MnROAD

Innovation in Pavement Technologies

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RPUG September 25, 2012

Your Destination...Our Priority

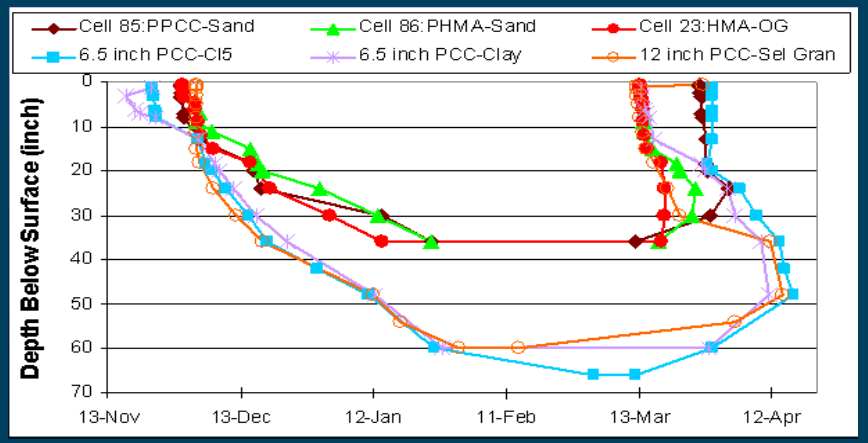

MnROAD
Office of Materials and Road Research
A long-term accelerated pavement testing facility that gives researchers a unique, real-life laboratory to study and evaluate the performance of materials used in roadway construction.

MnROAD Products

- Test Sections
  - Construction
  - Materials & Testing
  - Sensor Data
    - Over 9000 dynamic & environmental
  - Performance Data
- Research
  - Internal
  - Partners
- Workshops, Rodeos, Calibration, Demos
  - IP Certification

MnROAD Data

- Oracle Database
  - Over 1 Billion rows
  - 18 years of data
- Data Release 1.0 (January 2012)
  - Test cell parameters
  - Monitoring/Performance
  - Lab testing results
- Current Activities
  - Sensor data
  - Improve data validation
  - Annual Data Releases – Available to all

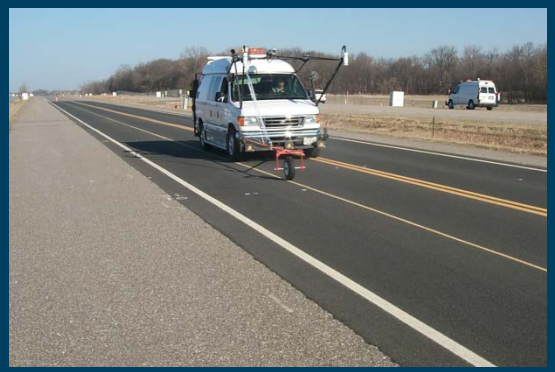


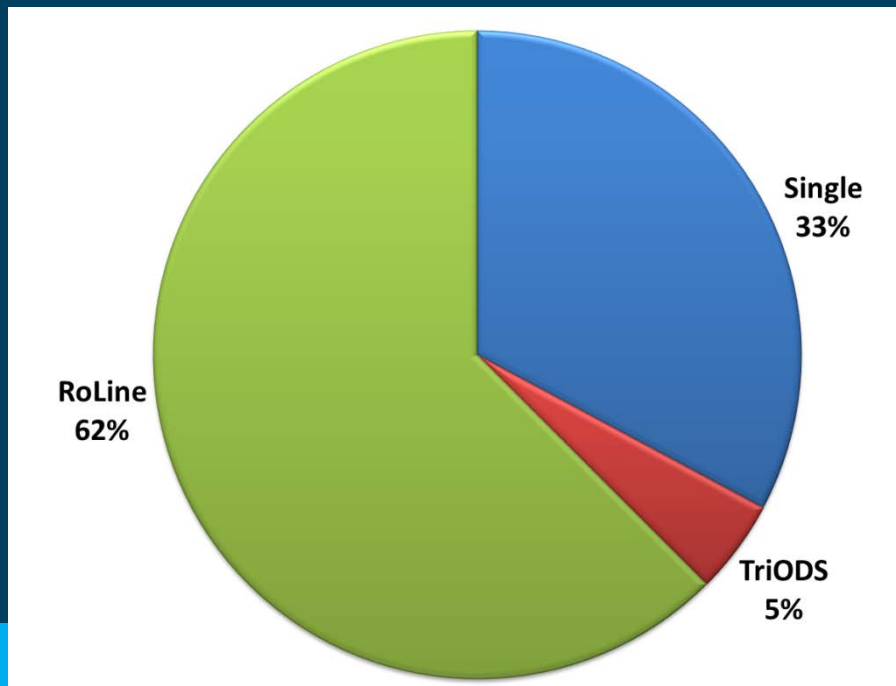
MnROAD Research Support

- Intelligent Transportation Systems (ITS)
- Pavement Marking (Striping)
- 60 inch Plastic Culverts
- Roadside Vegetation Studies
- Homeland Security Drills
- State Patrol Accident Reconstruction
- Profile and Noise Rodeo Support
- WIM Calibration

Inertial Profiler Certification

- MnDOT Certifies equipment and operation
- Equipment certified at MnROAD
  - Calibrate Equipment
  - Collect 6 profiles on each test section
  - Submit ERD and hard copy of 5 best

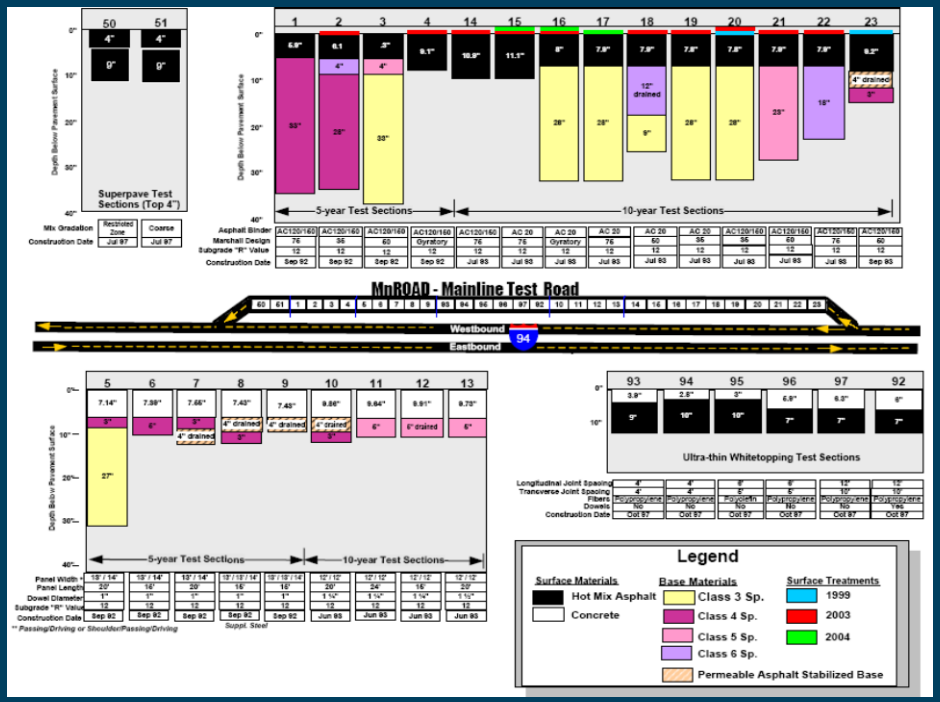




MnROAD Original Construction

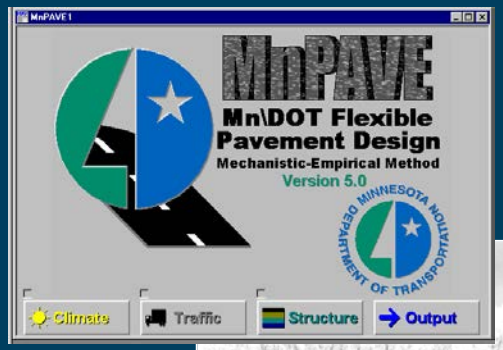
- **History**
  - Original Funding ($25 million)
  - Original Construction (1992–1993)
  - Open to Traffic (1994)

- **Phase I (1994–2006)**
- **Phase II (2007–present)**
- **Phase III (planning for 2016)**



MnROAD Phase I Benefits: $33 Million/Yr

- Seasonal Load Limits
  - Spring Restrictions / Winter Overloads
- Improved Design
  - Mechanistic Empirical Design
  - Whitetopping
  - Environment Drives Pavement Performance
- Improved Construction Methods
  - Dynamic Cone Penetrometer
  - Intelligent Compaction
- Young Engineer Training & Education



Transportation Engineering and Road Research Alliance

- TERRA formed in 2004
- Helped develop Phase-II
- Government, industry and academia members

- MnROAD Benefits
  - Attracts key public, industry, academic partners contributions
  - Participation in future initiatives- better results, implementation

TERRA Board Members

Industry

- Aggregate & Ready Mix Association of MN*
- American Concrete Pavement Association
- Associated General Contractors of MN*
- Concrete Paving Association of MN
- MN Asphalt Pavement Association
- Caterpillar Global Paving
- Mathy Technology and Engineering Services
- RMC Research and Education Foundation
- Road Science**
- American Engineering and Testing
- Braun Intertec

National

- Norwegian Public Roads Administration
- United States Federal Highway Association

State and Local

- Minnesota DOT*
- Minnesota Local Road Research Board
- Iowa DOT
- Michigan DOT*
- New York State DOT
- North Dakota DOT
- Wisconsin DOT**

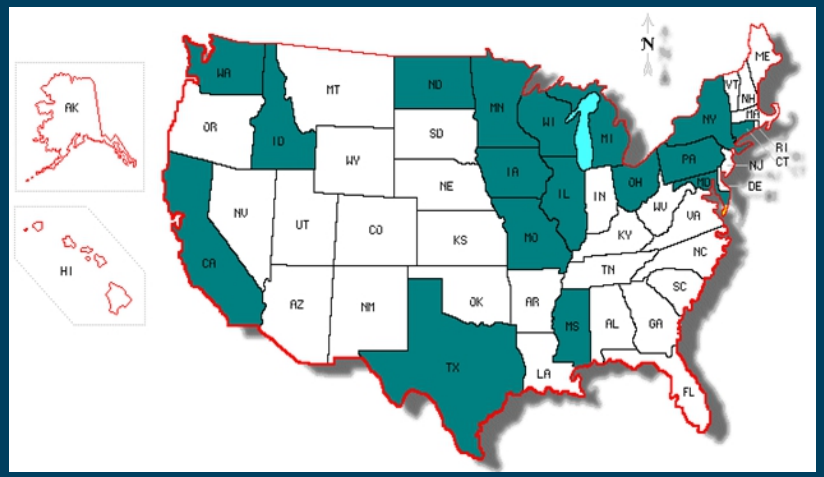
University

- Iowa State University
- Michigan Tech University
- University of Minnesota

* Past Co-Chair

** Present Co-Chair

MnROAD Phase 2 Core Research Areas



- Innovative Construction
- Green Roads
- Preservation and Rapid Renewal
- Surface Characteristics
- Non-Pavement Research

- 7 Pooled Fund Projects
- 17 Partnership Projects

MnROAD Phase 2 Contributors

- Aggregate Ready Mix Association of Minnesota
- American Concrete Pavement Association
- Applied Research Associates, Inc.
- Bloom Consultants
- Catepillar Inc.
- Concrete Paving Association of Minnesota
- Diamond Surfacing Inc.
- ICL Performance Products Inc.

- 17 State DOT's
- FHWA
- Environmental Protection Agency
- Minnesota Local Road Research Board
- Strategic Highway Research Program 2

- Innophos Inc.
- International Grooving and Grinding Association
- Marathon
- Mathy – MTE
- Paragon
- Portland Cement Association
- Professional Nutrient Agricultural Association of Wisconsin
- RoadScience

- Western Research Institute
- Natural Resources Research Institute
- Center for Transportation Research and Education, Iowa State University
- U of Wisconsin Extension Service

PCC Surface Characteristics (Rehab)

- **TPF-5(134) Pooled Fund**
  - Diamond Grinding Study – LVR & Mainline
  - Traditional, Innovative, Ultimate, Whisper, ….)
- **Findings**
  - Noise & Safety Improvements have been documented
  - Working with environmental groups – TNM
  - Cost are becoming more competitive with greater use
- **Benefits**
  - Implemented: I94 Clearwater, TH52 St. Paul, I35 Duluth
  - Noise/Durability/Safety
  - Good for areas where no room for noise walls

MnROAD Concrete Surfaces

- Conventional Diamond Grind
- 3 Quiet Grind Configs
- Longitudinal Turf Drag
- Transverse Tine
- Longitudinal Broom Drag
- Transverse Broom Drag
- Exposed Aggregate
- Pervious Concrete
- Longitudinal Tine
- Roller Compacted



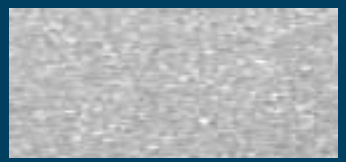







MnROAD Asphalt Surfaces

- Ultra Thin Bonded Wear Course
- 4.75 mm taconite
- Chip seals
- 12.5 mm Mixes
- 12.5 mm + fog seal
- Porous Asphalt
- Stone Matrix (TH 212)
- Microsurfacing

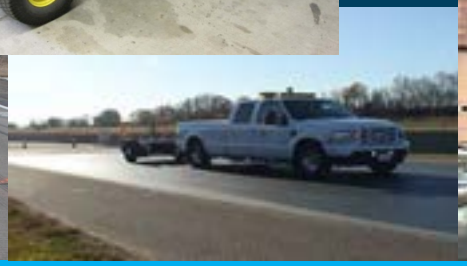


Smoothness & Friction

- LWP, IP, PMS– IRI
- ALPS – rutting
- ALPS 2 – Warp and Curl
- Fault Meter
- Skid Trailer
- Dynamic Friction Tester
- Grip Tester (FHWA)

- Combined IRI spec
- Texture effects
- IP Certification
- Surface Char over time
- Wet Weather Accidents





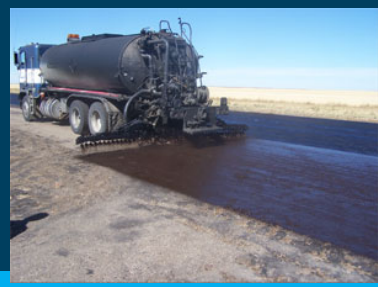

Texture and Acoustics

- Circular Texture Meter
- RoboTex
- Rolling Resistance
- Sand Patch
- OBSI
- Sound Adsorption

- Texture and IRI
- Drag surface- Wet Weather Accidents
- Texture and Noise
- Acoustics and Pavement Rating

Preventative Maintenance

- **TPF-5(153) Pooled Fund, MnROAD Studies**
  - Understand asphalt aging
  - HMA Cells and other state roadways
- **Observations**
  - PF Study ongoing- Asphalt Institute
  - Roadways observed to age from top down and bottom up
- **Benefits**
  - When is the most effective time for maintenance?
  - Safety Benefits – Microsurfacing increased friction, reduced crashes
  - Chip Seal, Fog Seal, Microsurfacing, Crack Seal…..
  - High and Low Volume applications



Composite Pavements

- **TPF-5(149) Pooled Fund & SHRP II**
  - 4 Cells – (HMA/PCC, PCC/PCC)
- **Observations**
  - Good Performance
  - Demonstrated low quality aggregate, recycled concrete, flyash substitution options for underlying concrete mixes
  - RCA tricky with low water-cement requirements
  - Documented the reduced thermal gradient for HMA/Concrete
- **Benefits**
  - Economical option for locations with low quality/few aggregates
    - McCrossen Cost Estimate (2 PCC Pavers – Trucking Costs) are ~equal
  - New designs option for long life, durable, rapid renewal

Low Temperature Cracking

- **TPF-5(132) Pooled Fund**
  - National mix test and specification
- **Observations**
  - Fracture Energy factors
    - Aggregate Type
    - Aggregate Gradation Size
    - Binder Grade
    - Binder Modification
    - Air Voids
    - Use of Recycle
- **Benefits**
  - Fracture energy key to cracking
  - Performance specification
  - Major distress in cold climates

Thin Whitetopping Design

- **TPF-5(165) Pooled Fund**
  - National design tool
  - 14 Cells (1997, 2004, 2008) + around the state
- **Observations**
  - Learned the important factors – accelerated testing
    - Thickness
    - Panel size
    - HMA condition and seasonal behavior
    - Importance of bond, sealing

- **Benefits**
  - Competitive solution for HMA rehab
  - Alternate bid option

Full Depth Reclamation

- **Road Science Partnership**
  - 3 Cells (mainline)
  - 1 Cell (LVR)
- **Observations**
  - 2.75” Interstate surface on engineered FDR
  - Engineered emulsion balances stiffness and flexibility
- **Benefits**
  - Solution for Full Depth Asphalt
  - Solution for distressed pavements
  - Sustainable construction practice
  - Alternative Bid
  - Lightly surfaced low volume

Future Trends

- Preservation
- Rehabilitation
- Construction Uniformity
- Sustainability
- Surface Characteristics

2012-2013 Research Plan

- Sustainable Concrete
  - RCA in PCC and Drainable Base
- Thin Unbonded Fiber Reinforced Overlay
  - Use of fibers and fabric interlayer
- Fiber Reinforced Whitetopping
  - Effects of fiber to increase panel size – less joints
- Dowel Bar Retrofit –thin PCC Pavement
  - Rehabilitation for thin concrete streets
- Diamond Grinding of Pervious Concrete
  - Evaluate clogging & ride
- Lightly Surfaced low volume road
  - FDR with cement+ Chip Seal
- Flexible Microsurfacing
  - Performance of softer emulsions on rough, aged asphalt

MnROAD Phase 3

- Beginning to Plan for 2016
  - Working with Research Partners & Customers
    - MnDOT
    - LRRB
    - TERRA
    - FHWA

- Continue to Develop Partnerships
  - Please contact us – we are interested in your input

"If Transportation technology was moving along as fast as microprocessor technology, then the day after tomorrow I would be able to get in a taxi cab and be in Tokyo in 30 seconds."

Danny Hillis
Co-founder, Applied Minds

MnROAD Tour

www.mndot.gov/mnroad