Refinery Operation

FIELD STORAGE
PUMPING STATION
LIGHT DISTILLATE
MEDIUM DISTILLATE
HEAVY DISTILLATE
PROCESS UNIT
ASPHALT CEMENTS
FOR PROCESSING INTO EMULSIFIED AND CUTBACK ASPHALTS
STILL
AIR
GAS
PETROLEUM
SAND AND WATER
TOWER DISTILLATION REFINERY
STORAGE
TUBE HEATER
CONDENSERS AND COOLERS
RESIDUUM
OR
AIR BLOWN ASPHALT
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
Aggregate Properties

Gradation
Crushed Faces
Fine Aggregate Angularity
Absorption
Gradation
Washed Gradation
Percent Crushed Particles

0% Crushed

100% with 2 or More Crushed Faces

- Aggregate shape influences
  - strength
  - compactability
Fine Aggregate Angularity

Natural sands:
typically 37 to 44

Manufactured sands:
typically 42 to 52
Percent Passing

Sieve Size (mm) Raised to 0.45 Power

Primary control sieve

max density line

control point

nom max size

max size

0

100

.075 .3 2.36 4.75 9.5 12.5 19.0

#200 #8 #4 3/8 1/2 3/4

Percent Passing

Primary control sieve

max density line

control point

nom max size

max size

0

100

.075 .3 2.36 4.75 9.5 12.5 19.0

#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
- Blend 3
- VMA
- DP
- $\% G_{mm}$ 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
Bag house Dust Collector
Bag house Dust Collector
Storage Silos
Mix Discharge
Plants are computer controlled
Next