

# Construction Specifications for Hot In-Place Recycling



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**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 ( $>200^{\circ}\text{F}$ ) recycle layer





# HIR – Repaving

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



# Multiple-Stage

- ▶ Multiple passes for increased depth



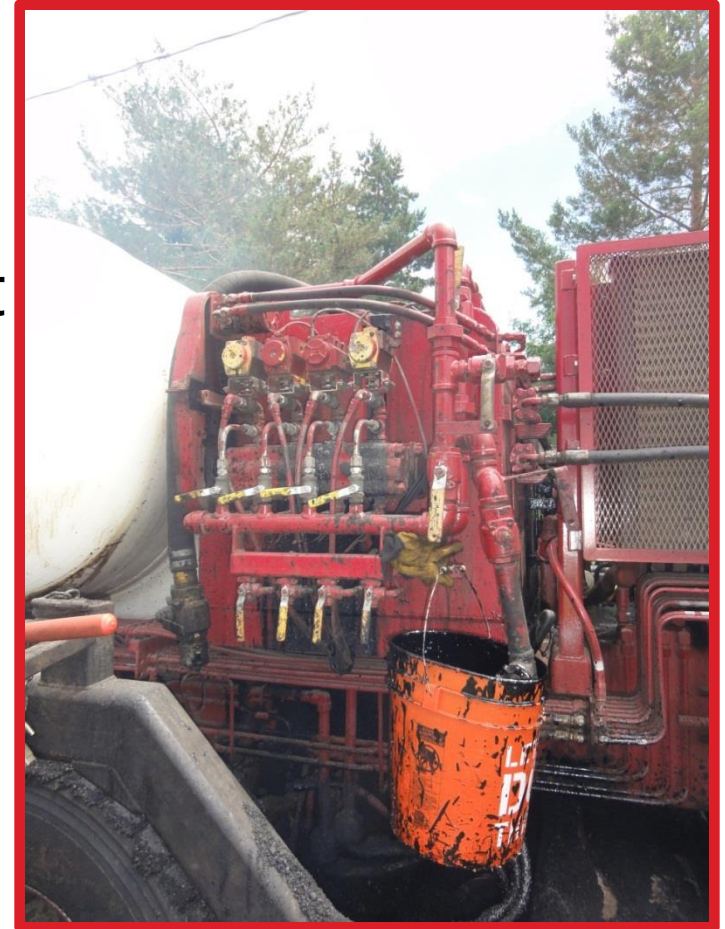


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# Materials: Liquids

- ▶ Recycling Agent
  - ASTM D 4552
- ▶ Asphalt Rejuvenating Agent
- ▶ Type and rate determined in mix design
  
- ▶ Others:
  - WMA





# Materials: Mix

	Surface Recycling	Remixing	Repaving
Recycle Mix Design	Superpave	Superpave	Superpave
New Mix (Mixed)	N / A	Lean or Rich Coarse or Fine	N / A
New Mix (Overlay)	Optional	Optional	Superpave



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# Equipment: Pre-Heaters

- ▶ 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



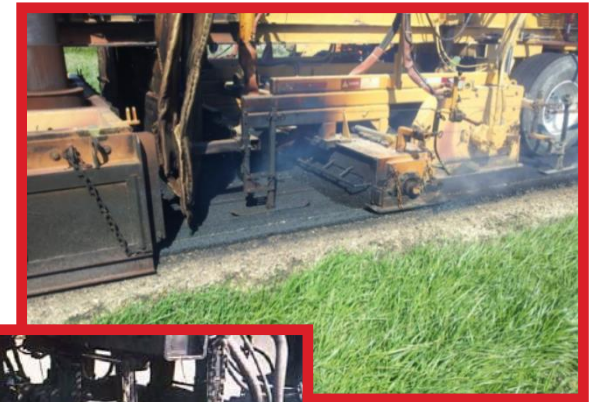


# Equipment: Scarifying / Milling

- ▶ Automatic grade control for milling depth
- ▶ Height controls to facilitate clearance of manholes and other obstructions



Scarifying



Milling

# Equipment: Mixing

	Surface Recycling	Remixing	Repaving
Apply	X		
Mixing augers	X		X
Twin-shaft pugmill		X	



Mixing Augers





# 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





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# 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

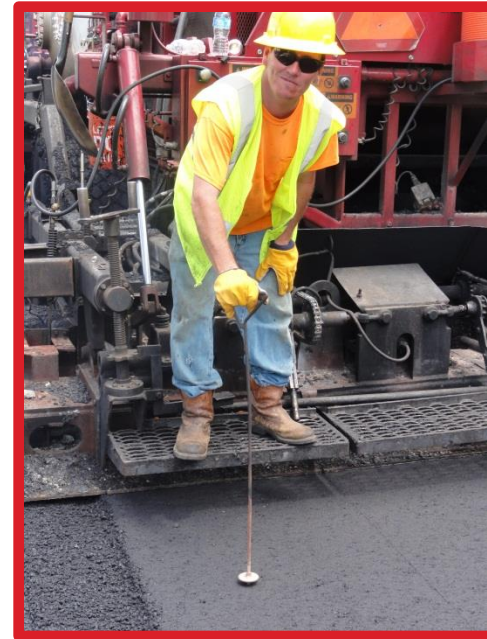
Contractor must:

- ▶ 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

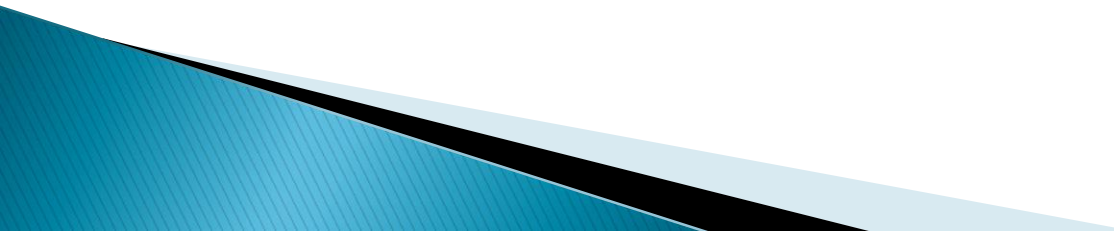


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# Basis of Payment

- ▶ 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



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## QUESTIONS ?



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