Indiana Department of Transportation

Ground Penetrating Radar Bridge Deck Testing
Randy Strain
• Resource International, Inc. is in the process of completing our first contract of non-destructive bridge deck testing using ground penetrating radar.

• The contract included testing for 230 bridge decks.

• The bridges were selected by the INDOT Bridge Asset Engineers and Bridge Inspection Supervisors.
Bridge Deck constructed in 1994  
25 year old deck  
Deterioration less than 10%
Bridge deck constructed in 1994 – 25 year old bridge deck
Deterioration just over 10%
Bartholomew County Complex Bridge built with a latex overlay

The deterioration is just over 10%

The structure is 20 years old.
In order to obtain a 28 day yield strength of 4000 psi, 658 pounds of cement is used in the mix design.

Indiana is known for its’ Indiana Limestone, also known as Bedford Limestone.

Bedford Indiana has been noted to have the highest quality quarried limestone in the United States.

Wonderful product for building products.

Not a great stone for obtaining a high strength concrete.
It appears that building a bridge deck with an overlay may not provide additional protection to the deck. The shrinkage cracks from the deck seem to extend into the overlay.

Our best protection with our current mix design is to allow the shrinkage cracks to form and provide protection with a polymeric concrete bridge deck overlay.

Designing a concrete mix to overcome the shrinkage cracks increases the cost of the concrete by about four and a half times.
INDOT NDT

- 41-42-5935 BSBL

- 9.7% highly deteriorated
- 38.2% total deterioration
- 48 year old deck
- 24 year old 2nd overlay
- Structure is programmed to be rehabilitated in 2020. The inspector rated the deck a low 6 by notation and recommend the deck be replaced.
Preliminary statistical findings

• Bridges with approximately 10% deterioration should be considered to be in fair condition.

• Bridges with approximately 10% – 20% deterioration may require further testing.

• Bridges with grater than 20% deterioration should be considered in poor condition.
The relation between percent deterioration and percent patching is not a one to one correlation. This graph is an approximation of the relationship.
When and how often should testing be done?

- The deterioration appears to be minor in bridge decks less than twenty years old.
- The deterioration in latex overlays appears to follow very closely to the same time line.
- The bridge inspectors cannot accurately determine the condition of the bridge decks by visual inspection. A large amount of the deterioration is simply not visible.
- Using NDT at the appropriate time line can assist in the proper evaluation of the bridge deck.
INDOT NDT

• INDOT Bridge Inspectors can use the NDT results to more accurately rate bridge decks.

• Percentage of deterioration does not directly correlate to bridge deck patching.

• Ground penetrating radar is a valuable tool for screening bridge decks.

• The correlation of deterioration percentage to patching has not been accurately determined.
INDOT NDT

• In 2019 we would like to use different methods of NDT and perform quality assurance on the bridge desks tested.

• Perhaps in order to minimize traffic disruption, the touch based NDT might be performed on the bridge deck shoulder then the traffic lanes can be tested at highway speeds.

• Several bridge decks will be followed through the construction contract in order to obtain the correlation between percentage deterioration to bridge deck patching.

• The upper limit of deterioration needs to be identified.