Warm Mix Asphalt at MnROAD

53rd Annual Asphalt Contractors' Workshop
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Earle Brown Heritage Center, Brooklyn Center, MN

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Benefits of WMA

Environmental

- Lower greenhouse gas emissions
- Lower fuel consumption
- Reduced exposure of workers to fumes

Performance

- Reduced binder aging
- More time for mixture compaction
- Cold weather paving
- Longer haul distances
Early WMA Trials at MnROAD (Oil Gravel)

Cell 32 (1998) – Cold Mix Paving Practice
Cell 27 (1999) – Chip Seal / Large Stone Base
Cell 28 (1999) – Oil Gravel (luke warm mix) / Large Stone Base
Cell 26 (2000) – Oil Gravel (warm mix) / Reclaimed Base
Cell 27 (2000) – Oil Gravel (warm mix) / Large Stone Base
Several County Roads throughout Minnesota

★ Oil Gravel requires solid base
★ No Transverse Cracking or Rutting
★ Some Fatigue and Rough Ride
★ Similar to current WMA development
After 12 years and a catchy name…
Warm Mix Asphalt

WMA – Mathy Process
★ Olmsted & Goodhue Counties (July 2007)

2008 Planned Projectes
★ Bituminous Roadways
★ Crow Wing County
★ MnROAD Mainline
  6 Cells, 1 process
## 2008 MnROAD Construction

<table>
<thead>
<tr>
<th>Warm Mix Asphalt</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>15</strong></td>
<td><strong>16</strong></td>
</tr>
<tr>
<td>3&quot; WM 58-34</td>
<td>5&quot; WM 58-34</td>
</tr>
<tr>
<td>11.1&quot; 64-22 1993 HMA</td>
<td>12&quot; 50% Recycle PCC</td>
</tr>
<tr>
<td>Clay 58-34 Surface Binder</td>
<td>12&quot; Clay 13sp</td>
</tr>
<tr>
<td></td>
<td>7&quot; Select Gran</td>
</tr>
<tr>
<td></td>
<td>Clay</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand</td>
<td>100' Fog Seal 2008</td>
</tr>
<tr>
<td></td>
<td>100' Chip Seals 2009 2010 2011 2012</td>
</tr>
</tbody>
</table>

- Warm Mix Asphalt: 3" and 5" layers, with options for 58-34 and 58-34, including 12" 100% recycle PCC, 12" 50% Recycle PCC, 12" 100% RAP, 12" Mesabi Ballast.
Thanks to Matt Corrigan, FHWA

FHWA does not endorse any particular proprietary product or technology.
Evotherm 3G – Revix

• Waterless - Reduced Temperature Technology
• Process is a co-development of Mathy Technology & Engineering Services and Paragon Technical Services, Inc
• A patent application has been filed on the technology

“It was our belief that if you could coat the aggregate you could compact the mix given current roller technology”

Thanks to Gerald Reinke, Mathy Construction
Revix Summary

• Several different additives evaluated in the field, more in the lab.
• Temperature reductions range from 60 to 80°F below typical hot mix temperatures for the same mix.
• All additives necessary to produce the mix are typically added at the asphalt terminal.
  ★ Additives can be added at the HMA plant.
  ★ Binder preferably comes to contractor ready to use—all he does is run the plant as he normally does but at a lower temperature
Revix Summary

• A mix design is necessary to adjust additive loading and check TSR properties

• Mathy demonstrated that irrespective of plant type or possible moisture content left from aggregate and/or RAP that this approach would work
Sampling and Testing

Samples Collected
- Asphalt Binder
- Mix Samples

Testing Currently Underway
- NCAT
- FHWA
- Texas Transportation Institute
- Ohio University
- University of Minnesota
- Mn/DOT
Asphalt Binder Testing

- PG Grade (Continuous)
- Direct Tension
- Double Edge Notched Tension
- Bending Beam Rheometer

Neat & Extracted Binders

- ABCD Binder Test
- DSR Master Curves
- Multi Stress Creep & Recovery
HMA Mixture Testing

- Volumetrics Verification
- ABCD Mix Test
- TTI Overlay Test
- Hamburg Rut Test (wet)
- Dynamic Modulus
- Flow Number
- Permeability

- SemiCircular Bend Bending Beam
- Rheometer Mix Test
- Indirect Tensile Strength & Creep
- APA Rut Test
- Moisture Sensitivity (TSR)
Stripping Potential

<table>
<thead>
<tr>
<th>Strength, psi</th>
<th>Dry</th>
<th>Wet</th>
<th>TSR</th>
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</thead>
<tbody>
<tr>
<td>wear</td>
<td>85.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>non-wear</td>
<td>83.4%</td>
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Binder DSR Testing

T = 58°C

<table>
<thead>
<tr>
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<th>Original</th>
<th>RTFO</th>
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<tbody>
<tr>
<td>PG 58-34</td>
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<tr>
<td>PG 58-34 WMA</td>
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</table>

G*/sinθ kPa
Binder BBR Testing

Low Fail Temperature, °C

PG 58-34

PG 58-34 WMA

Stiffness

m-value
Performance Measures

FWD

Saw

ALPS

Faultmeter

Core Truck

Distress
Surface Characteristics

Circular Texture Meter

Skid Trailer

LISA

OBSI

Pathways Van

Dynamic Friction Tester
Load Testing, Sensor Monitoring
Plant and Construction Experiences

Chris Miller - Harddrives