Superpave System

FHWA after a 5-yr. study developed a HMA design named as – **SU**perior **PER**forming Asphalt **PAVE**ments -- SUPERPAVE system

Salient feature: pg. 552-553 text book, W & D (২ para)

Selection of Asphalt Binder: pg. 553 (4টা point) 1.2.3.4 , Table 554

Selection of Aggregates: pg. 556 4টা Test এর নাম ও value

Selection of Design Aggregate Structure: pg. 558

Selection of Design Asphalt Binder Content: pg. 559 step 1–6

Evaluation of Moisture Sensitivity: pg.559

Other Specialty Mixes [MS-2, 7th Edition, TAI]

I	Airfield mixes
II	Open-graded mixes
III	Stone matrix asphalt (SMA)
IV	Rich bottom layer mixes
V	Hot in-place recycling (HIPR)
VI	Cold mix
VII	Crumb rubber modified (CRM) mix
VIII	Hydraulic mixes
IX	Railway track bed mixes
X	Ultra-thin bonded wearing course
XI	Bridge deck mixes
XII	Sand-asphalt mixes
XIII	Warm mix asphalt (WMA)

STEPS FOR MIX DESIGN

- Step 1 : Procurement of aggs. and asphalt as per 'Specification'
- Step 2 : Determination of 'Job-mix-formula' for agg. blend.
- Step 3 : Determination of OBC/DBC to satisfy requirements.

COORDINATION OF MIX DESIGN TESTING

- Preliminary Design Testing
- Source Acceptance Testing
- Job-Mix Control Testing
- Construction Control Testing

STEP 1. Aggregates : types : crushed stone, gravel, slag etc.
: requirements – hard, tough, clean, durable
– loss in LAA $\ngtr 40$; $\ngtr 12\%$ in sq.

Sand : Natural or stone screenings, tough, clean, rough. non plastic

Mineral Filler : limestone, dolomite dust; slag dust, OPC, NP. soil.
3-5% লাগে. 100kg agg. হলে
(M. Akhtar & A. Sobhan)

Asphalt: AC-20/40 – for heavy traffic in hot climate
AC-10 – for med. to light traffic in hot climate
AC-2.5/5 – for cold climates.

STEP 2.

Requirements related to aggregate gradation.
ombined grading is the blend of C.A. F.A and M.F.
irading by Fuller's Equation

$$P = 100(d/D)^{0.5}$$

P = total % passing a sieve
d = size of sieve opening
D = largest size in gradation

gives max. density and min. voids.

Fuller's grading curves are seen to be parabolic.
FHWA modified Fuller's curves using a power of 0.45

$$P = 100(d/D)^{0.45}$$

Grading curves of this type is seen to be straight lines romthe origin at the lower left of the chart to the esired nominal maximum particle size.

Typical Aggregate Gradings:
e.g. 582 (WP 5th Ed) Table 19.1 – Alabama Hwy Dept. (USA)
Pg. 583 (WP 5th Ed) Table 19.2 – Kentucky Dept. of Hwys.

STEP 2 & STEP 3 : DETERMINATION OF JOB-MIX FORMULA (WP)
- Selection & combination of aggs. (STEP 2)
- Determination of Optimum Asphalt Content (STEP 3)

Selection & Combination of Aggs. (WP)

Selection as per specification requirement.

Combination by 'Trial & Error', 'Graphical' or 'Equation' method

Example of combination : WP. 4th / 5th Edition. Pg.
Table – 19-5 (Paul বই)
Trial method Aziz বই, agg, x,y,z দিয়ে math example.
Math → Chapter 18 এর (18-1) exercise.

STEP 3 Optimum Asphalt Content (কত % বিটুমিন দিব?)

1. Methods for OAC / DAC or OBC / DBC
   - Marshall Method (BD ✓) of mix design
   - Hveem Method
   - Hubberd – Field Method
   - Smith Triaxial Method

   } USA
   - BS 594 (UK) – involves Marshall for Rolled Asphalt
   - Lees Asphaltic Concrete
   - LDM (Leeds Design Method) for superpave

2. General Steps
   - Preparation of trial specimens
   - Determination of density, stability, flow etc. of specimens
   - Density – void Analysis to find
     - Voids in Mineral Aggregate (VMA)
     - Voids in Compacted Mix (P_a)
     - Voids Filled with Asphalt (VFA)
   - Plotting of parameters for different asphalt content
   - Determination of avg. / 4% (P_a) asphalt content.
   - Checking with 'Design Criteria'.

MARSHALL METHOD OF MIX DESIGN ; DESIGN PROBLEM 19-5. ; IEB – ASPHALT PVT. COURSE : 8.12.93.

ASPHALT CONTENT (P_b)%	SPECIMEN WT. IN AIR (W_a) gm	SPECIMEN WT. IN WATER (W_w) gm	G_{mb}.	UNIT WT. γ lb/cft $G_{mb} \times 62.4$	G_{mm}	P_i	G_{sb}	P_a or V%	VMA%	VFA%	HEIGHT OF SPECIMEN INCHES	CORRELAL FACTOR	CORRECTED STABILITY LBS	FLOW VALUE (1/100) IN.	
4·5															
5															
5·5															
6															
6·5															

$G_{mb} = \dfrac{W_a}{W_a - W_w}$; $G_{mm} = \dfrac{P_{mm}}{\dfrac{P_s}{G_{se}} + \dfrac{P_b}{G_b}}$; $P_s = 100 - P_b$; $P_{mm} = 100$; $G_{se} = \dfrac{P_{mm} - P_b}{\dfrac{P_{mm}}{G_{mm}} - \dfrac{P_b}{G_b}}$ (D 2041) ; $G_{sb} = \dfrac{P_1 + P_2 + P_3}{\dfrac{P_1}{G_1} + \dfrac{P_2}{G_2} + \dfrac{P_3}{G_3}}$.

$V\% \, (P_a) = 100 \, \dfrac{G_{mm} - G_{mb}}{G_{mm}}$; $VMA\% = 100 - \dfrac{G_{mb} \cdot P_s}{G_{sb}}$; $VFA\% = \dfrac{VMA\% - V\%}{VMA\%}$

Approx. $G_{mm} = \dfrac{100}{\dfrac{P_4}{G_1} + \dfrac{P_5}{G_2} + \dfrac{P_6}{G_3} + \dfrac{P_b}{G_b}}$

(18)

graph – 6টা
chap 18 or 19.