Construction Specifications for Hot In-Place Recycling

Tim Aschenbrener
FHWA Resource Center
Pavement and Materials Team
Timothy.Aschenbrener@dot.gov
(720) 963-3247

International and Western States In-Place Recycling Conference
August 5-7, 2014
Denver, CO
Our Visit

1. Description
2. Materials
3. Construction: Equipment
4. Construction: Methods
5. Method of Measurement
6. Basis of Payment
General Description

- Heating the existing pavement
- Hot milling/scarifying the existing surface
- Adding:
  - admixtures and/or
  - new HMA and/or
  - new aggregate
- Mixing
- Paving and compacting the recycled mixture
Hot In-place Recycling (HIR)

Three Processes:

1. Surface Recycling
   - Single-Pass
   - Multi-Pass

2. Remixing

3. Repaving
   - Single-Pass
   - Multi-Pass

Multiple Stage
HIR – Surface Recycling

- Top 1 to 2 inches of existing pavement
- Heating and reworking
- Adding admixture
- Placing and compacting recycled mixture
- Placing surface treatment
HIR – Surface Recycling

- Multiple Pass
- Single Pass (shown here)
HIR – Remixing

- Top 1 to 2 inches of existing pavement
- Heating and reworking
- Adding
  - admixture and/or
  - virgin aggregate and/or
  - HMA
- Mixing in a pugmill
- Placing and compacting
HIR – Repaving

- Top 1 to 2 inches of existing pavement
- Heating and reworking
- Adding and mixing admixture
- Placing and compacting (simultaneously) an overlay on the hot (>200°F) recycle layer
HIR – Repaving

- Single Pass (shown here)
- Multiple Pass
Multiple-Stage

- Multiple passes for increased depth
Our Visit

1. Description
2. Materials
3. Construction: Equipment
4. Construction: Methods
5. Method of Measurement
6. Basis of Payment
Materials: Liquids

- Recycling Agent
  - ASTM D 4552
- Asphalt Rejuvenating Agent
- Type and rate determined in mix design

- Others:
  - WMA
## Materials: Mix

<table>
<thead>
<tr>
<th></th>
<th>Surface Recycling</th>
<th>Remixing</th>
<th>Repaving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recycle Mix Design</td>
<td>Superpave</td>
<td>Superpave</td>
<td>Superpave</td>
</tr>
<tr>
<td>New Mix (Mixed)</td>
<td>N / A</td>
<td>Lean or Rich Coarse or Fine</td>
<td>N / A</td>
</tr>
<tr>
<td>New Mix (Overlay)</td>
<td>Optional</td>
<td>Optional</td>
<td>Superpave</td>
</tr>
</tbody>
</table>
Our Visit

1. Description
2. Materials
3. Construction: Equipment
4. Construction: Methods
5. Method of Measurement
6. Basis of Payment
Modern equipment includes:
- Enclosed, insulated and shielded hoods
  - Better heat transfer
  - Better heat penetration
  - Minimize damage to binder
Equipment: Pre–Heaters

- Depth
  - Number
  - Speed
- Temperatures:
  - Minimum behind paver (e.g. 300°F to 320°F)
  - Maximum: avoid burning or charring (e.g. <330°F)
  - Never exceed 375°F
Equipment: Scarifying / Milling

- Automatic grade control for milling depth
- Height controls to facilitate clearance of manholes and other obstructions
# Equipment: Mixing

<table>
<thead>
<tr>
<th></th>
<th>Surface Recycling</th>
<th>Remixing</th>
<th>Repaving</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Apply</strong></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mixing augers</strong></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Twin–shaft pugmill</strong></td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
Equipment: Paving

- Similar to asphalt paving
- Automated screed controls for slope and grade
  - Note: Surface-recycling, single-pass HIR does not
Equipment: Compaction

- Similar to asphalt paving
  - Steel wheel
  - Pneumatic tire
- Minimum temperature to achieve compaction
  - e.g. 160°F / 185°F
Methods – Weather Limitations

- Temperature
  - Ambient air – (e.g. 45°F)
  - Road surface – (e.g. 55°F)
- Dry surface
- Not foggy or rainy
- Not windy
Methods – Test Strip

- Evaluate the suitability and adequacy of:
  - Equipment
  - Process
  - Ability to make adjustments the process prior to full production
Methods – Surface Preparation

- Power broom
- Place blotter sand on crack filler / sealant
- Typically remove:
  - 75% of rubberized materials
  - 75% of thermoplastic pavement markings
- No fabric in top 1 inch
Methods – Joints

- Longitudinal Joints
  - Adjacent pass extends at least 2 inches into previously placed mat

- Transverse Joints
  - Same as asphalt paving
Methods – Utilities

- Lower and Raise
- Check for flammable gasses
Methods – Air Pollution

Contractor must:

- Meet air pollution regulations
- Replace heat damaged areas
- Furnish firefighting equipment
Acceptance

- Depth
  - Probe
  - Survey
- Field compaction
- Longitudinal smoothness
- Cross-slope
- Laboratory mix verification
  - Air voids
  - Strength
- Additives
Our Visit

1. Description
2. Materials
3. Construction: Equipment
4. Construction: Methods
5. Method of Measurement
6. Basis of Payment
Basis of Payment

- HIR measured and paid by the square yard
  - Includes: Labor and equipment required to complete the work including cleaning, heating, scarifying, redistributing, re-leveling, and compacting

- Admixture, new HMA and/or new aggregate paid for separately
Finished Surface and Product
Construction Specifications for Hot In-Place Recycling

QUESTIONS?

Tim Aschenbrener
FHWA Resource Center
Pavement and Materials Team
Timothy.Aschenbrener@dot.gov
(720) 963–3247

International and Western States In-Place Recycling Conference
August 5-7, 2014
Denver, CO