NCAT Pavement Test Track

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Buzz Powell

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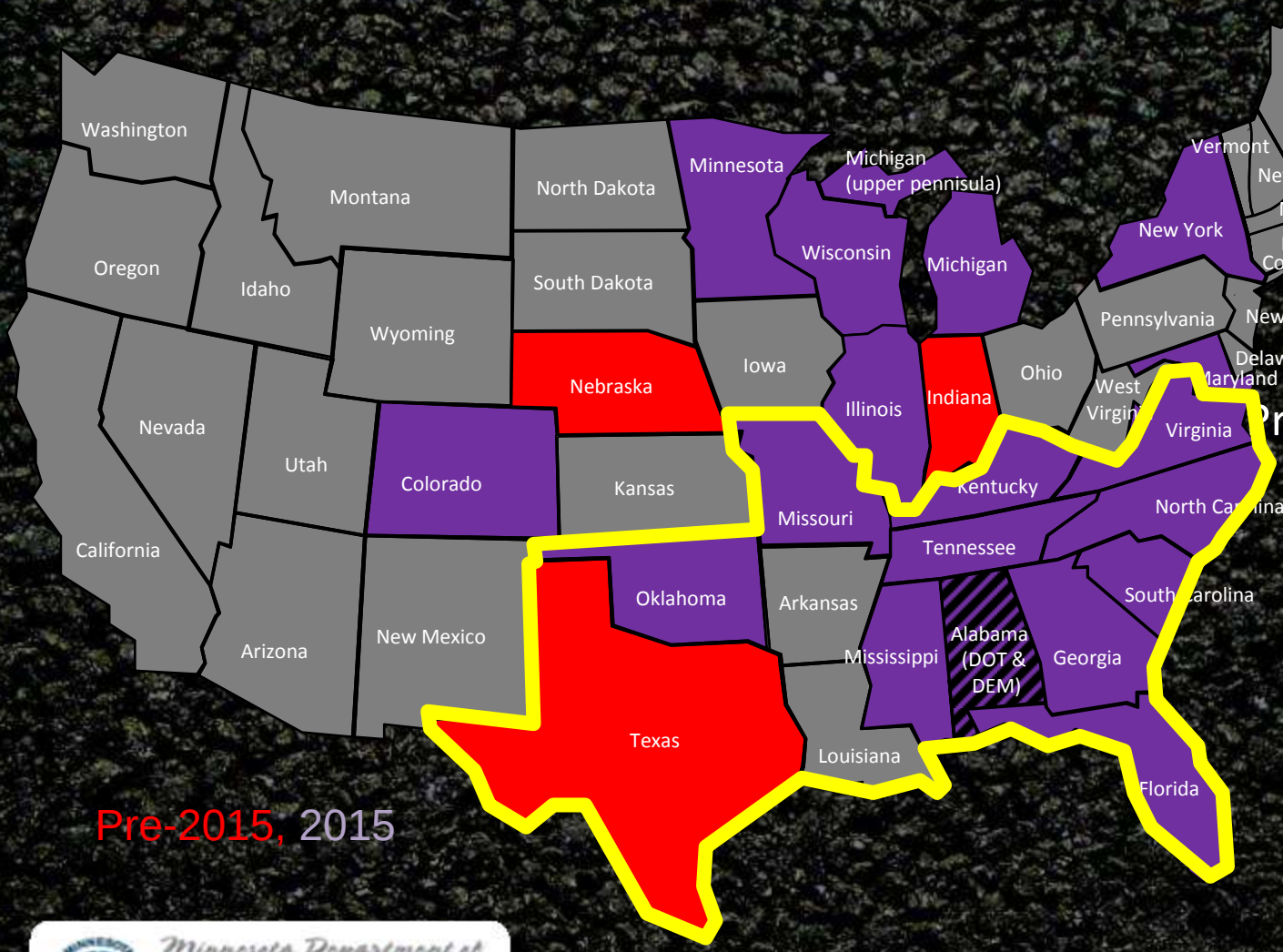

Pre-2015, 2015

FHWA

Private Sector Sponsors

Cargill Deicing Technology

Collaborative Aggregates

FP^2

Kraton Polymers

Modified Asphalt Solutions

Oldcastle Materials

Polycon Manufacturing

Seneca Petroleum

Shell Sulfur Solutions

Trinidad Lake Asphalt

Minnesota Department of Transportation

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Content

- MnROAD Partnership
- Pavement preservation
- Laboratory cracking test(s)
- Standalone studies
- 2015 Track status report.

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Research Goals

- Help state DOTs implement positive change
- Promote real innovation for the industry.

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NCAT+MnROAD Research Partnership

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.

Minnesota Department of Transportation

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NCAT+MnROAD Research Partnership

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.

Minnesota Department of Transportation

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2015 Preservation Research

- NCAT Pavement Test Track (accelerated)
  - Thinlay, micro surface, Cape seal, scrub/chip seals
- Lee Road 159 (low ADT, high percent trucks)
  - Single/double/triple chips, scrub, FiberMat, sealing
  - Single/double micro surface, Cape x 3, sealing
  - Track thinlay, neat binder, ABR variants, CCPR base
- US-280 (high ADT, moderate percent trucks)
  - 159 + CCPR/CIR, OGFC, durable/friction micro, etc.
- Duplicate NCAT preservation sections at MnROAD.

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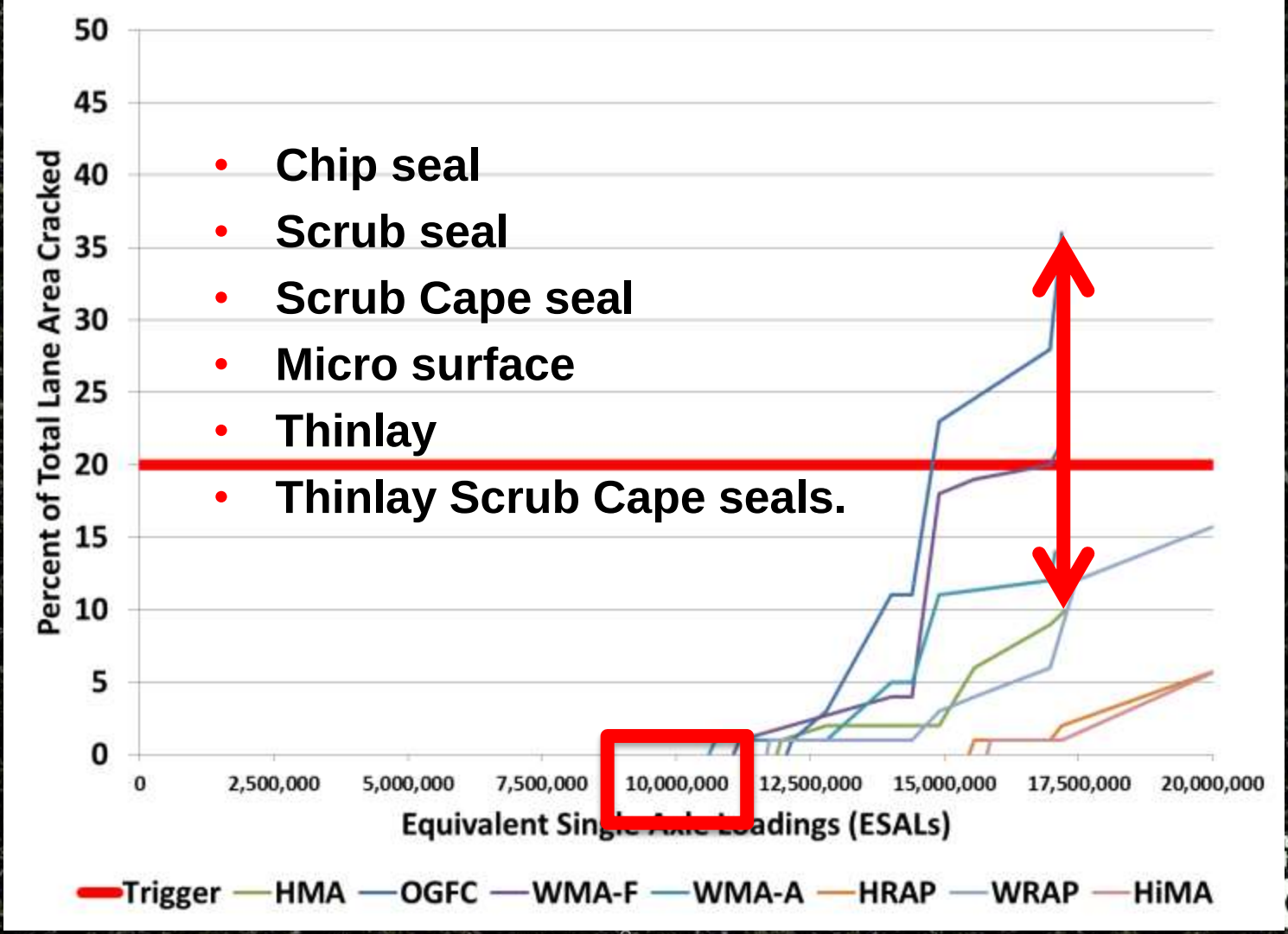
Track Pavement Preservation



Track Pavement Preservation

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Track Pavement Preservation

Lee Road 159 Low Traffic Preservation

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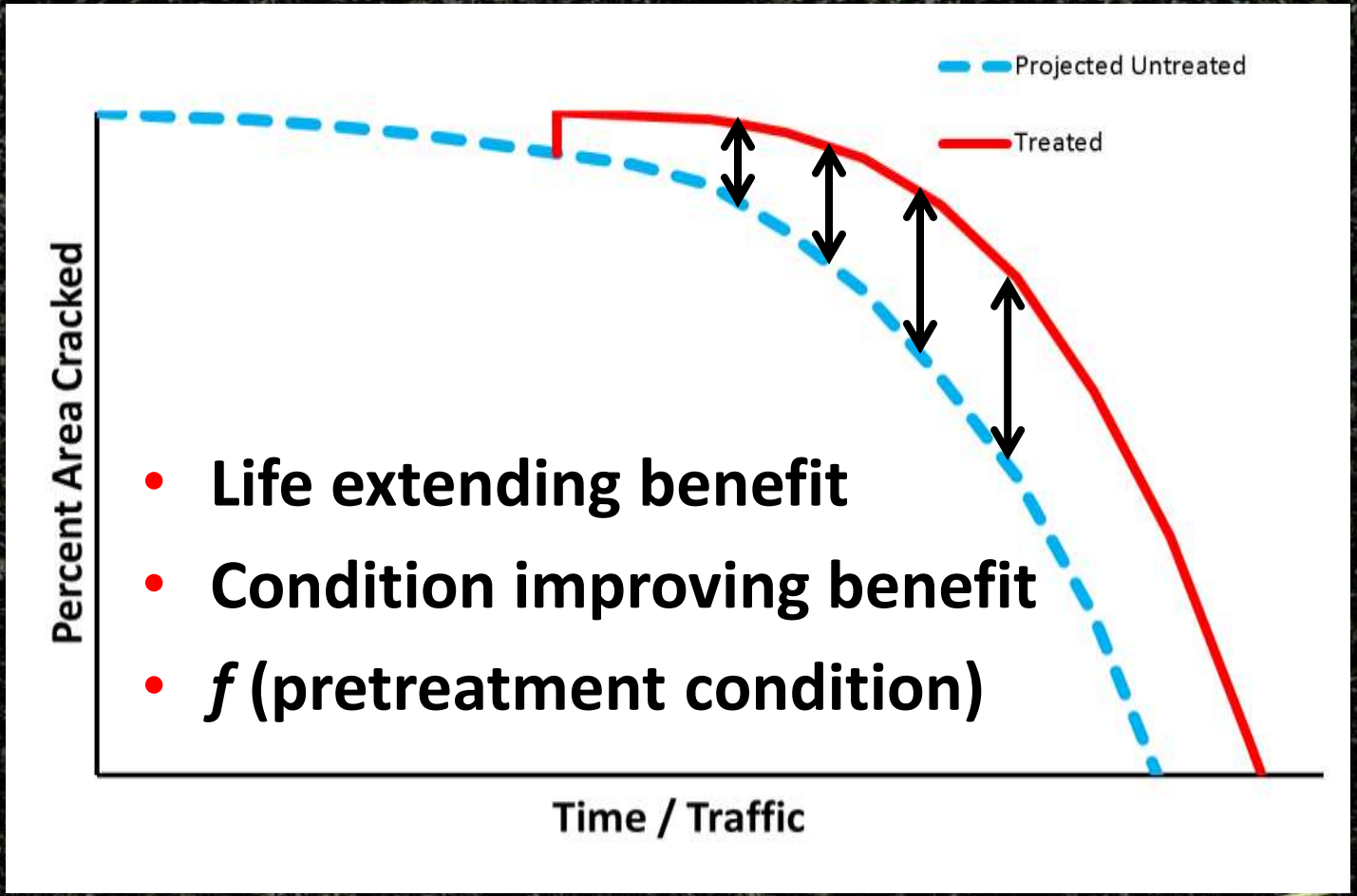
Benefits of Preservation



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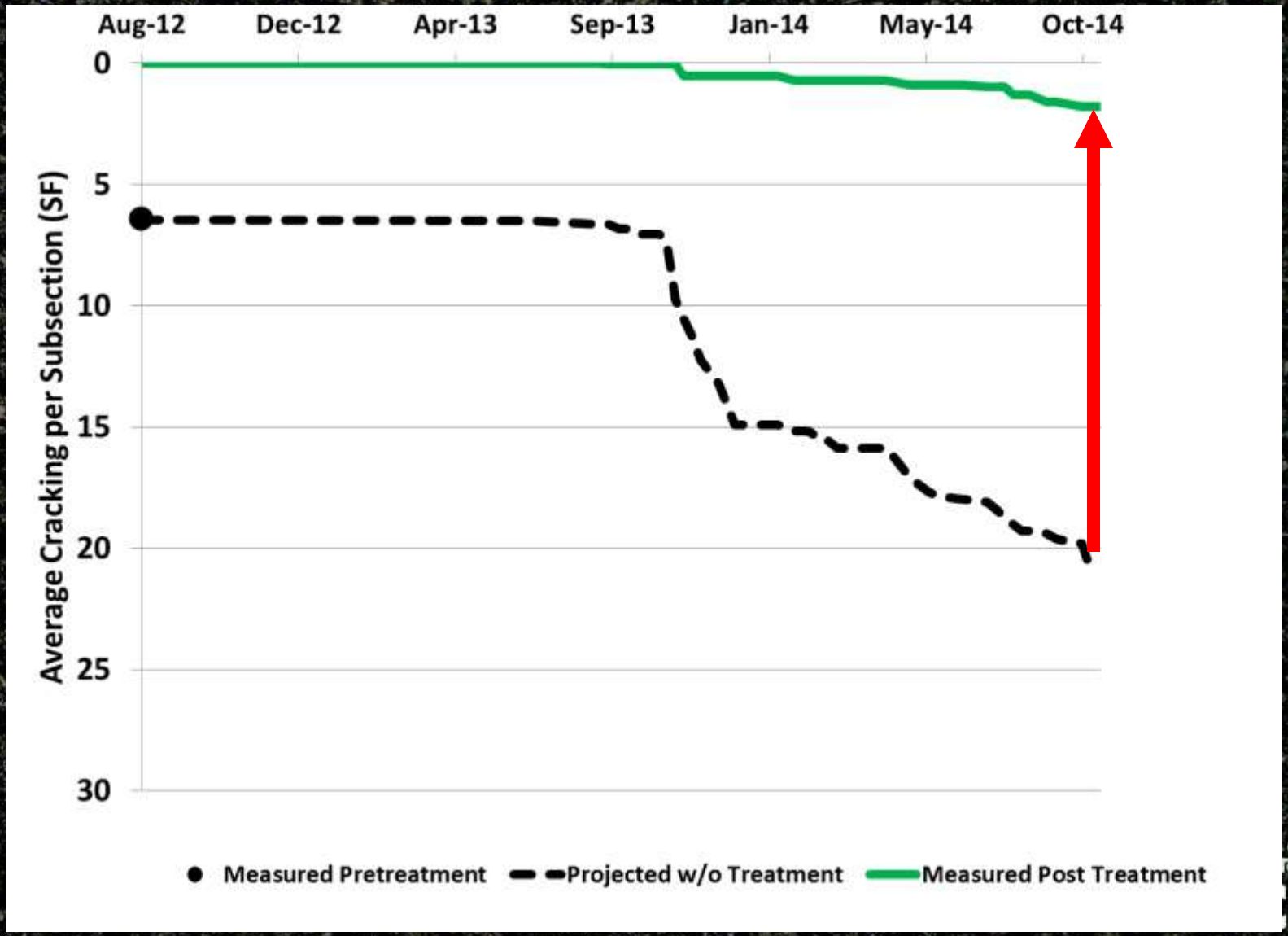

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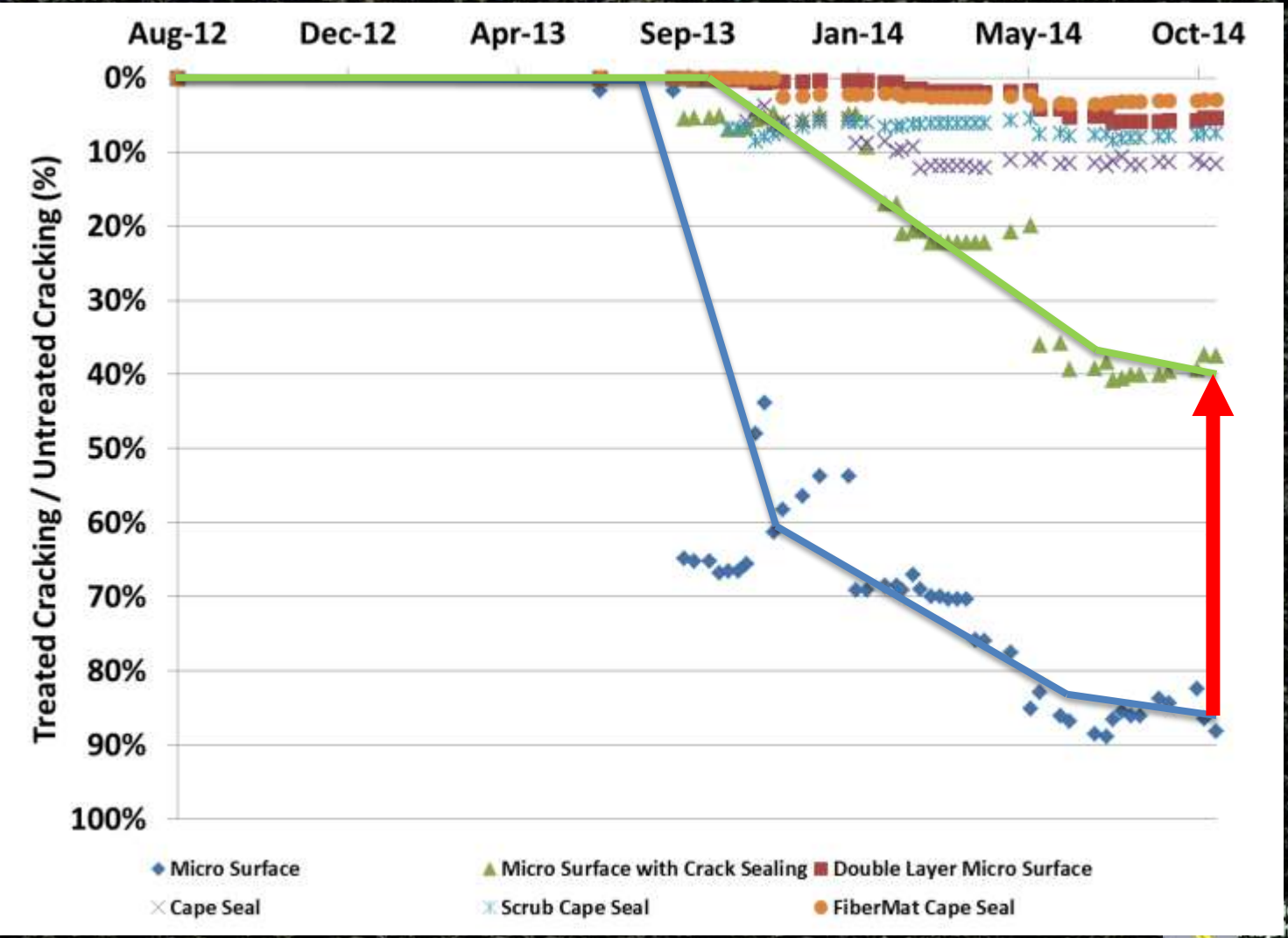

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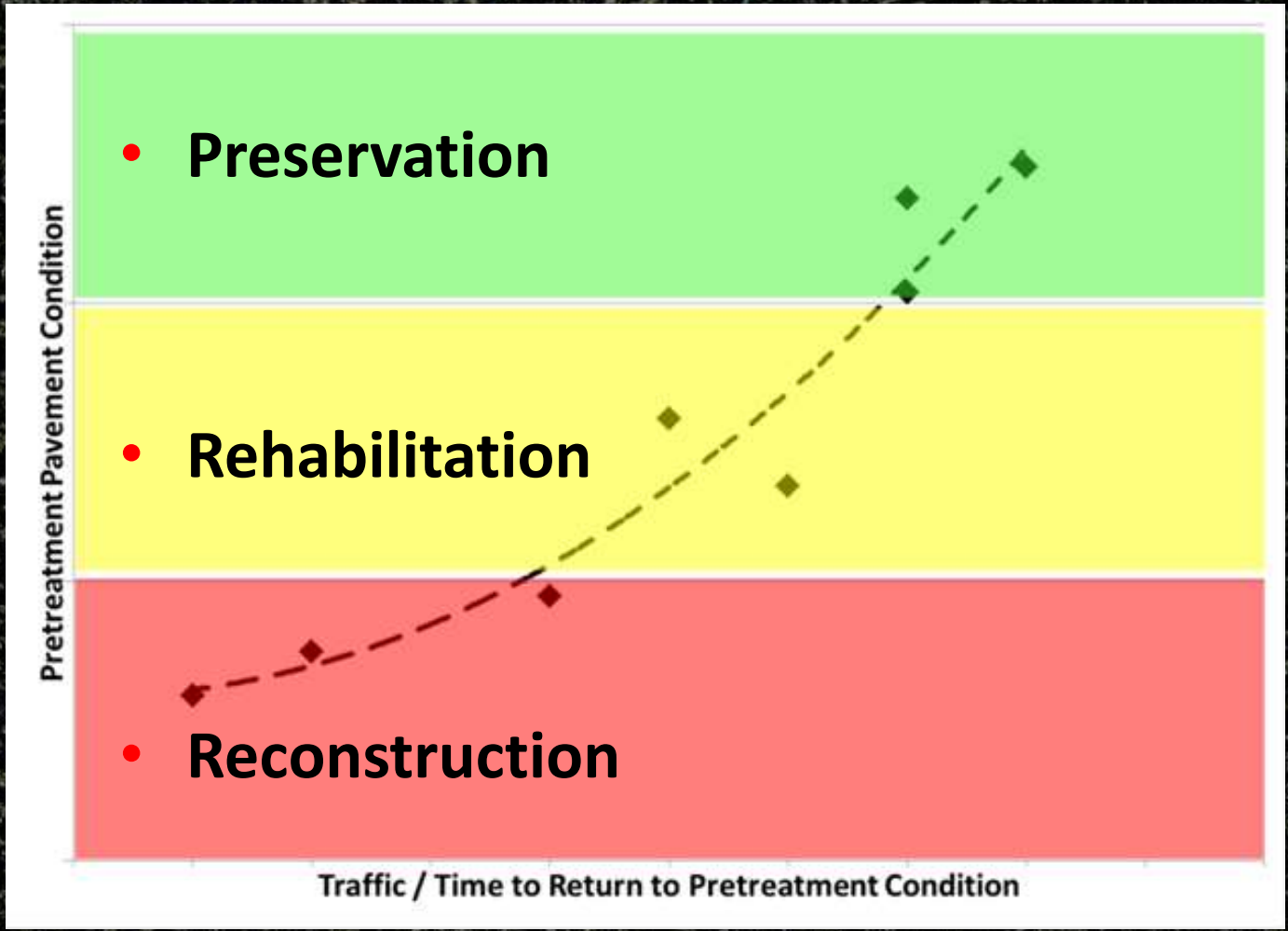

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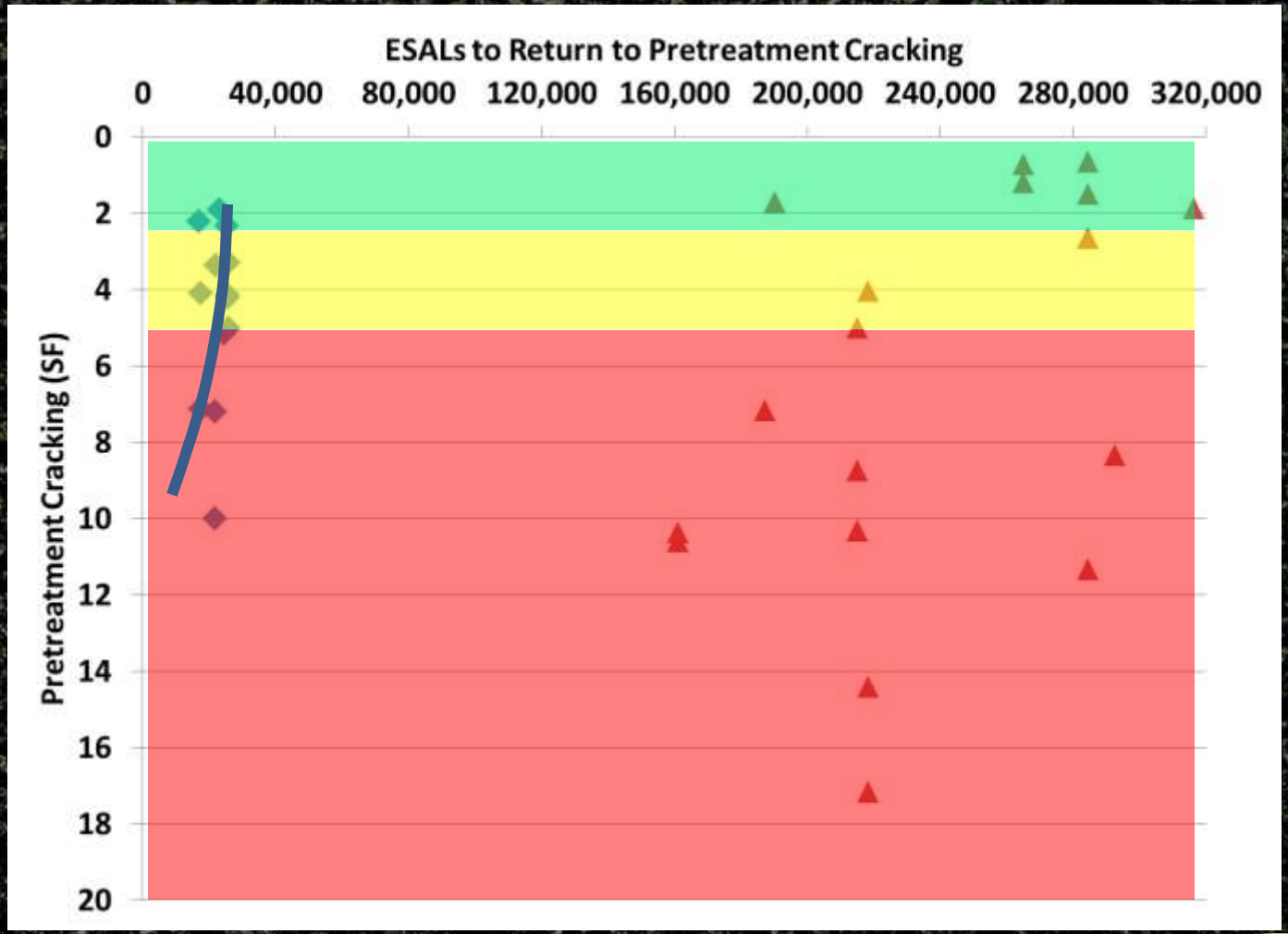
Benefits of Preservation



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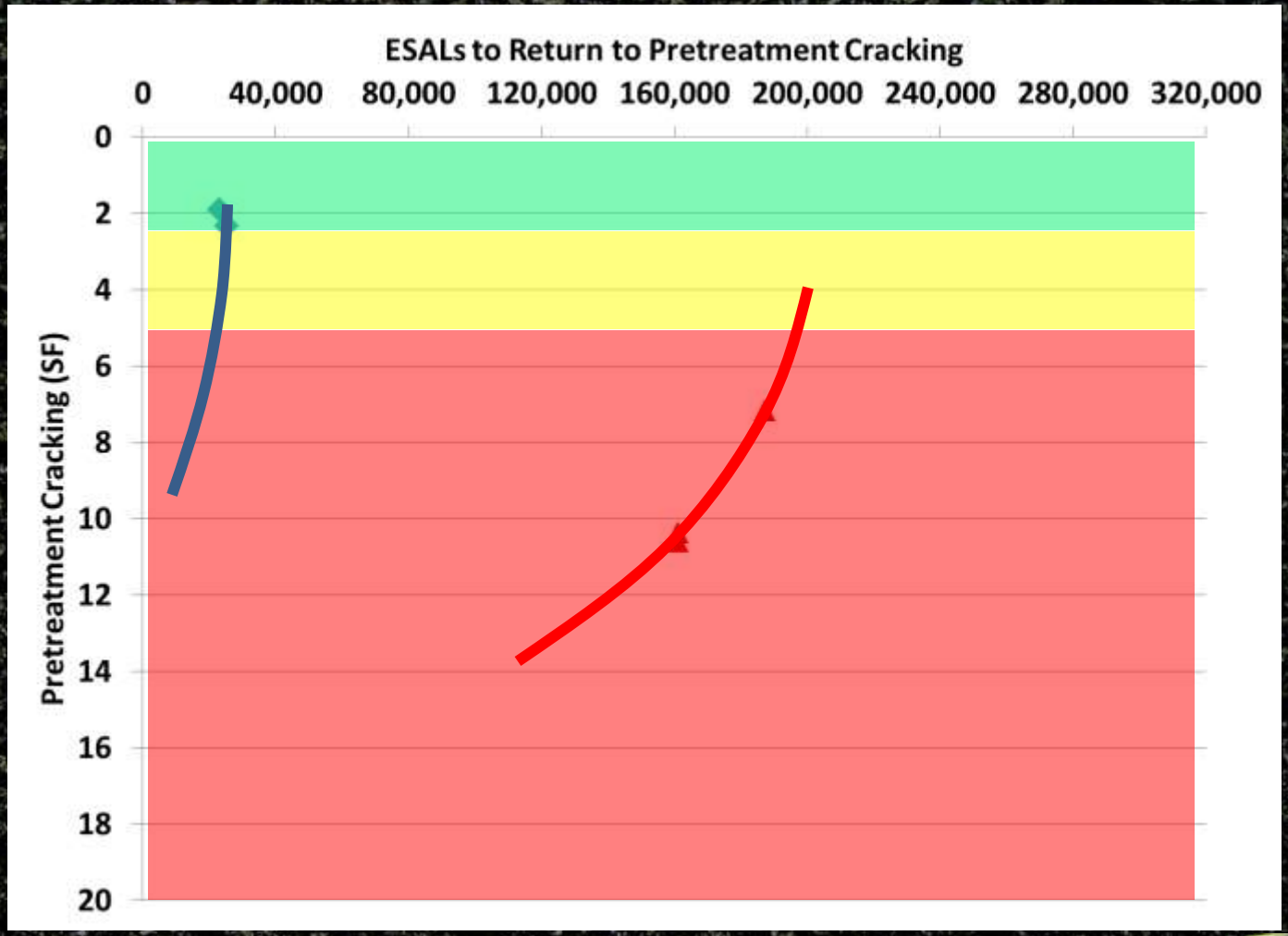

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US-280 High Traffic Preservation

US-280 High Traffic Preservation

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US-280 High Traffic Preservation

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US-280 High Traffic Preservation

US-280 High Traffic Preservation

ABR Thinlays on Cold Recycle$_{F,E}$

CCPR (KMA220)

CIR (3800CR)

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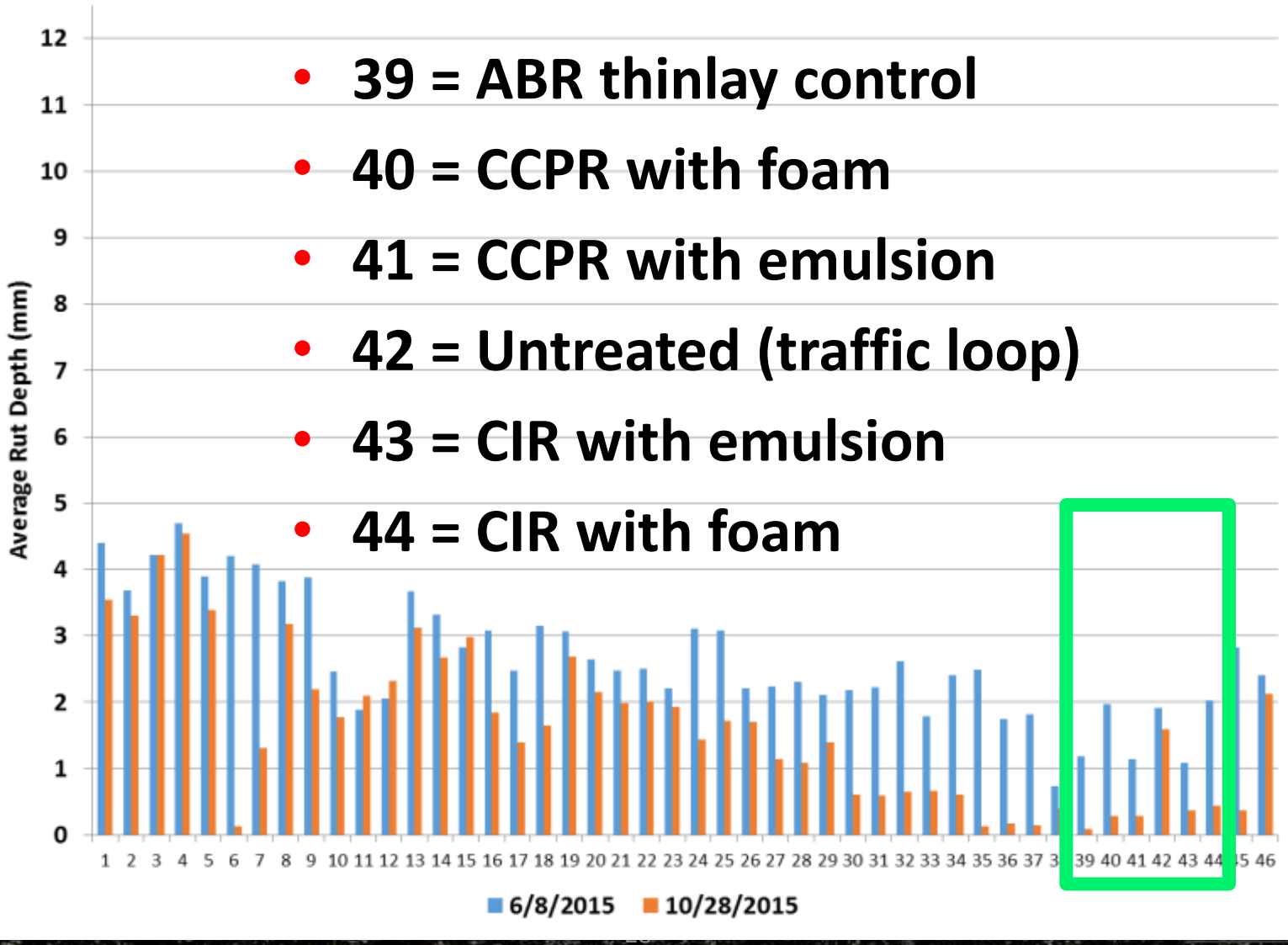
HMA Thin Overlays on US-280

- 39 = ABR thinlay control
- 40 = CCPR with foam
- 41 = CCPR with emulsion
- 42 = Untreated (traffic loop)
- 43 = CIR with emulsion
- 44 = CIR with foam



Cracking Group (CG) Section Surfaces

- 20% RAP control$_{N1@20/0}$
- High density control$_{N2@20/0}$
- Low AC/density control$_{N5@21/0}$
- Control + 5% RAS$_{N8@20/14}$
- Control +15% RAP with PG58-28$_{S5@33/0}$
- Control with HiMA$_{S6@19/0}$
- 15% RAP AZ rubber with ARB20$_{S13@7/0}$.

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Standalone Research

- Use of fine/small blends
- Reduced design gyration levels
- Best use of RAP, RAS, and GTR
- Healthy (balanced) binder content
- Preventing reflective cracks.

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Fine/Small Blends

- Similar rutting performance to coarse/large
- Longer path for crack propagation
- Higher effective binder content
- Better cracking/raveling performance
- Sustainability of using surplus stockpiles
- Pavement preservation treatment option.

Fine/Small Blends

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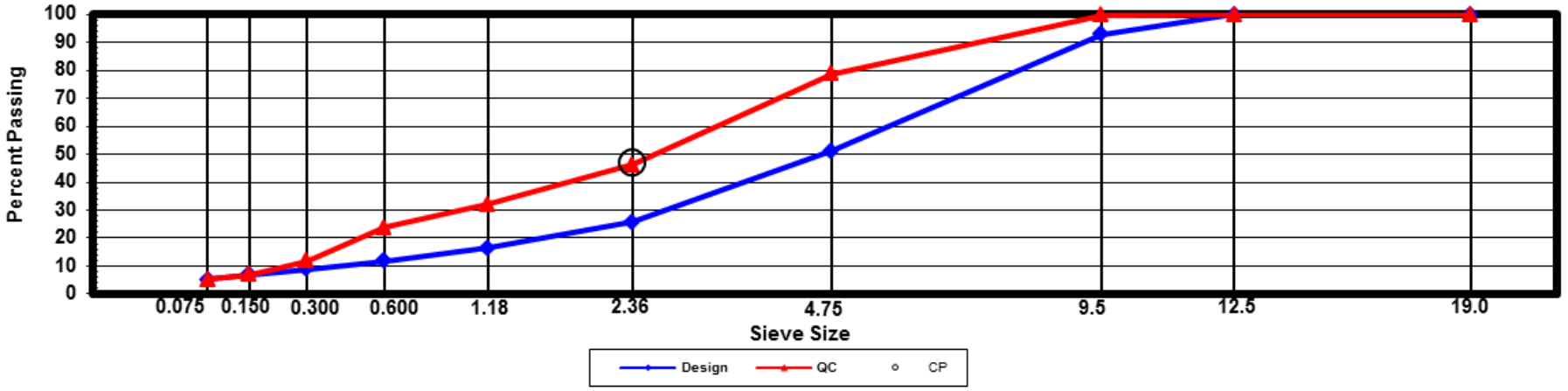
Reduced Design Gyration Levels

- 139 to 125 to 100 to 80 to 60 gyrations…
- "Locking point" to prevent aggregate breakdown
- Often more gyrations for higher traffic mixes
- More gyrations can mean lower binder contents
- Lowering gyrations alone is not enough
- Remember that VMA = V_a + V_{be} (G_{sb} is wildcard).

Finer Mixes with Lower N_{des}

Finer Mixes with Lower N_{des}



Best Use of RAP, RAS, and GTR

Purpose of Each Layer	N5 Control	S5 Higher RAP	S6 RAP+RAS	S13 Recyc Tires
Durable, Rut Resistant Surface	20% RAP_{20} 67-22/82-16 DG	25% RAP_{11} 67-22/[illegible]6-22 SMA	5% RAS_{21} 67-22/88-16 SMA	VIRGIN $82\text{-}22_{12}$ SMA
Stiff, Strain Reducing Middle	35% RAP_{39} 67-22/88-10 DG	50% RAP_{41} 67-22/[illegible]82-16 DG	50% $AGED_{26\text{-}24}$ 67-22/94-10 DG	35% RAP_{37} $82\text{-}22_{12}$ DG
Fatigue Resistant Base Layer	35% RAP_{39} 67-22/88-10 DG	35% RAP_{34} 94-28/[illegible]4-10 DG	25% RAP_{24} +76-22/88-16 DG	VIRGIN $88\text{-}22_{20}$ AZ

Green = Evotherm Q1 Additive, Blue = Astec Green Foamer

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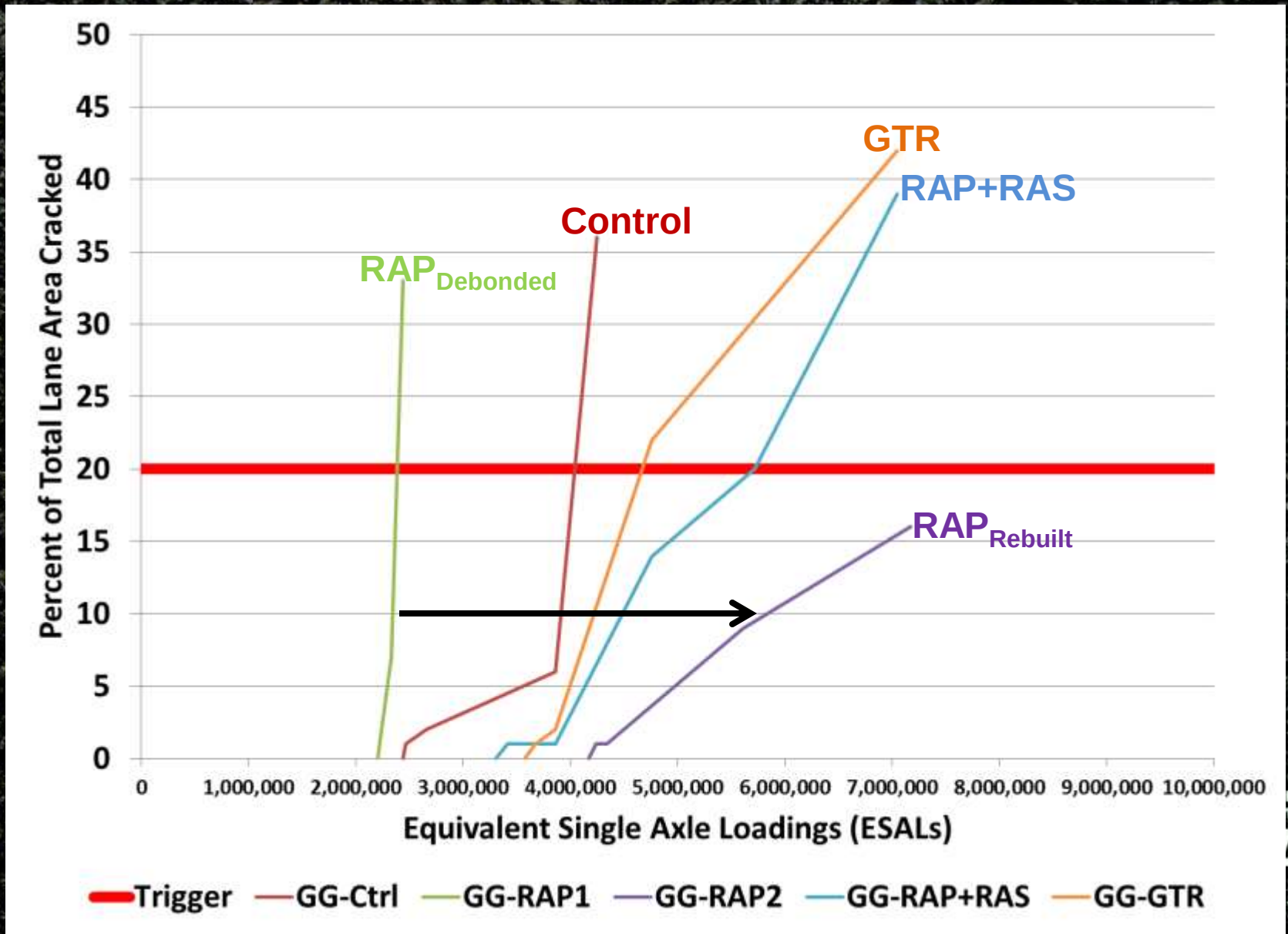
Best Use of RAP, RAS, and GTR



Best Use of RAP, RAS, and GTR

- HMA = 0.44 to 0.54
- CAB ≈ 0.15
- CR ≈ 0.36 tp 0.39

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Healthy Binder Content

- RAP in the past ≠ current RAP ≠ future RAP
- “Reclaimed/recycled content” is not enough
- “Aged binder ratio” (ABR) is not enough
- Use “RAP binder ratio” and “RAS binder ratio”
- Post consumer RAS vs manufacturing waste
- Soft asphalts, rejuvenators, richer mix designs
- Discounting contribution of RAP/RAS binders.

Polymer Binders in Higher RAP Mixes

Preventing Reflective Cracks

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Preventing Reflective Cracks

1st Treatment Applied:	7 Chip Seal
Placement Date:	8/8/2012
Emulsion Grade:	CRS-2HP
Target Emulsion Rate (GSY):	0.26
Meas. Emulsion Rate (GSY):	0.28
Aggregate Type:	Granite
Meas. Aggregate Rate (PSY):	23.0
2nd Treatment Applied:	89 Chip Seal
Placement Date:	8/8/2012
Emulsion Grade:	CRS-2HP
Target Rate (gals / SY):	0.34
Measured Rate (gals / SY):	0.28
Aggregate Type:	Granite
Meas. Agg. Rate (lbs / SY):	16.0
3rd Treatment Applied:	W10 Chip Seal
Placement Date:	8/9/2012
Emulsion Grade:	CRS-2HP
Target Rate (gals / SY):	0.15
Measured Rate (gals / SY):	0.14
Aggregate Type:	Granite
Meas. Agg. Rate (lbs / SY):	15.0

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Preventing Reflective Cracks

12/6/2014

Quadrant: N
Section: 12

Surface Mix and Materials

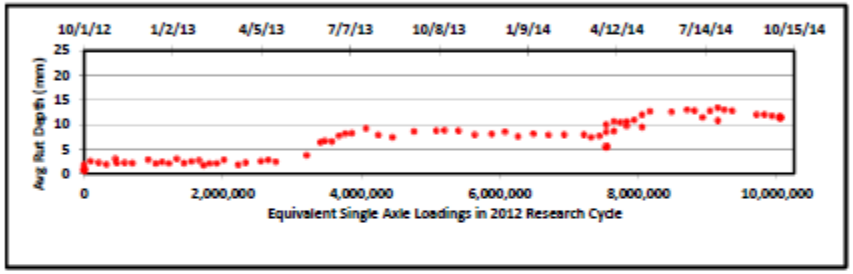
Year of Completion:	2012
Mix Design Methodology:	Superpave
Specified Binder:	PG67-22
Surface Mix Stockpiles:	Georgia Granite

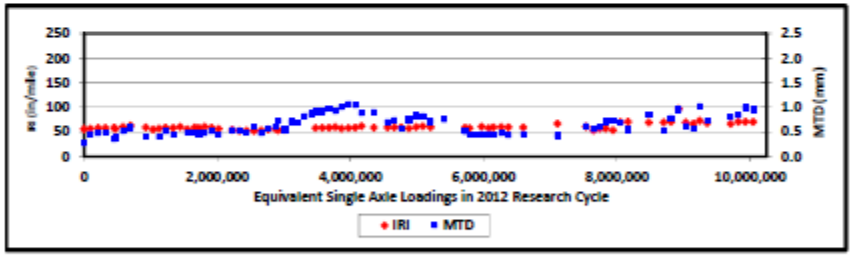
Structural Buildup Information

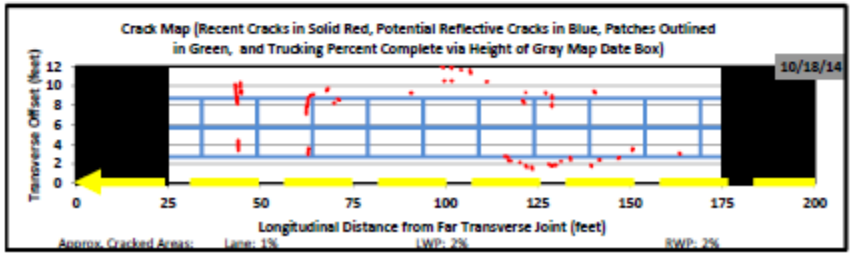
Study HMA (in):	2
Total HMA (in):	24
Base Material:	Granite
Subgrade:	Stiff

Research Objective: Reflective Crack Prevention with Triple Chip

Preliminary Field Performance Data







12/6/2014

Quadrant: N
Section: 13

Surface Mix and Materials

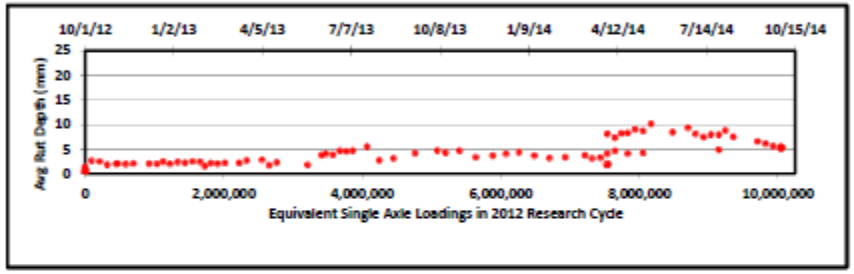
Year of Completion:	2012
Mix Design Methodology:	Superpave
Specified Binder:	PG67-22
Surface Mix Stockpiles:	Georgia Granite

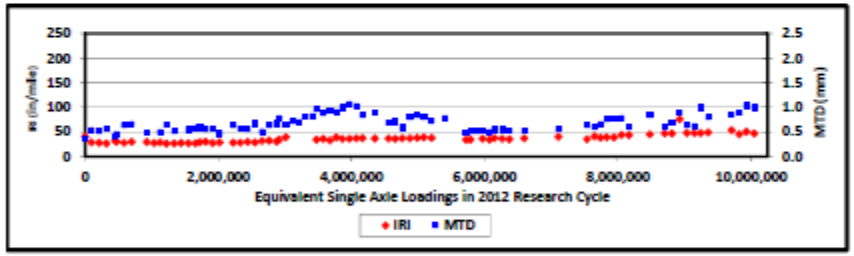
Structural Buildup Information

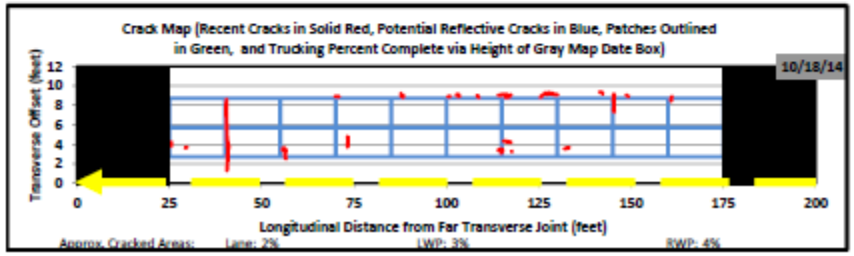
Study HMA (in):	2.75
Total HMA (in):	24
Base Material:	Granite
Subgrade:	Stiff

Research Objective: Reflective Crack Prevention with Open Graded Interlayer

Preliminary Field Performance Data







Preventing Reflective Cracks

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Status Report

- High level of construction quality achieved
- ≈2 million ESALs on Track with no early concerns
  - >4½ million ESALs on Track preservation sections
- ≈½ million ESALs on LR-159 with good results
- ≈1 million vehicles on US-280 with good results
- Weekly data collection on Track, 159, & 280
- Planning for MnROAD treatments summer 2016.

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End-of-Cycle Track Conference

- High RAP/RAS balanced mix designs
- Nationwide pavement preservation
- Preventing reflective distresses
- Optimized structural design
- Implementation

Pavement Test Track Conference

March 6-8, 2018

The Hotel at Auburn University
and Dixon Conference Center

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