



Minnesota Road Research Facility (MnROAD) Asphalt Research Update

Kansas Asphalt Paving Conference – December 2023

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MnROAD Assistant Operations Engineer



MnROAD and NRRA

**Focus on the power of good people,
quality data,
and Partnership Opportunities**

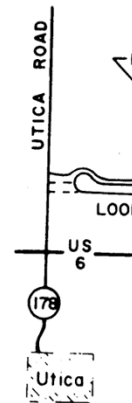


- Takeaways

1. What is MnROAD?
2. Importance of Partnerships and Collaboration to successful research and implementation
 1. How MnROAD research can benefit Kansas
 2. How MnROAD/MnDOT can learn and grow from Kansas

MnROAD Early History

- **AASHO Road Test (1956-58 built – traffic loadings from 1958-60)**
- **Need for Local Calibrations**
 - MnDOT started Investigation 183 / Flexible Designs (Started 1960's)
 - SHRP/LTPP started for national efforts (8/8/1988)
 - Idea of a cold regions testing facility (1980's)
- **MnROAD Development**
 - Development of Support
 - Getting 25 million in 1990
 - Soil Foundation
 - Instrumentation
 - 1992 and 1993 Construction
 - August 2, 1994 Traffic



MnROAD Background

- **MnROAD Owned and Operated by Minnesota DOT**

- 27 Dedicated Road Research Staff
- 10 MnROAD Staff

- **HMA and PCC Research**

- **30 Years of Long-Term Customer Service**

- Minnesota Department of Transportation (MnDOT)
- Minnesota Local Road Research Board (LRRB)
- National Partnerships (SHRP II / NCHRP / FHWA)
- National Center of Asphalt Technology (NCAT)
- National Road Research Alliance (NRRRA)



MnROAD- Minnesota Road Research Facility



I 94 eastbound
to Minneapolis

I 94 westbound
to St. Cloud

MnROAD Site
Office and
Operations

MnROAD I 94 Original
westbound (1972)

MnROAD Low
Volume Road

MnROAD I 94 Mainline

Also includes

- MnROAD Farm Loop
- MN-6
- US-169 / CSAH-8
- 15th Street
- 70th Street
- + Others



mndot.gov

Mack Tractor (93406) with Fruehauf Trailer (93410)

MnROAD Performance Data

- **Performance Monitoring**
- **List is missing**
 - Albedo Measurements
 - Drone Videos
 - Road Doctor with GPR
 - Detailed Forensics
 - Rolling Weight Deflectometer
 - Rolling Density Meter
 - Many others
- Working towards greater automation

Each Data type has detailed information on the equipment and data collection used

Measurement	Frequency	Comment
Aging Samples	1 / year	Cores taken to monitor aging of HMA mix and PCC joint condition Modified LTPP Survey on all cells
Distress Survey	2 / year	
Dynamic Load Testing	4 / year	Dynamic load testing of sensors. Loading from MnROAD truck and FWD.
Joint Faulting/ Shoulder Dropoff	2 / year	Use an automated Georgia Faultmeter per modified LTPP protocol
Friction	1-2 / year	KJ Law profiler, grip tester and dynamic friction tester used
Falling Weight Deflectometer	8 / year	Testing schedule varies throughout the year. Routine and special testing on HMA and PCC.
HMA Rutting/ Crack Cupping	3 / year	Advanced Laser Profile System (ALPS) used to characterize rutting and crack cupping
Noise	3 / year	On Board Sound Intensity (OBSI) measurements and sound absorption
Piezometer	4 / year	Monitoring well measurements
Permeability	2-4 / year	Test permeability of pervious/porous test cells
Ride Quality	2-4 / year	Pathways and lightweight profiler Sound absorption measurements.
Sound Absorption	3 / year	
Surface Texture	1 / year	Sand Patch and Circular Texture Meter

MnROAD Sensor Data

• Sensors

- MnROAD Data Collection Network
- ~15,000+ Sensors Installed
- Static (every 15 min)
 - Temperature
 - Moisture
 - Joint Opening
 - Concrete Maturity
 - Environmental Stain
 - Pressure
 - Ground Water
 - Frost Depth



• Dynamic Data

- Live Traffic Loading - Controlled Loading
- Earth Pressure Cells
- Pore-Water Pressure
- Asphalt and Concrete Stains
- Displacement

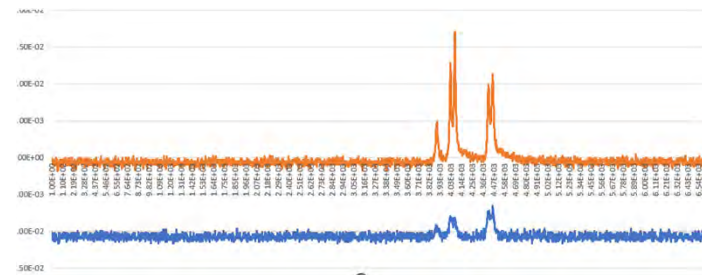


• 2 Weather Stations

• Traffic Data

- 2022 Installing a new systems

Each Data type has detailed information on the equipment and data collection used



Access to MnROAD Data

- **National Database**

- MnROAD InfoPave
 - Non-LTPP / Tied to LTPP
 - NRRRA funding
 - FHWA partnership

- Allows users to:

- Get a MnROAD overview
- Find test sections
- See available data
- View Data
- See Maps
- Related Reports (working)
- Download Data
- Working on Sensors

- New release soon

The screenshot shows the LTPP InfoPave: Non-LTPP website. At the top, there is a navigation bar with the U.S. Department of Transportation Federal Highway Administration logo and links for About, Programs, Resources, Briefing Room, Contact, and Search FHWA. Below this is the LTPP InfoPave: Non-LTPP logo and a search bar. The main navigation menu includes HOME, DATA, VISUALIZATION, ANALYSIS, TOOLS, LIBRARY, OPERATIONS, and NON-LTPP. The current page is titled "MnROAD Data" and has a sub-navigation bar with Overview, Select Sections, Data Availability, View Data, Maps, Library, and Download Data. The Overview section is active, displaying a description of MnROAD and a list of instructions on how to use the data portal. A video player is embedded at the bottom right of the page, showing an aerial view of a highway with a play button overlay.

U.S. Department of Transportation
Federal Highway Administration

About Programs Resources Briefing Room Contact Search FHWA

Data Bucket (0) | Customer Support | Help | FHWA InfoHighway

Search Go ?

HOME DATA VISUALIZATION ANALYSIS TOOLS LIBRARY OPERATIONS **NON-LTPP**

MnROAD Data ?

Overview Select Sections Data Availability View Data Maps Library Download Data

Overview

MnROAD includes two test roadways, located along westbound I-94 between Albertville and Monticello, Minnesota. It is owned and operated by the Minnesota Department of Transportation in cooperation with its [National Road Research \(NRRRA\)](#) partners. MnROAD test roadways have over 75 unique pavement test "cells" designed to investigate the performance of different pavement designs and materials and exposed to actual vehicles and Minnesota climate. Their performance is monitored by sensors within the road structure, as well as many non-destructive and surface tests, such as ride quality testing, deflection measurements (falling-weight deflectometer), and visual distress surveys. In addition to the two test roadways, several other test sections on other roadways are tracked and evaluated within the MnROAD system.

Here is how you can use this MnROAD data portal:

- [Select sections](#) using attributes of your interest.
- [View the data](#) using several available features.
- [Download data](#) by selecting the desired tables and file format.
- [Click here](#) for a quick help video.

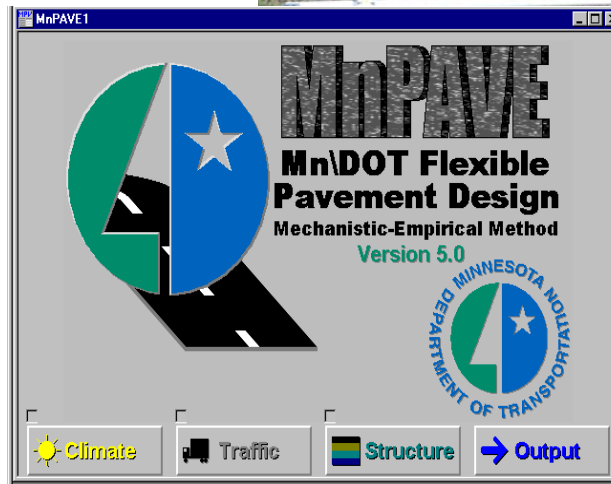
Section ID

MnROAD data is presented by Section ID. Section ID is comprised of the cell the study is in, which lane the

LTPP InfoPave

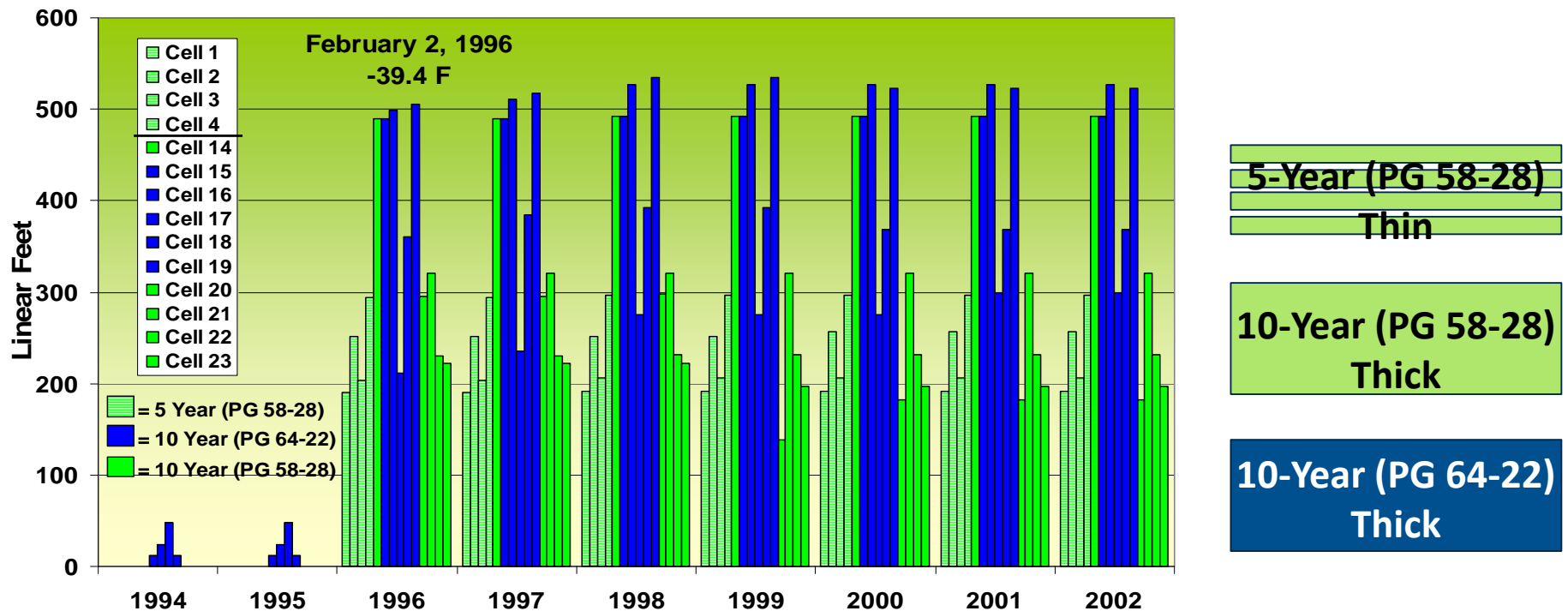
MnROAD Key Projects

- Rigid Pavement – can build thinner
- Flexible Pavement – environment plays a key role
- Flexible – MnPAVE (Inputs into PavementME)
- Rigid – MnPAVE Rigid
- Concrete Overlay of Asphalt



Low Temperature Cracking Initial Findings

- 1994 MnROAD Test Sections (PG 64-22, PG 58-28)

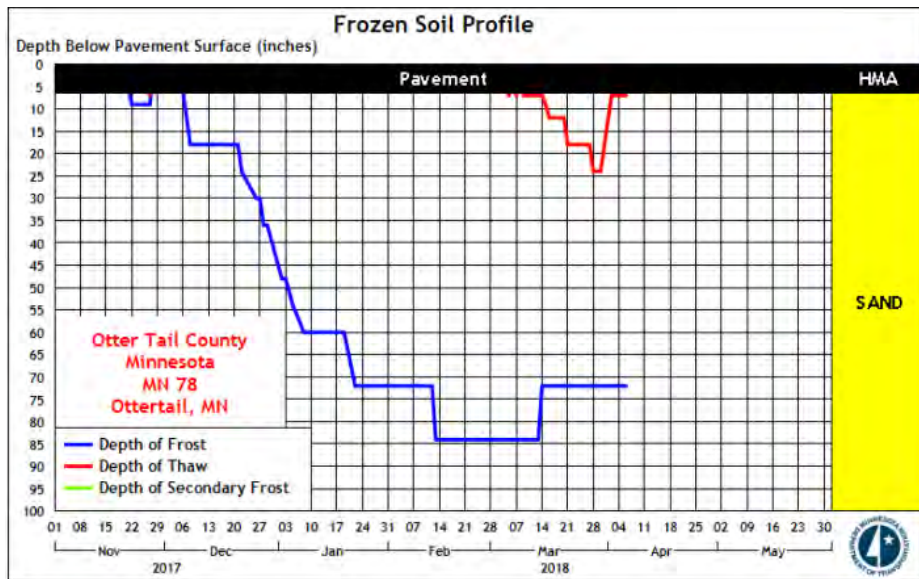


- 1999 LVR (PG 58-28, 58-34, 58-40)

Seasonal Load Limits

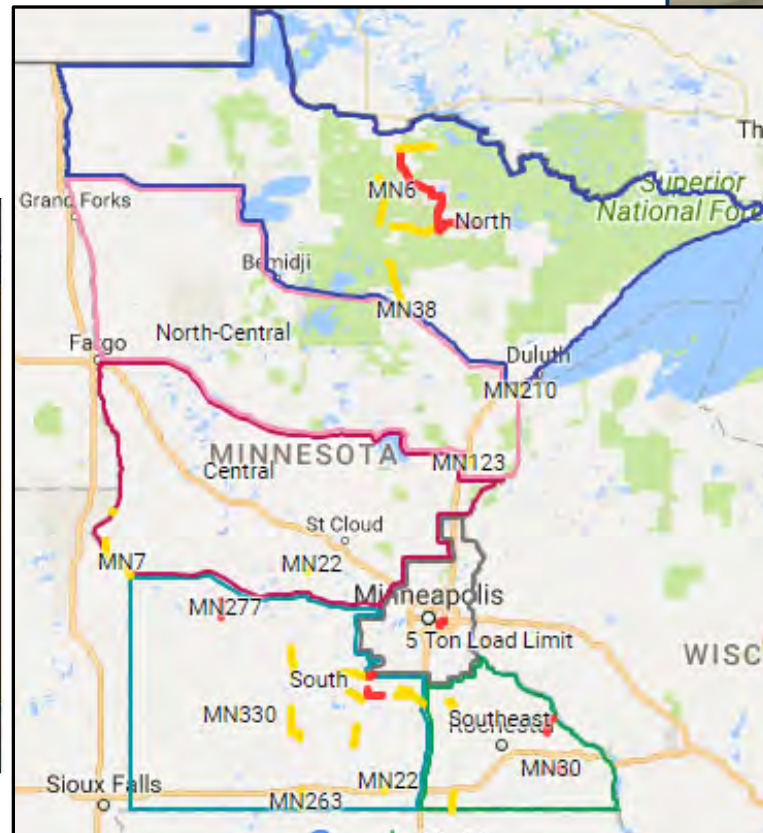
Spring Restrictions / Winter Overloads

MnROAD Data/Models Statewide Implementation



Monitoring Sites Installed around the State

MnDOT Website



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



MnROAD / NCAT Partnership

Formalized Partnership working on National Needs:

- Full scale accelerated test facilities
- North / South Climatic Zones / Sections
- CAPRI (NCAT Lead National HMA Consortium)

Cracking Group Experiments

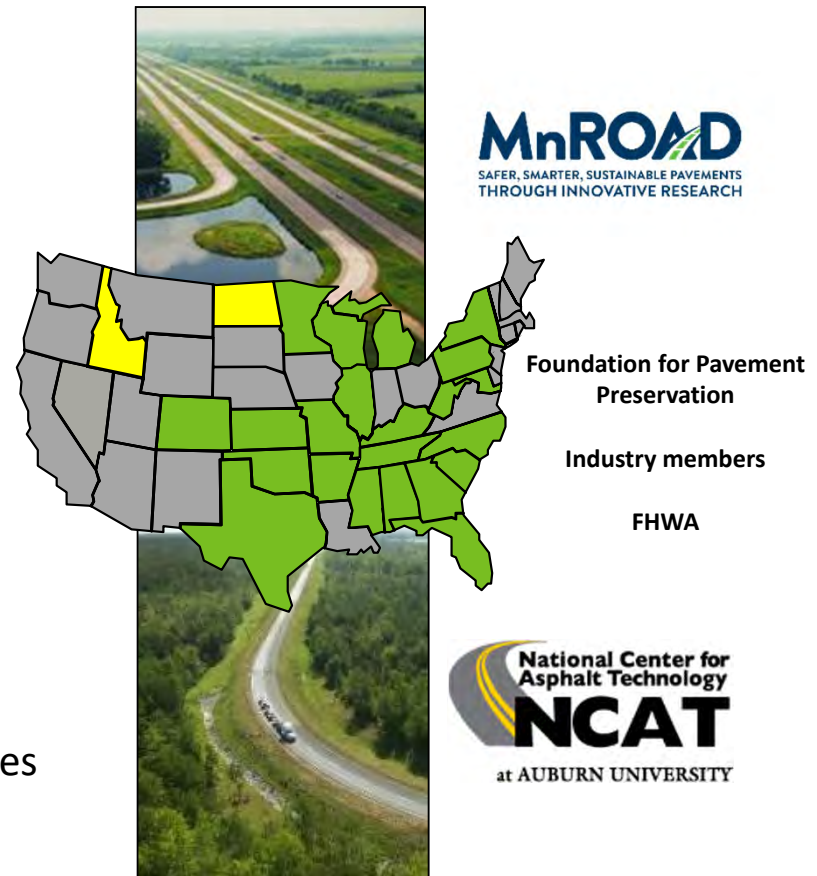
- 6 year of partnership with 10 Government Agencies
- HMA cracking test for LTC and fatigue cracking

Additive Group Experiment

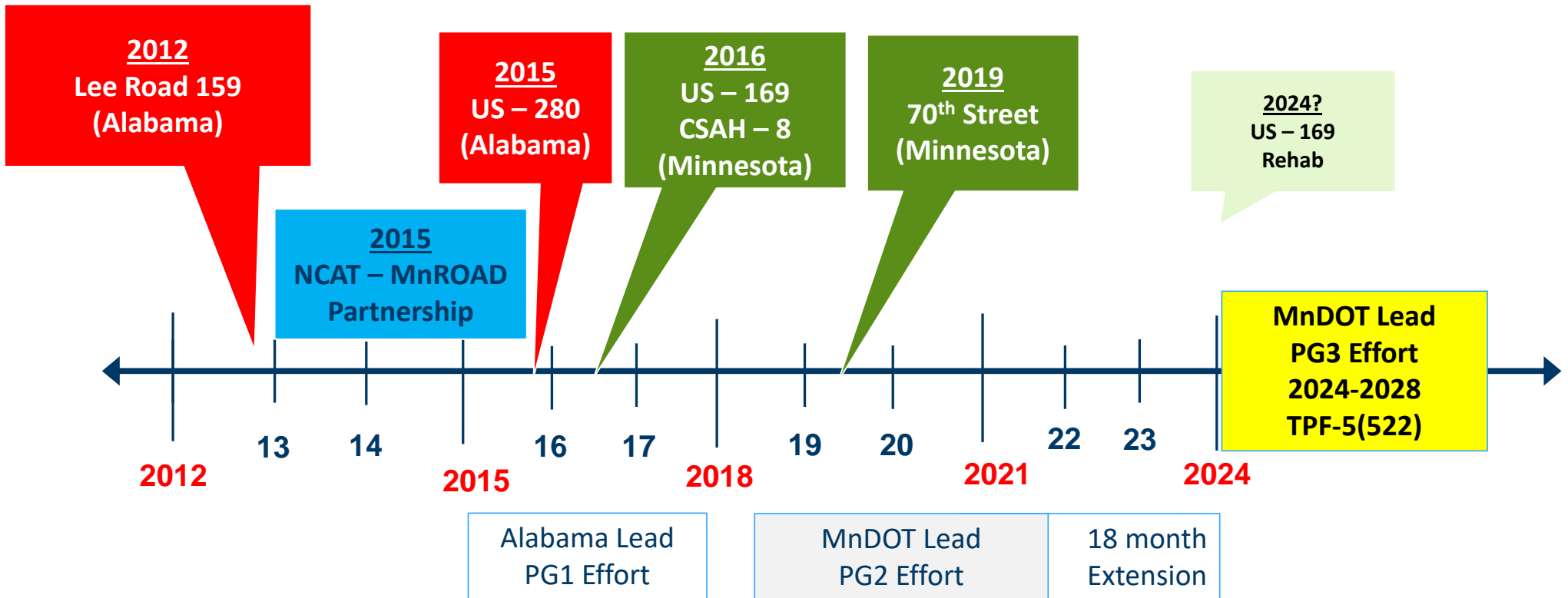
- NCAT focus on fatigue cracking
- MnROAD focus on Reflective Cracking
- Continued National Research Coordination

Preservation Group Experiments

- Life extending benefits of pavement preservation techniques
- 8 year of partnership with over 24+ agencies
- Developing next phase – starting in January 2024



Preservation Group Study



2016 Pavement Preservation in Pease, MN

- 28 preservation sections on high-volume MnDOT highway
- 28 preservation sections on low-volume country road
- Chip seals, overlays, micro-surface and combos



Pavement Preservation Future

*H KMJQDIB DC@ 2 P<GOT JALM@Q@IQQ@!. <DI@I<I>@ \$JINMP>QJI <I? % <Q \$JG@>QJI IM<>D>@N

Phase III (Jan 2024-Dec 2028)

- TPF-5 (522)
- Focus on State Implementation of Pavement Preservation Treatments
 - Specification review
 - Preconstruction technical support & training (virtual)
 - Construction support (on-site)
 - Performance monitoring
- Contracts with both NCPP and NCAT to support the effort
- Technical Advisory Panel Led
 - Additional input from agencies
 - Sponsor meetings
 - Two in-person/year
 - Two virtual/year
- Pooled Fund Starting Jan 2024

2016 MnROAD NCAT Cracking Group

- 2016 - 8 sections constructed on MnROAD to evaluate Low temperature cracking and laboratory predictions of performance
- 2015 - 8 sections constructed on MnROAD to evaluate top-down cracking and laboratory predictions of performance



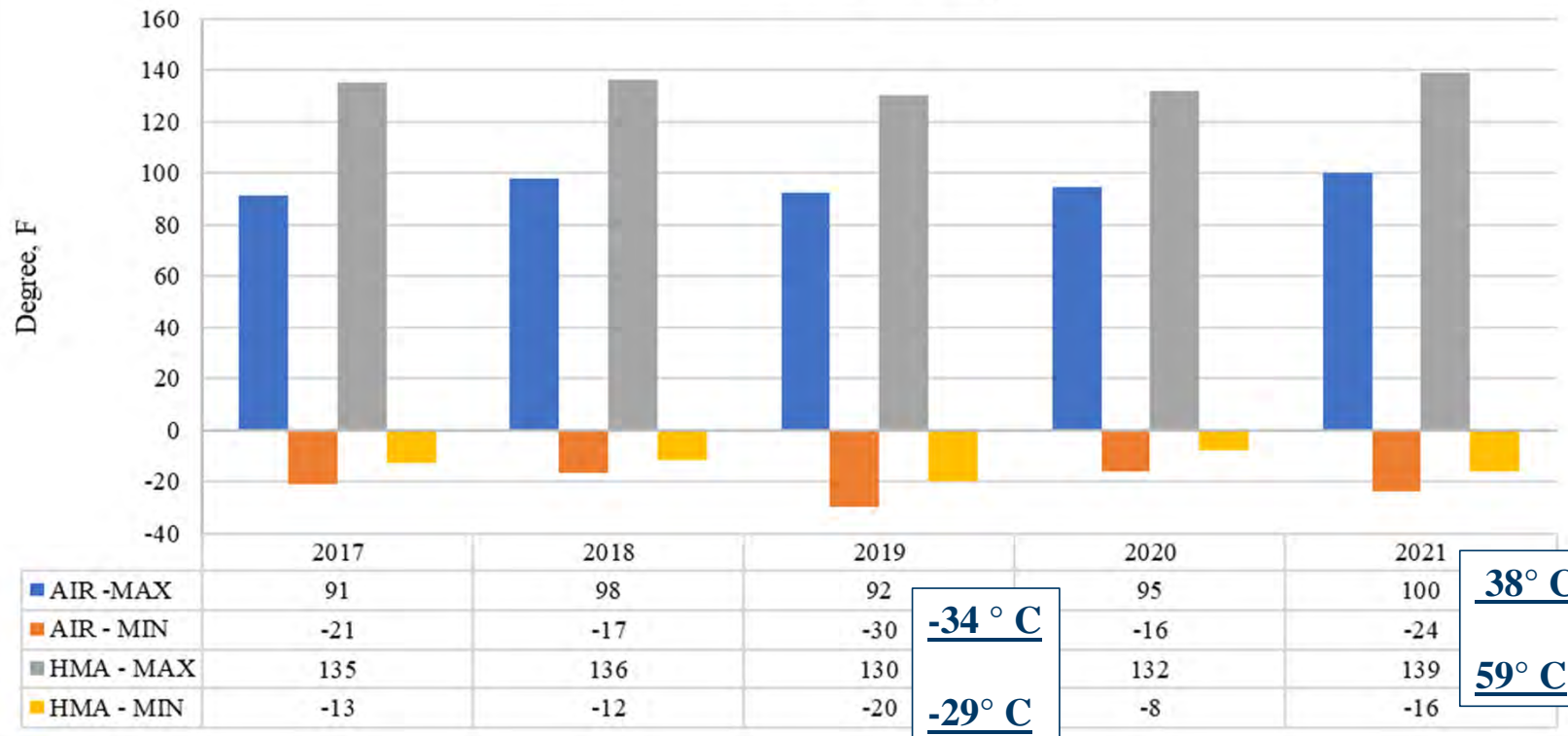
Traffic and Weather



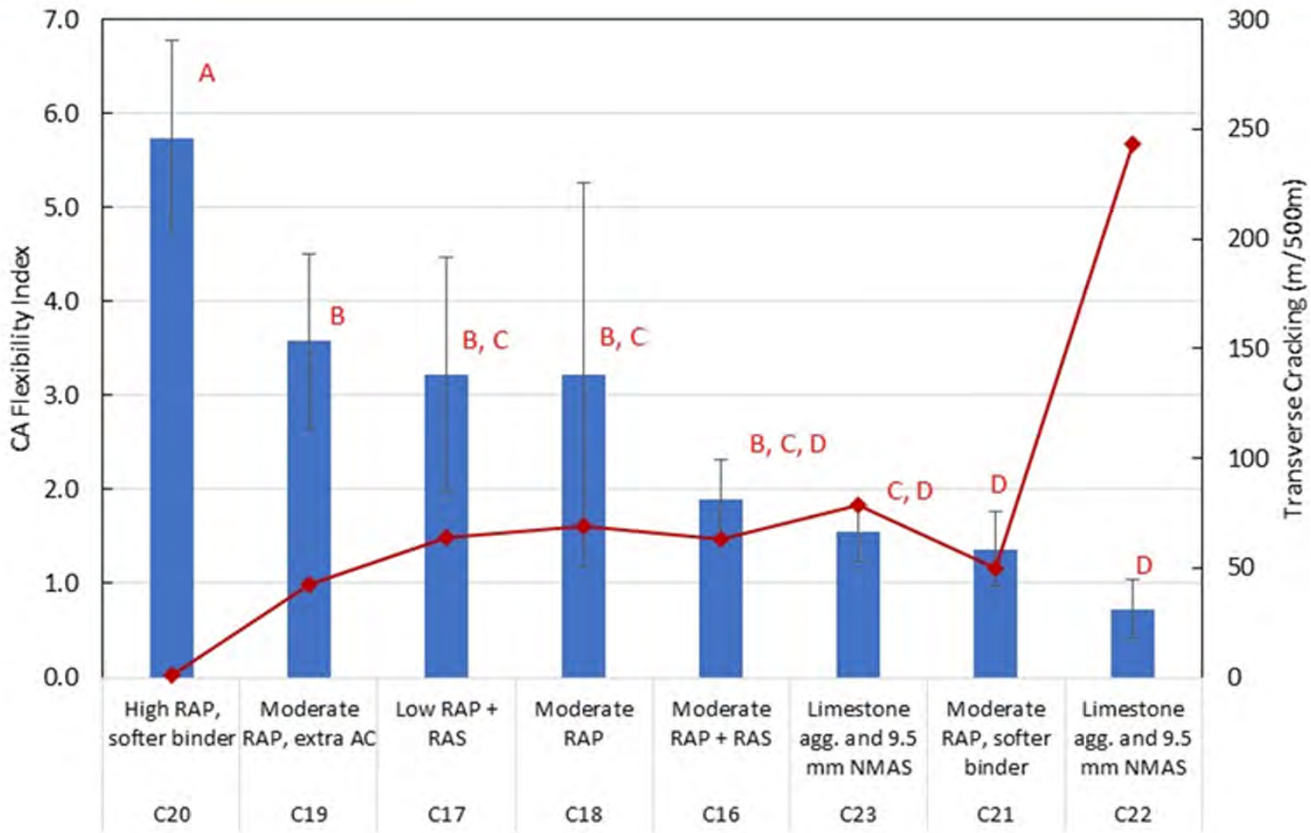
Open to traffic:
November 2, 2016

~4,500,000 ESALs
through Spring 2022

MnROAD Cracking Group



2016 MnROAD NCAT Carcking Group

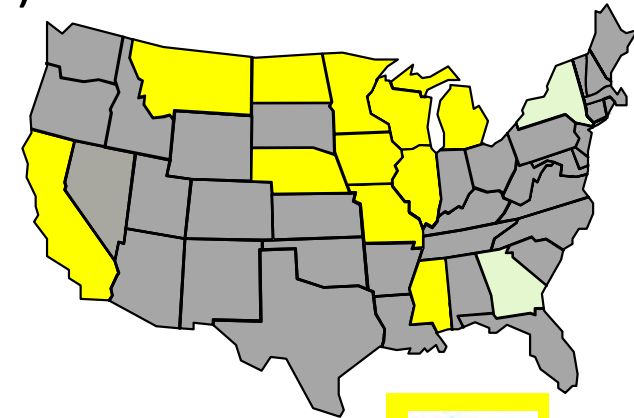


National Road Research Alliance Membership Overview



TPF-5(466) - Fee Structure / year (five years)

- **Phase-1 complete (5 yr) – Now into Phase-2 (year 2/5)**
- **13 Full Agency Commitments (yellow)**
 - \$75K /\$150K Annual Commitment
 - 11 States, Illinois Tollway, LRRB
 - FHWA is also a contributing partner
- **2 ICT Commitments (Green)**
 - \$25K (ICT Team only – Veta Efforts)
 - GA and NY
- **~85+ Associate membership**
 - 2K/year - Associations, Industry, Consultants, Universities



National Road Research Alliance Overview

- **NRRA has averaged ~\$1 million research/year**
- **NRRA Funded 48 projects (phase1) and 14+13 (phase2)**
 - Short and long term research
 - Multiple Researchers Contracted
- **2023 Call for Innovation ~\$1.7 million**
 - 55 Proposals Received
 - 22 Proposals Prioritized by the Technical Teams
 - **13** Projects being funded (counted above)
 - TAP being developed
 - TAP finalize workplans
 - MnDOT contracting
- **2017 & 2022 MnDOT provided MnROAD construction funding**
- **2024 MnROAD is expecting on 1 million in mainline construction funding**



National Road Research Alliance Overview

- **Organizational Structure**

- Executive Committee (2 reps/agency)
- 5 Technical Teams (agency and associate reps)
 - Technical Chairs
 - MnDOT Representative
- MnROAD Facility Utilized

- Outreach is done in the technical teams
 - Lauren Dao, MnDOT



National Road Research Alliance (Flexible Technical Team Membership)

Caltrans

Kee Foo*
Raghubar Shrestha*

FHWA

Peter Eakman

Illinois

Brian Hill*
James Trepanier
Charles Wienrank*

Illinois Tollway

Jay Behnke*
Ross Bentsen*
John Lavallee

Iowa

Chris Brakke*
Ashley Buss*

Michigan

Andrew Bennet
Tyler Hunt
Kevin Kennedy
Nathan Maack*

Minnesota

Michael Vrtis, MnDOT

Ryan Baasen
Emil Bautista
Shongtao Dai*
John Garrity*
Jerry Geib
Joseph Podolsky
Dave Van Deusen
Ben Worel
Eyoab Zegeye Teshale

Minnesota LRRB

James Foldesi*

Mississippi

Heath Patterson*
Griffin Sullivan*

Missouri

Jason Blomberg*
Paul Denkler
Willie Johnson*
Dan Oesch

Montana

Josh Heck*
Oak Metcalfe*
Matt Needham

Nebraska

Bruce Barrett*
Lieska Halsey
Wally Heyen
Robert Rea
Brandon Varilek

North Dakota

Curt Dunn, chair
Andy Ayash
Amy Beise
Brandon Bennes
Matt Kurle
Matt Linneman
Arlen Norris
Korby Seward
Tyler Wollmuth*

Wisconsin

Ali Arabzadeh*
Dan Kopacz*
Tirupan Mandal
Ali Morovatdar
Barry Paye*



* indicates voting
agency member

National Road Research Alliance (Flexible Technical Team Associate Membership)

Mohiuddin Ahmad, University of Texas-El Paso (UTEP)

Riaz Ahmad, iENGINEERING Corporation

Allen Akowicz, Pacific Geosource

Edith Arambula, Texas A&M Transportation Institute

Jason Bausano, Ingevity

Thomas Bennert, Rutgers University

Jay Bianchini, Collaborative Aggregates

Justin Black, Cargill

Andrea Blanchette, Terracon

Brandon Brever, Minnesota Asphalt Pavement Association (MAPA)

Tom Brovold, Testquip

Bill Buttler, University of Missouri - Columbia

Mike Byrnes, Mathy Construction Co.

Douglas Carlson, Liberty Tire Recycling

Eshan Dave, University of New Hampshire

Jonathan Davis, Uberbinder

Mohamed Elkashef, University of California Pavement Research Center

Amy Epps Martin, Texas A&M Transportation Institute

Rouzbeh Ghabchi, South Dakota State University

Oliver Giraldo-Londono, University of Missouri - Columbia

Stacy Glidden, Payne & Dolan

Jonathan Groeger, iENGINEERING Corporation

Fan Gu, NCAT

Elie Hajj, University of Nevada - Reno

Bill Hall, Resource Recycling Systems

Katie Hasslett, HRG Lab

Majeed Hayat, Marquette University

David J. Jones, University of California Pavement Research Center

Dennis Kelley, J. Rettenmaier USA LP

Lev Khazanovich, University of Pittsburgh

Candice Kohn, Pacific Geosource

Emin Kutay, Michigan State University

Brett Lambden, Husky Energy

Fabricio Leiva, Pacific Geosource

Chad Longcore, J. Rettenmaier USA LP

Rajib Mallick, UTEP

Todd Mansell, Caterpillar Paving Products

Mihai Marasteanu, University of Minnesota - Twin Cities

Ken Maser, Infrasense

Luke Meyer, Bio-Based Spray Systems

Danial Mirzaiyanrajeh, Solmax

Kiran Mohanraj, The Transtec Group

Pete Montenegro, Collaborative Aggregates

Raquel Moraes, NCAT

Chibuike Ogbo, Terracon

Eric Olson, Solmax

Brian Orr, BASF

Andrew Peterson, South Dakota State's Local Transportation Program

Hadi Rashidi, National Stone Sand and Gravel Association (NSSGA)

Dave Rettner, American Engineering Testing

Farhad Reza, Minnesota State University - Mankato

Roger Roberts, GSSI

Mohammad Reza Sabouri, Braun Intertec

Baris Salman, Syracuse University

Michael Scardina, Surface Tech

Nick Schaefer, Surface Systems and Instruments, Inc. (SSI)

Debbie Schwerman, Wisconsin Asphalt Pavement Association

Jo Sias, University of New Hampshire

Dan Staebell, Asphalt Pavement Alliance (APA)

Dave Stanczak, Asphalt Materials, Inc.

Brandon Strand, Asphalt Pavement Alliance (APA)

Nabil Suleiman, University of North Dakota

Hassan Tabatabaee, Cargill

Cheng Thao, Payne & Dolan

Chris Theriot, Resource Recycling Systems

Kim Tolzmann, Hardrives

Derek Tompkins, American Engineering Testing

Feng Wang, Texas State University

Hao Wang, Rutgers University

Randy West, National Center for Asphalt Technology (NCAT)

Jason Wielinski, ARRA

R. Chris William, Asphalt Materials & Paving Program (Iowa State)

Richard Willis, National Asphalt Pavement Association (NAPA)

Trey Wurst, Ingevity

Jett Yang, Uberbinder

Fan Yin, NCAT

Hao Yin, Horizon Engineering Consulting

Zhanping You, Michigan Tech Transportation Institute

Fujie Zhou, Texas A&M Transportation Institute



National Road Research Alliance (Flexible Technical Team Projects)

<https://www.dot.state.mn.us/mnroad/nrra/structure-teams/flexible/index.html>

Asphalt Mix Rejuvenator Test Sections (added 50K in April 2020)	UNH
Asphalt Mixture Rejuvenator Synthesis	WSB
Cold Asphalt Recycling Technologies using Rejuvenating Asphalt Emulsion: Impact; Implementation; Specification	UNH
Cold Central Plant Recycling	AET
Continued Monitoring of Original I-94 Westbound Asphalt Overlay Sections	UNH
Continued Monitoring of TH6 RA Field Sections	UNH
Field Validation of Using Warm Mix Asphalt at Reduced Production Temperatures for Balanced Mix Design	Auburn University
HMA Overlay and Rehab of Concrete and Methods of Enhancing Compaction	UNH
Impact of Polymer Modification on IDEAL-CT and I-FIT for Balanced Mix Design	NCAT
Innovative Practical Approach To Assessing Bitumen Compatibility As A Means Of Material Specification	Cargill
Longitudinal Joint Construction Performance	SRF
Maintaining Poor Pavements	SRF
MnROAD Reflective Cracking Challenge (NRRRA)	UNH / Auburn
Novel Methods for Adding Rejuvenators in Asphalt Mixtures with High Recycled Binder Ratios	Auburn University
Perpetual Pavements in Wet Freeze Climate	RFP
Reclamation and Recycling Techniques to Achieve Perpetual Pavements Characteristics	Braun Intertec
Recycled Binder Availability	RFP
Reflective Cracking Challenge Coordination (Missouri - 400K)	University of Missouri-Columbia
Standardization of SIP Calculation for Hamburg Wheel Tracking Test	Auburn University
Tack Coats	SRF
Understanding and Improving Pavement Milling Operations	University of New Hampshire
Validation of Loose Mix Aging Procedures for Cracking Resistance Evaluation in Balanced Mix Design	Auburn University / UNH - TTI

National Road Research Alliance (Flexible Technical Team Projects)

<https://www.dot.state.mn.us/mnroad/nrra/structure-teams/flexible/index.html>

2017 HMA Overlay of Concrete
 2017 Cold Central Plant Recycling
 2019 HMA Mix Rejuvenator
 2021 Spray Rejuvenator
 2022 MnROAD NCAT Reflective Cracking
 Challenge
 2023 Perpetual Pavement
 2023 Low-Volume Reflective Cracking Challenge

Track Coats

Understanding and Improving Pavement Milling Operations

Validation of Loose Mix Aging Procedures for Cracking Resistance Evaluation in Balanced Mix Design

UNH
WSB
UNH
AET
UNH
UNH
Auburn University
UNH
NCAT
Cargill
SRF
SRF
UNH / Auburn
Auburn University
RFP
Braun Intertec
RFP
University of Missouri-Columbia
Auburn University
SRF
University of New Hampshire
Auburn University / UNH - TTI

2017 HMA Overlay of PCC

- **Developing Best Practices for Rehabilitation of Concrete with Hot Mix Asphalt (HMA) Overlays Related to Density and Reflective Cracking**
- <https://www.dot.state.mn.us/mnroad/nrra/structure-teams/flexible/longterm2.html>
- UNH Research Team – Drs. Dave and Haslett
- Test Sections on “Original Westbound I-94” – 1970’s PCC
- Higher density mixes (SP5 and regressed airvoids) delayed reflective cracking
- All HMA overlays improved ride.
- Project has phase 2 NRRA funding (2023)

12/10/2023

mndot.gov



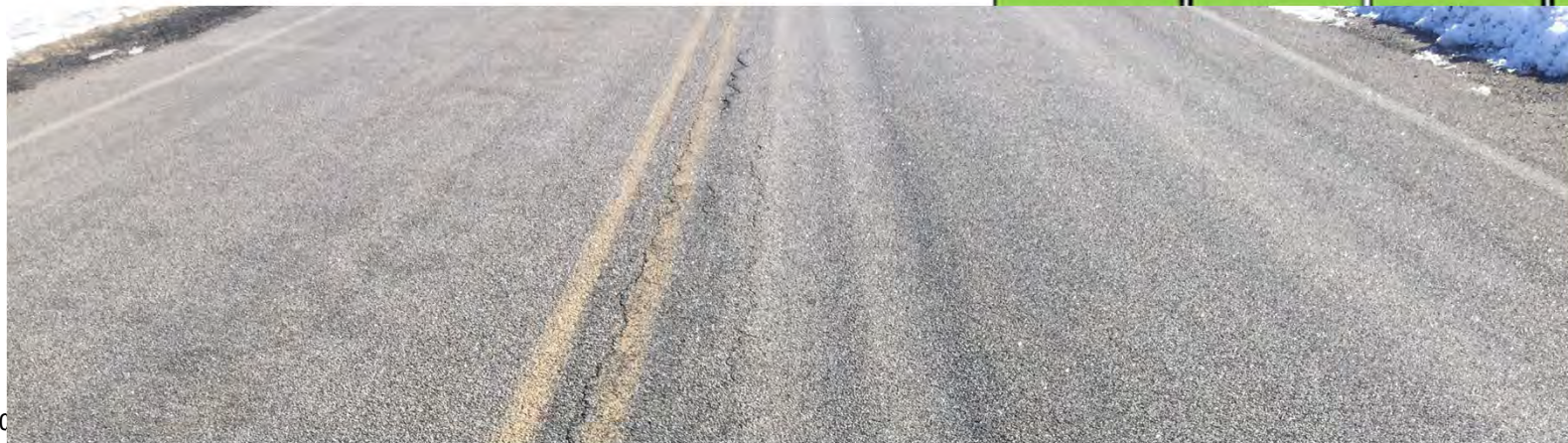
2017 NRRA Cold



September 2018
Cells 133, 233
Double Chip (F28, E28)

- Constructed 4 sections in 2017 on MnROAD L
- Comparison of:
 - CCPR Foam versus CCPR Emulsion
 - Chip seal surface versus 1.5" HMA overlay

133	233	135	235
2X Chip	2X Chip	1.5" HMA	1.5" HMA
4" CCPR Emulsion	4" CCPR Foam	4" CCPR Foam	4" CCPR Emulsion
			12" Class 6
			Clay



12/10/20

2019 NRRA Mix Rejuvenator Study



- 2019 mill/inlay job in Northern Minnesota (Emily, MN)
- 7 Rejuvenating Products
- 40% RAP content – targeted xx-34 (original 58-28)
- Measuring long-term:
 - Field performance, asphalt binder + mix properties,
- NRRA Funded for additional 4 years!



2021 NRRA Spray-Applied Rejuvenator Study

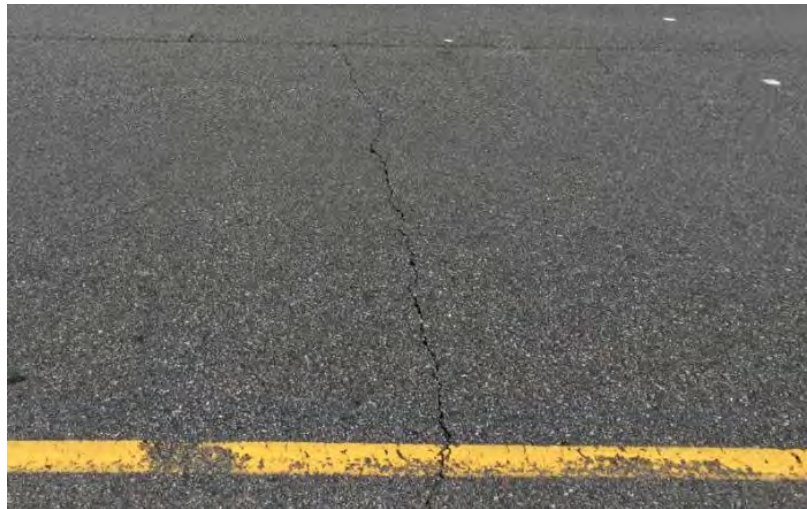
- **12 different products applied in 2021**
- **Applied at 3 locations**
 - MnROAD 58-28 (50')
 - MnROAD 58-34 (50')
 - St. Michael (500')
- **Measuring long-term:**
 - Friction, paint reflectivity, permeability, asphalt binder
- **Over 1,500 cores taken in first 2 years of study**



2022 MnROAD Reflective Cracking Challenge

- Experiment designed to better match APT research to MnDOT network applications

- BOB = bituminous over bituminous ~50% network
- <https://www.dot.state.mn.us/mnroad/nrra/structure-teams/flexible/reflective-cracking-challenge.html>



Statewide (All Districts)

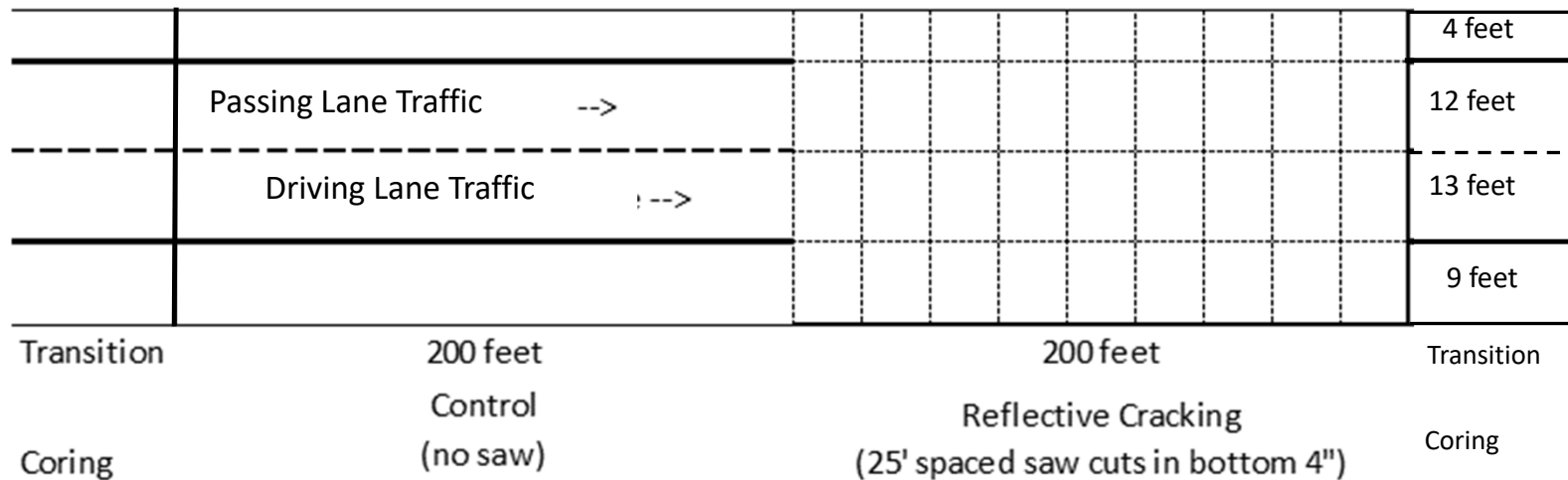
<u>Pavement</u>	<u>Percent</u>	<u>Miles</u>
BIT	12%	1,682
BOB	50%	7,104
BOC	22%	3,136
CON	17%	2,377
CRCP	0%	2
All	100%	14,301

<u>Pavement</u>	<u>POI</u>	<u>ROI</u>	<u>SR</u>
BIT	3.6	3.5	3.8
BOB	3.3	3.2	3.4
BOC	3.4	3.3	3.6
CON	3.6	3.4	3.9
CRCP	3.8	3.6	4.0
All	3.4	3.3	3.6

2022 NRRRA Reflective Cracking Challenge MnROAD Test Sections

10 Test Sections with different HMA surfaces

- Tied to NCAT additive group 2021 construction
- Missouri funded 400K to tie Missouri Test Sections into each study
- ~450' of paving per surface mix (50' transitions)
- 200' of sawing to recreate/induce reflective cracking
- Milled before final 2" was placed



NRRA Reflective Cracking Challenge NCAT Additive Group

2022 MnROAD Construction

Partnerships

- Tied to NCAT Additive Group (NY participation)
 - Additive Donations similar
- CAT Milling – Initial Milling
- VRAM donated

Contractor

- Paves All HMA (Lift 3 and 2)
- Saws and 1" Milling (Lift 2)
- Places donated VRAM
- Paves HMA surfaces (Lift 1)
 - Contractor provided 2230 and 2231
 - MnDOT provided rest of the mixes

2022 HMA Reflective Cracking Challenge Additive Group Studies (NCAT Partnership)	
2239 - 2230	
Lift 1	2" HMA Surface Mix
Lift 2	4" HMA *
Lift 3	12" Class 6
	12" Class 3
	7" Select Gran
	Clay
	Aug 2022
	400
	* Each Test Section Consists of 200 ft of Sawn and ~200 ft of Non-Sawn Nonwear Lower Base Coarse Layers in the HMA
2230	Control Mix SPWEAB540B - PG 58S-28
2231	Superpave 5.0 SPWEAB550F - PG 58V-34
2232	Wet Plastic Additive Dow SPWEAB540A - PG 52-34
2233	Fiber Additive Ace SPWEAB540C - PG 58H-34
2234	Fiber Additive Forta Fi SPWEAB540C - PG 58H-34
2235	Wet Rubber Additive Entech SPWEAB540A - PG 52-34
2236	Dry Plastic Additive Avangard SPWEAB540A - PG 49-34
2237	Dry Rubber Additive Liberty Tire SPWEAB540A - PG 49-34
2238	Control Mix SPWEAB540A - PG 49-34
2239	Control Mix SPWEAB540C - PG 58H-34

Saw-cutting

- Full depth (5") saw cuts were made 24' through travel lanes
- Cuts were minimally cleaned with leaf blower and wire
- No cleaning after milling



NCAT Additive Group -Surface HMA Mix Details

- **10 Sections with differing surface HMA**

- Controls

1. PG 58H -34 (modified)
2. PG 58S -28 (unmodified)
3. PG ~49 -34 (unmodified)

- Additive Sections

4. Aramid Fiber 1 w/ PG 58H -34 (modified)
 5. Aramid Fiber 2 w/ PG 58H -34 (modified)
 6. Dry Plastic Additive w/ PG ~49 -34
 7. Dry Rubber Additive w/ PG ~49 -34
 8. Wet Plastic Additive
 9. Wet Rubber Additive
- } w/ PG 52-34 from Mathy

- Super Pave 5.0

10. PG 58V -34 (modified) (NRRRA)

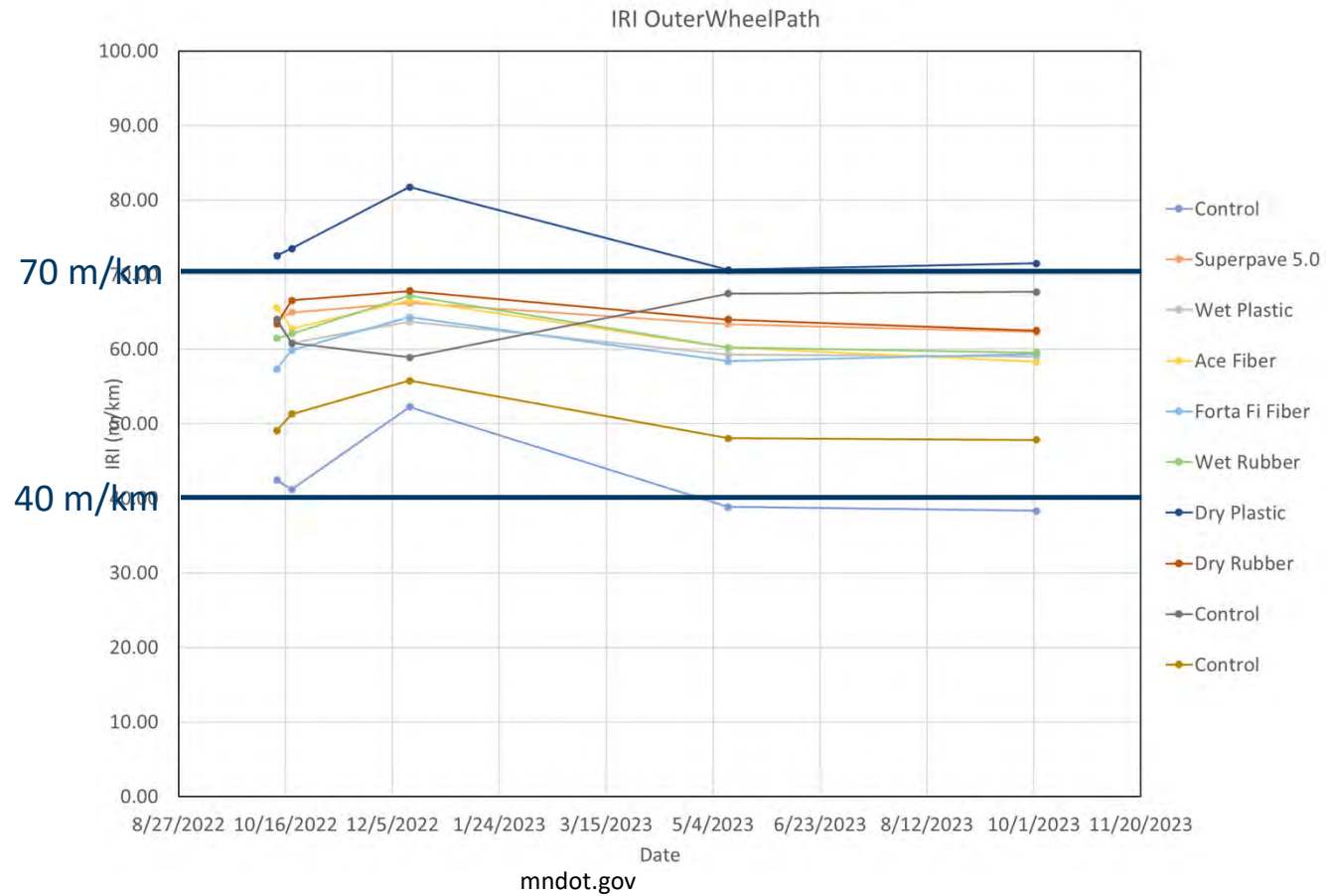


- **All mixes contain**

- MnDOT Traffic Level 5 (10<30 mESALS)
- Superpave Gyrotory BMD
- ¾" Max Agg (SP 12.5mm)
- 20% RAP

Reflective Cracking Challenge Performance

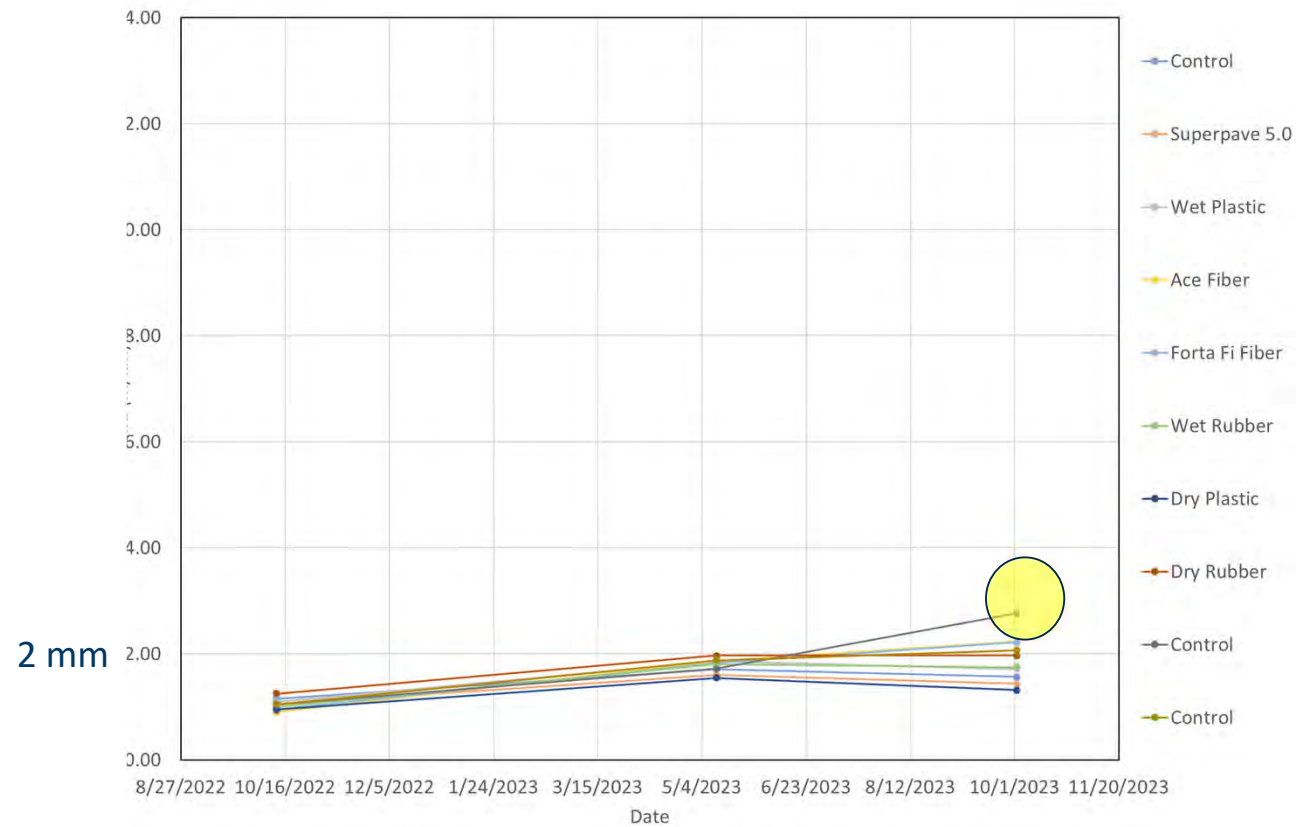
Good initial ride and no change over 1st year



12/10/2023

Reflective Cracking Challenge Performance

No rutting over 1st year but may be developing in PG49-34 Control Section



12/10/2023

2022/2023 NRRRA HMA Perpetual Pavement

- 2022 - MnROAD 8.5" HMA perpetual pavement section built
- 2023 - WisDOT Deep Strength HMA sections (12.5" HMA) built in Osseo, WI on I-94
- All sections have instrumentation for temperature, moisture, strain and pressure
- Request for Proposal in 2024



12/10/2023

<https://www.dot.state.mn.us/mnroad/nrra/structure-teams/flexible/perpetual-pavement-test-sections.html>



2023 Low-Volume Reflective Cracking Challenge

- Designed to evaluate Reflective cracking potential of low-volume mixes in Minnesota
 - Constructed October 30 and November 1
 - Temps during paving 23-35 and 35-45
1. MnDOT B Oil (PG 58S-28)
 2. MnDOT C Oil (PG 58H-34)
 3. MnDOT B+ Oil (PG 58S-28) @+0.5%AC
 4. MnDOT C+ Oil (PG 58H-34) @+0.5%AC



2023 Low-Volume Reflective Cracking Challenge



National Road Research Alliance (ICT Technical Team Projects)

Levels 3-4 Intelligent Compaction Measurement Values (ICMV) for Soils Subgrade/Aggregate Subbase Compaction	Transtec Group
Support Importing, Viewing and Analysis of Dielectric Constant Data in Veta (paid by Veta pooled fund)	Transtec Group
HD and VHD Seismic Approaches for Roadway Evaluation	Park Consulting
Asphalt Real Time Smoothness (ARTS) for Asphalt Paving	Transtec Group
Veta Web and Veta MDMS Standardized Platform	Transtec Group
InfoPAVE MnROAD Database Support and Development	i-Engineering
Effective Use of Traffic Speed Deflectometer for Network-based and Project-based Applications	UTEP
Establishing Applicability of NDT Methods for Project-Level Evaluation	UTEP
E-Ticketing	SRF

- **Veta Software** TPF-5(334) now NRRRA
- HMA Rolling Patterns
- Paver Operations / IR Temperature Bar
- 3D GPR / Rolling Density Meter



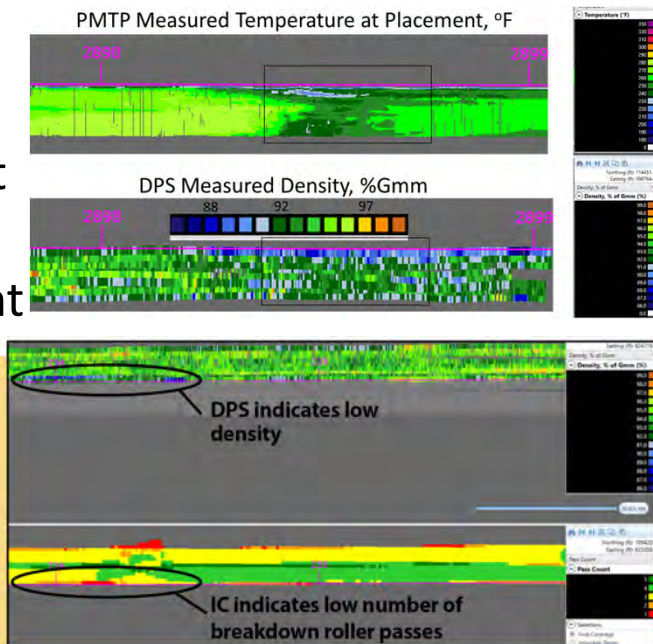
DPS National Pooled Fund Program



DPS Contacts - Materials & Road
Research - MnDOT
www.dot.state.mn.us

Continuous Asphalt Mixture Compaction Assessment Using Density Profiling System (DPS) [TPF-5(443)]

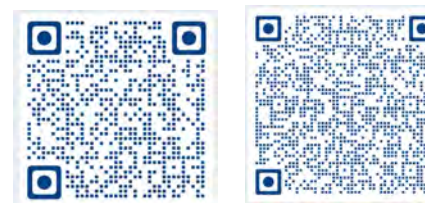
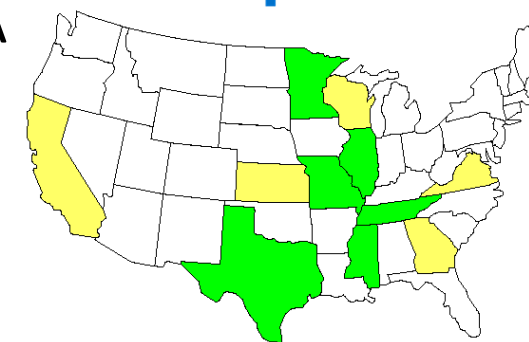
- **Objective:** Use the DPS method to improve asphalt pavement density
 - Increased coverage and comprehensiveness of assessment
 - Timely information to improve construction process
 - Reduce coring
- **Lead Agency:** MnDOT
 - Contact: Kyle Hoegh, kyle.hoegh@state.mn.us (MnDOT)
- **Committed agencies:** MN, FHWA, GA, ID, MD, ME, MO, MS, ND, NY, OH, PADOT, UT, WA, WI
- **Commitment level:** \$25K/year



Continuous Bituminous Pavement Stripping Assessment Through Non-Destructive testing

TPF-5(504): Continuous Bituminous Pavement Stripping Assessment Through Non-Destructive testing (4 years)

- **Objective:** Develop testing and analysis procedures for automatic detection and rating of stripped section for project and network level pavement evaluations
- **Lead Agency:** MnDOT
 - Contact: Eyoab Zegeye, eyoab.zegeye@state.mn.us (MNDOT)
- **Committed agencies:** MN, IL, MO, TN, MS, TX, GA & FHWA
- **Pending:** CA, KS, WI, VA and IN
- **100% SP&R Approval:** Approved
- **Commitment level:** \$25K/year



VFDQ#KV

“MnROAD Construction Prospects”

Fall of 2023

- Wisconsin Perpetual Pavement Installation (done)
- Local Reflective Cracking Experiment (done)
 - 4 Cells on the LVR (31,77,78,79)
- Unbound Water Repellency (done) - NRRRA/NSF
 - 2 Cells (NW corner of the LVR)

2024

- HMA Stripping Calibration Sections – Pooled Fund – 12 Cells (LVR service road)
- 11 Mainline Test Sections (Open for NRRRA Planning)
 - NRRRA Cement Alternatives
 - NRRRA Thick Lift HMA



2022 MnROAD Construction Overview

Main theme from NRRRA: Sustainability and Resilience

What new materials will help meet future sustainability guidelines?



45 New Test Sections

- 4 – In-Place Recycling
- 4 – Preventive Maintenance
- 6 – PCC Innovative Patching / Diamond Grinding
- 16 – PCC Reduced Cement
- 1 – PCC WIM area
- 2 – PCC Recycled Fiber
- 2 – HMA Perpetual Pavement
 - 1 of 2 with Wicking Geotextile
- 10 – Reflective Cracking Challenge

Partners Donated Materials

- CAT – HMA Milling
- Geotextile Fabric
- VRAM – J-Band
- CIR Rejuvenator Donation

MnDOT Furnished Materials

- HMA Plant Mix Furnished (~1/2 mixes)
 - Additive Suppliers
- PCC Plant Mix Furnished (all mixes)
 - Additive Suppliers

Industry Partnerships

- Partnerships have been key to gaining **trust** between various stakeholders and led to new (and fun) collaborations
- CAT – Caterpillar Inc.
 - Donate paving and milling at MnROAD
- Mid-state Reclamation
 - Donate reclamation recycling efforts at MnROAD



Summary - Takeaways

- Takeaways

1. What is MnROAD? **Always welcome for visits/ tours**
2. Importance of Partnerships and Collaboration to successful research and implementation
 1. How MnROAD research can Kansas benefit
 2. How MnROAD/MnDOT can learn and grow from Kansas

Questions / Comments

Working together you can be a part of something bigger than yourself

Michael Vrtis

Michael.vrtis@state.mn.us

How to get involved?

- TPF-5(466) NRRRA Membership
- TPF-5(TBD) NCAT 2024 Test Track
- TPF-5(522) PG3 Pavement Preservation
- TPF-5(443) Density Profile System
- TPF-5(504) Non-Destructive Testing
- Research Pays off Webinars (free)

