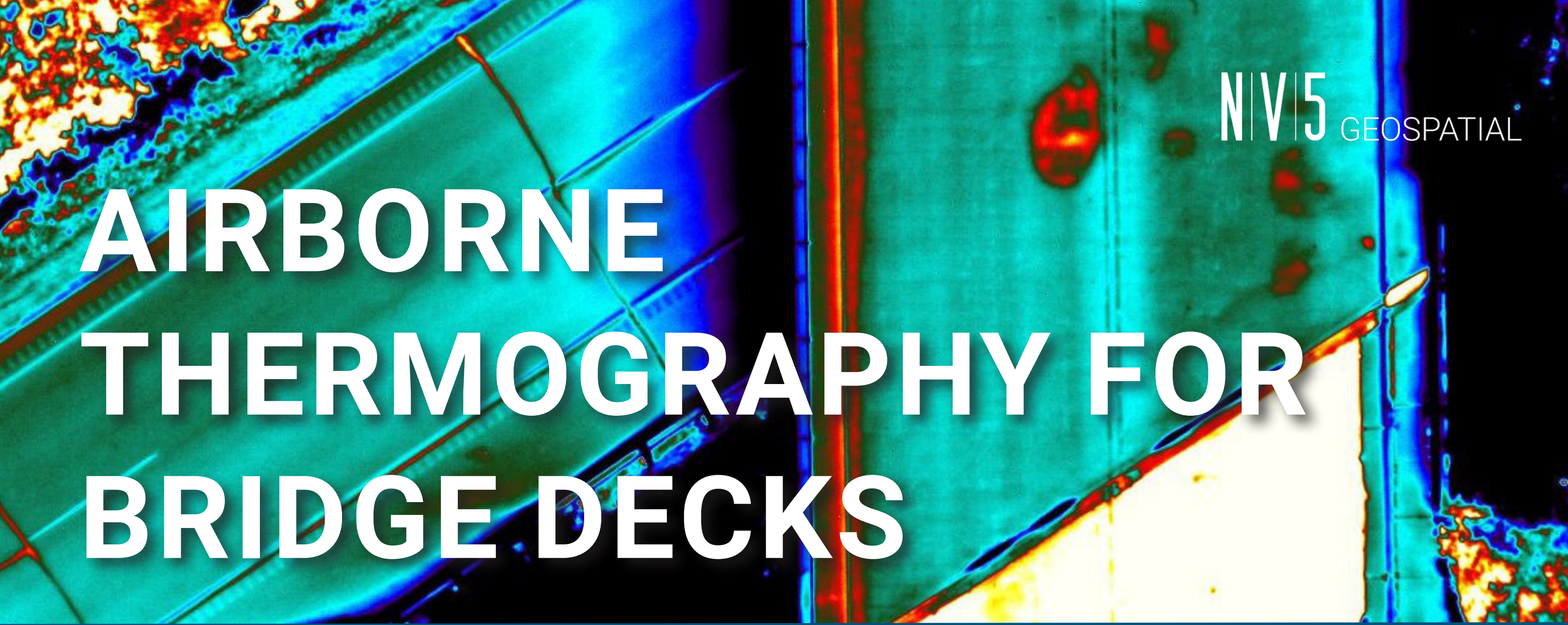


NV5 GEOSPATIAL

AIRBORNE THERMOGRAPHY FOR BRIDGE DECKS

ACQUIRE ANALYZE ANSWER

A NEW LOOK AT THERMAL

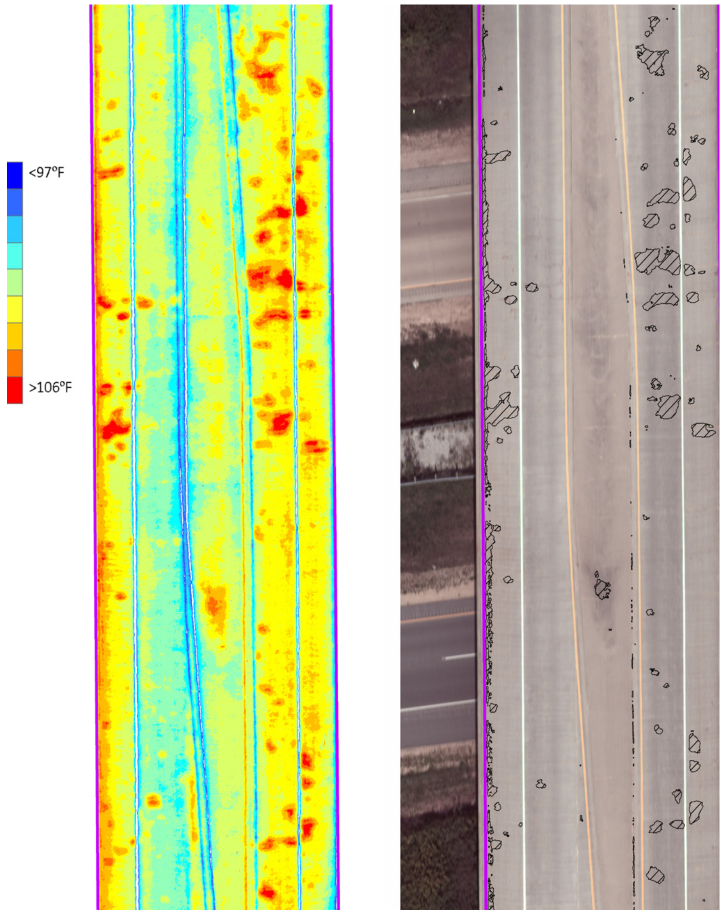
In partnership with a large Midwest Department of Transportation, NV5 Geospatial explores a new approach to analyze bridges using airborne thermal infrared imagery.

It is crucial to understand the structural integrity of bridge decks, monitor changes, and plan for informed repairs of this critical infrastructure. Naturally, it takes both time and money to do an accurate assessment. There are a variety of methods to choose from that can often be disruptive to normal traffic flow and provide somewhat indeterminate results.

For infrastructure, thermography or thermal infrared (TIR) is one viable solution. TIR is a fascinating remote sensing technology that can help identify otherwise undetectable structural problems well before they reach the surface of bridge decks, and long before they can be seen during close range visual inspections.

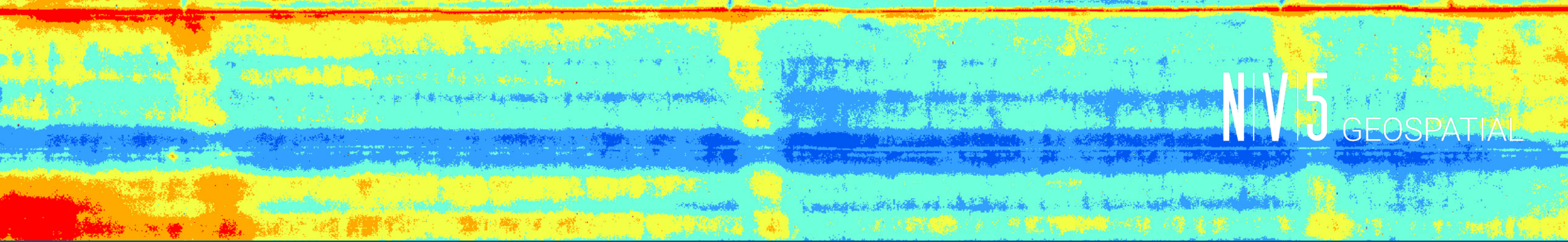
In partnership with a large Midwest Department of Transportation (DOT), NV5 Geospatial began a new and innovative airborne TIR approach to analyze bridges on state roadways. This culminated with the acquisition of high-resolution data that was used to analyze the structural integrity of 41 bridges using TIR imagery captured from a fixed wing airborne platform in a low-altitude pass. This pilot project has provided impressive results and validated the use of TIR analytics to identify structural anomalies in concrete.

Moreover, TIR is defining a new path for a cost effective, highly accurate analysis that is sure to reap considerable benefits for DOTs and Structural Engineers.



Thermal infrared image (left) with an RGB aerial image (right) of the same bridge span with structural anomalies identified.

For more information or to schedule a meeting contact **Robert.VanderMeer@nv5.com**



ACQUIRE ANALYZE ANSWER

APPLICATIONS

THE SCIENCE BEHIND THE DATA

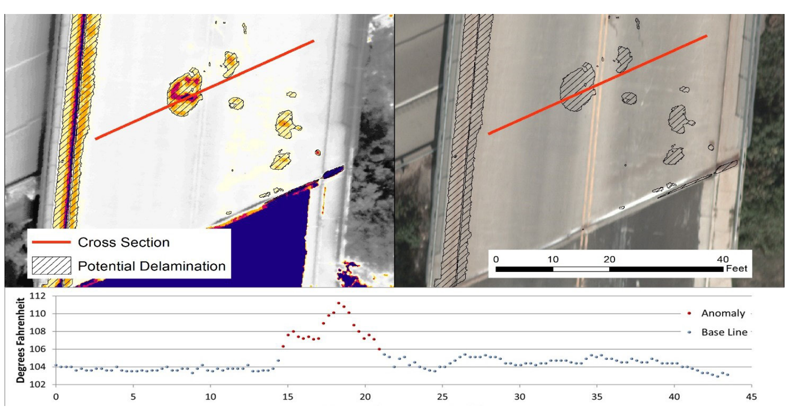
To understand how TIR imagery can detect structural anomalies in a non-destructive way, we need to “look inside.” Debonding or delamination within the concrete interrupts the efficient transfer of heat within the deck. During the day under peak solar conditions, areas experiencing debonding or delamination will have surface temperatures considerably higher than sound concrete nearby. Simply put, more heat is radiated in these areas instead of being conducted deeper into the slab. The analytics work best under peak solar loading. This happens during mid-day flights in warm seasons on days that are void of environmental conditions that tend to decrease the surface temperature of the decks – namely clouds, rain and high winds.

THERMOGRAPHY AND COMPETING APPROACHES

Enter thermography, which has been used to analyze bridge decks over the last two decades. In fact, ASTM D4788 (first released in 1997) describes the methods, equipment, and environmental conditions for evaluating bridge decks with TIR technology from a moving, ground-based vehicle. But ground-based capture is time consuming and costly, and comes with undesirable impacts on traffic flow and safety. Moreover, this requires all lanes to be driven individually given the narrow swath widths captured from a ground-based approach.

IMPRESSIVE RESULTS

For one project alone, NV5 Geospatial collected data over 41 bridges in a single afternoon using a fixed wing platform (airplane) at 1,000 feet above ground at speeds of 110 knots (126 mph). This provides a TIR image resolution of 3.5 cm on the bridge decks below. The nominal swath width of 150 feet allows for full coverage from a single pass on all bridges in the pilot program. This resolution proved highly effective at the detection of structural anomalies. The camera was cycled multiple times per second, allowing for the removal of cars and trucks on the bridge given the multiple looks and movement of the traffic during the bridge capture.



Structural problems in the bridge deck are evident in the TIR image (left), and the temperature differential of about 8 degrees F is shown in the cross section (below).

For more information or to schedule a meeting contact Robert.VanderMeer@nv5.com