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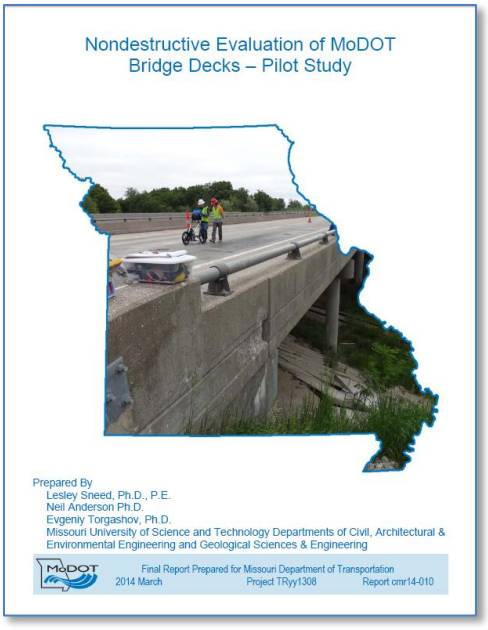
Research Summary

Nondestructive Evaluation of MoDOT Bridge Decks – Pilot Study



In 2013, researchers from the Missouri University of Science and Technology assessed nondestructive technologies used for evaluation of bridge deck conditions. These technologies included ground coupled GPR (ground penetrating radar) and PSPA (portable seismic property analyzer). The results of these deck assessments were compared to visual deck inspection, concrete cores, and chloride ion concentration measurements. Additionally, three of the structures were rehabilitated during the project via hydro demolition which yielded a unique visual and measurable assessment of the quality of concrete at any given location on the bridge decks.

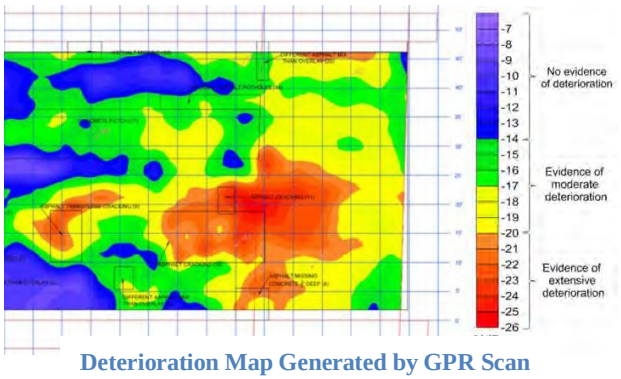
Ground coupled GPR measures the response of radar pulses from the surface of bridge deck rebar to determine the level of deterioration of the concrete above the rebar. Deterioration in the concrete causes distortions and a change in amplitude of the GPR signal. From this information, a map of the bridge deck deterioration can be created.

The PSPA consists of an acoustic impact source and two receiver transducers together in one portable device. The device records acoustic signals sent through the bridge deck properties through the USW (ultrasonic wave) method and the IE (Impact Echo) method. The USW method estimates the elastic modulus of the concrete by recording the difference in the sound wave velocity between the transducers as it propagates along the surface of the bridge deck. The IE method is used to estimate the apparent thickness of the bridge deck and to search for flaws in the deck by recording changes in the velocity of sound waves that bounce off the bottom of the deck. Any type of concrete debonding will result in an early reflection of the sound wave which is then recorded. This is similar to the hammer sounding method traditionally used to evaluate debonding.

Bridge deck rehabilitation via hydro demolition uses ultra-high pressure water jets to remove poor quality concrete from the deck surface. After this process is complete, the deck is overlaid with new material. The surfaces of three structures were surveyed before and after a hydro demolition with LiDAR (light detecting and ranging). The LiDAR surveys allowed researchers to determine the amount of concrete removed at any given location of the deck. This

information was correlated with the GPR scan and PSPA scans which were completed prior to the hydro demolition. This correlation helped determine accuracy and consistency of these nondestructive scanning methods.

This study found a ground coupled GPR data to have a good correlation with areas of high deterioration while only having fair correlation on areas with little to no deterioration as verified by hydro demolition results, cores, and visual inspection. Data collection, processing, and interpretation of results from the PSPA scans proved to be very time consuming and inappropriate for large bridge decks.



Deterioration Map Generated by GPR Scan

Ground Coupled GPR Scanning

Project Information

PROJECT NAME: Nondestructive Evaluation of MoDOT Bridge Decks – Pilot Study

PROJECT START/END DATE: August 23, 2012 – March 3, 2014

PROJECT COST: $53,089

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REPORT NAME: Nondestructive Evaluation of MoDOT Bridge Decks – Pilot Study

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