NCHRP 9-43
Mix Design Practices for Warm Mix Asphalt

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Objective

• To develop a laboratory mixture design and analysis procedure for WMA
  – Compatible with HMA procedures
  – Address wide range of warm mix processes
    • Current
    • Future
Research Team

- Advanced Asphalt Technologies, LLC
- UMass, Dartmouth
- Western Research Institute
- Quality Engineering Solutions, Inc.
NCHRP 9-43 Tasks

• Phase I
  – Task 1. Evaluate WMA Design and Analysis
  – Task 2. Develop Design Procedure for WMA
  – Task 3. Select Performance Tests
  – Task 4. Prepare Phase I Report
NCHRP 9-43 Tasks

• Phase II
  - Task 5. Conduct Laboratory Sensitivity Experiments
  - Task 6. Field Validation
  - Task 7. Prepare Warm Mix Design Workshop
  - Task 8. Prepare Final Report
Status

• About 3 months behind
• Phase I nearing completion
• Phase I Report to Panel in February, 2008
WMA Mix Design & Analysis

• Design Mixture Based on AASHTO M323 Requirements
  – Materials Selection
  – Volumetric Design

• Standard Practice for WMA
  – Similar to AASHTO R35 for Volumetric Design
    • Modifications to address WMA
  – Optional Performance Tests
    • Modulus
    • Fatigue Cracking
    • Thermal Cracking
## Key Differences Material Selection

<table>
<thead>
<tr>
<th>Item</th>
<th>HMA AASHTO R35</th>
<th>WMA Proposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>WMA Process</td>
<td>NA</td>
<td>Producer Selected</td>
</tr>
<tr>
<td>Gradation</td>
<td>AASHTO M323</td>
<td>AASHTO M323</td>
</tr>
<tr>
<td>Aggregate</td>
<td>AASHTO M323</td>
<td>AASHTO M323</td>
</tr>
<tr>
<td>Binder Selection</td>
<td>PG Grade</td>
<td>Modified PG Grade</td>
</tr>
<tr>
<td>RAP</td>
<td>AASHTO M323</td>
<td>Under Study</td>
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</tbody>
</table>
## Key Differences Volumetric Design

<table>
<thead>
<tr>
<th>Item</th>
<th>HMA AASHTO R35</th>
<th>WMA Proposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixing &amp; Compaction Temperatures</td>
<td>Viscosity</td>
<td>Coating Workability Compactability</td>
</tr>
<tr>
<td>Specimen Preparation</td>
<td>Standard</td>
<td>Process specific Short-term aging</td>
</tr>
<tr>
<td>Optimum Binder Content</td>
<td>AASHTO M323 Volumetrics</td>
<td>AASHTO M323 Volumetrics</td>
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<tr>
<td>Moisture Sensitivity</td>
<td>AASHTO T283</td>
<td>AASHTO T283</td>
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<tr>
<td>Rutting Resistance</td>
<td>None</td>
<td>Flow Number Test</td>
</tr>
</tbody>
</table>
Performance Testing

• Moisture Sensitivity
  – AASHTO T283

• Rutting Resistance
  – Flow Number Standard Proposed

• Mixture Stiffness
  – Dynamic Modulus AASHTO TP62

• Fatigue Cracking
  – Cyclic Tension-Compression (Under Development)

• Thermal Cracking
  – IDT Creep and Strength AASHTO T322
Simple Performance Test System

- Servo-Hydraulic Machine
- HMA Testing
  - Modulus
  - Repeated Load
  - Fatigue
- Temperature Control
  - 4 to 60 °C
- Confinement
  - 0 to 210 kPa
Suggestions/Questions

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