




MnROAD – A National Treasure

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Presentation Outline



- Why Research
- MnROAD Introduction
- MnROAD Past
- MnROAD Future

4/26/2017 2

Minnesota Weather

Northern Minnesota

- Colder than 96% of the world's population

MnROAD Facts

- Low temp = -39F
- 60" Frost Depths

2013-2014 Winter (Duluth)

- 74 days below ZERO for the year
- 23 consecutive days below zero




4/26/2017 3

Minnesota Roadways

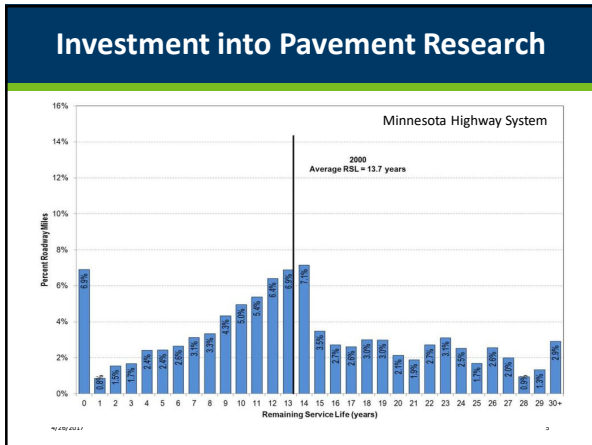
- MnDOT Broken into 8 Districts
- Many Cities and 87 Counties
- Minnesota Trunk Highway System

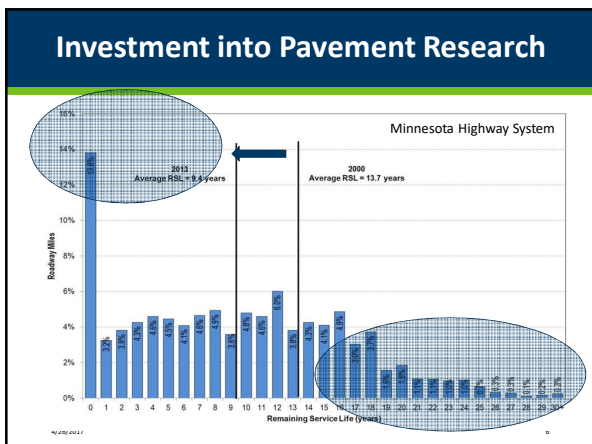
Pavement	Percent	Miles
BIT	12%	1,679
BOB	50%	7,147
BOC	23%	3,291
CON	15%	2,196
CRCP	0%	2
All	100%	14,316



- Total Roads in MN: 142,913 miles (229,996 km)

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MnROAD Background

- **MnROAD Owned and Operated by Minnesota DOT**
- **22-Years of Long Term Customer Service**
 - Minnesota Department of Transportation
 - Minnesota Local Road Research Board
 - Pooled Funds Efforts (States) / Industry
 - SHRP II / FHWA
 - National Road Research Alliance
- **HMA and PCC Pavements**
- **Major Experiments**
 - Phase I (1994-2006)
 - Phase II (2007-2016)
 - Phase III (Currently Planning → NRRRA Directed)



4/26/2017

7

MnROAD Original Goals

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.



4/26/2017

8

MnROAD Initial Layout



4/26/2017

9

MnROAD Mainline (Started 1994)

MnROAD "Mainline", Westbound Interstate-94

W.B. I-94 Traffic Diverted (3 days / month)

4/26/2017 10

This slide features an aerial photograph of a multi-lane highway. A red line is drawn along the highway, indicating the MnROAD Mainline. A white arrow points from the text label to this red line. Another white arrow points from the text label to a section of the highway where traffic is diverted. The surrounding landscape is green and rural.

MnROAD Low Volume Road (Started 1994)

MnROAD "Low Volume Road" Controlled Access

4/26/2017 11

This slide features an aerial photograph of a highway. A blue line is drawn along a section of the highway, indicating the MnROAD Low Volume Road. A white arrow points from the text label to this blue line. The surrounding landscape is green and rural.


MnROAD I-94 Westbound (Started 2010)

Existing I-94

4/26/2017 12


This slide features an aerial photograph of a highway. A red line is drawn along a section of the highway, indicating the MnROAD I-94 Westbound. A white arrow points from the text label to this red line. The surrounding landscape is green and rural.

MnROAD Traffic Loading



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

Low Volume Road
5-axle Tractor-Trailer Truck
80,000 Inside Lane = 5 days/week
Outside Lane Environmental
Rigid ~ 25,500 ESALs/yr
Flexible ~ 16,000 ESALs/yr



4/26/2017 13

MnROAD Operations

- **Research Development**
- **Construction**
- **Performance Monitoring**
 - Cracking / Rutting / Ride
 - Deflection (FWD),
- **Sensors**
 - Static (Environmental)
 - Dynamic (Traffic Loading)
- **MnROAD Database**
- **Technology Transfer**
- **Traffic Loadings**








4/26/2017 14

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/Stable Bases



4/26/2017 15

National Research Initiatives



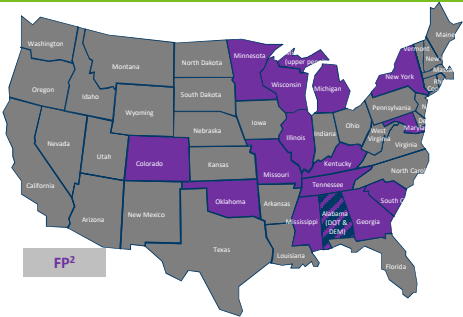





**National Pavement Preservation Study
Development of a National Cracking Test**

4/26/2017 16

2015 Pavement Preservation Research Sponsors



4/26/2017 17

MnROAD Operations

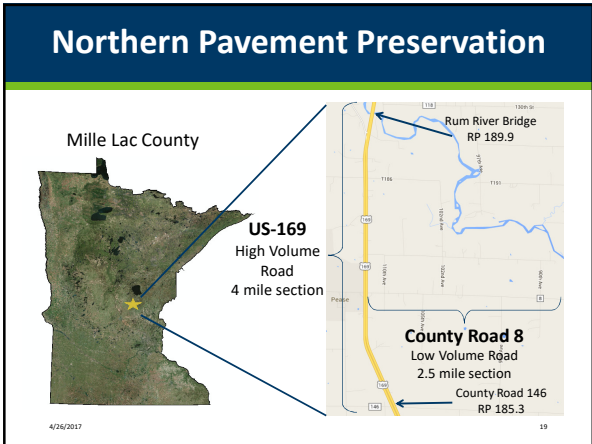
- **Partnership**
 - MnROAD (North) / NCAT (South)
 - *Offsite* Low and High Volume Road Installations
 - FP² / National Center for Pavement Preservation
 - Government / Academia / Industry involvement
- **Goals**
 - National Study (Climatic zones)
 - Provide consistently collected data / analysis
 - Quantify the life extending benefits

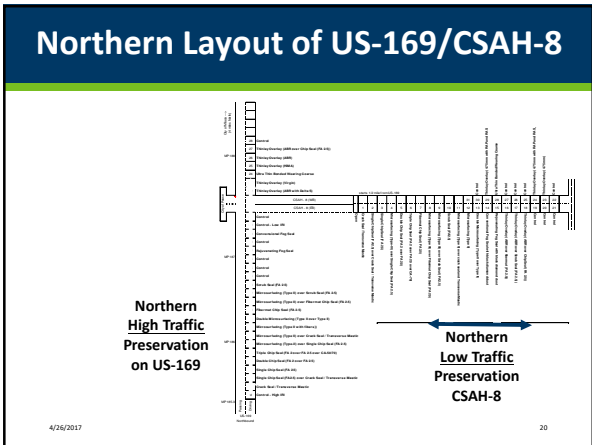


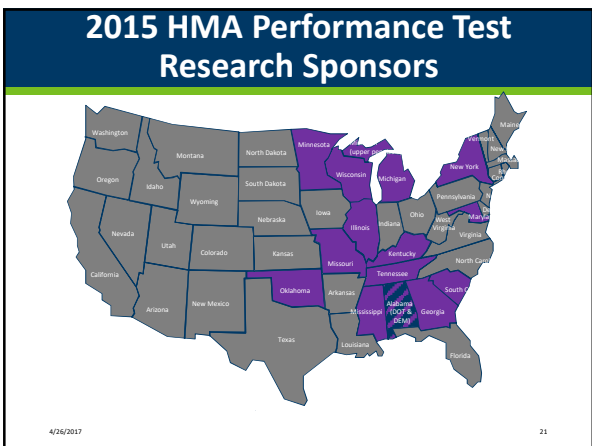




4/26/2017 18







National HMA Cracking Performance Test

Partnerships

- Utilize both MnROAD / NCAT Test Tracks
 - Top Down / Reflection / LTC cracking Efforts
 - Range of cracking potential mixes
 - Battery of testing of many different existing tests Nationally

Goals

- 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.



4/26/2017

22

Minnesota Low Temperature Cracking

Two Pooled Fund Studies

- Testing materials before they are placed
- Develop / Refine Testing Process
- Fracture Energy Effected by
 - Aggregate Type / Gradation
 - Binder Grade / Modification
 - Binder Content / Air Voids
 - Recycle Materials

2008 Test Sections

- Very Few Transverse Cracks
- 6 Winters

Fits into National Effort with NCAT



4/26/2017

23

2016 MnROAD Construction HMA Performance Testing Experiment



4/26/2017

24

2016 MnROAD Mix Designs HMA Performance Test Experiment							
MIX DESCRIPTION	RAP	RAS	CELL	BINDER	Aggregate Size	POLY	CRACK POTENTIAL
High Temp Mix	~30	5	16	PG 64S-22	12.5mm	No	High
High Temp Mix	<20	3	17	PG 64S-22	12.5mm	No	High
High Temp Mix	<20	0	18	PG 64S-22	12.5mm	No	Med/High
High Temp Mix + regressed voids (3.0)	<20	0	19	PG 64S-22	12.5mm	No	Med/High
Soft Binder Mix	>30	0	20	PG 52S-34	12.5mm	No	Med
Typical Low-Temp Mix	<20	0	21	PG 58H-34	12.5mm	Yes	Low
Typical Low-Temp Mix + limestone	<20	0	22	PG 58H-34	12.5mm	Yes	Low/Med
HIMA Mix	<15	0	23	PG 64E-34	12.5mm	Yes	Low

4/26/2017 25





NRRRA
National Road Research Alliance

NRRRA Agency Members

Develop ◀ Collaborate ◀ Research ◀ Implement ◀ Sustain.

NRRRA
National Road Research Alliance

NRRRA Universities

Develop ◀ Collaborate ◀ Research ◀ Implement ◀ Sustain.

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NRRRA Associations

Develop ◀ Collaborate ◀ Research ◀ Implement ◀ Sustain.

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NRRRA Industry

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National Road Research Alliance

Technical Teams/Budget

Given six states and 18 Associate members

- 65% Research
 - \$1,825,200 / \$608,400 yr
- 30% Tech Transfer
 - \$842,400 / \$280,800 yr
- 5% Administration
 - \$140,400 / \$46,800 yr

Develop ◀ Collaborate ◀ Research ◀ Implement ◀ Sustain.

NRRRA
National Road Research Alliance

**NRRRA Technical Teams
2017 Construction**


Mainline (I-94)

- Maintaining HMA and PCC Roadways (3)
- Fiber Reinforcement of PCC (3)

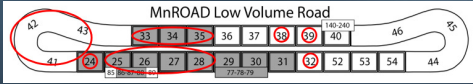
ByPass (I-94)

- HMA Overlays of PCC (8)
- Enhancing Compaction (4)
- Partial Depth PCC Patches (3/panels/manufacture)

Develop ◀ Collaborate ◀ Research ◀ Implement ◀ Sustain.



NRRRA Technical Teams 2017 Construction



Low Volume Roadway

- Diamond Grinding effects on ASR Acceleration (3)
- Fiber Reinforcement City Street (1)
- Compacted Concrete Pavement City Street (1)
- Cold Central Plant Mix (4)
- Recycled Base Effectiveness (4)
- Use of Large Stone Subbases (4)
- PCC Early Opening to Traffic (1)
- PCC Optimized Mixes (2)

Develop ◀ Collaborate ◀ Research ◀ Implement ◀ Sustain.

How to Get Involved

- **Research Pays Off Seminar Series**
 - Every 3rd Tuesday
 - 10-11 am
 - Started in June 2015
 - 20 Seminars so far
 - Sign-Up



- **NRRRA Conference / Workshop**
 - May 23/24 2017
- **Join NRRRA**



35

Thank You



Strategic Implementation Through Cooperative Pavement Research

Looking for Partners -
<http://www.dot.state.mn.us/mnroad/nrra/index.html>

4/26/2017 **Questions?**

36
