Warm Mix Asphalt
NAPA Strategic Goal:
Reduce Emissions, Fumes and Odors
Strategies

• Engineering Controls
• Best Management Practices
• Low Fuming Asphalts
• Warm Mix Asphalt
What is Warm Mix Asphalt?

- **Hot Mix Asphalt 275-325°F**
- **Warm Mix Asphalt 250-275°F**
- **Cold Mix Asphalt 60°F**
Advantages of Lower Temperatures

• Lower fumes and emissions
• Lower energy consumption
• Lower plant wear
• Decreased binder aging
• Early site opening
• Cool weather paving
• Compaction aid for stiff mixes
• Improved working conditions
Goals for **Warm Mix Asphalt**

- Use existing Hot Mix Asphalt plants
- To meet existing standards for Hot Mix Asphalt specifications
- Focus on dense graded mixes for wearing courses
- **WMA quality** = Hot Mix Asphalt quality
Available WMA Technologies

Processes include:

- WAM Foam – Shell/Kolo Veidekke
- Zeolite – Eurovia/Hubbard Construction
- Sasobit – Sasol Int./Moore and Munger
- Evotherm - MeadWestvaco
- New processes
Warm Asphalt Mixes by adding aspha-min®, a synthetic zeolite
Aspha-Min®

• Zeolites
  – Framework silicates have vacant spaces in their structures that can trap water
    • Spaces interconnected forming long wide channels
  – Can lose and absorb water without damage to 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
    • 185 to 360° F
    • Foams the asphalt
      – Reduces viscosity

• Reported by Eurovia
  – 54° F reduction
  – Fuel savings of 30%
Production of warm asphalt mix

• No modifications to mix design.
• Increase workability at low temperatures.
• Mixing temperature between 130 and 145 °C (266 to 293 °F).
Aspha-Min®
Aspha-min Field Sections

- Paving project in Germany – Fall 2003
- Orlando Paving Company – First U.S. trial February 2004
- World of Asphalt – March 2004
- Charlotte, NC – Blythe Construction – September 2004
Polymer Modified Warm Asphalt with Zeolite at 250 F

94% Gmm
55 F Air Temp.

4 passes of Rubber Tire, followed by 4 vibratory passes, followed by static finish roller
Seeing is Believing!

Hot Mix 314 F

Warm Mix 254 F

138.1 pcf

138.5 pcf
Sasobit®

- Product of
  - Sasol Wax GmbH (Germany)
- Fischer-Tropsch paraffin wax
  - Fine crystalline long chain aliphatic hydrocarbon
  - Produced from coal gasification
- Available in
  - Flakes or powdered form
  - 2, 5, 20, and 600 kg bags
Sasobit
How organic additives work

Organic additives

Viscosity

Temperature

Bitumen

Additive
Influence of organic additives (FT)

Wheel tracking tests of binder course asphalt (Hamburg device)

Organic additives

Wheel tracking test (Hamburg device) with growing %-FT-paraffin

Organic additives
Frankfurt Airport

- Asphalt mixture laid at low temperature
- Better compactability
- Increased resistance to deformation at high temperatures
Frankfurt Airport

- Bear heaviest aircraft in 2-3 hours
- Reduced cooling, key to 300-step project
EVOTHERM
Effective Temperature Range*

Hot Mix: 150°C (302°F)

Temperature Difference:
45-90°C (81-162°F)

EVOTHERM: 60-105°C (140-221°F)

*Mixing Temperature
• Innovative chemical additive technology
• Chemical structure developed & optimized for warm mix performance
• Molecular structure imparts coating, workability, strength, and adhesion
• Dispersed Asphalt Technology (D.A.T.) delivery system
• Mix & compaction temperatures as low as 60°C (140°F)
• Openly available to end users; no licensing
• Mix & compaction temperatures as low as 60°C (140°F)
• No plant modifications required
• No unit operations problems encountered
• Reduced dust generation
• Siloable mixes
EVOTHERM Field Trials

SHRP and conventional mixes, using standard production, laydown, & compaction methods

Immediate release to traffic
NCAT Study on Warm Mix Asphalt

Voids in the mix versus temperature via vibratory compactor (PG 64-22 mixes)

![Graph showing Voids in the mix versus temperature via vibratory compactor for GRANITE and LIMESTONE. The graph compares different temperatures (300F, 265F, 230F, 190F) for HMA and EVOTHERM.]
Resilient moduli of granite / PG 64-22 mixes were comparable (voids notwithstanding)
APA and Hamburg results were similar for HMA and EVOTHERM granite / PG 64-22 mixes.
NCAT Study

• Evaluate Warm Asphalt Technologies for U.S. Paving Practices
  – High production
  – Rapid Turn-over to traffic

• Potential Concerns
  – “Curing” Time
  – Increased Potential for Moisture Damage
  – Binder effects
Questions?