Implementable Findings from the 2012 NCAT Pavement Test Track
2015 Pavement Test Track Conference

March 3-5, 2015
The Hotel at Auburn University and Dixon Conference Center
Auburn, Alabama

- WMA & High RAP/RAS/GTR Mixes
- Optimized Structural Design
- Pavement Preservation
- Implementation

Official registration information will soon be available at www.ncat.us
Content

- Materials
- Mixes
- Structures
- Construction
- Preservation
Materials

• Cost of crude & virgin binder is disconnected
• Utilization of fractionated RAP & processed RAS
• Need enough “healthy” binder for mix durability
• Compatibility of additives for WMA & antistrip
• Sustainable binder modifiers (GTR, biopolymers)
• Kevlar fibers to improve mix durability (OGFC)
• Highly polymer modified asphalt (HiMA).
Materials
Mixes

- Higher binder contents in balanced mix designs
- Benefits of smaller NMAS and/or finer mixes
- Expanded use of otherwise wasted stockpiles
- Aged binder ratio (ABR) mix design references
- Differentiated designs (ABR = RAPBR + RASBR)
- Cracking test needed for design approval & QC (!).
2015 Cracking Group (CG)
Smaller NMAS Mix in S3
Structures

- “M-E” versus “E” pavement buildup design
- Need for local calibration & strain thresholds
- Consideration for alternative materials
- Layer coefficient increase from 0.44 to 0.54
- Reduces to ≥ 0.15 for OGFC/PFC surfaces
- Fog sealing prolongs OGFC/PFC surface life
- $0.36 \leq 100\% \text{ RAP CCPR base mix} \leq 0.39$. 
100% RAP Foamed CR Base Mix
100% RAP Foamed CR Base Mix
Construction

- WMA and higher aged binder ratio (ABR) mixes
- Less distinction between HMA and WMA
- Smaller NMAS and/or finer mixes
- Longitudinal joint quality/performance
- Prevention of premature/reflective distresses
- Tack coat is critical to pavement performance (!).
<table>
<thead>
<tr>
<th>Purpose of Each Layer</th>
<th>N5 Control</th>
<th>S5 Higher RAP</th>
<th>S6 RAP+RAS</th>
<th>S13 Recyc Tires</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Durable, Rut Resistant Surface</strong></td>
<td>20% RAP\textsubscript{20} 67-22/82-16 DG</td>
<td>25% RAP\textsubscript{11} 67-22/86-22 SMA</td>
<td>5% RAS\textsubscript{21} 67-22/88-16 SMA</td>
<td>VIRGIN 82-22\textsubscript{12} SMA</td>
</tr>
<tr>
<td><strong>Stiff, Strain Reducing Middle</strong></td>
<td>35% RAP\textsubscript{39} 67-22/88-10 DG</td>
<td>50% RAP\textsubscript{41} 67-22/82-16 DG</td>
<td>50% AGED\textsubscript{26-24} 67-22/94-10 DG</td>
<td>35% RAP\textsubscript{37} 82-22\textsubscript{12} DG</td>
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<td><strong>Fatigue Resistant Base Layer</strong></td>
<td>35% RAP\textsubscript{39} 67-22/88-10 DG</td>
<td>35% RAP\textsubscript{34} 94-28/94-10 DG</td>
<td>25% RAP\textsubscript{24} +76-22/88-16 DG</td>
<td>VIRGIN 88-22\textsubscript{20} AZ</td>
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Green = Evotherm Q1 Additive, Blue = Astec Green Foamer
## 2012 Green Group (GG) Study

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Preservation

- Crack sealing improves cracking performance
- Differences between route/fill and blow/band
- Scrub seals exhibit both crack & chip seal benefit
- Treatments reduce subgrade moisture, but...
- Robust treatments provide more life extension
- Objective selection of preservation alternatives.
Preservation

- Crack sealing improves cracking performance
- Differences between route/fill and blow/band
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- Treatments reduce subgrade moisture, but...
- Robust treatments provide more life extension
- Objective selection of preservation alternatives.
Objective Treatment Selection

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

1. Rejuvenating Fog Seal
2. Fibermat
3. Control with Less Cracking
4. Control with More Cracking
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. Cape Seal
11. Micro Surface
12. CS + Micro Surface
13. Double Layer Micro Surface
14. Fibermat Cape Seal
15. Scrub Cape Seal
16. Scrub Seal
17. Fibermat Chip Seal
18. Fibermat HMA Cape
19. HMA Thinlay
20. Thinlay on CCPR Base
21. HMA Polymer Thinlay
22. NovaChip
23. HMA 50% RAP Thinlay
24. HMA 5% RAS Thinlay
25. HMA HiMA Thinlay
Reduction in Cracking
Reduction in Cracking
Reduction in Cracking

![Graph showing reduction in cracking over time for different treatments.](image-url)
Reduction in Cracking

Treated Cracking / Untreated Cracking (%)

Aug-12  Dec-12  Apr-13  Sep-13  Jan-14  May-14  Oct-14

- 54% Aged FRAP Binder Thinlay
- 19% Aged PCRA Binder Thinlay
- Thinlay
- Thinlay Cape Seal
- Polymer Thinlay
- HiMA Thinlay
Rutting Performance

![Graph showing average rut depth in millimeters over different sections, comparing pre-treatment, post-treatment, and post-traffic conditions.](Image)
Roughness Performance

International Roughness Index (inches/mile)

Date
Aug-12 Nov-12 Feb-13 May-13 Sep-13 Dec-13 Mar-14 Jul-14 Oct-14

Average Control Chip Seal Micro Surface with Crack Sealing Thinlay
Track Preservation
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2015 Preservation Group (PG15)

• 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}, HIR, etc.
• High ABR thin overlays
• Connection to Cracking Group.

7 ¾” Asphalt Pavement
10” Aggregate Base
NCAT+MnROAD Preservation 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.
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Performance data for each section can be viewed by positioning your mouse over the section in question and left clicking. Based on feedback from our research sponsors, the performance reports have been revised to include crack maps. The 2009 performance reports are now a fully integrated and active part of the web presentation.

- N1, N11, S5, and S8 - S13 are structural sections.
- All other sections have deep perpetual foundations.
- Research cycle of surface placement shown by color.
- Off-Track sections on Lee Road 159 shown below.
2015 Track Research Sponsors

Private Sector Sponsors
- Cargill Deicing Technology
- FP2
- Kraton Polymers
- Modified Asphalt Solutions
- Oldcastle Materials
- Polycon Manufacturing
- Seneca Petroleum
- Shell Sulfur Solutions
- Trinidad Lake Asphalt

FHWA

Minnesotta Department of Transportation

National Center for Asphalt Technology (NCAT) at Auburn University
Pavement Test Track Conference
March 6-8, 2018
The Hotel at Auburn University and Dixon Conference Center

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