National Partnership
NCAT and MnROAD Pavement Test Tracks

Benjamin Worel (MnDOT)
Subcommittee on Materials Meeting
July 22, 2015

We all have a stake in A→B
Presentation Outline

Describe NCAT and MnROAD

Define the Partnership

Pavement Preservation / HMA Performance Test

How to get Involved
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
Office of Materials and Road Research

“Mainline”, Westbound Interstate-94

W.B. I-94 Traffic Diverted (3 days / month)
MnROAD "Low Volume Road"
Controlled Access
MnROAD

• MnROAD Designs
  – ~50 Test Cells (500’ long)
  – Asphalt and Concrete
  – New and Rehabilitation
  – Sensors and Performance Monitoring
  – Accelerated Findings
  – Real Traffic Loadings
  – Low Impact / Risk to the Public

• Three Major Experiments
  – Phase I (1994-2006)
  – Future Phase III (2018 - 2028)
MnROAD Benefits

• Phase I (1994-2006)
  – Saves $33 million Annually
  – Seasonal Load Limits
  – Spring Restrictions / Winter Overloads
  – Improved Design Methods

• Phase II (2007-2018)
  – Saves $10.4 million Annually
  – HMA Rehabilitation
    • Whitetopping
    • Full-depth Reclamation
  – Improved base designs

• Future Phase III (2018 - 2028)
  – Expect similar benefits
NCAT Established in 1986

Test Track Established in 2000
1.7 Mile Oval
46 (200’) Test Sections
3 Year Cycles
5 Triple Trailers
Two-8 hour Shifts
5-Days/Week
3 Year Cycle ~ 10 million ESALS
NCAT Partners Cycle #5

The NCAT Test Track
The 5th Cycle
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.
MnROAD & NCAT Partnership

• Development
  – Informal in the past
  – June 2014 @ MnROAD
  – October 2014 @ NCAT
  – Formalized in 2015
  – FP² / NCPP Participation

• Partnership Benefits
  – Individual Strengths of Each Other
  – Operations / Data Sharing / Analysis
  – Create Greater National Appeal
MnROAD-NCAT Focus

Focusing on 2 National Research Needs
National Pavement Preservation Study
Development of a National Cracking Test
Pavement Preservation

Similar to Pavements

RIGHT TREATMENT
RIGHT PAVEMENT
RIGHT TIME

BE PROACTIVE ‘NOT’ REACTIVE!
Pavement Preservation Benefits/Analysis

Develop **life extending** and **condition improvement benefits** curves for:

- Different treatments
- Different pavement condition ranges

Agencies need guidelines on expected benefits for future investment
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
<table>
<thead>
<tr>
<th></th>
<th>Pavement Preservation on Lee Road 159</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Rejuvenating Fog Seal</td>
</tr>
<tr>
<td>2.</td>
<td>Fibermat</td>
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<tr>
<td>3.</td>
<td>Control</td>
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<tr>
<td>4.</td>
<td>Control</td>
</tr>
<tr>
<td>5.</td>
<td>Crack Seal (CS)</td>
</tr>
<tr>
<td>6.</td>
<td>Single Layer Chip Seal</td>
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<tr>
<td>7.</td>
<td>CS + Single Layer Chip Seal</td>
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<tr>
<td>8.</td>
<td>Triple Layer Chip Seal</td>
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<tr>
<td>9.</td>
<td>Double Layer Chip Seal</td>
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<tr>
<td>10.</td>
<td>Microsurfacing + Single Chip (Cape)</td>
</tr>
<tr>
<td>11.</td>
<td>Microsurfacing</td>
</tr>
<tr>
<td>12.</td>
<td>CS + Microsurfacing</td>
</tr>
<tr>
<td>13.</td>
<td>Double Layer Microsurfacing</td>
</tr>
<tr>
<td>14.</td>
<td>Fibermat + Microsurfacing (Cape)</td>
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<tr>
<td>15.</td>
<td>Scrub Seal + Microsurfacing (Cape)</td>
</tr>
<tr>
<td>16.</td>
<td>Scrub Seal</td>
</tr>
<tr>
<td>17.</td>
<td>Distress Demo Section</td>
</tr>
<tr>
<td>18.</td>
<td>Fibermat + HMA thinlay (HMA Cape)</td>
</tr>
<tr>
<td>19.</td>
<td>HMA Thinlay (PG 67-22)</td>
</tr>
<tr>
<td>20.</td>
<td>HMA + 100% Foamed Recycle Inlay</td>
</tr>
<tr>
<td>21.</td>
<td>HMA Thinlay (PG 76-22)</td>
</tr>
<tr>
<td>22.</td>
<td>Ultra Thin Bonded Wearing Course</td>
</tr>
<tr>
<td>23.</td>
<td>HMA Thinlay (50% RAP)</td>
</tr>
<tr>
<td>24.</td>
<td>HMA Thinlay (5% PCRAS)</td>
</tr>
<tr>
<td>25.</td>
<td>HMA Thinlay (High Polymer)</td>
</tr>
</tbody>
</table>
Pavement Preservation Monitoring Done
(Lee Road)

- Rutting, roughness, texture
- Surface friction
- Subgrade moisture contents
- Falling weight deflectometer (FWD)
- Ground penetrating radar (GPR)
- Visual and video based cracking measurement
# MnROAD-NCAT Partnership

## Analysis
- Subsections to develop life-extending benefit curves
- Subsections to develop life-extending benefit curves

## Higher Volume (US 280)
- Control sections
- Treated sections
- Replicate LR 159 treatments
- Additional treatments (CIR, ABR thin overlay, etc.)

## Low Volume (LR 159)
- 2 control sections
- 23 treated sections

## MnROAD
- Analysis
- Control sections
- Treated sections
- Replicate LR 159 treatments
- Possibly additional treatments

## Low Volume (CR-2 or 8)
- Control sections
- Treated sections
Planned Treatments

- Control Sections
- Surface Treatments
  - Crack Sealing
  - Fog Seal
  - Chip Seals
  - Scrub Seals
  - Microsurfacing
  - Combinations (Cape Seals)
- Cold Recycling + 1.5” overlay
  - Cold-in-place (CIR)
  - Cold Central Plant Recycle (CCPR)
- Thin Overlays
  - Dense Graded (4.75 mm)
  - OGFC
  - UTBWC
  - Combinations
US-280 Alabama - High Volume Off-Track

- 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$F,E$
- High ABR thin overlays

10” Aggregate Base

NCAT Track
Minnesota Off-Site Locations

US-169 (High)
Mille Lacs CR-2 or 8 (Low)
4-5 miles each roadway

Northern States meeting every 2 weeks to discuss study

40 minutes
North of MnROAD
Cracking Test Validation Experiment
National HMA Cracking Performance Test

• **Goal**
  – Which test should be run to predict future performance?
  – Nationally → Many tests proposed → which is best?

• **Agency Needs**
  – Agencies need a Tests/Criteria that relate to field performance
  – Agencies 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.
    • How to we keep ahead of the constant changes in mixtures?
2015 HMA Performance Test Research Sponsors
Southern Top-Down Cracking Tests$_{CG}$

Only the SCB-LTRC test will be conducted on LMLC samples prior to construction.

NCAT will conduct these tests on PMLC samples at two aging conditions.
Possible Northern Experimental Mixture Combinations

<table>
<thead>
<tr>
<th>Fracture Energy</th>
<th>Asphalt Binder Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal (20-30%)</td>
</tr>
<tr>
<td>Low (&lt;300 J/m²)</td>
<td>X</td>
</tr>
<tr>
<td>Med (350-450 J/m²)</td>
<td>X</td>
</tr>
<tr>
<td>High (&gt;600 J/m²)</td>
<td>X</td>
</tr>
</tbody>
</table>
MnROAD Asphalt Cell Availability

• 9 Mainline Test Cells

Resurface?

New construction?

10 cell opportunities
Timeline

**Spring/Summer 2015:** “South” Treatment Layout/Designs

**Fall 2015:** Sponsor Meeting @ NCAT

**2015-2016:** “North” Treatment Layout/Designs

**Fall 2016:** Sponsor Meeting @ MnROAD

**August 2015:** “South” NCAT and PP Construction

**Spring 2016:** Sponsor Meeting @ NCAT

**Summer 2016:** MnROAD Construction

**Summer 2016:** Minnesota PP Construction
Joining the MnROAD-NCAT Partnership

• Pooled Fund
  – Alabama DOT Lead
  – [Link](http://www.pooledfund.org/Details/Study/496)
  – MnROAD is a subcontractor to Auburn University (NCAT)
  – MnROAD Partnership Focus on two projects
    • Pavement Preservation
      – 120K/year (first 3-years)
      – 40K/year (following years)
    • National HMA Cracking Performance Test
      – 210K/year
  – Agencies can direct funding as they wish
National Road Research Alliance

• Pooled Fund
  – **Minnesota DOT Lead** (Posted ~August 2015)
  – Road Agencies @ 150K/yr
  – Industry and Consultants @ 2K/yr

• Emphasis on
  • Research to utilize the MnROAD research facility
    • Guide Phase III Research and Construction of MnROAD in 2018
    • 2.5 Million of Construction Matching Dollars
  • State and Local Sponsored Research
  • Technology Transfer / Implementation
  • Training

• Pavement Preservation (Year 4)
• Concrete / Other HMA Research
Follow Up

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