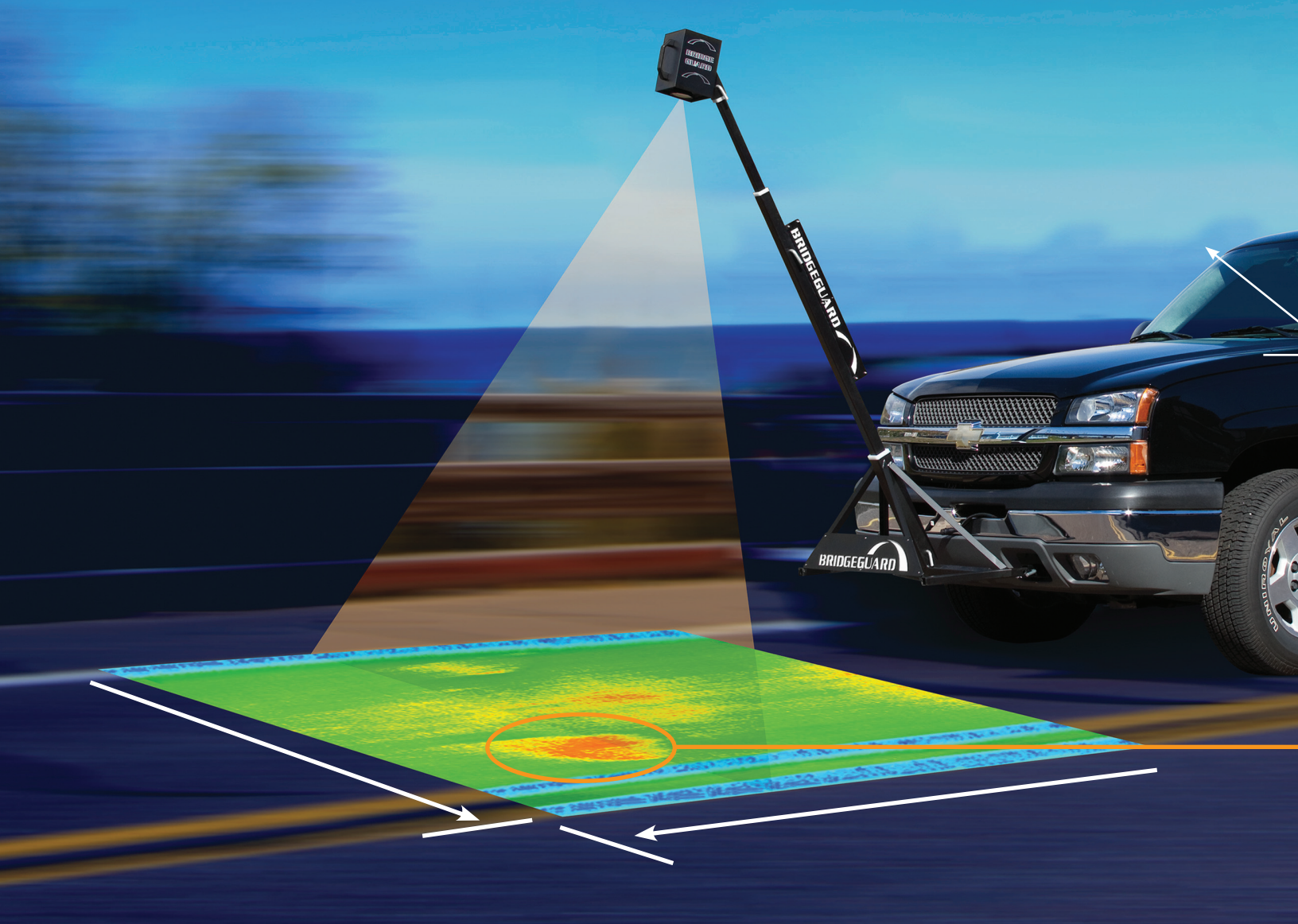
BRIDGEGUARD™

INFRARED BRIDGE INSPECTION

INFRARED BRIDGE DECK SCANNING

BridgeGuard™ is a revolutionary scoping tool that uses an IR sensor which is used to identify and locate delaminations in bridge decks. BridgeGuard™ provides initial bridge scanning and scoping to identify decks that need further investigation. Deck scanning is executed at near highway speeds allowing traffic to maintain a continuous flow. Commerce can continue at a steady pace, and all highway personnel are kept safe within the vehicle.



BridgeGuard™ links satellite GPS data with a thermal scan of the bridge deck via an onboard laptop.

BridgeGuard™ uses an infrared (IR) imaging sensor and sophisticated proprietary analysis software to identify the thermal indicators of a delamination. Delaminations interrupt the vertical conduction of heat through the concrete that occurs as temperatures rise and fall through a normal daily cycle. During periods of significant heat flow, delaminations become “visible” to the BridgeGuard™ sensors.

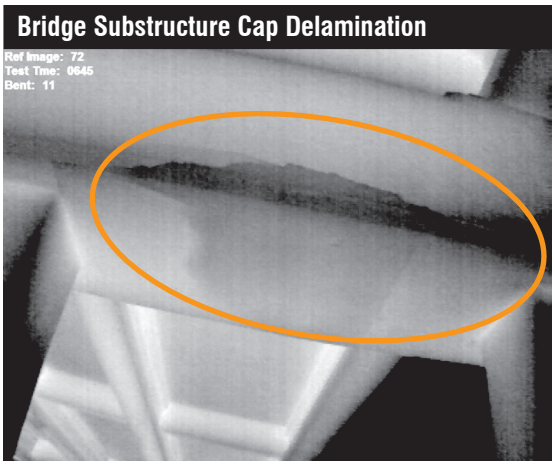
BridgeGuard™ was developed by engineers who specialize in the infrared detection of hidden objects; their experience includes military, environmental, security, medical, and machine vision applications.

Safe and Cost-Conscious

With BridgeGuard™, inspection personnel are not exposed to the dangers of lane closures caused by working within the confined lane. Furthermore, there is no need for diverting or rerouting traffic, which translates to a dramatic reduction in costs. By eliminating traffic backups, BridgeGuard™ avoids long lines of idling vehicles and results in a lower-carbon emission footprint.

INFRARED BRIDGE SUBSTRUCTURE SCANNING

BridgeGuard™ locates delaminations up to 125’ away.



BridgeGuard™ Services

- Quantify area of delaminations
- Inspect elevated concrete structures (125')
- Eliminate or reduce lane closures
- Lower emissions without traffic backups
- Infrared and digital images
- Operated from a surveyor’s tri-pod, boat or hand-held
- IR certified technicians perform data collection and analysis
- Electronic web-based downloads and report notifications for clients

In the past, locating delaminations in elevated substructure elements such as caps, piles and deck undersides required lane closures and snooper trucks to perform soundings. Subsurface defects like delaminations become thermally visible during periods of thermal flux.

With BridgeGuard™ infrared inspection services, these thermally visible delaminations in concrete structures can now be detected from up to 125’ away. Using a high-end digital range finder provides accurate distance measurements used for post processing and allows for scalability of delaminations. The area of delamination (sf) is later quantified during analysis from collected image data and entered into the report data.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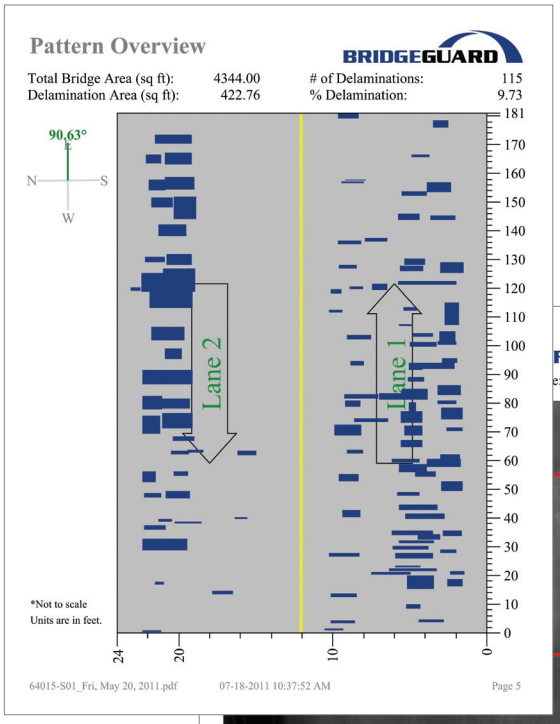
DECK REPORTING

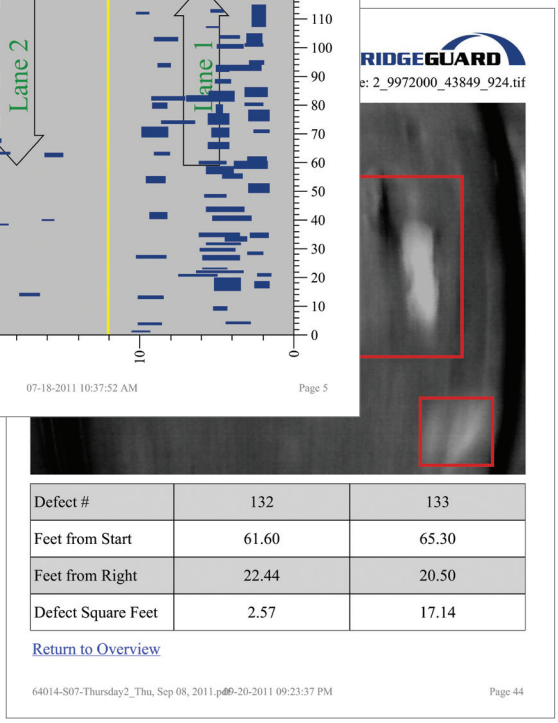
Eliminate Lane Closures

BridgeGuard™ scans one bridge lane per pass. To optimize the vehicle pathway, it allows for planning a bridge corridor path or series across multiple bridges and bridge lanes to cover maximum bridge area in minimal time.

Identifying Delaminations

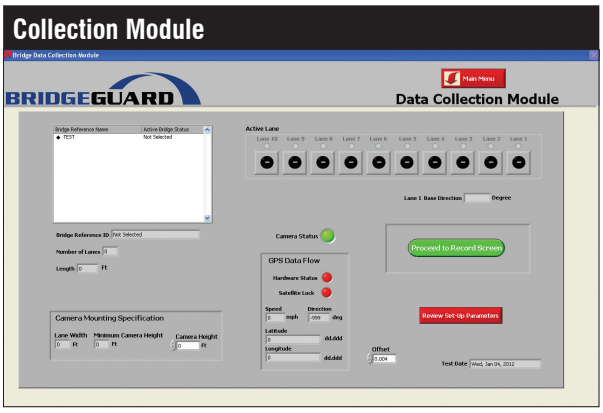
BridgeGuard™ software records the thermal scan of the bridge while driving over each lane. After scanning a corridor of bridges, a certified technician reviews the scan data in the office. The BridgeGuard™ Analysis and Reporting Service provides intuitive tools for locating, marking, mapping and recording the size of delaminations. As bridge data is compiled over time, regression models may be generated for comparison of bridge decks, rate of delamination growth, and an analysis of multiple bridge deck characteristics. Digital “visual” video of the lane is also included to enhance the bridge manager’s overall deck evaluation.



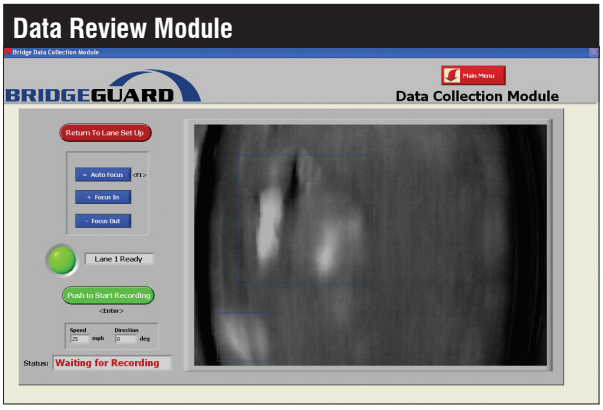


Weather Module

Collection Module



Data Review Module



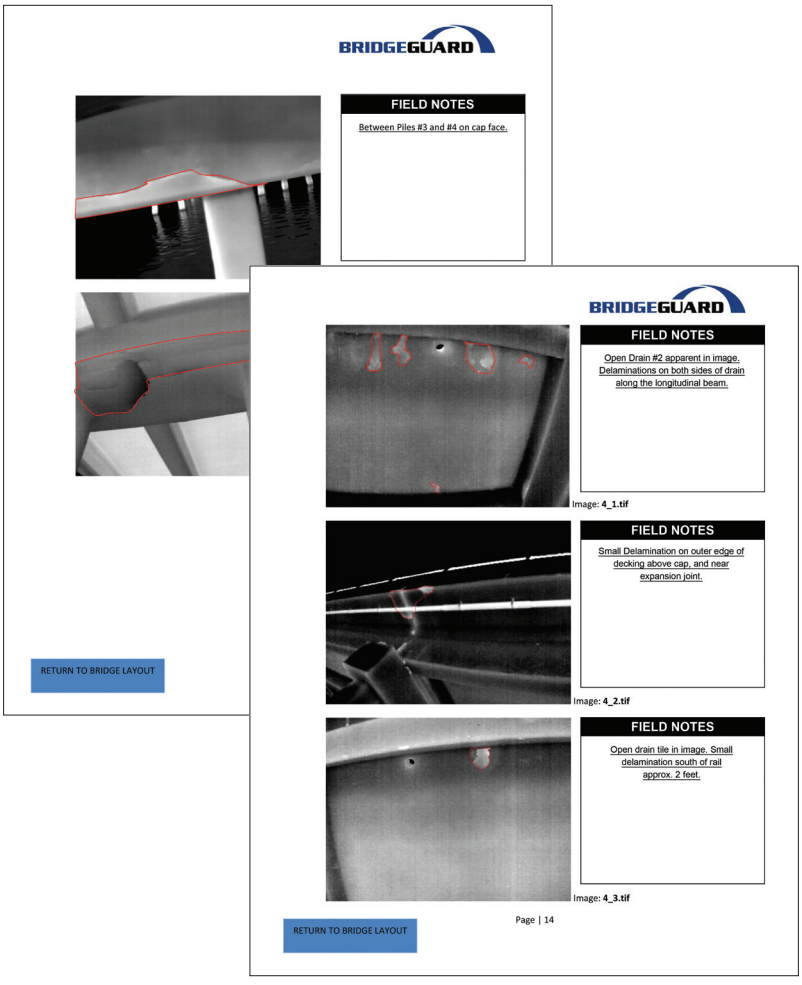
Reporting Results

BridgeGuard™ allows you to communicate the results of your scans to all engineering and management teams. Trained and certified technicians provide analysis and reporting from the data uploaded to the secure web site. The reports are then available to be downloaded to the client’s system for review and export to others.

The report will identify the delamination locations and determine a percentage of the entire deck area that is delaminated. The percent delamination is used with bridge matrix guidelines to determine appropriate action. The reports can be printed, merged to a PDF document, or posted online for management review.

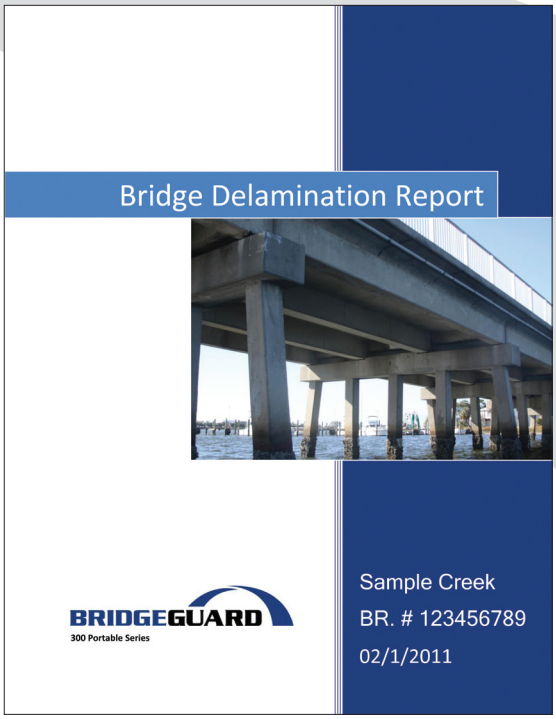
SUBSTRUCTURE REPORTING

Our detailed reports provide a comprehensive infrared and visual understanding of the bridge condition.



Reporting Results

A certified infrared analysis technician exports a detailed bridge condition report showing the position and area (sf) of each delamination. Upon report upload, the client is automatically notified, via email, of the report availability and can then access the secure site to retrieve the bridge report. The report along with IR and digital images is also securely archived for the client and provides a historical record of bridge conditions. The reports can be printed, merged to a PDF document, or posted online for management review.



Identifying Delaminations

Detailed reports are compiled and summarized; the collected data files are then exported via a web-based interface, providing a comprehensive infrared and visual understanding of the bridge condition. Bridge management personnel can now “see” each delamination’s thermal “footprint” in the detailed inspection report along with a digital photo.

- Detailed reports include:

- Quantified area (sf) of each delamination and element
- Number of delaminations
- % of each element delaminated
- Location of delaminations

- Asset management module

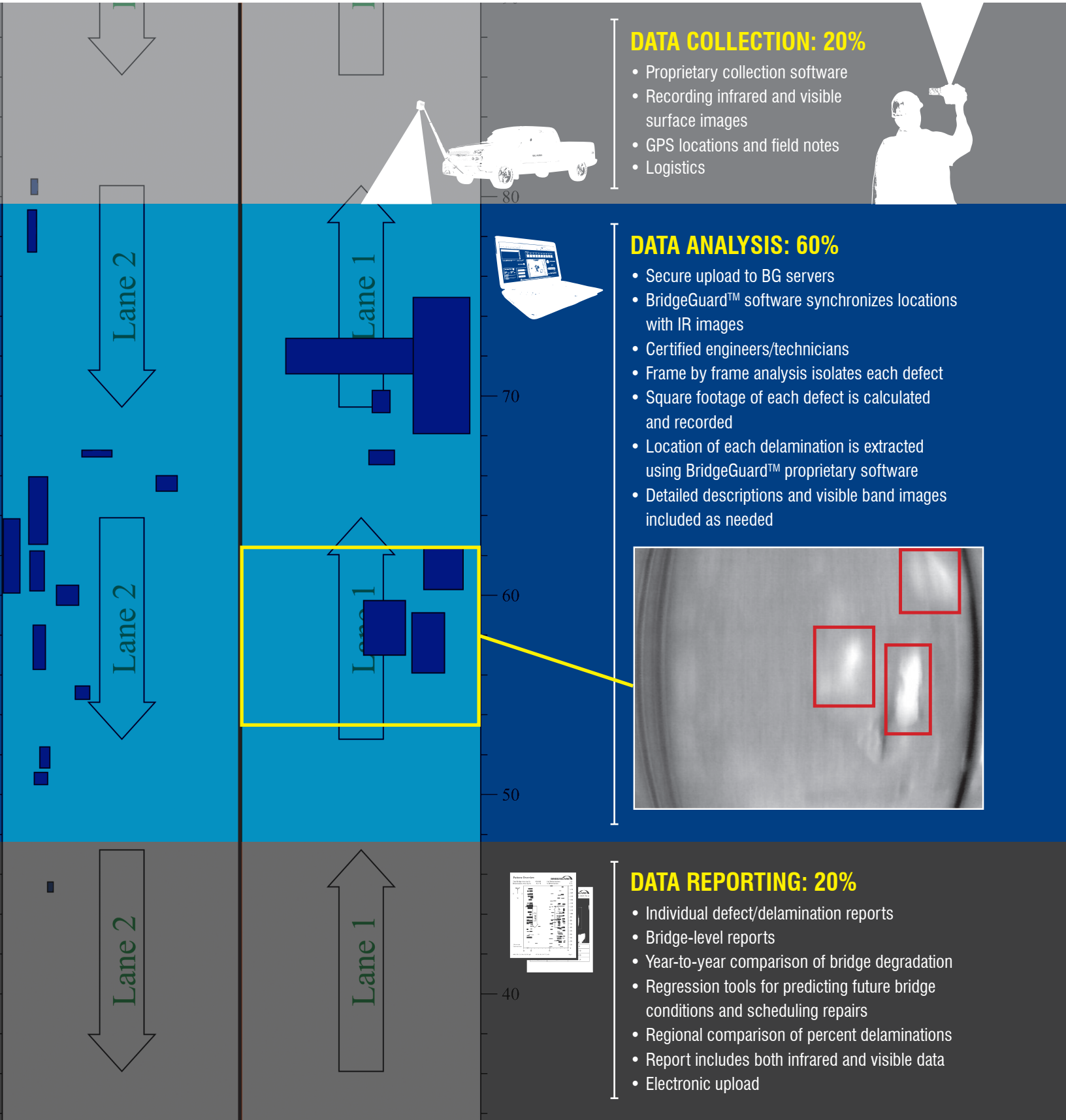
- Regression models
  - Compare rate of growth over time
  - Compare district to district
  - Predict budgetary requirements

- Electronic 3D bridge model with hyperlinks

- Infrared and digital images for archiving

TYPICAL BRIDGEGUARD™ WORKFLOW

Project Timeline



DATA COLLECTION: 20%

- Proprietary collection software
- Recording infrared and visible surface images
- GPS locations and field notes
- Logistics

DATA ANALYSIS: 60%

- Secure upload to BG servers
- BridgeGuard™ software synchronizes locations with IR images
- Certified engineers/technicians
- Frame by frame analysis isolates each defect
- Square footage of each defect is calculated and recorded
- Location of each delamination is extracted using BridgeGuard™ proprietary software
- Detailed descriptions and visible band images included as needed

DATA REPORTING: 20%

- Individual defect/delamination reports
- Bridge-level reports
- Year-to-year comparison of bridge degradation
- Regression tools for predicting future bridge conditions and scheduling repairs
- Regional comparison of percent delaminations
- Report includes both infrared and visible data
- Electronic upload

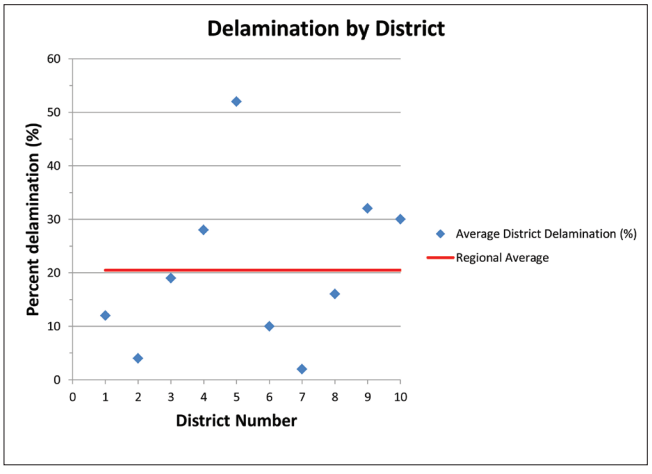
ASSET MANAGEMENT MODULE

The BridgeGuard™ Asset Management Module is designed to allow the end user to request a variety of statistical bridge data. The module allows BridgeGuard™ personnel the ability to compare specific bridge results against previous results or regional or state data. This comparison can be used to evaluate the statistical standard deviation from a single bridge to the district or state mean or any combination thereof. Below are several standard sample BridgeGuard™ graphical reports that can be developed from collected bridge data.

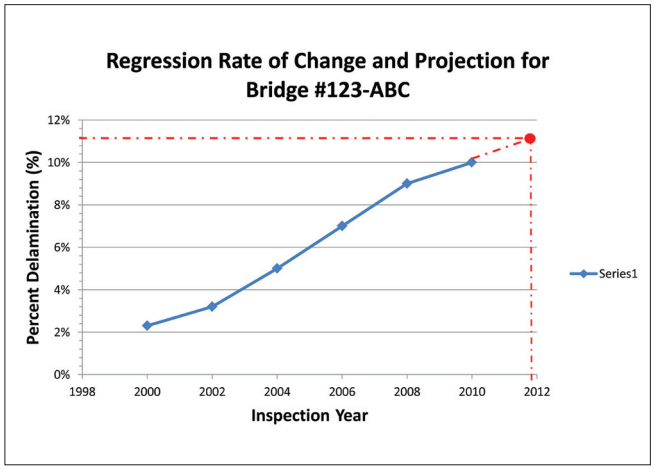
Regional/District Bridge Ranking

Bridge Name/#	Location	Total Bridge Area (sf)	Overlay Type	# Delaminations	Total Delam. 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%

The ranking of individual bridges or regions within a state can easily be summarized in this report. By doing so the user can identify “at a glance” bridges or districts that may need additional attention. Ranking takes place based upon total percentage of delamination for the bridge or average overall percentage of delamination for the district.



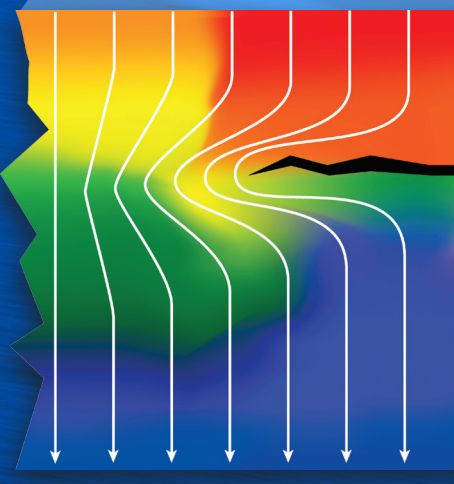
The “Delamination by District” chart explains how the average percentage of delamination of a collection of bridges in any given district compares to the average of all the bridges in the sample population of the state.



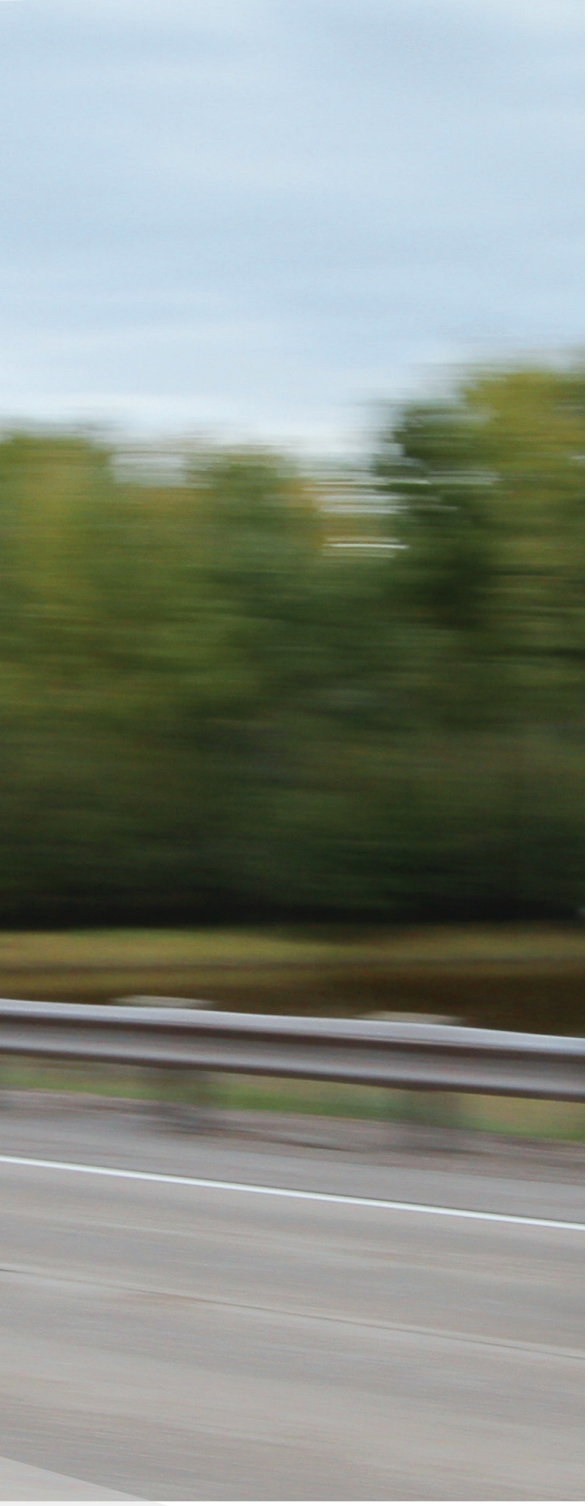
The “Regression Rate of Change and Projection for Bridge #123-ABC” chart explains the rate of growth from each inspection as well as providing a projected amount of delamination for forthcoming inspections.

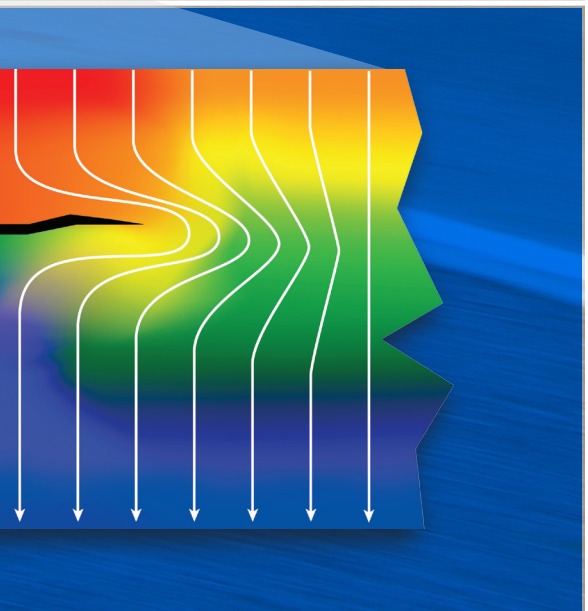
IR Analysis of Bridge Elements

Bridge surfaces are subject to continuously varying thermal inputs due to their exposure to atmospheric events, such as convection forces, solar radiation, and thermal radiation exchanges. In fact, we choose when an IR scan will occur based on the natural thermal environmental conditions which create thermal anomalies consistent with bridge delaminations (or signatures). This change in signature is a predictable pattern resulting from the natural cyclic rise and fall of thermal conditions that occur during the transition from day to night and back again, referred to as the Diurnal Cycle.



At Right: Conduction paths around a delamination in the bridge deck during morning warm-up. Delamination interrupts the conduction path as the bridge is heated by solar load or by radiant cooling to a clear night sky.





UNDERSTANDING INFRARED

Sensing temperatures at the surface enables us to detect delaminations inside the bridge structure.

A standard video camera intercepts and records the reflection of visible light, whereas infrared cameras record naturally-occurring emissions and reflections of thermal light. Unlike radar or microwave systems that both transmit and measure radiation, the BridgeGuard™ sensor is a safe, passive system that does not emit. It can be used directly by operators in any situation without health or safety concerns. In this aspect it is no different than regular video or digital cameras. It simply records light—or radiance—of a longer wavelength than the human eye can perceive.

High accuracy detection

BridgeGuard™ thermal imaging records the infrared radiance of the bridge elements to locate cold and hot spots. These thermal variations can indicate the presence of delaminations within the concrete during periods of thermal flux. The delaminations break the conduction path of heat moving into or out of the bridge (see illustration at left). The longer conduction pathway around a delamination creates telltale hot patches or cold patches that the BridgeGuard™ sensor records. The sensitivity of the BridgeGuard™ sensor can detect temperature differences below .05 degrees Celsius (NETD).

Daily thermal cycles make delaminations visible to the BridgeGuard™ sensor

Bridge surfaces are constantly heating and cooling through daily cycles. Changes in air temperature, solar intensity, and radiant cooling to night skies move heat into and out of the bridge elements. IR scans are best performed during the steepest changes in bridge temperature. In addition to enabling technicians to identify and report delaminations, the BridgeGuard™ software package requires technicians to record data during optimal conditions. In the case of inclement weather the BridgeGuard™ software will advise the technician to refrain from acquiring data until conditions have optimized.

Getting Started with BridgeGuard™

Online and live demonstrations of BridgeGuard™ are available to qualified organizations. Contact us to schedule a review with your team.

Scan this code with your smart phone to visit us online.

BRIDGEGUARD™

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