In-Place Pavement Recycling: VDOT Experiences and Expectations

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Pavement Recycling

• Overview
• VDOT experiences
  – Why VDOT recycles
  – Performance and cost examples

• Goal
  – Show how pavement recycling can work in South Carolina
Most Use

• New York
  – 350 lane miles in 2015

• Iowa
  – 2300 lane miles over last 5 years

• Nevada
  – Has recycled nearly 25% of their system
Definitions

• Processes
  – Full-depth reclamation (FDR)
  – Cold in-place recycling (CIR)
  – Cold central-plant recycling (CCPR)

• Differences
  – Location & thickness
Full-Depth Reclamation

- Bound layers, agg base, and subgrade
- Creates a stabilized base course
- 4 to 12 inches
Cold In-Place Recycling

- Within the asphalt layers
- 2 to 5 inches
Cold Central-Plant Recycling

- Similar to CIR
- Multiple layers
- Stockpiles of existing RAP
More Information

• ARRA
  – Basic Asphalt Recycling Manual

• NCPP regional workshops
  – Presentations online (free)

• NHI
  – Asphalt Pavement In-Place Recycling Techniques

• Wirtgen
  – Cold Recycling Technology (free)
Why VDOT Recycles
(and why SCDOT should too)

• Economic
  – Nevada DOT saved $600 million over 20 years
  – 30-50 percent cost savings per project

• Environment
  – MTO (Ontario) estimated 50 percent less greenhouse gases emitted

• Construction
  – Fixes deterioration causes rather than symptoms
Rapid deterioration
– Overlays had 2-3 year service-life
I-81 Design & Construction

• 30 year design
  – AADT = 23,000 with 28% trucks
  – 102 million ESALs
  – 7.9 required SN

• Construction
  – 8 months
  – Innovative traffic management
  – $10 million (vs $16 million)
I-81 Processes

• Right lane
  1) Mill 10 inches
  2) FDR 12 inches
  3) 8 & 6 inch CCPR
  4) 4 & 6 inch asphalt overlay

• Left lane
  1) Mill 2 inches
  2) CIR 5 inches
  3) 4 inch asphalt overlay
I-81 Performance

• Summer 2015
  – 4 years ~ 7 million ESALs (right lane)
  – Average rut depth = 0.1 inches
  – Average IRI = 53 / 44 (left / right)
  – $SN_{eff} > 9$ (right lane)

• 3-year performance report
  – AASHTO High Value Research project
NCAT

N3
- 6-in AC
- 5-in CCPR
- 6-in Agg
- Subgrade

N4
- 4-in AC
- 5-in CCPR
- 6-in Agg
- Subgrade

S12
- 4-in AC
- 5-in CCPR
- 8-in FDR
- Subgrade
NCAT Performance

• 2012 Track Cycle
  – 10 million ESALs
  – No surface cracking
  – Average rut depth < 1/4 inch

• 2015 Track Cycle
  – About 1.5 million ESALs so far
  – 11.5 million total
### S12 Recycled Content

<table>
<thead>
<tr>
<th>Layer</th>
<th>Recycled Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-inch AC</td>
<td>12.5% recycled</td>
</tr>
<tr>
<td>5-inch CCPR</td>
<td>30% recycled</td>
</tr>
<tr>
<td>8-inch FDR</td>
<td>100% recycled</td>
</tr>
</tbody>
</table>

- Entire cross section: 80% recycled

- New construction?

- 17 inches manipulated:
  - Layer 1 = 12.5% recycled
  - Layer 2 = 30% recycled
  - Layer 3 = 100% recycled
  - Layer 4 = 100% recycled
I-64 Lane Widening

Current AADT = 37,500 w/ 8.5% trucks
I-64 Lane Widening

• Design build, 7.08 miles
  – Add travel lane and shoulder to the inside
    • CCPR
  – Reconstruct existing two lanes
    • FDR + CCPR
  – Awarded January 2016

• Benefits
  – RAP use could exceed 200,000 tons
  – Cost savings could exceed $10 million
NCHRP 9-51

- Material Properties for CIR and FDR for Pavement Design

- Cores from 24 projects

- Partners
  - Univ of Maryland
  - Virginia DOT
  - Wirtgen
  - Colas Solutions
Higher temperature

Lower temperature

Dynamic Modulus (MPa)

Reduced Frequency (Hz)

Emulsified Asphalt

Foamed Asphalt

NCHRP 9-51
Summary

- Pavement recycling can reduce costs by 30-50%.
- It can reduce greenhouse gas emissions by more than 50%.
- It has been used successfully on high volume roadways.
- It can be used on new construction and rehabilitation projects.
Thank you!

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