Innovative Pavement Rehabilitation Techniques Using Asphalt Recycling Technology

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The Life of a Pavement
Rehabilitation Candidates
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How do you fix roads with these distresses?

• Complete reconstruction
  – Remove and Replace
  – Expensive
  – Time consuming

• Rehabilitation
  – Mill and Fill
  – Are we addressing all cracking issues?

• In-place Recycling
What is Asphalt Recycling?

• Types of Recycling
  – Full Depth Reclamation (FDR) –
    • depth 6” – 10” with bituminous stabilizers
  – Cold in Place Recycling (CIR) – depth 3” – 5”
    • Partial Depth Recycling
What is In-Place Recycling
Equipment

CIR Example

FDR Example
What is Asphalt Recycling?

• Provides an additional rehabilitation method for existing roadways.

• Benefits
  – Reuse and conservation of non-renewable natural resources
  – Reduction in landfilling or stock-piling material
  – Energy conservation
  – Reduction in user delays
  – Corrections to pavement cross slope and cross section
  – Improve physical properties of the existing pavement section
  – Elimination of pavement cracking pattern
  – Improve pavement performance
  – Cost savings over traditional rehabilitation methods
What is Asphalt Emulsion?

• Combination of:
  – Asphalt
  – Water
  – Surfactants

• Delivered and mixed at low temperatures
  – “Cold” Process
  – Workability

• Chemical Break
  – Formulated to release water
  – Gains strength upon break
  – Curing
How are they built?
FDR: 2 Step Process

Pre-Pulverization

Injection
The FDR Reclaimer
FDR: Seating and Spreading
FDR: Compaction and Finishing
The CIR Single Unit Train
Single Unit CIR Train
CIR: Rollers
Recycling Project Selection

• Full Depth Reclamation
  – Compared to reconstruction
  – Cost Savings
  – Quicker Construction
  – Stabilizing Agent
  – Depth
  – Drainage
  – Constructability

• Cold In-place Recycling
  – Compared to “Mill and Fill”
  – Sufficient HMA Thickness
  – Suitable strength in base and subgrade
  – Smoothness and Profile
  – Stabilizing Agent
  – Drainage
FDR Project Selection
Depth

• Depth of FDR influenced by
  – Thickness of HMA
    • Needs to get through all the HMA
    • Incorporate Aggregate Base
    • Stay above subgrade
  – Pavement Design
    • SN for bituminous FDR (0.25 to 0.30)
    • FDR must have a surface treatment
Cold In-Place Recycling
How Can We Stop Cracking?
Reflective Cracking
Reflective Cracking
CIR Project Selection

• Compared to Deep Mill and Fill
• Structural Number ~0.28 - 0.33
• Paver laid material
  – Smoother than FDR
• Suitable HMA thickness required
  – Some cases entire structure can be CIR
• Strong base required
  – CIR cannot bridge poor subgrades
CIR Treatment Depths

- Where is the cracking?
- Weak underling layers?
- Address layers with stripping
- Strong well compacted base
How do we add structure or widen?
Additional Rock/RAP
In-place Recycling Mix Design Process

How do we get from this... to this?
Purpose of Mix Design

- Verify suitability of selected materials
- Establishes stabilizing agent to improve engineering properties of recycled materials
- Established type of agent and dosage
- Determine if recycling additives are required
- Initial investigation is critical
Recycling Mix Design Parameters

• Which parameters do we investigate for good performance?
  – Stability
    • Resistance to rutting
  – Adhesion
    • Resistance to water damage
  – Strength Development
    • Rate of Development
Mix Design Example

- Are all emulsions the same?

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Emulsion A</th>
<th>Emulsion B</th>
<th>Emulsion C</th>
<th>Design Requirement</th>
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<tbody>
<tr>
<td>Emulsion Content</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td></td>
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<tr>
<td>Maximum Stability (lbs.)</td>
<td>2400</td>
<td>1600</td>
<td>1150</td>
<td>1250 lbs. Min</td>
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<td>Retained Stability (%)</td>
<td>52%</td>
<td>85%</td>
<td>78%</td>
<td>70% Min,</td>
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<tr>
<td>Raveling Resistance (% Loss)</td>
<td>11</td>
<td>1.8</td>
<td>&gt;15</td>
<td>2% Max.</td>
</tr>
</tbody>
</table>
County Highway CIR Example
CIR County Highway Example
County Highway FDR Example
County Highway FDR Example
References

• Asphalt Recycling and Reclamation Association (ARRA) Basic Asphalt Recycling Manual
• Wirtgen Recycling Manual
• ARRA Guidelines
  – www.arra.org
Thank you!

• Questions or Comments

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