

Shell Thiopave

Technologies for Sulphur Enhanced Road Construction

Thiopave[®] - Sulphur Enhancement for Asphalt Mixtures



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DELIVERING INNOVATION TO YOUR ADVANTAGE

<http://www.shell.com/sulphur>



Shell Sulphur Solutions

Overview

- Background on Sulphur
- Thiopave Product
- Production

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

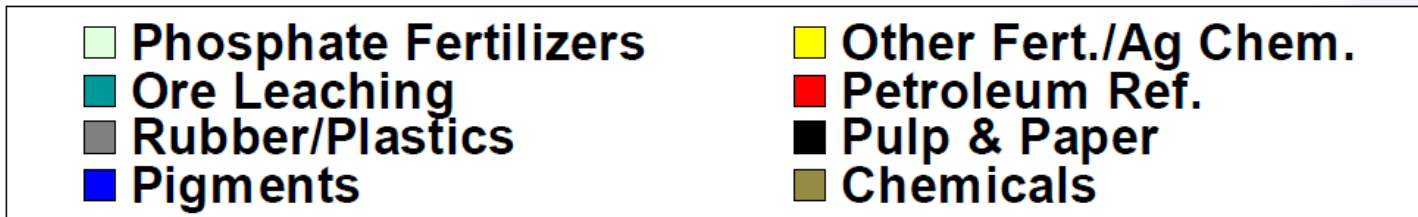
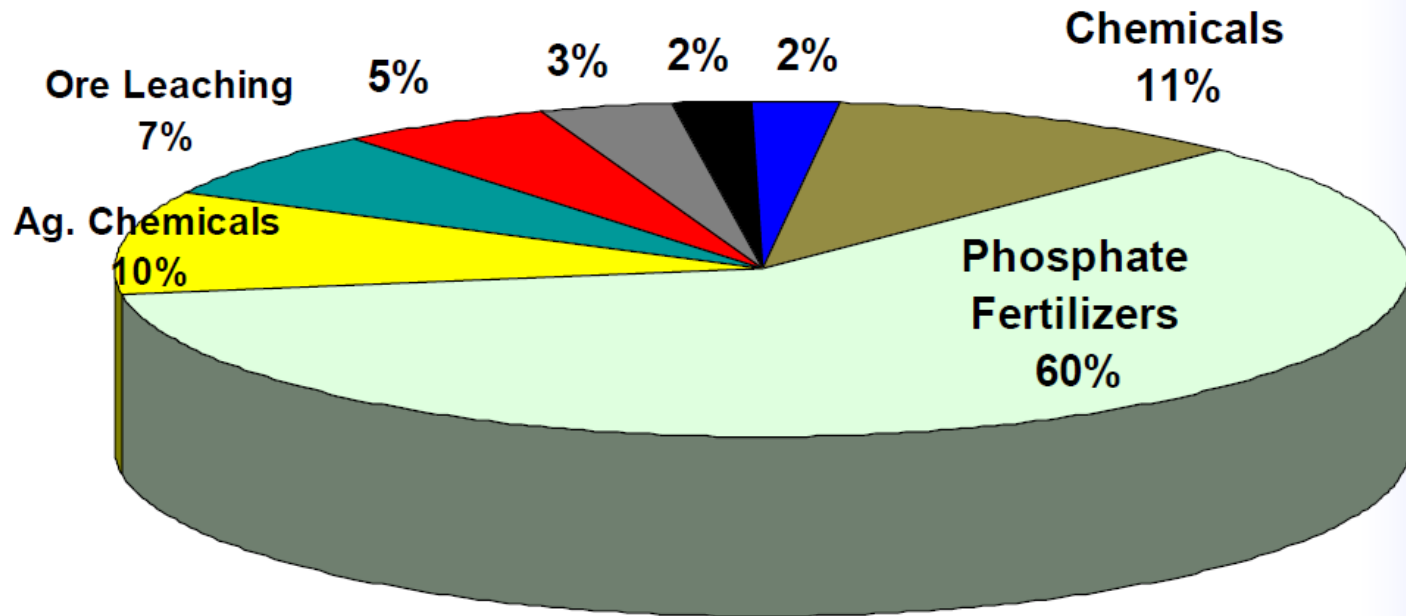


Thiopave

“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

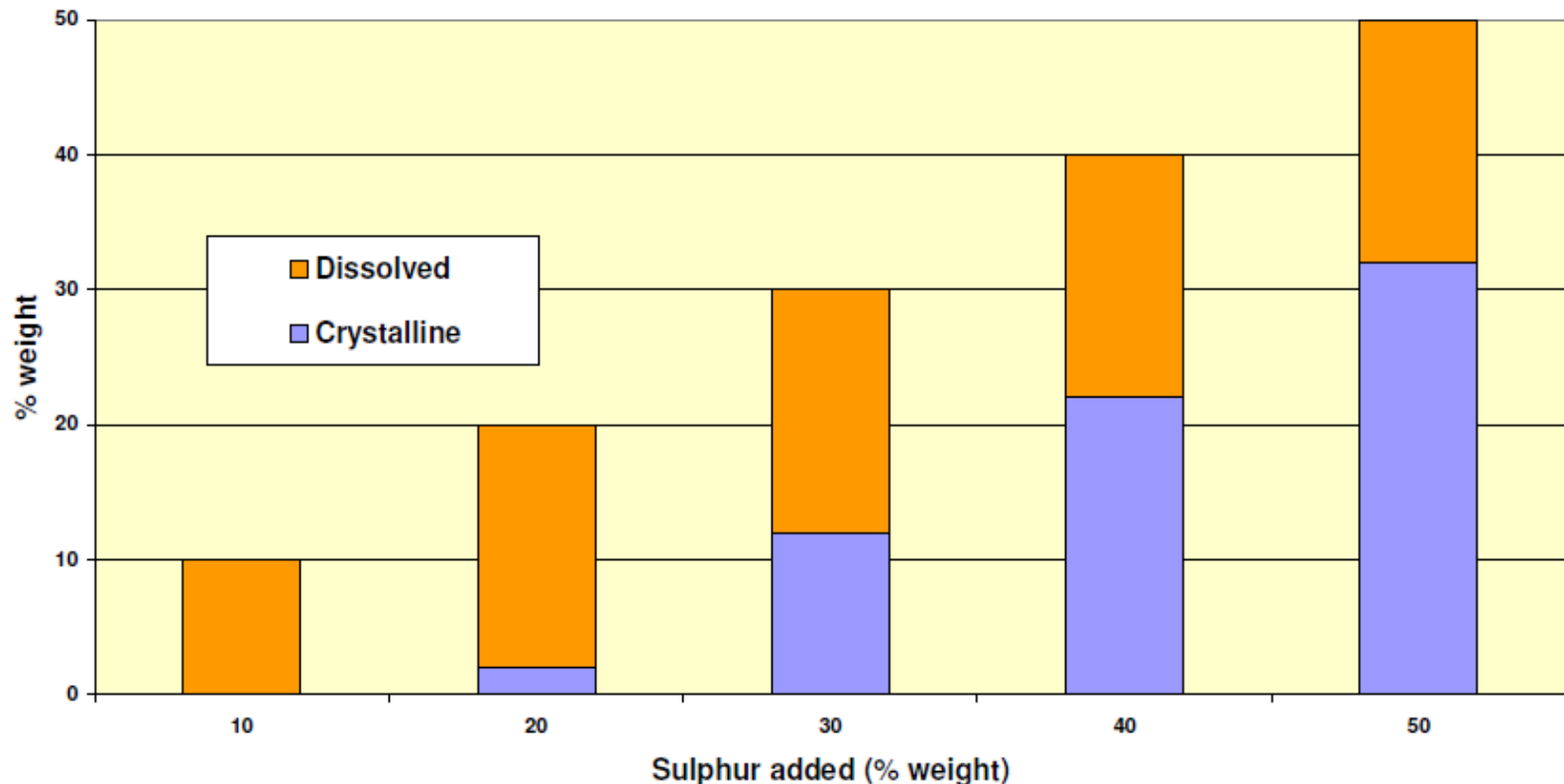


What Role Does Sulphur Play?

- 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



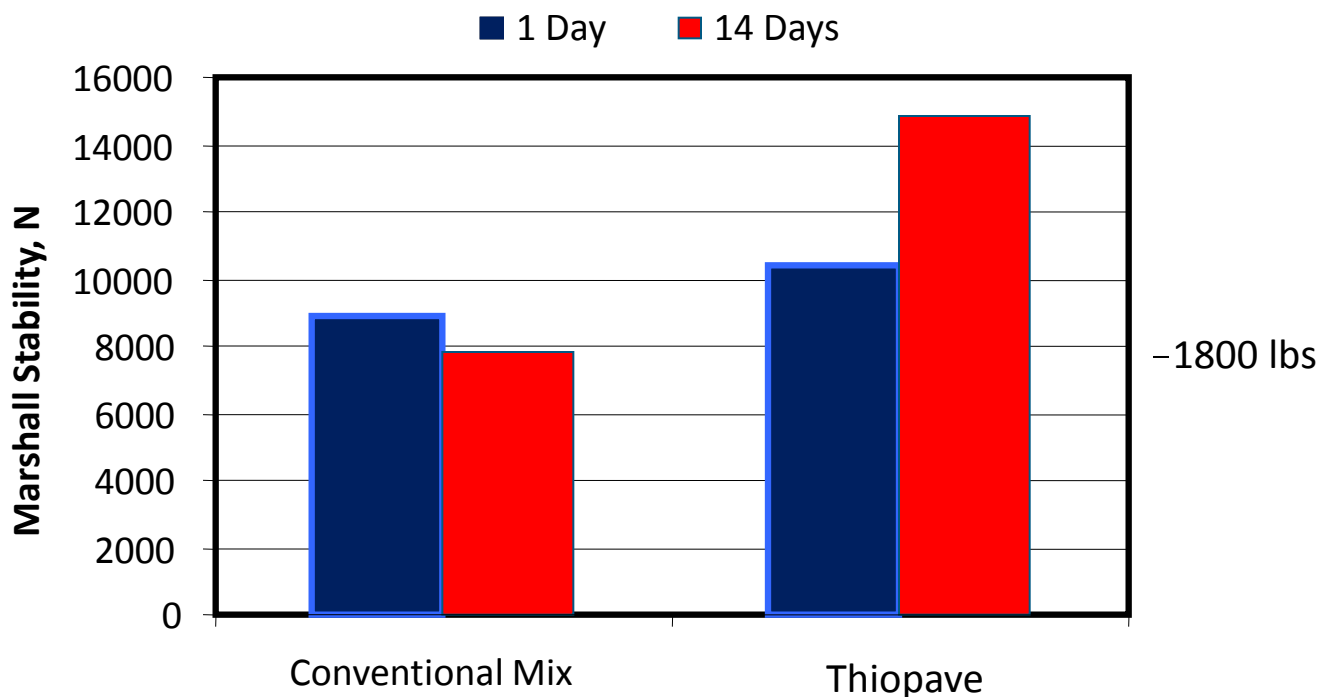
Sulphur in Bitumen



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

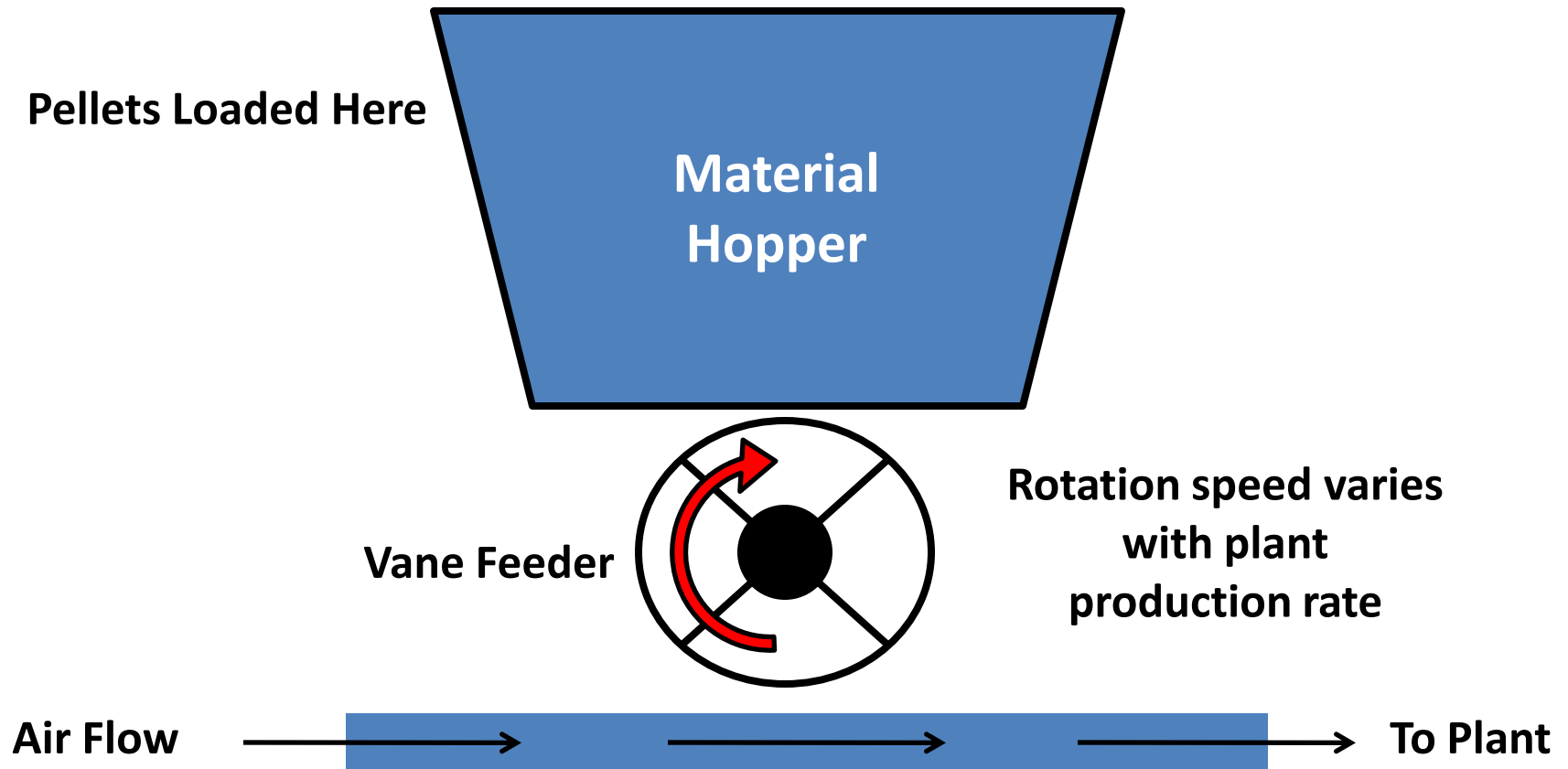


Pneumatic Feed System



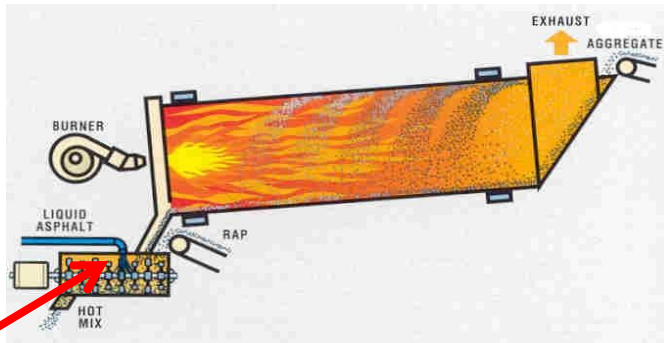
Wax Feeder

Pneumatic System Basics

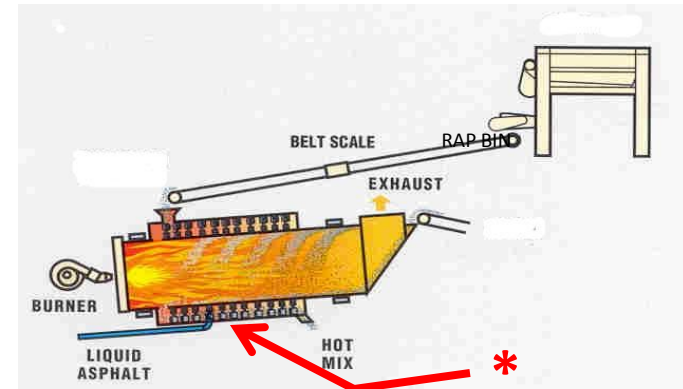


Production

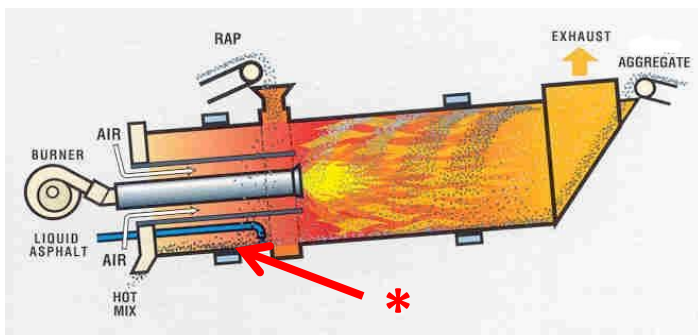
* Thiopave add point



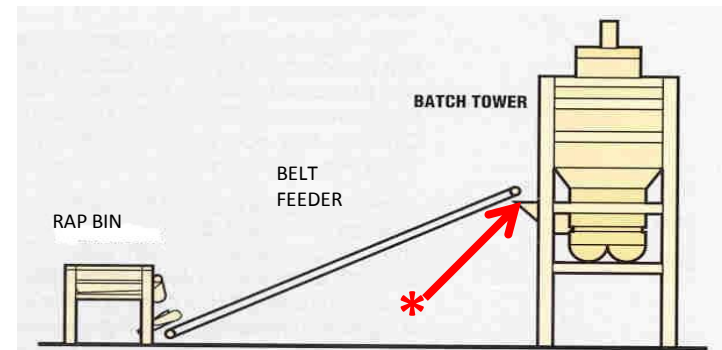
* **DRUM MIXER WITH SEPARATE COATING MIXER**



DOUBLE BARREL DRUM MIXER



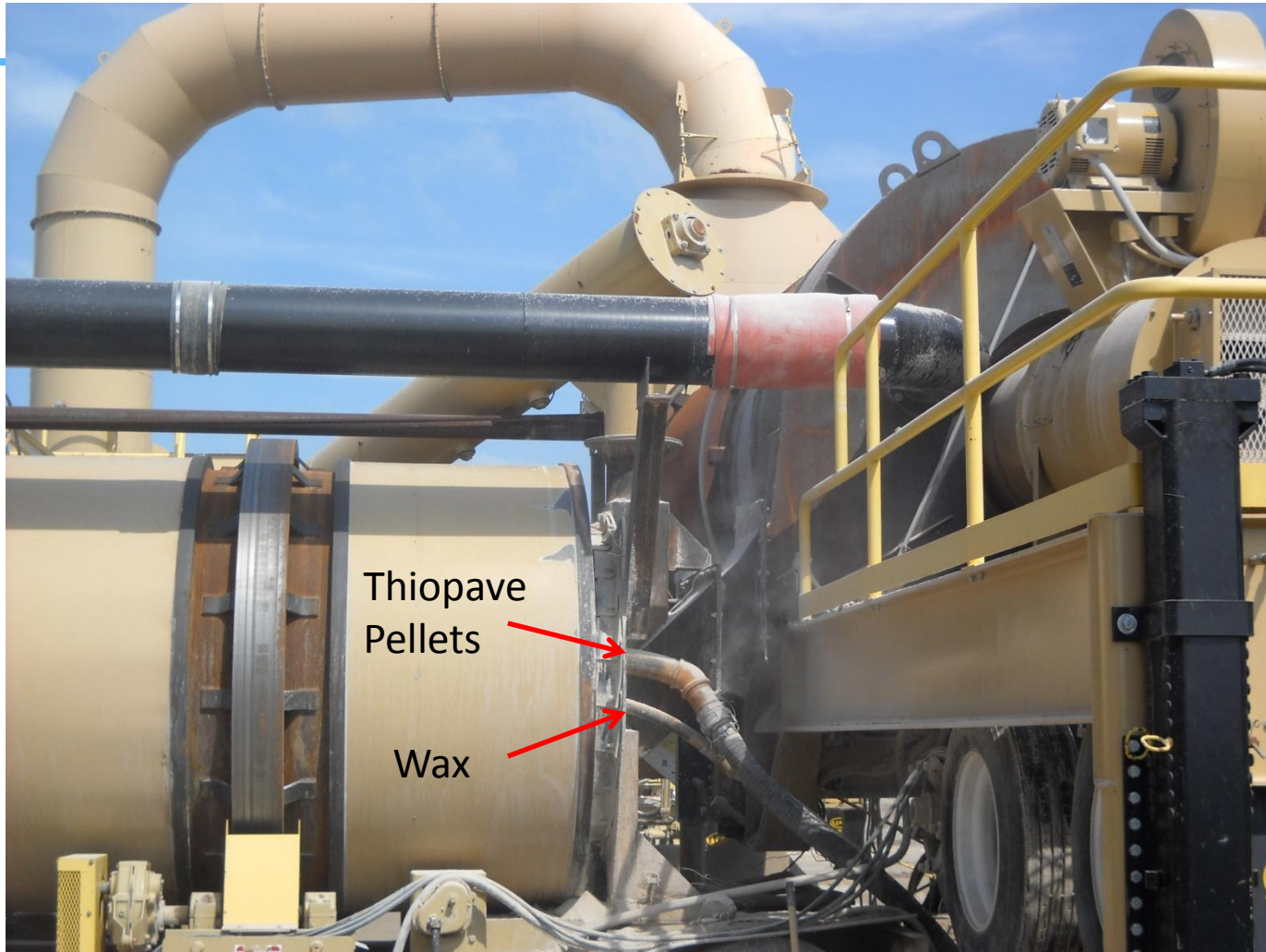
COUNTERFLOW DRUM MIXER



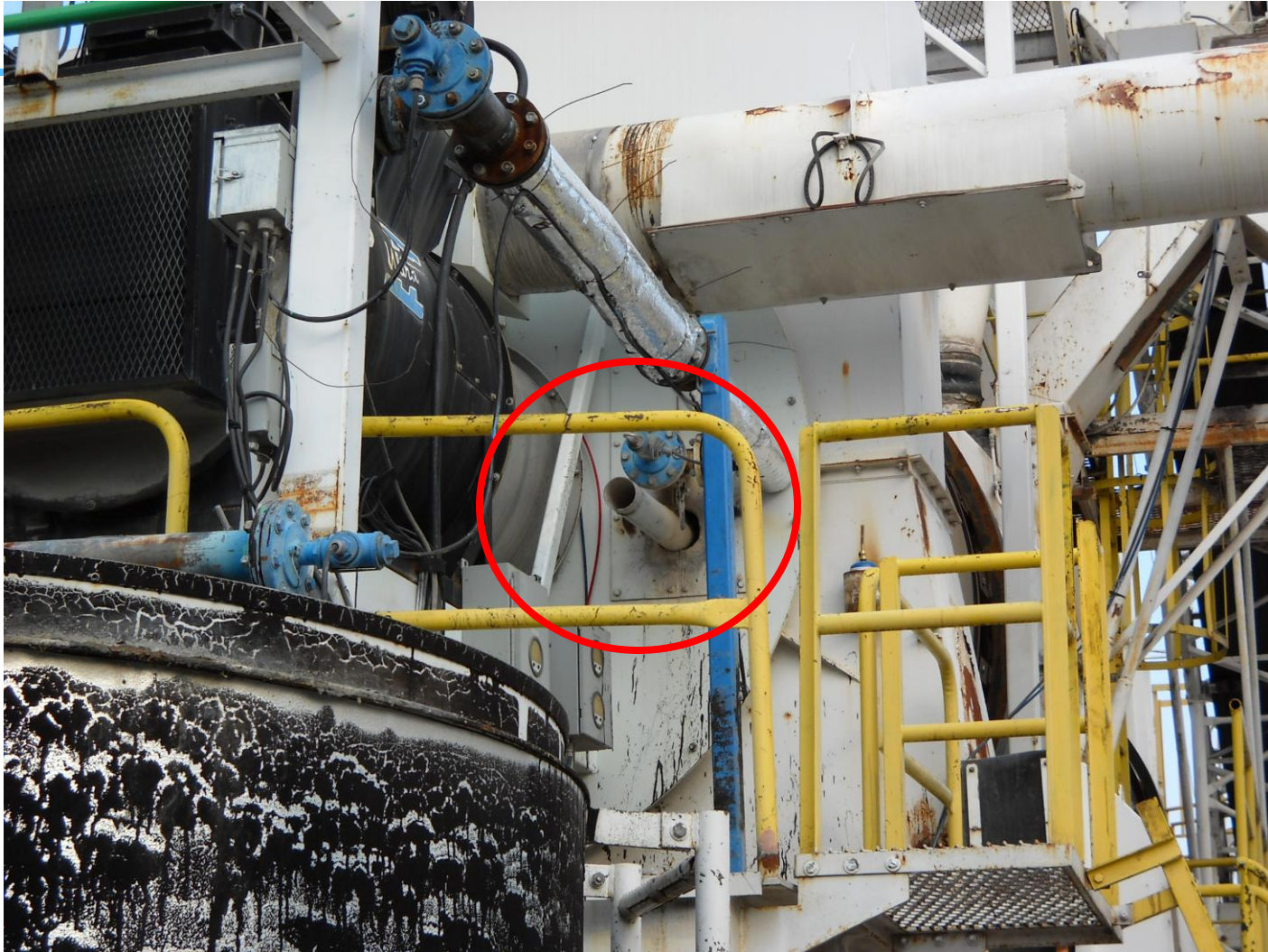
BATCH MIXING PLANT WITH RAP FEEDER



Plant Introduction Point



Plant Introduction Point



Plant Introduction Point



Plant Introduction Point



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

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