HMA & WMA Technologies

Kent R. Hansen, P.E.
Director of Engineering
National Asphalt Pavement Association
Pavement evaluation and project selection

Materials and Mix Design

Construction & Quality Control

Performance
Recommended Mix Types
Surface Courses

- Low Traffic
- Medium Traffic
- High Traffic

Mix Type
- DFG 4.75
- DFG 9.5
- DFG 12.5
- DFG 19
- SMA 9.5
- SMA 12.5
- SMA 19.0
- OGFC 9.5
- OGFC 12.5
- DCG 9.5
- DCG 12.5
- DCG 19.0

Min Lift Thick Range, mm
Results of Long-Term Pavement Performance SPS-3 Analysis: Preventive Maintenance of Flexible Pavements

FHWA Publication No.: FHWA-HRT-11-049

FHWA Contact: Larry Wiser, HRDI-30, (202) 493-3079, larry.wiser@dot.gov
Recycling
RAP & RAS
Why use RAP and RAS?

It’s free asphalt, man
Almost

<table>
<thead>
<tr>
<th>Component</th>
<th>Organic Shingles (%)</th>
<th>Fiberglass Shingles (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt cement</td>
<td>30-36</td>
<td>19-22</td>
</tr>
<tr>
<td>Felt</td>
<td>2-15</td>
<td>2-15</td>
</tr>
<tr>
<td>Mineral granules</td>
<td>20-38</td>
<td>20-38</td>
</tr>
<tr>
<td>aggregate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mineral Filler/stabilizer</td>
<td>8-40</td>
<td>8-40</td>
</tr>
</tbody>
</table>

![NYMEX Crude Oil Futures Close (Front Month)](chart.png)

NYMEX Crude Oil
Close (Front Month)
Reclaimed Asphalt Pavement in Asphalt Mixtures: State of the Practice

PUBLICATION NO. FHWA-HRT-11-021

APRIL 2011

U.S. Department of Transportation
Federal Highway Administration

Research, Development, and Technology
Turner-Fairbank Highway Research Center
6300 Georgetown Pike
McLean, VA 22102

NAPA
States increasing RAP use
States that have experimented with or routinely use high RAP mixtures
High RAP Performance

The performance and life of pavement containing up to 30 percent RAP is similar to virgin pavements with no RAP. A survey of LTPP sections containing at least 30 percent RAP showed similar performance to virgin sections.
The Value of Milling

- Removes cracked and aged pavement surface
- Improves pavement smoothness
- Maintains curb height, drainage inlets, and bridge clearances
- Improves bond with overlay

Ref: Randy West, NCAT
Why use asphalt shingles in asphalt pavement?

All materials commonly used in asphalt pavements
Sources

Manufactures’ waste
- Limited ~1 MT annual
- Not in every state

Tear-offs
- ~10 MT annual
- Everywhere?
  - State regulations
  - Processors
States Allowing RAS in Asphalt Mixes
Pooled Fund Study

- TPF-5(213) Performance of Recycled Asphalt Shingles in Hot Mix Asphalt
- Sponsoring Agency – Missouri DOT
- Partners – CA, CO, IA, IN, MN, MO

http://www.pooledfund.org/projectdetails.asp?id=441&status=4
RAS Summary

- Shingles are too valuable to throw away.
- Use manufacturers’ waste if available
- Tear-offs
  - Work with roofers to get clean material.
  - Work with local agencies on sampling plan
- Performance
  - Improved rutting resistance
  - Reduced temperature susceptibility
  - Minimum affect on cold temperature properties
RAS Summary (cont)

- Mix AC Content
  - Will reduce the amount of new asphalt required
  - Total asphalt contents often higher (0.2-0.4%)

- Plant production
  - Similar to RAP

- Mix design
  - Similar to RAP

- Construction
  - Use conventional equipment
  - Some contractors report easier density
Guidelines for the Use of Reclaimed Asphalt Shingles in Asphalt Pavements
Warm-mix Asphalt, the Wave of the Future

Warm-mix asphalt is the generic term for a variety of technologies that allow the producer of hot-mix asphalt pavement material to lower the temperatures at which the material is mixed and placed on the road. Reductions of 50 to 100 degrees Fahrenheit have been documented. Such drastic reductions have the obvious benefits of cutting fuel consumption and decreasing the production of greenhouse gases. In addition, engineering benefits include better compaction on the road, the ability to haul paving mix for longer distances, and extending the paving season by being able to pave at lower temperatures.

Mark Your Calendar!
2nd International Conference on Warm-mix Asphalt Slated for October 2011
What is WMA?

- Allows a reduction in the temperatures at which asphalt mixes are produced and placed.
Technology Overview

- WAM-Foam
- Low Emission Asphalt
- Aspha-Min
- Advera
- Sasobit
- REVIX
- Evotherm
- Cecabase RT
- Thiopave
- Rediset WMX
- AquaFoam
- Ultrafoam GX
- Terex
- Accu•Shear
- Aquabrack
- Double Barrel Green

**FHWA does not endorse any particular proprietary product or technology.**
Technology Overview**

- TLA-X
- Iterlow-T & HyperTherm
- Static Inline Vortex Asphalt Blender
- Ad-RAP (ECOBIT)

More to come …
Many other technologies are also used internationally.

**FHWA does not endorse any particular proprietary product or technology.
WMA Trials and Demonstrations

Jan 2009

Alaska

Hawaii

Mobile Asphalt Mixture Testing Laboratory (MAMTL)
Over 140 documented WMA projects constructed to date.

Mobile Asphalt Mixture Testing Laboratory (MAMTL)
National Research Initiatives

- NCHRP 9-43 “Mix Design Practices for Warm Mix Asphalt” - Complete
- NCHRP 9-47A “Engineering Properties, Emissions, and Field Performance” - NCAT
- NCHRP 9-49 “Performance of Warm Mix Asphalt Technologies”
  - Phase I, Moisture Susceptibility - TTI
  - Phase II, Long-Term Performance – Washington State
NCHRP 9-53 “Asphalt Foaming Characteristics for Warm Mix Asphalt Applications” - Anticipated

- Phase I—Characterize Asphalt Foam and Relate Properties to WMA Performance
- Phase II—Simulate WMA Foaming Technologies in WMA Mix Design
- Phase III—Guidelines for Mix Design and Field Production with WMA Foaming Technologies
WMA TWG future initiatives?

- WMA plus RAP/Shingles/Crumb Rubber
- Laboratory versus in service field ageing of WMA mixtures
- Conditioning criteria for mechanical testing of WMA
- Laboratory versus production ageing of WMA mixtures
- Synthesis/Collection of information on State DOT usage/implementation of WMA
WMA TWG future initiatives?

- National Evaluation Program for WMA Technologies
- Understanding the role of additives in WMA production and construction
- Understanding the role of asphalt foam in aggregate coating, workability, compaction, and long term performance
- Quality control and acceptance testing for WMA mixtures
- Open Graded Friction Course (OGFC) plus WMA
WMA Specification Language

**Preliminary WMA TWG Information**
<table>
<thead>
<tr>
<th>Year</th>
<th>Total Estimated Tons</th>
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<tbody>
<tr>
<td></td>
<td>Million</td>
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<tr>
<td>Year</td>
<td>2009</td>
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<tr>
<td>Tons Accepted</td>
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<td>Tons used in HMA/WMA</td>
<td>56.1</td>
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<td>Tons used in Aggregate</td>
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<td>Tons used in Cold Mix</td>
<td>1.5</td>
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<tr>
<td>Tons used in Other</td>
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<td>Tons Landfilled</td>
<td>0.1</td>
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<tr>
<td>Avg. RAP %</td>
<td>16.2</td>
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### RAP/RAS/WMA Survey

#### RAS

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<thead>
<tr>
<th>Category</th>
<th>Total Estimated Tons Thousand</th>
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<tr>
<td></td>
<td>2009</td>
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<tr>
<td>Companies/branches reporting using RAS</td>
<td>44</td>
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<tr>
<td>Tons Accepted</td>
<td>957</td>
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<tr>
<td>Tons use in HMA/WMA</td>
<td>701</td>
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<tr>
<td>Tons used in Aggregate</td>
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<tr>
<td>Tons used in Cold Mix</td>
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<tr>
<td>Tons used in Other</td>
<td>123</td>
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<tr>
<td>Tons Landfilled</td>
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</table>

57% increase
## RAP/RAS/WMA Survey

### WMA

<table>
<thead>
<tr>
<th>Companies/branches reporting using WMA</th>
<th>Estimated Total Tons, million</th>
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<tbody>
<tr>
<td></td>
<td>2009</td>
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<tr>
<td>Companies/branches reporting using WMA</td>
<td>85</td>
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<td>DOT</td>
<td>10.7</td>
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<td>Other Agency</td>
<td>3.7</td>
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<tr>
<td>Commercial &amp; Residential</td>
<td>4.8</td>
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<tr>
<td>Total</td>
<td>19.2</td>
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Percent increase = 148%
Save the Date!  •  October 11–13, 2011

2nd INTERNATIONAL WARM-MIX CONFERENCE

Hyatt Regency at the Arch
St. Louis, Missouri, USA

This international conference will spotlight the advances in warm-mix technologies.

Warm-mix service providers and technical services have a unique opportunity to reach out to the international as well as expand their national market through tabletop exhibiting. Call for more details on exhibiting or for registration questions.