Lessons Learned: VDOT’s In-Place Pavement Recycling Research

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Pavement Recycling

• A set of cost-effective and environmentally sensitive techniques for pavement rehab

• Benefits
  – 30 to 50 percent cost savings
  – 50 percent less greenhouse gases emitted
  – Fix deterioration causes rather than symptoms

• Used by VDOT
  – Full-depth reclamation, cold in-place recycling, cold central-plant recycling
I-81

- 23,000 AADT
- 28% trucks
- 7.2 lane miles
- Constructed 2011
Rut Depth

Rut Depth, inches

<table>
<thead>
<tr>
<th>Rut Depth, inches</th>
<th>Months after construction</th>
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<tbody>
<tr>
<td>0.04</td>
<td>5</td>
</tr>
<tr>
<td>0.03</td>
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</table>

Left lane

Right lane
Ride Quality

Average of 0.01 mile data

1 standard deviation ~ 15 IRI

IRI, inches / mile

Months after construction

Left lane

Right lane

Excellent

Good

Fair
I-81: What We Learned

• Construction can be completed quickly
  – Right lane
    • Mill, FDR, pave CCPR, pave first lift of AC
    • 3 to 4 days each for 2,100 to 7,900 ft sections
  – Left lane
    • Mill, CIR, pave first lift of AC for 3.6 miles
    • 3 day closure

• Alternative lane closure used successfully
  – Advance notice
  – Detour route
I-81: What We Learned

• Lab testing
  – Performance of CIR and CCPR was similar

• Field testing (34 months)
  – Rut depth is not increasing
  – Ride quality is not decreasing
  – Right lane (4 over 8 vs. 6 over 6)
    • 4 over 8 started with a higher IRI
    • Rut depth is not increasing
    • Ride quality is not decreasing
I-81: What We Learned

• Layer coefficients from this project (based on lab & field tests)
  – FDR + CCPR \sim 0.37
  – CCPR range = 0.36 to 0.44
  – CIR range = 0.35 to 0.39
NCAT Recycled Sections

- 10 million ESALs
- 2 years
- Constructed 2012
- 5 inch CCPR base
Rutting

% of 10 million ESALs

Rut depth, inches

N3, 6 inch AC
N4, 4 inch AC
S12, 4 inch AC+FDR
NCAT: What We Learned

• Field testing (at 9.4 million ESALs)
  – Ride quality not decreasing
  – Rutting increasing but not yet significant
    • However, trends are beginning to develop
  – Strain data showing differences between sections

• Layer coefficient from NCAT
  – Based on FWD testing
  – CCPR range = 0.36 to 0.39
What We Still Need to Work On

• **Design**
  – Representative layer stiffness *(see 9-51 study)*
    • Source materials, gradation, additives, etc.

• **Performance**
  – Deterioration prediction models
  – Failure mechanisms
  – Performance with thinner overlays / surface treatments
Using Existing RAP

4.5+ million tons statewide
Using Existing RAP

- With CCPR, we could pave a 12-foot wide lane at 6 inches thick for about 2,100 miles.
Years to 10 million ESALs

- **SB I-81, Augusta County**
  - a) <5, b) 5-10, c) 10-20, d) >20  
    - 4.6 years

- **NB I-95, Prince William County**
  - a) <5, b) 5-10, c) 10-20, d) >20  
    - 7.7 years

- **WB I-64, Ft. Eustis Boulevard**
  - a) <5, b) 5-10, c) 10-20, d) >20  
    - 20 years

- **NB I-95, Prince William HOT / HOV Lanes**
  - a) <5, b) 5-10, c) 10-20, d) >20  
    - 46 years
An Example

- Lane widening project
  - 5.5 miles
  - 2 directions
  - 12 foot travel lane + 10 foot shoulder
  - Proposed 6-inch CCPR base

- How many tons could be used?
  a) 5,000 tons
  b) 10,000 tons
  c) 20,000 tons
  d) 30,000 tons
  e) 43,100 tons
Summary

• Pavement recycling is feasible
• It can be completed quickly & successfully
• It can perform in high traffic volume areas
• We have locations where it can be used
• NCAT shows it can last
  – 9.4 million ESALs (so far…)


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  – VAA
Thank you!

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