Seven Steps of Implementing In-Place Recycling by Public Agencies

Midwestern States Regional In-Place Recycling Conference
Schaumburg, IL

Presented by:
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Federal Highway Administration

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Our Visit

1. Designate a Point of Contact
2. Assess the Situation
3. Formulate a Plan
4. Develop Tools
5. Train Staff and Take Action
6. Track and Evaluate Progress
7. Communicate Results
Designate a Point of Contact

• Provide focus
• Comfortable with technical information and communication
• Obtain full support from top managers
• Partner with industry
• Lead training
Our Visit

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Assess the Situation Nationally

Environmental
Economics
Engineering
Mill & Overlay vs. CIR & Overlay

3” Mill & 3” HMA

- Existing HMA (SN-0.2/inch)
- New HMA (SN-0.42/inch)

Total SN-
(3”*0.42)-3*0.2=0.66

3” CIR & 1.5” HMA

- 0.3-CIR (SN-0.3/inch)
- 0.42 New ACP (SN-0.42/inch)

Total SN-
(3*(0.3-0.2)+0.42*1.5=0.93

40% Increase in SN value
Cost Comparison

3” Mill & 3” overlay

- 3” Milling - $1.5/ Sq. Yd.
- 3” HMA - $18/ Sq.Yd.
- Total cost for one mile (32’ wide) = $370 K

3” CIR & 1.5” overlay

- 3” CIR - $4.5
- 1.5” HMA - $9/ Sq.Yd.
- Total cost for one mile (32’ wide) = $253K

30% Cost decrease
Long-Term Performance

9-year Performance

CIR and 2” Overlay Section, Reno, Nevada
Long-Term Performance
20-year Performance - US-95 Nevada
Colorado DOT, Region 2
I-25 south of Pueblo

• Life Cycle Cost Analysis
  – 6-inch CIR and 4-inch overlay ($24.7M)
  – 4-inch mill and 5.5-inch overlay ($28.9M)

• “Go Green” Calculations
  – Save 17,000 tons of aggregate
  – Save 1,200 tons of binder
  – Recycle 85,000 tons of material
Assess the Situation Locally

Type of in-place recycling that offers biggest competitive advantage

• Geographic locations for aggregates hauled
• Type of traffic
• Type of pavement distresses
• Type of in-place recycling that offers most promise
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Formulate a

• Goals
  – Try in-place recycling for the first time
  – Try a different type of in-place recycling technique for the first time
  – Expand current number of projects by a certain number or percentage
Formulate a **PLAN**

- **Strategies**
  - What are you going to do?
  - Where are you going to do it?
  - How are you going to do it?
  - When are you going to do it?
Formulate a **PLAN**

<table>
<thead>
<tr>
<th><strong>EXAMPLE</strong></th>
<th><strong>In-Place Recycling: Type 1</strong></th>
<th><strong>In-Place Recycling: Type 2</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>Develop tools, train, communicate</td>
<td></td>
</tr>
<tr>
<td>Year 2</td>
<td>One pilot project</td>
<td>Develop tools, train, communicate</td>
</tr>
<tr>
<td>Year 3</td>
<td>One project per District</td>
<td>One pilot project</td>
</tr>
<tr>
<td>Year 4</td>
<td>Expand use</td>
<td>One project per District</td>
</tr>
<tr>
<td>Year 5</td>
<td>Keep tracking, communicating and improving</td>
<td>Expand use</td>
</tr>
</tbody>
</table>
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Develop Tools

- Project selection guidelines
- Develop pavement design guidelines
- Develop mix design guidelines
- Develop construction specifications
Project Selection Guidelines

Right Location

Right Strategy

Right Time
Timing of Rehabilitation Techniques

Pavement Preservation Techniques

- HIR
- CIR
- FDR/Reconstruct

Pavement Condition
- Very Good
- Good
- Fair
- Poor
- Very Poor

Time / Traffic Loading
Existing Pavement Evaluation

- Condition Survey
- Core or Depth Check
- FWD on Project with Questionable Structural Section

Determine Cause of Pavement Distress

- Functional Distress
- Structural Distress

Surface Distress

- Cracking >2”

FDR and Overlay

- HIR
- CIR and Wearing Surface
What is a good strategy for surface raveling?

HIR
What is a good strategy for transverse and block cracking?
What is a good strategy for alligator cracking?

FDR
Pavement Design Guidelines

- MEPDG
- 1993-AASHTO Design Guide
  - Use structural number 0.28-0.35 for CIR
  - Mr. for CIR varies from low 200’s to 1 M
## Pavement Design Guidelines

<table>
<thead>
<tr>
<th>FDR Method</th>
<th>Minimum Thickness of Riding Surface</th>
<th>Typical Structural Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical</td>
<td>2” HMA</td>
<td>0.10 – 0.12</td>
</tr>
<tr>
<td>Bituminous</td>
<td>Surface Treatment or Structural HMA</td>
<td>0.20 – 0.28</td>
</tr>
<tr>
<td>Cement</td>
<td>Surface Treatment or Structural HMA</td>
<td>0.15 – 0.20</td>
</tr>
</tbody>
</table>
Mix Design Process

- Gyratory Compactor
- Marshall Stability
- Raveling Test
- RAP Preparation
Constructing a Successful Project
Constructing a Successful Project

- End-result specifications
- Inspector checklist
- Field acceptance testing
- Pre- and post-construction meetings
- Partnering - successful projects are based on win-win strategy
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Training

- NHI 131050 – Asphalt Paving In-Place Recycling Technologies
- ARRA – Basic Asphalt Recycling Manual
- Just-in-time training for:
  - Project selection
  - Pavement and materials mix design
  - Construction and inspection
Resources

➢ FHWA:  http://www.fhwa.dot.gov/pavement/recycling/currentproj.cfm

➢ National Center for Pavement Preservation:  http://www.pavementpreservation.org/

➢ Foundation for Pavement Preservation:  www.fp2.org/

➢ Greenroads:  https://www.greenroads.org/

➢ Pavement Recycling Systems:  www.pavementrecycling.com
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Develop a Tracking System

- Projects
- Volume of recycled materials
- Performance
- Dollars saved
- Environmental benefits
Evaluate Progress

- Compare results: traditional vs. recycled
  - Costs, performance
  - Collect, tabulate and calculate
- Update specifications
- Continue improving process
# Cost-Effectiveness for Nevada DOT

<table>
<thead>
<tr>
<th>Category</th>
<th>ESALs</th>
<th>Strategy</th>
<th>Total GRAVEL FACTOR Numbers</th>
<th>Strategy Cost</th>
<th>Reduced Cost/ Mile</th>
<th>Change in SN</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW</td>
<td>&lt; 1 Million</td>
<td>2” Mill &amp;fill</td>
<td>2”(0.35-0.18)= 0.34</td>
<td>625K</td>
<td>63%</td>
<td>(12%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3” CIR Double Chip Seal</td>
<td>3(0.28-0.18) =0.30</td>
<td>230K</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEDIUM</td>
<td>&gt; 1 Million &lt; 3 Million</td>
<td>3” Mill 3” HMA</td>
<td>3”( 0.35-0.18)=0.51</td>
<td>910K</td>
<td>37%</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3” CIR 1.5” HMA</td>
<td>3” (0.28-0.18) +1.5” *0.35=0.82</td>
<td>570K</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HIGH</td>
<td>&gt; 3 Million</td>
<td>3” Mill 6” HMA</td>
<td>(6”)(0.35)-(3”)(0.18)=1.56</td>
<td>1.82 M</td>
<td>28%</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3” CIR 4” HMA</td>
<td>3(0.28-0.18) +4(0.35)=1.70</td>
<td>1.3 M</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Cost-Effectiveness for MNDOT

<table>
<thead>
<tr>
<th></th>
<th>3” CIR &amp; 1.5” HMA</th>
<th>3” Mill &amp; 3” HMA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GF</strong></td>
<td>(3(1.5 - 1.25) + (1.5” \times 2.25) = 4.125)</td>
<td>(3 \times (2.25-1.25) = 3)</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CIR:</strong></td>
<td></td>
<td><strong>Rotomill:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>HMA:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>50,688 S.Y. @ $2.30 = $116,582</td>
</tr>
<tr>
<td>Recycling Binder:</td>
<td>196 tons @ $535 = $104,860</td>
<td></td>
</tr>
<tr>
<td><strong>1.25 inch HMA Overlay</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3,659 tons @ $95.00 = $347,605</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL:</strong></td>
<td>$569,047</td>
<td><strong>TOTAL:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$910,227</td>
</tr>
</tbody>
</table>

**CIR & HMA provides** 37% less cost

**Save $341,180** 37% increase in SN

GF for MNDOT
- New HMA = 2.25
- CIR = 1.5
- Existing HMA = 1.25
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Communicate

- Marketing is critical to success
- Repeating the message several times
- Monitor, evaluate and report projects
- Conference presentations
- Videos
- Apply for awards
Summary

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Questions for you:

1) What additional steps are there?
2) Which step is the most challenging?
3) How can you overcome it?
QUESTIONS?

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