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 SMA column in Table 1 as follows:)*

TABLE 1
PHYSICAL PROPERTIES OF AGGREGATES

Test	SMA
L.A Abrasion [a], % wear, maximum	30
Sand Equivalent(b), % minimum	50
Mechanically Fractured Faces [b c j], % minimum	100/95
Aggregate Durability Index [a], minimum	40
Insoluble Residue [d e], % minimum	40
Micro-Deval [a], % wear, maximum	25
Flat and Elongated Pieces [a c f], % maximum	10
Natural Sand and Gravel [b], % maximum	0
Clay Balls and Friable Particles [g], % maximum	0
Soft Particles [a], % maximum	5
Sticks or Roots [a], % maximum	0

[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] Flat and elongated particles have a ratio of length to thickness greater than 5:1.

[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.

[h] 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.

[i] 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 SMA 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 SMA shall be that part of the aggregate passing the No. 8 (2.36mm) sieve and shall consist of hard, durable crushed stone, stone dust, crushed gravel, or mine chat or any combination of these materials.

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

(a) Asphalt Mix Design and Initial Job-Mix Formula. The SMA mix design and initial job-mix formula are the responsibility of the Contractor and shall be submitted to the Materials Division for review. The review of the proposed mix design will be to determine that the mix meets the design criteria.

The Contractor shall furnish one mix design for each specific SMA mixture listed on the plans or in the Contract. The mix design shall be prepared in an approved laboratory of the Contractor's choice. A request for laboratory approval may be made either by a Contractor or a Laboratory. Approval will be according to the Materials Division Policy for Asphalt Mix Design Laboratories. Mix designs will not be approved for use until the Contractor submits an acceptance letter stating acceptance status, project number and mix design designation, or signs and returns the mix design to the Materials Engineer.

The initial job-mix formula shall meet the requirements of tables 5E and 6E. The contractor shall prepare a trial mixture.

The trial mixture, prepared at the initial job-mix formula proportions, must meet the requirements for the following properties: gradation, AC content, air voids, and VMA. If the trial mixture fails to meet any of the requirements, the Contractor may propose changes to the job-mix formula. If the changes result in a mixture meeting these Specifications, the job-mix formula will be adjusted accordingly.

The job-mix formula shall establish a single percentage of aggregate passing each required sieve, a single percentage of asphalt to be contained in the mixture, and a single temperature of the mixture at point of discharge from the plant.

The job-mix formula with the allowable tolerances shown in Table 7 shall establish the Specification limits for each mixture. These limits may be outside the broad range in Table 5E except for the absolute maximum sieve size. (3/4" Sieve for SMA.)

(c) Recycled Bituminous Pavements. (Delete and replace as follows:) No reclaimed asphalt pavement shall be used in SMA.

TABLE 5E
SMA MIXTURE GRADATION AND BINDER CRITERIA

	(Percent Passing)
3/4" (19.0mm)	100
1/2" (12.5mm)	90 - 100
3/8" (9.5mm)	65 - 80
No. 4 (4.75mm)	22 - 30
No. 8 (2.36mm)	16 - 24
No. 200 (0.075mm)	8 - 12
Binder Content, % of mix weight	6.0 min.[a]
Performance Grade of Binder	PG 76-28 OK
Cellulose Fiber Content, % of mix weight	0.3 [b]

[a] Minimum binder content may be lowered with Engineer's approval for SMA mixes with a combined aggregate bulk specific gravity over 2.75.

[a] Cellulose fiber content may be increased to 0.4% if needed to control draindown.

TABLE 6E
PROPERTIES OF LABORATORY MOLDED SPECIMENS

Mixture Property	SMA Design Requirements	SMA Field Requirements
VMA, min. % [a]	17.0	16.5
Air Voids, % [b]	4	4.0 ± 1.2
Tensile Strength Ratio (TSR), min.	0.8	0.75
Drain-down, %	< 0.20	< 0.20
Permeability, cm/s x 10^{-5}, max.	12.5	-
APA Rut Depth, mm, max.	3	-

[a] VMA of the mix is calculated using the following equation:

$$VMA = 100 - (G_{mb} / G_{sb}) P_s$$

where: G_{mb} = bulk specific gravity of the compacted mixture (OHD L-14)
G_{sb} = bulk specific gravity of the total aggregate
P_s = percent of aggregate in the mixture

[a] Air Voids are calculated from lab-molded specimens compacted to N=50 gyrations with the Superpave Gyratory Compactor (SGC).

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

TABLE 7
RANGE OF TOLERANCES FOR SMA MIXTURES

Sieve Size	Percent Passing
No.4 (4.75mm) & larger	± 7
No.8 (2.36mm)	± 5
No.16 (1.18mm)	± 4
No.30 (0.60mm)	± 4
No.50 (0.30mm)	± 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 SMA.

(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
Bulk Density and Voids in Aggregate	T 19
Los Angeles Abrasion	T 96
Mud, Clay Balls, Sand Clusters, Sticks and Roots, Retained on No. 4 (4.75 mm) Sieve	OHD L9
Fractured Faces	OHD L-18
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:

Mechanical Analysis of Extracted Aggregate	T 30
Sampling [a]	T 168
Bitumen Content	OHD L-26
Maximum Specific Gravity of Bituminous Paving Mixtures	T 209
Preparation and Density of Hot Mix Asphalt Specimens by SHRP Gyratory Compactor [b c]	T 312
Determination of Draindown Characteristics In Uncompacted Asphalt Mixtures	T 305
Determining the Specific Gravity and Unit Weight of Compacted Bituminous Mixtures	OHD L-14
Resistance of Compacted Bituminous Mixture to Moisture Induced Damage [d]	T 283
Designing Stone Matrix Asphalt (SMA)	PP 41

[a] The sample size of compacted bituminous pavement shall be in accordance with T 168.

[b] All reported values shall be the average of 2 specimens.

[d] 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).

[e] AASHTO T 283 shall be run on 150mm diameter specimens compacted by the Superpave Gyratory Compactor to an approximate height of 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	R 29
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