

SUPERPAVE MIXTURE DESIGN

AGGREGATE AND GRADATION REQUIREMENTS

Percent Passing Criteria (Control Points)					
Standard Sieve (mm)	Nominal Maximum Sieve Size (mm)				
	9.5	12.5	19.0	25.0	37.5
50.0					100
37.5				100	90—100
25.0			100	90—100	
19.0		100	90—100		
12.5	100	90—100			
9.5	90—100				
2.36	32—67	28—58	23—49	19—45	15—41
0.075	2—10	2—10	2—8	1—7	0—6

Traffic Million ESALs	Coarse Aggregate Angularity		Fine Aggregate Angularity		Flat and Elongated Particles Maximum Percent	Clay Content Sand Equivalent, minimum
	Depth from Surface		Depth from Surface			
	≤100 mm	>100 mm	≤100 mm	>100 mm		
<0.3	55/—	—/—	—	—	—	40
<1	65/—	—/—	40	—	—	40
<3	75/—	50/—	40	40	10	40
<10	85/80	60/—	45	40	10	45
<30	95/90	80/75	45	40	10	45
<100	100/100	95/90	45	45	10	50
≥100	100/100	100/100	45	45	10	50

Mixture Designations						
Superpave Designation (mm)	9.5	12.5	19.0	25.0	37.5	
Nominal Maximum size (mm)	9.5	12.5	19.0	25.0	37.5	
Maximum size (mm)	12.5	19.0	25.0	37.5	50.0	

Additional Requirements	
Fines-to-effective asphalt ratio, wt./wt.	0.6—1.2
Short-term oven aging at 135°C, hr.	4
Tensile strength ratio T283, min.	0.80
Traffic (for design) based on, yr. [†]	15

[†]This is a recommendation

Recommended Restricted Zone					
Standard Sieve (mm)	Nominal Maximum Aggregate Size (mm)				
	9.5	12.5	19.0	25.0	37.5
4.75				39.5	34.7
2.36	47.2	39.1	34.6	26.8—30.8	23.3—27.3
1.18	31.6—37.6	25.6—31.6	22.3—28.3	18.1—24.1	15.5—21.5
0.60	23.5—27.5	19.1—23.1	16.7—20.7	13.6—17.6	11.7—15.7
0.30	18.7	15.5	13.7	11.4	10.0

Coarse Aggregate Authority: "85/80" means that 85% of the coarse aggregate has a minimum of one fractured face and 80% has two fractured faces.

Fine Aggregate Angularity: Criteria are presented as the minimum percent air voids in loosely-compacted fine aggregate.

Flat and Elongated Particles: Criteria are presented as a maximum percent by weight of flat and elongated particles.

Clay Content: Clay content is expressed as a percentage of total sediment height in a sedimentation test.

ESAL: Equivalent single axel load.

Maximum Size: One sieve larger than the nominal maximum size.

Nominal Maximum Size: On sieve size larger than the first sieve to retain more than 10 % of aggregate.

COMPACTION REQUIREMENTS

Superpave Gyrotory Compaction Effort												
Traffic Million ESALs	Average Design High Air Temperature											
	<39°C			39-40°C			41-42°C			42-43°C		
	N _{mi}	N _{des}	N _{max}	N _{mi}	N _{des}	N _{max}	N _{mi}	N _{des}	N _{max}	N _{mi}	N _{des}	N _{max}
<0.3	7	68	104	7	74	114	7	78	121	7	82	127
<1	7	76	117	7	83	129	7	88	138	8	93	146
<3	7	86	134	8	95	150	8	100	158	8	105	167
<10	8	96	152	8	106	169	8	113	181	9	119	192
<30	8	109	174	9	121	195	9	128	208	9	135	220
<100	9	126	204	9	139	228	9	146	240	10	153	253
≥100	9	142	233	10	158	262	10	165	275	10	172	288

VFA Requirements	
Traffic Million ESALs	Design VFA (%)
<0.3	70—80
<1	65—78
<3	65—78
<10	65—75
<30	65—75
<100	65—75
≥100	65—75

VMA Requirements					
Nominal Maximum Aggregate Size (mm)	9.5	12.5	19.0	25.0	37.5
Minimum VMA (%)	15	14	13	12	11

Compaction Key			
Superpave Gyrotory Compaction	N _{mi}	N _{des}	N _{max}
Percent of Gmm	≤89%	96%	≤98%



PG-BINDER GRADING SYSTEM

PERFORMANCE GRADE	PG 46-			PG 52-						PG 58-					PG 64-						PG 70-						PG 76-					PG 82-					
	34	40	46	10	16	22	28	34	40	46	16	22	28	34	40	10	16	22	28	34	40	10	16	22	28	34	40	10	16	22	28	34	10	16	22	28	34
Avg. 7-day max. Pavement design Temp., °C	<46			<52						<58					<64						<70						<76					<82					
Min. Pavement Design Temp., °C (a)	>34	>40	>46	>10	>16	>22	>28	>34	>40	>46	>16	>22	>28	>34	>40	>10	>16	>22	>28	>34	>40	>10	>16	>22	>28	>34	>40	>10	>16	>22	>28	>34	>10	>16	>22	>28	>34
ORIGINAL BINDER																																					
Flash Point Temp., T48: Min., °C	230																																				
Viscosity, ASTM D 4402: Max. 3 Pa·s, Test Temp., °C ^(b)	135																																				
Dynamic Shear TP5: G*/sin δ, Min., 1.00 kPa; Test Temp. @ 10 rad/s, °C ^(c)	46			52						58					64						70						76					82					
ROLLING THIN FILM OVEN RESIDUE (T240)																																					
Mass Loss, Max., Percent	1.00																																				
Dynamic Shear TP5: G*/sin δ, Min., 2.20 kPa; Test Temp. @ 10 rad/s, °C	46			52						58					64						70						76					82					
PRESSURE AGING VESSEL RESIDUE (PP1)																																					
PAV Aging Temp., °C ^(d)	90			90						100					100						100(110)						100(110)					100(110)					
Dynamic Shear TP5: G*/sin δ, Max., 5000 kPa; Test Temp. @ 10 rad/s, °C	10	7	4	25	22	19	16	13	10	7	25	22	19	16	13	31	28	25	22	19	16	34	31	28	25	22	19	37	34	31	28	25	40	37	34	31	28
Physical Hardening ^(e)	REPORT																																				
Creep Stiffness, TP1: Max., 300 MPa; m-value, Min., 0.300 Test Temp. @ 60 s, °C	-24	-30	-36	0	-6	-12	-18	-24	-30	-36	-6	-12	-18	-24	-30	0	-6	-12	-18	-24	-30	0	-6	-12	-18	-24	-30	0	-6	-12	-18	-24	0	-6	-12	-18	-24
Direct Tension, TP3: Failure strain, Min., 1.0%; Test Temp. @ 1.0 mm/min, °C ^(f)	-24	-30	-36	0	-6	-12	-18	-24	-30	-36	-6	-12	-18	-24	-30	0	-6	-12	-18	-24	-30	0	-6	-12	-18	-24	-30	0	-6	-12	-18	-24	0	-6	-12	-18	-24

a. Pavement temperatures can be estimated from air temperatures using an algorithm contained in the LTPPBIND software, or may be provided by the specifying agency, or by following the procedures as outlined in the PPX.

b. This requirement may be waived at the discretion of the specifying agency if the supplier warrants that the asphalt binder can be adequately pumped and mixed at temperatures that meet all applicable safety standards.

c. For quality control of unmodified asphalt cement production, measurement of the viscosity of the original asphalt cement may be substituted for dynamic shear measurements of G*/sin(δ) at test temperatures where the asphalt is a Newtonian fluid. Any suitable standard means of viscosity measurement may be used, including capillary or rotational viscometry (T201 or T202).

d. The PAV aging temperature is based on

simulated climactic conditions and is one of three temperatures 90°C, 100°C or 110°C. The PAV aging temperature is 100°C for PG 58- and above, except in desert climates, where it is 110°C.

e. Physical hardening—TP1 is performed on a set of asphalt beams according to section 13.1, except the conditioning time is extended to 24 hr ± 10 minutes at 10°C above the minimum performance temperature. The 24-

hour stiffness and m-value are reported for information purposes only.

f. If the creep stiffness is below 300 MPa, the direct tension is not required. If the creep stiffness is between 300 and 600 MPa, the direct tension failure strain requirement can be used in lieu of the creep stiffness requirement. The m-value requirement must be satisfied in both cases.