Pavement Recycling

Process, Field Performance, Sustainability and Savings

TRENTON M. CLARK, P.E.
Executive Vice President
VIRGINIA ASPHALT ASSOCIATION
OVERVIEW

RECYCLING
- Why
- Process

RESEARCH IMPLEMENTATION
- I-81
- NCAT
- I-64
WHY RECYCLE PAVEMENTS?

- COST
  - 30% to 50% reduction

- ADDRESS CAUSES
  - rather than symptoms

- GREENHOUSE GASES
  - up to 50% reduction

- ACCUMULATING RAP
5 ACRES
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
SO, WHAT HURDLES REMAIN?

- LIMITED EXPERIENCE
- FAILURE MECHANISMS ARE NOT WELL UNDERSTOOD
- FEW RECYCLING CONTRACTORS
- SMALL 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
First project in US to combine recycling processes on the interstate system

- AADT = 24,000
- 29% trucks about 6,900 a day
- 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>
</tr>
</tbody>
</table>
Fleet of trucks drive 6 days per week for 2 year test cycles

Two sections continued in 2018

Auburn University
2 cycles at 10 million ESAL’s per test cycle
Instrumented pavement sections

VDOT RECYCLING RESEARCH NCAT 2012 - 2021
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
- 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**
  
  \[ y = 0.2851x + 134.79 \]
  
  \[ R^2 = 0.0029 \]
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 1 – 5.6 MILES
- Widen, overlay existing jointed concrete
- Finished 2017

SEGMENT 2 – 7.8 MILES
- Widen, reconstruct
- Estimated finish Spring 2019

SEGMENT 3 – 8.3 MILES
- Widen, reconstruct
- Start Mid 2018, finish 2021
I-64 RECYCLE DESIGNS

NEW LANES
Import crushed concrete or RAP, stabilize in FDR process

EXISTING LANES
FDR existing base after concrete is removed

- 12” FDR
- 2” OGDL
- 6” CCPR
- 4” SMA (12.5/19.0)
Processed RAP

100% passing 12.5mm
#10’s
CCPR

- 85% RAP
- 15% 10’s
FDR & CCPR are Included

More Than 1 Million Tons of Material Will be Recycled

Compared to A Traditional Design, Cost Savings Will Exceed $15 Million

Still Working on Greenhouse Gas Calculations
SO, WHAT’S NEXT?

- INSTRUMENTING I-64
- UPDATED VDOT PAVEMENT DESIGN GUIDES
- MORE ALTERNATE BID PROJECTS
- CONTINUED LAB RESEARCH
- MATERIALS CERT. CLASSES
Questions

Trenton Clark, P.E. – Virginia Asphalt Association
Executive Vice President
804-929-2331
tclark@vaasphalt.com

Dr. Brian Diefenderfer, P.E. – VTRC
Senior Research Scientist
Brian.Diefenderfer@vdot.virginia.gov