LTPP SPS-10:
Warm Mix Asphalt Experiment

FHWA Asphalt Mixture ETG
September 19, 2014
Baton Rouge, LA

Ray Bonaquist
Jim Musselman
Florida Pavement Performance

% of SHS Deficient

PCS Year


Crack

Ride

Rut
Objectives

• Long-term performance of WMA relative to HMA
• Capture data on WMA with RAP
# Experimental Design

<table>
<thead>
<tr>
<th>WMA Technology</th>
<th>Core Test Sections on Project</th>
<th>Wet</th>
<th>Dry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Wet</td>
<td>Dry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Freeze</td>
<td>No Freeze</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>HMA (Control)</td>
<td>WMA (Foaming Process)</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>WMA (Chemical Additive)</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

- **WMA Technology** refers to Warm Mix Asphalt Technology.
- **Core Test Sections on Project** indicates the different test sections with varying conditions.
- **Wet** and **Dry** columns represent the moisture conditions.
- **Freeze** and **No Freeze** columns indicate the freezing conditions.
- **High** and **Low** columns represent the temperature levels.
SPS-10 Requirements

• Overview
  – AC overlay of existing AC pavements
  – 2” to 4” overlay thickness
  – Dense graded mix
  – RAP content 10-25% (binder replacement)
  – 1 HMA control test section
  – 2 WMA test sections
    • Foaming Process
    • Chemical Additive
  – Tack Coats between lifts
Experiment Layer Requirements

• Mix design/binder grade selection based on Agency’s standard practice
• Overlay thickness selected by Agency’s standard practice
• Uniformity between HMA and WMA
  – Same binder source/grade
  – Same aggregate source/gradations
  – Mix design/JMF
Supplemental Sections

• Agencies can build additional test sections that will be monitored as part of the LTPP program
  – Varying levels of RAP
  – Additional WMA technologies
  – Layer thickness variation
  – Open or gap graded mixtures
  – Varying aggregate sources/absorption levels
  – Other variables of interest to Agency
Tests on Experiment Layer

- Dynamic Modulus – Small-scale AMPT (TP 79)
  - 0, 6, 12 and 18 months after construction
- 38 mm diameter x 110 mm height specimens
  - Re-cored horizontally from 6” diameter core
  - Otherwise in accordance with AASHTO TP79
Tests on Experiment Layer (cont.)

• Binder Testing – DSR, BBR, MSCR
  – Tank Binder
  – Extracted binder at 0, 6, 12 and 18 months

• Hamburg Wheel Tracker
  – Initial time period only

• Basic Mix Characterization
  – BSG, $G_{mm}$, $P_b$, $G_{se}$, $G_b$, aggregate gradation
Tests on Existing AC Layers

- Dynamic Modulus – Small-scale AMPT (TP 79)
- Binder Testing – DSR, BBR, MSCR
- Hamburg Wheel Tracker
- Basic Mix Characterization
  - BSG, $G_{mm}$, $P_b$, $G_{se}$, $G_b$, aggregate gradation

All tests performed at initial time period only
ETG Recommendations

• Supplementary Tests:
  – Based on NCHRP Research Digest 370
  – “Guidelines for Project Selection and Materials Sampling, Conditioning, and Testing in WMA Research Studies”
## Supplementary Tests

### Rutting

<table>
<thead>
<tr>
<th>Test</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow Number (AMPT)</td>
<td>AASHTO TP 79</td>
</tr>
<tr>
<td>Hamburg Test</td>
<td>AASHTO T 324 (Note: Prepare specimens at air voids content of 7±1% and conduct test at standard conditions: 50°C under water.)</td>
</tr>
<tr>
<td>APA</td>
<td>AASHTO T 340</td>
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</table>

### Modulus

<table>
<thead>
<tr>
<th>Test</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Dynamic Modulus (AMPT)</td>
<td>AASHTO PP 61</td>
</tr>
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</table>

### Fatigue Cracking

<table>
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<tr>
<th>Test</th>
<th>Reference</th>
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</thead>
<tbody>
<tr>
<td>Beam Fatigue</td>
<td>AASHTO T 321</td>
</tr>
<tr>
<td>Overlay Test</td>
<td>TxDOT Method: Tex-248-F, Test Procedure for Overlay Test, February 2014</td>
</tr>
<tr>
<td>Simplified Viscoelastic Continuum Damage (S-VECD)</td>
<td>AASHTO TP 107</td>
</tr>
<tr>
<td>Superpave Indirect Tension Test (IDT)</td>
<td>University of Florida</td>
</tr>
<tr>
<td>Semi-Circular Bending Test at Intermediate Temperatures</td>
<td>Louisiana Transportation Research Center (LTRC)</td>
</tr>
</tbody>
</table>

### Thermal (Low Temperature) Cracking

<table>
<thead>
<tr>
<th>Test</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDT Creep Compliance and Strength</td>
<td>AASHTO T 322</td>
</tr>
<tr>
<td>Semi-Circular Bending Test</td>
<td>AASHTO TP 105</td>
</tr>
<tr>
<td>Disk Shaped Compact Tension – DC(T) Test</td>
<td>ASTM D7313</td>
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Supplementary Tests

<table>
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<tr>
<th>Durability</th>
<th></th>
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<tr>
<td>Moisture Sensitivity</td>
<td>AASHTO T 283 (Note: 1 Freeze/Thaw cycle)</td>
</tr>
<tr>
<td>Hamburg Test</td>
<td>AASHTO T 324 (Note: Prepare specimens at air voids content of 7±1% and conduct test at standard conditions: 50°C under water.)</td>
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<tr>
<th>Other</th>
<th></th>
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<tbody>
<tr>
<td>$G_{mm}$</td>
<td>AASHTO T 209</td>
</tr>
<tr>
<td>Volumetric Properties</td>
<td>AASHTO R 35</td>
</tr>
<tr>
<td>Gyratory Compaction to $N_{design}$</td>
<td>AASHTO T 312</td>
</tr>
</tbody>
</table>

Additional information on these recommended tests can be found at the following location:

ETG Recommendations

• Supplementary Test Sections:
  – Variable Density Levels
  – WMA produced at HMA temperatures
  – Other WMA technologies
  – High Recycle Binder Ratio (>0.25) Mixes
Current Status

- The White Paper developed by the Asphalt ETG was distributed to each Highway Agency.
- 17 SPS-10 projects have been nominated by Highway Agencies.
  - 8 have been accepted and approved;
  - 2 have been rejected.
  - The remainder of projects nominated are currently under evaluation by FHWA.
- FHWA is actively meeting with other agencies to recruit additional projects.
- Two projects will be constructed this fall. One each in New Mexico and Texas.
Status

• All of the final report, guidelines, and supporting documentation will be submitted for publication by the end of September which includes:
  – Experimental Design
  – Nomination Guidelines
  – Materials Sampling and Testing Guidelines (including testing protocols and materials tracking system)
  – Construction Data Collection Requirements
  – Long term performance monitoring Requirements
Contact

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