New Mexico DOT

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SHRP2 R06A
NDT Bridge Decks
= primarily GRP

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special thanks to:
Dr. Manuel Celaya, Advanced Infrastructure Design
Agenda

- Introduction
- Start with the end in mind
- Things of interest
- Executive Summary
- Details / Pretty Pictures
- Conclusions
Why GPR
Existing Equipment

Air Coupled (2 Antenna’s)
2Ghz Frequency

Ground Coupled (4 Antenna’s, 2/freq.)
400Mhz and 900Mhz Frequency

NMDOT CURRENT EQUIPMENT- SIR 30
Ground Penetrating Radar (GPR) for Concrete Bridge Deck Evaluation

Daniel E. Diaz
Dr. Brad D. Weldon

Department of Civil Engineering, New Mexico State University
Existing Equipment
At the end of the day, we intended to **create a capability** that we did not previously have.

The capability needed to be readily accessible through our bridge inspection contract with NMSU.
pretty pictures = required
Things of Interest

- NMDOT does use chlorides (deicing salts) - but not in the whole state
- Unique and variable deterioration models
- Various and often unintentional overlays
Things of Interest

- Estimating quantities is not very scientific – we pay by actual quantity
- Difficulties in correlating preservation scope and budget
Things of Interest

- $14M in bridge preservation funds controlled by the State Bridge Engineer
GPR is not the magic bullet

But it has value when applied appropriately

Decision must be project specific (bridge type, data need)
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Nine Bridges

6134
6840
6932
6939
7032
7113
7299
8845
8852
GPR Evaluation Results: Bridge 8845
GPR Evaluation Results: Bridge 8845

- AASHTO Girder

- From most current inspection report:
  - Deck: 7
  - Superstructure: 7
  - Substructure: 7

- Deck inspection reports:
  - Isolated transverse and longitudinal cracks up to 1/32” with light leaching (Underside)
  - Transverse and vertical cracks up to 1/16” with light leaching (Deck edges)
GPR Evaluation Results: Bridge 8845
GPR Evaluation Results: Bridge 6840
GPR Evaluation Results: Bridge 6840

- AASHTO Prestressed Girder

- From most current inspection report:
  - Deck: 4
  - Superstructure: 5
  - Substructure: 6

- Deck inspection reports:
  - Transverse and longitudinal cracks up to 1/8” with heavy leaching (deck edges); transverse and longitudinal cracks up to 1/16” with heavy leaching and rust stains near joints
GPR Evaluation Results: Typical B Scan from Bridge 6840

- Reflection amplitudes picks, X and Y location coordinates, and two-way travel time are obtained using Radan 7
GPR Evaluation Results: Excel Processing Bridge 6840

- Information obtained from Radan 7 exported to Excel for further processing
GPR Evaluation Results: Bridge 6840
GPR Evaluation Results: Bridge 6932
GPR Evaluation Results: Bridge 6932

- Concrete Slab Bridge – Asphalt Overlay

- From most current inspection report:
  - Deck: 5
  - Superstructure: 5
  - Substructure: 6

- Deck inspection reports:
  - Vertical, horizontal, transverse and map cracks up to 1/4” (deck edges); transverse and map cracks up to 1/16”, areas of moderate leaching, and spalls up to 6” by 5” (Underside)
GPR Evaluation Results: Bridge 6932 (Southbound Lanes and Left Turn Lane)
GPR Evaluation Results: Bridge 6932 (Northbound Lanes)
GPR Evaluation Results: Bridge 6939 (slab)
GPR Evaluation Results: Bridge 6939 (Southbound Outside Lane and Shoulder)
GPR Evaluation Results: Bridge 6939 (Southbound Inside Lane)
GPR Evaluation Results: Bridge 6939 (Northbound Inside Lane)
GPR Evaluation Results: Bridge 7032

• THIS BRIDGE HAS A COMPLETELY DELAMINATE LATEX MODIFIED CONCRETE DECK OVERLAY

• From most current inspection report:
  – Deck: 5
  – Superstructure: 5
  – Substructure: 5

• Deck inspection reports:
  – Vertical, transverse, longitudinal cracks up to 1/4"; exposed rebar up to 22’, spalls up to 8’x6”, apparent delaminations up to 28’, and minor leaching and water stains (Deck edges)
GPR Evaluation Results: Bridge 7032 (East Bound)
GPR Evaluation Results: Bridge 7032 (West Bound)
GPR Evaluation Results: Bridge 7113
GPR Evaluation Results: Bridge 7113

• AASHTO Girder – construction defect (cover)

• From most current inspection report:
  – Deck: 5
  – Superstructure: 7
  – Substructure: 7

• Deck inspection reports:
  – Transverse cracks up to 1/16” and minor leaching (Deck edges); transverse and map cracks up to 1/16”, exposed rebar, and spalls (Top of Deck); Rust stains at the joint locations (Underside)
GPR Evaluation Results: Bridge 7113
GPR Evaluation Results: Bridge 7299
GPR Evaluation Results: Bridge 7299

- Grant Application

- From most current inspection report:
  - Deck: 5
  - Superstructure: 5
  - Substructure: 5

- Deck inspection reports:
  - Transverse and vertical cracks up to 1/8” with heavy leaching (Deck edges); transverse and longitudinal cracks up to 1/8” with heavy leaching (Underside)
GPR Evaluation Results: Bridge 7299

(a)

(b)
“Normal Deck”

- It works to help determine whether a deck is a preservation candidate versus replacement.
“Slab Deck”

- Good as first pass
- Second pass (more detailed) really necessary as DEPTH of the areas of concern is critical to decision / quantity
Overlay

- Seems to work in “seeing through” asphalt
- Seems to work with “seeing through” epoxy overlay (by extension, will likely work with polyester overlay)
- Does NOT seem to work with latex modified overlay
Successful Project

- We learned a lot
- We developed a capability that we did not previously have
- Research value, published research
- Developing a remarkable engineer Daniel Diaz
New Mexico DOT

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