OKLAHOMA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISIONS FOR
PLANT MIX BITUMINOUS BASES AND SURFACES

These Special Provisions revise, amend and where in conflict, supersede applicable sections of the 1999 Standard Specifications for Highway Construction, English and Metric, as applicable. Units of measurement are provided in the subsections in both English and Metric equivalents. The units applicable for this project will be those specified in the project plans.

708.02. MINERAL AGGREGATE. *(Add NMS column in Table 1 as follows:)*

TABLE 1
PHYSICAL PROPERTIES OF AGGREGATES

Test		**Superpave**
L.A Abrasion(a) , % wear, maximum		40
Sand Equivalent(b), % minimum		
less than 3 Million ESALs		40
3 Million ESALs to 30 Million ESALs		45
greater than 30 Million ESALs		50
Mechanically Fractured Faces(b,c,j), % minimum	Depth From Surface(k)	
Traffic, million ESALs (l)	less than or equal 4 in.(100mm)	greater than 4 in.(100mm)
less than 3	75/75	65/65
3 to less than 10	85/80	75/75
10 to less than 30	95/90	80/75
30 to less than 100	100/100	95/90
100 or more	100/100	100/100
Aggregate Durability Index(a), minimum		40
Insoluble Residue(d,e), % minimum		
less than 3 million ESALs		30
3 million ESALs or more		40
Flat or Elongated Pieces(b,c,f), % maximum		
less than 0.3 million ESALs		-
0.3 million ESALs or more		10
Natural Sand and Gravel(b), % maximum		
less than 0.3 million ESALs		25
0.3 million ESALs or more		15
Clay Balls and Friable Particles(g), % maximum		1.0

Soft Particles(a), % maximum	5
Sticks or Roots(a), % maximum	0.5

Uncompacted Void Content of Fine Aggregate (b,i), % min.	Depth from Surface(k)	
Traffic, million ESALs	less than or equal 4 in.(100mm)	greater than 4 in.(100mm)
less than 0.3	-	-
0.3 to less than 3	40	40
3 to less than 30	45	40
30 or more	45	45

(a) Applies to each source except as noted.
(b) Applies to the combined aggregate except as noted.
(c) Applies to the aggregate retained on the No.4 (4.75mm) sieve
(d) Applies to the combined coarse aggregate.
(e) Applies to the coarse aggregate used in the surface course. Does not apply to shoulders and temporary detours.
(f) A flat piece is one in which the maximum width is greater than 5 times the maximum thickness. An elongated piece is one in which the maximum length is greater than 5 times the maximum width.
(g) Applies to the combined aggregate. Provided the maximum for the combined aggregate is not exceeded, a maximum 1.5 percent will be allowed for any one source.
(i) Applies to the aggregate passing the No.8 (2.36mm) sieve.
(j) In the requirement format "xx/yy", "xx" denotes the percentage of coarse aggregate requiring one fractured face and "yy" denotes the percentage of coarse aggregate requiring 2 fractured faces.
(k) If less than 25% of a layer is within 4 inches (100mm) of the surface, the layer may be considered to be below 4 inches (100mm) for mixture design purposes.
(l) Regardless of the actual design life of the roadway, the design ESALs are based on 20 years.

(a) Coarse Aggregate. (Add the following:) The coarse aggregate for NMS shall be that part of the aggregate retained on the No.8 (2.36mm) sieve and shall consist of clean, tough, durable particles.

(b) Fine Aggregate. (Add the following:) Fine aggregate for NMS shall be that part of the aggregate passing the No.8 (2.36mm) sieve and shall consist of hard, durable grains of natural sand, crushed stone, stone dust, crushed gravel, mine chat or jig-sand or any combination of these materials.

708.04. COMPOSITION OF MIXTURES. *(Change as follows:)*

Change all references to "Tables 5A or 5B" to include Table 5C. Change all references to "Tables 6A or 6B" to include Tables 6C and 6D.

(a) Asphalt Mix Design and Initial Job-Mix Formula. (Add the following to the second paragraph:) The NMS mix design shall be prepared as shown in Special Provision 708-5(a), Special Provision for Job-Mix Formulation of Asphalt Concrete, and AASHTO PP 28, except where in conflict with these specifications.

(c) Recycled Bituminous Pavements. (Delete the first paragraph and replace as follows:) Unless otherwise noted on the Plans, bituminous mixtures containing up to 25 percent

reclaimed asphalt concrete pavement will be accepted provided that the mixture meets all the requirements of these specifications. For roadways with 0.3 million ESALs or more, bituminous mixtures containing reclaimed asphalt concrete pavement will not be accepted in the wearing course.

(Add the following: Tables 5C, 6C, and 6D:)

TABLE 5C
TABLE OF NMS MIXTURES
(Percent Passing)

Mix Type	S2		S3		S4		S5		S6	
NMS(c)	1 in.		¾ in.		½ in.		⅜ in.		No. 4	
	(25.0mm)		(19.0mm)		(12.5mm)		(9.5mm)		(4.75mm)	
Sieve Size(d)	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1½ in.(37.5mm)	100	-	-	-	-	-	-	-	-	-
1 in.(25.0mm)	90	100	100	-	-	-	-	-	-	-
¾ in.(19.0mm)	-	90	90	100	100	-	-	-	-	-
½ in.(12.5mm)	-	-	-	90	90	100	100	-	-	-
⅜ in.(9.5mm)	-	-	-	-	-	90	90	100	100	-
No.4(4.75mm)	40	-	-	-	-	-	-	90	80	100
No.8(2.36mm)	29	45	31	49	34	58	37	67	54	90
No. 16(1.18mm)	-	-	-	-	-	-	-	-	-	-
No. 30(0.60mm)	-	-	-	-	-	-	-	-	-	-
No. 50(0.30mm)	-	-	-	-	-	-	-	-	-	-
No. 100(0.150mm)	-	-	-	-	-	-	-	-	-	-
No.200(0.075mm)	1(a)	7(a)	2(a)	8(a)	2(a)	10(a)	2(a)	10(a)	5	15
Asphalt Cement, % of mix mass	3.7	-	4.1	-	4.6	-	5.1	-	5.6	-
Performance Grade Asphalt Cement	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)

FOOTNOTES FOR TABLES 5C

(a) The ratio of the percent passing the No.200 (0.075mm) sieve to the percent *effective* asphalt content shall be a minimum of 0.6 to a maximum of 1.6.

(b) Three grades of asphalt cement will be used unless otherwise specified on the Plans:
Use PG 64-22 OK in roadways with < 3M ESALs (< 5000 ADT) and with all mixes more than 5 inches (125mm) below the surface of the pavements in roadways with ≥3M ESALs (≥5000 ADT) and with all mixes used for shoulders and temporary detours. Use PG 70-28 OK with all mixes in the top 5 inches (125mm) of pavements in roadways with ≥3M ESALs (≥5000 ADT). Use PG 76-28 OK with all mixes in the top 5 inches (125mm) of pavements in roadways with ≥10M ESALs (≥10000 ADT) or in roadways with slow, standing, or turning traffic such as urban intersections with ≥3M ESALs (≥5000 ADT). For convenience, a higher grade asphalt binder in a type of asphaltic concrete than was indicated on the plans initially may be used, but at no additional cost to the Department.

(c) NMS is defined as one size larger than the first sieve to retain more than 10 percent. Control points

are shown as percent passing the respective sieve size.

(d) Table 5C reflects sieve size boundaries for design and job-mix formula (JMF) purposes only. After the design has been established, the combined aggregate sieve requirements will be designated by the JMF with the tolerances set in Table 7.

TABLE 6C
PROPERTIES OF LABORATORY MOLDED SPECIMENS

Mixture Property	NMS	
	Design Requirements	Field Requirements
Density @ Nini, % of max. theo. sp. gr.(a,d)	greater than 85.5 and less than 89	greater than 85.5 and less than 89
Density @ Ndes, % of max. theo. sp. gr.(a)	96	95-97
Density @ Nmax, % of max. theo. sp. gr.(a)	less than 98	less than 98
Tensile Strength Ratio (TSR), min.	0.80	0.75
VFA, %(b,e,f)		
Traffic, million ESALs		
less than 0.3	70-80	-
0.3 to less than 3	65-78	-
3 or greater	65-76	-

TABLE 6D
PROPERTIES OF LABORATORY MOLDED SPECIMENS FOR NMS MIXTURES

Mix Type NMS	S2 1 in. (25mm)	S3 ¾ in. (19mm)	S4 ½ in. (12.5mm)	S5 ⅜ in. (9.5mm)	S6 No. 4 (4.75mm)
VMA, min. %(c)	12	13	14	15	16

(a) Nini, Ndes, and Nmax are determined from the following table:

Design ESALs (millions)	Nini	Ndes	Nmax
less than 0.3	6	50	75
0.3 to less than 3	7	75	115
3 to less than 30	8	100	160
30 or more	9	125	205

(b) VFA (Voids Filled with Asphalt) is defined as the percentage of VMA containing asphalt binder.

(c) VMA (Voids in the Mineral Aggregate) is based on the bulk specific gravity of the aggregates. A new bulk specific gravity will be computed based on the most recent AASHTO T-209 test result and design aggregate specific gravities.

$$G_{sb}new = G_{sb}design * G_{se}new / G_{se}design$$

(d) Density requirements for both design and field specimens at Nini shall be less than or equal 91.5 % of max. theo. sp. gr. for design traffic levels less than 0.3 million ESALs and less than or equal to 90.5 % of max. theo. sp. gr. for design traffic levels from 0.3 to less than 3 million ESALs.

(e) For Mix Type S2, the specified lower limit of the VFA shall be 67% for design ESALs for less than 0.3 million.

(f) For Mix Type S6, the specified upper limit for VFA shall be 79% for all design ESALs less than 3 million. If greater than or equal to 3 million ESALs, the upper limit of the VFA shall be 78%. These requirements apply to mix designs and JMF changes only (no field Requirements).

708.05. TOLERANCES. *(Add NMS column to Table 7:)*

TABLE 7

RANGE OF TOLERANCES FOR NMS MIXTURES

Sieve Size	Percent Passing
No.4 (4.75mm) & larger	± 7
No.8 (2.36mm)	± 5
No.16 (1.18mm)	± 4
No.30 (0.6mm)	± 4
No.50 (0.3mm)	± 4
No.100 (0.15mm)	± 3
No.200 (0.075mm)	± 2
Asphalt Cement	± 0.4(a)
Temp. of mix as discharged from mixer, °F (°C)	± 20 (± 10)

(a) The tolerance shown for asphalt content is for individual samples. The average asphalt content by OHD L-26 shall be within ± 0.2 percent of the job-mix formula.

708.07. SAMPLING AND TESTING FOR NMS.

(a) Methods. Sampling and testing shall be done in accordance with AASHTO methods, except as noted below:

1. ***Sampling and Testing Aggregates:***

Sampling	T 2
Sieve Analysis	T 27
Material Passing No.200 (0.075 mm) Sieve	T 11
Specific Gravity and Absorption of Fine Aggregate	T 84
Specific Gravity and Absorption of Coarse Aggregate	T 85
Los Angeles Abrasion	T 96
Mud, Clay Balls, Sand Clusters, Sticks and Roots, Retained on No. 4 (4.75 mm) Sieve	OHD L-9
Fractured Faces	OHD L-18
Uncompacted Void Content of Fine Aggregate	T 304, Method A
Flat or Elongated Particles in Coarse Aggregate	ASTM D4791
Sand Equivalent (Clay Content)	T 176
Aggregate Durability Index	T 210
Insoluble Residue	OHD L-25
Soft Particles	OHD L-38

2. ***Sampling and Testing Bituminous Mixtures:***

SUPERPAVE Volumetric Mix Design(a)	MP 2
Designing SUPERPAVE HMA	PP 28
Mechanical Analysis of Extracted Aggregate	T 30
Sampling(b)	T 168
Bitumen Content	OHD L-26
Recovery of Asphalt from Solution by Abson Method	T 170
Maximum Specific Gravity of Bituminous Paving Mixtures	T 209
Preparing and Determining the Density of Hot Mix Asphalt Specimens by SHRP Gyratory Compactor(c)	T 312
Specific Gravity and Wt. per cubic meter of Compressed Bituminous Mixtures	OHD L-14
Resistance of Compacted Bituminous Mixture to Moisture Induced Damage(d)	T 283

(a) Lab molded specimens shall be compacted to Ndes gyrations to determine the density @ Ndes, % of max. theo. sp. gr.. The density @ Nini, % of max. theo. sp. gr. shall be back calculated from these specimens. Separate specimens shall be compacted to Nmax gyrations to determine the density @ Nmax, % of max. theo. sp. gr. for mix designs and JMF changes only. All reported values shall be the average of 2 specimens.
(b) The sample size of compacted bituminous pavement shall be in accordance with T 168.

(c) Design mixtures shall be mixed at 325°F (163°C), aged at 300°F (149°C) for a minimum of 2 hours and a maximum of 4 hours, and compacted at 300°F (149°C). Field samples shall be compacted at 300°F(149°C). No aging period is required for field samples, but they should be heated for a minimum of 2 hours to completely dry the sample and to ensure that the sample has stabilized at 300°F(149°C).

(d) AASHTO T 283 shall be run on 6 inch (150mm) diameter specimens compacted by the SHRP Gyratory Compactor to an approximate height of 3.74 inches (95mm).

3. ***Testing Asphalt Materials***

Performance Graded Asphalt Binder	M 320
Accelerated Aging of Asphalt Binder Using a Pressure Aging Vessel	R 28
Creep Stiffness by Bending Beam Rheometer	T 313
Rheological Properties by Dynamic Shear Rheometer	T 315
Grading or Verifying Asphalt Binder	PP 6
Solubility in Trichloroethylene	T 44
Flash and Fire Points by Cleveland Open Cup	T 48
Water	T 55
Rolling Thin Film Oven Test	T 240
Specific Gravity by Pycnometer	T 228
Viscosity Determination of Asphalt Binder Using Rotational Viscometer	T 316