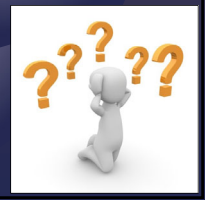
About the Presenter

- **Brett Trautman** works for the Missouri Department of Transportation as the Physical Laboratory Director
- He has worked for MoDOT for over 30 years. The first 6 years he worked in the Materials Section of the Central District before joining the Construction and Materials Division as a Field Materials Engineer. In 2013, Brett was promoted to his current position where he oversees the testing of concrete, bituminous mixtures, aggregates, rebar, and other highway construction materials
- He serves as the Departments representative and voting member of the AASHTO Committee on Materials and Pavements (COMP) and is the Vice-Chair for Technical Subcommittee 3a Hydraulic Cement and Lime
- Brett is the current Chair of the NRRA Rigid Team
- Brett graduated from the University of Missouri – Columbia with a degree in Civil Engineering and is a registered professional engineer in Missouri

What is the NRRA?

- A pool fund focusing on solving problems that impact highway agencies
  - Minnesota lead state
- Highway agencies provide input and participate in decision making needed for future construction and research
- Industry and academia provide their knowledge and experience
  - Barriers to implementation



National Road Research Alliance (NRRA) Project Update

Brett Trautman
Physical Laboratory Director
Missouri DOT

2020 Fall National Concrete Consortium
September 3, 2020

Agency Members

- 10 Total
  - California (CalTran), Illinois DOT, Illinois Tollway, Iowa DOT, Michigan DOT, Minnesota DOT, Minnesota Local Road Research Board, Missouri DOT, North Dakota DOT, and Wisconsin DOT

Slide 1

BT1 Brett Trautman, 8/19/2020

Associate Members

- 60 Total
  - 17 Academia
  - 7 Associations
  - 36 Private

Rigid Team Efforts

2017 Synthesis (2)

- Design & Performance of Concrete Unbonded Overlays
- Repair of Joints Associated Distress in Concrete Pavement

2017 Projects (4)

- Fiber-Reinforced Concrete Pavement
- Evaluation of Long-Term Impacts of Early Opening of Concrete Pavements
- Reduced Cementitious Materials in Optimized Concrete Mixtures
- Compacted Concrete for Local Streets




Structure

- Executive Committee
  - 2 members per agency
- 5 Teams

Rigid Team Efforts

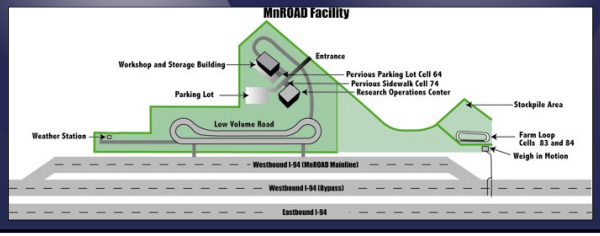
2019 Projects (5)

- Solutions to Mitigate Dowel/Tie-Bar Propagated Cracking
- Construction Report for Jointless FRC Roundabout in Minnesota
- Incorporate Joint Faulting Model into BCOA-ME
- Blending of Higher Strength Aggregates with Recycled Concrete and Marginal Aggregates to Improve Concrete Properties
- Performance of Concrete Overlays over Full Depth Reclamation (FDR)

2020 NRRA Initiatives

- Call for Innovations
  - Additional funding available
  - Evaluated several projects
  - Three select for funding
  - Pavement Specific Structural Synthetic Fibers
- Call for Construction
  - For associate members
  - Fund construction
  - MnROAD monitors
  - Satellite locations considered

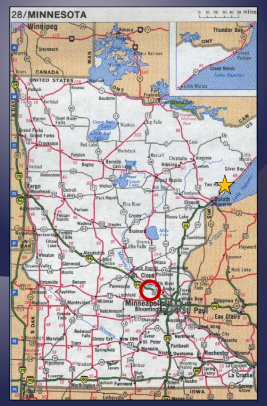
MnROAD



2017 Projects

- Three constructed at MnROAD
  - 3.5 mi. Mainline
  - 3.5 mi. Bypass
  - 2.5 mi. Low Volume Road
- Live traffic
  - Interstate 94, EB & WB
- Opened in 1994

MnROAD
Safer, Smarter, Sustainable Pavements Through Innovative Research



Fiber-Reinforced Concrete

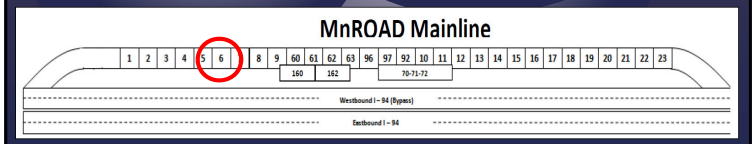
Objectives

1) Determine contribution of fibers in reducing panel fatigue cracking
2) Determine contribution of fibers in mitigating joint faulting
3) Determine optimal panel size for thin unbonded concrete overlays
4) Determine minimum thickness of FRC for low-volume streets

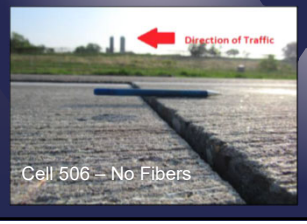
Fiber-Reinforced Concrete

- Four Cells (506, 606, 706, & 806)
- Evaluating the impact fiber dosage has on fatigue cracking & joint faulting
- Cell lengths:

Cell No.	506	606	706	806
Length	144 ft.	138 ft.	138 ft.	138 ft.



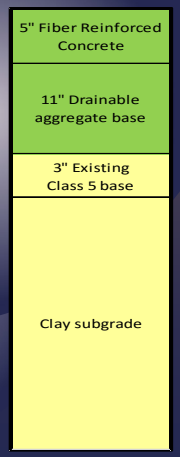
Fiber-Reinforced Concrete



Fiber-Reinforced Concrete

Pavement Details

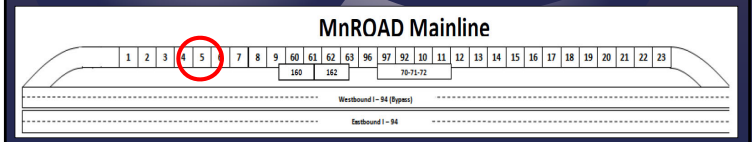
- Full depth pavement on grade
- All cells: 6' x 6' panels
- Fiber content:
  - Cell 506: No fibers (control)
  - Cell 606: 20% RSR
  - Cell 706: 30% RSR
  - Cell 806: 0.75% fibers by volume



Fiber-Reinforced Concrete

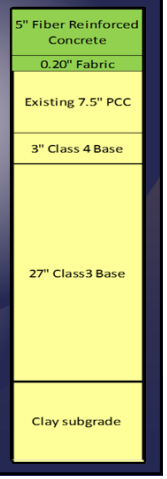
- Two Cells (705 & 805)
- Evaluating the impact fibers have on fatigue cracking, joint faulting, & panel size
- Cell Lengths:

Cell No.	705	805
Length	144 ft.	124 ft.



Fiber-Reinforced Concrete
Pavement Details

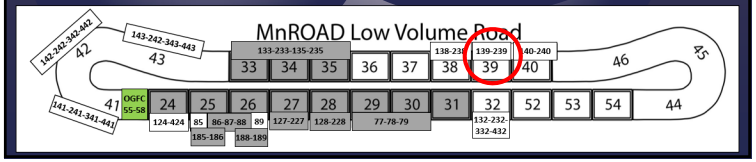
- Unbonded Overlay
- Non-woven geotextile fabric interlayer
- Cell 705
- 14'W x 12'L & 12'x12' panels
- Cell 805
- 6' Wx12'L & 8'Wx12'L panels
- Fiber content: 20% RSR



Fiber-Reinforced Concrete

- Two cells (139 & 239)
- Evaluate using fiber-reinforced concrete pavement for city streets
- Cell Lengths:

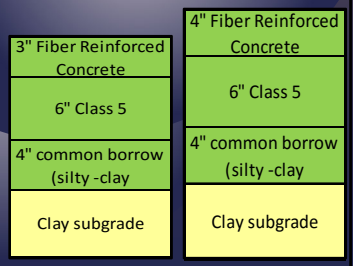
Cell No.	139	239
Length	270 ft.	273 ft.



Fiber-Reinforced Concrete

Fiber-Reinforced Concrete
Pavement Details

- Cells 139 & 239: 6' x 6' panels
- Full depth concrete on grade
- Fiber content: 30% RSR

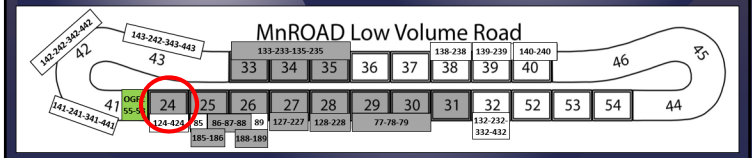


Fiber-Reinforced Concrete

Early Opening to Traffic

- Six cells (124, 224, 324, 424, 524 & 624)
- Early sequential traffic loadings

Cell No.	124	224	324	424	524	624
Length	120 ft.	120 ft.	120 ft.	115 ft.	60 ft.	20 ft.



Early Opening to Traffic

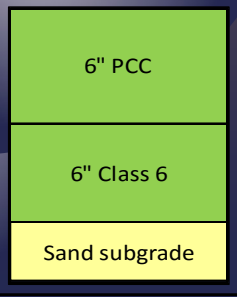
Objectives

1) Evaluate visible and non-visible immediate damage caused by early age loading
2) Quantify the effect of early loading damage on long-term performance
3) Determine minimum strength at opening or other measurable variables associated with this parameter
4) Recommend strategies for minimizing or avoiding early loading damage detrimental to long-term performance

Early Opening to Traffic

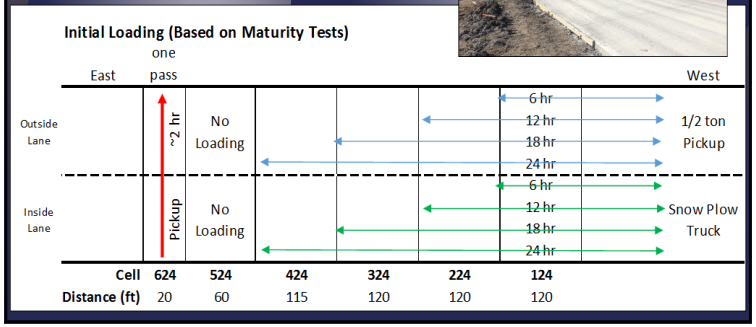
Pavement Details

- Standard panel size 12'W x 15'L
- Full depth concrete on grade
- Standard concrete mix
- Doweled joints



Early Opening to Traffic

- Initial Loading
  - Half ton pickup truck
  - Snow plow truck

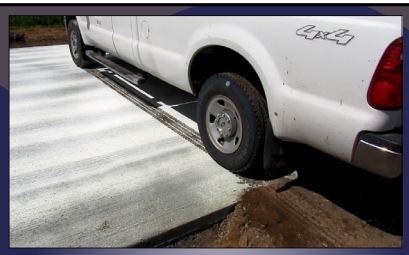


Initial Loading

- Cells 124 – 424
  - Half ton pickup truck
  - Outside Lane

Initial Loading

- Cell 624
  - 2-hrs (hot day)

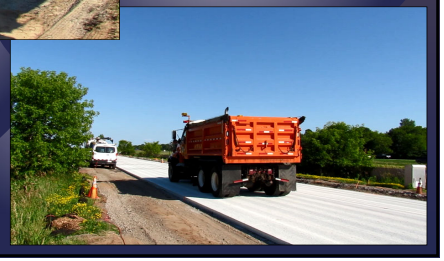


Inside Lane

Outside Lane

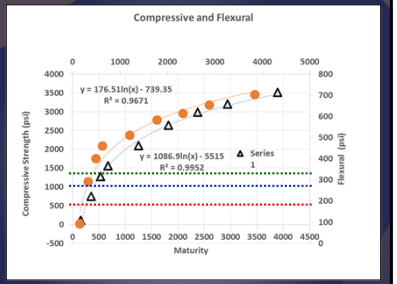
Initial Loading

- Cells 124 – 424
  - Snow plow truck
  - Inside Lane



Initial Loading

- Cells 124 – 424
- Cell 524 not loaded early
  - Control



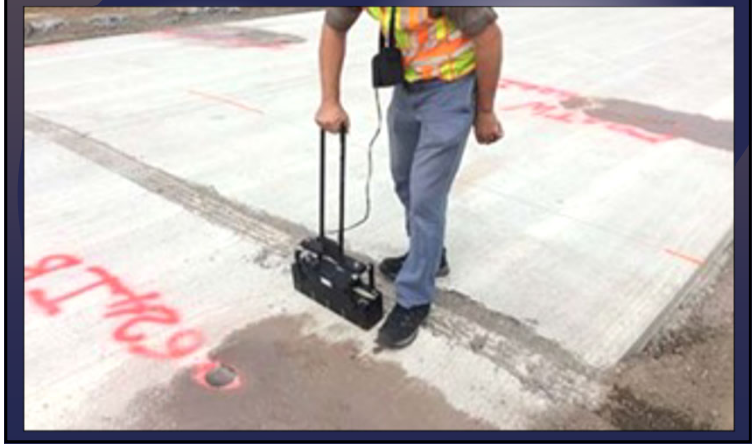
Cell x24 Early Loading Sequence		
Maturity (Deg-Hr)	Flexural (psi)	Loads applied to lanes
100	73	1st Load on Cell 124 (forward and back)
200	196	1st Load on Cell 224, 2nd load on Cell 124
300	267	1st Load on Cell 324, 2nd load on Cell 224, 3rd load on Cell 124
400	318	1st Load on Cell 424, 2nd load on Cell 324, 3rd load on Cell 224, 4th load on Cell 124
Starting Day 2, 5 passes per day for first week		

Reduced Cementitious Content

Objectives

1) Investigate the early-age characteristics of concrete paving mixes containing low cementitious content
2) Assess the potential for durability issues with very low cementitious content
3) Identify effect of reduced cementitious content on long term serviceability and economics of concrete pavements
4) Develop recommended specifications, mixing and placement practices for the use of low cementitious content concrete mixes

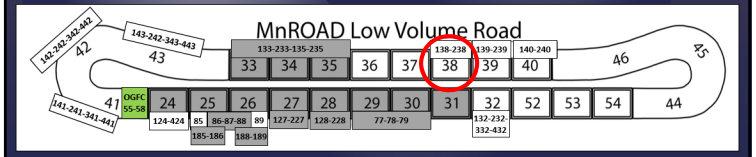
Early Opening to Traffic



Reduced Cementitious Content

- Two Cells (138 & 238)
- Cells will be exposed to deicing agents
- Cell Lengths:

Cell No.	138	238
Length	258 ft.	260 ft.



Reduced Cementitious Content

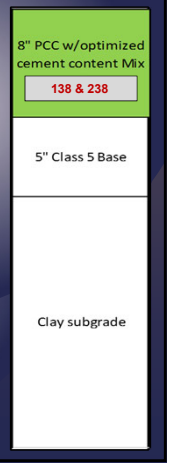
Pavement Details

- Standard panel size 12'W x 15'L
- Full depth concrete on grade
- Doweled Joints
- Cell 138

- Cementitious content = 500 lb./cy

- Cell 238

- Cementitious content = 470 lb./cy

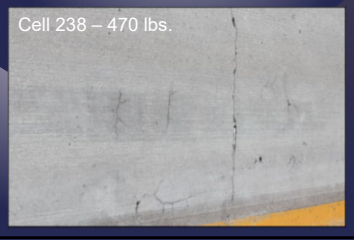


Compacted Concrete for Local Streets

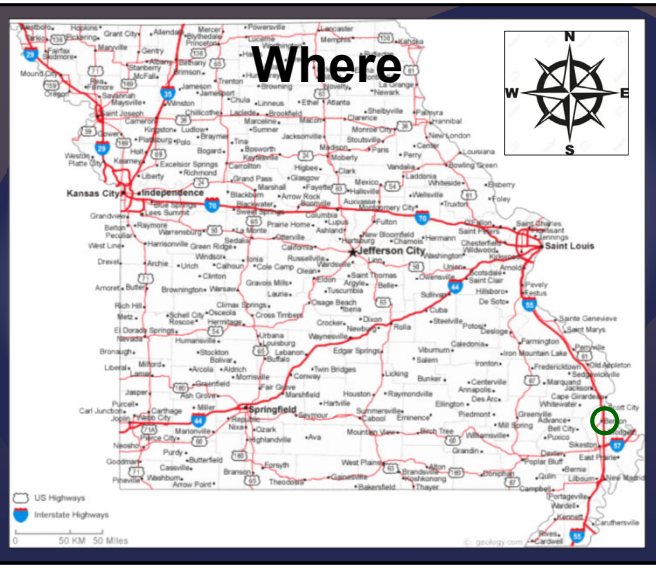
Objectives

1) Evaluate the feasibility of producing and placing compact concrete pavement
2) Evaluate overall field performance
3) Determine if longer joint spacing can be utilized
4) Evaluate the effectiveness of utilizing macro fibers for load transfer

Reduced Cementitious Content



Where



NRRA Involvement

- Rigid Team selected CCP
  - Cost more than anticipated
- SE District added CCP to a project
  - Contract awarded
  - Asked if NRRA funds could be used for research
  - First NRRA satellite project

Test Sections

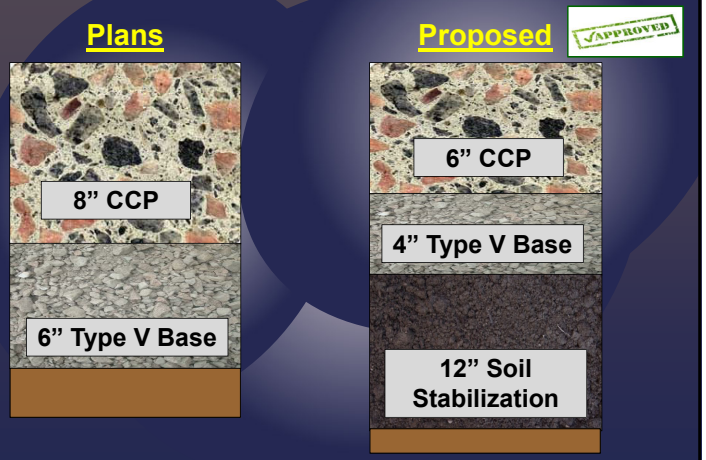
Constructed three test sections (SBL's)

- Test Section No. 1 (495 ft.)
  - 15 ft. joint spacing
  - No fibers
- Test Section No. 2 (504 ft.)
  - 12 ft. joint spacing
  - No fibers
- Test Section No. 3 (255 ft.)
  - 15 ft. joint spacing
  - 5 lbs./C.Y. macro fibers utilized (2" length)

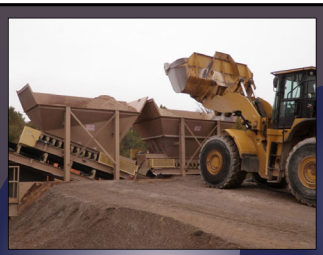
Project Location

- Outer Road – East side of I-55
- Scott County
- Approx. 2 miles
- Test Strip on Oct. 24, 2018
- Full Production started on Oct. 25, 2018
  - SBL placed first

Pavement Structure

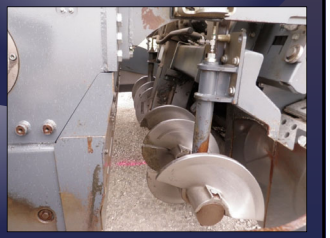


Concrete Plant

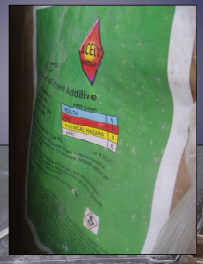



High Density Paver



Adding ACEit Admixture


CCP Placement



Finishing CCP

Curing

Texturing CCP

Sawing

Test Sections


Test Section No. 1


Test Section No. 2


Test Section No. 3

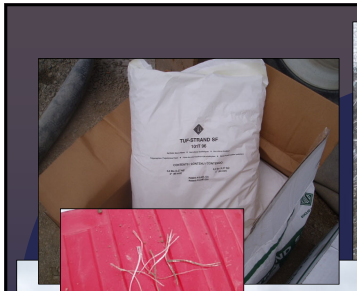
Performance – May 2020


Test Section No. 1


Test Section No. 2


Test Section No. 3


Test Section No. 1



Test Section No. 3

Interested

- If interested in joining contact:

Glenn Engstrom (Email: glenn.engstrom@state.mn.us)

or

Ben Worel (Email: ben.worel@state.mn.us)

- The pool fund solicitation is posted at:

https://www.pooledfund.org/Details/Solicitation/1531

Questions

Email: Brett.Trautman@modot.mo.gov
Office: 573-751-1036