Implementing Pavement Recycling Research

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Overview

• Recycling
  – Why
  – Processes

• Research implementation
  – I-81
  – NCAT
  – I-64
Why VDOT Should Recycle Pavements

• Costs
  – 30-50% reduction

• Greenhouse gases
  – Up to 50% reduction

• Address causes rather than symptoms

• Accumulating RAP
More than 10 million tons of RAP stockpiled in Virginia
Recycling Processes

• Full-depth reclamation
  – Stabilize the pavement foundation
  – Typically 8-12 inches

• Cold in-place recycling
  – Recycle the upper portions of the asphalt layers
  – Typically 2-5 inches

• Cold central plant recycling
  – Similar to CIR but happens at a mobile plant
  – Up to 8 inches
  – Multiple layers
  – Existing RAP
Full depth reclamation
Cold in-place recycling
Cold central plant recycling
So what hurdles remain?

• Limited experience
• Failure mechanisms are not well understood
• Limited number of recycling contractors
• Limited number of projects
• It’s something different
VDOT Recycling Research Efforts

- Help establish specifications
- Monitor performance of existing VDOT projects
- Provide design assistance
- Synthesize experience from other agencies
VDOT Recycling Research, I-81

- 2011
- AADT = 24,000
- 29% trucks (about 6,900 per day)
- First project in US to combine recycling processes on the interstate system
- About 17 million ESALs
<table>
<thead>
<tr>
<th>Left Lane</th>
<th>Right Lane</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-in Asphalt</td>
<td>4 &amp; 6-in Asphalt</td>
</tr>
<tr>
<td>5-in CIR</td>
<td>6 &amp; 8-in CCPR</td>
</tr>
<tr>
<td>~4-in Exist. Asphalt</td>
<td>12-in FDR</td>
</tr>
<tr>
<td>8-in Agg Base</td>
<td></td>
</tr>
<tr>
<td>Subgrade</td>
<td>Subgrade</td>
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</tbody>
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VDO Recycle Research, NCAT

- 2012
- Auburn University
- Fleet of trucks drive 6 days per week for 2 year test cycles
- 2 cycles at 10 million ESALs per test cycle
- Instrumented pavement sections
NCAT Test Track Sections

N3
- 6-inch AC
- 5-inch CCPR
- 6-inch Agg Base
- Subgrade

N4
- 4-inch AC
- 5-inch CCPR
- 6-inch Agg Base
- Subgrade

S12
- 4-inch AC
- 5-inch CCPR
- 6-inch Agg Base
- 8-inch FDR
- Subgrade
Tensile Microstrain Normalized to 68°F

- N3-6" AC: $y = 5.1641x + 242.61$, $R^2 = 0.2687$
- N4-4" AC: $y = 7.0714x + 382.13$, $R^2 = 0.095$
- S12-4" AC SB: $y = 0.2851x + 134.79$, $R^2 = 0.0029$

Million ESALs
Section S12

- Recycled content
  - Layer 1 = 12.5%
  - Layer 2 = 30%
  - Layer 3 = 100%
  - Layer 4 = 100%

- Entire cross section
  - 80% recycled
Implementing Research, I-64

• Segment I, 5.6 miles
  – Widen, overlay existing jointed concrete
  – Completed 2017

• Segment II, 7.08 miles
  – Widen, reconstruct
  – Estimated completion Spring 2019

• Segment III, 8.3 miles
  – Widen, reconstruct
  – Start Summer 2018, completion 2021
I-64 Recycle Designs

• New lanes
  – Import crushed concrete or RAP, stabilize in FDR process
  – OGDL
  – CCPR
  – 4 inches asphalt surface

• Existing lanes
  – FDR existing base after concrete is removed
  – OGDL
  – CCPR
  – 4 inches asphalt surface
Processed RAP

100% passing 12.5mm
#10s
CCPR

85% RAP, 15% #10s
Considering Segments 2 and 3, I-64

- FDR and CCPR are included
- More than a million tons of material will be recycled
- Compared to a traditional design, cost savings will exceed $15 million
- Still working on greenhouse gas calculations
Thank you!

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