

Hot-Mix Asphalt Material Properties

SCDOT Designation: SC-M-402 (10/09)

APPROVED: <u>Aug. 20, 2009</u> Division Administrator <i>David B. Law</i> FEDERAL HIGHWAY ADMINISTRATION

1. SCOPE

- 1.1 Use the following specifications for preparing, constructing, and accepting Hot-Mix Asphalt (HMA) material properties. **NOTE: Refer to the Standard Specifications, Division 300 for HMA Base Courses and Division 400 for HMA Surface and Intermediate Courses for additional properties and specifications that are not included here.**

2. REFERENCED DOCUMENTS

- 2.1 SCDOT Standard Specifications
 - 2.1.1 Division 300, Division 400, SC-M-407
- 2.2 AASHTO Standards
 - 2.2.1 T85, T96, T104, T335
- 2.3 SCDOT Test Methods
 - 2.3.1 SC-T-77

3. REQUIREMENTS FOR MIXTURES

- 3.1 Requirements for all HMA mixtures
 - 3.1.1 Have no more than 10% flat and elongated particles based on a 5:1 ratio based on SC-T-77.
 - 3.1.2 Determine coarse aggregate Sodium Sulfate Soundness by AASHTO T 104
 - 3.1.3 Determine LA Abrasion by AASHTO T 96
 - 3.1.4 Determine Absorption by AASHTO T 85
 - 3.1.5 The composition limits are master ranges of tolerances. Conform to a closer control meeting the tolerance requirements as specified in Section 401.2.3.3.
 - 3.1.6 VMA requirements for Surface and Intermediate Courses:

Nominal Max. Aggregate Size	Minimum, %
3/4"	13.5
1/2"	14.5
3/8"	15.5
No. 4	17.5

- 3.1.7 Use hydrated lime as an asphalt anti-stripping additive (ASA) in all mixes unless otherwise permitted in the following tables.
- 3.2 If crushed stone is required in the following tables, use crushed coarse aggregate meeting the following requirements:
 - 3.2.1 Have 2 or more freshly mechanically-induced fractured faces meeting the percentage stated in each table based on count of the material retained on the No. 4 sieve as determined by AASHTO T-335.
- 3.3 Ensure the Recycled Asphalt Pavement (RAP) conforms to Supplemental Technical Specification SC-M 407.

3.4

Summary of Surface Course Requirements

HMA Surface Courses						
Designation	Type A	Type B	Type CM	Type C	Type D	Type E
Old Designation	12.5 mm Superpave	Surface Type 1C	Surface Type 1D	Surface Type 1,3	Surface Type 4	Thin Lift Seal Course
System Application	Interstate / Intersections	High Volume Primary	Low Volume Primary	Secondary	Low Volume Secondary	Seal Course
Gradation Requirements						
1"	100.0	100.0	---	---	---	---
¾"	98.0 - 100.0	98.0 - 100.0	100.0	100.0	100.0	---
½"	90.0 - 100.0	90.0 - 100.0	97.0 - 100.0	97.0 - 100.0	97.0 - 100.0	---
3/8"	72.0 - 90.0	72.0 - 90.0	83.0 - 100.0	83.0 - 100.0	90.0 - 100.0	100.0
No. 4	44.0 - 62.0	44.0 - 62.0	58.0 - 80.0	58.0 - 80.0	70.0 - 95.0	90.0 - 100.0
No. 8	23.0 - 43.0	23.0 - 43.0	42.0 - 62.0	42.0 - 62.0	50.0 - 82.0	70.0 - 100.0
No. 30	10.0 - 25.0	10.0 - 25.0	20.0 - 40.0	20.0 - 40.0	20.0 - 50.0	36.0 - 70.0
No. 100	4.0 - 12.0	4.0 - 12.0	8.0 - 20.0	8.0 - 20.0	6.0 - 20.0	4.0 - 28.0
No. 200	2.00 - 8.00	2.00 - 8.00	3.00 - 9.00	3.00 - 9.00	2.00 - 10.00	2.00 - 10.00
Required Job Mix Criteria						
Gyrations	100	75	75	50	50	50
Binder Limits, %	4.5 - 6.0	4.5 - 6.0	5.0 - 6.8	5.0 - 6.8	5.0 - 6.8	6.0 - 7.0
Binder Grade	PG 76-22	PG 64-22	PG 64-22	PG 64-22	PG 64-22	PG 64-22
Air Voids, %	3.0 - 4.0	3.0 - 4.0	3.5 - 4.5	3.5 - 4.5	4.0 - 9.0	NR
VFA, %	70.0 - 80.0	70.0 - 80.0	70.0 - 77.0	70.0 - 77.0	60.0 - 70.0	NR
D/A Ratio	0.60 - 1.20	0.60 - 1.20	0.60 - 1.20	0.60 - 1.20	0.60 - 1.20	NR
Min. Stability - 6" (lbs.)	No Requirement (NR)					2500
ITS Testing Required?	Yes	Yes	Yes	Yes	No	No
Rutting Susceptibility (max mm)	3.0	5.0	5.0	NR	NR	NR
Liquid ASA Permitted	No	No	No	Yes	Yes	Yes
Required Aggregate Criteria						
Local Sand Allowed?	No	No	No	Yes	Yes	No
Crushed Coarse Aggr. Required? (% fractured faces)	Yes (90% min)	Yes (90% min)	Yes (90% min)	Yes (70% min)	No	NR
Coarse Aggr. Max. % Passing No.200	1.50	1.50	1.50	1.50	1.50	NR
LA Abrasion (B), max %	55.0	55.0	55.0	60.0	60.0	60.0
Sodium Sulfate Soundness, max %	15.0	15.0	15.0	15.0	NR	NR
Crusher Run / Asphalt Sand Allowed?	No	No	No	Yes (25% max)	Yes (50% max)	No
Absorption, max. %	1.5	1.5	1.5	1.5	NR	1.5
Limestone allowed (Coarse/Scr.)?	No / No	No / Yes	No / Yes	No / Yes	Yes / Yes	No
Slag Allowed?	No	No	No	Yes	Yes	No
RAP	Yes	Yes	Yes	Yes	Yes	Yes (-4)

3.5 Summary of HMA Intermediate Course Requirements

HMA Intermediate Courses			
Designation	Type A	Type B	Type C *
Old Designation	19.0 mm for Intersections	19.0 mm / Binder Type 1	Binder Type 2
System Application	Intersections	Interstates / High Volume Primary (> 15% Truck Traffic)	Low Volume Primary / Secondary / Leveling / Patching
Gradation Requirements			
1"	100.0	100.0	100.0
¾"	90.0 - 100.0	90.0 - 100.0	90.0 - 100.0
½"	75.0 - 90.0	75.0 - 90.0	80.0 - 95.0
3/8"	64.0 - 80.0	64.0 - 80.0	68.0 - 87.0
No. 4	38.0 - 54.0	38.0 - 54.0	45.0 - 68.0
No. 8	22.0 - 36.0	22.0 - 36.0	30.0 - 46.0
No. 30	8.0 - 22.0	8.0 - 22.0	12.0 - 29.0
No. 100	3.0 - 10.0	3.0 - 10.0	4.0 - 13.0
No. 200	2.00 - 8.00	2.00 - 8.00	2.00 - 8.00
Required Design Criteria			
Gyrations	100	75	50
Binder Limits, %	4.0 - 6.0	4.0 - 6.0	4.0 - 6.0
Binder Grade	PG 76-22	PG 64-22	PG 64-22
Air Voids, %	3.0 - 4.0	3.5 - 4.5	3.5 - 4.5
VFA, %	70.0 - 80.0	70.0 - 80.0	70.0 - 77.0
D/A Ratio	0.60 - 1.20	0.60 - 1.20	0.60 - 1.20
Min. Stability (lbs.)	No Requirement (NR)		
ITS Testing Required?	Yes	Yes	Yes
Rutting Susceptibility (max mm)	3.0	5.0	NR
Liquid ASA Permitted	No	No	Yes
Required Aggregate Criteria			
Local Sand Allowed?	No	No	Yes
Crushed Coarse Aggregate Required? (% fractured faces)	Yes (90% min.)	Yes (90% min.)	No
Coarse Aggr. - max. % Passing No. 200	1.5	1.5	NR
LA Abrasion (B), max. %	55.0	55.0	60.0
Sodium Sulfate Soundness, max %	No Requirement (NR)		
Crusher Run / Asphalt Sand Allowed?	No	No	Yes (50% max)
Absorption, max. %	1.5	1.5	NR
Limestone allowed (Coarse/Scr.)?	No / No	No / Yes	Yes / Yes
Slag Allowed?	Yes	Yes	Yes
RAP	Yes	Yes	Yes

* - Use Intermediate Type C for leveling, patching and other non-mainline type applications

3.6

Summary of HMA Base Course Requirements

HMA Base Courses				
Designation	Type A	Type B	Type C	Type D
<i>Old Designation</i>	<i>Base Type 1</i>	<i>Base Type 2</i>	<i>Sand Base Type 3</i>	<i>Sand Base Type 2</i>
System Application	Interstates / Primary	Secondary	Specialty	Specialty
Gradation Requirements				
1 1/2"	100.0	100.0	----	----
1"	85.0 - 100.0	85.0 - 100.0	----	----
1/2"	60.0 - 80.0	60.0 - 80.0	----	----
3/8"	----	----	100.0	----
No. 4	40.0 - 55.0	40.0 - 55.0	90.0 - 100.0	----
No. 8	30.0 - 45.0	30.0 - 45.0	70.0 - 100.0	----
No. 30	----	----	36.0 - 70.0	----
No. 100	----	----	4.0 - 28.0	----
No. 200	----	----	2.00 - 10.00	----
Required Design Criteria				
Gyrations	----	----	50	50
Binder Limits, %	4.0 - 5.5 *	4.0 - 5.5 *	4.3 - 5.7	3.8 - 5.2
Binder Grade	PG 64-22	PG 64-22	PG 64-22	PG 64-22
Min. Stability, lbs.	NR	NR	2500	1500
ITS Testing Required?	No Requirement (NR)			
Rutting Susceptibility (max mm)	No Requirement (NR)			
Liquid ASA Permitted	No	Yes	Yes	Yes
Required Aggregate Criteria				
Local Sand Allowed?	No	Yes	No	Yes
Crushed Coarse Aggregate Required? (% fractured faces)	Yes (90% min)	No	No	No
LA Abrasion (B), max. %	60.0	60.0	60.0	60.0
Sodium Sulfate Soundness, max %	No Requirement (NR)			
Crusher Run / Asphalt Sand Allowed?	Yes (50% max)	Yes (50% max)	No	No
Absorption, max. %	No Requirement (NR)			
Limestone allowed (Coarse/Scrn.)?	Yes / Yes	Yes / Yes	Yes / Yes	Yes / Yes
Slag Allowed?	Yes	Yes	Yes	Yes
RAP	Yes	Yes	Yes (-4)	Yes (-4)

* Binder content determined visually during design.