HOT IN PLACE RECYCLING

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TxDOT - San Antonio District
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What is HIR

**Categories of HIR**

- Recycling
- Remixing
- Repaving
What is HIR

Repaving

hopper

pug mill

screeds

integrated new/recycled overlay
What is HIR

- **screed**
- **pug mill**
- **heaters**
- **new hot mix**
What is HIR

- 100% or close to it
- Can be overlaid
What is HIR - Recycling Process

- Continuous Process with Self-Contained Train
  - Asphalt Surface Heated
  - Heated Pavement Milled in ½” to ¾” increments
  - Engineered Emulsion Added at Design Content
  - Materials Mixed and Windrowed
  - Recycled Mix Placed by Paver with Vibratory Screed
  - Mat Compacted
  - Surface Applied
What is HIR – Milling Heater

- Milling Heater cutting \( \frac{1}{2}''-3/4'' \) of heated material. The milling heads are capable of milling 15’ wide.
Milling heater’s windrow of material. This material is being processed between 200 and 275 degrees F.
What is HIR – Milling Heater
What is HIR – Milling Heater

- Windrow of material from milling heater going under a tunnel heater. Heat is transferred into underlying pavement and into windrow.
What is HIR – Adding Recycling Agent

- Distribute Evenly
- Based on volume of mix recycled
- Typically: ARA-1P
What is HIR – Adding Recycling Agent
What is HIR – Laydown

- Windrowed 100% recycled material is picked up and paved in a conventional paver to the specified width
- **Utilize conventional pavers**
What is HIR – Laydown

- Utilize conventional pavers
When/Where to use HIR – Scoping applicability

- Restoring the top 3 to 4 inches of the pavement (HIR should not be left as the final surface)
  - Flood plains can be an issue if raising elevation
- Need to have at least 2” of HMA or Concrete underneath the HIR train
- No more than 1 seal coat within recycling layers
- No grid
- No AR or TR asphalt allowed (it burns)
Why use HIR

- **Fast**
  - For 2” layer we’ve seen typical rates of 2 miles per day (~17,000 sy/day)

- **Smaller Carbon Footprint**
  - Reduced transportation, reusing existing material

- **Increased Competition**
  - Alternates yield: Better prices, innovation, proof of concept
Why use HIR - Pricing

<table>
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<tr>
<th>Material</th>
<th>Unit Cost for Material</th>
<th>Unit Cost for placement ($/SY-inch)</th>
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<tbody>
<tr>
<td>Type D PG 70-22</td>
<td>$72.28/TON</td>
<td>$3.98</td>
</tr>
<tr>
<td>Planing 1”</td>
<td>$0.93/SY-in.</td>
<td>$0.93</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td></td>
<td><strong>$4.91/SY-in.</strong></td>
</tr>
<tr>
<td>HIR</td>
<td>$4.40/SY-2in.</td>
<td>$2.20/SY</td>
</tr>
<tr>
<td>Rejuvenator (~0.25 gal/sy-in.)</td>
<td>$2.83/gal</td>
<td>$0.71/SY</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td></td>
<td><strong>$2.91/SY-in.</strong></td>
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~70% difference between HIR and Type D mixture

* - Unit costs obtained from TxDOT 12 month moving average cost (September 30, 2013)
* - Rejuvenator rate obtained from last 3 projects in San Antonio District
Lessons Learned

- **Hamburg requirements**
  - All RAP, no mix design has seen less than 20,000 passes

- **Rejuvenator (ARA-1P)**
  - All samples obtained easily meet Item 300. Potential modification to account for new materials

- **General Notes**
  - Penetration doesn’t capture material performance
  - Utilize Overlay Tester to help identify cracking resistance/capability of combined mixture. Most jobs have been able to obtain over 100 cycles during mix design.
  - Utilize general note for remove and replace mixture

- **Expand out limits on QA test requirements**
  - Current HIR Spec In-Place Air Voids: 4%-9%
  - Current Dense Graded Spec In-Place Air Voids: 2.7%-9.9%
Lessons Learned

- **Items to monitor in the field**
  - Temperature behind the screed
  - Temperature of the left behind pavement (don’t want big temperature differential between HIR and existing pavement).
  - In-Place Air Voids

- **Modifications in the field**
  - Temperature – More/less heaters or changing speed on HIR train. To accommodate density.
  - Rejuvenator Content – More/Less to accommodate density
  - Depth of recycling – Generally, deeper to lower density. Generally, higher to increase density or account for subsurface irregularities.

- **Difficulties**
  - Segregation
  - Surface irregularities
  - Material is what it is
  - Re-recycling has had difficulties in San Antonio
  - Alternates (Performance or Cost?)
Lessons Learned

- Recycling Alternates

  - Cost

    - Asphalt
    - Aggregate
    - Underseal
    - Thickness

  - Performance (HIR to alternate OR consider design without alternate when making material selection)
    - HIR will have great Hamburg, but does not necessarily warrant speccing out PG76-22 alternate
    - HIR will typically have a SAC aggregate, does not warrant having SAC alternate if subsurface
    - HIR does not use an underseal, does not necessarily warrant removal of underseal for alternate. Need engineering judgment to identify if one is needed (i.e. bonding, sealing, etc...).
    - Different thicknesses should not be considered to meet equal payment