Warm Mix Asphalt
"National Perspective"

Matthew Corrigan, P.E.
Asphalt Pavement Engineer
Federal Highway Administration
Office of Pavement Technology
Washington D.C.
In 2005

WMA Technologies Available in U.S.
WMA Technologies Available in U.S.

In 2012

30+
WMA Technologies Available in U.S.

... and beyond
General Technology Categories

Material Processing
- Ex. LEA (Hot Coated Coarse Agg + Moist Fine Agg + Additives)

Organic Additives
- Waxes, Zeolite

Chemical Additives
- Surfactants

Foaming Processing
- Water Injection, Zeolite

Hybrid Systems
- Ex. H₂O + Surfactant
Technology Overview**

- Materials Processing
  - WAM-Foam
  - Low Emission Asphalt

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

- Mix additives (Chemical)
  - Evotherm (ET, DAT, 3G)
  - REVIX (Evotherm 3G)
  - Cecabase RT
  - Iterlow-T; HyperTherm; QualiTherm
  - Rediset LQ

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

- Mix additives (wax)
  - Sasobit
  - Rediset WMX
  - SonneWarmix
  - Thiopave
  - a sulphur extender used w/ WMA
  - LEADCAP

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

- Mix additives (water bearing filler)
  - Aspha-Min
  - Advera

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

- Water injection at the plant
  - Ultrafoam GX
  - Terex
  - Double Barrel Green & Green Pac
  - Stansteel
  - Aquablack
  - ECOFOAM-II
  - Meeker WMA
  - AquaFoam
  - Tri-Mix

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Technology Overview

• Many US technologies’ web-link at:
http://warmmixasphalt.com/wmatechnologies.aspx

“This listing does NOT constitute an endorsement or approval...”
Warm-Mix Asphalt: Best Practices, 3rd Edition

- Technologies & Lab Foam Equip.
- Stockpile Moisture Management
- Burner Adjustments and Efficiency
- Aggregate Drying and Baghouse Temperatures
- Drum Slope and Flighting
- Combustion Air
- RAP usage
- Placement Changes
1st International Conference
• November 11-13, 2008 in Nashville, TN
  – Processes, Mix Production & Placement, Energy consumption, Mix Design, Material Properties

2nd International Conference
• October 11-13, 2011 in St. Louis, MO
  – Lab & Field Properties, Design & Performance, Health & Environment, RAP w/ WMA, Binder & Mix Properties, Moisture Susceptibility, Construction, etc.

Speaker Proceedings (MTG-WM2E) available @ http://store.asphaltpavement.org
Stakeholder Engagement: WMA Technical Working Group

Established 2005

Co-Chairs: Matthew Corrigan, Ron White
National Research Initiatives

- NCHRP 9-43 “Mix Design Practices for Warm Mix Asphalt” $500,000
- NCHRP 9-47A “Engineering Properties, Emissions, and Field Performance” $900,000
- NCHRP 9-49 “Performance of WMA Technologies: Stage I - Moisture Susceptibility” $450,000
- NCHRP 9-49A “Performance of WMA Technologies: Stage II - Long-Term Field Performance” $900,000
National Research Initiatives

- NCHRP 9-43 “Mix Design Practices for Warm Mix Asphalt” $522,501.00

NCHRP Project 09-43

- Products:
  - Appendix to AASHTO R35 with commentary “Special Mixture Design Considerations and Methods for Warm Mix Asphalt (WMA)”
  - WMA Mix Design Workshop/Training Module
  - “Standard Practice For Measuring Properties of Warm Mix Asphalt (WMA) for Performance Analysis Using the AASHTO MEPDG” (AASHTO Darwin ME Software)
  - Chapter on WMA Mix Design for the NCHRP Project 09-33 Mix Design Manual
National Research Initiatives

- NCHRP Report 691 “Mix Design Practices for Warm Mix Asphalt” – Appendix D
National Research Initiatives


www.trb.org/main/blurbs/166517.aspx
Appendix to AASHTO R35 with commentary “Special Mixture Design Considerations and Methods for Warm Mix Asphalt (WMA)”

Course Description

Special Mixture Design Considerations and Methods for Warm Mix Asphalt - WEB-BASED

PROGRAM AREA: Pavements and Materials
COURSE NUMBER: FHWA-NHI-131137

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<td>$0 Per Participant</td>
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<tr>
<td>2012</td>
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TRAINING LEVEL: Basic

CLASS SIZE: Minimum:1; Maximum:1

DESCRIPTION:

Highway transportation agencies are exploring the use of warm mix asphalt (WMA) for pavement projects. One of their main questions, particularly for agency mixture design technicians and engineers, is how WMA design differs from hot mix asphalt (HMA) design. "Mixture Design for Warm Mix Asphalt" is a Web-based training that presents the modifications to the current Superpave volumetric design procedure, as described in AASHTO R35, that are needed to complete a WMA mixture design. The training highlights key differences in WMA and HMA design procedures, and provides an opportunity to apply the AASHTO R35 standard practice to a WMA design modification.

OUTCOMES:

Upon completion of the course, participants will be able to:
National Research Initiatives

• WMA TWG Task Force 08-02 “National Program for WMA Technologies”
  – To utilize AASHTO National Transportation Product Evaluation Program (NTPEP)
• Resulted in... NCHRP 20-07 Task 311 “Development of a Warm Mix Asphalt Technology Evaluation Program”
  – ... to develop a standardized evaluation program compatible with AASHTO NTPEP’s centralized system of testing, evaluation, and data reporting of engineering materials for the state DOTs.
Four TWG Proposed NCHRP projects for 2012:

- D-05 Develop an Approach for Lab Mix Short Term Aging That Correlates to Various HMA Plant Processing and Warm Mix Asphalts
- D-07 Short-Term Laboratory Conditioning of WMA Mixtures for Mix Design and Performance Testing
- D-08 Asphalt Foaming Characteristics for Warm Mix Asphalt Applications
- D-09 Laboratory Foaming and Mixing Processes for WMA Mix Design
Combined into two WMA NCHRP projects for 2012:

- **NCHRP 9-52 “Short-Term Laboratory Conditioning of Asphalt Mixtures”**  
  $800,000, 30 months  
  – includes short-term laboratory conditioning of WMA mixtures for mix design and performance testing

- **NCHRP 9-53 “Properties of Foamed Asphalt for Warm Mix Asphalt Applications”**  
  $700,000, 27 months
Commercially Available Laboratory Foaming Devices

- PTi – THE FOAMER
- D&H Equipment – Hydro Foamer
- Wirtgen, WLB 10 S
Proposed WMA focused NCHRP project for 2013:

- “Recycled Asphalt Shingles (RAS) and Recycled Asphalt Pavement (RAP) in HMA/WMA Mixtures”
- Endorsement by:
  - AASHTO SOM TS2c Asphalt-Aggregate Mixtures
  - FHWA WMA Technical Working Group
  - FHWA RAP Expert Task Group
  - TRB Committee AFK10 General Issues in Asphalt Technology
WMA Usage

Percentage of **Total** Asphalt Production in US

source: National Asphalt Pavement Association

- **2009**: 19.2 million tons (5.4%)
- **2010**: 47.6 million tons (13.2%)
- **2011**: (Increasing trend)

Source: National Asphalt Pavement Association
WMA Usage

Percentage of Asphalt Production for State DOTs

Source: National Asphalt Pavement Association
Interstate Highway WMA Usage
The Every Day Counts Initiative

Accelerating Technology Deployment

Warm Mix Asphalt (WMA)

www.fhwa.dot.gov/everydaycounts
EDC WMA Memorable Message

• I.C. = I.P.

Improved Compaction = Improved Performance

• F.E.W. key benefits
  – Fuel
  – Emissions
  – Worker Comfort
1. By December 2011, 40 State DOTs and all Federal Lands Divisions will have a specification &/or contractual language that allows WMA on Federal-aid or Federal Lands projects.

2. By December 2012, at least 30 State DOTs will have achieved set targets for WMA usage.
The Future
NEXT EXIT
The Givens

- WMA will continue to gain market share
- New innovations will occur
- Research will be challenged to keep up
- The demand for knowledge and training will grow

- Change is certain!!
Where do we go from here?

• Implementation of standardized mixture design procedure (AASHTO R35 Appendix)

• Emphasize performance testing of WMA
  – Asphalt Mixture Performance Performance Tester (AMPT)
    • Dynamic Modulus, Flow Number, Fatigue
  – Lab conditioning of WMA mixtures for mechanical testing
Where do we go from here?

• Evaluation processes ... AASHTO NTPEP
  – Rigorous but not burdensome
    • Demonstrate successful projects
    • Document test results
    • Successful field trials
  – Not too time-consuming
Where do we go from here?

• Research
  – Short term performance is very promising
  – Document long term performance
    • Fatigue and cold temperature properties
  – WMA pavement ageing progression in the field
  – Lubricating phenomenon within mixture
  – Lab performance vs. field performance
FHWA will...

- Continue to work in partnership
  - WMA TWG & other Asphalt ETG’s
  - AASHTO Subcommittee on Materials
  - Asphalt User-Producer Groups

- Continue to provide technical support
  - Mobile Asphalt Testing Laboratory Program
  - HQ/Resource Center

- Continue to explore
  - Turner-Fairbank Highway Research Center
FHWA will...

- Continue to support investigation, research, and training
  - Cooperative agreements with...
    - National Center for Asphalt Technology
    - Asphalt Institute
  - Focus on
    - Mixture design & performance testing
    - Binder ageing impacts
    - Production & lay-down
    - Forensics
Thank You!
Matthew Corrigan, P.E.
Mobile Asphalt Laboratory Program Manager
Warm Mix Asphalt Program Manager
Office of Pavement Technology
HIPT-10, Room E73-465
1200 New Jersey Ave. S.E.
Washington, DC 20590

matthew.corrigan@fhwa.dot.gov
www.fhwa.dot.gov/pavement