ASPHALT BINDER

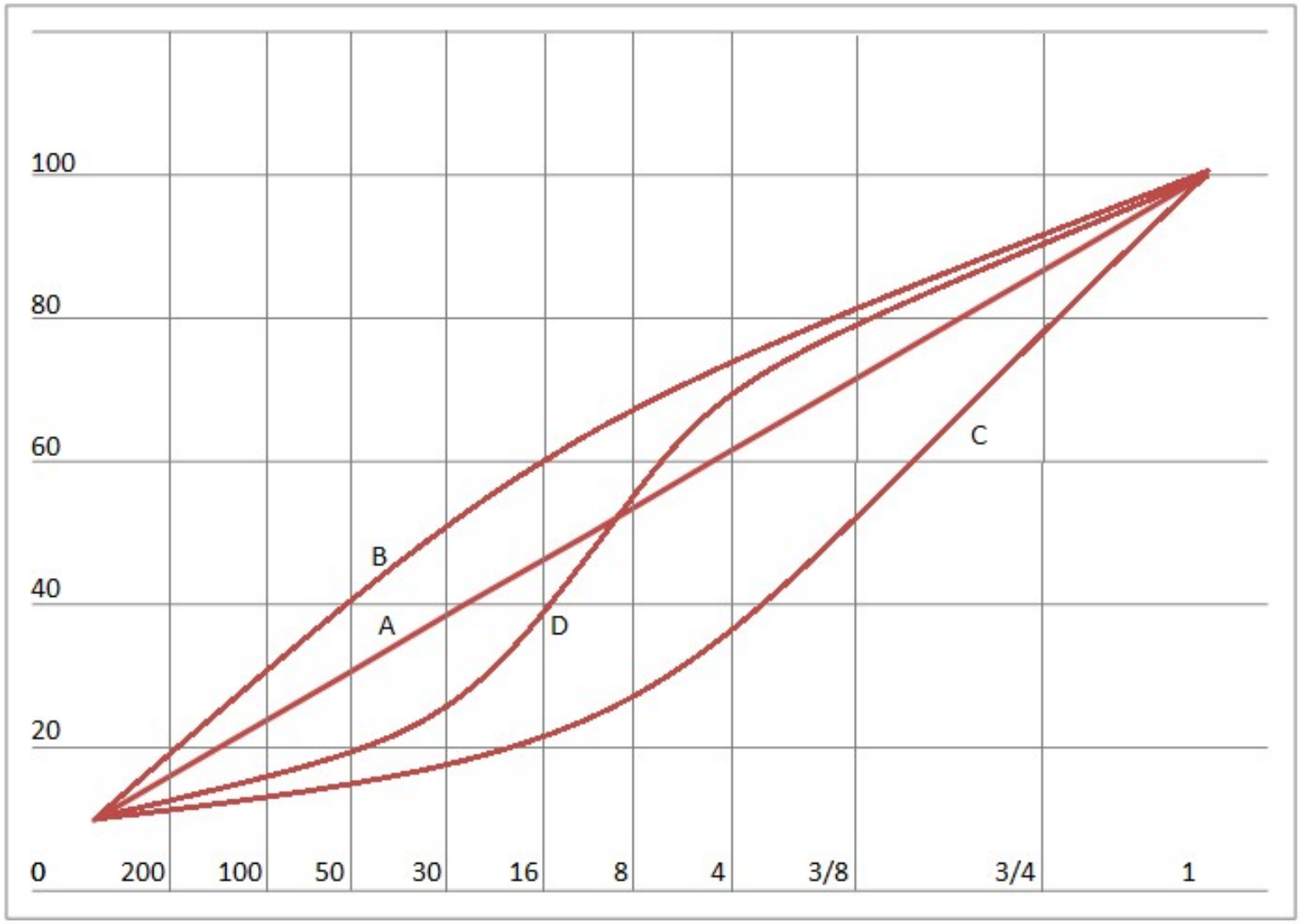
Section 6 –Superpave

Superpave

Gradation

- Maximum density line
- Superpave Gradation Limits

Superpave


Percent Passing
100
80
60
40
20
0
200
100
50
30
16
8
4
3/8
3/4
1
A
B
C
D
Sieve Sizes

Gradation Requirements, Marshall and Superpave Mixes

Table 803.5.5-1

Sieve	% Passing, Nominal Maximum Size			
	1 in	3/4 in	1/2 in	3/8 in
1 1/4 in	100	-	-	-
1 in	90-100	100	-	-
3/4 in	65-90	90-100	100	-
1/2 in	50-85	55-90	90-100	100
3/8 in	40-75	45-85	55-90	90-100
No. 4	30-60	30-65	35-70	45-85
No. 8	20-45	20-50	20-55	30-65
No. 30	5-25	5-30	5-35	10-40
No. 200	2-7	2-7	2-7	2-7

Aggregate Properties, Flexible Pavements

Table 803.5.5-2

Property	Aggregate Type				
	Agg I	Agg II	Agg III	Agg IV	Agg V
LA Abrasion maximum loss, %	35	40	40	40	40
Flat and Elongated (1 to 5 ratio) maximum, %	10	10	10	10	-
Sand Equivalent Minimum (2), %	45	45	45	40	40
Fractured Faces minimum (1), %	95/90	95/90	85/80	75/-	55/-
Fine Aggregate Angularity minimum (2), %	45	45	45	40	40
Plastic Index (2)	NP	NP	NP	NP	NP
Soundness ($MgSO_4$) Maximum loss, %	18	18	18	18	18

(1) "95/90" denotes that 95 percent of the coarse aggregate has one or more fractured faces and 90 percent has two or more fractured faces.

(2) Based on the minus No. 4 fraction of the composite blend.

Superpave

Equipment

- **Superpave Gyratory Compactor (SGC)**
  - **600 kPa compaction pressure**
  - **6” sample**
  - **The base rotates @ 30 rotations per minute**
  - **Compaction (internal) angle 1.25°**

The Gyratory Compactor

Superpave

Equipment

- Ovens
- Mechanical Mixer
- Pans
- Thermometer
- Balances

Superpave

Mix Design
(Design Aggregate Structure)

- Establish trial blends and compare them to specifications.
- Select three trial blends satisfying specifications.

Superpave

- Perform a preliminary evaluation of the blended aggregate properties
  - Four consensus properties
  - Bulk and apparent specific gravities of aggregate
  - Any source aggregate properties

Superpave

Mix Design
(Design Aggregate Structure)
(continued)

- Prepare a minimum of two specimens for each trial blend.
- Compact specimens in the SGC to Ndes.

Superpave

Number of Gyrations

- N_{des}: A function of traffic and traffic level.
- N_{ini}: To estimate the compactability of the mixture.
- N_{max}: To estimate the maximum compaction under traffic.

$$\text{Log } N_{max} = 1.10 \text{ Log } N_{des}$$

$$\text{Log } N_{ini} = 0.45 \text{ Log } N_{des}$$

Superpave

Gyratory Compactive Effort (Continued)

Class	N_{ini}	N_{des}	N_{max}
III-S	6	50	75
II-S	7	75	115
I-S	8	100	160

Superpave

Mix Design
(Design Aggregate Structure)
(Continued)

- Perform the volumetric analysis to determine:
  - VMA
  - VFA
  - Dust proportion DP

    DP = P0.075/Pbe

    P0.075=% passing #200

    Pbe = effective asphalt content

    DP range (0.8 – 1.4)
- Based on SUPERPAVE criteria, decide which blend if any is acceptable

Superpave

Table 401.4.1-2
Superpave Plant Mix Properties

	Class I-S	Class II-S	Class III-S
Number of Superpave Gyrations	100	75	50
% Voids in Laboratory Mix	4.0-5.0	4.0-5.0	4.0-5.0
% Voids in Production Mix	3.0-5.0	3.0-5.0	2.5-5.0
Dust/Effective Asphalt	0.8-1.4	0.8-1.4	0.8-1.4
Minimum % Asphalt	4.5	4.5	4.5
Minimum Tensile Strength Retained %	75	75	75
Film Thickness μm^2	6-12	6-12	6-12
Voids Filled with Asphalt (VFA)	65-75	65-78	65-78

Superpave

VMA Criteria

Table 401.4.1-3

Percent Voids in Mineral Aggregate (VMA)

	1" Maximum Nominal Size	3/4" Maximum Nominal Size	1/2" Maximum Nominal Size	3/8" Maximum Nominal Size
Laboratory Mix				
CLASS IS, IIS	12.0-15.0	13.0-16.0	14.0-17.0	14.0-17.0
CLASS IIIS	11.0-14.0	12.0-15.0	13.0-16.0	13.0-16.0
Production Mix				
CLASS IS, IIS	11.0-15.0	12.0-16.0	13.0-17.0	13.0-17.0
CLASS IIIS	10.0-14.0	11.0-15.0	12.0-16.0	12.0-16.0

Superpave

Mix Design
(Design Aggregate Structure)
(Continued)

- After selection the design aggregate structure, a minimum of 2 specimens should be prepared at the estimated asphalt contents, at +/- 0.5%, and +/- 1.0% of the estimated asphalt content.
- A minimum of 2 specimens should be prepared for determinations of maximum theoretical specific gravity.
- Mix properties are evaluated by using the densification data @ N_{ini} and N_{des} and N_{max}.

Superpave

Mix Design
(Design Asphalt Content)

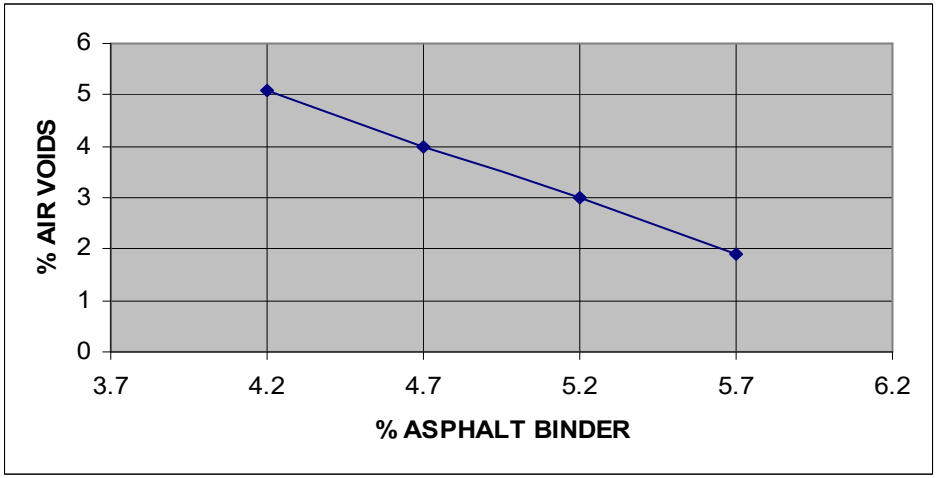
- Volumetric properties are calculated at Ndes.
- Graphs should be developed for
  - Air voids
  - VMA vs. asphalt content
  - VFA vs. asphalt content

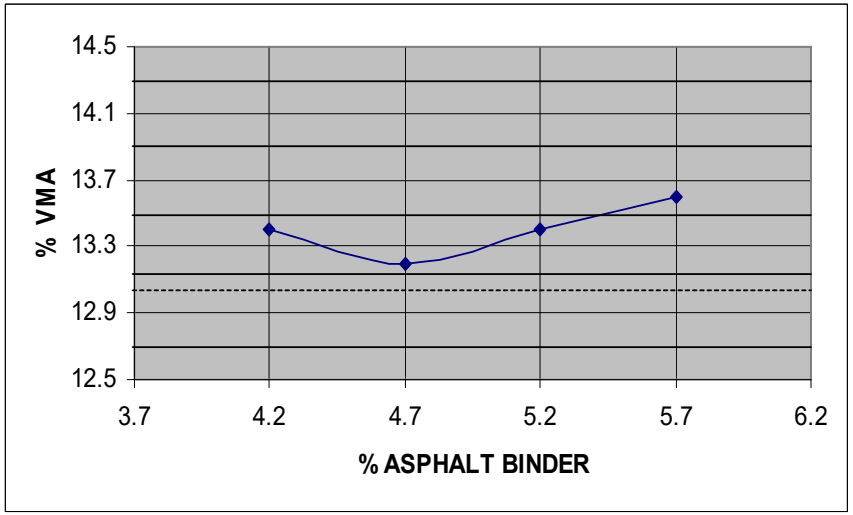
Superpave

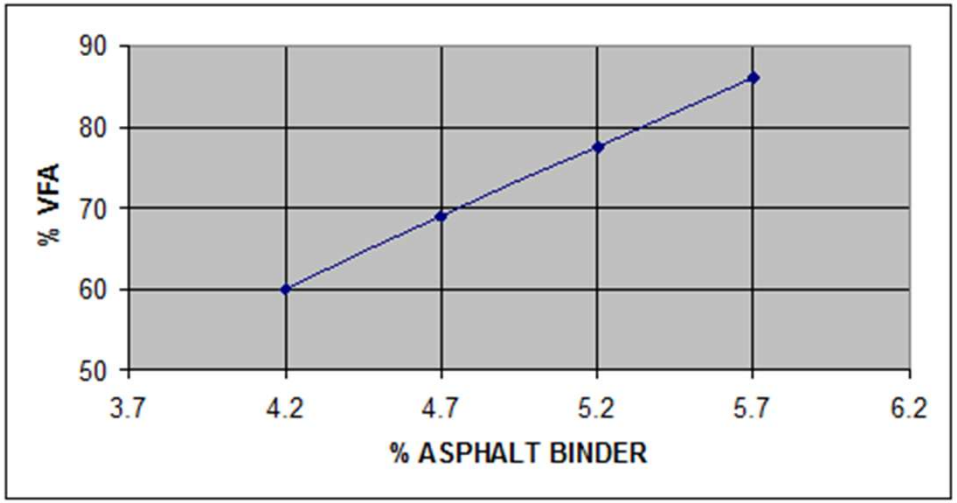
Mix Design
(Design Asphalt Context)
(continued)

- **Design content should be established @ 4 % air voids**
- **Other mixture properties should be checked**

Superpave Graphs







Superpave

Mix Design

- Two samples should be mixed at the design asphalt content
- The samples should be compacted to Nmax in the gyratory compactor
- The density of the samples should be less than 98% of maximum density