

NCAT Pavement Test Track



at AUBURN UNIVERSITY

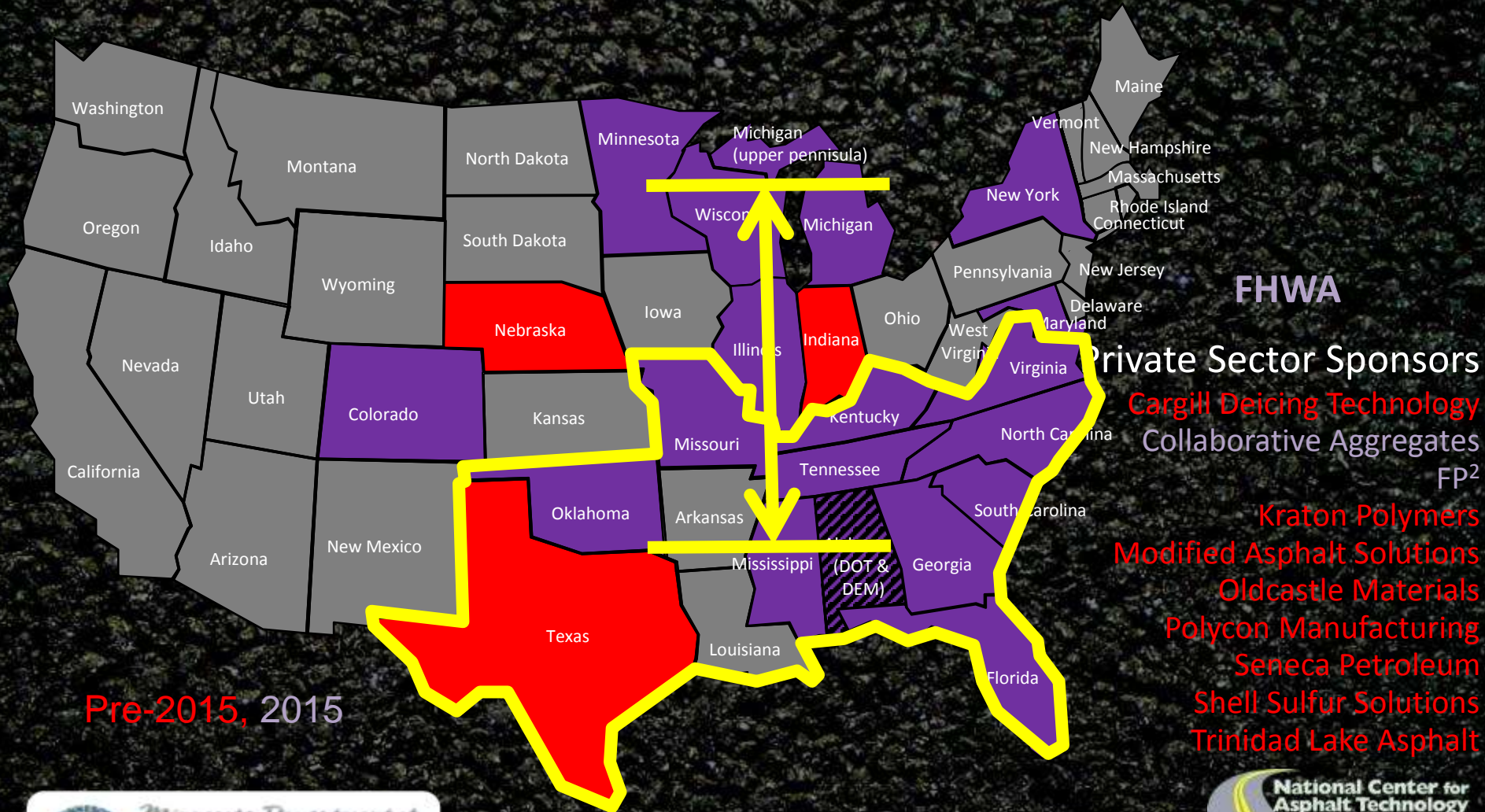


US-280

Buzz Powell

Research Update at ND Asphalt Conference

NCAT Pavement Test Track



FHWA

Private Sector Sponsors

Cargill Deicing Technology

Collaborative Aggregates

FP2

Kraton Polymers

Modified Asphalt Solutions

Oldcastle Materials

Polycon Manufacturing

Seneca Petroleum

Shell Sulfur Solutions

Trinidad Lake Asphalt



Content

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

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.



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.



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.

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.

Fine/Small Blends

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

Fine/Small Blends

NCAT West Curve Cam 1970-01-06 23:43:51



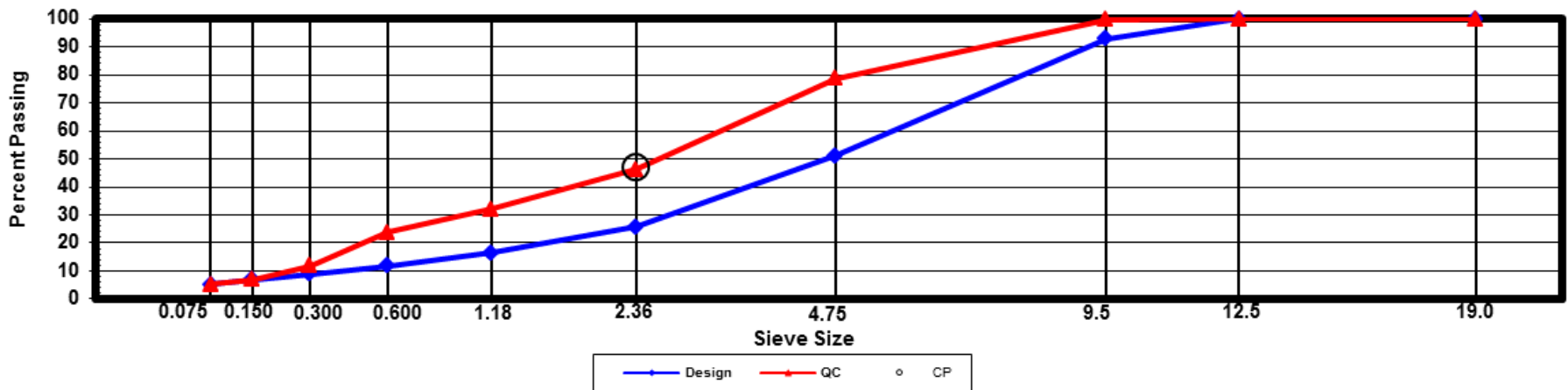
Reduced Design Gyration Levels

- 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).

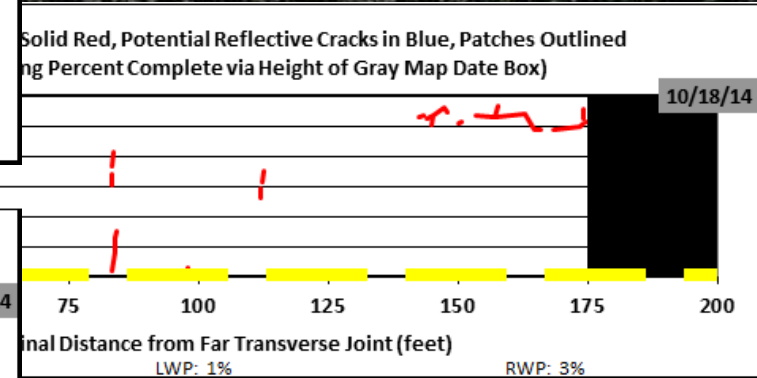
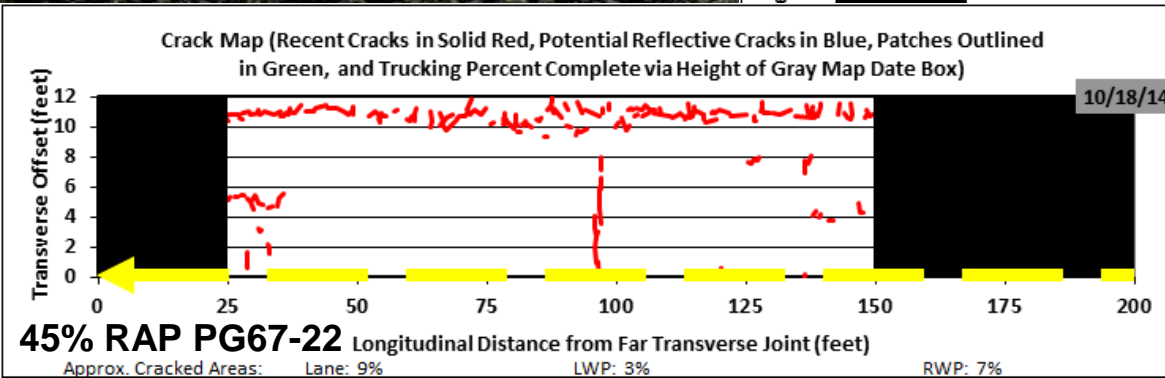
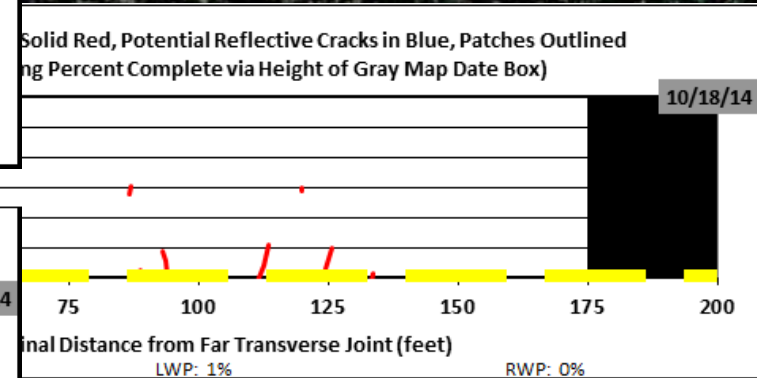
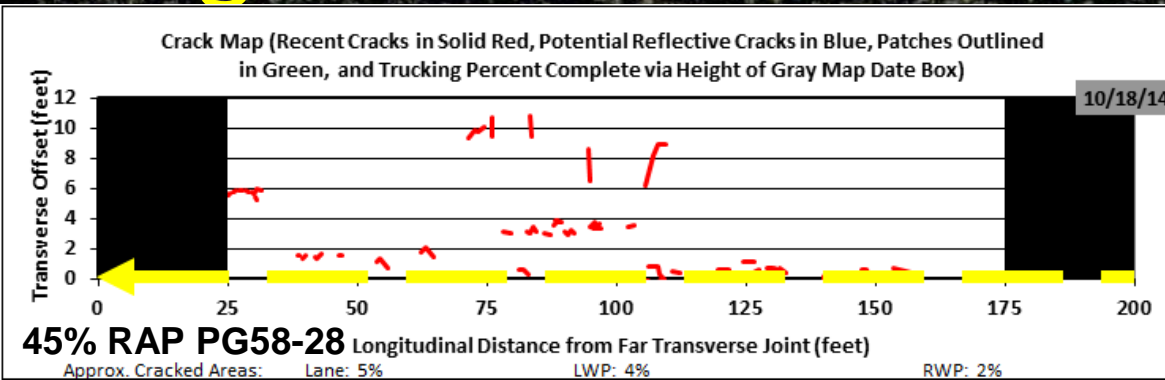
Finer Mixes with Lower N_{des}



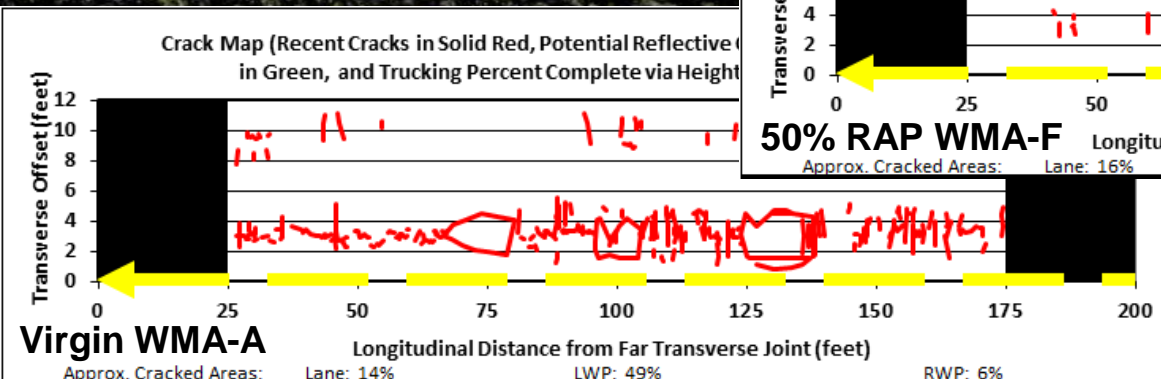
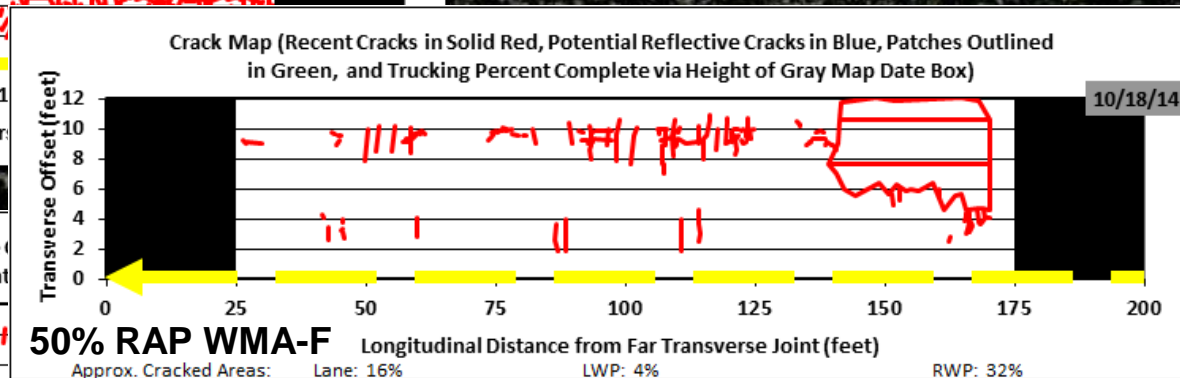
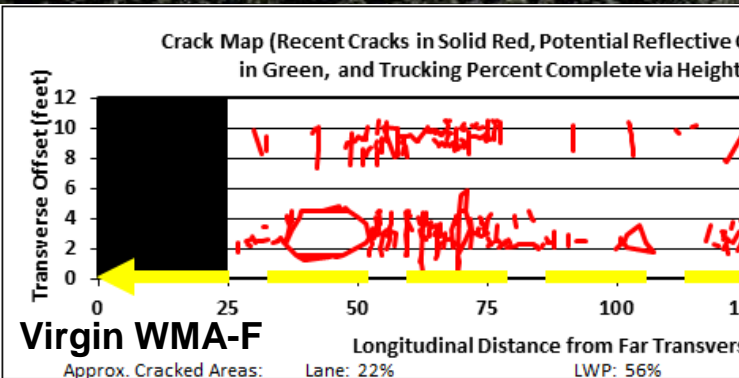
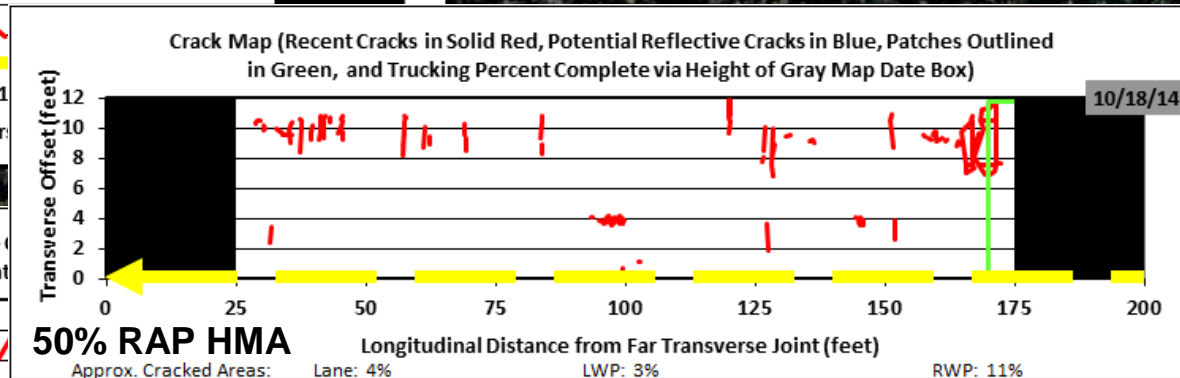
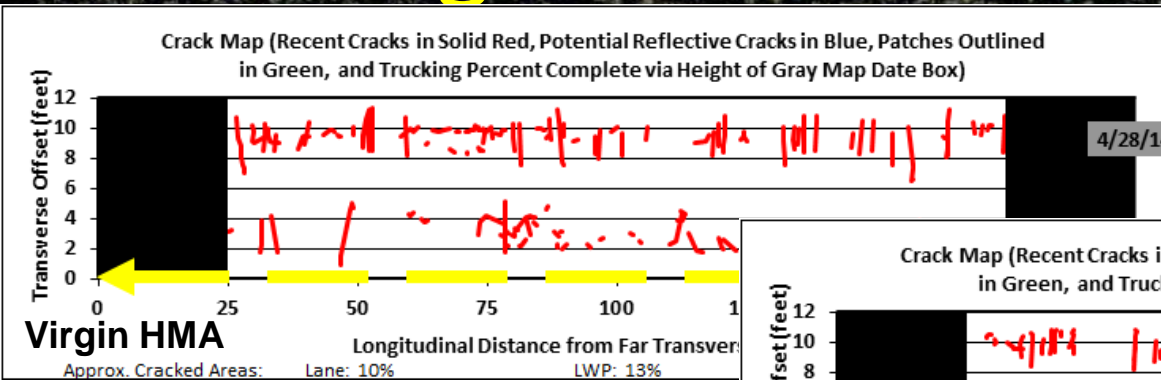
Finer Mixes with Lower N_{des}



High RAP Mixes and Virgin AC Grade



High RAP Mixes and WMA

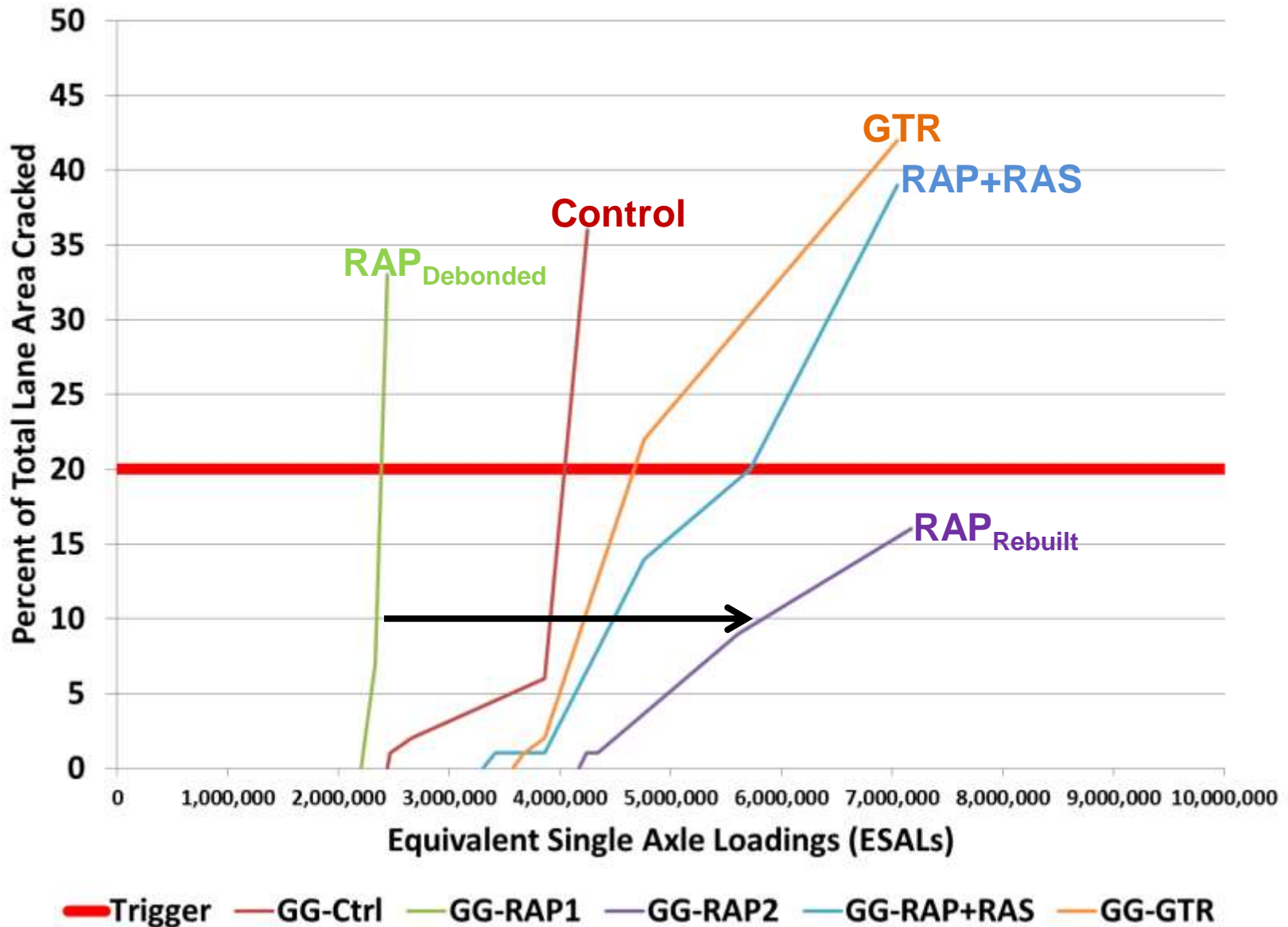


Targeted Use of RAP, RAS, and GTR

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 67-22/16-22 SMA	5% RAS ₂₁ 67-22/88-16 SMA	VIRGIN 82-22 ₁₂ SMA
Stiff, Strain Reducing Middle	35% RAP ₃₉ 67-22/88-10 DG	50% RAP ₄₁ 67-22/82-16 DG	50% AGED ₂₆₋₂₄ 67-22/94-10 DG	35% RAP ₃₇ 82-22 ₁₂ DG
Fatigue Resistant Base Layer	35% RAP ₃₉ 67-22/88-10 DG	35% RAP ₃₄ 94-28/94-10 DG	25% RAP ₂₄ +76-22/88-16 DG	VIRGIN 88-22 ₂₀ AZ

Green = Evotherm Q1 Additive, Blue = Astec Green Foamer

Targeted Use of RAP, RAS, and GTR



Cold Recycle & Full Depth Reclamation



Lanford Brothers Uses

**In-Place
Recycling
on I-81 Project**

Three recycling methods used in combination for the first time on a project in the U.S. will save Virginia both time and money.

By Lisa Cleaver, editor

**23,000 AADT
28% Trucks
7.2 Lane Miles
CIR and
FDR+CCPR
\$7.6 Million**



Cold Recycle & Full Depth Reclamation

S12

4-inch AC

5-inch CCPR

8-inch FDR

Subgrade

N4

4-inch AC

5-inch CCPR

6-inch Agg

Subgrade

N3

6-inch AC

5-inch CCPR

6-inch Agg

Subgrade

Cold Recycle & Full Depth Reclamation



Cold Recycle & Full Depth Reclamation



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Cold Recycle in a Hot-Mix Plant



Cold Recycle in a Hot-Mix Plant



Cold Recycle in a Hot-Mix Plant

- HMA = 0.44 to 0.54
- CAB \approx 0.15
- CR \approx 0.36 to 0.39

Healthy Binder Content

- RAP in the past \neq current RAP \neq future RAP
- “Reclaimed/recycled content” is not enough
- “Aged binder ratio” (ABR) alone 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



Open Graded Interlayer (OGI)



Triple Chip Interlayer

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

Preventing Reflective Cracks

12/6/2014

Quadrant: N
Section: 12

Surface Mix and Materials

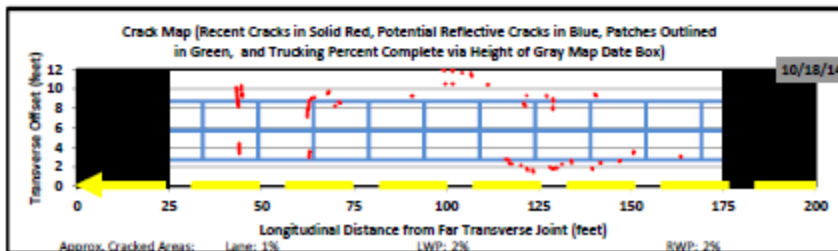
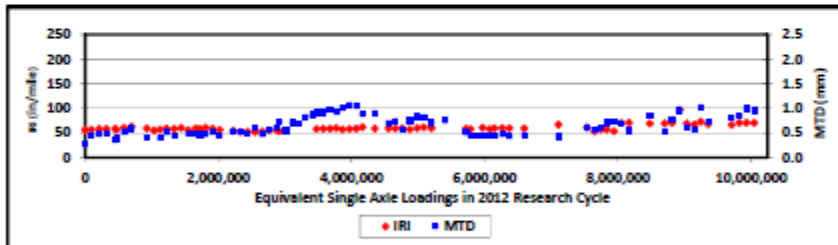
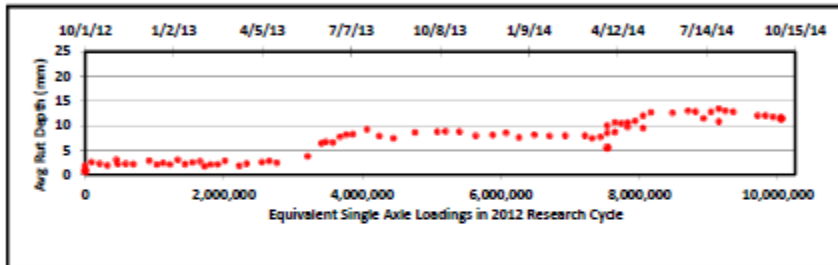
Structural Buildup Information

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

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
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Surface Mix and Materials

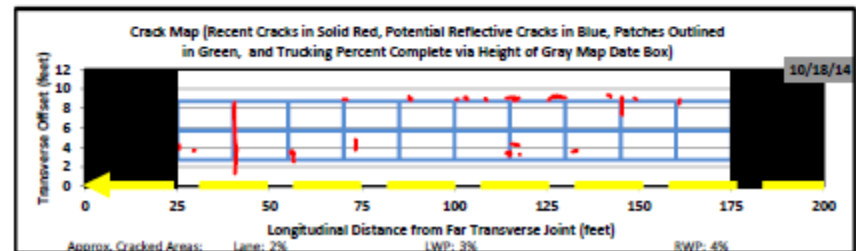
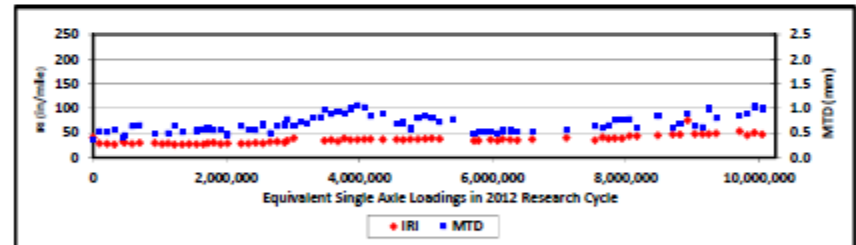
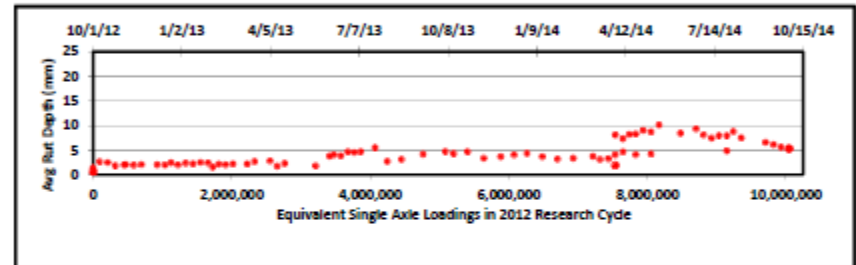
Structural Buildup Information

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

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



Status Report

- High level of construction quality achieved
- >2 million ESALs on Track with nothing pending
- $\approx \frac{1}{2}$ 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.

Takeaways

- Nationwide preservation with MnROAD
- Laboratory cracking test(s) with MnROAD
- Use of fine/small blends for (high ADT)
- Reduced design gyration levels (durability)
- Best use of RAP, RAS, and GTR (\$, sustainable)
- Healthy (balanced) binder content (cracking)
- Preventing reflective cracks in inlays/overlays.

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

www.ncat.us





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