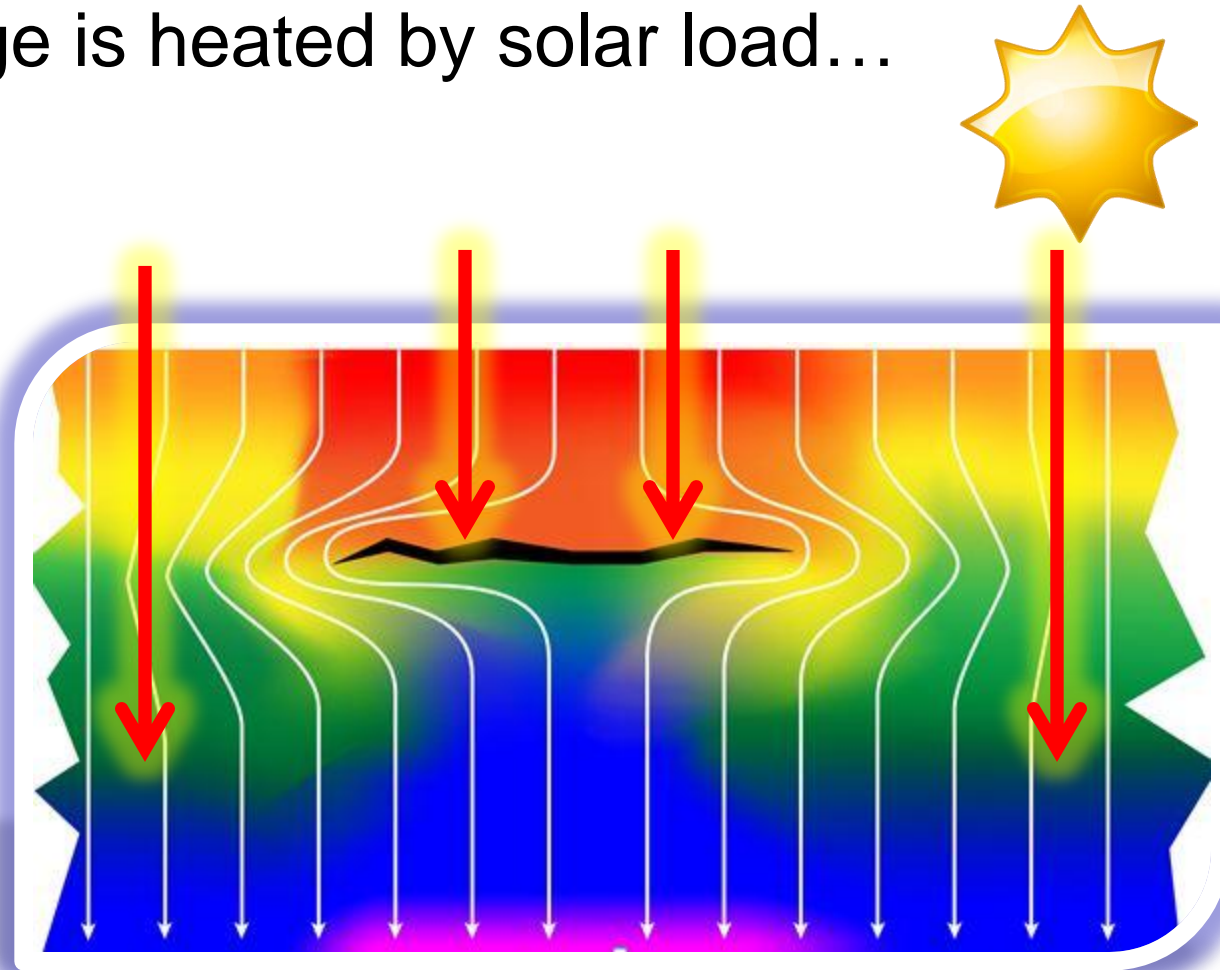


Digital

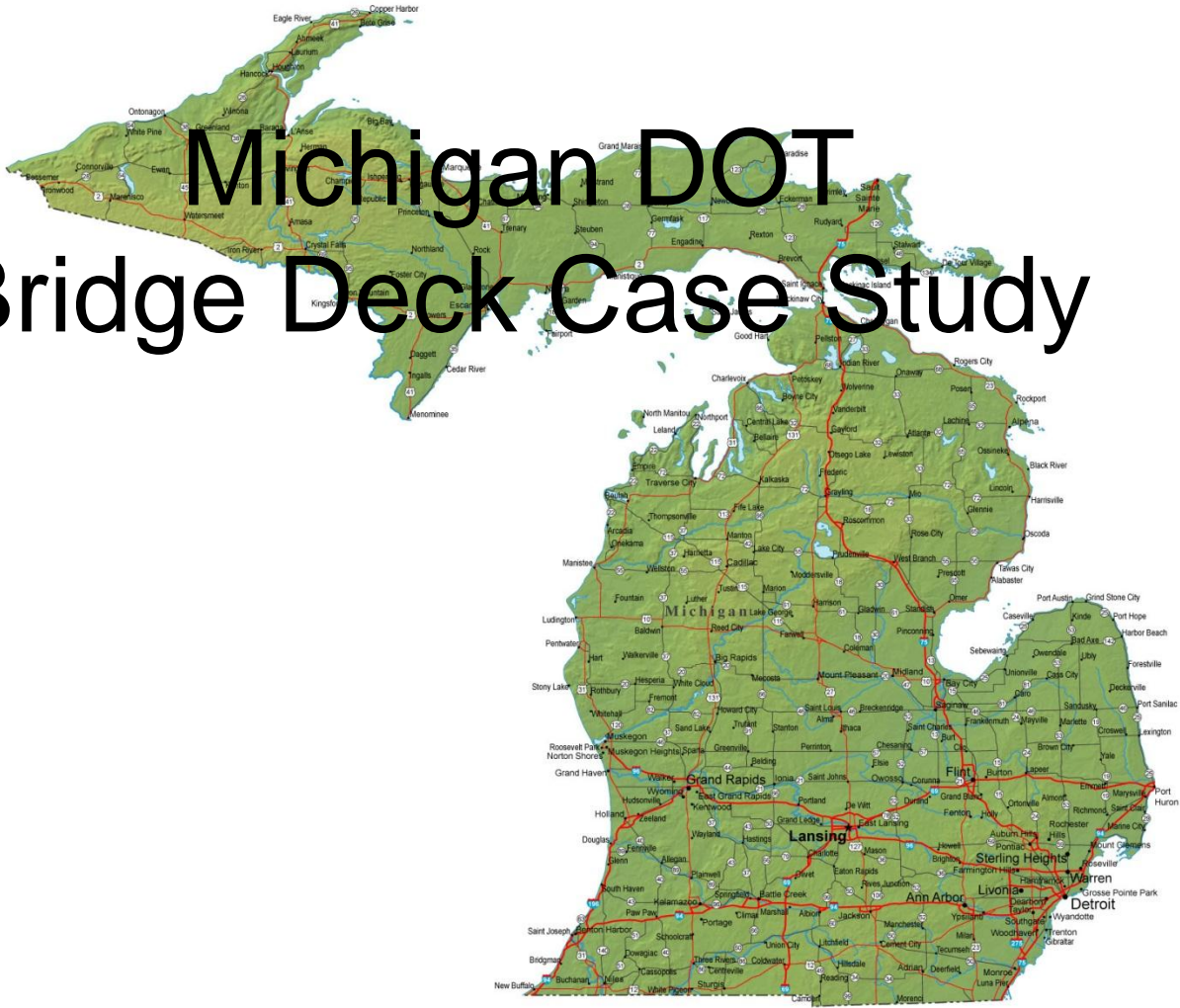


Thermal Principle

Delamination interrupts conduction path as the bridge is heated by solar load...



Michigan DOT Bridge Deck Case Study

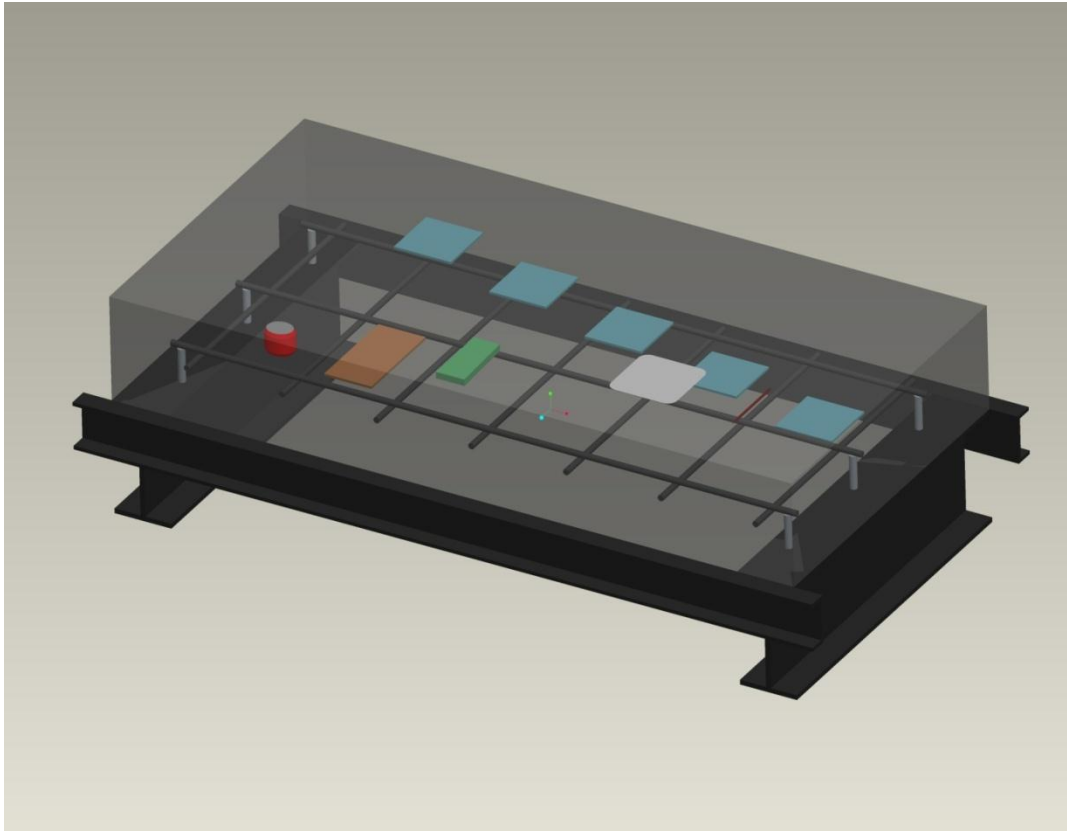


MDOT Feedback

Criteria

- # of Delaminations
- Location
- Size
- % of Deck
- Map

MDOT Test Slab



- Delaminations:
 - Styrofoam
 - Plywood
 - Cardboard
 - .7 ml plastic
 - Surface crack
 - Pencil
 - Soda can

6' x 3' x 11" Concrete on 6" channel & 12" I Beams

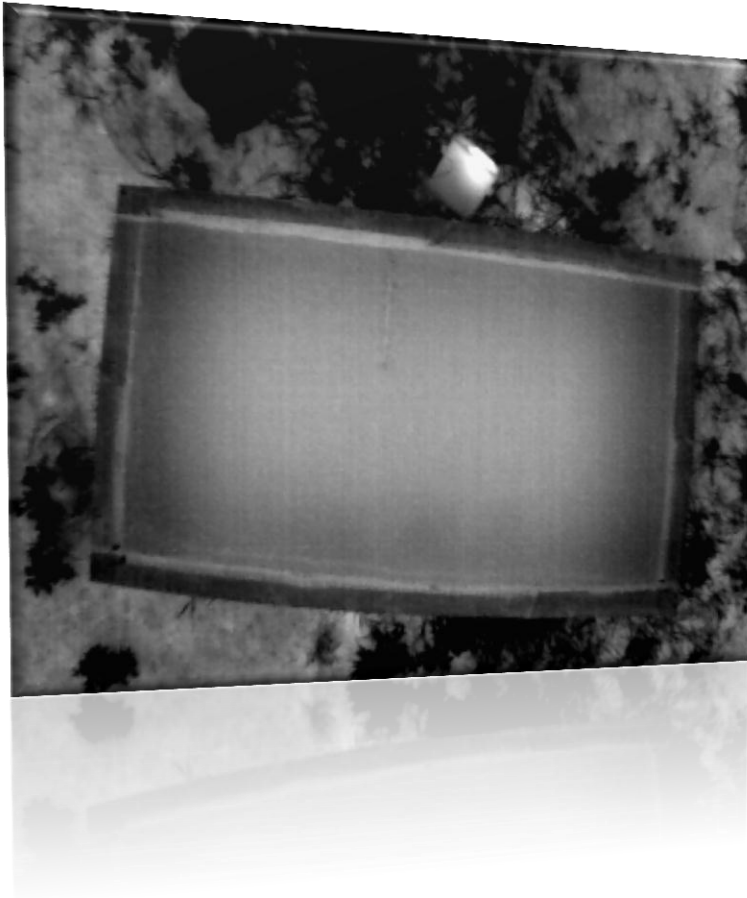
Test Slab

- MDOT Bridge Specs
 - Rebar size
 - Placement
 - Mixture – test cylinders
- 5 Thermocouples

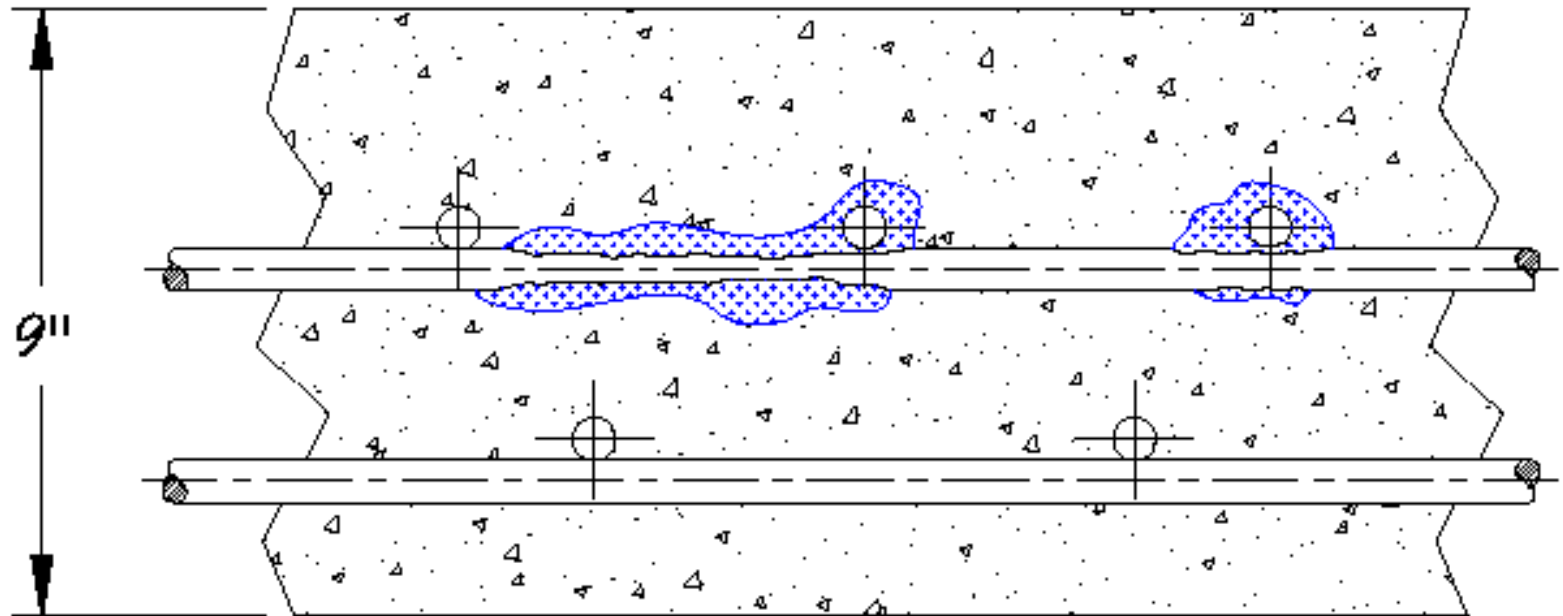


- 24 Hour Diurnal Study

Thermal Contrast Images



Deck Slab Cross Section

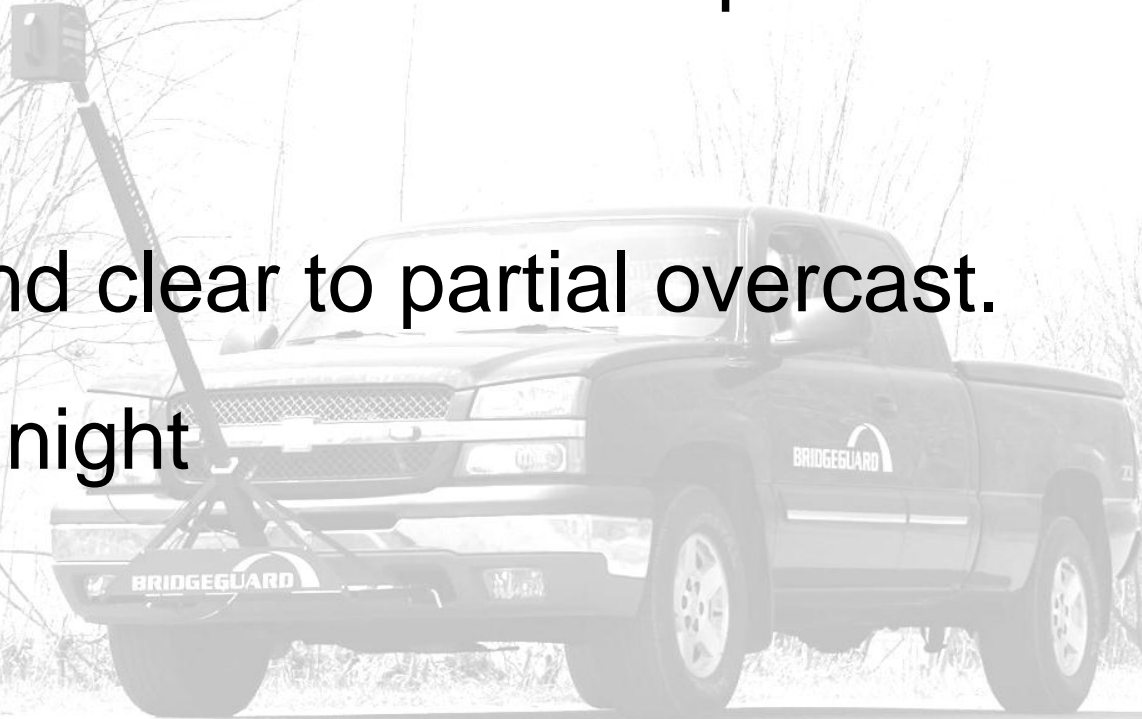


Oceana County



Bridge Test Details

- 5 Bridges tested- 18 month period
- 8 scans
- Sunny and clear to partial overcast.
- Day and night



Bridge Information

- **Average Bridge Size**

- Length 280'

- Width 24'

- 6720 sf



Reporting Results

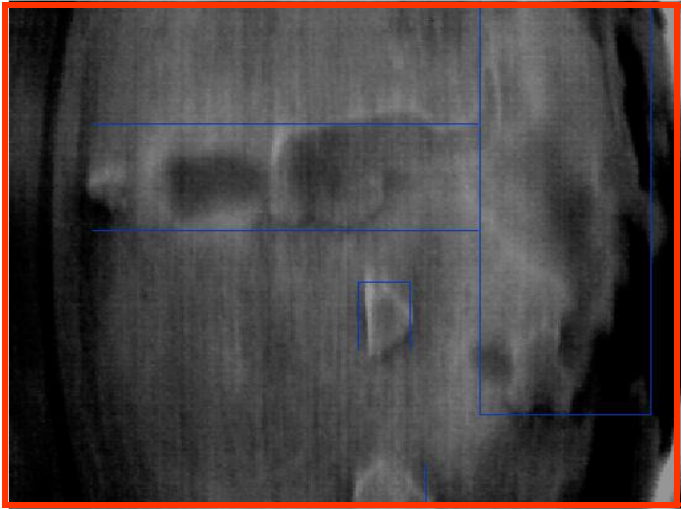
Delaminations



Bridge: NSEW 123

Lane: 1

Image Name: 1_4525000_41561_408.tif



Defect #	3	4	5	6
Feet from Start	66.90	69.70	71.50	72.00
Feet from Right	4.94	5.00	2.01	6.63
Defect Square Feet	0.95	0.99	19.34	11.36

[Return to Overview](#)

SAMPLE.pdf

10-05-2011 02:16:27 PM

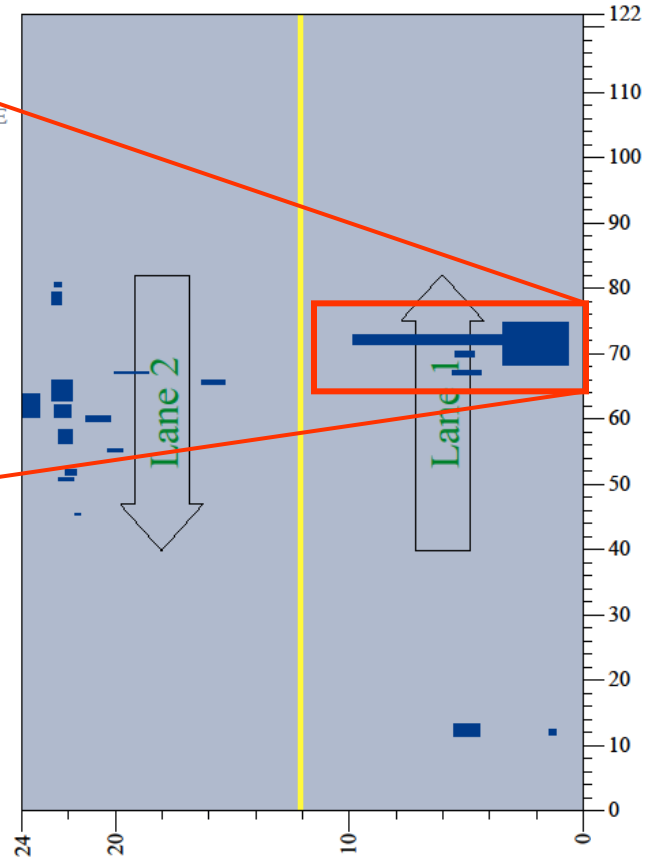
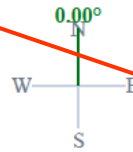
Page 9

Pattern Overview



Total Bridge Area (sq ft): 2928.00
 Delamination Area (sq ft): 49.67

of Delaminations: 19
 % Delamination: 1.70



*Not to scale
 Units are in feet.

SAMPLE.pdf

10-05-2011 02:16:27 PM

Page 5

Actual Case Study Findings

Oceana County Findings

Delaminations

Low **28**

High **337**

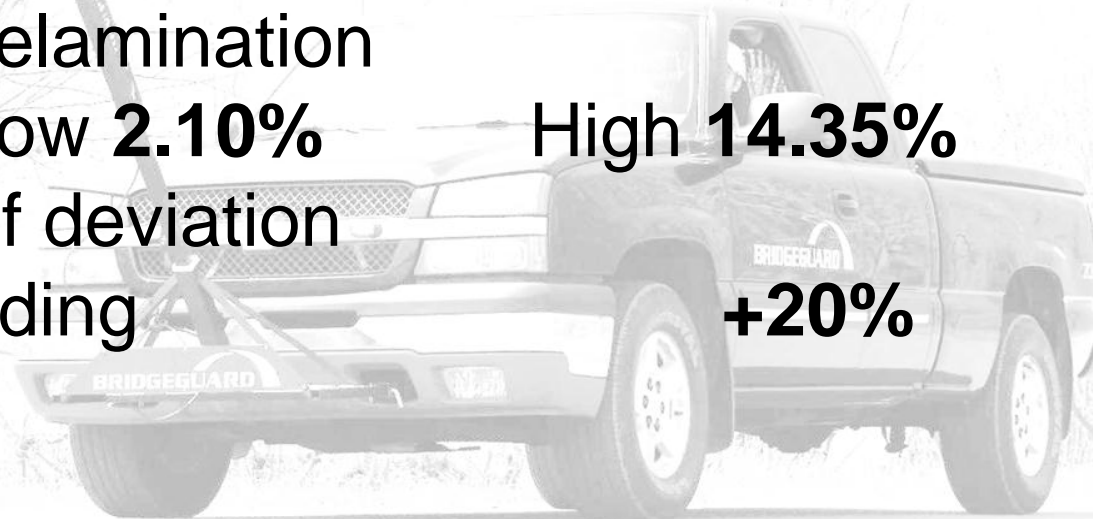
% Lane Delamination

Low **2.10%**

High **14.35%**

Average sf deviation
from sounding

+20%

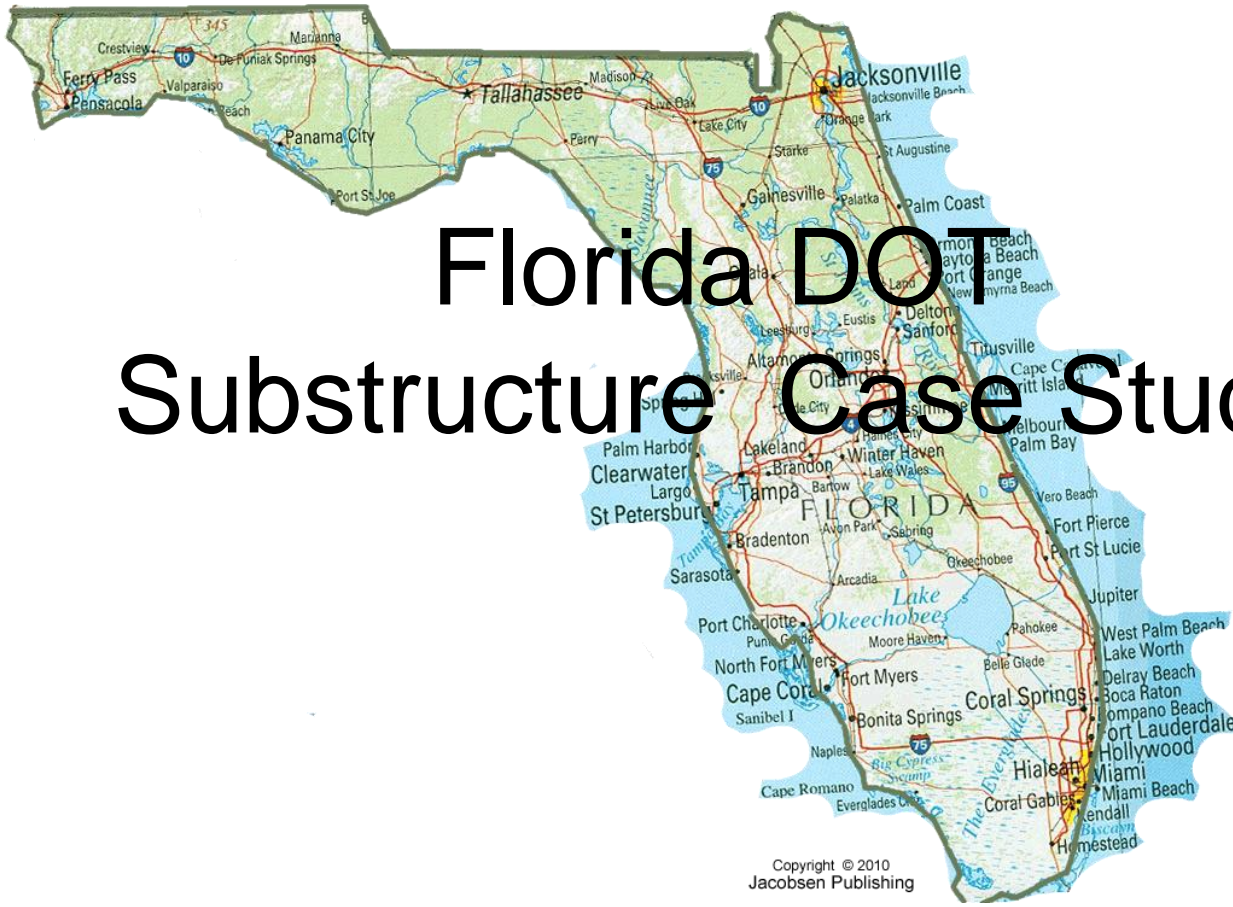


Commerce flow



Video Available at bridgeguard.net

Florida DOT Substructure Case Study



Copyright © 2010
Jacobsen Publishing

Considerations

- DOT - # of delams, location, size and %
 - Location
- Reporting
 - Format representation of delaminations
 - Web integration, upload/download
- IR Sensors
 - Data integration sensitivity
 - In-situ software programming

Diurnal Bridge Information



Bridge #1
2 lanes
952' length
44' wide

On Site

DOT Personnel



Set-up

Testing



Sounding



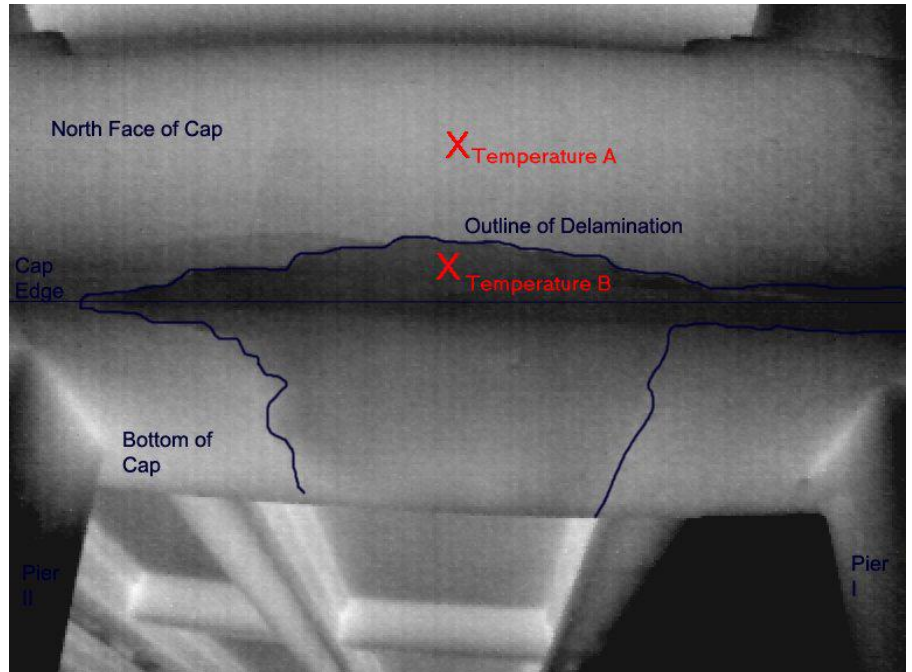
Sensor testing

Digital vs Infrared Image

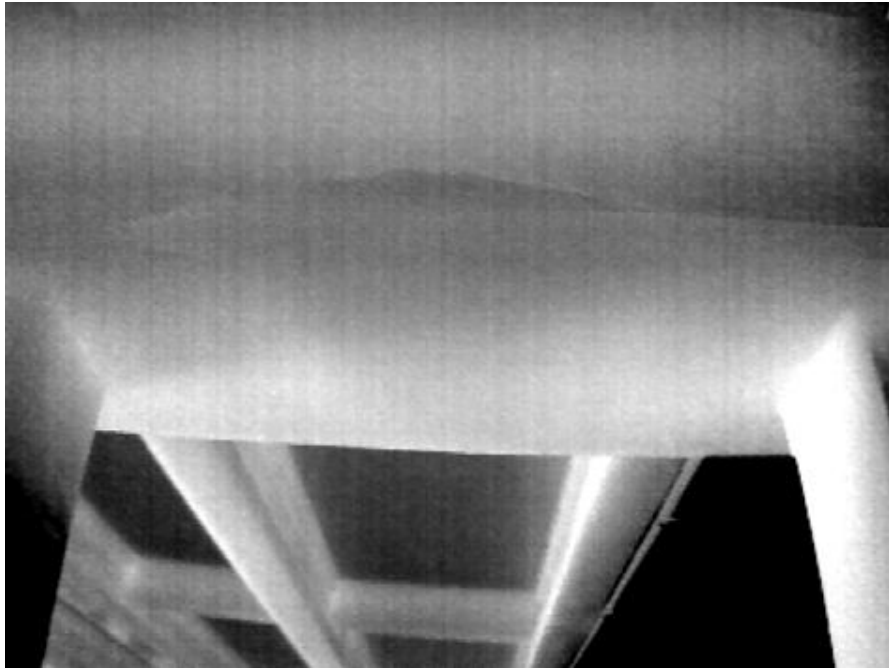


Delamination measurement
Digital Image

Infrared image



Thermal Contrast Images



Bridge Information



Bridge #2
2 Lanes
Length 760'
Width 39'



Bridge #3
2 Lanes
Length 912'
Width 35'

Details

- 3 bridges tested
- Sunny and clear to partially overcast
- Day and night
- 39F to 55F.

Results

- Bridge #1

Diurnal Case Study

Caps 82 Delaminations

Range: 2.4 in² -1074.2 in²

- Bridge #2

Under-deck 306 Delaminations

Range: 4.5 in² -1511 in²

- Bridge #3

Under-Deck 212 Delaminations

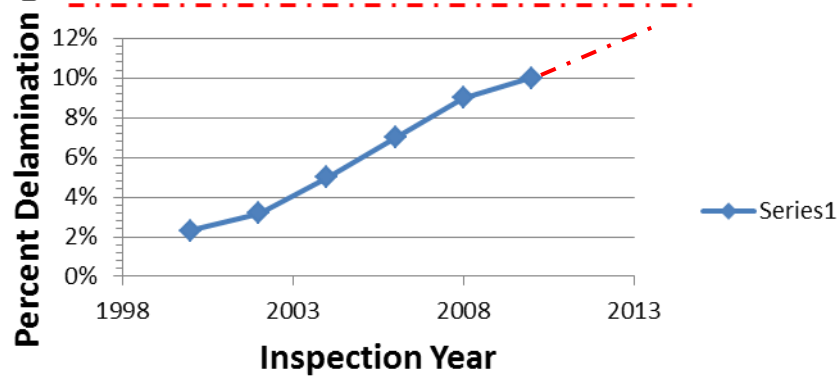
Range: 3.1 in² -985.4 in²

Caps 106 Delaminations

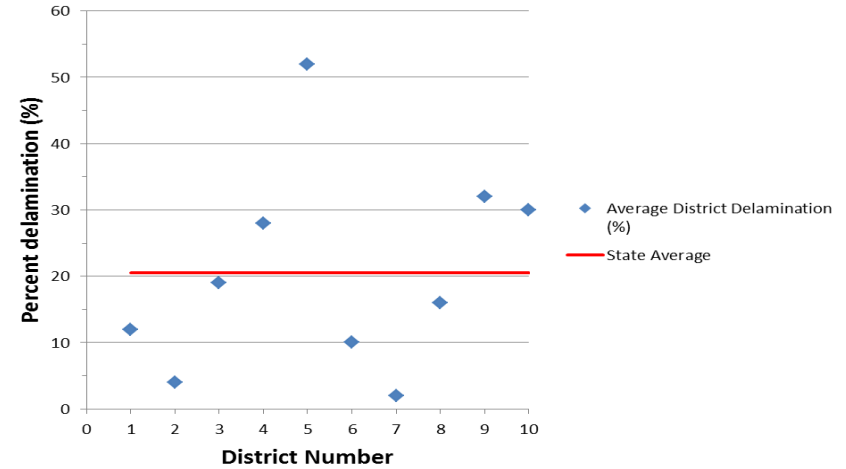
Range: 39.1 in² -1330.1 in²

Asset Management

Regression Rate of Change and Projection for Bridge #123-ABC



Delamination by District



Regional/District Bridge Prioritization

Client Name: DOT

Date: 01/16/2012

Bridge Name/#	Location	Total Bridge Area (SF)	Overlay Type	# Delaminations	Total Delamination Area SF	% Delamination
SR 385-B01	1W Chatham	1,752	N/A	52	510	29.10%
B794	7SW Springville	1188	Asphalt	7	214	18.00%
A-117B	2E Trenton	1,560	N/A	13	177	11.36%
R-934-S05	3E Central	2,548	N/A	17	286	11.24%
B-638	3NE Stratton	2,880	N/A	34	228	7.91%
A-2286	4N Corson	1,464	asphalt	4	88	6.00%
ST 733-25	0W Chatham	1752	N/A	21	73	4.19%
A-1387	4W Trenton	1,464	asphalt	4	41	2.80%
SR 26-A13	1E Thor	1,368	N/A	5	28	2.05%



Thank you!

www.BridgeGuard.net
info@BridgeGuard.net
866-780-8722

To view this and past recorded webinars,
please visit our website and click on **webinars**