National Partnership

NCAT and MnROAD Pavement Test Tracks

Jerry Geib

Midwestern Pavement Preservation Partnership

September 30, 2015

We all have a stake in A to B

Presentation Outline

Describe NCAT and MnROAD

Define the Partnership

Pavement Preservation / HMA Performance Test

How to get Involved

HOW FP² WORKS FOR YOU

NCAT, MnROAD Partnership New Era in Preservation Study

By Tom Kuennen

A growing partnership between the National Center for Asphalt Technology in Alabama and the MnROAD research facility of the Minnesota DOT will advance research in preservation techniques for high-volume roadways.

It will do so by providing research in preservation techniques for both flexible [bituminous] and rigid [portland cement concrete] pavements, and supplying real world accelerated pavement preservation performance testing in both hot and cold climates.

And by leveraging economies of scale, it may deliver research products for a larger base of supportive agencies and private sector clients at lower buy-in costs. The partnership has the potential to play a much larger role in the national effort to validate pavement performance.

National Center for Asphalt Technology NCAT at AUBURN UNIVERSITY

MINNESOTA DEPARTMENT OF TRANSPORTATION

This new collaboration was a major theme of the SHRP2 R26 *Workshop for the Preservation of High Traffic Volume Roadways*, held in Minneapolis in early September (see article pp. 15-19). There it was announced that MnROAD and NCAT are partnering to advance pavement preservation research.

Sharing resources and expertise will improve coordination of experiments and expand evaluation of pavement performance in both northern and southern climates.

"Working together will help validate what's done at our facilities both north and south," said Benjamin Worel, P.E., MnROAD operations engineer. "MnROAD has built test pavements in the north and obtained results which southern states sometimes say do not pertain to them, because we're in a northern climate. The same thing goes for the northern states utilizing results from NCAT. But working together will allow more states to accept and use our combined research results and get more involved with both facilities. That will help implement pavement preservation techniques and boost how agencies go about implementing these types of results in more states than just those adjoining Alabama or Minnesota."

The collaboration also permits testing of PCC pavements and the inclusion of the results in comprehensive research products, which is not possible when NCAT works on its own.

"Our focus at the National Center for Asphalt Technology is flexible pavements," said Dr. Buzz Powell, P.E., assistant director, NCAT Test Track, Auburn, Ala. "The partnership with MnROAD can provide us the two things that we don't have at NCAT, the two Cs of *climate* and *concrete*. In the Deep South we have a very limited climate for testing pavement performance, and as Ben says, our clients are primarily in the southern half of the United States, and we don't have any concrete test sections. A partnership with MnROAD lets us leverage their cold weather conditions and concrete pavements that constitute a big part of the preservation picture."

TRACKS NORTH AND SOUTH

MnROAD and NCAT are full-scale test tracks that use real-world pavement construction, full-scale test tracks, and in the case of MnROAD, live interstate traffic on I-94 northwest of the Twin Cities, all under actual climate conditions that affect pavement performance. The combination of traffic, loading types and the range in climate conditions provide unique opportunities to address pavement performance issues.

The National Center for Asphalt Technology was established in 1986 as a partnership between Auburn University and the National Asphalt Pavement Association Research & Education Foundation.

NCAT has 46 different test sections on its 1.7-mile oval track. Sections are upgraded on three-year cycles by state DOTs, the Federal Highway Administration, and private industry. Sponsors have specific research objectives for their sections, and shared objectives for the whole track. The focus of research at the track has logically grown in conjunction with NCAT's expanding mission from just mix performance in the original 2000 research cycle, to both structural performance and pavement preservation in the just-ended (2012) fifth research cycle.

More recently, pavement preservation research has been a big part of NCAT's mission. Pavement preservation research at NCAT began in the facility's fifth cycle in summer 2012, and was initiated and sponsored by seven state DOTs, plus FP Inc. and its supporters. In addition to the track, pavement preservation test sections were placed on nearby Lee Road 159, with Dr. Mary Robbins serving as the principal investigator of the integrated research effort. While the fifth cycle of track tests has ended, preservation group research on Lee Road 159 will continue through March 2015, with the sixth cycle of testing at the track itself to begin later that year. NCAT researchers are optimistic that the 2012 Preservation Group study will continue as the "PG 15" study in the coming research cycle beginning in summer 2015.

Unlike NCAT, MnROAD is owned and operated by the Minnesota DOT near Albertville, some 40 miles northwest of Minneapolis. Established in 1994, the test track consists of a 3.5-mile interstate (1-94) high-volume roadway, and a 2.5-mile closed loop low volume road simulating rural roads. The interstate

Minnesota DOT's MnROAD facility track consists of a 3.5-mile interstate (I-94) high-volume roadway, and a 2.5-mile closed loop low volume road simulating rural roads.

Dr. Buzz Powell, P.E., assistant director, NCAT Test Track, and Benjamin Worel, P.E., MnROAD operations engineer, anticipate research partnership during 'Ight-Volume Roadway Workshop in Minneapolis in early September

The NCAT test facility has 46 different test sections on its 1.7-mile oval track


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


MnROAD
Office of Materials and Road Research
Built along
Existing I-94


MnROAD
Office of Materials and Road Research
MnROAD
"Mainline",
Westbound
Interstate-94
W.B. I-94 Traffic Diverted
(3 days / month)


MnROAD
Office of Materials and Road Research
MnROAD "Low Volume Road"
Controlled Access

MnROAD

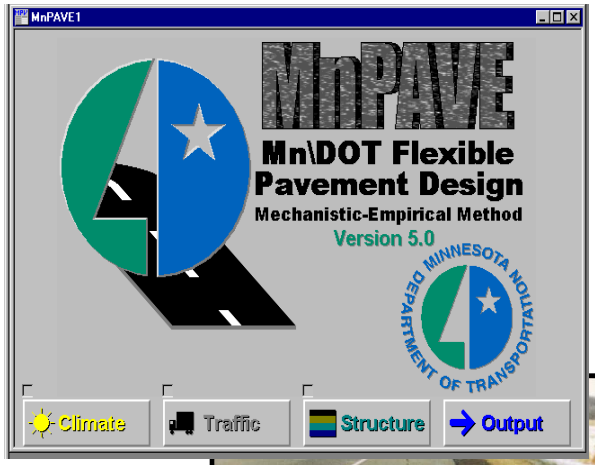
- **MnROAD Designs**
  - ~50 Test Cells (500’ long)
  - Asphalt and Concrete
  - New and Rehabilitation
  - Sensors and Performance Monitoring
  - Real Traffic Loadings
  - Low Impact / Risk to the Public

- **Three Major Experiments**
  - Phase I (1994-2006)
  - Phase II (2007-2017)
  - Future Phase III (2018 - 2028)

MnROAD Benefits

- **Phase I (1994-2006)**
  - **Saves $33 million Annually**
  - Seasonal Load Limits
  - Spring Restrictions / Winter Overloads
  - Improved Design Methods
- **Phase II (2007-2018)**
  - **Saves $10.4 million Annually**
  - HMA Rehabilitation
    - Whitetopping
    - Full-depth Reclaimation
  - Improved base designs

- <u>Future</u> Phase III (2018 - 2028)
  - Expect similar benefits



National Center for Asphalt Technology

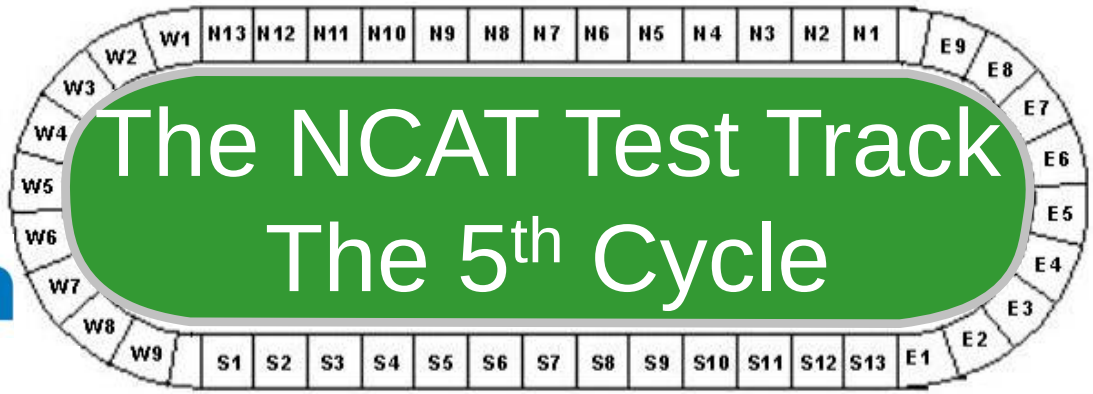
NCAT

at AUBURN UNIVERSITY


NCAT Established in 1986
Test Track Established in 2000
1.7 Mile Oval
46 (200’) Test Sections
3 Year Cycles

5 Triple Trailers
Two-8 hour Shifts
5-Days/Week
3 Year Cycle ~ 10 million ESALS

NCAT Partners Cycle #5 (2012-2015)



2015 Construction Cycle #6


U.S. GOVERNMENT
DOT 40935


NCAT
ARAN
ARAN

Lab Testing

Partnership Vision for Nationwide Impact

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National Center for Asphalt Technology NCAT at AUBURN UNIVERSITY

To facilitate high value pavement research that addresses national needs using full-scale pavement testing facilities in both warm and cold climates on flexible, rigid, and composite pavement structures.

MnROAD & NCAT Partnership

- Development
  - Informal in the past
  - June 2014 @ MnROAD
  - October 2014 @ NCAT
  - Formalized in 2015
  - FP^2 / NCPP Participation
- Partnership Benefits
  - Individual Strengths of Each Other
  - Operations / Data Sharing / Analysis
  - Create Greater National Appeal


October 2014 @ NCAT

MnROAD-NCAT Focus

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<u>Focusing on 2 National Research Needs</u>

National Pavement Preservation Study

Development of a National Cracking Test

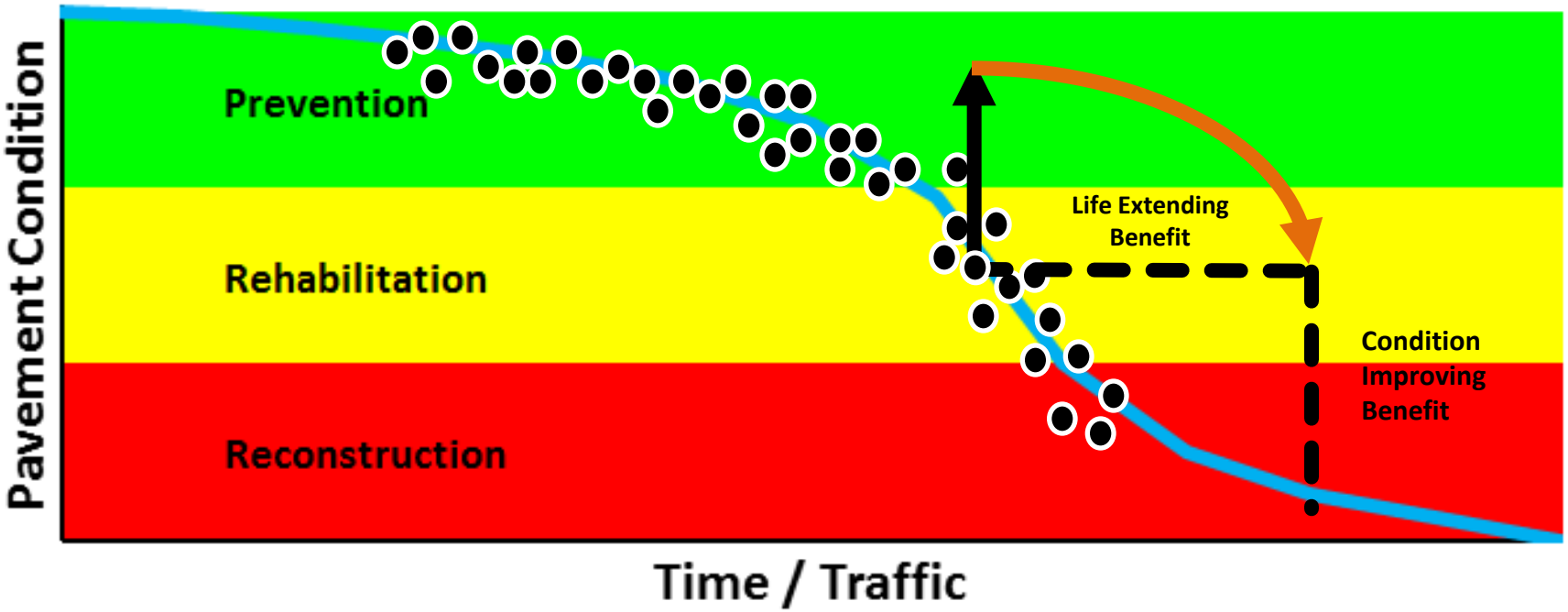
Pavement Preservation

Similar to Pavements

RIGHT TREATMENT
RIGHT PAVEMENT
RIGHT TIME

BE <u>PROACTIVE</u> ‘NOT’ REACTIVE!

Pavement Preservation Benefits/Analysis

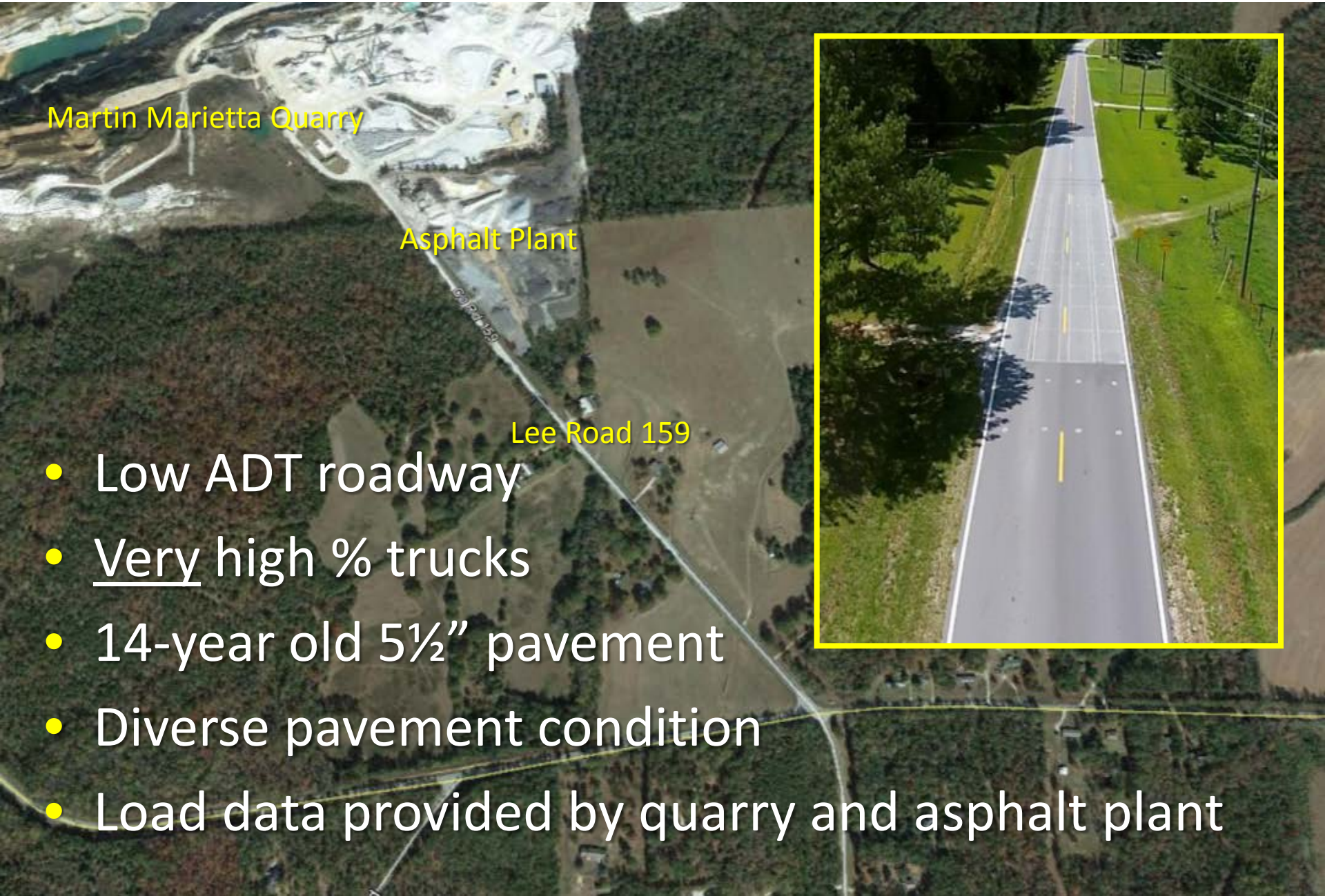


Develop <u>life extending</u> and <u>condition improvement benefits</u> curves for:

- Different treatments
- Different pavement condition ranges

Agencies need guidelines on expected benefits for future investment

Pavement Preservation on Lee Road 159



- Low ADT roadway
- Very high % trucks
- 14-year old 5½” pavement
- Diverse pavement condition
- Load data provided by quarry and asphalt plant

Pavement Preservation on Lee Road 159

1. Rejuvenating Fog Seal
2. Fibermat
3. Control
4. Control
5. Crack Seal (CS)
6. Single Layer Chip Seal
7. CS + Single Layer Chip Seal
8. Triple Layer Chip Seal
9. Double Layer Chip Seal
10. Microsurfacing + Single Chip (Cape)
11. Microsurfacing
12. CS + Microsurfacing
13. Double Layer Microsurfacing
14. Fibermat + Microsurfacing (Cape)
15. Scrub Seal + Microsurfacing (Cape)
16. Scrub Seal
17. Distress Demo Section
18. Fibermat + HMA thinlay (HMA Cape)
19. HMA Thinlay (PG 67-22)
20. HMA + 100% Foamed Recycle Inlay
21. HMA Thinlay (PG 76-22)
22. Ultra Thin Bonded Wearing Course
23. HMA Thinlay (50% RAP)
24. HMA Thinlay (5% PCRAS)
25. HMA Thinlay (High Polymer)

Pavement Preservation Monitoring Done (Lee Road)

- Rutting, roughness, texture
- Surface friction
- Subgrade moisture contents
- Falling weight deflectometer (FWD)
- Ground penetrating radar (GPR)
- Visual and video based cracking measurement

2012 Pavement Preservation Research Sponsors

FP2

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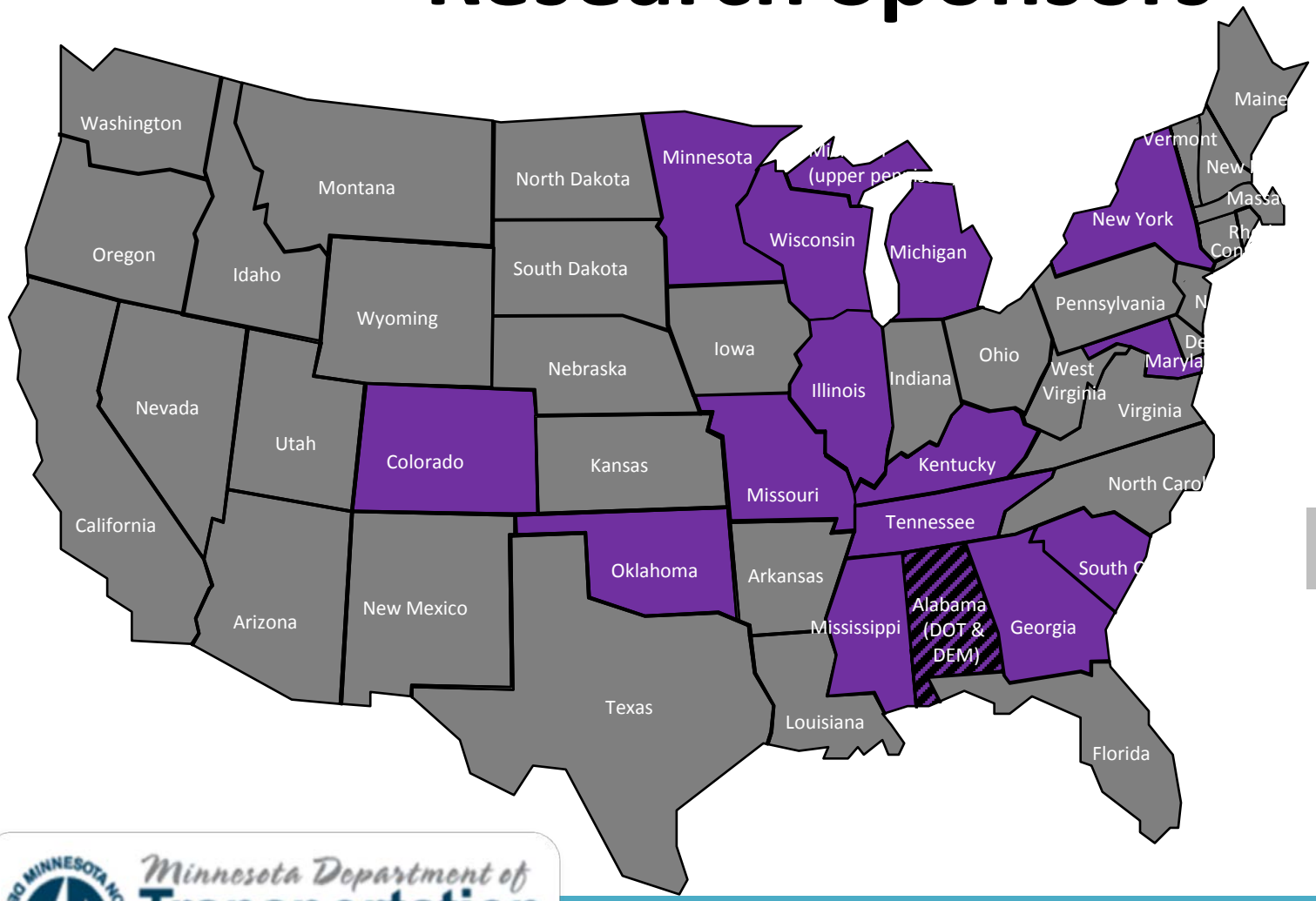
2015 Pavement Preservation Research Sponsors



FP²

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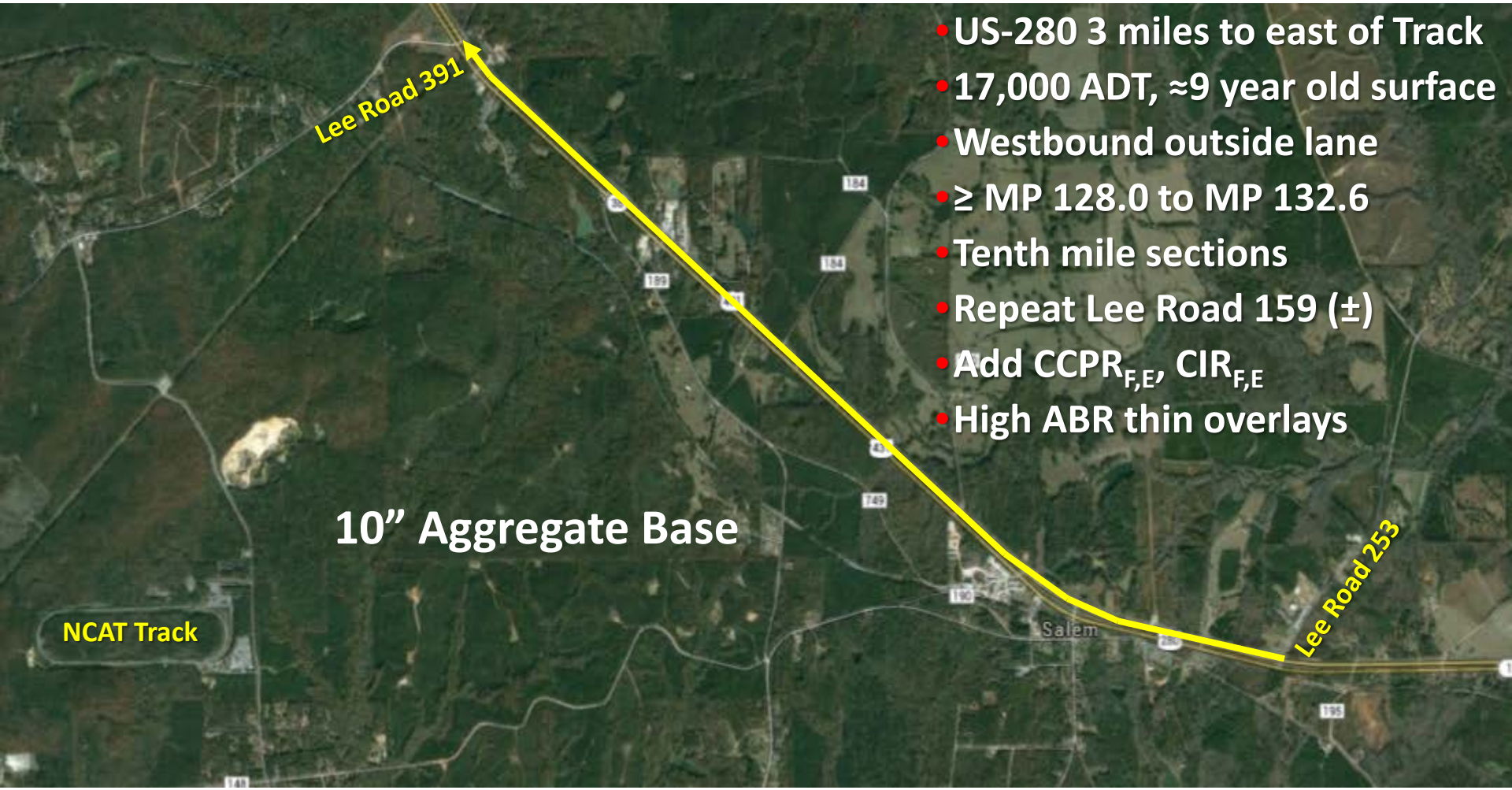
MnROAD-NCAT Partnership

NCAT	MnROAD
Analysis	*Analysis*
- Subsections to develop life-extending benefit curves	- Subsections to develop life-extending benefit curves
Higher Volume (US 280)	*Higher Volume (US-169)*
Control sections Treated sections	Control sections Treated sections
Replicate LR 159 treatments	Replicate LR 159 treatments
Additional treatments (CIR, ABR thin overlay, etc.)	Possibly additional treatments
Low Volume (LR 159)	*Low Volume (CR-2 or 8)*
2 control sections 23 treated sections	Control sections Treated sections

Planned Treatments

- Control Sections
- Surface Treatments
  - Crack Sealing
  - Fog Seal
  - Chip Seals
  - Scrub Seals
  - Microsurfacing
  - Combinations (Cape Seals)
- Cold Recycling + 1.5” overlay
  - Cold-in-place (CIR)
  - Cold Central Plant Recycle (CCPR)
- Thin Overlays
  - Dense Graded (4.75 mm)
  - OGFC
  - UTBWC
  - Combinations

US-280 Alabama - High Volume Off-Track



- US-280 3 miles to east of Track
- 17,000 ADT, ≈9 year old surface
- Westbound outside lane
- ≥ MP 128.0 to MP 132.6
- Tenth mile sections
- Repeat Lee Road 159 (±)
- Add $CCPR_{F,E}$, $CIR_{F,E}$
- High ABR thin overlays

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Minnesota Off-Site Locations

US-169 (High)
Mille Lacs CR-2 or 8 (Low)
4-5 miles each roadway

Northern States meeting every 2 weeks to discuss study

40 minutes
North of MnROAD

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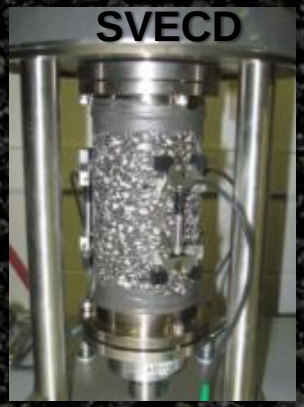
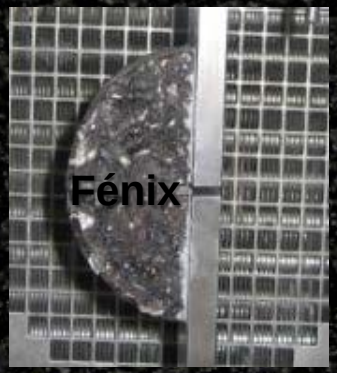
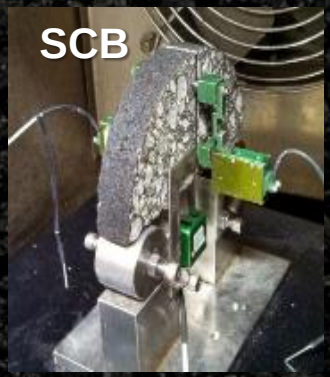
Cracking Test Validation Experiment







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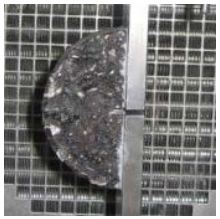
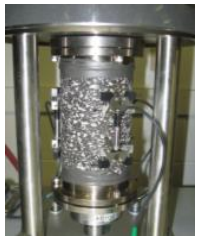
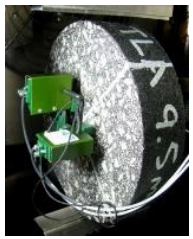
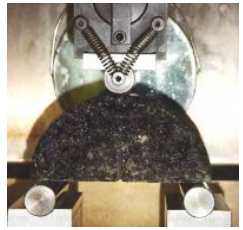
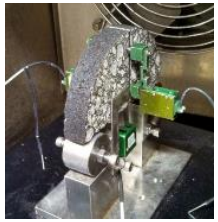
National HMA Cracking Performance Test

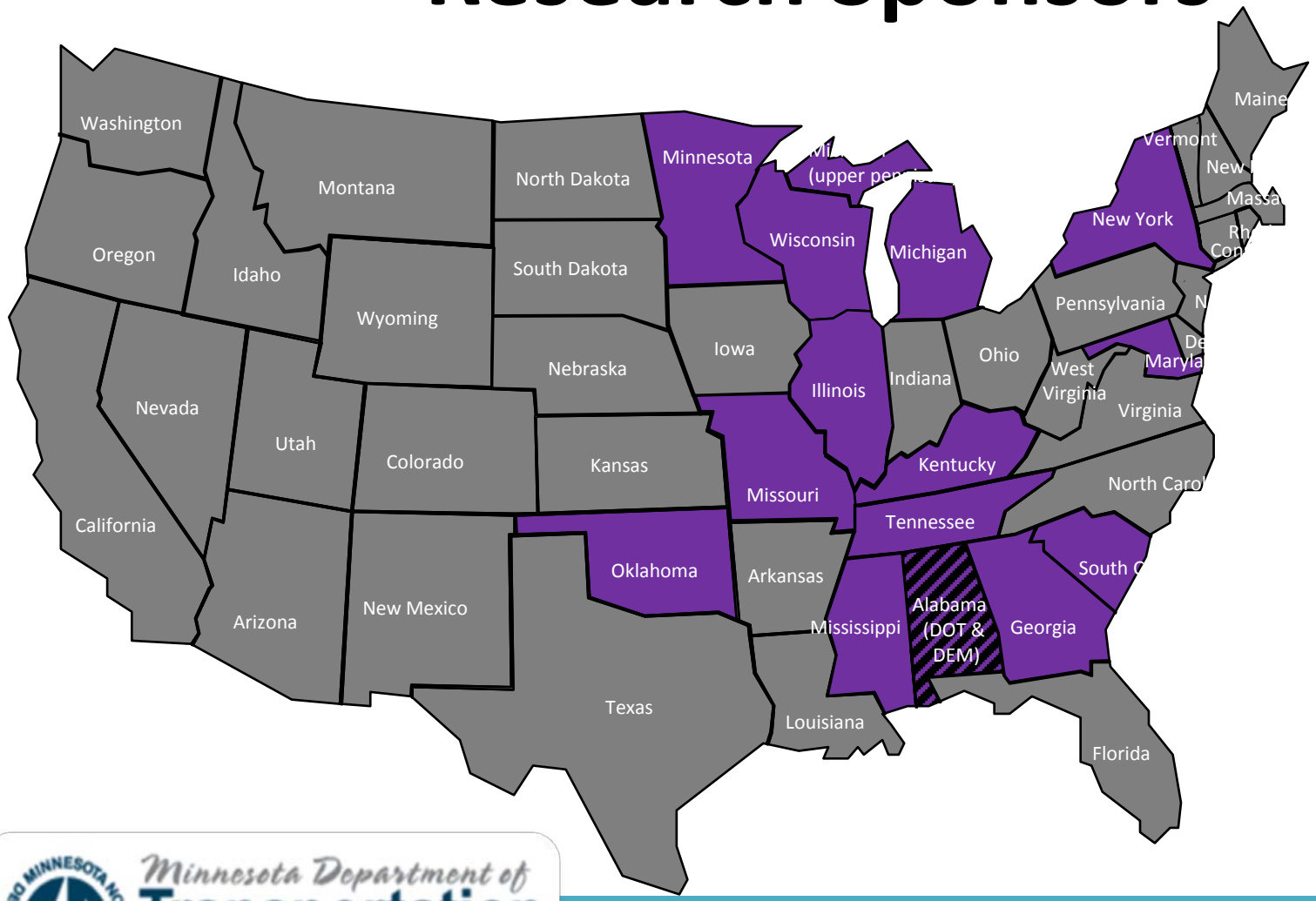
- **Goal**
  - Which test should be run to predict future performance?
  - Nationally → Many tests proposed → which is best?
- **Agency Needs**
  - Agencies need a Tests/Criteria that relate to field performance
  - Agencies need tests that are practical for both mix design verification and quality control testing purposes.
  - We need tests that accommodate recycled materials, new and future additives, and combinations.
    - How to we keep ahead of the constant changes in mixtures?



2015 HMA Performance Test Research Sponsors



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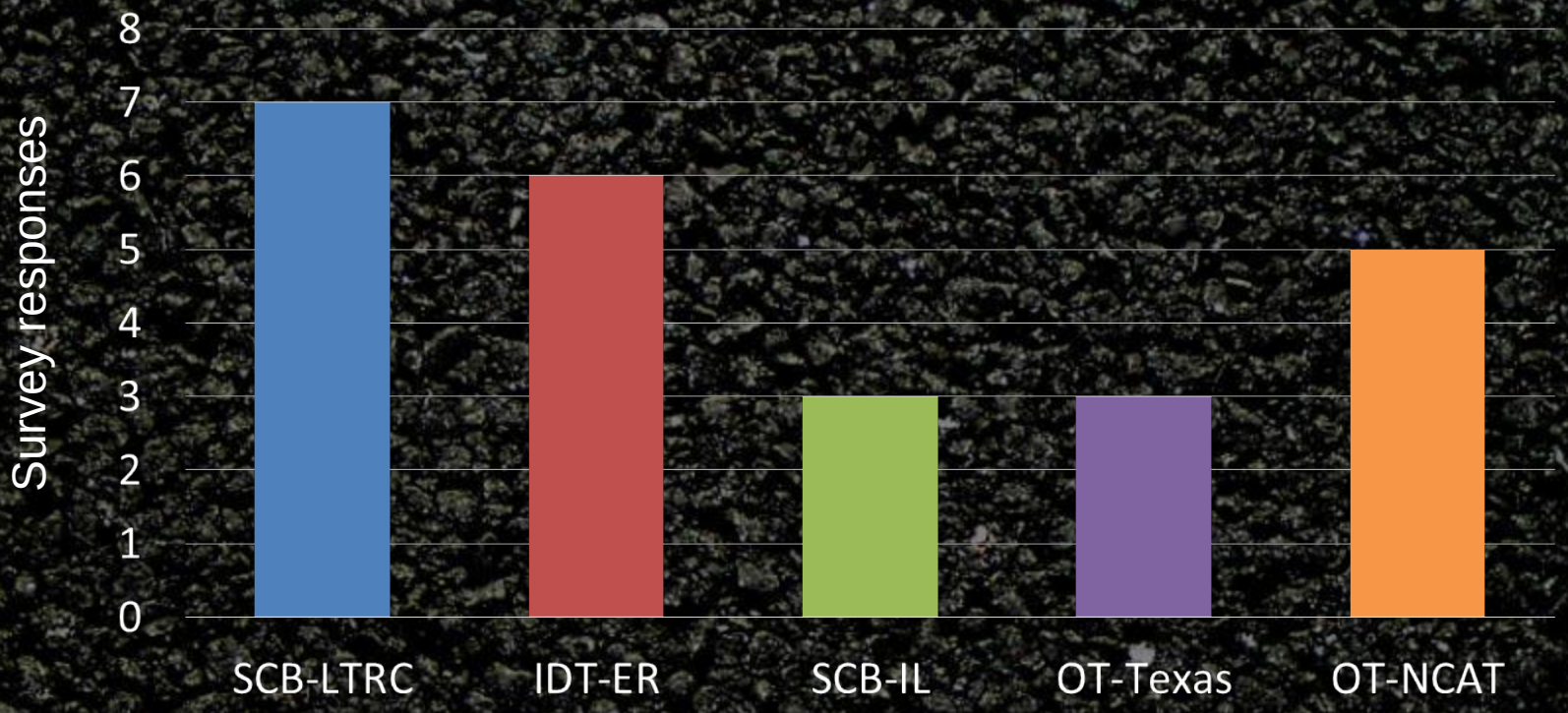
Southern Top-Down Cracking Tests$_{CG}$

Only the SCB-LTRC test will be conducted on LMLC samples *prior* to construction.



NCAT will conduct these tests on PMLC samples at two aging conditions.

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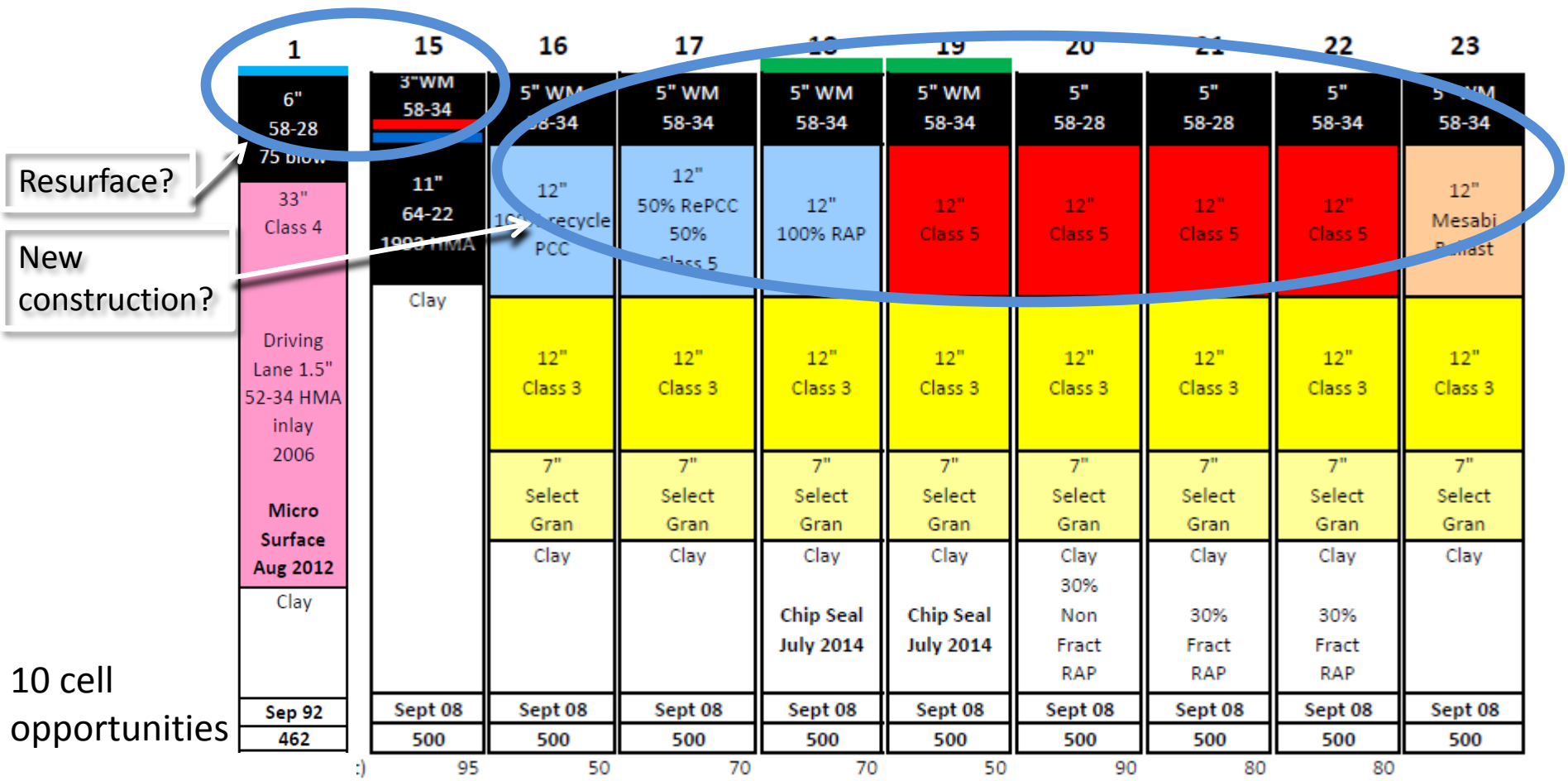
Possible Northern Experimental Mixture Combinations

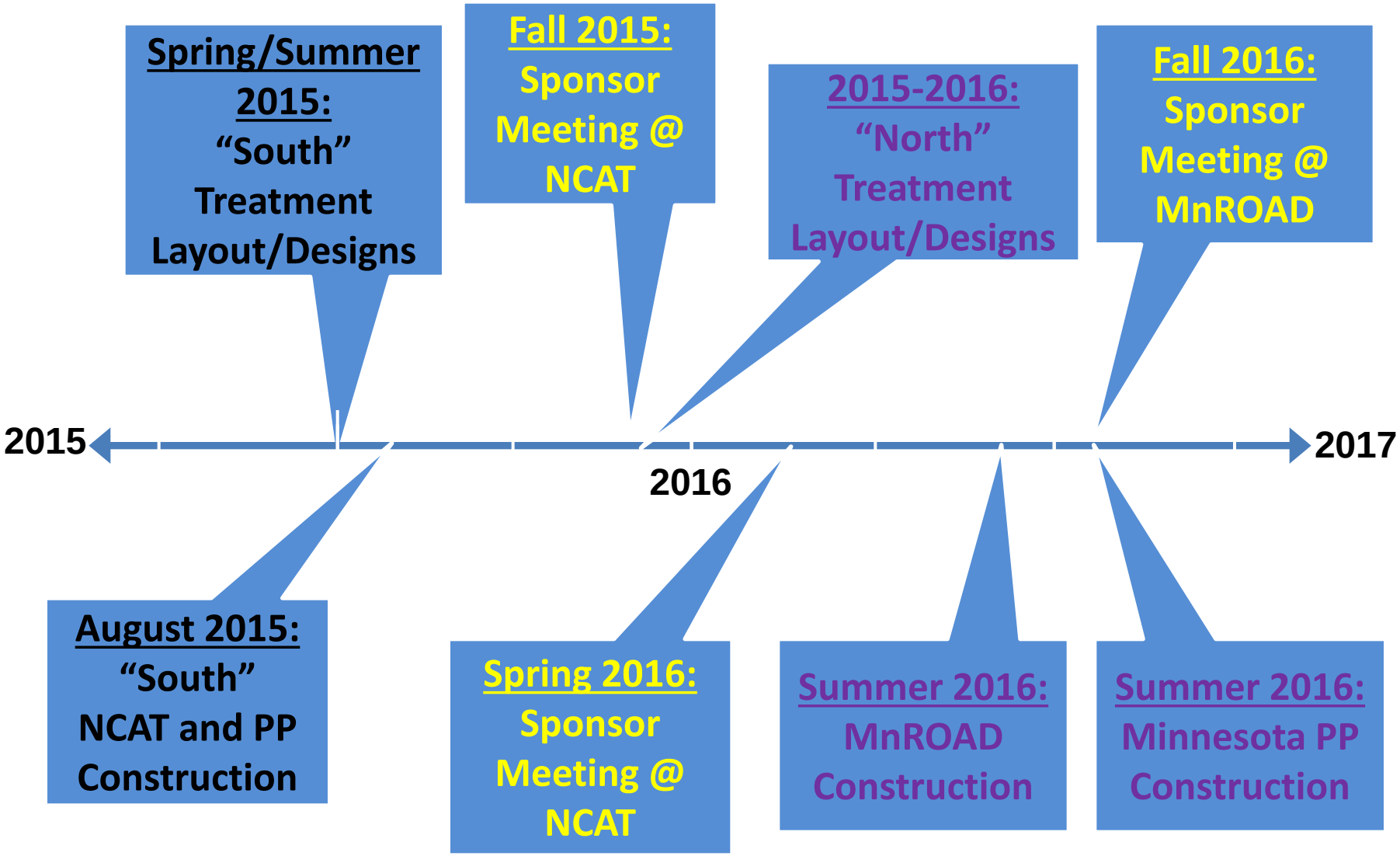
Fracture Energy	Asphalt Binder Replacement: Normal (20-30%)	High (40-50%)	Very High (60%)
Low (<300 J/m^2)	X	X	X
Med (350-450 J/m^2)	X	X	X
High (>600 J/m^2)	X	X	X

MnROAD Asphalt Cell Availability

- **9 Mainline Test Cells**



Timeline


Spring/Summer 2015: "South" Treatment Layout/Designs
Fall 2015: Sponsor Meeting @ NCAT
2015-2016: "North" Treatment Layout/Designs
Fall 2016: Sponsor Meeting @ MnROAD
2015
2016
2017
August 2015: "South" NCAT and PP Construction
Spring 2016: Sponsor Meeting @ NCAT
Summer 2016: MnROAD Construction
Summer 2016: Minnesota PP Construction

Joining the MnROAD-NCAT Partnership

- **Pooled Fund**
  - Alabama DOT Lead
  - http://www.pooledfund.org/Details/Study/496
  - MnROAD is a subcontractor to Auburn University (NCAT)
  - MnROAD Partnership Focus on two projects
    - Pavement Preservation
      - 120K/year (first 3-years)
      - 40K/year (following years)
    - National HMA Cracking Performance Test
      - 210K/year
  - Agencies can direct funding as they wish

National Road Research Alliance

- **Pooled Fund**
  - **Minnesota DOT Lead** (Posted ~August 2015)
  - Road Agencies @ 150K/yr
  - Industry and Consultants @ 2K/yr
- **Emphasis on**
  - Research to utilize the MnROAD research facility
    - Guide Phase III Research and Construction of MnROAD in 2018
    - 2.5 Million of Construction Matching Dollars
  - State and Local Sponsored Research
  - Technology Transfer / Implementation
  - Training

  - Pavement Preservation (Year 4)
  - Concrete / Other HMA Research

Follow Up

Contact Information

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