WARM MIX ASPHALT TECHNOLOGY

AASHTO STANDING COMMITTEE ON HIGHWAYS TECHNICAL MEETING

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What is WMA?

- Allows a reduction in the temperatures at which asphalt mixes are produced and placed
  - Reduced viscosity at lower temps
    - Complete aggregate coating
Hot Mix Asphalt 275-325°F

Warm Mix Asphalt 250-275°F

Cold Mix Asphalt 60°F
Why WMA?

Advantages

- Energy Savings
- Decreased Emissions
  - Visible and Non-Visible
- Decreased Fumes
- Decreased Binder Ageing
- Decreased Plant Wear
- Extended Paving Season
- Compaction Aid
Hot Mix Asphalt
320°F

Warm Mix Asphalt
250°F
**Brief History**

- 1995 Preliminary Lab Experiments
- 1997 German Bitumen Forum
- 2000 First International Conference of Asphalt Pavements (Sydney)
- 2000 Second Euroasphalt & Eurobitume Congress (Barcelona)
- NAPA 2002 European Scan Tour
  - Germany and Norway
- NAPA 2003 Annual Convention
  - San Diego
Technology Overview

- Materials Processing
  - Two Component Asphalt Binder
    - WAM-Foam®
- Emulsion Technology
  - Chemical Structure Developed for WMA
    - Evotherm®

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

- Mix additives
  - Mineral
    - Aspha-Min®
  - Organic
    - Sasobit®
    - Asphaltan B®

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WAM-Foam®

mixer

aggregate
WAM-Foam®

soft asphalt
WAM-Foam®

water

hard asphalt foam
WAM-Foam®

final asphalt properties
WAM-Foam®

Plant Modification Required

Production equipment is provided by Amman Asphalt AG in Europe
Evotherm®

- Emulsion
  - MeadWestvaco Asphalt Innovations (USA)
- Dispersed Asphalt Technology Delivery
  - Chemical Additive Package
    - Chemical Structure was Developed for WMA
- Mix Temperatures
  - 140 to 220°F
- No plant modifications
Aspha-Min®

- Product of Eurovia Services GmbH (Germany)
- Manufactured Synthetic Zeolite
  - Sodium Aluminum Silicate
  - Hydro thermally crystallized
- Available in
  - 25 or 30 kg bags
  - Bulk for Silos
Aspha-Min®
Aspha-Min®

[Images of Aspha-Min® equipment]
Zeolites

- Framework silicates which have large vacant spaces in their structures that can trap water
  - Spaces are interconnected and form long wide channels of varying size
- Ability to lose and absorb water without damage to their crystal structures
  - The trapped water is driven off by heat
**Aspha-Min®**

- Add 0.3 percent by mass to mix
  - Water is released at high temperatures
    - Range of 185 to 360°F
    - Foams the asphalt
      - Reduced viscosity
- Reported by Eurovia
  - 54°F reduction
  - Fuel savings of 30%

Aspha-Min® is a fine white powder
Sasobit®

- Product of Sasol Wax GmbH (Germany)
- Fischer-Tropsch paraffin wax
  - Fine crystalline long chain aliphatic hydrocarbon
  - Produced from coal gasification
- Available in Beads, Flakes or Powdered form
  - 2, 5, 20, and 600 kg bags
Sasobit®
Research Partners

- U.S. Department of Transportation
  - Federal Highway Administration
- NAPA
  - StateAPA
- National Center for Asphalt Technology (NCAT)
- Aspha-Min®
- EUROVIA
- Hubbard
- Sasobit®
- Asphalt Innovations
  - A MeadWestvaco Business
- Evotherm®

25
Research

- Compatibility with US?
  - Mix designs
  - Equipment
  - Climate conditions
  - Work practices

- Success in Europe = Success in US?
Research

- Investigation into
  - Long term performance
    - Binder Effects
    - Increased Potential for Moisture Damage
  - Cost benefits
    - Quantify Reduction in Fuel, Fumes, Emissions
  - Plant operations
    - High Production Rates and Plant Permitting
  - Control of mixing process
  - Workability at the paving site
  - Quick turnover to traffic
Written Summary of WMA @
www.fhwa.dot.gov/pavement/asphalt/wma.cfm

Warm Mix Asphalt Technologies and Research

European countries are using technologies that appear to allow a reduction in the temperatures at which asphalt mixes are produced and placed. These technologies have been labeled Warm Mix Asphalt (WMA). The immediate benefit to producing WMA is the reduction in energy consumption required by burning fuels to heat traditional hot mix asphalt (HMA) to temperatures in excess of 300°F at the production plant. These high production temperatures are needed to allow the asphalt binder to become viscous enough to completely coat the aggregate in the HMA. This is achieved by adding materials that lower the glass transition temperature of the binder, allowing it to be placed at lower temperatures. WMA technologies also improve workability, allowing the WMA to be placed more easily.

There are three technologies that have been observed in the European countries to produce WMA:

1. The addition of a synthetic zeolite called Aspha-Min® during mixing at the plant to create a foaming effect in the binder.
2. A two-component binder system called WAM-Foam® (Warm Asphalt Mix Foam), that introduces a soft and hard foamed binder at different stages during plant production.
3. The use of organic additives such as Saszol®, a Fischer-Tropsch paraffin wax and Asphaltan B®, a low molecular weight wax.
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