Warm Mix Technology to Improve Compaction

2005 NEAUPG Annual Meeting
Burlington Vt.
Warm Mix Technology

- Reduce Mixing and Compaction Temperature
- Reduce Fumes
- Reduce Fuel Costs
- Improve Workability
- Improve Density
- Extend Paving Window
- Improve Quality
CONCERNS:

- Costs
- Process
- Binder Storage Tanks
- PG Binder Grade
- Long Term Performance
- DOT Acceptance
- There’s No Smoke
Available WMA Technologies

Processes include:

- WAM Foam – Shell/Kolo Veidekke
- Zeolite – Eurovia/Hubbard Construction
- Sasobit – Sasol Int./Moore and Munger
- Evotherm - MeadWestvaco
- New processes
Sasobit®

- **Product of**
  - Sasol Wax GmbH (Germany)
- **Fischer-Tropsch parrafin 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®

- Fischer-Tropsch waxes
  - Different than naturally occurring asphalt waxes in structure and physical properties
  - Higher melting point
  - Lower penetration
  - Higher viscosity
  - Higher molecular weight
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
Will Sasobit have a negative effect on mix quality?
NCAT Evaluation

- Improved compact ability to 190°F
- Did not affect resilient modulus
- Did not increase rutting potential (APA)
- Cure time to open to traffic is not an issue
- Moisture damage with lower temperature may be an issue
- Anti-aging Properties
Cracking Temperature (°C)

-30.0
-27.5
-25.0

-30.0
-27.5
-25.0

Unmodified
Unmodified
Sasobit 3%
Sasobit 3%

Replicate 1
Replicate 2
Replicate 3
Average

Replicate 1
Replicate 2
Replicate 3
Average

TSRST
Field Trials

1. 45% RAP 19mm Base
2. SMA 19.0mm Intermediate Base
3. 35% RAP 9.5mm Surface Mix

Added – 1.5% Sasobit by weight of total binder
45 % Rap
Performance Evaluation of High RAP Base Mixture Containing Sasobit

Maryland State Highway Administration

Advanced Asphalt Technologies, LLC
108 Powers Court, Suite 100
Sterling, VA 20166-9321
(703) 444-4200
August 19, 2005
Mixture Dynamic Modulus Master Curves for Plant Aged Conditions

- Plant Aged Control
- Plant Aged SASOBIT

Reduced Frequency, Hz

E*, ksi

Temperature, C

Log Shift Factor

Mixture Dynamic Modulus Master Curves for Plant Aged Conditions
Mixture Dynamic modulus Master Curves for Long-Term Oven Aged Conditions

Reduced Frequency, Hz

E*, ksi

LTOA Control
LTOA SASOBIT

Temperature, C

Log Shift Factor

Master Curves for Long-Term Oven Aged Conditions
Effect of Simulated Long-Term Aging

Plant Aged $E^* / LTOA E^*$

Control
Sasobit

Reduced Frequency, Hz

Plant Aged $E^* / LTOA E^*$ vs Reduced Frequency, Hz
Repeated Load Permanent Deformation Response for Control and Sasobit® Mixture
Estimated Thermal Stresses and Critical Cracking Temperatures

- Control
- SASOBIT

Stress, psi

Temperature, F
Comparison of Master Creep Compliance Curves

![Graph showing the comparison of creep compliance curves between Control and SASOBIT. The x-axis represents loading time in seconds, and the y-axis represents D(t) in 1/psi. The graph illustrates the trends and differences between the two materials over time.](image-url)

- **Control**

- **SASOBIT**
19.0mm SMA
Sasobit: Mix temp 252°F. Using tighter temp scale. Mat looks good.
Intelligent Compaction

- Improve Compaction Efficiency
- Improve Compaction Quality
- Real Time Information
- Identify Questionable Areas
- Improve Quality
ICC Draft Report

- Stiffness of Conventional Mix and Sasobit were statistically the same with Sasobit being placed 50°F cooler.
9.5mm with 35% RAP
350 F without Sasobit

09/13/2005
SUMMARY

*With Sasobit you can:*

- Reduce Mixing and Compaction Temperature
- Reduce Fumes
- Reduce Fuel Costs
- Improve Workability
- Improve Density
- Extend Paving Window
- Improve Quality
Questions?