Trends in Asphalt Binder Materials
Marathon Petroleum Corporation

- More than 125 years in business
- Fourth largest U.S. refiner
  - Largest refiner in Midwest
- Employees: approx. 45,340
- Approx. 2,760 Speedway store
- Approx. 5,600 Marathon outlets

- MPC ranked #3 in Forbes “Americas Best Employers” list
Focused and Integrated Network

As of Dec. 4, 2015

- Marketing Area
- MPC Refineries
  - Light Product Terminals
    - MPC owned and Part-owned
    - Third Party
  - Asphalt/Heavy Oil Terminals
    - MPC Owned
    - Third Party
- Water Supplied Terminals
  - Coastal
  - Inland
- Pipelines
  - MPC Owned and Operated
  - MPC Interest: Operated by MPC
  - MPC Interest: Operated by Others
- Pipelines Used by MPC
  - Ethanol Facility
  - Biodiesel Facility
- Tank Farms
- Butane Cavern
- Pipelines
- Barge Dock
- MarkWest Facility

Refineries
Biodiesel/Ethanol Facilities
Terminals
Pipelines
Coastal Water Terminals
Inland Water Terminals
Speedway
Brand Marketing
Asphalt and Heavy Oil Overview

- One of the largest asphalt producers in the U.S. in terms of capacity
- 18 owned and two third-party asphalt terminals
- Market flexibility
- Key indicators
  - Sweet/sour crude differentials
  - Refinery crack spread
  - Market demand
Trends in Asphalt Binder Materials

- **Penetration Grades**
  (85-100, 60-70)
  - 1918, cold climate

- **Viscosity Grades**
  (AC-10, AC-20)
  - 1963, cold climate

- **PG Grades**
  (PG64-22, PG76-22P)
  - 1993

- **More Traffic**
  - 2016

- **RAP**
  - More Traffic
  - More RAP + RAS

- **Polymer**
  - More Traffic
  - More Modifiers

- **Testing time**
  - 2 hours
  - 5 hours
  - 26 hours
ODOT initiating Warning Band Limits

- ODOT not matching *some* supplier results
  - m-Value: Supplier 0.304; ODOT off-spec 0.298 (0.300 min.)
  - ODOT less tolerance for test method precision

- ODOT requires additions to QC Plan
  - **Warning Band** for each criteria: 0.300 – 0.308
  - **Action Plan** if result in the band: retest, adjust, delay shipment

- **Issues Remaining to be Resolved**
  - Each Supplier likely have different Warning Band
    - Supplier with poor history may have wider Warning Band
  - Higher “specification” on refinery sales
  - Managing supply to Ohio (versus surrounding states)
  - First year growing pains
MSCR is being implemented

AsphaltInstitute.org: Specification Databases

- Improved binder correlation to high traffic rutting performance
  - Jnr & %Recovery better describes benefit of polymer modification
- Few States – full implementation
  - PG76-22PM \( \rightarrow \) PG64E-22
- More States – partial implement
  - %Recovery only: replace PG Plus
    - Elastic Recovery - 7 method variations
- ODOT Testing / Evaluating
  - Suppliers need state/state uniformity
  - Stay tuned for future discussions

Source: Asphalt Institute
REOB blending into PG binders is under review

- Significant Industry Issue – DOT scrutiny
  - Many New England States have banned use
  - Discovered use without prior notification
- Claims of premature pavement cracking
- NORA: Trade Association Specifications
  - Re-refining with vacuum distillation (VTAE)
  - More than just re-claimed used engine oil
- Asphalt Institute Task Force
  - Developing publication
  - "State of the Knowledge: The Use of REOB / VTAE in Asphalt"
  - AI does not endorse or promote any materials
Bio-based modifiers for PG binders

- Renewable & Sustainable
  - Not tied to crude oil cost
  - Chemical processing of:
    - Soybean Oil
    - Other vegetable Oil
    - Corn fodder & Switch grass
    - Algae based

- Proposed benefits
  - Soften binders for RAP mixes
  - Achieve low temperature grade

Sources: MPC
Shale Crude – minimum impact on asphalt

Sources: MPC, CAPP
“New” PG binders may require new specification

- NCHRP 9-60 Research Program
- “Addressing Impacts of Changes in Asphalt Binder Formulation and Manufacture on Pavement Performance through Changes in Asphalt Binder Specifications”
- Problem statement: changes since SHRP ‘87
  - Wider, more variable range of crude oils
  - Wider variety of additives: Polymers, REOB, PPA, Bio Oils, GTR
- MSCR resulted from the last NCHRP on asphalt binders