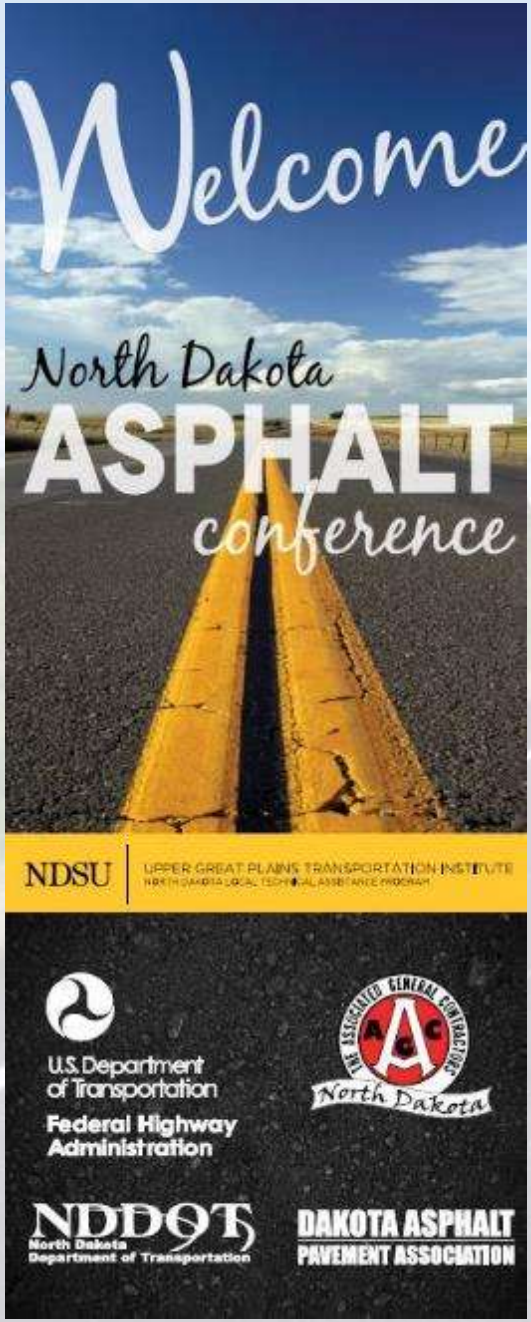


MnROAD/NRRA Pavement Preservation Efforts

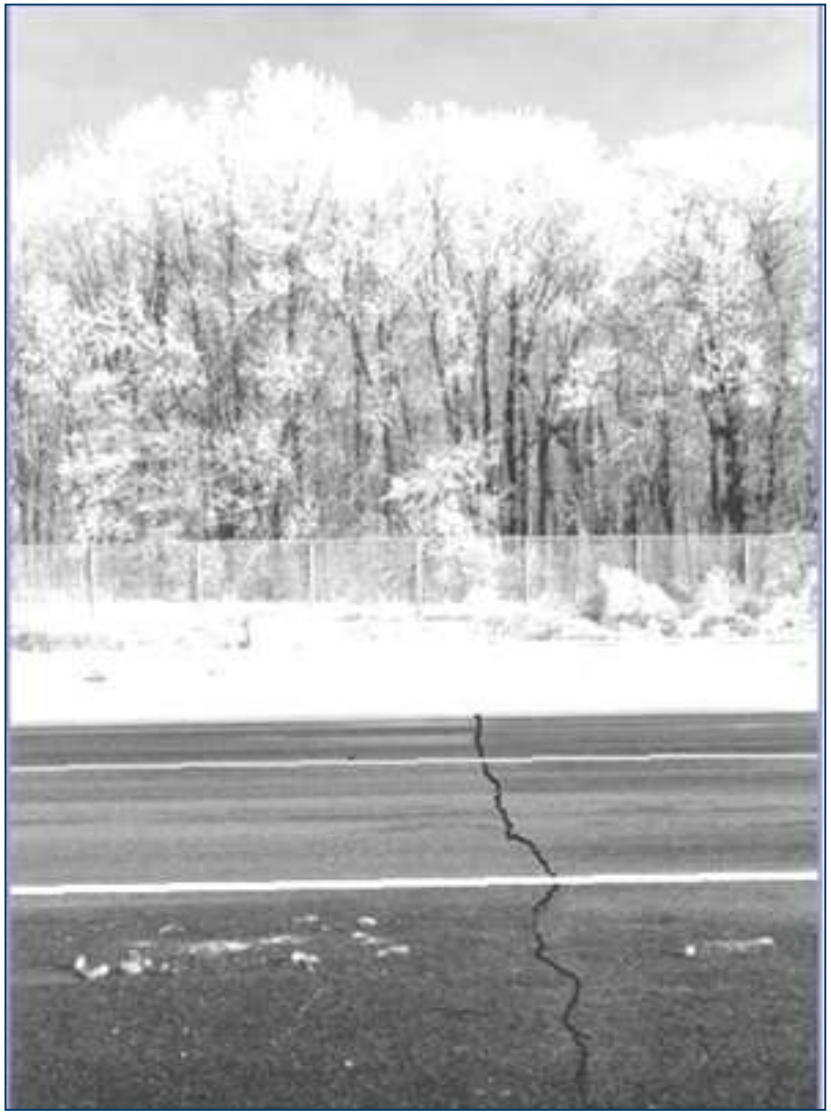
Ben Worel – MnROAD Operations Engineer
Ben.worel@state.mn.us

DEPARTMENT OF TRANSPORTATION

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**

Low Volume Road

- Local Road Research Board
- (MN - City and Counties)
- 19 Studies / 49 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

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)

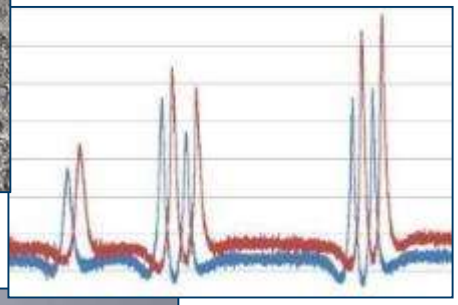
Rigid ~ 1.2 Million ESALs/yr

Flexible ~ 0.8 Million ESALs/yr

MnROAD Operations Support

- **Research Development**
- **Partnerships**
- **Construction**

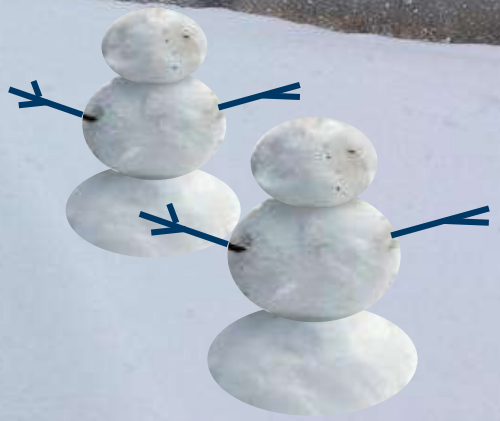
- **Traffic Loadings**
- **Performance Monitoring**
  - Pathways Van
  - Cracking / Rutting / Ride / FWD, …..



- **Sensors**
  - Static (Environmental)
  - Dynamic (Traffic Loading)

- **MnROAD Database**

MnROAD Winter Operations



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

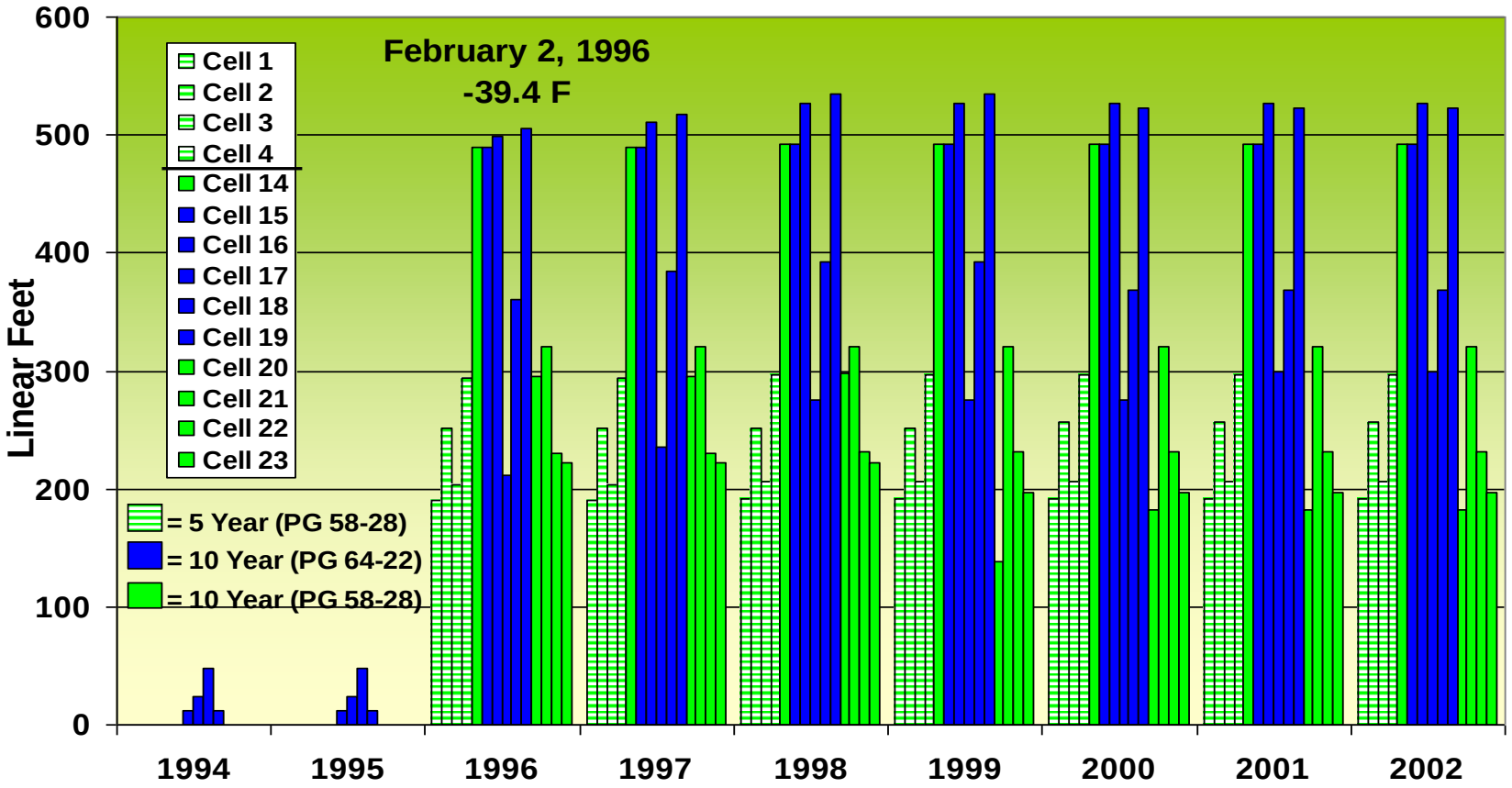
Phase-2

5:1 B/C Ratio

Surface Characteristics (HMA/PCC), Pervious Pavements, Implements Husbandry, **Stabilized Full Depth Reclaimation**, 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

National Center for Asphalt Technology
NCAT
at AUBURN UNIVERSITY

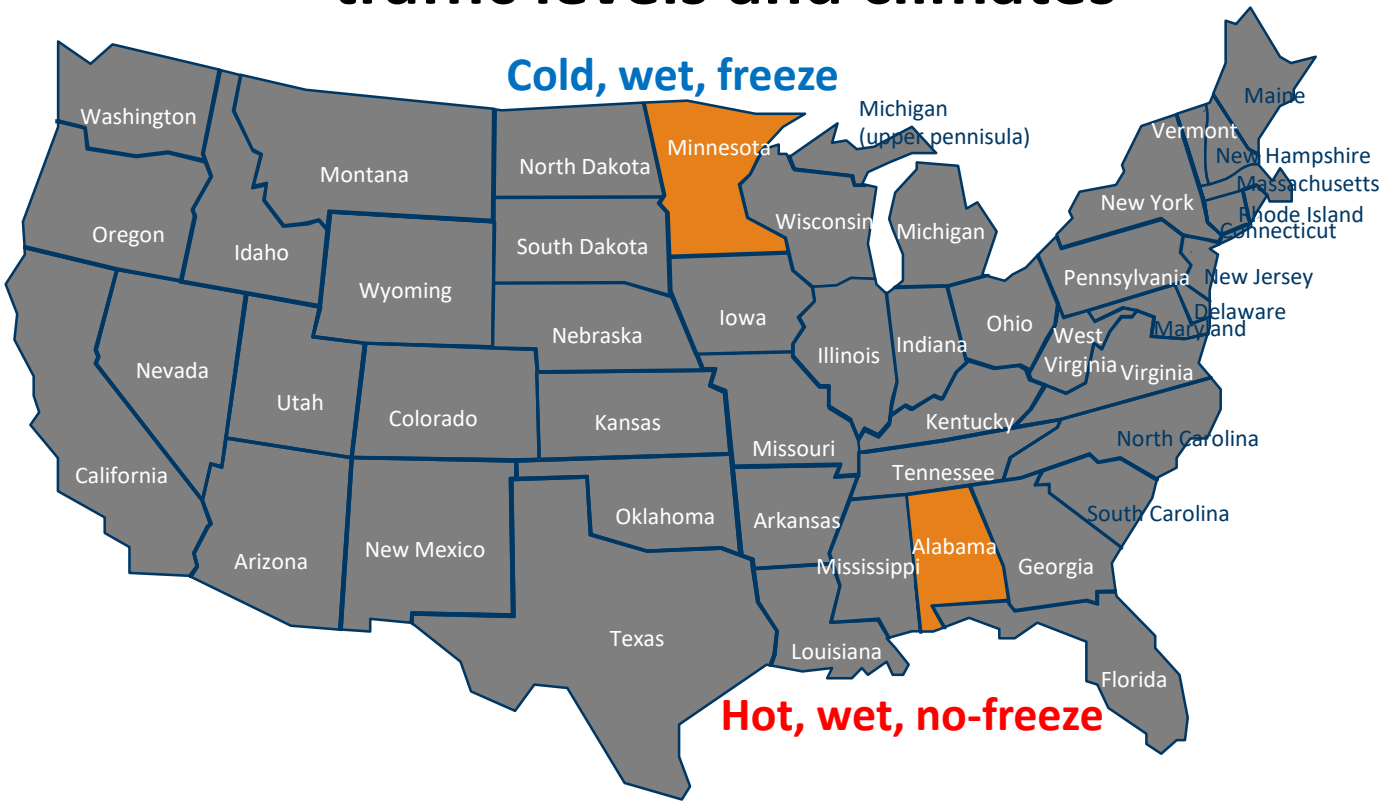
DEPARTMENT OF TRANSPORTATION

Development of a National HMA Cracking Test

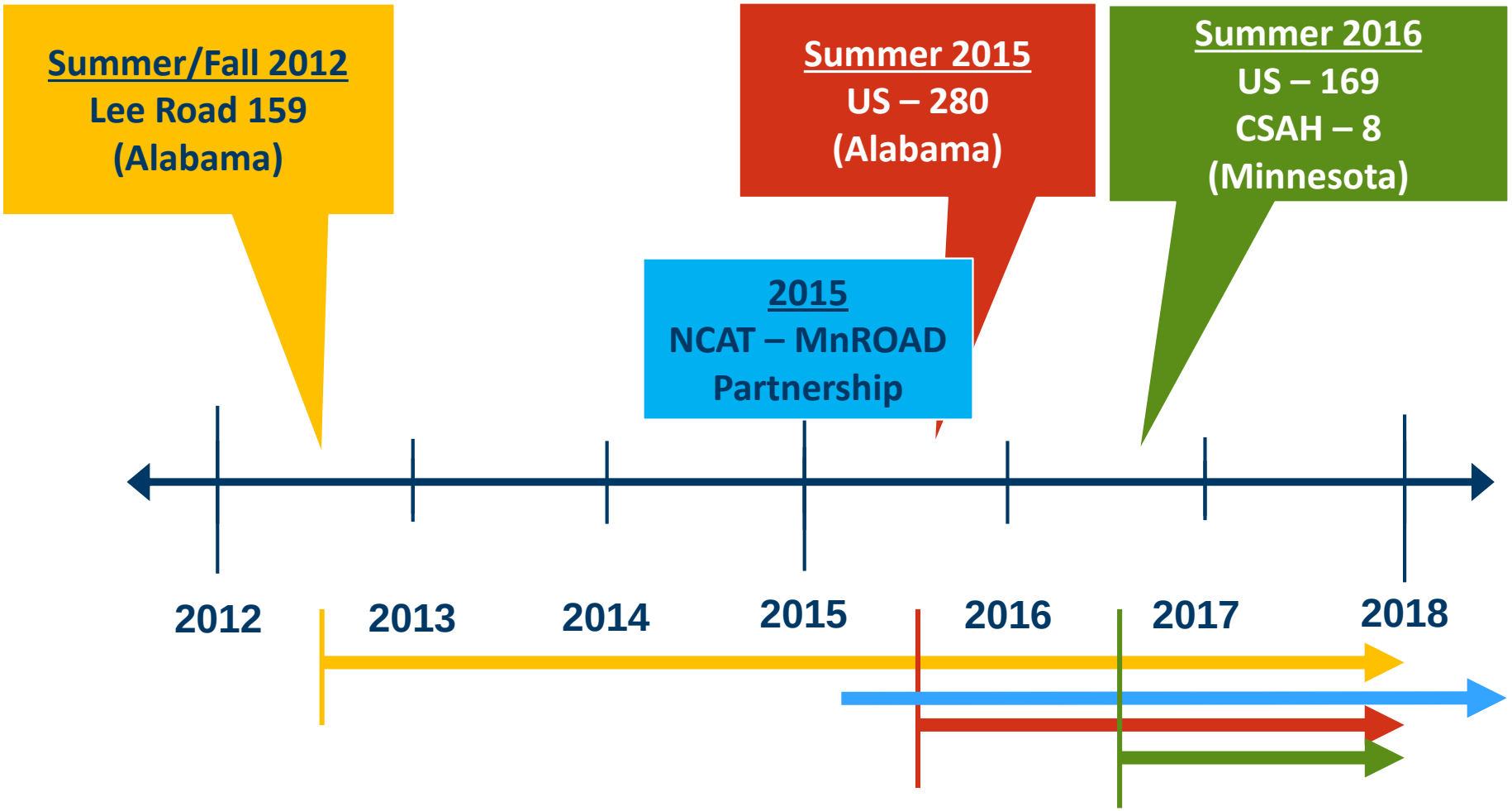
National Pavement Preservation Study

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



MnROAD/NCAT Partnership

- **Partnership**
  - Build Off of Lee Road 159 Experience
  - MnROAD (North) / NCAT (South)
    - Offsite Low and High Volume Road Installations
  - FP^2 / 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

DEPARTMENT OF TRANSPORTATION

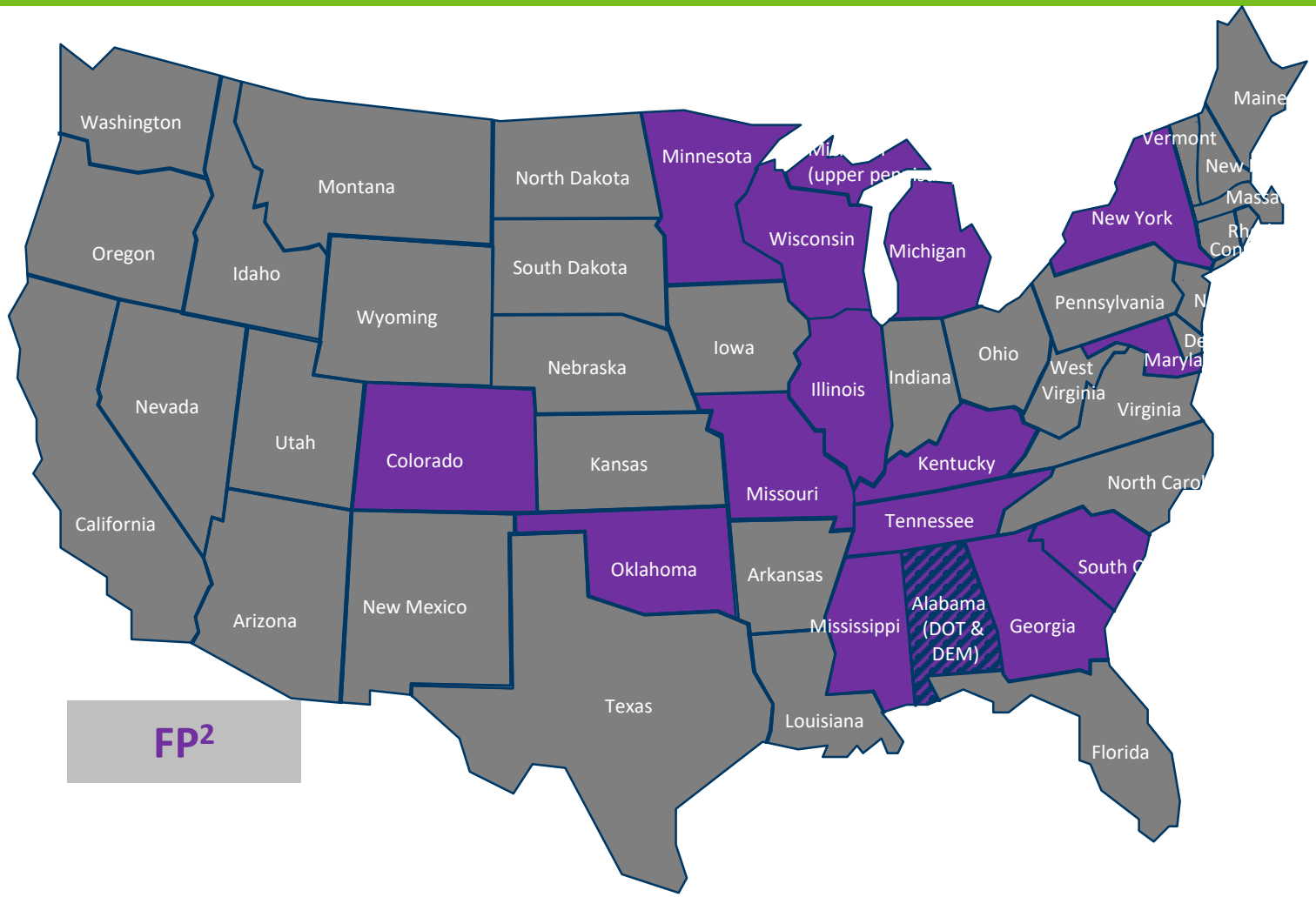
National Center for Asphalt Technology NCAT at AUBURN UNIVERSITY

FP^2

ncpp National Center for Pavement Preservation

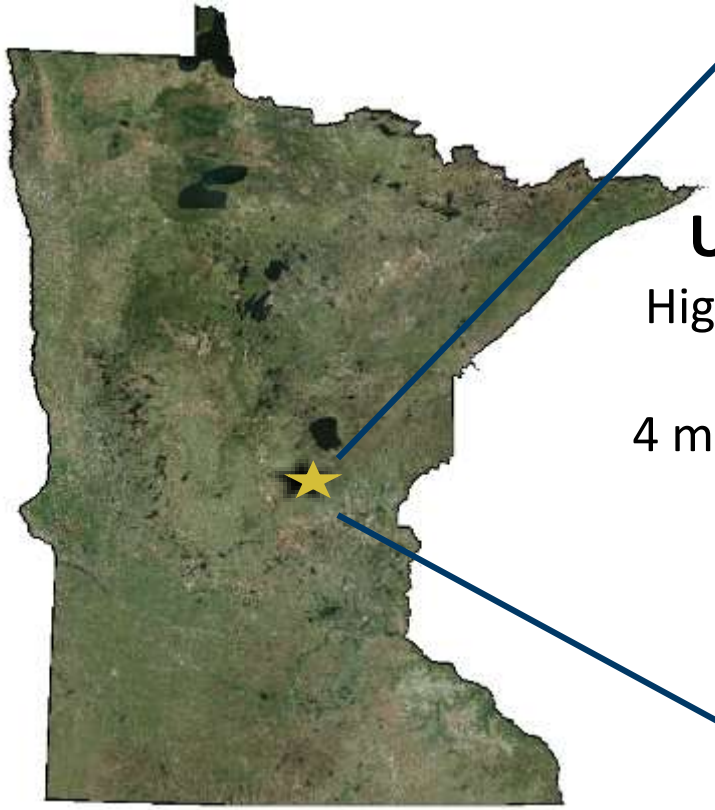
National Center for Pavement Preservation
MICHIGAN STATE UNIVERSITY
DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

2015-2018 Pavement Preservation Research Sponsors

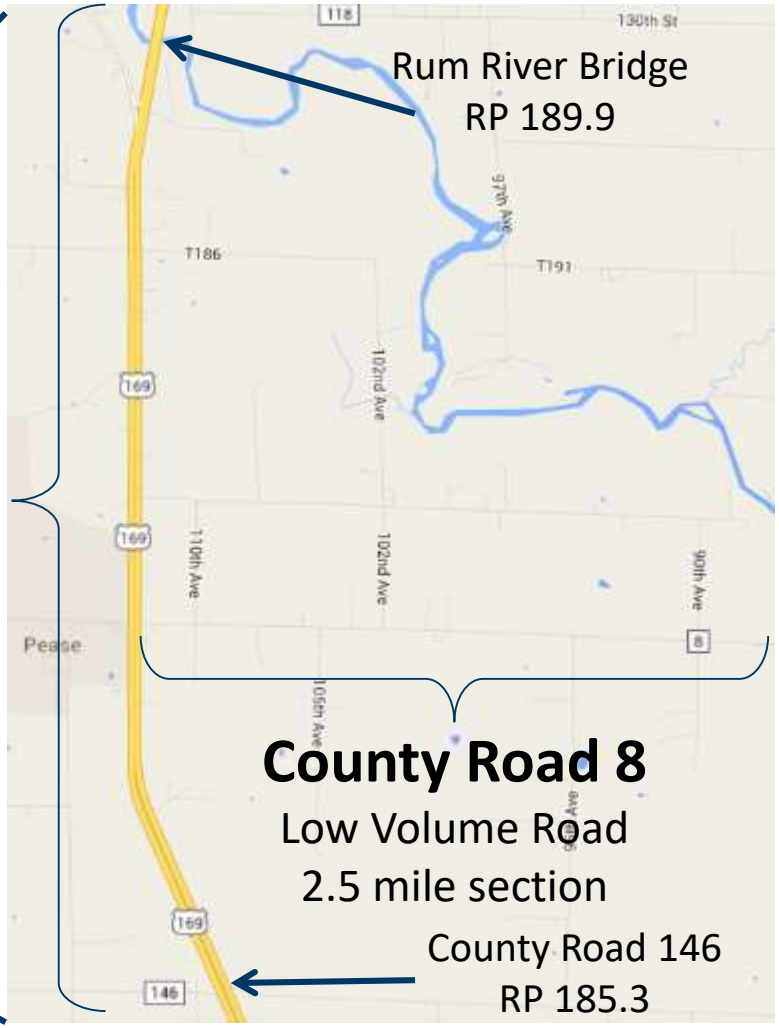


Northern Pavement Preservation

Mille Lac County

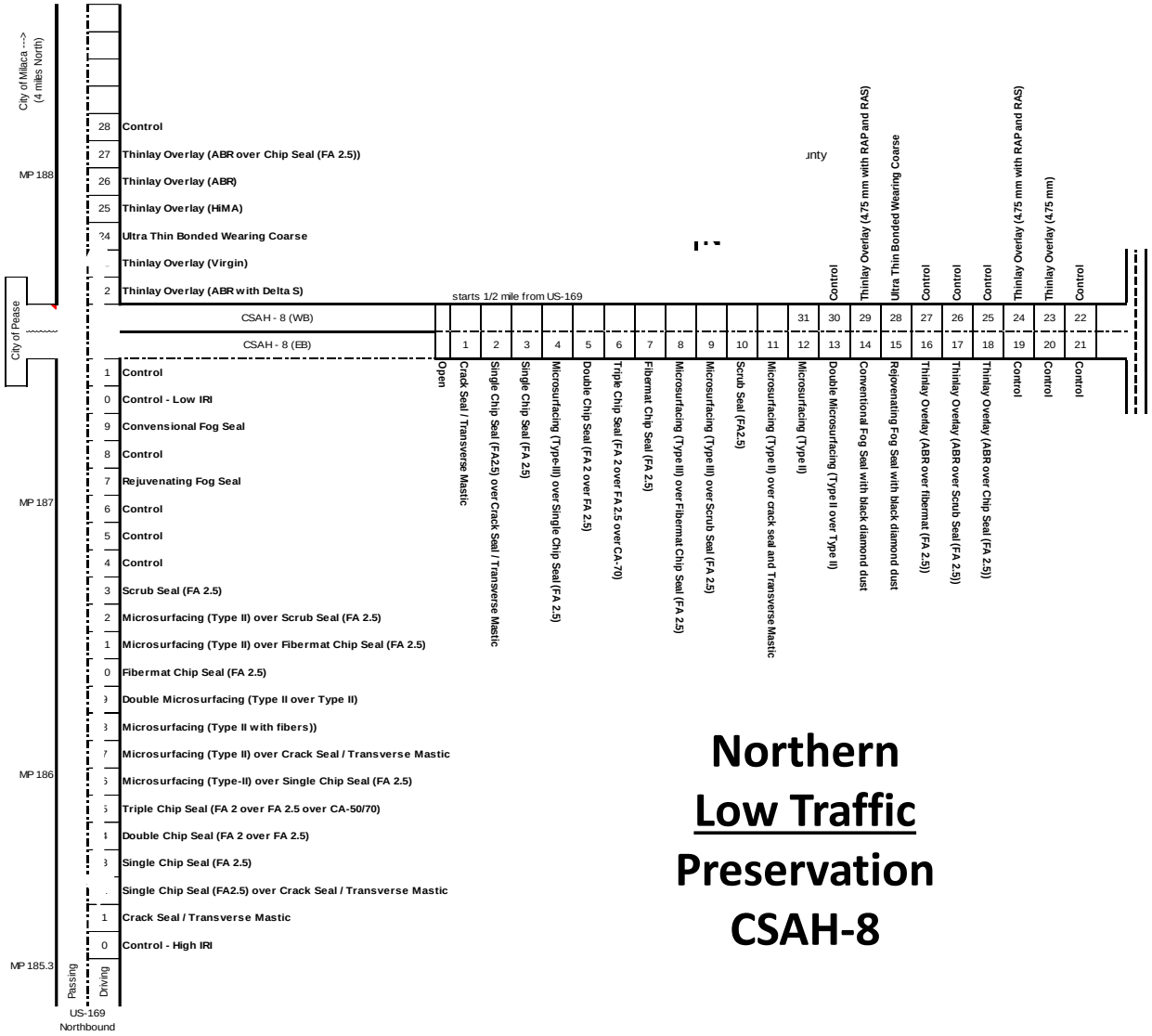


US-169
High Volume
Road
4 mile section



Northern Layout of US-169/CSAH-8

Northern
<u>High Traffic</u>
Preservation on US-169



Northern
<u>Low Traffic</u>
Preservation CSAH-8

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

<u>Built on US-280</u>

Cold Recycling + Thin Overlay

Cold-In-Place (CIR)

Cold Central Plant Recycle (CCPR)

Future Efforts?

Open Graded Friction Coarse “OGFC”

August 2016 – Hardrives Contractor

OGFC/PCC conventional tack
OGFC/PCC ultrafuse tack

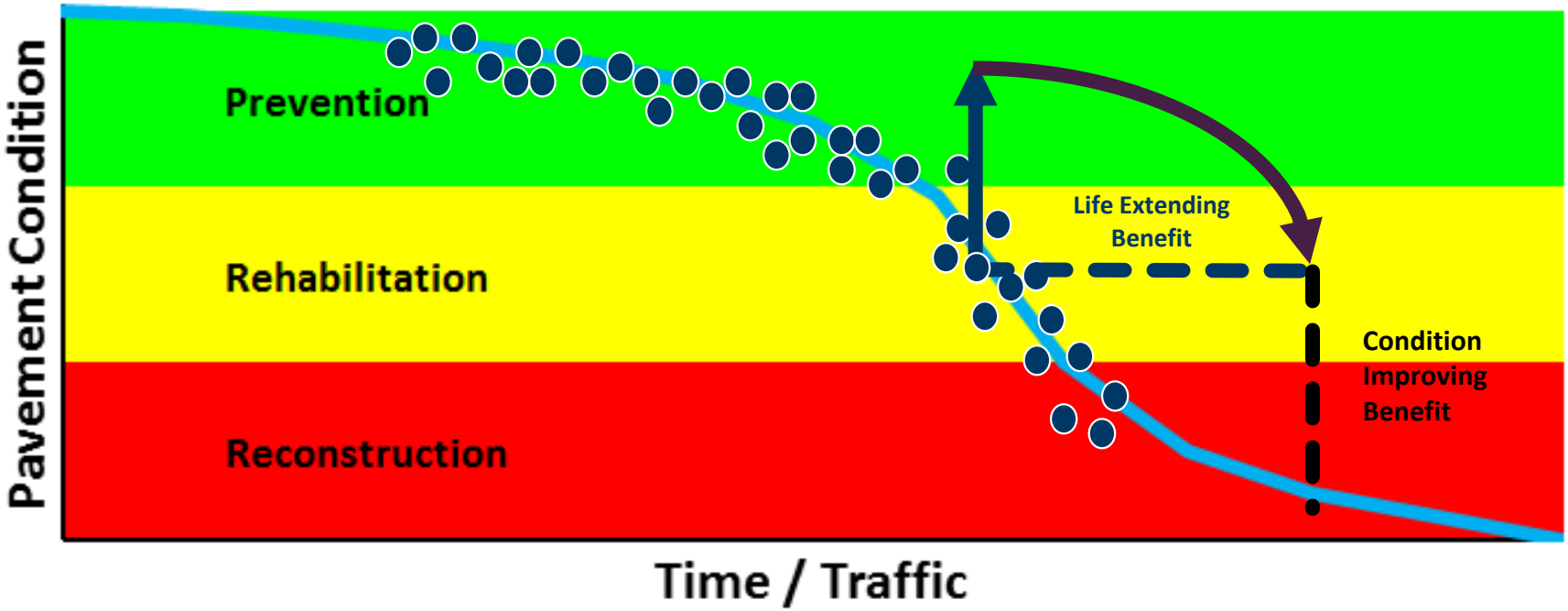
OGFC/HMA ultrafuse tack
OGFC/HMA conventional tack

Roadway Details

Roadway	LR-159	US-280	CSAH-8	US-169
Traffic volume	Low	High	Low	High
Thickness (inch)	5.5	9.9	7.0	6.5
Section length (feet)	100	528	528	528
# Test Sections	23	34	22	21
Age (Years) @placement	14	9	6	6

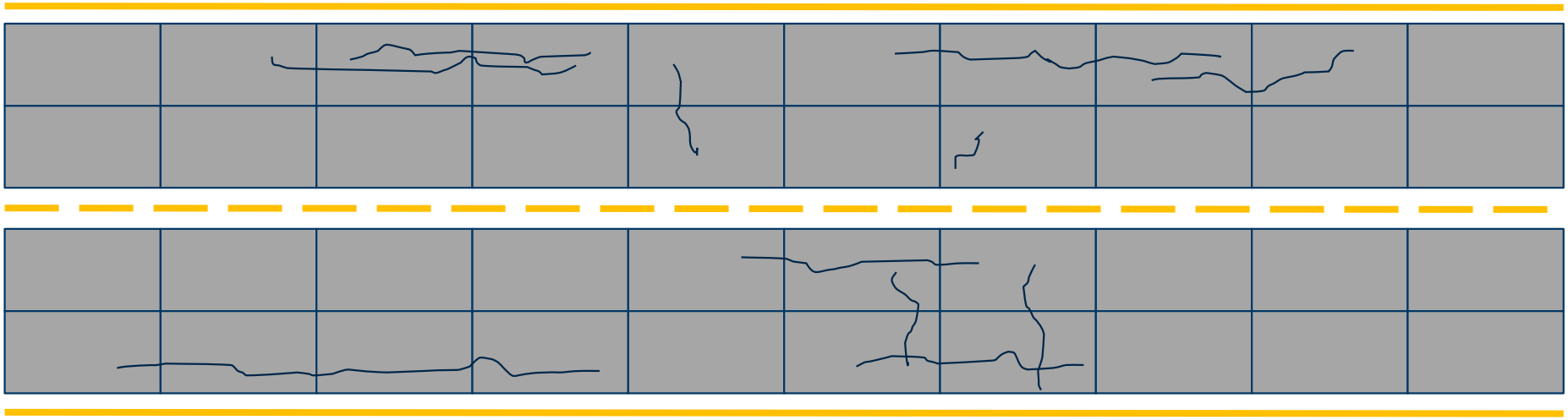
Knowns – Treatment Performance

Pavement Preservation Benefits/Analysis

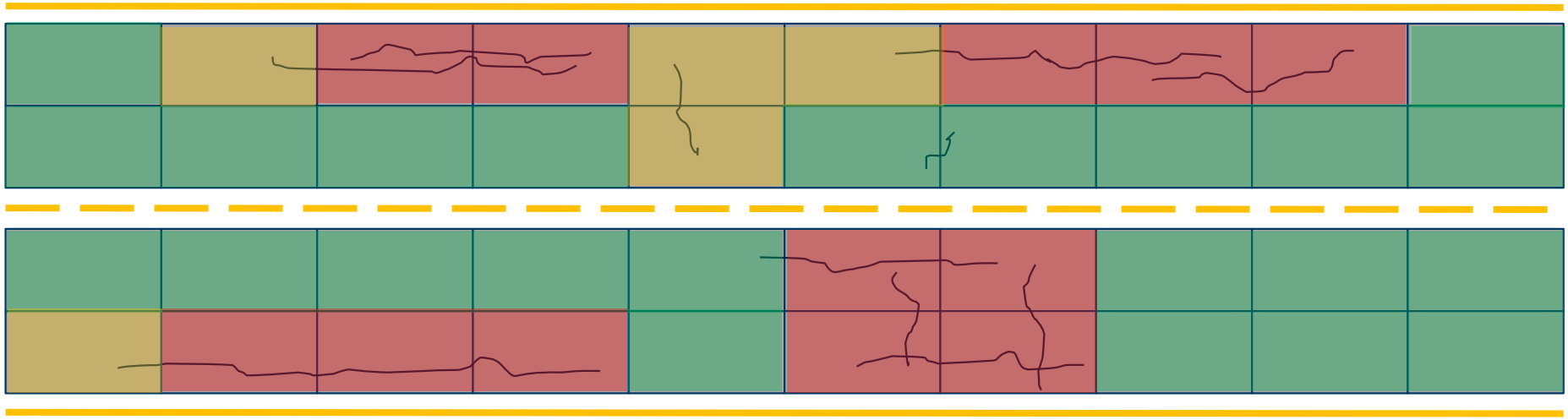


Test Section Layout - Assessment

Test Sub-Sections



Test Sub-Sections



Good: < 5%

Fair: 5 - 20%

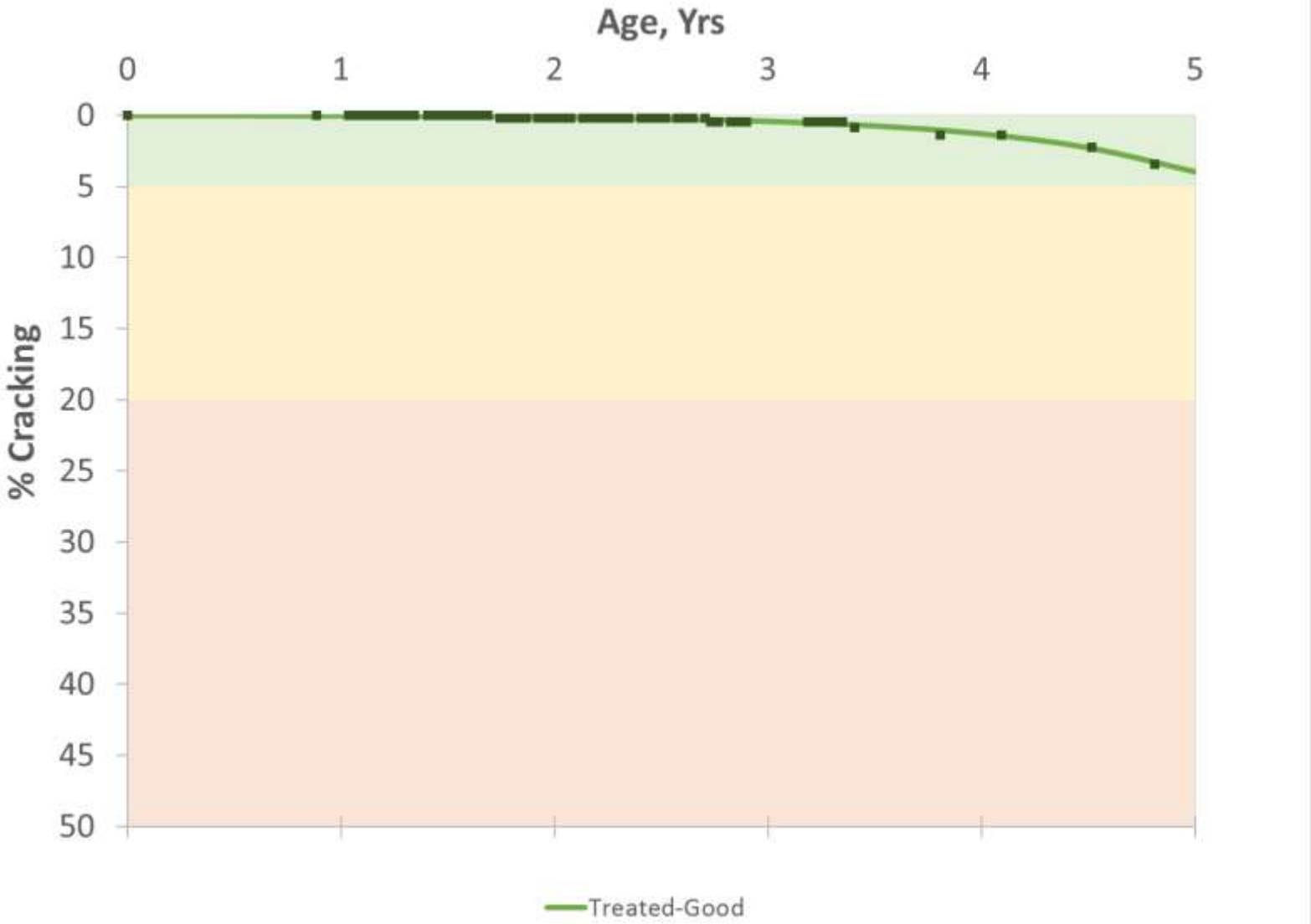
Poor: > 20%

Utilizing FHWA Performance Measures

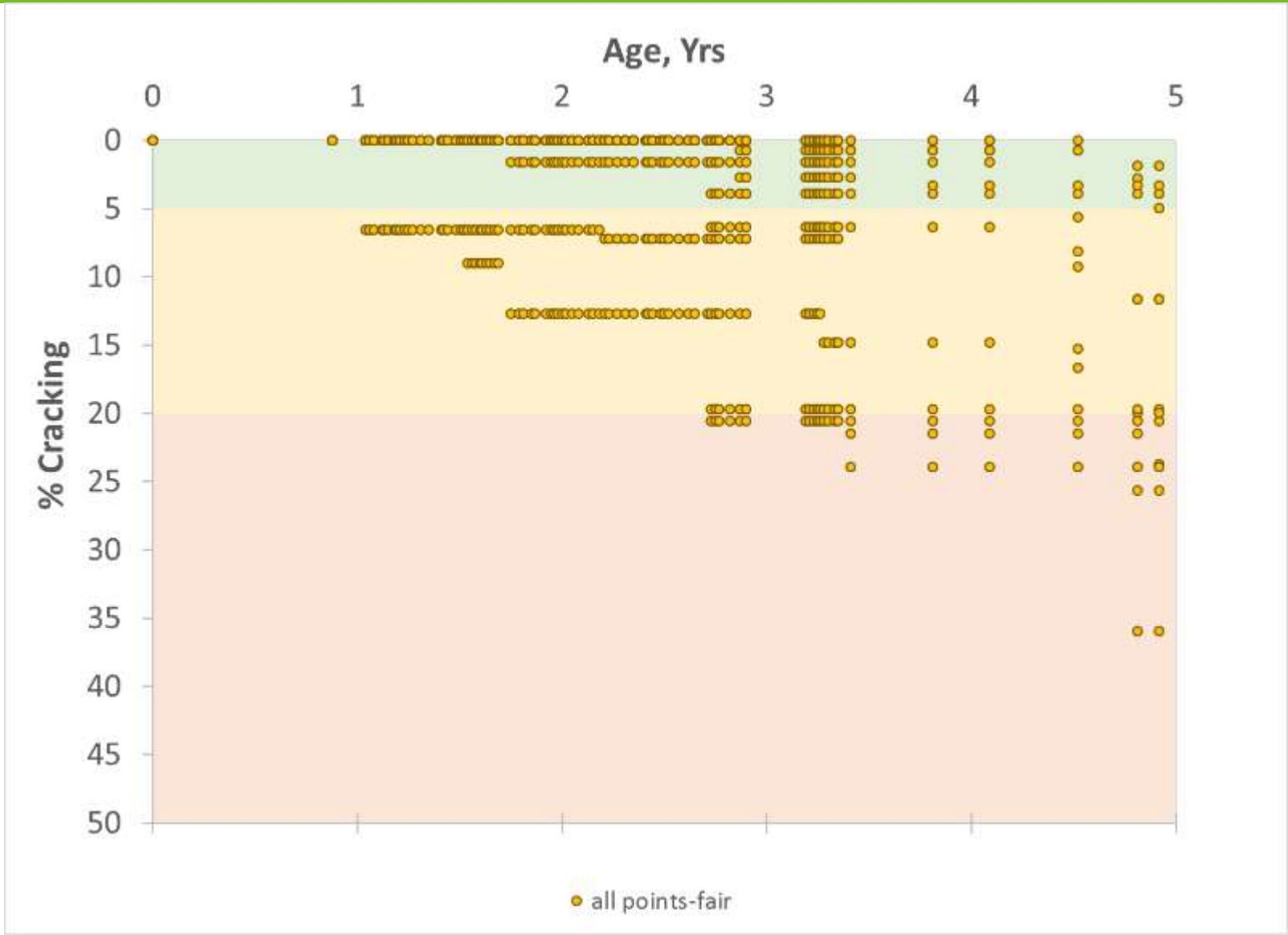
Test Sub-Section Analysis (all of the data)

Test Sub-Section Analysis (low severity data)

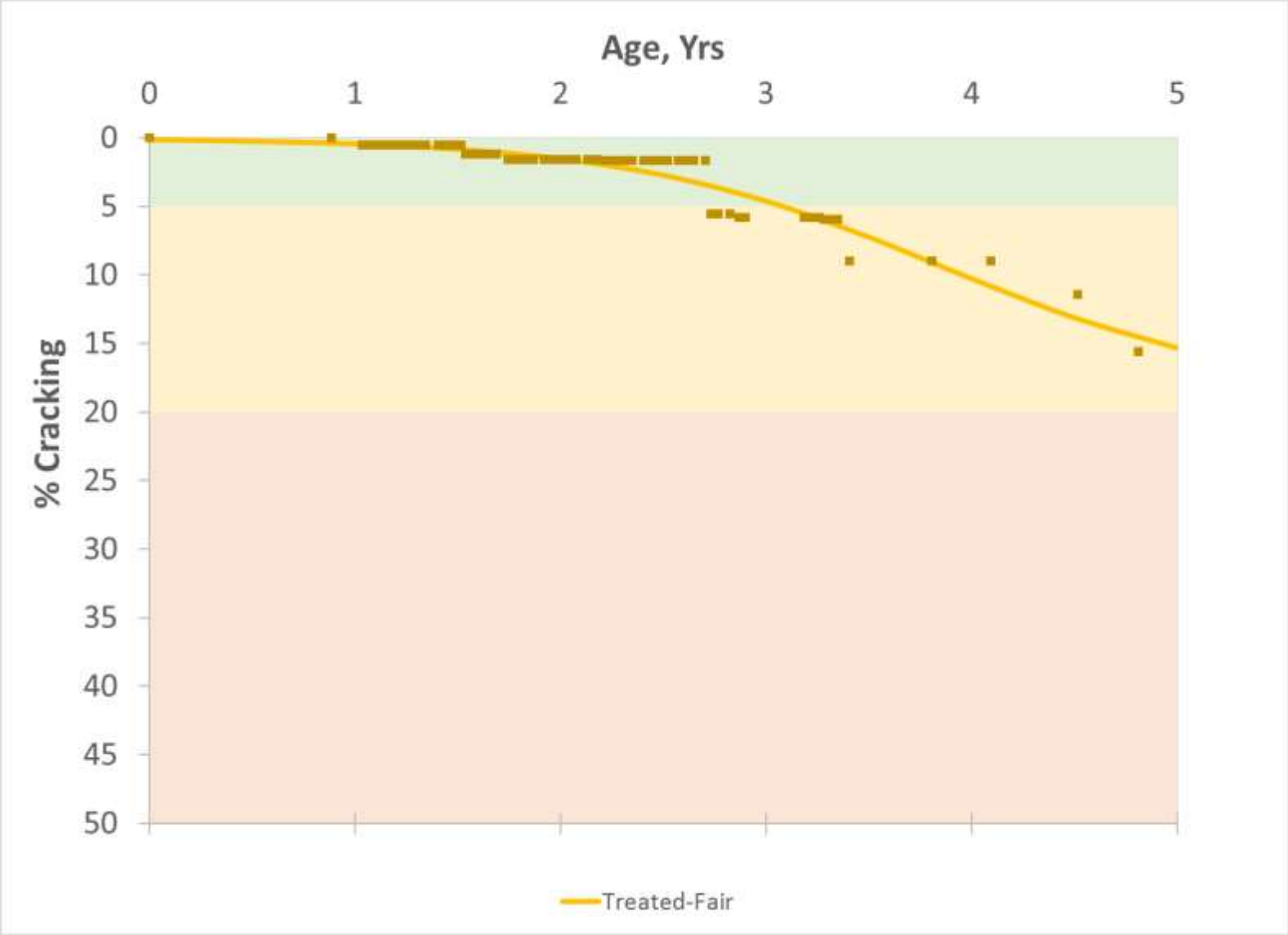
Test Sub-Section Analysis (low severity data)



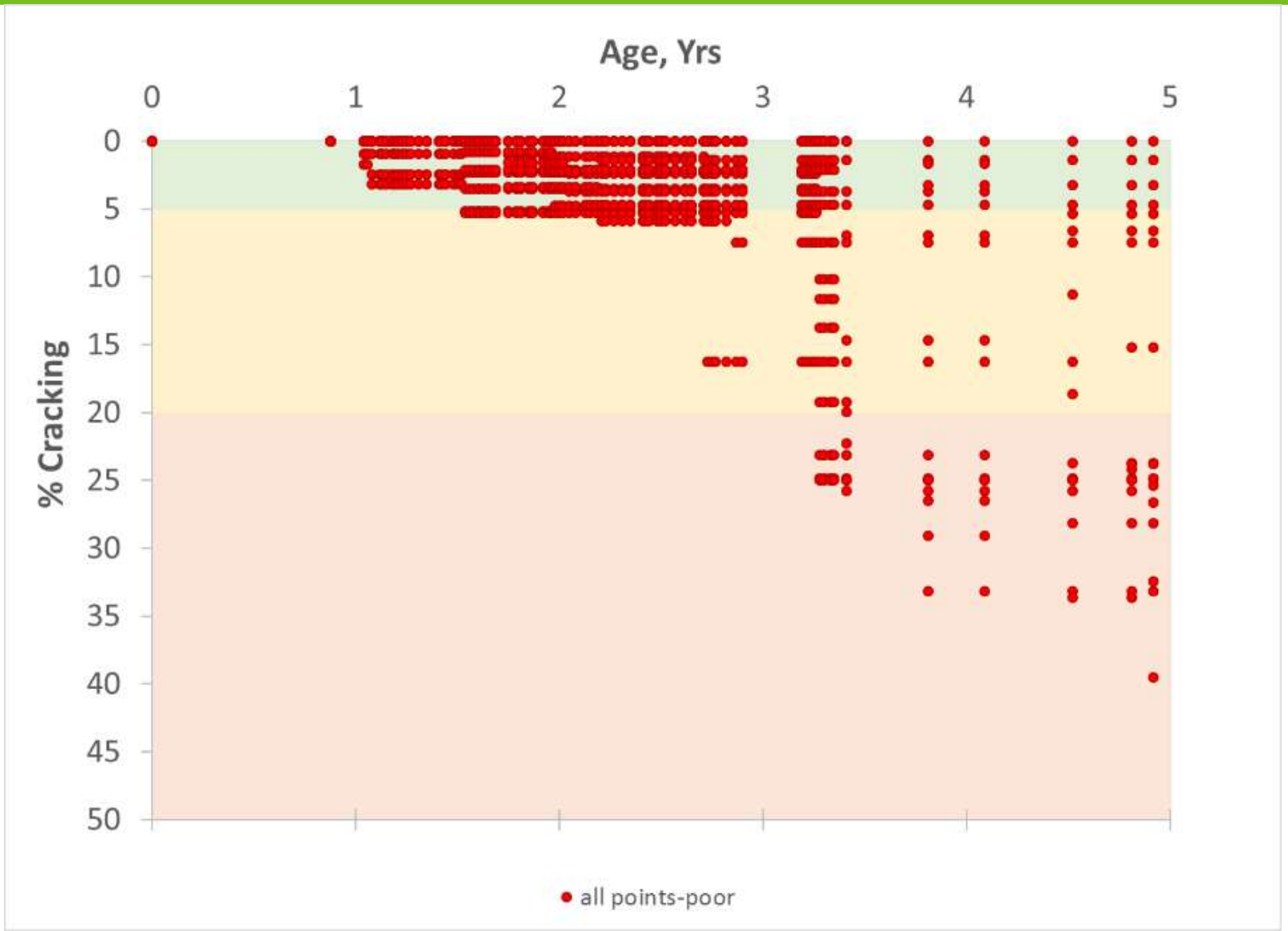
Test Sub-Section Analysis (fair severity data)



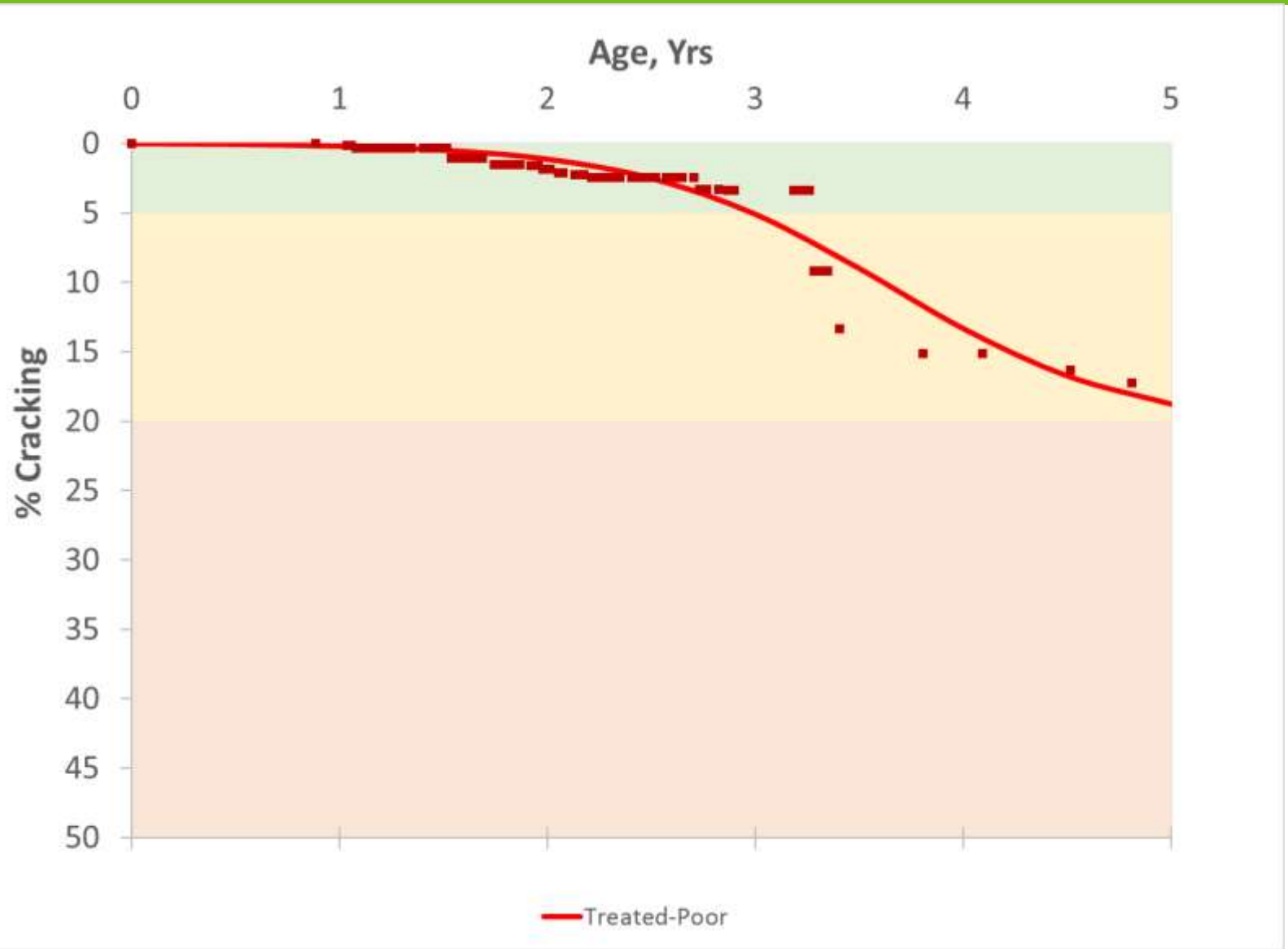
Test Sub-Section Analysis (fair severity data)



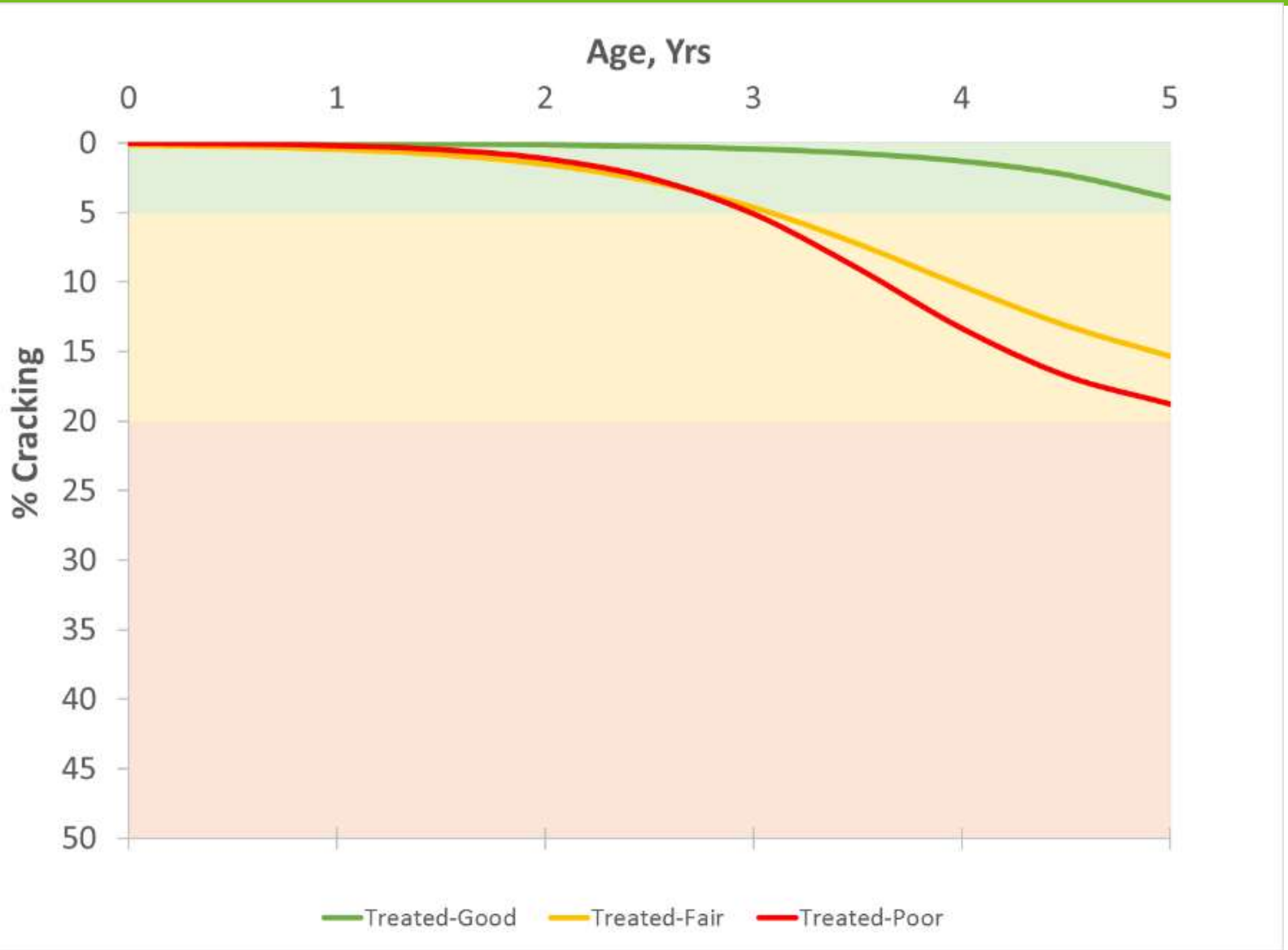
Test Sub-Section Analysis (poor severity data)



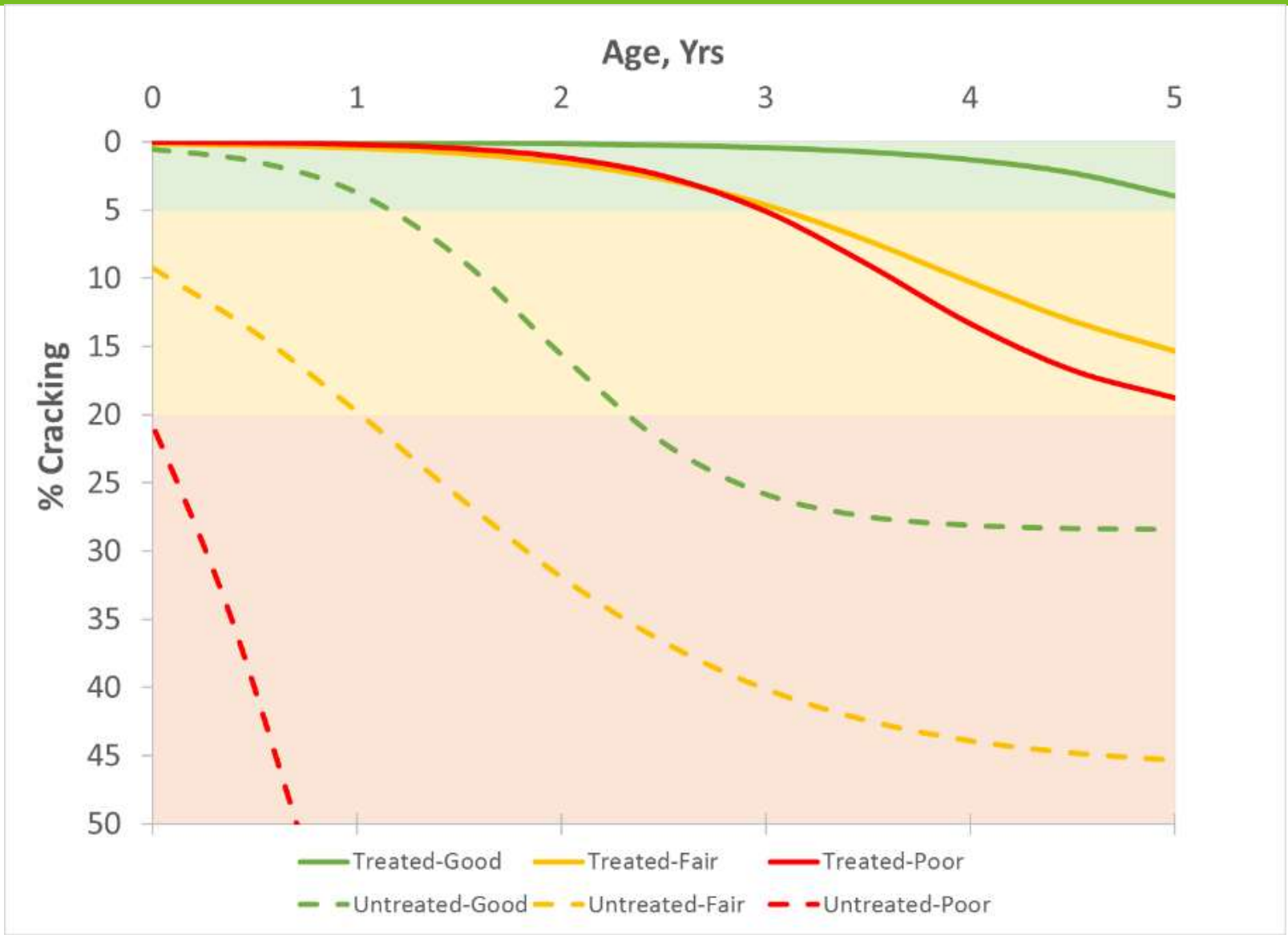
Test Sub-Section Analysis (poor severity data)



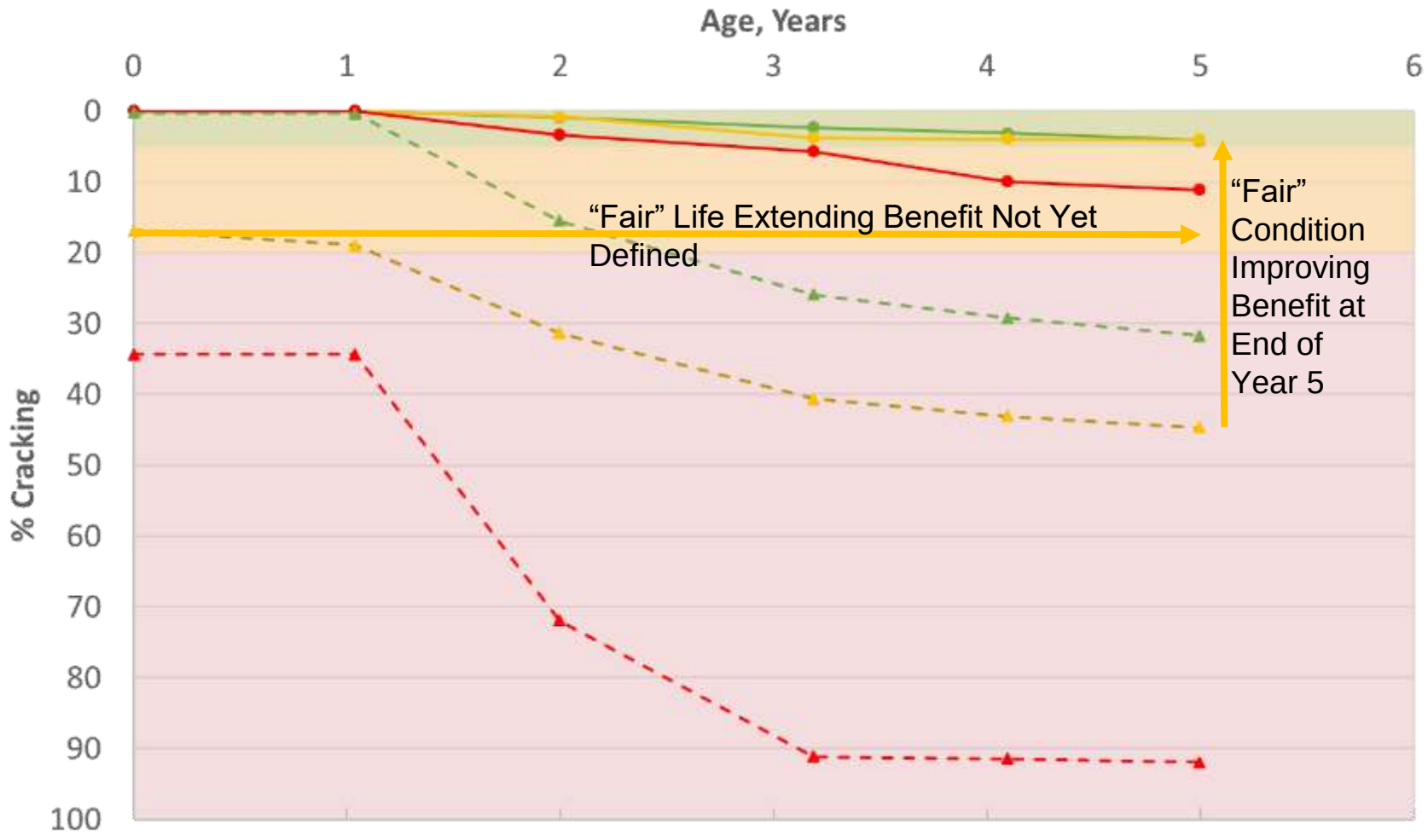
Test Sub-Section Analysis (all trends per severity data)



Test Sub-Section Analysis (compare to control subsections)

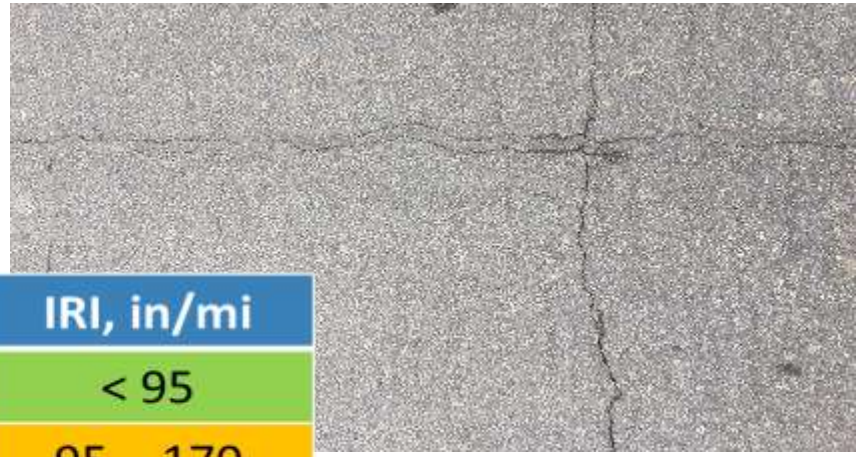


Test Sub-Section Example



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**



Category	% Cracking	Rutting, mm	IRI, in/mi
Good	< 5	< 5	< 95
Fair	5 – 20	5 – 10	95 – 170
Poor	> 20	> 10	> 170

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

DEPARTMENT OF TRANSPORTATION

National Center for Asphalt Technology NCAT at AUBURN UNIVERSITY

Phase – 1

NCAT Lead

(2015-2017)

- 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


NRRA
National Road Research Alliance
Strategic Implementation Through
Cooperative Pavement Research

NRRA
National Road Research Alliance

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

Develop Collaborate Research Implement Sustain.

NRRA
National Road Research Alliance

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

Develop Collaborate Research Implement Sustain.

National Road Research Alliance

Technology Transfer Short Term Research

NRRA Team	Topic
Flexible	Tack Coats
	Longitudinal Joint Construction Performance
Rigid	Design and Performance of Concrete Unbonded Overlays
	Repair of Joint Associated Distress Pavements
Geotechnical	Larger Subbase Materials
	Subgrade Design for New and Reconstructed Roadways
Pavement Maintenance	Surface Characteristics of Diamond Ground PCC Surfaces
	Pavement Preservation Approaches for Lightly Surface Roadways

SRF Consulting

Develop Collaborate Research Implement Sustain.

NRRA
National Road Research Alliance

Long Term Research

Flexible Team

Rigid Team

Team	Project	Contractor
Flexible	HMA Overlay of PC and Methods of Enhancing Compaction	University of New Hampshire
	Cold Central Plant Recycling	American Engineering and Testing
Rigid	Fiber Reinforced Concrete	University of Minnesota Duluth
	Early Opening Strength to Traffic	University of Pittsburg
	Optimizing Concrete Mix Components	Iowa State

NRRA
National Road Research Alliance

Long Term Research

Geotechnical Team

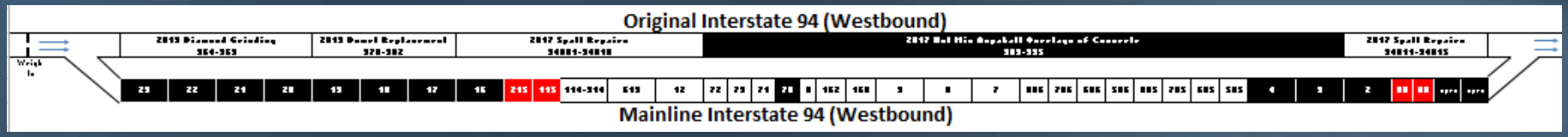
Pavement Maintenance Team

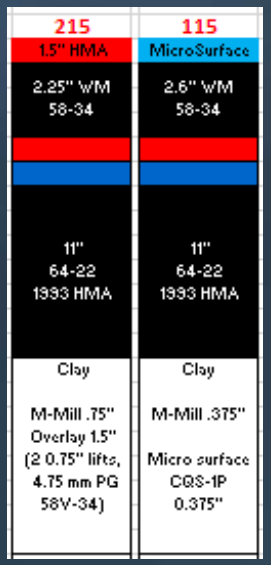
Team	Project	Contractor
Geotechnical	Recycled Aggregates	Iowa State
	Large Stone Subbase	
Pavement Maintenance	Maintaining Poor Pavements	SRF Consulting
	Partial Depth Repair	Braun Intertec

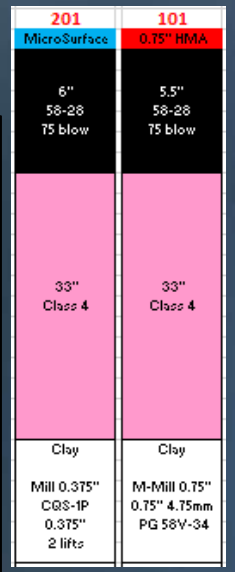
National Road Research Alliance

Preventative Maintenance Team

Maintaining Poor Roadways







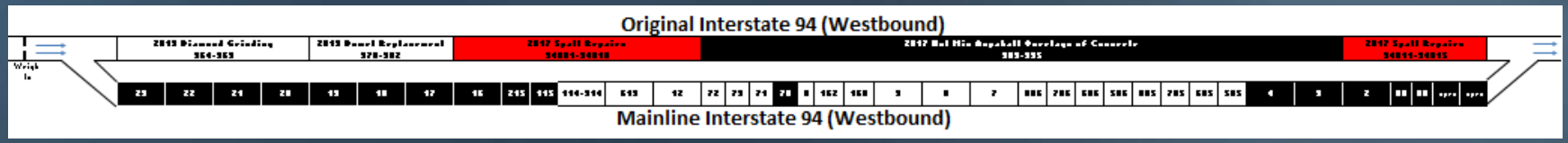
Goal - Best practices for maintaining existing asphalt and concrete roadways?

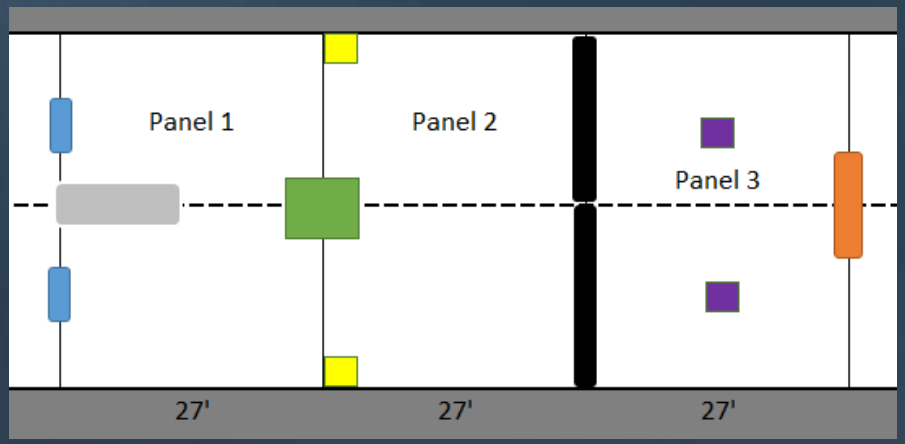
Develop ➔ Collaborate ➔ Research ➔ Implement ➔ Sustain.

National Road Research Alliance

Preventative Maintenance Team

Partial Depth Repair





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

Develop Collaborate Research Implement Sustain.

2018 NRRA Pavement Workshop
May 23-24, 2018

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**

NRRA
National Road Research Alliance

(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

Ben Worel
MnROAD Operations Engineer
ben.worel@state.mn.us