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

Jason Thorenson

OUTLINE

- FR-SCC to Enhance Serviceability of Damaged Beams

- The First UHPC Bridge Deck Overlay in North America

FR-SCC TO ENHANCE SERVICEABILITY OF DAMAGED BEAMS

- 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

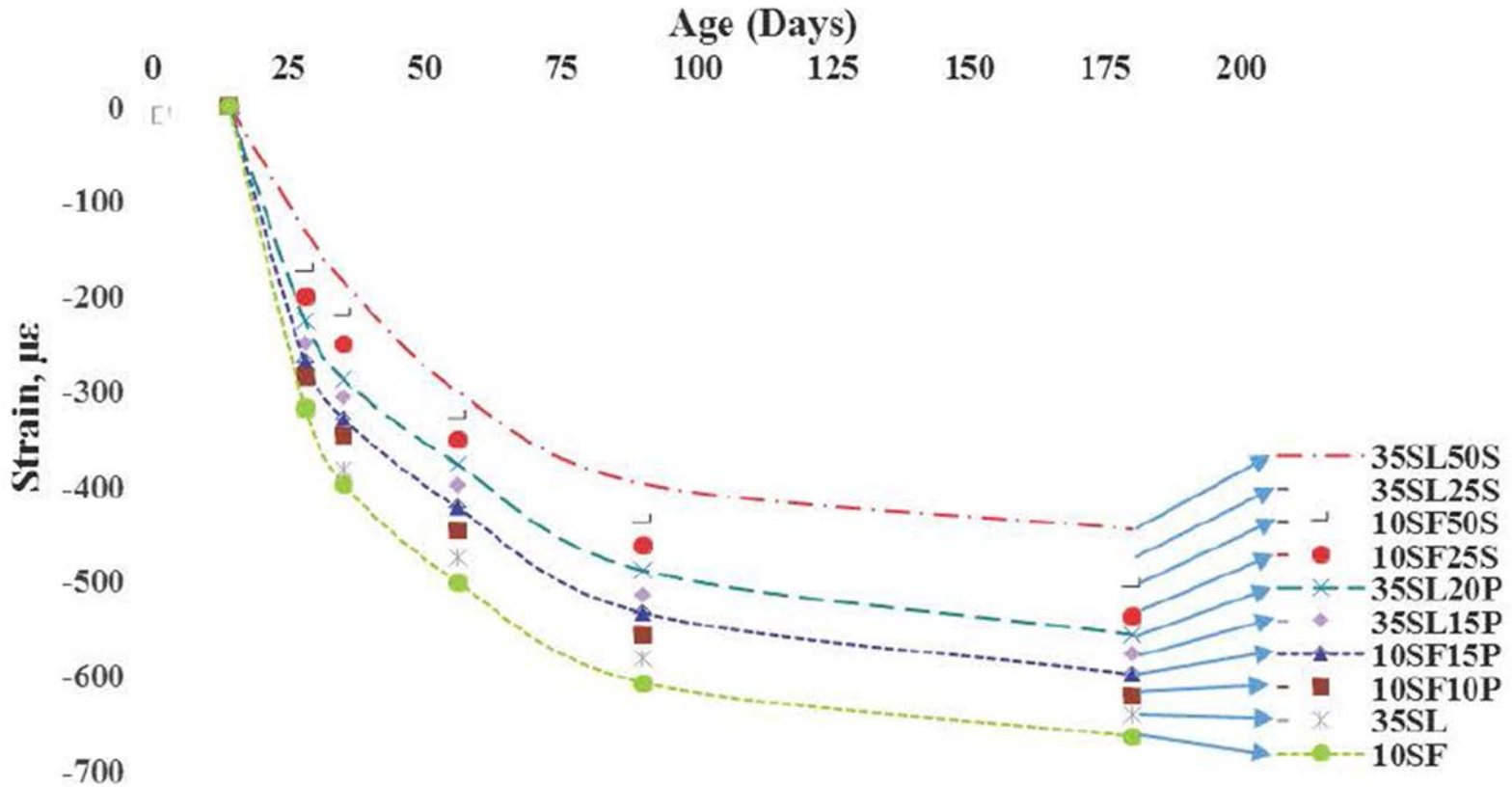
TABLE 1 Mixture Proportions for One Cubic Yard and Fresh Properties of SCC and FR-SCC Mixes

		Composition										Fresh Properties						
Mixture	Identification	Cement, lb	SL or SF, lb	Total Binder Weight, lb	Water, lb	w/cm	Coarse Aggregate (#8), lb	Fine Aggregate (Sand), lb	AEA, oz./cwt	HRWRA, oz/cwt	MRWRA, oz/cwt	Slump Flow, in.	T20, S	VSI	J-Ring, in.	Modified L-Box, h2/h1	Air Content, %	Difference in Flows, in.*
Class A	Class A	611	0	611	259	0.420	1800	1275	4.9	0.0	24.4	-	-	-	-	-	-	-
35SL	35% SL									7.0		23.5	4.0	0	22.5	1.00	7.0	1.0
35SL25S	35% SL+0.25%STF									7.5		21.5	5.5	1	20.0	1.00	6.5	1.5
35SL50S	35% SL+0.50%STF	439	236							8.5		22.0	6.5	1	19.0	0.90	6.5	3.0
35SL15P	35% SL+0.15%PPF									10.0		23.5	4.5	0	19.0	0.90	6.5	3.5
35SL20P	35% SL+0.20%PPF									11.0		23.0	4.5	0	18.0	0.80	6.0	5.0
10SF	10% SF			675	287	0.425	1436	1436	0.5	8.5	0	25.0	5.0	0	21.5	1.00	6.5	3.5
10SF25S	10% SF+0.25%STF									12.3		25.0	5.3	0	21.0	0.95	6.5	4.0
10SF50S	10% SF+0.50%STF	608	68							22.0		24.0	6.0	0	19.0	0.93	6.0	5.0
10SF10P	10% SF+0.10%PPF									17.2		23.0	5.0	0	18.0	0.90	6.5	5.0
10SF15P	10% SF+0.15%PPF									26.5		21.0	8.0	0	17.0	0.80	6.0	4.0

*Difference in flow= Slump flow – J-Ring

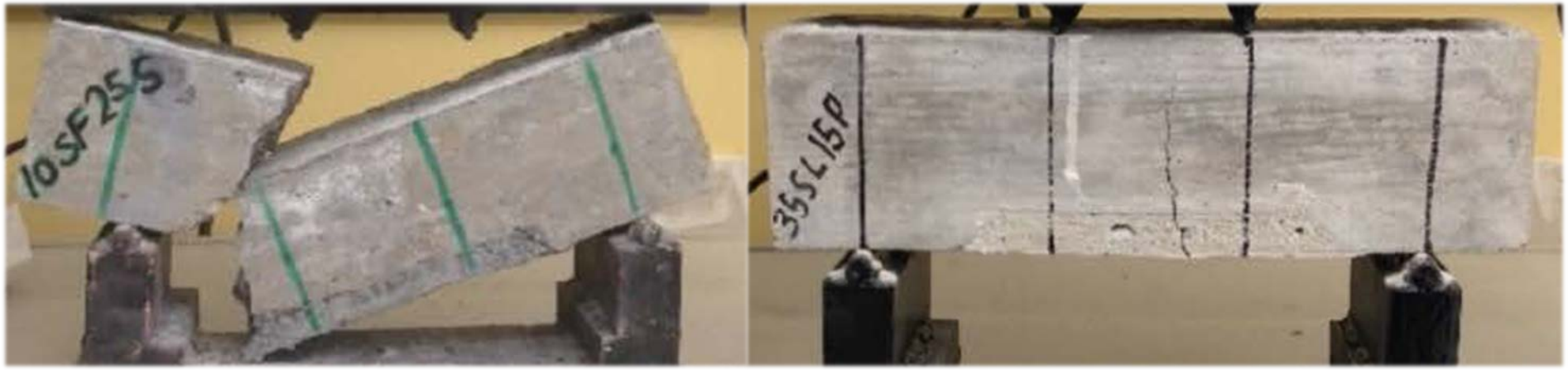
FR-SCC TO ENHANCE SERVICEABILITY OF DAMAGED BEAMS

- Free Shrinkage Results at Different Ages:
  - Mixtures with fibers reduced shrinkage



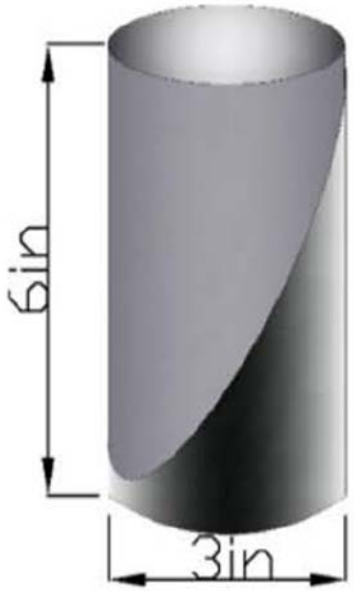
FR-SCC TO ENHANCE SERVICEABILITY OF DAMAGED BEAMS

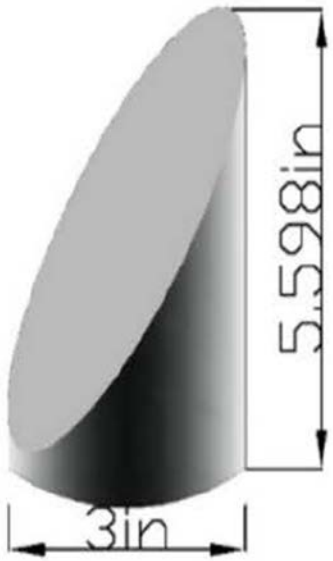
- Third Point Loading Composite Prism Test:
  - Compatibility test of repair material with substrate
    - Crack at interface between substrate and repair indicates incompatibility
    - Crack through repair and substrate shows good compatibility
    - In general all mixes showed good compatibility



FR-SCC TO ENHANCE SERVICEABILITY OF DAMAGED BEAMS

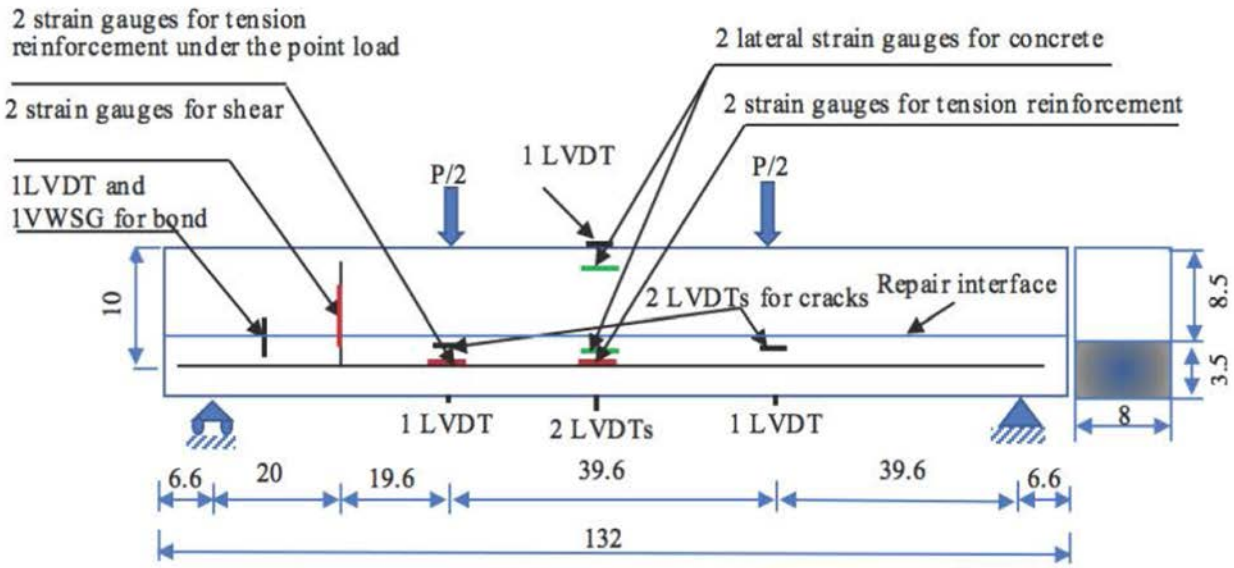
- Bond Strength Test:
  - Repair material bonded to substrate on a slanted elliptical plane inclined at 30º
  - Fibers increased bond strength in all mixes





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



*All dimensions are in inches.

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

Beam	Main reinforcement rebar #	Cracking load, lbs	Increase in Cracking Load, %	Ultimate load, lbs
Control 1	5	4700	-	32000
Control 2	5	4600	-	30000
35SL25S	4	5500	18.3	24000
35SL15P	4	4900	5.4	22700
10SF25S	4	5500	18.3	26200
10SF10P	4	5500	18.3	23000
35SL50S	3	5700	22.6	16000
35SL20P	3	5100	9.7	15492
10SF50S	3	6000	29.0	19000
10SF15P	3	5700	22.6	15500

FR-SCC TO ENHANCE SERVICEABILITY OF DAMAGED BEAMS

- 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

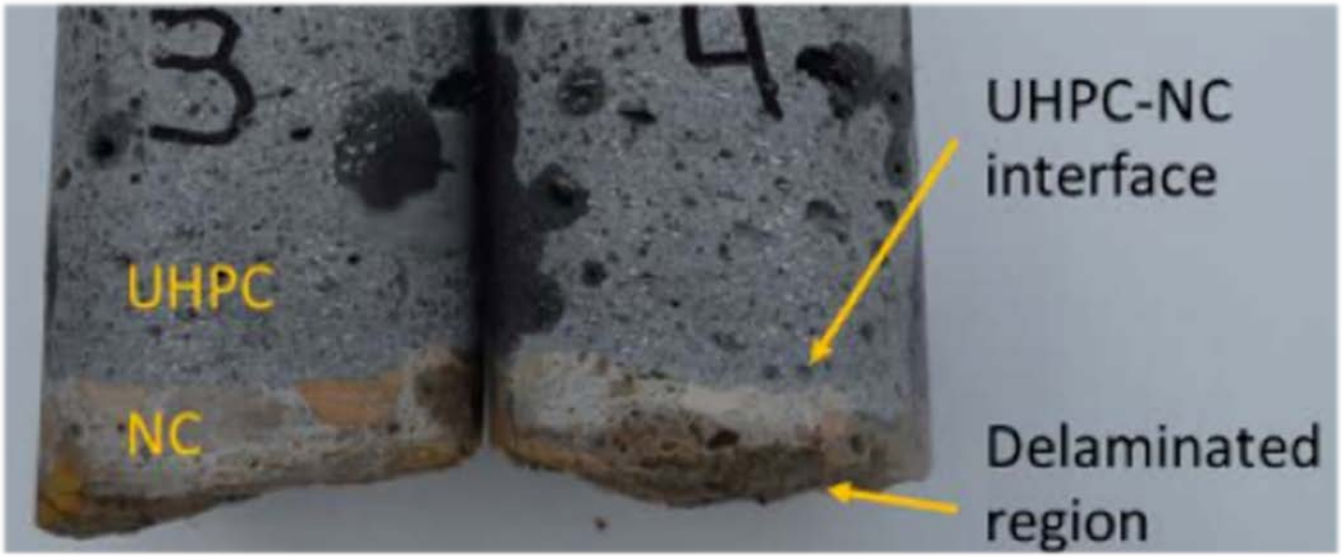
- Field Test of Prototype Bridge
  - Local Contractor - no prior experience with UHPC
  - 6 mm of existing deck surface was removed
  - Grooved surface to achieve 2 to 3 mm minimum amplitude for roughness
  - Used wire mesh in negative moment region
  - Cleaned deck and saturated surface prior to 1.5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

FIRST UHPC DECK OVERLAY IN NORTH AMERICA

- 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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Ben Ehreth

- Disruptive Technologies
- Multi-modal Mobility
- Public Engagement
- Freight
- Transportation and the Economy
- Transportation and Communities

Ben Ehreth

- 3 Revolutions
  1. Shared
  2. Electric
  3. Autonomous


www.world.honda.com


www.sharedusemobilitycenter.org


www.dot.state.mn.us

American Planning Association

Ben Ehreth

- 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 Transportations 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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Jeani Borchert

TRB Committees

Transportation Research Board

The National Academies Of Sciences, Engineering And Medicine

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

Research

http://www.trb.org/InformationServices/InformationServices.aspx

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

http://www.trb.org/Environment/ElectronicSessions.aspx

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Dale Heglund

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

Yichang James Tsai, Zhaohua Wang, Georgia Institute of Technology

ABSTRACT

Traffic signs and pavements are indispensable assets to facilitate safe and uninterrupted travel. Manual methods are used for both traffic sign inventory and pavement condition evaluation by the Georgia Department of Transportation, although they take excessive time, consume great amounts of labor, and sometimes expose field engineers to roadway hazards. GDOT still lacks a complete traffic sign inventory for its interstate highway system. For pavement condition evaluation, although the current Pavement Condition Evaluation System performs well on non-interstate roadways, it is challenging to survey interstate highways due to limited parking space and high-speed, high-volume traffic. To leverage the automated methods developed through its national demonstration project, the research team surveyed more than 2,500-survey-mile interstate highways in Georgia and established a complete traffic sign inventory and Computerized PACES in Georgia using newly proposed streamlined procedures. The successful implementation demonstrated that the streamlined procedures provide a consistent, reliable, and cost-effective means for traffic sign inventory and pavement condition evaluation.

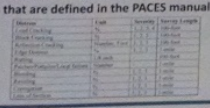
BACKGROUND

The objectives of this research project focusing on the interstate highways maintained by GDOT (more than 2,500 survey miles) include:

- To comprehensively collect traffic sign and pavement condition data
- To validate the performance of the automatic traffic sign inventory and the automatic pavement distress detection and classification method
- To validate the streamlined data collection procedures for traffic sign inventory and pavement condition.

The traffic sign inventory includes sign locations, sign types, MUTCD codes, and traffic sign conditions based on the Signs Chapter of GDOT's Foremans Academy (2008).

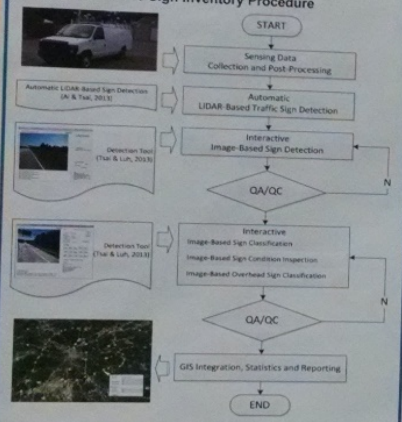
Pavement condition data includes ten types of pavement distresses that are defined in the PACES manual (2007)



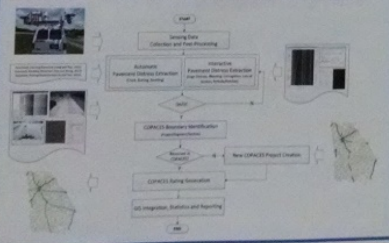
METHODOLOGY

Sensing Data

Streamlined Traffic Sign Inventory Procedure

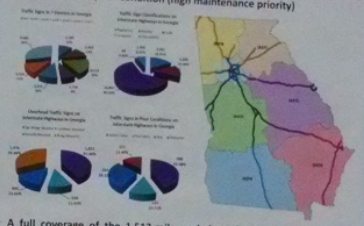


Streamlined Pavement Condition Evaluation Procedure

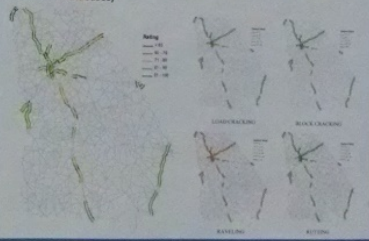


OUTCOME

- A complete 22,344 sign inventory on Georgia's interstate highway system has been created, including 4,414 overhead signs (high maintenance risk) and 897 signs in poor condition (high maintenance priority)



- A full coverage of the 1,513-mile asphalt surface is Georgia's interstate highway system has been evaluated (including all COPACES-defined 10 types of distresses, and all of the 1,434 surveyed segments in the FY2015 COPACES databases)



SUMMARY

- A complete 22,344 sign inventory on Georgia's interstate highway system has been created, for the first time, in GDOT with the MUTCD codes, classification, overhead sign (with potential risk), and conditions using a streamlined procedure
- A complete 1,513 survey miles of asphalt pavement condition (COPACES) data, based on GDOT pavement distress protocol and crack classification, has been collected with the detailed pavement distresses and ratings to support GDOT Georgia Asset Management System (GAMS)
- Safe, reliable and cost-effective sign inventory and pavement condition evaluation methods using sensing data (e.g., videolog image, LiDAR, laser scanning profile, etc.) have been established to survey Georgia's interstate highway under heavy traffic condition

Acknowledgement: The research team would like to thank the following for their strong support and heavy involvement: Ms. Meg Perkle, Ms. Angela Alexander, Mr. David Jared, and Mr. Binh Bui from the Office of Research; Mr. Dale Brantley, Ms. Ernay Robinson, Mr. Larry Barnes, Mr. Michael Keene, Mr. David Sparks, Mr. Sam Wheeler, and Mr. Thomas Mims (retired) from the Office of Maintenance


DEPARTMENT OF TRANSPORTATION
HYDRAULIC INSPECTION VEHICLE EXPLORER (HIVE)
2018 TRB Annual Meeting
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 less than $1,000). Without this information, the invert would have been assumed to be deteriorated for the majority of the culvert length, and the recommended repair would have been CIPP lining (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 apron 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, infiltration would have likely continued until a sinkhole developed in the new pavement, requiring emergency repair with maintenance or an emergency contract.
By using the HIVE unit, 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
4x4 drive
$1,200 vehicle/camera
$300 tablet
2016 Minnesota Governor's Better Government Award
2017 State Government Innovation Awards
2017 AASHTO Research Advisory Committee Sweet Sixteen High-Value Research Projects
Andrew
New Attendee


AT&T LTE
11:49 AM
Back
Measure
SL01-000-0018 22
Mean
None
psi
46
5469
2883
Type N
R
21.0
25
2883
21.0
x̄
2883


Next Generation's
Road Transport
EINRIDE
www.einride.eu
EINRIDE

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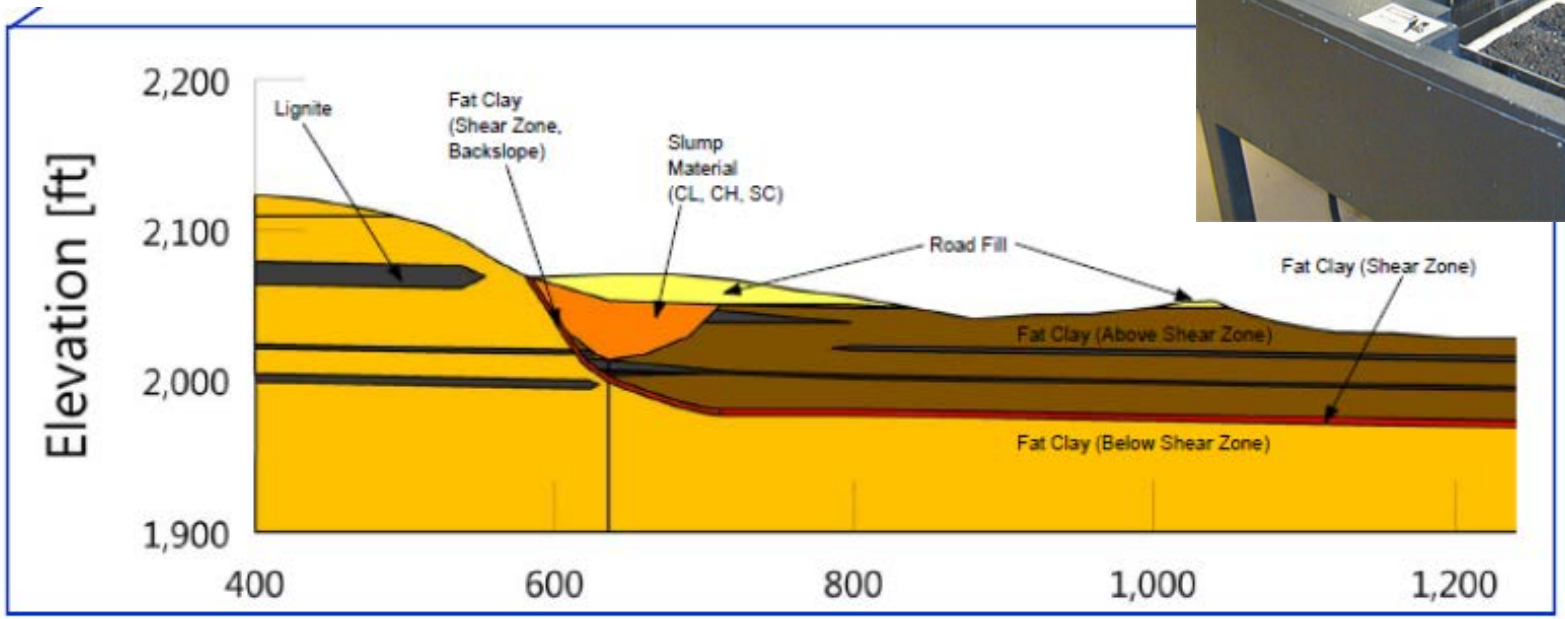
Matt Linneman

- 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 22nd
  - Right Of Way
    - New Procedures, Forms and More
- Please visit our website to RSVP:

https://www.dot.nd.gov/lunchandlearn.htm