Tack Coat Best Practices

FHWA Cooperative Agreement Subtask

Intelligent Compaction
Far too frequent practices
Days later!

Courtesy of Road Science
• **Tack Coat**—sprayed application of asphalt cement upon an existing asphalt or Portland cement concrete pavement which may or may not have been milled before an overlay, or between layers of fresh asphalt concrete.

• **Original Emulsion**—an undiluted emulsion which consists of a paving grade binder, water, and an emulsifying agent.

• **Diluted Emulsion**—an emulsion that has been diluted with additional water.
  • Critical to control
  • 1:1 typical (Original Emulsion : Added Water)
**Terminology**

- **Residual Asphalt**—the remaining asphalt after an emulsion has set typically 57-70 percent.

- **Tack Coat Break**—the moment when water separates enough from the asphalt showing a color change from brown to black.

- **Tack Coat Set**—when all the water has evaporated, leaving only the residual asphalt. Some refer to this as completely broken.
Importance of Tack Coats

• To promote the bond between pavement layers.
  • To prevent slippage between pavement layers.
  • Vital for structural performance of the pavement.
  • All layers working together.
  • Apply along all transverse and longitudinal vertical surfaces.
Pavement Behavior

Shear Transfer?

Stress Distribution

Compression

Tension

Aggregate Base

Soil Subgrade

Load Distributed by Tire
Consequences of Debonding

Courtesy of NCAT
Bonded Strength Demonstration

½" Deflection, 60# Load

Unbonded

¼" Deflection, 160# Load

Fully Bonded
Consequences of Poor Bond

- Layer independence
  - Reduced fatigue life
  - Increased rutting
  - Slippage
  - Shoving
- Compaction difficulty

Direction of traffic?
Loss of Fatigue Life Examples

- May & King (2004):
  - 10% bond loss = 50% less fatigue life

- Roffe & Chaignon (2002)
  - No bond = 60% loss of life

- Brown & Brunton (1984)
  - No Bond = 75% loss of life
  - 30% bond loss = 70% loss of life
8 – 10 years (est.) Interstate Pavement

Courtesy of MODOT
Cores Showing Debonding

Bonding Failures

 Courtesy of MODOT
So is it worth it to apply a tack coat?

Cost of Tack Coat

• New or Reconstruction
  • About 0.1-0.2% of Project Total
  • About 1.0-1.5% of Pavement Total Cost

• Mill and Overlay
  • About 1.0-2.0% of Project Total
  • About 1.0-2.5% of Pavement Total Cost
Common Tack Coat Materials

- Emulsified Asphalt
  - Most common option
    - SS-1, SS-1H
    - CSS-1, CSS-1H
    - RS-1, RS-1H, RS-2
    - CRS-1, CRS-2
    - PMAE

- PG Graded Binders
  - Neat Binders
    - PG 58-28
    - PG 64-22
    - PG 67-22
  - Polymer Modified

- Reduced or Non-Tracking Tack Coat Emulsions
Best Practices

• Surfaces — clean and dry.
• Uniform application.
• All surfaces are tacked.
• Tack should not be tracked off the road.
• Match application to conditions.
  • Materials
  • Residual rate
• Verify application rate.
• Resist tacking too far ahead of paver.
Nozzles are clogged, but triple overlap covering the gap.

Note: not a tack coat, but principle applies.
Common Tack Coat Questions

• Experts commonly disagree
• “Do I still need to tack...”
  • Milled Surface
  • “Fresh” Pavement
  • Late season/cooler days

• Asphalt Institute recommends tacking all surfaces
Common Tack Coat Questions

• “When can I pave on the emulsion?”
  • Has it Broken?
  • Does it need to be Set?
  • Fresh—spray pavers

• Asphalt Institute recommends paving begin after the emulsion has broken.

• Spray pavers are an engineered system that are designed to perform without emulsion break.
Can I speed up the set?
**Common Tack Coat Questions**

- **What is the Optimal Application Rate?**
  - Surface Type
  - Surface Condition

- **Workshop Recommended Ranges**

<table>
<thead>
<tr>
<th>Surface Type</th>
<th>Residual Rate (L/m²)</th>
<th>Approx. Bar Rate Undiluted* (L/m²)</th>
<th>Approx. Bar Rate Diluted 1:1* (L/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Asphalt</td>
<td>0.090 - 0.200</td>
<td>0.150 - 0.340</td>
<td>0.300 - 0.680</td>
</tr>
<tr>
<td>Existing Asphalt</td>
<td>0.180 - 0.320</td>
<td>0.300 - 0.530</td>
<td>0.600 - 1.060</td>
</tr>
<tr>
<td>Milled Surface</td>
<td>0.180 - 0.360</td>
<td>0.300 - 0.600</td>
<td>0.600 - 1.200</td>
</tr>
<tr>
<td>Portland Cement Concrete</td>
<td>0.140 - 0.230</td>
<td>0.225 - 0.380</td>
<td>0.450 - 0.760</td>
</tr>
</tbody>
</table>

*Assume emulsion is 40% water and 60% asphalt.
Areas of Known Agreement

- Application Quality Vital
  - Proper Rate
  - Consistency
- Distributor Truck
  - Setup
  - Calibration/Verification
  - Maintenance
- Tacking of Longitudinal Joints
  - Bonding
  - Confinement
- Excessive Tack is Bad
• Tack Coat Rate Depends on Surface Condition
  • Fresh
  • Weathered
  • Raveled
  • Milled

• Need for Research
  • Field Performance
  • Field Testing
    • Bond strength and application amount

• Treat Tack as **Separate Pay Item** vs. Incidental Item
4-hour workshop by Asphalt Institute

Questions?