Transportation Research Board (TRB)
2018 Annual Meeting Update

NDDOT Lunch & Learn
February 14, 2018
TRB 2018 Annual Meeting

• Transportation: Moving the Economy of the Future
  – January 7-11, 2018
  – Washington, DC

• Purpose
  – Opportunity to share knowledge and perspectives with colleagues.
  – Learn about the latest developments in transportation research, policy, and practice.

• Size & Scope
  – 5000+ Presentations
  – 800+ Sessions
  – 200+ Exhibitors
  – 14,000 Attendees
North Dakota Representation

• NDDOT
  – Tom Sorel – DOT Director
  – Jason Thorenson – Bridge Division
  – Ben Ehreth – Planning & Asset Management Division
  – Jeani Borchert – ETS Division, Cultural Resources
  – Matt Linneman – Materials & Research Division

• NDLTAP
  – Dale Heglund – NDLTAP Director

• NDSU & UND – Many professors & researchers
Tom Sorel

• DOT Leadership Perspective of the TRB Annual Meeting

• Peer Perspectives

• Learning and validation of issues and approaches to problems

• NDDOT Team Involvement with TRB
OUTLINE

• FR-SCC to Enhance Serviceability of Damaged Beams

• The First UHPC Bridge Deck Overlay in North America
• Study conducted to design & test properties of SCC and FR-SCC mixtures for use in repairing damaged beams

• Repair Mix:
  – 5,000 psi minimum compressive strength
  – Tested Two Types of Cementitious Material
    ▪ Dense silica fume (SF)
    ▪ Grade 120 slag (SL)
FR-SCC TO ENHANCE SERVICEABILITY OF DAMAGED BEAMS

• Repair Mix Cont’d:
  – Tested two types of fiber reinforcement
    ▪ Steel Fiber (STF) – macro crimped fiber length of 1.5 in
    ▪ Polypropylene fiber (PPF) – micro fiber length of 0.25 in
# FR-SCC TO ENHANCE SERVICEABILITY OF DAMAGED BEAMS

## TABLE 1 Mixture Proportions for One Cubic Yard and Fresh Properties of SCC and FR-SCC Mixes

<table>
<thead>
<tr>
<th>Mixture</th>
<th>Identification</th>
<th>Cement, lb</th>
<th>SL or SF, lb</th>
<th>Total Binder Weight, lb</th>
<th>Water, lb</th>
<th>w/cm</th>
<th>Coarse Aggregate (#8), lb</th>
<th>Fine Aggregate (Sand), lb</th>
<th>AEA, oz/cwt</th>
<th>HRWR, oz/cwt</th>
<th>MRWR, oz/cwt</th>
<th>Slump Flow, in.</th>
<th>T20, S</th>
<th>VSI</th>
<th>J-Ring, in.</th>
<th>Modified L-Rox, k2/h1</th>
<th>Air Content, %</th>
<th>Difference in Flows, in.*</th>
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<tr>
<td>Class A</td>
<td>Class A</td>
<td>611</td>
<td>0</td>
<td>611</td>
<td>259</td>
<td>0.420</td>
<td>1800</td>
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<td>1.00</td>
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<td>3.5</td>
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<tr>
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<td>23.5</td>
<td>4.5</td>
<td>0</td>
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<td>0.90</td>
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<td>10SF</td>
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<td>0.90</td>
<td>6.5</td>
<td>4.0</td>
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</table>

*Difference in flow = Slump flow – J-Ring
Free Shrinkage Results at Different Ages:
- Mixtures with fibers reduced shrinkage
• Third Point Loading Composite Prism Test:
  - Compatibility test of repair material with substrate
    ▪ Crack at interface between substrate and repair indicates incompatibility
    ▪ Crack through repair and substrate shows good compatibility
    ▪ In general all mixes showed good compatibility
FR-SCC TO ENHANCE SERVICEABILITY OF DAMAGED BEAMS

• Bond Strength Test:
  – Repair material bonded to substrate on a slanted elliptical plane inclined at 30º
  – Fibers increased bond strength in all mixes
FR-SCC TO ENHANCE SERVICEABILITY OF DAMAGED BEAMS

• Full Scale Flexural Beam Strength Test:
  – Composite beams:
    ▪ #4 or #3 main reinforcement to simulate 35% and 65% reduction of bar areas, respectively, due to corrosion
    ▪ #4 top reinforcement
    ▪ #3 shear reinforcement
FR-SCC TO ENHANCE SERVICEABILITY OF DAMAGED BEAMS

- Full Scale Flexural Beam Test Results:
  - Flexural tests show repair mixtures were able to increase cracking load for repaired beams
  - STF mixes show better flexural strength than PPF
  - 10SF50S showed highest increase

<table>
<thead>
<tr>
<th>Beam</th>
<th>Main reinforcement rebar #</th>
<th>Cracking load, lbs</th>
<th>Increase in Cracking Load, %</th>
<th>Ultimate load, lbs</th>
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<td>4700</td>
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<td>Control 2</td>
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<td>3</td>
<td>5700</td>
<td>22.6</td>
<td>15500</td>
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</table>
• Conclusions and Findings:
  – FR-SCC reduced shrinkage
  – FR-SCC reduced crack density & crack opening
  – FR-SCC increased bond strength
  – FR-SCC improved tensile & flexural strengths
FIRST UHPC DECK OVERLAY IN NORTH AMERICA

• Mud Creek Bridge near Brandon, Iowa
  – 102 ft long, 30 ft wide built in 1960’s
  – 3-Span, two-lane, continuous concrete slab bridge, 5% superelevation
  – UHPC overlay in May 2016
    ▪ 18 ksi compressive strength
    ▪ 3.25% STF (0.008 in Ø & 0.5 in long)
FIRST UHPC DECK OVERLAY IN NORTH AMERICA

• Field Test of Prototype Bridge
  – Local Contractor - no prior experience with UHPC
  – 6 mm of existing deck surface was removed
  – Grooved surface to achieve 2 to 3 mm minimum amplitude for roughness
  – Used wire mesh in negative moment region
  – Cleaned deck and saturated surface prior to 1.5 inch overlay
FIRST UHPC DECK OVERLAY IN NORTH AMERICA

• Field Test of Prototype Bridge
  – Batching performed with two high shear pan portable mixers. 0.65 CY per batch
  – Loading and batching took 20 min. Used a mini concrete dumper
  – Vibratory truss screed used to consolidate
  – Completed one lane per day. Second day took 3 to 4 hours
  – Grinding and grooving after 3 days
  – Reopened to traffic in two weeks
• Periodic Field Inspection
  – Chain dragging identified some areas of concern
  – Conducted pull-off tests which indicated delamination within existing concrete
FIRST UHPC DECK OVERLAY IN NORTH AMERICA

• Conclusions & Findings:
  – Larger projects should utilize portable batch plant or batched delivery
  – Larger crew needed due to workability
  – STF could be introduced more quickly into the mix to speed up batching
  – Specially designed equipment for placement may be appropriate to place more efficiently
  – Curing compound is extremely important to keep moisture within UHPC layer after consolidation
  – Need to determine optimal curing time before grinding

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- Disruptive Technologies
- Multi-modal Mobility
- Public Engagement
- Freight
- Transportation and the Economy
- Transportation and Communities
• 3 Revolutions
  1. Shared
  2. Electric
  3. Autonomous
• Sessions
  - Three Revolutions for Public Transit: From Service Agency to Mobility Platform
  - Disruptive Technologies: Impacts on Transportation Revenues
  - Mobility of the Future
  - Electric Vehicles: Infrastructure, Economics, and Planning
  - Competing Visions of Transportation Future
  - Planning for the Economy of the Future
  - Developing Customer Experience Through Art and Design Practices and Policies
  - Agriculture Commodity Data: Challenges and Applications
  - Visualization: Lightning Talks
  - Communicating with John and Jane Q. Public 2017 Competition Results
  - Walkability and Pedestrian Level of Service
  - The Built Environment, Travel Behavior, and Smart Growth
  - The Future of Measuring Trucks and Their Use in the United States
  - Built Environment and Demographic Issues
  - Limitations in Detection Technologies for Automated Driving Systems and Implications for Pedestrians
  - On the Road with Alternative Fuels: Progress in Deploying New Vehicle and Fueling Infrastructure

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TRB’s mission and services

• TRB provides innovative, research-based solutions to improve transportation
• TRB is a program unit of the National Academy of Sciences, Engineering and Medicine, a non-profit organization that provides independent, objective, and interdisciplinary solutions.
• TRB manages transportation research by producing publications and online resources.
• It convenes experts that help to develop solutions to problems and issues facing transportation professionals.
• TRB also provides advice through its policy studies that tackle complex and often controversial issues of national significance.
• TRB is powered by volunteers, learn how to connect with TRB to find out about new research and volunteer opportunities.
Transportation Research Board

• 15 Divisions of Interests/Functions, some subdivided into Sections, that organize the 272 Standing Committees of the TRB

• 11 Groups and 4 Others with Executive Functions
  – Executive Committee
  – Technical Activities Council
  – TRB Information Services Committee
  – ACRP Oversight Committee
  – Policy and Organization Group
  – Planning and Environment Group
  – Design and Construction Group
  – Operations and Preservation Group
  – Legal Resources Group
  – Safety and Systems Users Group
  – Public Transportation Group
  – Rail Group
  – Freight Systems Group
  – Aviation Group
Planning and Environment Group

• 4 Sections
  – Transportation System Policy, Planning, and Process Section
  – Travel Analysis Methods Section
  – Environment and Energy Section
  – Social, Economic, and Cultural Issues Section
ADC 50 part of the Environment and Energy Section

- ADC50 Standing Committee on Historic and Archeological Preservation in Transportation
  - Communications Subcommittee
  - Research Needs Subcommittee
  - Programs Subcommittee
  - Tribal Historical and Archeological Preservation, Joint Subcommittee with ABE80 Committee
    - ABE80: Native American Transportation Issues Committee is part of the Transportation Policy Section of the Policy and Organization Group
ADC 50 Committee

• Currently has 32 Members and Many Friends
• Annual Meeting Attendance is around 30
• Current Research:
  – Integrating Tribal Knowledge into Processes to Identify, Evaluate, and Record Cultural Resources
  – National Survey of State DOT Recommendations for Additional Section 106 Program Comments or Exemptions
  – Context Sensitive Design Options for Workhorse Bridges in Rural Historic Districts

http://www.trb.org/BridgesOtherStructures/TRBPublications.aspx


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412 - Converting Distressed Paved Roads to Engineered Unpaved Roads

209C
3:45 PM - 5:30 PM
North Dakota

Converting Distressed Paved Roads to Engineered Unpaved Roads

Monday, January 8, 2018, 3:45 PM - 5:30 PM
Convention Center, 209C - Lectern Session 412 - #P18-21139

Sponsored by: Standing Committee on Low-Volume Roads (AFB30)

Dale C. Heglund, PE/PLS
North Dakota LTAP Director
Air Force Comments

... steadily deteriorating condition
... condition below a gravel road
... condition may affect their mission

__________________________

... very happy with the results

... no longer a concern that the road may adversely affect their mission
RP 15-11: Implementation of Automatic Sign Inventory and Pavement Condition Evaluation on Georgia's Interstate Highways

Vickang James Tsai, Zhanhui Wang, Georgia Institute of Technology

ABSTRACT
Traffic signs and pavements are indispensable assets to facilities and uninterrupted travel. Manual methods for traffic sign inventory and pavement condition evaluation by the Georgia Department of Transportation. Although, they take great amount of labor, and sometimes exposed inspectors to hazardous conditions. The installation of traffic signs inventory for its smart autonomy highway system for pavement condition evaluation, although it can be affected by non-standardized conditions. It is challenging to accurately measure the performance of current manual procedures. In this study, the authors developed and validated an automatic traffic sign inventory and pavement condition evaluation system. The system was successfully implemented on Georgia's interstate highways and established a complete traffic sign inventory and pavement condition evaluation system. The system can significantly reduce the time required for traffic sign inventory and pavement condition evaluation.

BACKGROUND
The objective of this research project focusing on the interstate highways maintained by GDOT is to develop a system that:

1. To accurately and efficiently collect traffic sign and pavement condition data.
2. To validate the effectiveness of the automatic traffic sign inventory and the automatic pavement condition detection and classification method.
3. To utilize the automatic data collection procedure to traffic sign inventory and pavement condition evaluation.
4. To develop an automatic traffic sign inventory and pavement condition evaluation system.

The traffic sign inventory includes traffic signs, traffic signs, MUTCD codes, and traffic sign condition based on the signs chart of GDOT's inventory system.

Pavement condition includes pavement types of pavement structures that are defined in the AASHTO manual (2005).

METHODOLOGY

1. Streamlined Traffic Sign Inventory Procedure
   - Data Collection
   - Data Processing
   - Traffic Sign Inventory
2. Streamlined Pavement Condition Evaluation Procedure
   - Data Collection
   - Data Processing
   - Pavement Condition Evaluation

OUTCOME

1. A complete traffic sign inventory on Georgia's interstate highway system has been created, including 21,968 signs identified as high-priority signs and 3,169 signs with potential condition assessment.
2. A full coverage of the urban arterial section of Georgia's interstate highway system has been evaluated, including 3,302 identified with potential condition assessment.
3. The system has been validated and can significantly reduce the time required for traffic sign inventory and pavement condition evaluation.

SUMMARY

- A complete traffic sign inventory on Georgia's interstate highway system has been created, including 21,968 signs identified as high-priority signs and 3,169 signs with potential condition assessment.
- A complete traffic sign inventory on Georgia's interstate highway system has been validated, including 3,302 identified with potential condition assessment.
- The system has been successfully implemented on Georgia's interstate highways and established a complete traffic sign inventory and pavement condition evaluation system.
Results

In a 24-inch culvert, the HIVE video revealed that the deteriorated culvert invert was only present in the last 12 feet of the culvert and could be repaired partially (cost $15,000) or full replacement (cost $45,000).

A 24-inch diameter concrete culvert on Highway 52, which appeared in good condition from visual inspection at the portal was inspected with the HIVE. The video revealed areas of exposed rebar, deformation, and infiltration. These conditions require replacement. Had the HIVE not been used, the culvert would not have been replaced with the upcoming mill and overlay. Instead, information would have likely continued until a schedule developed in the new pavement, requiring emergency repair with maintenance or an emergency contract.

By using the HIVE until eight culverts changed from no work needed to repair needed, because large joint separations or broken flanges with exposed soil visible were detected by video far into the pipe.

Specifications

- Waterproof
- Wi-Fi transmission
- 4wd drive
- 1,200 vehicle/camera
- 3000 tablet
- Transported in 11”x13” box
Contact Information
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701-318-6893
• NDDOT is a member of TRB
  – Through the Research Program
  – Access to all TRB and NCHRP Reports

• TRB State DOT Representative
  – Tried to hit a variety of sessions to cover wide department perspective
  – Reps and Directors Luncheon to help shape the strategic direction of TRB

• Concurrent Meetings at TRB
  – AASHTO Committee on Materials & Pavements
  – AASHTO Research Advisory Committee
  – NRRA Meeting
Sessions of Interest (Workshops)

• Balanced Asphalt Mix Design
• Geotechnical Instrumentation & Modeling
Sessions of Interest

• Creating a Culture of Innovation at DOTs
  http://www.transportationlab.org/

• Technological Advances in Road Ecology
Sessions of Interest

• Competing Visions of Transportations Future
• Vehicle Electrification in the Medium & Heavy Duty Sectors

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Meeting Materials & Resources

• NDDOT Employees have access to all the papers and presentations at the following location (at no charge): http://amonline.trb.org/

• TRB Attendees are available anytime for questions.

• Any Questions?
Lunch and Learn Schedule

• Thursday, March 22\textsuperscript{nd}
  – Right Of Way
    ▪ New Procedures, Forms and More

• Please visit our website to RSVP:
  https://www.dot.nd.gov/lunchandlearn.htm