NCAT Pavement Test Track

Buzz Powell
Research Update at ND Asphalt Conference
NCAT Pavement Test Track

Pre-2015, 2015

FHWA

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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.
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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.
Cracking Group (CG) Section Surfaces

- 20% RAP control $N_1@20/0$
- High density control $N_2@20/0$
- Low AC/density control $N_5@21/0$
- Control + 5% RAS $N_8@20/14$
- Control +15% RAP with PG58-28 $S_5@33/0$
- Control with HiMA $S_6@19/0$
- 15% RAP AZ rubber with ARB20 $S_{13}@7/0$. 
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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
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

45% RAP PG58-28
Approx. Cracked Areas: 5%
Lane: 5%
LWP: 4%
RWP: 2%

45% RAP PG67-22
Approx. Cracked Areas: 9%
Lane: 9%
LWP: 3%
RWP: 7%

45% RAP PG76-22
Approx. Cracked Areas: 12%
Lane: 12%
LWP: 7%
RWP: 15%
Targeted Use of RAP, RAS, and GTR

<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>Durable, Rut Resistant Surface</td>
<td>20% RAP&lt;sub&gt;20&lt;/sub&gt; 67-22/82-16 DG</td>
<td>25% RAP&lt;sub&gt;11&lt;/sub&gt; 67-22/16-22 SMA</td>
<td>5% RAS&lt;sub&gt;21&lt;/sub&gt; 67-22/88-16 SMA</td>
<td>VIRGIN 82-22&lt;sub&gt;12&lt;/sub&gt; SMA</td>
</tr>
<tr>
<td>Stiff, Strain Reducing Middle</td>
<td>35% RAP&lt;sub&gt;39&lt;/sub&gt; 67-22/88-10 DG</td>
<td>50% RAP&lt;sub&gt;41&lt;/sub&gt; 67-22/82-16 DG</td>
<td>50% AGED&lt;sub&gt;26-24&lt;/sub&gt; 67-22/94-10 DG</td>
<td>35% RAP&lt;sub&gt;37&lt;/sub&gt; 82-22&lt;sub&gt;12&lt;/sub&gt; DG</td>
</tr>
<tr>
<td>Fatigue Resistant Base Layer</td>
<td>35% RAP&lt;sub&gt;39&lt;/sub&gt; 67-22/88-10 DG</td>
<td>35% RAP&lt;sub&gt;34&lt;/sub&gt; 94-28/94-10 DG</td>
<td>25% RAP&lt;sub&gt;24&lt;/sub&gt; +76-22/88-16 DG</td>
<td>VIRGIN 88-22&lt;sub&gt;20&lt;/sub&gt; AZ</td>
</tr>
</tbody>
</table>

Green = Evotherm Q1 Additive, Blue = Astec Green Foamer
Targeted Use of RAP, RAS, and GTR
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 time and money, 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
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Cracking Group (CG) Study

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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 ≈ 0.15
- CR ≈ 0.36 to 0.39
Healthy Binder Content

- RAP in the past ≠ current RAP ≠ 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

<table>
<thead>
<tr>
<th>Treatment</th>
<th>1st Treatment Applied:</th>
<th>Placement Date:</th>
<th>8/8/2012</th>
<th>Emulsion Grade:</th>
<th>CRS-2HP</th>
<th>Target Emulsion Rate (GSY):</th>
<th>0.26</th>
<th>Meas. Emulsion Rate (GSY):</th>
<th>0.28</th>
<th>Aggregate Type:</th>
<th>Granite</th>
<th>Meas. Aggregate Rate (PSY):</th>
<th>23.0</th>
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<tbody>
<tr>
<td></td>
<td>2nd Treatment Applied:</td>
<td>Placement Date:</td>
<td>8/8/2012</td>
<td>Emulsion Grade:</td>
<td>CRS-2HP</td>
<td>Target Rate (gals / SY):</td>
<td>0.34</td>
<td>Measured Rate (gals / SY):</td>
<td>0.28</td>
<td>Aggregate Type:</td>
<td>Granite</td>
<td>Meas. Agg. Rate (lbs / SY):</td>
<td>16.0</td>
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<tr>
<td></td>
<td></td>
<td>Placement Date:</td>
<td>8/9/2012</td>
<td>Emulsion Grade:</td>
<td>CRS-2HP</td>
<td>Target Rate (gals / SY):</td>
<td>0.15</td>
<td>Measured Rate (gals / SY):</td>
<td>0.14</td>
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Preventing Reflective Cracks
Preventing Reflective Cracks
Status Report

• High level of construction quality achieved
• >2 million ESALs on Track with nothing pending
• ≈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.
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

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