From Europe to Corrigan then onto the Land of Lincoln

Warm Mix Asphalt – Global View

IAPA Annual Convention
March 9, 2009
Timothy R. Murphy, P.E.
Murphy Pavement Technology
Lincoln Knows…
“Asphalt, more than any other single product, sustains the nation's highway system and facilitates the flow of commerce."
The stimulus package signed into law in February includes $48B for transportation projects, with $27.5B allotted for highway and bridge construction and repair. Creating more environmentally responsible or sustainable roads and infrastructures is a pivotal part of the plan.

Asphalt is the sustainable material for constructing pavements. From the production of the paving material, to the placement of the pavement on the road, to rehabilitation, through recycling, asphalt pavements minimize impact on the environment. Low consumption of energy for production and construction, low emission of greenhouse gases, and conservation of natural resources help to make asphalt the environmental pavement of choice.
Warm Mix Asphalt (WMA) Technologies that appear to allow a reduction in the temperatures at which asphalt mixes are produced and placed.

![Graph showing temperature and viscosity relationship for Warm Mix Asphalt (WMA) with compactability range and 64-22 foamed asphalt.]
WMA technologies available

- Synthetic Zeolite
- WAM Foam
- Wax
- Chemical Additive
- H₂O
Potential Benefits of WMA

- Increased durability due to less oxidation and less absorption = better fatigue life
- Good in-place density
- Wider paving window
  - Winter Paving
  - Night Paving

Especially with Polymer-Modified Asphalt
Potential Benefits of WMA

- Reduced emissions and odor
- Reduced heating and energy requirements; direct Energy Savings ~ $1/ton
- Reduced plant wear
MODEL OF DEVELOPMENT OF TECHNOLOGY

Oujian and Carne, 1987

Implement or Transfer

Research

Development

Engineering

Basic

Applied

Technical Feasibility

Engineering Demonstration

Prototype Field Trial

Products, Services, Processes, & Policies

Tasks

Technology

Discover

Organize

Knowledge

Research

Development

Engineering
On a Life-Cycle Analysis, if Warm Mix Asphalt (WMA) does not perform as well, then there will not be energy savings nor reduced emissions and benefits in the long run.
Warm Mix Asphalt SCAN

May – June 2007
Norway-Germany-Belgium-France
Issues of Interest

The purpose of the SCAN was to investigate innovative technologies and policies related to WMA.

- WMA processes
- Mix design & construction practices
- WMA performance
- Limitations
- Benefits
2007 WMA Scan Team
Plus Two German Colleagues
Who Did We Visit?

- Oslo, Norway
- Köln, Germany
- Frankfurt, Germany
- Paris, France
- Brussels, Belgium
- Nantes, France
European Experience

The PUSH for Implementation

- Norway
  - Contractor/Supplier Driven
- Germany
  - Contractor Driven
  - Bitumen Forum
  - Gussasphalt (Fumes)
- France
  - Contractor Driven/Agency Supported
  - Sustainable Technologies
- Netherlands
  - Contractor Driven
WMA Technologies

- Organic, Wax-like additives
  - Sasobit® – Sasol International
  - Asphaltan B – Romanta
  - Fatty Acid Amides – Licomont S 100

- Foaming Processes
  - Aspha-min zeolite – MHI/Eurovia
  - Low Energy Asphalt – Fairco/Eiffage Travaux Publics
  - WAM Foam – Kolo Veidekke/Shell/BP
  - LEAB® – BAM

- Emulsion Based
  - Evotherm™ – MeadWestvaco

- Vegetable based synthetic binders
- Other … Emerging US Technologies
Implementation Goals

WMA should be an acceptable alternative to HMA, used at the Contractor’s discretion, provided the WMA meets applicable HMA specifications.
WMA: Best Practices

- Quality Improvement Series 125
- Stockpile Moisture Management
- Burner Adjustments and Efficiency
- Aggregate Drying and Baghouse Temperatures
- Drum Slope and Flighting
- Combustion Air
- RAP Usage
- Placement Changes
WMA Technical Working Group

Co-Chairs
- Matthew Corrigan, FHWA
- Ron White, Industry

Represented
- State DOT
- State APA
- NCAT
- Academia
- Hot Mix Asphalt Industry
Ongoing National Research

- NCHRP 9-43 “Mix Design Practices for Warm Mix Asphalt” $500,000
- NCHRP 9-47 “Engineering Properties, Emissions, and Field Performance” $900,000
To adapt a laboratory mixture design and analysis procedure to WMA

- Compatible with HMA procedures
- Address wide range of warm mix processes
  - Organic Additives
  - Foaming
  - Chemical
Future National Research?

- Short Term Ageing of WMA Binders During Production
- Differences between Field Produced WMA and HMA Volumetric Properties
- More to come ...??
Proposed National Research

- D-06 “Long Term Field Performance of Warm Mix Asphalt Technologies” $1,200,000
- D-08 “Moisture Sensitivity of Warm Mix Asphalt Technologies” $600,000
- D-05 “Development of a New Protocol for Determination of Moisture Susceptibility of Asphalt Mixtures” $300,000
Initial U.S. Research Partners

U.S. Department of Transportation
Federal Highway Administration

NAPA
StateAPA

2004 - 2005

National Center for Asphalt Technology
Auburn University

Asphalt Innovations
A MeadWestvaco Business
Evotherm®

Aspha-Min®
EUROVIA

HC Hubbard
Construction Company
Sasobit®
Sasol
reaching new frontiers

U.S. Department of Transportation
Federal Highway Administration
Technology Overview

- WAM-Foam
- Low Emission Asphalt
- Aspha-Min
- Advera
- Sasobit
- REVIX
- Evotherm
- Cecabase RT
- Rediset WMX
- Ultrafoam GX
- Terex
- Stansteel
- Aquablack
- Double Barrel Green

**FHWA does not endorse any particular proprietary product or technology.**
WMA-Texas Experience

2009 TRB Annual Meeting

Gary L. Fitts, P.E.
SE Regional Manager
Sulphur Asphalt Solutions
Shell Oil Products, USA

Technology - Delivery - Partnership

DELIVERING INNOVATION TO YOUR ADVANTAGE

http://www.shell.com/sulphur
Ground level ozone is considered to be a respiratory irritant. It is caused by chemical interaction between sunlight, nitrous oxides (NOx) and volatile organic compounds (VOC’s).
LP 368-San Antonio

- No visible fumes, minimal odor
- Acceptable HMA in-place density and joints
US 380 – Young Co.

PG 70-22 (Polymer-modified)
Hamburg-One Year Cores
HWT Testing - Lufkin

2 Hour Cure

Cycles 1

Advera
RediSet
Evotherm
Sasobit
Control

WMA
FM 324 - Lufkin

HMA

WMA
FOAM NOZZLE CLOSED

- NOZZLE VALVE CLOSED
- ADJUSTABLE JET
- AC MANIFOLD
- WATER PASSAGE
- BOILING CHAMBER
- SPRAY NOZZLE

FOAM NOZZLE OPEN

- NOZZLE VALVE OPEN
- ADJUSTABLE JET
- AC MANIFOLD
- WATER PASSAGE
- WATER PASSAGE 360°
- BOILING CHAMBER
- SPRAY NOZZLE

FOAM NOZZLE
NORMAL COATING

DB GREEN FOAM COATING

COATING THICKNESS
Construction temps often too high
- Delays rolling
- Temperature segregation
- Increases fumes
  - 10°F increase = double VOCs
  - Very low VOC (20 g from 75 tons of asphalt) can be visible, especially at night
  - Opacity - affected by plant operations, asphalt source, asphalt grade
We state: ‘It's ok to ask permission to change’

We might want to consider: ‘You can do HMA (275 – 300) as WMA (220-275) and put the details in your QC plan.’
Experimental Features

FHWA policy prohibits the use of a patented or proprietary material, specification, or process ...:

- ...competitive bidding with equally suitable unpatented items
- ...used for research or for a special type of construction on relatively short sections of road for experimental purposes
- www fhwa dot gov/construction/cqit/propriet.cfm
Experimental Features
Warm Mix Asphalt

The Green Alternative

The Illinois Department of Transportation recently partnered with Gallagher Asphalt Corporation and Chicago Testing Laboratory to complete comprehensive technical trials using Warm Mix Asphalt (WMA) technology. IDOT is very interested in this new process, and with the support of CTL, will be evaluating the performance of WMA in the laboratory and field to determine how Warm
“The Department is always interested in new technologies that will improve the quality, durability, and cost effectiveness of HMA. Warm Mix Asphalt Technology seems to have the ability to provide all that and more in terms of its positive environmental impact.”
Placement Experiences
In-Place Density Achieved
At NAPA convention I met with the other 37 state executives and WMA was a real hot topic that is being pushed all across the country and everything still points up.
Many factors are driving the development and implementation of WMA technologies globally.
In order for WMA to succeed in the U.S., these pavements must have equal or better performance when compared to traditional HMA pavements and be economically affordable.
Data collection guidelines developed and cataloged by the WMA TWG

WMA Technologies

Test Frameworks.
The Warm-Mix Asphalt Technical Working Group has devised test frameworks to help researchers obtain data in a uniform format so that analysis can be done by using data from a multitude of projects. There is one framework for material properties and another for emissions and energy reductions.

Products and Processes
These products and processes are listed for information only. The WMA Technical Working Group does not endorse any particular proprietary product or technology. These applications should be considered as experimental.

Advanced Concepts Engineering Co.: LFA CO
Arkema Group: ECABASE RT
Ashpa-mix: Aspha-mix Online
Asphalt Industries: Double Barrel Green System
MeadWestvaco Asphalt Innovations: Cypherm
PO Corporation: Advance WMA
Sasol Wax Americas, Inc.: Sasabilt

PLEASE NOTE:
The contents of this web site are to promote the understanding of warm-mix asphalt during its research and development phase in the United States. This website cannot be used to promote or single out any one specific asphalt technology.
Questions about WMA

Future Plans
- Economic Analysis (LCC)
- Industry Response and Responsibilities
- Research
  - Performance,
  - Economics,
  - Specifications
- Time-table