

STATE

OF

TENNESSEE

(Rev. 7-15-01)

March 1, 2006

SPECIAL PROVISION

REGARDING

BITUMINOUS PLANT MIX BASE (HOT MIX)

SUPERPAVE BINDER MIX

Description. The work shall consist of the construction of a bituminous plant mix base in accordance with Section 307, 407 and 903 of the Specifications. All requirements for Bituminous Plant Mix Base (Hot-mix) Grading B-M2 in section 307 and section 407 shall apply to this item except as revised herein.

Composition of Mixture. The mix shall be designed according to AASHTO MP2 (Specification for Superpave Volumetric Mix Design). If requested, the Department will assist the contractor, in the Regional DOT lab, on phase 2 of the design process as defined below. The Proportions of Total Mixture for the 307 Grading B-M2 shall not apply to 307-S mix. The Superpave binder mix shall meet the gradation for Superpave Designation 19.0 mm (3/4") as defined below. The 307-S mix may contain up to 20% RAP if PG 64-22 is specified; but if PG 76-22 is specified, a maximum of 15% RAP may be used.

Aggregate properties

Aggregate properties shall be those required in Table 1 for the required design ESAL range shown on the plans. The gradation of the combined aggregate blend shall be in the following design range:

Sieve Size	Grading
	19.0mm (3/4")
1"(25.0mm)	100
3/4"(19.0mm)	90-100
1/2"(12.5mm)	72-87
3/8"(9.5mm)	62-80
#4(4.75mm)	42-60
#8(2.36mm)	28-49
#16(1.18mm)	*
#30(600µm)	13-25
#50(300µm)	*
#100(150µm)	*
#200(75µm)	2-6.5

* Include on JMF and Daily Reports for information purposes

Mix properties

All requirements for mix properties are listed in AASHTO MP2. The design gyratory compactive effort will be based on Table 1 for the 20 year ESAL value shown on the plans. The design VMA range shall be 14.0%-18.5% and shall be based on VMA calculated using the effective specific gravity of the mix.

Definition of Mix Design Phases

During Phase 1, the contractor shall determine which materials can be used to meet the required gradation and aggregate properties.

Phase 2 includes mixing and compacting trial blends, and choosing the best blend to continue with design. After the best blend has been chosen, samples shall be compacted to determine an optimum asphalt content. Marshall analysis and Moisture Susceptibility testing will complete the design requirements.

If the contractor chooses to provide the mix design without the assistance of the department, the design will be approved after the department has checked the mixture and aggregate properties and determined test results within the design ranges specified. If the contractor requests assistance from the department, the contractor's documentation showing completion of phase 1 will be reviewed prior to beginning phase 2. Also the department will check the best blend aggregate properties prior to optimum asphalt content determination.

Mix Design Considerations

In order to identify critical mixes and make appropriate adjustment, the mix design shall have the required field properties (Air Voids and VMA) for the bitumen content range of Optimum Asphalt Content $\pm 0.35\%$. During the Superpave trial blend and design procedures, gyrations shall cease at N_{des} for bulk specific gravity determination. The optimum AC content shall be based on an air void range of 3.5-4.0% at N_{des} . After the optimum asphalt content has been determined, two samples shall be compacted to N_{max} where the compaction shall not exceed 98% of Theoretical Maximum Specific Gravity. The mix shall also be evaluated with Marshall equipment at 3 AC contents. Marshall voids at optimum AC content shall not exceed 5.5%. For resurfacing projects, the design shall be completed before the pre-construction meeting may be held.

Table 1. Superpave Design Compactive Effort and Aggregate Consensus Property Requirements

Estimated Design Traffic Level (Million ESALs)	Superpave Compaction Parameters			% Gmm Ninitial Requirement	Aggregate Consensus Properties					
					Coarse Aggregate Angularity ² ASTM D 5821		Fine Aggregate Angularity T304 Method A		Sand Equiv. Value	Flat and Elong. (By Count) ³
	Nini	Ndes	Nmax		≤ 100 mm	> 100 mm	≤ 100 mm	> 100 mm	All mixtures	All mixtures
< 0.3	6	50	75	≤91.5	55/-	-/-	-	-	40	<10%
0.3-3	7	75	115	≤90.5	75/-	50/-	40.0	40.0	40	<10%
3-10	8	100	160	≤89.0	85/80	60/-	43.0 ¹	40.0	45	<10%
10-30	8	100	160	≤89.0	95/90	80/75	43.0 ¹	40.0	45	<10%
>30	9	125	212	≤89.0	100/100	100/100	43.0 ¹	43.0 ¹	50	<10%

¹A maximum of 20% natural sand shall be allowed. The limit on natural sand will be increased to 25% for a minimum FAA value of 44.0% and 30% for a minimum FAA value of 45.0%. Fine Aggregate Angularity shall be measured on the total aggregate blend including RAP aggregates.

²For example, 85/80 denotes that 85% of the coarse aggregate has one fractured face and 80% has two or more fractured faces.

³Criterion based upon a 5:1 maximum to minimum ratio.

Field Verification Requirements

The mix will require verification utilizing a Superpave Gyrotory Compactor (if the Superpave Gyrotory Compactor is not available, Marshall Hammer Compaction may be substituted). Density at Nmax, shall not exceed 98.5% of Maximum Theoretical Specific Gravity. Ndes air voids shall be within 1% of the design target, and the VMA shall be within 1.5%. If Marshall Hammer Compaction is used for field verification, the air void range shall be 2.5-5.0%, and the VMA shall be within 1.5% of the design target. The Maximum Theoretical Specific Gravity shall be within ±0.025 of the design target. The Dust to Total Asphalt ratio shall be 0.6-1.2. If these criteria are not met, follow guidelines in Section 407.03 to correct the mixture properties.

Field Verification Sampling Schedule

Samples to be tested at Ndes for Air Voids and VMA shall be performed twice per day, once in the morning and once in the afternoon. Samples to be tested at Nmax shall be compacted once per day for the first three days of production. If the Nmax criteria is met for the first three days, then one test shall be performed every three days until the criteria is not met. Daily testing shall resume when the criteria are not met.

Payment shall be made on the basis of Table 2.

The following are referenced AASHTO tests:

- MP1 Specification for Performance Graded Asphalt Binder
- MP2 Specification for SUPERPAVE™ Volumetric Design
- PP2 Practice for Short and Long Term Aging of Hot Mix Asphalt (HMA)
- PP19 Practice for Volumetric Analysis of Compacted Hot Mix Asphalt (HMA)
- PP28 Practice for Designing SUPERPAVE™ Hot Mix Asphalt (HMA)
- TP4 Method for Preparing and Determining the Density of Hot Mix Asphalt (HMA) Specimens by Means of the SHRP Gyrotory Compactor

Table 2. Acceptance Schedule of Payment (Asphalt Plant Mix Characteristics)

Characteristic	Pay Factor	Average Arithmetic Deviation of the Lot Acceptance Test from the Job Mix Formula	
		1 Test	2 Test or More
Asphalt Content	1.03*	0-0.26	0-0.22
	1.00	0.27-0.40	0.23-0.35
	0.97	0.41-0.46	0.36-0.40
	0.90	0.47-0.52	0.41-0.45
	0.80**	>0.52	>0.45
3/8" and larger Sieve*** (Gradation)	1.03*	0-4.50	0-4.33
	1.00	4.51-6.50	4.34-5.70
	0.97	6.51-7.08	5.71-6.20
	0.90	7.09-7.66	6.21-6.69
	0.80**	>7.66	>6.69
#4 Sieve*** (Gradation)	1.03*	0-3.29	0-2.92
	1.00	3.30-4.62	2.93-4.00
	0.97	4.63-5.20	4.01-4.50
	0.90	5.21-5.77	4.51-5.00
	0.80**	>5.77	>5.00
#30 Sieve*** (Gradation)	1.03*	0-2.44	0-2.14
	1.00	2.45-3.80	2.15-3.30
	0.97	3.81-4.46	3.31-3.91
	0.90	4.47-5.12	3.92-4.52
	0.80**	>5.12	>4.52
#200 Sieve*** (Gradation)	1.03*	0-1.25	0-1.08
	1.00	1.26-1.80	1.09-1.60
	0.97	1.81-2.00	1.61-1.75
	0.90	2.01-2.20	1.76-1.90
	0.80**	>2.20	>1.90

* All of the above criteria shall be in the 1.03 Pay Factor range to receive an incentive under the pay item for A.C. content and gradation, addition.

** If approved by the Engineer, the Contractor may accept the indicated partial pay. The Department may require removal and replacement at no cost. The Contractor has the option to remove and replace at no cost to the Department at any time.

*** When there is more than one reduced payment relating to gradation in one LOT of material, only the greatest reduction in payment will be applied. Reductions applicable for any other reason will be cumulative.