Thiopave® - Sulphur Enhancement for Asphalt Mixtures

W. Allen Palmer, P.E.
NC Region Marketing Manager
Shell Sulphur Solutions
Tulsa, OK
Overview

- Background on Sulphur
- Thiopave Product
- Production

- Mix Designs with Thiopave
  - Scott Quire – Frankfort Testing Laboratory
Thiopave

“Thio” is the Greek word for Sulphur
Uses For Sulphur

Source: Utilization of Sulfur Wastes from Sour Gas and Crude Oil Production, Krishnan and Freeman, Integrated Environmental Solutions
Sulphur Extended Asphalt (SEA)

• Great deal of interest in 1970’s and 1980’s
  – Driven by oil embargo and supply shortage
  – Sulphur offered means to extend bitumen supply

• Molten sulphur was used
  – Incorporated directly into hot bitumen
  – High mixing temperatures

• Economics eventually flipped
What Role Does Sulphur Play?

• Partially replaces (extends) bitumen
  – 20% - 25% of bitumen replaced with similar volume of sulphur
  – Actual amount varies based on particular mix/project

• **Mixture** modifier - not Bitumen modifier
What Role Does Sulphur Play?

- Crystallizes in mixture when cooled
  - Acts as solid mineral filler in mixture
  - Increased pavement stiffness (modulus) at high temperatures
    - AMPT studies
  - No adverse effect on low temp properties
    - TSRST studies
Sulphur in Bitumen

Source: *Performance Properties of Sulphur Extended Asphalt Mixtures with SEAM* (Shell internal)
Marshall Stability Comparison

Qatar Test Road Results

> 10% higher initially, over 80% higher after 14 days
What Is Thiopave

• Currently, a system of two components
• Solid pellets introduced into mixing drum
  – Melts quickly to form part of the total binder
• Includes organic compaction agent (wax)
  – Improves workability at lower mix temps
Production-Feed System

Pneumatic Feed System

Wax Feeder
Pneumatic System Basics

Pellets Loaded Here

Material Hopper

Vane Feeder
Rotation speed varies with plant production rate

Air Flow
To Plant
Production

- Drum Mixer with Separate Coating Mixer
- Counterflow Drum Mixer
- Double Barrel Drum Mixer
- Batch Mixing Plant with Rap Feeder

*Thiopave add point
Plant Introduction Point
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Order of Addition

- “Ideally”, materials should be mixed in this order
  - Hot Aggregate
  - RAP
  - Virgin Bitumen
  - Wax
  - Baghouse Dust
  - Thiopave pellets
Temperature Control

• Critical Temperatures
  - 240°F: Pellets melt
  - 300°F: H₂S generation likely
  - 265°F: Ideal plant discharge

* By necessity, a warm mix application

• Compaction Agent
  - Allows for improved workability at reduced temperatures
Stockpiling on Site
Mix Designs With Thiopave

Thank You

Al Palmer
Shell Oil Products – US
w.allen.palmer@gmail.com
(918) 237-1233