Refinery Operation

- Field Storage
- Pumping Station
- Light Distillate
- Medium Distillate
- Heavy Distillate
- Storage Tower
- Tower Distillation Refinery
- Condensers and Coolers
- Residuum
- Process Unit
- Asphalt Cements
- Air Blown Asphalt
- For processing into emulsified and cutback asphalts
- Gas
- Petroleum
- Sand and Water
- Storage
- Tube Heater
- Air
- Still
Not All Crude is the Same
How Asphalt Behaves

- Behavior Depends on
  - Temperature
  - Time of Loading
Effect of Temperature
How hard is the water?
SUPERPAVE Asphalt Binder Specification

Grading System
Based on Pavement Temperatures

PG 64-22

Performance Grade
Max pavement design temp
Min pavement design temp

(Summer) (Winter)
Asphalt Binder Tests

*Done at different temperatures*
Temperature Grades

- High Temperature
  - 58
  - 64
  - 70
  - 76

- Low Temperature
  - -22
  - -28

Rule of 90
Aggregates
Quarry
Aggregate Properties

Gradation
Crushed Faces
Fine Aggregate Angularity
Absorption
Gradation
Percent Crushed Particles

- 0% Crushed
- 100% with 2 or More Crushed Faces

- Aggregate shape influences
  - strength
  - compactability
Fine Aggregate
Fine Aggregate Angularity

Natural sands: typically 37 to 44

Manufactured sands: typically 42 to 52
Absorption
Percent Passing

Sieve Size (mm) Raised to 0.45 Power

- Primary control sieve
- Max density line
- Control point

- Nominal max size
- Max size

- #200
- #8
- #4
- 3/8
- 1/2
- 3/4
Mix Size Designations

- By Nominal Maximum Sieve
- By Gradation
- e.g. 12.5 mm, coarse graded

- Sizes
  - 25.0 mm  1 in
  - 19.0 mm  ¾ in
  - 12.5 mm  ½ in
  - 9.5 mm   3/8 in
  - 4.75 mm  #4

- Coarse
- Fine
Asphalt Mix Design
Asphalt Mixture Design

- Superpave Mix Design
  - Gyratory Compactor

- Volumetric Properties
  - Asphalt content for durability
  - Air Voids
    - Upper limit to control aging
    - Lower limit for traffic densification
Mixing

Place pre-heated aggregate in bowl and add hot asphalt
Mixing

Mix until aggregate is well-coated
Short Term Aging

- Simulate Construction

- Oven Aging
  - 2 hours at 275°F
Compaction

Place funnel on top of mold and place mix in mold.
Compaction

Gyratory Compactor.
Compaction

- Gyratory compactor
  - Shearing action
  - 150 mm (6 inch) diameter molds
    - Aggregate size up to 1.5 inches
    - Measure height during compaction

Ram pressure
600 kPa
(90 psi)

1.25°
Selection of Design Asphalt Binder Content

- $V_a$
- VFA
- $V_{\text{Max}}$
- DP
- Blend 3

Variables:
- $\% \text{ binder}$
- $G_{mm}$ at $N_{ini}$
- $G_{mm}$ at $N_{max}$
HMA Plant Operation
Basic Purpose Of HMA Plants

Produce quality asphalt mixture

Contains the desired proportions
  Asphalt
  Aggregate

Meets specifications.
Drum Mixer Plant
Typical Layout

- Aggregate Bins
- Conveyor Belts
- Dryer-Mixer
- Burner
- Storage Silo
- Asphalt Storage
Asphalt Binder Storage Tanks
Aggregate Stockpile
Cold Feed Bins
Weigh Bridge Control
Dust Control??
Bag house Dust Collector
Storage Silos
Mix Discharge
Plants are computer controlled
Next