WMA Specification and Policy Document Development in Minnesota

Tim Clyne
Mn/DOT

TRB 90th Annual Meeting
Acknowledgements

Mn/DOT
★ John Garrity, Greg Johnson, Greg Schneider
★ Roger Olson, Ed Johnson

Industry
★ Gerald Reinke, MTE
★ Chris Miller, Hardrives
★ Rich Wolters & Jill Thomas, MAPA
Potential Benefits of WMA

Environmental
- Lower greenhouse gas emissions
- Lower fuel consumption

Operational
- Better compaction
- More comfortable working conditions

Performance
- Can use RAP and/or shingles with WMA
- Eliminates bumps in overlays
- Reduced binder aging – reduced cracking
WMA EXPERIENCE IN MINNESOTA
Oil Gravel

*Early WMA by Another Name*

TRB LVR Conference (1995) – Demo Project Outside MnROAD
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 in 1990’s

- Oil Gravel requires solid base
- No Transverse Cracking or Rutting
- Some Fatigue and Rough Ride
Olmsted & Goodhue Counties

First known true WMA jobs in MN (2007)

- Revix (Evotherm 3G) technology
- Olmsted CR 104
  - 5 mile stretch
- Goodhue CSAH11
  - 537 tons placed in 4,200 feet of the EB lane
Crow Wing County

County Road 108 (2008)
- 2913 tons WMA, 272 tons HMA
- 58-34 HMA vs. 58-28 WMA
- Estimated 5 years of extended service life
  - Life cycle cost analyses are favorable for WMA
  - *ASCE Cold Regions paper 2009*

County now allows alternate bids on several projects
- 20,000 tons WMA in 2009 (CR 2)
2008 MnROAD Construction

6 Cells on Mainline
Wear and Non-Wear
12.5 mm NMAS
Traffic Level 4
PG 58-34
20% RAP from MnROAD
No requirements for WMA technology
Mn/DOT Trunk Highway 95

Late season paving (2009)

- Contractor was delayed, needed to finish paving before winter
- Supplemental Agreement – Mn/DOT paid extra $0.60 per ton for WMA
- Business as usual (mostly)
  - Good density 2nd day after going back to HMA rolling pattern
Mn/DOT District 3 and 7 Projects in 2010

First “regular” Mn/DOT projects requiring WMA

S-1 (2360) PLANT MIXED ASPHALT PAVEMENT – USE OF WARM MIX ASPHALT TECHNOLOGIES

The provisions of the attached 2360 Plant Mixed Asphalt Pavement (Gyratory Design) Specification is hereby modified as follows in order to use Warm Mix Asphalt (WMA). All provisions for the production and placement of WMA will be the same as the conventional HMA mixtures as stipulated in 2360 Plant Mixed Asphalt Pavement (Gyratory Design) Specification except as noted below.

S-2.1 MIXTURE DESIGN

The contractor is responsible to use the same design used to produce the Hot Mix Asphalt, then modifying it to accommodate products or processes to meet the Warm mix criteria. This modification process will be limited to the same as described by the WMA Technical Working Group and found at [http://www.warmmixasphalt.com/WmaTechnologies.aspx](http://www.warmmixasphalt.com/WmaTechnologies.aspx).

Recycled Asphalt Shingles will not be allowed in any mixes on this project.

S-3.1 MIXTURE QUALITY MANAGEMENT

The Warm Mix Asphalt produced will not be allowed to exceed temperatures greater than 275 °F. Any WMA over that temperature will not be allowed to be used.
REVIX / Evotherm 3G

REVIX™ developed by Mathy Technology & Engineering and Paragon Technical Services, Inc.

- Chemical additive added at terminal or HMA plant
- Requires no plant modification
- Binder shipped from supplier with WMA chemical package already added

This technology is now marketed as Evotherm 3G
Maxam AquaBlack

Bituminous Roadways
★ Installed on 2 local plants
★ Try for a 3rd failed
★ 15% of production was WMA

Knife River
Duininck Brothers
Pavement Surface Temp

MOBA Pave-IR

12 sensors spaced 1 foot apart, reading interval = every 6 inches
Production Temperature Change

235°F WMA

275°F WMA

Paver Stops
This picture is HMA WMA paving did not see same segregation at end of truck
### Table 2360.6-C5
Mixture Temperature Control (C)

<table>
<thead>
<tr>
<th>Air Temperature</th>
<th>1 inch [25 mm]</th>
<th>1-1/2 inch [40 mm]</th>
<th>2 inch [50 mm]</th>
<th>≥3 inch [75 mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>°F [°C]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+32-40 [0-5]</td>
<td>--</td>
<td>265 (B) [129]</td>
<td>255 [124]</td>
<td>250 [121]</td>
</tr>
<tr>
<td>+41-50 [6-10]</td>
<td>270 (B) [130]</td>
<td>260 [127]</td>
<td>250 [121]</td>
<td>245 [118]</td>
</tr>
<tr>
<td>+61-70 [16-21]</td>
<td>250 (B) [121]</td>
<td>245 [118]</td>
<td>240 [115]</td>
<td>235 [113]</td>
</tr>
</tbody>
</table>

A minimum of one pneumatic-tire roller shall be used for intermediate rolling unless otherwise directed by the Engineer. The Engineer may specify or modify in writing (with concurrence from the Department Bituminous Engineer) a minimum laydown temperature.

A. Based on approved or specified compacted lift thickness.

B. Not applicable if a WMA additive or process is used.
Frequently Asked Questions about Warm Mix Asphalt (WMA)

Warm Mix Asphalt (WMA) is a relatively new technology in the United States, and in Minnesota in particular. The list below is not an exhaustive list of questions about warm mix, but it does try to answer some of the most common questions about this technology.

What is Warm Mix Asphalt?
Warm Mix Asphalt (WMA) is the generic term for any technology (additive or water foaming technique) added to an asphalt mixture that allows the mixing and compaction temperature to be reduced by 20 to 100°F. It allows the mix to remain workable at lower temperatures, and has potential environmental, operational, and performance benefits over traditional hot mix asphalt (HMA).

The contractor has approached us (local agencies) about substituting WMA for HMA. Should we use WMA on our project?
Mn/DOT supports the use of WMA as an alternate to HMA on most projects.

Should we pay an additional cost for warm mix?
The use of WMA may add between $0.60 to $2.00 per ton of mix, although as WMA becomes more commonly used that price differential should be reduced. However, agencies should not pay the additional costs if WMA is proposed after the project has already been let.

Are there any pavement performance issues with WMA?
The oldest WMA projects in the US are only 6 years old, so no long term performance data is available. Early rutting and moisture damage are potentially of concern, although no known WMA projects have shown these distresses to date.
Thank You!

Tim Clyne
MnROAD
651-366-5473
tim.clyne@state.mn.us