

Section 828—Hot Mix Asphaltic Concrete Mixtures

828.1 General Description

This specification includes the requirements for hot mix asphaltic concrete mixtures, including:

- Open-graded surface mixtures
- Stone Matrix Asphalt mixtures
- Superpave asphaltic concrete mixtures
- Fine-graded mixtures

828.1.01 Definitions

Nominal Maximum Sieve Size: One standard sieve size larger than the first sieve to retain more than ten percent.

828.1.02 Related References

A. Standard Specifications

[Section 800—Coarse Aggregate](#)

[Section 802—Aggregates for Asphaltic Concrete](#)

[Section 820—Asphalt Cement](#)

[Section 831—Admixtures](#)

B. Referenced Documents

AASHTO TP 4

AASHTO PP 2

AASHTO TP 8-94

AASHTO T 112

AASHTO T 209

AASHTO T 305

Standard Operating Procedure (SOP) 2 SP—Control of Superpave Bituminous Mixture Designs

[GDT 4](#)

[GDT 56](#)

[GDT 66](#)

[GDT 115](#)

[GDT 125](#)

[QPL 26](#)

[QPL 41](#)

828.2 Materials

A. Requirements

All mixtures are designated based on the Nominal Maximum Sieve Size. Determine the amount finer than No. 200 (75 μm) by washing (See [GDT 4](#)) or by the correlation procedure described in [GDT 125](#).

Use hot mix asphaltic concrete mixtures that meet the following requirements:

1. Ensure the materials used to prepare the mixtures are approved by the Engineer before incorporating into the Work.
2. Use aggregate groups and blends that meet the following pay item designations, as indicated in the Proposal and Plans:

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Pay Item Designation	Allowable Aggregate Groups
Group I or II	100% of Group I, Group II, or Blend I.
Group II only	Only 100% Group II.
Blend I	Either 100% Group II material or a blend of Group I and Group II. Do not use Group I material for more than 60% by weight of the total aggregates, nor more than 50% by weight of the coarse aggregate portion.

3. Use Group I, Group II, or a blend of both aggregate groups, for patching or leveling. Mixes are listed in [Subsection 828.2.03](#) and [Subsection 828.2.04](#).
4. Design mixes using the Superpave System for Volumetric Design (AASHTO TP 4 and AASHTO PP 2) unless stated otherwise. Designs shall be performed by qualified and approved laboratories and technicians as specified in SOP-2 SP - Control of Superpave Bituminous Mixture Designs.
5. Ensure individual test results meet Mixture Control Tolerances
6. Include hydrated lime in all paving courses except where noted. For a list of hydrated lime sources, see [OPL 41](#).
 - a. Add lime to virgin aggregate mixtures at a minimum rate of 1 percent of the total dry aggregate weight.
 - b. Add lime to recycled mixtures at a minimum rate of 1 percent of the virgin aggregate portion, plus a minimum of 0.5 percent of the aggregate in the reclaimed asphalt pavement (RAP) portion.
 - c. Add more lime and an approved heat-stable, anti-stripping additive that meets the requirements of [Subsection 831.2.04](#), “Heat Stable Anti-Stripping Additive,” if necessary, to meet requirements for mixture properties. However, the Department will not pay for the additional required materials. For a list of Heat Stable Anti-Stripping Additive sources, please see [OPL 26](#).
 - d. On PR, LARP, airport, bridge replacement, and parking lot projects designated at Mix Design Level A, asphalt cement may include an approved, heat-stable, anti-stripping additive that meets the requirements of [Subsection 831.2.04](#), “Heat Stable Anti-Stripping Additive” instead of hydrated lime, unless specified in the Pay Item.
 - 1) Add at a minimum rate of 0.5 percent of the AC portion.
 - 2) Ensure the additive treated mix meets the minimum tensile splitting ratio:

Tensile Splitting Ratio	Type of Asphaltic Concrete
0.4	4.75 mm mix
0.6	All other mixes

7. Use performance grade PG 67-22 asphalt cement in all mixtures except as follows:
 - a. For RAP mixtures, the Engineer will determine the performance grade to be used.
 - b. On PR, LARP, airport, bridge replacement, and parking lot projects, PG 64-22 may be substituted for PG 67-22.
 - c. Use only performance grade PG 76-22 for all mixtures that specify polymer-modified asphalt in the pay item designation.
8. Use of local sand is restricted as follows:
 - a. No more than 20 percent, based on total aggregate weight, may be used in mixtures for shoulder construction and on projects designed at Mix Design Level A.
 - b. For mixtures placed on the mainline traveled way of projects designed at Mix Design Level B, C, or D (except interstate projects), local sand may be used only in the 25 mm Superpave and shall not exceed 20 percent based on total aggregate weight.
 - c. Do not use local sand in any mixture placed on the traveled way of Interstate mainline or ramps. No more than 20 percent local sand, based on total aggregate weight, may be used in mixtures for shoulder construction.
 - d. Do not use local sand that contains more than 7 percent clay.
 - e. Do not use local sand that contains any clay lumps as determined by AASHTO T 112.

B. Fabrication

General Provisions 101 through 150.

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C. Acceptance

Ensure the mix design has been reviewed and approved by the Department prior to beginning production.

1. Rutting Susceptibility Testing

- Fabricate three beams or six cylindrical specimens from each asphalt mix for the test using [GDT 115](#).
- Design mixtures which meet the following criteria for rutting where tested using [GDT 115](#):
- Mix Design Level A – 0.3 in (7 mm) maximum

- Mix Design Level B – 0.25 in (6 mm) maximum
- Mix Design Level C & D – 0.2 in (5 mm) maximum

Mixtures designed prior to July 1, 2001 which do not exceed 0.2 in (5 mm) rutting when tested at 120 °F (49 °C) using [GDT 115](#) may be acceptable.

Tests will not be required for mixtures designed exclusively for trench widening nor for the 4.75 mm mix, nor for open-graded surface mixtures.

2. Fatigue Testing

The Department may perform the test according to AASHTO TP 8-94 or other Department approved procedure.

D. Materials Warranty

General Provisions 101 through 150.

828.2.01 Open-Graded Surface Mixture

A. Requirements

- Use the information in the following table for job mix formulas and design limits:

Mixture Control Tolerance	Asphaltic Concrete	9.5 mm OGFC	12.5 mm OGFC	12.5 mm PEM
	Grading Requirements	Percent Passing		
±0.0	3/4 in (19 mm) sieve		100	100
±6.1	1/2 in (12.5 mm) sieve	100*	85-100	80-100
±5.6	3/8 in (9.5 mm) sieve	85-100	55-75	35-60
±5.7	No. 4 (4.75 mm) sieve	20-40	15-25	10-25
±4.6	No. 8 (2.36 mm) sieve	5-10	5-10	5-10
±2.0	No. 200 (75 µm) sieve	2-4	2-4	1-4
	Design Requirements			
±0.4	Range for % AC	6.0-7.25	5.75-7.25	5.5-7.0
	Class of stone (Section 800)	"A" only	"A" only	"A" only
	Coating retention (GDT-56)	95	95	95
	Drain-down, AASHTO T 305 (%)	<0.3	<0.3	<0.3

* Mixture control tolerance not applicable to this sieve for this mix.

- Use only PG 76-22 (specified in [Section 820](#)) in the 12.5 mm OGFC and 12.5 mm PEM mixtures.
- Use a stabilizing fiber, which meets the requirements of [Section 819](#) in 12.5 mm OGFC and 12.5 mm PEM mixtures. The dosage rate will be as recommended by the Engineer and shall be sufficient to prevent excessive drain-down.

B. Fabrication

General Provisions 101 through 150.

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C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

General Provisions 101 through 150.

828.2.02 Stone Matrix Asphalt Mixtures

A. Requirements

Use the information in the following table for the job mix formula and design limits.

Mixture Control Tolerance	Asphaltic Concrete	9.5 mm SMA	12.5 mm SMA	19 mm SMA
	Grading Requirements	Percent Passing		
±0.0	1- in (25 mm) sieve			100
±7.0	3/4 in (19 mm) sieve		100*	90-100
±6.1	1/2 in (12.5 mm) sieve	100*	85-100	44-70
±5.6	3/8 in (9.5 mm) sieve	70-100	50-75	25-60
±5.7	No. 4 (4.75 mm) sieve	28-50	20-28	20-28
±4.6	No. 8 (2.36 mm) sieve	15-30	16-24	15-22
±3.8	No. 50 (300 μm) sieve	10-17	10-20	10-20
±2.0	No. 200 (75 μm) sieve	8-13	8-12	8-12
	Design Requirements			
±0.4	Range for % AC	6.0-7.5	5.8-7.5	5.5-7.5
	Design optimum air voids (%)	3.5 ±0.5	3.5 ±0.5	3.5 ±0.5
	% aggregate voids filled with AC (VFA)	70-90	70-90	70-90
	Tensile splitting ratio after freeze-thaw cycle GDT-66	80%	80%	80%
	Drain-down AASHTO T 305 (%)	<0.3	<0.3	<0.3

* Mixture control tolerance not applicable to this sieve for this mix.

1. Compact SMA mixtures at 50 gyrations with the Superpave Gyratory compactor or 50 blows with the Marshall compactor.
2. A Tensile splitting ratio of no less than 70% may be acceptable so long as all individual test values exceed 100 psi (690 kPa).
3. Stone Matrix Asphalt mixtures shall contain asphalt cement, mineral filler, and fiber stabilizing additives which meet the following requirements:
 - a. Use asphalt cement that meets requirements of PG 76-22 of [Section 820](#).
 - b. Use mineral filler that meets requirements of [Section 883](#) and has been approved by the Engineer. Local sand shall not be used in lieu of mineral filler.
 - c. Treat these mixes with a fiber-stabilizing additive, which meets the requirements of [Section 819](#). The dosage rate will be as recommended by the Engineer and shall be sufficient to prevent excessive drain-down.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

See [Subsection 828.2.C](#).

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D. Materials Warranty

General Provisions 101 through 150.

828.2.03 Superpave Asphaltic Concrete Mixtures

A. Requirements

Use the information in the following table for job mix formula and design limits:

Mixture Control Tolerance	Asphaltic Concrete	9.5 mm Superpave Level A	9.5 mm Superpave Level B,C,D	12.5 mm Superpave	19 mm Superpave	25 mm Superpave
	Grading Requirements	Percent Passing				
	1-1/2 in (37.5 mm) sieve					100
± 8.0	1- in (25.0 mm) sieve				100*	90-100
±8.0	3/4 in (19.0 mm) sieve			100*	90-100	55-89
±6.0**	1/2 in (12.5 mm) sieve	100*	100*	90-100	60-89	50-70
±5.6	3/8 in (9.5 mm) sieve	90-100	90-100	70-85	55-75	
±5.6	No. 4 (4.75 mm) sieve	65-85	55-75			
±4.6	No. 8 (2.36 mm) sieve	53-58	42-47	34-39	29-34	25-30
±2.0	No. 200 (75 µm) sieve	4.0-7.0	4.0-7.0	3.5-7.0	3.5-6.0	3.0-6.0

* Mixture control tolerance not applicable to this sieve for this mix.

**Mixture control tolerance shall be ± 8.0% for this sieve for 19 mm Superpave.

Superpave mixtures shall also meet the following requirements:

1. The Mixture Control Tolerance for asphalt cement shall be ± 0.4%.
2. Volumetric Criteria

Design Parameter	Design Criteria
a. Percent of Maximum Specific Gravity (%G _{mm}) at the design number of gyrations, (N _d) (See Note 1)	96%
b. % G _{mm} at the initial number of gyrations, (N _i)	Level A <91.5% Level B <90.5% Level C & D <89%
c. Percent voids in mineral aggregate (VMA) at N _d	See Table 828.2.03.A.3
d. Percent voids filled with asphalt (VFA) at N _d	See Table 828.2.03.A.4
e. Fines to effective asphalt binder ratio (F/P _{be})	
1) Asphaltic concrete 9.5 mm Superpave (Level A)	0.6-1.2
2) All Superpave mixtures excluded in Item 1	0.8-1.6
f. Tensile strength (GDT 66)	
1) Ratio (See Note 2)	80% min.
2) Stress	60 psi (414 kPa) min.
g. Retention of Coating (GDT 56)	95% min.

Note 1: Maximum specific gravity (G_{mm}) determined in accordance with AASHTO T 209.

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Note 2: A tensile splitting ratio of no less than 70% may be acceptable so long as all individual test values exceed 100 psi (690 kPa).

3. VMA Criteria

Nominal Maximum Sieve Size	Minimum % VMA*
1 in (25 mm)	12
3/4 in (19 mm)	13
1/2 in (12.5 mm)	14
3/8 in (9.5)	15

* VMA is to be determined based on effective specific gravity of the aggregate (G_{se}).

4. VFA Criteria

MIX DESIGN LEVEL	RANGE % VFA	
	Minimum	Maximum
A	67	80
B	65	78
C	65	76
D	65	75

5. Superpave Gyrotory Compaction Criteria

MIX DESIGN LEVEL	NUMBER OF GYRATIONS	
	N_i	N_d
A	6	50
B	7	75
C	8	100
D	9	125

Use mix Design Level A for all Superpave mixes used as shoulder surface mixture, trench widening, temporary detour, or sub-base mixture under Portland cement concrete pavement unless specified otherwise in the plans.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

See [Subsection 828.2.C](#).

D. Materials Warranty

General Provisions 101 through 150.

828.2.04 Fine Graded Mixtures

A. Requirements

Use the following table for the job mix formula and design limits:

ASPHALTIC CONCRETE - 4.75 mm Mix		
MIXTURE CONTROL	GRADING	

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TOLERANCE	REQUIREMENTS	% Passing
±0.0	1/2 in (12.5 mm) sieve	100*
±5.6	3/8 in (9.5 mm) sieve	90-100
±5.7	No. 4 (4.75 mm) sieve	75-95
±4.6	No. 8 (2.36 mm) sieve	60-65
±3.8	No. 50 (300 μm) sieve	20-50
±2.0	No. 200 (75 μm) sieve	4-12
	DESIGN REQUIREMENTS	
±0.4	Range for % AC	6.00-7.50
	Design optimum air voids (%)	4-7
	% Aggregate voids filled with AC	50-80
	Tensile splitting ratio after freeze-thaw cycle (GDT 66)	80% minimum

* Mixture control tolerance not applicable to this sieve for this mix.

Design this mixture at Superpave Mix Design Level A.

B. Fabrication

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C. Acceptance

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D. Materials Warranty

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