Warm Mix Asphalt: Washington State’s Experience

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In the Beginning...

• 2003 Superior Materials Scan Tour
  – Gussasphalt (Hottest Mix Asphalt?)
  – New material: Warm Mix Asphalt
• 2006 FHWA WMA Technical Working Group formation
• 2007 WMA Scan Tour
• 2007 Development of WSDOT test program
• 2008 First WMA trial project
• 2009 Additional trial projects
• Fall 2009 spec change
• 2010 WMA Standard Specification
WSDOT’s Philosophy on Innovation

- Maximize savings to the taxpayer through innovation
- Take calculated risks
- Lead change through trial projects, collecting data and sharing results
- Maximize the power of the private sector
- Work nationally to maximize return on research and lessons learned
- All of these applied to WMA
2007 Development of WSDOT test program

- Key points for trial projects:
  - WMA added by change order only: want motivated pavers, willing to tackle innovation
  - WSDOT willing to pay contractors to try innovation
  - Wanted to compare WMA to standard HMA
    - WMA test section placed to experience the same conditions as the control HMA section: traffic, loadings, environment, location (grade or flat, turns, etc.)
  - Limited to 2 days WMA paving – enough time to dial in the plant, give good experience, while limiting risk to owner
  - Wanted greatest stress: wearing course only
  - First projects would be 100% owner’s risk
2008 First Trial Project

• I-90 Contract 7419 – West of George Paving
• Interstate highway near the middle of the state
• Climate is high desert: hot summers, cold winters
• WMA technology: Sasobit
# 2008 First Trial Project

## Project Information

<table>
<thead>
<tr>
<th>Contract:</th>
<th>7419 - I-90 West of George Paving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region:</td>
<td>North Central</td>
</tr>
<tr>
<td>P.E. Eric Pierson</td>
<td>Contractor: CWA</td>
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<tr>
<td>Class of Mix:</td>
<td>1/2” PG76-28</td>
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<tr>
<td>Asphalt Source:</td>
<td>SEM</td>
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<tr>
<td>WMA Technology:</td>
<td>Sasobit</td>
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<tr>
<td>Proposed Temp:</td>
<td>272°F</td>
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<tr>
<td>Actual Temp:</td>
<td>285-300°F</td>
</tr>
<tr>
<td>Design Pb:</td>
<td>5.5%</td>
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<tr>
<td>Anti-strip:</td>
<td>0.00%</td>
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<tr>
<td>Paving Dates:</td>
<td>6/23/08 - 6/24/08</td>
</tr>
<tr>
<td>Tons Placed:</td>
<td>4724</td>
</tr>
</tbody>
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[Image: Washington State Department of Transportation]
2008 First Trial Project

Compactive Effort

• The contractor used a breakdown, intermediate and finish roller.
• The breakdown roller was an Ingersoll Rand DDV 138, 15 tons, 3 passes
• The intermediate roller was an Ingersoll Rand DDV 130, 12 tons, 2 passes
• The finish roller was an Ingersoll Rand 412, 6 tons, 1 pass
2008 First Trial Project

• Lessons learned:
  – RAP “balls”
  – Dialing in plant operations, for optimum temperature
  – Trucking, placement, compaction same as HMA
2009 Trials: Six Projects

- C7748: WMA 1/2 Inch PG64-22 with Astec Double Barrel Green
- C7755: WMA 1/2 Inch PG64-28 with Gencor Ultrafoam GX
- C7645: WMA 1/2 Inch PG64-28 and PG70-28 (AllPave plant with water injection)
- C7640: WMA 1/2 Inch PG64-22 with Gencor Green Machine Ultrafoam GX
- C7669: WMA 1/2 Inch PG64-22 with Gencor Green Machine Ultrafoam GX
- C7679: WMA 1/2 Inch PG64-22 with Evotherm
- Discharge temps varied from 245°F to 293°F
- Laydown temps varied from 215°F to 280°F, most were between 250°F to 280°F
2009 Lessons Learned

• Two most important points:
  – WMA production and paving same as HMA
  – **WMA does not replace good paving practices learned under HMA**
    ▪ Mix design
    ▪ Tarp Trucks
    ▪ MTV/MTD Operations
    ▪ Equipment Operation Speed
    ▪ Windrow Construction
    ▪ Compaction Train
    ▪ Density
    ▪ Temperature, Temperature, Temperature
2009 Review

Issues: Will conditioning / cure time affect WMA?

• 2009 Conditioning / Curing Study
  • Production temperature
    • Used for Compaction
  • Multiple samples
    • Taken from split
  • Volumetric analysis
    • Specifically Va
2009 Cure Study Conclusion

- No clear trend on change in Va (air voids) over time (0-6 hours time range)
- Decided to continue current HMA testing protocols and operations for WMA
- Decided not to duplicate WMA action during mix design unless WMA additive is included in the asphalt binder
2009 – Draft Specification

- Exactly the same as HMA
  - Gradation
  - Asphalt Content
  - Va (air voids)
  - In-Place Density
- Incorporated into 2010 Standard Specifications
Current Situation

• WMA allowed on any project, any location, any lift
• WMA allowed with up to 20% RAP
• All HMA specifications apply to WMA
  – “WMA is just cooler HMA”
• Contractors make the decisions on whether or not to use WMA and whether or not to include RAP
• Any “common” WMA technology is allowed
WMA Use

- Tonnage to date:
  - 2008 4724 tons
  - 2009 25,000 tons
  - 2010 295,000 tons
  - 2011 237,000 tons

- Total placed to date: over 560,000 tons

- For comparison, WSDOT places about 1 million tons of HMA per year (about 25% is now WMA)
Industry Reaction

- Contractors like the ability to choose HMA or WMA as needed on the project
- Cautious expansion of use over time
- Some projects have started as WMA and converted back to HMA
- Learning curve on plant operations and field operations
- WSDOT continues to resist forcing contractors to use WMA or establishing quotas or other mandatory requirements for use
Next Steps

• Continue contributing on FHWA’s WMA TWG
• Staying in touch on WMA research (esp. NCHRP)
• State Pavement Technology Consortium (WSDOT, Caltrans, TxDOT and MnDOT) working together on common pavement issues, including WMA
• Running trials on the Hamburg Wheel Tracker
  – Potential as a mix design qualification test for rutting and stripping
  – Potential as field control on performance
  – Many details to work out
Other WMA Studies in Washington State

• Dr. Haifang Wen, Assistant Professor, Washington State University
• Looking at WSDOT WMA projects, testing HMA, WMA, initial plant samples and field cores – new and over time
• WSDOT providing samples, Dr. Wen performing testing and evaluation
• Initial observations:
  – WMA properties over time appear similar to HMA properties
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- Thank you
- Questions?