Warm Mix Asphalt
Presentation Outline

• What is WMA?
• State of the Practice
• Benefits of using WMA technology
• Michigan Examples
WMA – What is it?

- Hot Mix Asphalt adjusted in order for it to be produced and placed at lower temperatures; “Warm Mix”.
- Production and placement temperature **MAY** be lowered by 50°F – 70°F +.
- Conventional Definitions
Mixing Temperature

Typical Mixing Temperature Ranges
Warm Mix Asphalt

WMA encompasses a wide range of enabling technologies that enhance asphalt production and/or lay-down properties...
Warm Mix Asphalt

General Technology Categories:

- Organic Additives
- Chemical Additives
- Foaming Processes
- Hybrid Systems (combination of technologies)
Warm Mix Asphalt

Currently Twenty Two (+) Technologies Marketed and Available in the US.

Mathy Tech. & Eng. Services and Paragon Technical Services

Lake Asphalt of Trinidad and Tobago

KOLO

Terex

Asphalt Innovations™

Shell

Thiopave

Ceca

Arkema Group

Paragon Technical Services

MeekeR

Lake Asphalt of Trinidad and Tobago

PQ Corporation

Sasol

Maxam Equipment, Inc.

Tarmac International, Inc.

Eurovia

Qi

AKZO Nobel

Stansteel®

Asphalt Pavement Association of Michigan

Sonneborn

Reliable Asphalt Products

Asphalt.
Warm Mix Asphalt

State of the Practice

[Image of construction equipment and materials]
Warm Mix Asphalt

FIGURE 2
State usage of WMA, circa December 2011

- More Extensive Use
- Demonstration Projects
- No WMA Placed
- No response
Warm Mix Asphalt

FIGURE 3
States with WMA specifications, circa December 2011

States with Specifications for WMA

- Permissive spec.
- Have specification
- No specification to date
- No response
- **Not all mix types

Alaska

Hawaii

Puerto Rico

**
MDOT WMA Permissive Use
12SP501(Z) dated 07-31-12

• Allows only water-injection foaming device or water foaming additive to make WMA.

• Only E10 and below mixes.
MDOT WMA Permissive Use
12SP501(Z) dated 07-31-12

- WMA mixes must meet all acceptance test methods and procedures.
- Temperature must be greater than 225 degrees F, and cannot be greater than 20 degrees F above the maximum recommended mixing temp.
- No change to bid prices.
MDOT WMA Permissive Use
12SP501(aa) dated 12-21-12

- Local Agency warm mix specification
- Same requirements as MDOT projects.
MDOT WMA Permissive Use

Specification Changes, approved at Feb. EOC

- Allow the use of WMA on E30, E50 & GGSP mixes
- Allow the use of additives
  - Based on Colorado DOT approved products list.
  - Currently allow 4 additives:
    - Advera
    - Evotherm 3G
    - Evotherm DAT
    - Evotherm ET
Warm Mix Asphalt

Concerns being researched:

- Incomplete drying of aggregate
- Reduced production aging of binder

- Possible Perf. issues
  - Moisture susceptibility
  - Early rutting
National Research Initiatives

• NCHRP 9-43 “Mix Design Practices for Warm Mix Asphalt”
• NCHRP 9-47A “Engineering Properties, Emissions, and Field Performance”
• NCHRP 9-49 “Long Term Field Performance of Warm Mix Asphalt Technologies”
  – Phase I, Moisture Susceptibility
  – Phase II, Long-Term Performance
Benefits of using WMA technology

- Reduced Emissions
- Recycling of Materials
- Easier Workability
- Reduced Fuel Usage
- Paving Benefits
- Greener Construction LEED Credits
Benefits of using WMA technology

A method used to achieve one or more of the following:

– Compaction Aid
– Increased Workability
– Allow increased haul distances from the asphalt plant to the jobsite
– Allow for Cold Weather paving and extend the paving season
– Improve Ride “Paving over Crack sealant”
Benefits of using WMA technology

The benefits of WMA are numerous. They also include:

- Reduction in fuel consumption
- Reduction in plant emissions
- Worker comfort
Presentation Outline

Michigan Examples
Cases Studies

- M-95, Iron Mountain – Sasobit
- County Road 513, Rapid River – Advera & Evotherm
- Rice Lake Road – Evotherm
- M-59 – Water Injection (Foaming)
M-95, Iron Mountain

- 2006
- Passing relief lane
- MDOT PWL specification
M-95, Iron Mountain

• Mix Design
  – Existing approved MDOT design
  – Binder: PG 58-34
  – AC Target: 5.52%
  – Recycle: 14% RAP

• Project Specifics
  – Surface Layer: 1-¾ 5E3 (i.e. E-3 9.5 mm)
  – Normal Mix Temperature: 317° F
M-95, Iron Mountain

HOT MIX PAVING

WARM MIX PAVING
M-95, Iron Mountain
M-95, Iron Mountain

PWL = 100 for both Control and WMA sections

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<th>Sasobit</th>
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<td>5.61%</td>
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M-95, Iron Mountain

Final product
County Road 513, Rapid River

• Mix Design
  – MDOT approved mix design
  – Binder: PG 52-34
  – AC Target: 5.30%
  – Recycle: 17% RAP

• Project Specifics
  – Lower Layer: 2” 12.5mm
  – Surface Layer: 2” 12.5mm
  – Length: 11.25 miles
  – Tonnage: 25,000

2010
County Road 513, Rapid River

- Funded by MDOT and the Delta County Road Commission
- Part of NCHRP 09-47A, Being conducted by the National Center for Asphalt Technology (NCAT) in cooperation with Advanced Materials Services, LLC
County Road 513, Rapid River
### County Road 513, Rapid River

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County Road 513, Rapid River

- Plant Production Benefits
  - Energy Savings (>15%)
  - Lower Emissions
    - Improve Air Quality
  - Lower Drum Temps (-15%)
  - Decrease Inlet / Exit Temps of Baghouse
  - Wearpart Longevity
    - Flighting / Gearboxes / Motors
## Fuel & Emissions

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<th>Control HMA</th>
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Rice Lake Road

- **Mix Design**
  - MDOT approved 13A
  - Binder: PG 58-28
  - AC Target: 5.42%
  - Recycle: 27% RAP

- **Project Specifics**
  - One Lift at 2” 12.5mm
  - Length: 1.41 miles
  - Tonnage: 2,500

2011
Rice Lake Road
# Rice Lake Road

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<td>Pb</td>
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<td>5.36</td>
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M-59, Oakland County (2011)
M-59, Oakland County

Foaming Process:

- Increases the volume of the liquid
  • Better coating of the aggregate particles
  • Mix is more workable

- Water can be introduced to the mix by metering and injecting the water into the asphalt binder through a mechanical system at the asphalt plant.
M-59, Oakland County

Warm Shear Mix Machine
M-59, Oakland County

• Job Details – 45 Minute Haul to Project loss of 10 degrees of heat vs HMA 25 Minute Haul 20 degree heat loss

• Mix – No change in virgin AC from HMA to WMA, Added 1.25% water (1/2 gallon of water per ton of WMA)

• Density – Compaction Window 170 degrees, WMA 140 degrees
Summary

• The data collected thus far is consistent with national results and there has not been a significant difference between HMA and WMA testing results

  – Hot sample volumetrics are not significantly different than reheated sample volumetrics

  – No concern with early rutting
Summary

• Most WMA additives don’t require the mix design to be recreated
  – Field trials have shown that mixture volumetrics are nearly identical between HMA and that same HMA mix design with WMA additives.

Note: Depending on what WMA technology used, a new mix design or at least initial laboratory work may be required prior to field production.
Summary

In the end you still need to know your stuff
– Know your WMA product
– Know your aggregates
– Know your processes (BMP’S)
Summary

- Finally, WMA is really just HMA with improved workability and the ability to be produced at lower temperatures if desired.
- a.k.a. It’s another tool in the contractor’s toolbox!
Resources

www.asphaltpavement.org – Online Store
Thank You

A. John Becsey, P.E.  
Executive Director

Chuck Mills, P.E.  
Director of Engineering