MnROAD/NRRA Pavement Preservation Efforts

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North Dakota Asphalt Conference
Bismarck, ND - April 10-11-2018
Pavement Preservation Research Efforts

MnROAD
NCAT Partnership
National Road Research Alliance
How to get involved
MnROAD History

• MnROAD Owned and Operated by Minnesota DOT
• 23-Years of Long Term Customer Service
  • Minnesota Department of Transportation
  • Minnesota Local Road Research Board
  • SHRP II / NCHRP / FHWA
  • Pooled Funds Efforts (States) / Industry

• HMA and PCC Pavements
• Major Experiments
  • Phase I (1994-2006)
  • Phase II (2007-2016)
  • Phase III (2017 - )
MnROAD and Minnesota Test Sections

MnROAD Overall Studies
- 35 unique ongoing studies
- 141 unique test sections

Interstate 94 Westbound
- Mainline (3.5 miles)
  - 12 ongoing studies / 44 test sections
- Old Westbound (3.5 miles)
  - 4 ongoing studies / 48 test sections

Low Volume Road
- Local Road Research Board
- (MN - City and Counties)
- 19 Studies / 49 test sections

Additional Offsite Test Sections
- Partnership - National Center Asphalt Technology (NCAT)
- 50 Test Sections south of Milaca – US-169 and CSAH-8
MnROAD Traffic Loading

Low Volume Road
5-axle Tractor- Trailer Truck
Inside Lane – 80K (5 days/week)
Outside Lane - Environmental

Rigid ~ 25,500 ESALs/yr
Flexible ~ 16,000 ESALs/yr

Interstate Mainline
I-94 WB Public Traffic
29,700 AADT -- 13% HCAADT (2013)

Rigid ~ 1.2 Million ESALs/yr
Flexible ~ 0.8 Million ESALs/yr
MnROAD Operations Support

• Research Development
• Partnerships
• Construction

• Traffic Loadings
• Performance Monitoring
  • Pathways Van
  • Cracking / Rutting / Ride / FWD, ..... 

• Sensors
  • Static (Environmental)
  • Dynamic (Traffic Loading)

• MnROAD Database
Plow and Salt
Interstate 94 – Bare Pavement Policy
Low Volume Road – Like a county road

Limited Performance Monitoring
MnROAD Benefits

Phase-1

9:1 B/C Ratio

Seasonal Load Restrictions; Low Temp Cracking

Phase-2

5:1 B/C Ratio

Surface Characteristics (HMA/PCC), Pervious Pavements, Implements Husbandry, Stabilized Full Depth Reclamation, Lightly Surface Roadways, Chip Seal Video, Whitetopping, Thin PCC, Optimal Timing of Preventive Maintenance, Low Temperature Cracking II, Quiet Rumble Strips, Drainable/Stabile Bases
Low Temperature Cracking

- Major Findings
  - 1994 MnROAD Test Sections (PG 64-22, PG 58-28)
  - 1999 LVR (PG 58-28, 58-34, 58-40)
Importance of Sealing

PCC Lane / HMA Shoulder Sealing

- Cell 7 Control
- Cell 8 Sealed

Results

* 89% reduction between cells
• 86% reduction within Cell-8

Similar results for HMA Pavements
Importance of Drainage

Asphalt

- Deterioration asphalt
- Increased roughness (ride)

Concrete

- ML Observations (high traffic)
  - None - PASB used
  - Some - Class-5 / well sealed joints / edge drain
  - High amount - Class-5 / no edge drains
- LVR Observations (low traffic)
  - If sealed class-5 is not as destructive
  - If not-sealed class-5 can develop joint damage

Benefits

- Importance of drainable bases / sealing
- Effect on ride
Optimal Timing of Preventive Maintenance Addressing Environmental Aging

• TPF-5(153) Pooled Fund
  • Asphalt Institute
  • MnROAD test cells and other sections
  • Lab aging study with coring of roadways treated yearly

• Observations
  • The optimal timing to prevent aging of the asphalt is 1 year after HMA placement
  • Surface Treatments are benefit to our roadways
MnROAD Chip Seal Details

- CRS-2P on pavement markings
- 0.36 gal/sy of CRS-2P emulsion
- 18 lbs/sy of -3/8” granite chip
- 3 roller passes
- Fog seal CSS-1H diluted 1:1 (+shoulders)
- 0.12 gal/sy and 1’ lap at centerline

High Speed Chip Video - https://www.youtube.com/watch?v=Ol5R7n8zGoc
MnROAD MicroSurfacing

LVR ~ 1999
- Flexible MicroSurfacing

Mainline ~2000
- Multiple Treatments Best
- Double Micro
- Micro with Crack Sealing
- Micro with Transverse Crack Micro

Mainline ~ 2004 (HiMA)
- PG 49-34 base AC (vs. 64-22)
- Kraton SBS polymer D0243, at 6%
- Scratch 12 lbs/sy
- Surface course 15 lbs/sy
- 16% emulsion (vs. 13% typical)
National Research Initiatives

Development of a National HMA Cracking Test

National Pavement Preservation Study
Preservation Group Study Goals

Develop independent life-extending benefit curves for a range of pavement preservation treatments under varying traffic levels and climates.
MnROAD / NCAT Partnership History

Summer/Fall 2012
Lee Road 159
(Alabama)

Summer 2015
US – 280
(Alabama)

Summer 2015
US – 169
CSAH – 8
(Minnesota)

2015
NCAT – MnROAD Partnership
MnROAD/NCAT Partnership

• Partnership
  • Build Off of Lee Road 159 Experience
  • MnROAD (North) / NCAT (South)
    • Offsite Low and High Volume Road Installations
  • FP² / National Center for Pavement Preservation
  • Government / Academia / Industry involvement

• Goals
  • National Study (Climatic zones)
  • Construction Consistency
  • Provide consistently collected data / analysis
  • Quantify the life extending benefits
2015-2018 Pavement Preservation Research Sponsors

[Map showing the states that sponsored pavement preservation research from 2015 to 2018, with each state in a different color. The states are: Washington, Oregon, California, Nevada, Idaho, Montana, Wyoming, Colorado, Utah, New Mexico, Arizona, Texas, Oklahoma, Kansas, Nebraska, South Dakota, North Dakota, Minnesota, Wisconsin, Michigan, Illinois, Indiana, Ohio, West Virginia, Virginia, Pennsylvania, Delaware, New Jersey, Connecticut, Massachusetts, Rhode Island, and Vermont.]
Northern Pavement Preservation

Mille Lac County

US-169
High Volume Road
4 mile section

Rum River Bridge
RP 189.9

County Road 8
Low Volume Road
2.5 mile section

County Road 146
RP 185.3
Test Sections

• Control Sections

• Surface Treatments
  • Crack Sealing
  • Fog Seal
  • Chip Seals
  • Scrub Seals
  • Micro surfacing
  • Treatment Combinations

• Thin Overlays (3/4”)
  • Dense Graded (4.75 mm)
  • OGFC (Alabama and MnROAD)
  • UTBWC
  • Treatment Combinations

Built on US-280
Cold Recycling + Thin Overlay
  Cold-In-Place (CIR)
  Cold Central Plant Recycle (CCPR)

Future Efforts?
Open Graded Friction Coarse “OGFC”

OGFC/PCC conventional tack
OGFC/PCC ultrafuse tack
OGFC/HMA ultrafuse tack
OGFC/HMA conventional tack

August 2016 – Hardrives Contractor
## Roadway Details

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Traffic volume</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Thickness (inch)</td>
<td>5.5</td>
<td>9.9</td>
<td>7.0</td>
<td>6.5</td>
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<tr>
<td>Section length (feet)</td>
<td>100</td>
<td>528</td>
<td>528</td>
<td>528</td>
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<tr>
<td># Test Sections</td>
<td>23</td>
<td>34</td>
<td>22</td>
<td>21</td>
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<tr>
<td>Age (Years) @placement</td>
<td>14</td>
<td>9</td>
<td>6</td>
<td>6</td>
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</table>
Knowns – Treatment Performance

Highly dependent on existing condition
More deterioration → shorter life extension
Importance of timely intervention
Pavement Preservation Benefits/Analysis

- Prevention
- Rehabilitation
- Reconstruction

Life Extending Benefit
Condition Improving Benefit
Test Section Layout - Assessment
Test Sub-Sections
<table>
<thead>
<tr>
<th>Good: &lt; 5%</th>
<th>Fair: 5 - 20%</th>
<th>Poor: &gt; 20%</th>
</tr>
</thead>
</table>

Utilizing FHWA Performance Measures
Test Sub-Section Analysis (all of the data)
Test Sub-Section Analysis (low severity data)
Test Sub-Section Analysis (low severity data)
Test Sub-Section Analysis (fair severity data)
Test Sub-Section Analysis (fair severity data)
Test Sub-Section Analysis (poor severity data)
Test Sub-Section Analysis (poor severity data)
Test Sub-Section Analysis (all trends per severity data)
Test Sub-Section Analysis (compare to control subsections)
“Fair” Condition Improving Benefit at End of Year 5

“Fair” Life Extending Benefit Not Yet Defined
Alabama Study Observations

- **Lee Road – 159 Initial Analysis Starting Place**
  - Developing the subsection analysis
  - Tied to FHWA performance measures
- **Route and Seal – Good as a stand alone treatment**
- **Overbanding – Good with Treatment Combinations**
- **3X Chips (High Vol) – Bleeding tendency**
- **Thinlays good performance**

<table>
<thead>
<tr>
<th>Category</th>
<th>% Cracking</th>
<th>Rutting, mm</th>
<th>IRI, in/mi</th>
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<tbody>
<tr>
<td>Good</td>
<td>&lt; 5</td>
<td>&lt; 5</td>
<td>&lt; 95</td>
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<tr>
<td>Fair</td>
<td>5 – 20</td>
<td>5 – 10</td>
<td>95 – 170</td>
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<tr>
<td>Poor</td>
<td>&gt; 20</td>
<td>&gt; 10</td>
<td>&gt; 170</td>
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Minnesota Study Observations

- Early – only 2 winters
- Thermal Cracking Observations
- Snow Plow Damage
- Development of a MicroSurfacing Field Test
NCAT/MnROAD Funding
Membership Opportunities

National Pavement Preservation
National HMA Performance Test

Phase – 1
NCAT Lead
- PG = $120K/yr
- CG = $210K/yr

Phase – 2 Implementation
PG – (2018-2022)
MnDOT $50K/yr

CG – (2018-2020)
Alabama $100K/yr

Northern Sponsor Meeting
Minnesota - September 25-27, 2018
Welcome to Attend
Strategic Implementation Through Cooperative Pavement Research
What is NRRA?

• Pooled fund (2016-2021)
• Fulfill regional and national road research needs
• Foster innovation with states, academia, industry
  • Each Members Research Efforts
  • MnROAD Test Track
    – Direct Phase-III of MnROAD Construction
    – $3 million in MnDOT funding
• Develop innovative technologies
• Focus on implementation, technology transfer, and training into research projects from the ground up
Technical Teams/Budget

• 6 States and 40+ Associate Members
• Executive Committee (states)
• 5 Technical Teams (states /associates)
  – Meeting Schedules
• Investment in Research
  – 65% Research ~$1,825,200
  – 30% Tech Transfer ~$842,400
  – 5% Administration ~$140,400
<table>
<thead>
<tr>
<th>NRRA Team</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Flexible</td>
<td>Tack Coats</td>
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<tr>
<td></td>
<td>Longitudinal Joint Construction Performance</td>
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<tr>
<td>Rigid</td>
<td>Design and Performance of Concrete Unbonded Overlays</td>
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<td>Repair of Joint Associated Distress Pavements</td>
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<tr>
<td>Geotechnical</td>
<td>Larger Subbase Materials</td>
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<td>Subgrade Design for New and Reconstructed Roadways</td>
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<tr>
<td>Pavement Maintenance</td>
<td>Surface Characteristics of Diamond Ground PCC Surfaces</td>
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<td>Pavement Preservation Approaches for Lightly Surface Roadways</td>
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**Technology Transfer**

**Short Term Research**

**SRF Consulting**

**Develop ☛ Collaborate ☛ Research ☛ Implement ☛ Sustain.**
## Long Term Research

### Flexible Team
- **HMA Overlay of PC and Methods of Enhancing Compaction**
  - Contractor: University of New Hampshire
- **Cold Central Plant Recycling**
  - Contractor: American Engineering and Testing

### Rigid Team
- **Fiber Reinforced Concrete**
  - Contractor: University of Minnesota Duluth
- **Early Opening Strength to Traffic**
  - Contractor: University of Pittsburg
- **Optimizing Concrete Mix Components**
  - Contractor: Iowa State
### Long Term Research

**Geotechnical Team**

**Pavement Maintenance Team**

<table>
<thead>
<tr>
<th>Team</th>
<th>Project</th>
<th>Contractor</th>
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<tbody>
<tr>
<td>Geotechnical</td>
<td>Recycled Aggregates</td>
<td>Iowa State</td>
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<td>Large Stone Subbase</td>
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<tr>
<td>Pavement Maintenance</td>
<td>Maintaining Poor Pavements</td>
<td>SRF Consulting</td>
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<td>Partial Depth Repair</td>
<td>Braun Intertec</td>
</tr>
</tbody>
</table>
Preventative Maintenance Team
Maintaining Poor Roadways

Original Interstate 94 (Westbound)

Mainline Interstate 94 (Westbound)

Goal - Best practices for maintaining existing asphalt and concrete roadways?
Preventative Maintenance Team

Partial Depth Repair

Goal - What are some of the best partial depth repair methods used to fix concrete pavements?

Braun Intertec – 14 Repair Materials
Day 1 – Monticello
- Technical Team Updates
- Technical Team Breakout Sessions
- MnROAD Tour / Dinner

Day 2 – St Paul @University of MN
- Mike Anderson – Skok Distinguished Speaker
- Dave Rettner – Rohrbach Distinguished Speaker
- Buzz Powell – NCAT/MnROAD Partnership
- Caterpillar – Future of Paving Practices
- Technical Team Breakout Sessions

Information/Registration
http://www.dot.state.mn.us/mnroad/nrra/pavementconference/index.html
National Request for Ideas

- Test Sections Available Soon
  - New Construction
  - Rehabilitation
  - Maintenance

- Develop list of ideas before they are needed
  - Traditional Verification
  - New Technology

Spring 2018 NRRA members / MnROAD Staff will be working to solicit and prioritize these ideas.

Let us know your thoughts???
NRRA Funding
Membership Opportunities

• Membership

• Welcome more States/Associates

• Membership Rates
  • 150K – Membership Agency
  • 2K - Associate

(Executive Committee will be reviewing year 4-5 funding this spring)
Technology Transfer Efforts

Research Pays Off Seminar Series

• Every 3rd Tuesday
• 10-11 am
• Started in June 2015

NRRA

• Follow NRRA on Linkedin
• May 23-24 2018 Workshop

Newsletters

• Highlight Members
• Highlight NRRA Projects
• Highlight Emerging Technology

NCAT Partnership

• September 25-27, 2018 Sponsor Meeting