National Study to Quantify the Life Extending Benefit of Pavement Preservation

MnDOT (MnROAD) – NCAT Partnership Webinar
Content

- Keynote message on pressing research need
- Introduction to MnROAD & NCAT Pavement Test Track
- NCAT’s pavement preservation study on Lee Road 159
- Continuation/expansion of preservation research in 2015
- MnROAD partnership for nationwide impact study
- How state DOTs can get involved and when
- Questions and answers for the partnership team
Keynote Introduction by Mark McConnell
Mississippi DOT Chief Engineer and Current SCOM Chair

December 12, 2016

State DOT Directors
State DOT Chief Engineers
Members – AASHTO Subcommittee on Maintenance
Members – AASHTO Subcommittee on Materials
Members – AASHTO Standing Committee on Research

Request for Support for Continuing and Expanding Pavement Preservation Research

Dear Colleague:

I am writing to make you aware of an important national research effort that is being jointly developed by the National Center for Asphalt Technology (NCAT) and the Minnesota Department of Transportation (MnROAD research facility) and request your support.

During the 2016 Annual Meeting of the AASHTO Subcommittee on Maintenance in Charleston, WV, the Pavement Technical Working Group proposed that the Subcommittee support the continuation of pavement preservation research that is currently underway in Lee County, Alabama. In 2013, ten state transportation agencies, the Federal Highway Administration (FHWA), NCAT and the Foundation for Pavement Preservation (FP2) placed numerous pavement preservation test sections on both the NCAT Pavement Test Track and on Lee County Road 159 near Auburn, Alabama. These test sections are collectively known as the 2016 Pavement Preservation Group (2012 FP2 Experiment and are part of the Transportation Pooled Fund Program Study TP-FP2-10-270). More detailed information about the project along with quarterly progress reports can be found at the following address: http://www.gerpinstaff.com/Projects/D3495.

The experiment and current data collection cycle will end this calendar year. The final report on the work performed to date on pavement life extension, condition improvement, trigger values and effectiveness of the applied preservation treatments versus untreated control sections will be presented at the NCAT Test Track Conference in March 2015. There is a need to continue to monitor the current 2012 PS sections their life extension cycle until they return to their original untreated condition, and also to expand the research from the existing low volume roadway (Lee County 159) using similar treatments on a higher volume roadway in Alabama. Additionally, it is very important that the same pavement preservation treatments being studied in a hot environment are also placed and evaluated in a cold weather environment for both low and high traffic roadways in Minnesota. The partnership between NCAT and MnROAD will accomplish that as well as furthering two critical national pavement performance needs:

- National Pavement Preservation – Develop a better understanding nationally of the life extending benefits of pavement preservation techniques.
- National Asphalt Cracking Test – Develop an asphalt cracking test to help engineers better understand how pavement performance is affected by the use of recycled material (RAP), binder modification options, additives, warm/conventional mix designs, etc.

The research into these two focus areas will be supported and directed through participation in a Pooled Fund Study which gives State Transportation Agencies direct access to established, world-class test facilities at both MnROAD and NCAT. The researchers and staff members at these two facilities have a twenty-year history of producing research that is both useful and implementable. These two facilities also have strong ongoing partnerships with industry and academia, including FFP and the National Center for Pavement Preservation (NCPP).

I invite you to learn more of this partnership, its objective, and the research that is planned by participating in the NCAT/MnROAD Kick-off Webinar listed below.

"National Study to Quantify the Life Extending Benefits of Pavement Preservation"

January 8, 2016 (2pm to 3pm CST)

Register at https://attendee.gotowebinar.com/register/5945239545?000072

If you have questions about the proposed research and partnership, you may contact either Buzz Powell at NCAT (buzz@ncat.org) or Ben Wieland at MnROAD (ben.wieland@minn.mn.gov). Thank you for your consideration and I look forward to your involvement in this very important national research effort.

Sincerely,

Mark McConnell
Chair, AASHTO Subcommittee on Maintenance
Chief Engineer, Mississippi DOT

Co: FHWA (Cavity)
NCAT
Introduction to MnROAD

- MnROAD Owned and Operated by MnDOT
- 20-Years of Long Term Customer Service
  - Minnesota Department of Transportation
  - Minnesota Local Road Research Board
  - Pooled Funds Efforts (States) / Industry
  - SHRP II / FHWA
- Major Experiments
  - Phase I (1994-2006)
  - Phase II (2007-2016)
  - Phase III (Currently Planning → National Facility)
A long-term accelerated pavement testing facility that gives researchers a unique, real-life laboratory to study and evaluate the performance of materials used in roadway construction.
MnROAD
3.5 Mile “Mainline”,
Live Traffic WB
Interstate-94

W.B. I-94 Traffic Diverted
(3 days / month)
MnROAD “Low Volume Road”
2.5 Mile – MnDOT 5-Axle Semi
Controlled Access
MnROAD Phase-I (1994-2006) Benefits

Saves 33 million Annually
(Savings from 2006-2018)

- **Seasonal Load Limits**
  - Spring Restrictions / Winter Overloads

- **Improved Design Methods**
  - Flexible & Rigid Updated Designs
    - Environment Drives Pavement Performance
    - Current Designs are too Conservative

- **Sealing Pavement / Shoulder Joints**
MnROAD Phase-II (2007-2016) Benefits

- **Asphalt**
  - HMA Performance Test (DCT Test)
  - Full Depth Reclamation (FDR)
  - Asphalt Modification / Performance

- **Concrete**
  - Improved Concrete Overlay Design
  - Use of Recycled Materials in PCC / Fibers
  - Innovative Diamond Grinding
  - Concrete Repairs

- **Unbound**
  - Importance of Drainage
  - Use of Recycled Materials

- **Pavement Preservation** (discuss later)

*Similar Savings to Phase-I (Phase-II Report out soon)*
MnROAD Future Research

- **Phase-III Future Efforts (~2017)**
  - Utilize existing Mainline / Old WB PCC / Low Volume Road
  - Asphalt & Concrete Materials
  - Pavement Preservation / Rehabilitation / New Construction

- **Strength of MnROAD**
  - Controlled “Real Life” Experiment
    - Low Impact / Risk to the public
  - Constructed in 1994
    - Long Term Local Support
    - Experienced MnDOT Staff
  - Accelerated Findings / Implementation
  - Local and National Efforts
MnROAD WORKSHOP

“Safer, Smarter, Sustainable Pavements though Innovative Research”

February 11, 2015 (Half Day)

University of Minnesota

Followed by:

19th Annual TERRA Pavement Conference
Thursday, February 12, 2015
MnROAD-NCAT Partnership
State DOT’s with Research Contracts in 2014

- Alabama Department of Transportation
- South Dakota DOT
- ADOT
- FDOT
- MDOT
- NEVADA DOT
- Oregon Department of Transportation
- Autoridad de Carreteras y Transportación
The NCAT Test Track
The 5th Cycle
Mix Design

- Fine and coarse Superpave mixes perform similarly
- Modified binders cut rutting approximately 50%
- Dense-graded mixes perform as well as SMA for rutting resistance, but SMA is more durable
- Lowering Ndesign is OK
Aggregate Specifications

- Elimination of the Restricted Zone
- Polishing prone aggregates
- Gravel in SMA & OGFC
- F&E for SMA & OGFC
Low Air Voids Experiment
Recycled Materials
Other Mix Additives

- SBS
- Cellulose fibers
- Sulfur pellets
- Aramid & Polyolefin fibers
Warm Mix Asphalt

Water-Injection Foaming System

HMA

WMA
Pavement Preservation

“A program employing a network level, long-term strategy that enhances pavement performance by using an integrated, cost-effective set of practices that extend pavement life, improve safety and meet motorist expectations”

- FHWA Pavement Preservation Expert Task Group
Pavement Preservation

“A program employing a network level, long-term strategy that enhances pavement performance by using an integrated, cost-effective set of practices that extend pavement life, improve safety and meet motorist expectations”

- FHWA Pavement Preservation Expert Task Group
Pavement Preservation on Lee Road 159

- Low ADT roadway
- Very high % trucks
- 14-year old 5½” pavement
- Diverse pavement condition
- Load data provided by quarry and asphalt plant
Lee Road 159 Pavement Preservation Experiment to Reduce the Cost to Maintain Your Roads

Funding Provided by:
Alabama, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, and FP2 via Auburn University and the Lee County Commission
Pavement Preservation on Lee Road 159

1. Rejuvenating Fog Seal
2. Fibermat
3. Control
4. Control
5. Crack Seal (CS)
6. Single Layer Chip Seal
7. CS + Single Layer Chip Seal
8. Triple Layer Chip Seal
9. Double Layer Chip Seal
10. Microsurfacing + Single Chip (Cape)
11. Microsurfacing
12. CS + Microsurfacing
13. Double Layer Microsurfacing
14. Fibermat + Microsurfacing (Cape)
15. Scrub Seal + Microsurfacing (Cape)
16. Scrub Seal
17. Distress Demo Section
18. Fibermat + HMA thinlay (HMA Cape)
19. HMA Thinlay (PG 67-22)
20. HMA + 100% Foamed Recycle Inlay
21. HMA Thinlay (PG 76-22)
22. Ultra Thin Bonded Wearing Course
23. HMA Thinlay (50% RAP)
24. HMA Thinlay (5% PCRAS)
25. HMA Thinlay (High Polymer)
Pavement Preservation on Lee Road 159

- Rutting, roughness, texture
- Surface friction
- Subgrade moisture contents
- Falling weight deflectometer (FWD)
- Ground penetrating radar (GPR)
- Visual and video based cracking measurement
Sample Treated Section on Lee Road 159 Pretreatment (July, 2012)
Sample Treated Section on Lee Road 159
August, 2012

Outside Wheelpath Driving Towards Quarry

Inside Wheelpath Driving Towards Quarry
Sample Treated Section on Lee Road 159
July 2, 2013
Sample Treated Section on Lee Road 159
September 12, 2013
Sample Treated Section on Lee Road 159
October 29, 2013
Sample Treated Section on Lee Road 159
December 17, 2013
Sample Treated Section on Lee Road 159
January 31, 2014
Sample Treated Section on Lee Road 159
February 26, 2014
Sample Treated Section on Lee Road 159
March 25, 2014
Sample Treated Section on Lee Road 159
April 22, 2014
Sample Treated Section on Lee Road 159
May 27, 2014
Sample Treated Section on Lee Road 159
June 19, 2014
Sample Treated Section on Lee Road 159
July 24, 2014
Sample Treated Section on Lee Road 159
August 12, 2014
Sample Treated Section on Lee Road 159
October 7, 2014
Sample Treated Section on Lee Road 159
October 7, 2014
Sample Treated Section on Lee Road 159
October 7, 2014
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October 7, 2014
Sample Treated Section on Lee Road 159
October 7, 2014
Pavement Preservation on Lee Road 159
Pavement Preservation on Lee Road 159
Pavement Preservation on Lee Road 159
Pavement Preservation on Lee Road 159

![Graph showing the change in gravimetric moisture relative to control sections over time. The x-axis represents dates, and the y-axis represents the change in gravimetric moisture. Different colors represent different treatments: Crack Seal Only, Chip Seal, Crack Seal then Chip Seal, and Scrub Seal. The graph includes data points for dates such as 10/29/2012, 4/24/2013, 10/19/2013, 4/14/2014, and 10/9/2014.](image)
Pavement Preservation on Lee Road 159

- Crack sealing appears to be beneficial in all cases
- Differences between route/seal and blow/band
- Scrub seal appears to exhibit crack seal benefit
- Preservation treatments reduce subgrade moisture, but...
- Durability of micro surface in accelerated traffic
- Objective life extending benefit curves developing
- Interim results presented at 2015 Track Conference.
2015 Pavement Test Track Conference

March 3-5, 2015
The Hotel at Auburn University and Dixon Conference Center
Auburn, Alabama

- WMA & High RAP/RAS/GTR Mixes
- Optimized Structural Design
- Pavement Preservation
- Implementation

Official registration information will soon be available at www.ncat.us
2015 Preservation Continuation/Expansion

- Continue monitoring ‘12 sections (Track & 159)
- Capture life extending benefit curve data
- Partnership with MnROAD for nationwide scope
- Build new sections on higher ADT roadway.
Higher ADT Off-Track Preservation

- US-280 3 miles to east of Track
- 17,000 ADT, ≈9 year old surface
- Westbound outside lane
- ≥ MP 128.0 to MP 132.6
- Tenth mile sections
- Repeat Lee Road 159 (±)
  - Add CCPR$_{F,E}$, CIR$_{F,E}$, HIR, etc.
- High ABR thin overlays
- Connection to Cracking Group.

7¾” Asphalt Pavement
10” Aggregate Base
Higher ADT Off-Track Preservation
Higher ADT Off-Track Preservation
MnROAD Past Pavement Preservation Efforts

  - Surface Prep Study
  - More effort on the repairs → Longer Life / Smoothness (10 ML Cells)
- **Flexible MicroSurfacing (2006 and 2011)**
  - Can be effective on roads in poor condition (4 LVR Cells + 1 ML)
- **HMA Thin Overlays**
- **Concrete Repairs**
  - Full Depth / Partial Depth
- **Aging Pooled Fund Study**
- **Chip Seals**
  - Low Volume
  - High Speed Chip Seal (2014)
MnROAD & NCAT Partnership

• Development
  – Informal in the past
  – June 2014 @ MnROAD
  – October 2014 @ NCAT
  – FP² / NCPP Participation

• Partnership Benefits
  – Individual Strengths of Each Other
  – Operations / Data Sharing / Analysis
  – Greater National Appeal
Partnership Vision for Nationwide Impact

To facilitate high value pavement research that addresses national needs using full-scale pavement testing facilities in both warm and cold climates on flexible, rigid, and composite pavement structures.
Industry Participation and Support
National Focus on Pavement Preservation

NCAT Sections +
Alabama Offsite Sections
Lee Road 159 (Low Volume) +
US-280 (High Volume)

MnROAD Cells
(Past and Future)
+
Minnesota Offsite Sections
(High and Low Volume)

Possible Site
57th Street
Sherburne County
Landfill Roadway
Road Durability Issue Raises Town Spending Concerns

By Andrew Gorosko

Friday, November 14, 2014

In light of the deteriorated condition of some repaved local roads, whose asphalt surfaces have been degrading much sooner than would normally be expected, the town public works director is expressing caution about spending large sums for extensive road repaving projects while road durability remains in question.

Director Fred Hurley said November 12 that both locally and throughout the state, the durability of repaved asphalt roads has become an issue during the past several years, as those roads have physically deteriorated sooner than expected.

Mr Hurley suggested a range of reasons why repaved roads do not last as long as they formerly did. The problem has affected municipal roads across the state, as well as state roads, he said.

The problem of premature road-surface wear was first noticed about seven or eight years ago and has become more apparent across time, especially during the last several years, he said.

The problem is widespread because the suppliers of asphalt, or “bituminous concrete,” must conform to a formula for its preparation issued by the state, he said.

Among the factors that may be causing the problem, Mr Hurley said the components for asphalt now include a latex-based binder instead of an oil-based binder. That asphalt formula change was made to reduce the amount of “volatile organic compounds” which are released into the atmosphere during paving, thus serving as an air pollution control measure, he said.

Also, the percentage of recycled asphalt, also known as milling, that is included in new asphalt has increased. With a higher percentage of recycled asphalt in use, the adhesives that are used to bind asphalt may not be as effective as in past pavement formulations, he said.

Also, the composition of deicing mixtures that are used for snow and ice control in the wintertime has changed, he said. Such changes may result in briny water coating roadways longer than in the past, resulting in possible asphalt degradation, he said.

Also, some people have questioned whether the quality control for asphalt manufacturing is strict enough to ensure that good quality asphalt is consistently produced, he said.

More in News

Year In Review: Notable Moments Of 2014
Year In Review: Transitions Changed The Face Of Newtown’s School Administration In 2014
Year In Review: Moving Forward In 2014
Year In Review: Newtown Welcomes New Ambulance Corps Headquarters
Year In Review: Former State Hospital’s Danbury Hall Razed
Year In Review: Park And Bark Opens To Four-Legged Friends
Year In Review: A New Playground Is Built
Year In Review: Community Center, Charter Revision, Elections, Continuing 12/14
Recovery Dominated Headlines In 2014
Year In Review: Planning, And Breaking Ground, For A New School
Year In Review: Land Use Proposals Increased During 2014
Need for a Meaningful Cracking Test

- We need tests and criteria that relate to performance.
- We need tests that are practical for both mix design verification and quality control testing purposes.
- We need tests that accommodate recycled materials, new and future additives, and combinations.
## Cracking Test Validation Experiment (NCAT / MnROAD Contribution)

- Top-down / reflection / LTC cracking efforts
- HMA mixtures over HMA and Concrete
- Mixes with a range of expected cracking susceptibilities
- Sample plant mix for a battery of lab tests and offer samples to other labs for their analysis

### MnROAD

<table>
<thead>
<tr>
<th>Surface</th>
<th>Range of expected cracking resistance</th>
<th>AND</th>
<th>Range of expected cracking resistance</th>
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<tbody>
<tr>
<td>Both PCC and HMA</td>
<td>PCC</td>
<td></td>
<td>HMA</td>
</tr>
<tr>
<td>PCC</td>
<td></td>
<td></td>
<td>HMA</td>
</tr>
<tr>
<td>PCC</td>
<td></td>
<td></td>
<td>HMA</td>
</tr>
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</table>

### Range of expected cracking resistance

<table>
<thead>
<tr>
<th>Surface</th>
<th>PCC</th>
<th>PCC</th>
<th>PCC</th>
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<tbody>
<tr>
<td>Binder</td>
<td></td>
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<tr>
<td>Base</td>
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Cracking Test Validation Experiment
Benefits of Sponsorship

- A voice in the consensus experiment design (!)
- Turnkey funding for the full 3-year research cycle
- Travel funds to be on hand at the time of construction
- Specifications and best practices for placement
- Travel funds for 6-month sponsor meetings thereafter
- Support for technology transfer of interim findings
- Life extending and condition improving benefit curves
- Recommendation on cracking test implementation.
Cost of Sponsorship

- **PG15 study**
  - PG15 Front loaded to support construction, startup
  - Cost for first 3 years is $120k/year
  - Expectation of continuation of the initial 3-year project
  - Annual cost to drop significantly in year 4 (est. $40k/year)

- **CG study**
  - Thinner sections designed to fail within 3-year project
  - $210k per year for 3 years ($630k total)

- **Northern states needed for MnROAD partnership (!)**
Road to Sponsorship

- **January:** Follow-up with partnership representatives
- **March 3-5:** Attend Test Track Conference
- **Spring 2015:** Web meetings to finalize design of experiments
- **Fall 2015:** First 6-month, on-site sponsor meeting
- **February:** Submit Commitment Letter for PG 15 and/or CG 15 Studies
- **Summer 2015:** Construction

Commit: [http://www.pooledfund.org/Details/Study/496](http://www.pooledfund.org/Details/Study/496)
Q/A with the Partnership Team

- Jason Nelson
- Mark McConnell
- Ben Worel
- Randy West
- Buzz Powell
- Mary Robbins
Follow Up

- One-on-one discussions during TRB
  - 1/12 8:30 - 10:30 Marriott Marquis, Dahlia Board Rm (Mezz)

- Buzz Powell: buzz@auburn.edu
- Ben Worel: Ben.Worel@state.mn.us