

## RESEARCH SUMMARY

### Optimizing Field Data Collection & Developing Advanced GPR Processing Modules – Phase III

#### WHAT WAS THE NEED?

Starting in 2013, the Maryland Department of Transportation State Highway Administration (MDOT SHA) evaluated using Ground Penetrating Radar (GPR) for assessing the condition of bridge decks (such as surface condition, rebar cover depth and location, and deck thickness). In the second phase of the project completed in 2016, 80 bridge decks were scanned using 3D GPR and condition assessment was completed using the analysis pipeline developed by the research team. In this phase III project MDOT SHA worked with the Maryland Environmental Services (MES) and the University of Maryland (UMD) to collect data on more than 300 bridge decks, and to develop new analysis modules for concrete delamination and HMA overlay condition. The feasibility of higher data acquisition speed was also explored.

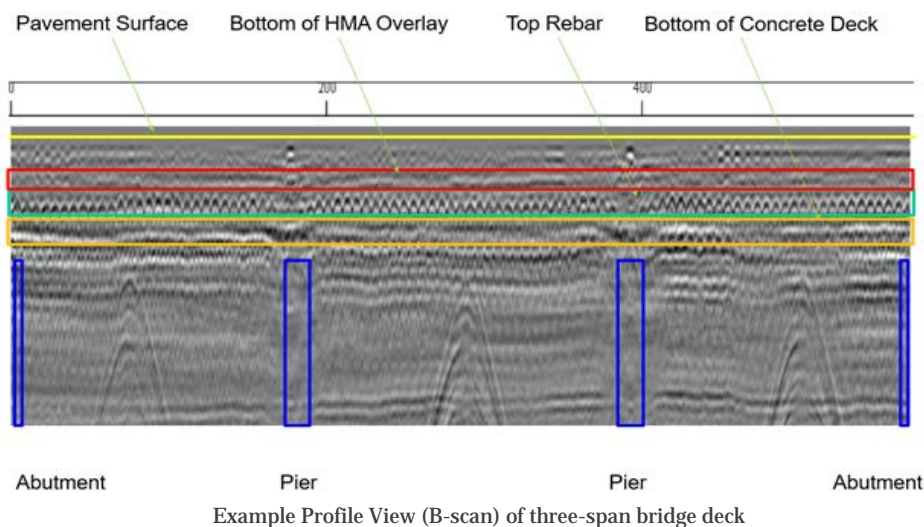
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Example Profile View (B-scan) of three-span bridge deck

## **WHAT WAS THE GOAL?**

In this Phase III project, a separate contract with Maryland Environmental Services (MES) and Starodub was issued to address: i) the development of new analysis modules for delamination and HMA overlay thickness and condition, and, ii) bridge deck SF-GPR data collection. The UMD task focused on the review and assessment of the proposed new GPR analysis modules, and an assessment of the impact of higher speed data collection protocol.

## **WHAT DID THE RESEARCH TEAM DO?**

A bridge deck condition assessment model (BDCAM) was developed to estimate the deck condition and condition state. Deck condition is defined based on a fuzzy model of the various levels of defect and deterioration of the deck. 219 bridge decks have been analyzed with the revised 2019 SF-GPR analysis pipeline. The BDCAM estimates were compared with the National Bridge Inventory (NBI) values.

Eight bridges were identified with bridge deck inspection reports and were surveyed with SF-GPR and analyzed with the 2019 SF-GPR analysis pipeline. The BDCAM analyses results were compared with the state inspection reports.

Under the MES/Starodub contract a new testing protocol was tested based on the common mid-point (CMP) synthetic aperture. The objective of the new testing protocol was to allow higher speed of data

collection, thus reducing monitoring time and cost. The UMD team reviewed and analyzed the possibility of higher data acquisition speeds.

## **WHAT WAS THE OUTCOME?**

The study concluded that the BDCAM model estimates agree with the NBI values for 90.9% of the 219 bridge decks analyzed within two level of the condition scale. The comparison of BDCAM analysis with state inspection deck reports for eight bridges provided consistent conclusions for seven out of the eight cases, all in the “fair” category. The study also concluded that it is possible to increase the GPR data acquisition speed from 10 mph to 13 mph on driving lanes with low surface roughness (IRI less than 100).

## **HOW WILL MDOT SHA USE THE RESULTS?**

MDOT SHA is currently evaluating how to set weights to reflect the relative importance of defects and deterioration near the surface, within the top steel cover, near the top mat of rebar, and below the top mat of rebar. Such weights will help produce a more reliable condition rating. The GPR data collection is continuing.

## **LEARN MORE**

To view the complete report, click [here](#).

To view the Phase I report, click [here](#).

To view the Phase II report, click [here](#).

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