

**DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA**

Special Provision

Section 828—Hot Mix Asphaltic Concrete Mixtures

Delete Section 828 and substitute the following:

828.1 General Description

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

- Open-graded surface mixtures (OGFC and PEM)
- Stone Matrix Asphalt mixtures (SMA)
- Superpave mixtures
- Fine-graded (4.75 mm) mixtures

828.1.01 Definitions

The Nominal Maximum Sieve Size is one standard sieve size larger than the first sieve to retain more than ten percent of the aggregate, per AASHTO R35. Mixture types in this section are identified according to Nominal Maximum Sieve Size.

828.1.02 Related References

A. Standard Specifications

[Section 400-Hot Mix Asphaltic Concrete Construction](#)

[Section 800-Coarse Aggregate](#)

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

[Section 819-Fiber Stabilizing Additives](#)

[Section 820-Asphalt Cement](#)

[Section 831-Admixtures](#)

[Section 882-Lime](#)

[Section 883-Mineral Filler](#)

B. Referenced Documents

AASHTO PP-2

~~— AASHTO PP28~~

~~— AASHTO TP-8-94~~

AASHTO R30

AASHTO R35

AASHTO T-321

AASHTO T 112

AASHTO T 209

AASHTO T 305

AASHTO T 312

AASHTO T-245

AASHTO TP63

ASTM PS-129

[SOP-36](#)

[SOP-2](#) **SP**

[GDT 56](#)

GDT 63

[GDT 66](#)

[GDT 114](#)

[GDT 115](#)

[GDT 123](#)

[QPL 1](#)

[QPL 2](#)

[QPL 7](#)

[QPL 26](#)

[QPL 41](#)

[QPL 77](#)

[QPL 81](#)

828.2 Materials

A. Requirements

Use approved hot mix asphalt concrete mixtures that meet the following requirements:

1. Produce each asphalt mixture according to a Job Mix Formula and Asphalt Mix Design approved by the Department for submittal and approval of Job Mix Formulas, see [Subsection 400.1](#).
2. Ensure that individual acceptance test results meet the Mixture Control Tolerances specified in the appropriate table below, [Subsections 828.2.01](#) through [828.2.04](#).
3. Ensure that the Engineer **currently** approves all materials used to prepare and place the mixtures before incorporating them into the Work. Use only the ingredients listed in the approved Asphalt Mix Design and Job Mix Formula. For virgin aggregates use sources which meet the requirements of [Section 802](#) and are listed in [QPL 1](#) or [QPL 2](#); for mixes in which local sand is permitted, use the approved sand source identified in the mix design. For mixtures containing Reclaimed Asphalt Pavement (RAP), use only RAP from the approved stockpile identified in the mix design. Use asphalt cement meeting the requirements of [Section 820](#), from a source listed in [QPL 7](#).
4. Obtain approved Superpave mix designs and 4.75 mm mix designs from a mix design laboratory certified by the Department. Obtain approved mix designs for types PEM, OGFC, and SMA mixtures from the Department's Office of Materials and Research, which produces and furnishes these mix designs.
5. Ensure that Superpave and 4.75 mm mix designs are designed in accordance with [SOP-2](#) ("Control of Superpave Bituminous Mixture Designs") and are approved by the Department as provided therein. Ensure that these mixes are designed by a laboratory and technician certified in accordance with [SOP-36](#), ("Certification of Laboratories and Personnel for Design of Superpave Asphalt Mixtures").
6. Use only mixtures composed of the aggregate groups and blends indicated in the Proposal and Plans by their pay item designations, defined as follows:

Pay Item Designation	Allowable Aggregate Groups
Group I or II	Group I, Group II, or Blend I
Group II only	Group II only
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 aggregate nor

= Change

more than 50%, by weight, of the coarse aggregate fraction.

7. For patching or leveling use Group I, Group II, or Blend I. Mix types for patching and leveling are specified in [Subsection 400.3.03.B](#).
8. Include lime (hydrated lime) from an approved source and meeting the requirements of [Section 882](#) in all paving courses except as otherwise provided in the Contract. For a list of approved sources of lime, see [QPL 41](#).
 - a. Add lime to each mixture at the rate prescribed in the approved mix design.
 - b. Mix designs using only virgin aggregate shall include lime at a minimum rate of 1.00 % of the total dry aggregate weight. Mix designs using RAP shall include lime at a minimum rate equal to 1.00 % of the virgin aggregate fraction plus 0.50 % of the aggregate in the RAP fraction.
 - c. If necessary to meet requirements for mixture properties, and pursuant to an approved mix design, add more lime or add lime plus an approved Heat-Stable Anti-Stripping Additive that meets the requirements of [Section 831](#). However, the Department will not make additional payment for these materials. For a list of sources of Heat-Stable Anti-Stripping Additives, see [QPL 26](#).
 - d. Where specifically allowed in the contract on LARP, airport, and parking lot projects, an approved Heat-Stable Anti-Stripping Additive that meets the requirements of [Section 831](#) may be substituted for hydrated lime. In this case the mix gradation shall be adjusted as necessary to replace the lime with an equivalent volume of fines passing the 0.075 mm sieve. Add Heat-Stable Anti-stripping Additive at a minimum rate of 0.5 percent of the asphalt cement portion.
9. Use performance grade PG 67-22 asphalt cement in all mix designs and mixtures except as follows:
 - a. For mixtures containing 25% or greater RAP, the Engineer will determine the performance grade to be used.
 - b. On PR, LARP, airport, and parking lot projects, PG 64-22 may be substituted for PG 67-22, with approval of the Office of Materials and Research, on [roads facilities](#) having current ADT less than 2,000.
 - c. Use only grade PG 76-22, [excluding shoulder construction](#) in the following mixes: [all](#) SMA, 12.5 mm PEM, 9.5 mm and 12.5 mm OGFC, 12.5 mm Superpave ; on projects with ADT greater than 25,000; and in all mixtures for which polymer-modified asphalt is specified in the pay item.
10. Use of local sand is restricted as follows:
 - a. Do not place mixtures containing local sand on the traveled way of the mainline or ramps of the Interstate System. Mixtures with local sand may be used for shoulder construction on these facilities.
 - b. Local sand shall not constitute more than 20 % of the total aggregate weight of any mix design or production mix.
 - c. Subject to the above limits, 19 mm, 12.5 mm, and 9.5 mm Superpave mix designs and 4.75 mm mix designs containing local sand may be used on projects with a current ADT not exceeding 2,000.
 - d. 25 mm Superpave mix designs containing not more than 20 % local sand may be used on all facilities except the main line and ramps of the Interstate System.
 - e. Obtain local sand for use in asphalt mixtures from a source approved by the Department.
 - f. Approval of local sand sources: The Department will sample, test, and approve sources of local sand. Local sand shall not contain more than 7.0 % clay by weight and shall be free of foreign substances, roots, twigs, and other organic matter. It shall be free of clay lumps, as determined by AASHTO T 112, and shall have a sand equivalent value exceeding 25%, as determined by [GDT 63](#).

B. Fabrication

1. Design procedures: For all Superpave and 4.75 mm mixes, designers shall adhere to the Superpave System for Volumetric Design (AASHTO T 312 and AASHTO R30), as adapted in SOP-2 [SP](#). [All Superpave mixes are to be designed at a design gyration number \(\$N_{des}\$ \) of 65 gyrations and initial gyration number \(\$N_{ini}\$ \) of 6 gyrations. For 4.75 mm mixes, \(\$N_{des}\$ \) shall be 50 gyrations, and \(\$N_{ini}\$ \) shall be 6 gyrations.](#) The Department will design open-graded mixes and Stone Matrix Asphalt (SMA) mixes according to [GDT 114](#) and [GDT 123](#), respectively. In all cases, the procedure for measuring Maximum Specific Gravity (G_{mm}) shall be AASHTO T 209. In addition to gradation and volumetric analysis, mix designs shall include the following performance tests, as applicable.
2. Performance Test:
 - a. Permeability test: Superpave and Stone Matrix mix designs shall include testing according to ASTM PS-129. Specimen air voids for this test shall be 6.0 ± 1.0 %. The average permeability of three specimens may not exceed 3.60 ft per day (125×10^{-5} cm per sec).

- b. Moisture susceptibility test: Mix designs of all types except open-graded surface mixes shall include testing for moisture susceptibility according to [GDT 66](#). Specimen air voids for this test shall be $7.0 \pm 1.0\%$. The minimum tensile splitting ratio is 0.80, except that a tensile splitting ratio of no less than 0.70 may be acceptable if all individual strength values exceed 100 psi (690 kPa). Average splitting strength of the three conditioned and three controlled samples shall be not less than 60 psi (415 kPa) for either group. Retention of coating as determined by [GDT 56](#) shall be not less than 95%.
- c. Rutting susceptibility test. Mix designs of all types except Open-graded Surface Mixes (OGFC and PEM), and mixtures designed exclusively for trench widening shall include testing according to [GDT 115](#) or [AASHTO TP63](#). Design limits for this test are as follows: Specimen air voids for this test shall be $5.0 \pm 1.0\%$ for all mix types. Testing temperature shall be 64°C (147°F) for all mix types except 25 mm Superpave mixes, which shall be tested at 49°C (120°F). Maximum deformation shall be 5.0 mm for all mixes except 4.75 mm mix, 9.5 mm Type I and 9.5 mm Type II Superpave mixes. Maximum deformation for the 9.5 mm Type II Superpave mix shall be 6.0 mm at 64°C (147°F) and 8.0 mm at 64°C (147°F) for the 4.75 mm and 9.5 mm Type I Superpave mix.
- d. Fatigue testing: The Department may verify Superpave designs by fatigue testing according to [AASHTO TP 8-94 AASHTO T 321](#) or other procedure approved by the Department.

C. Acceptance

See [Subsection 106.03](#) and [Section 400](#). Ensure that individual test results meet the Mixture Control Tolerances listed in [Subsections 828.2.01](#), [828.2.02](#), [828.2.03](#), or [828.2.04](#), whichever applies.

D. Materials Warranty

See General Provisions 101 through 150.

828.2.01 Open-Graded Surface Mixtures

A. Requirements

Use approved mixtures that meet the following mixture control tolerances and design criteria: Produce the mixture according to an approved mix design and Job Mix Formula. Ensure that Open-Graded Surface Mixtures meet the following mixture control tolerances and mix design criteria:

Sieve Size	Mixture Control Tolerance, %	Design Gradation Limits, % Passing		
		9.5 mm OGFC	12.5 mm OGFC	12.5 mm PEM
3/4 in (19 mm) sieve	± 0.0		100 <input type="checkbox"/>	100 <input type="checkbox"/>
1/2 in (12.5 mm) sieve	± 6.1	100*	85-100	80-100
3/8 in (9.5 mm) sieve	± 5.6	85-100	55-75	35-60
No. 4 (4.75 mm) sieve	± 5.7	20-40	15-25	10-25
No. 8 (2.36 mm) sieve	± 4.6	5-10	5-10	5-10
No. 200 (75 μm) sieve	± 2.0	2-4	2-4	1-4
Range for % AC	± 0.4	6.0-7.25	5.75-7.25	5.5-7.0
Class of stone (Section 800)		"A" only	"A" only	"A" only
Drain-down (AASHTO T305), %		<0.3	<0.3	<0.3

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

- In 12.5 mm and 9.5 mm OGFC and 12.5 mm PEM mixes, use only PG 76-22 asphalt cement (specified in [Section 820](#)).
- All OGFC and PEM mixes shall include a stabilizing fiber of the type (cellulose or mineral) specified in the mix design and meeting the requirements of [Section 819](#). The dosage rate shall be as specified in the mix design and shall be sufficient to prevent drain-down exceeding the above tolerance.

B. Fabrication

See Section 400.

See General Provisions 101 through 150.

828.2.02 Stone Matrix Asphalt Mixtures

A. Requirements

~~Use approved mixtures that meet the following mixture control tolerances and design criteria: Produce the mixture according to an approved mix design and Job Mix Formula. Ensure that Stone Matrix Asphalt mixtures meet the following mixture control tolerances and mix design criteria:~~

Sieve Size	Mixture Control Tolerance	Design Gradation Limits, Percent Passing		
		9.5 mm SMA	12.5 mm SMA	19 mm SMA
1- in (25 mm) sieve	±0.0			100
3/4 in (19 mm) sieve	±7.0	100*	100*	90-100
1/2 in (12.5 mm) sieve	±6.1	98-100**	85-100	44-70
3/8 in (9.5 mm) sieve	±5.6	70-100	50-75	25-60
No. 4 (4.75 mm) sieve	±5.7	28-50	20-28	20-28
No. 8 (2.36 mm) sieve	±4.6	15-30	16-24	15-22
No. 50 (300 µm) sieve	±3.8	10-17	10-20	10-20
No. 200 (75 µm) sieve	±2.0	8-13	8-12	8-12
Range for % AC	±0.4	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 T305), %		<0.3	<0.3	<0.3

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

**Mixture control tolerance shall be ± 2.0% for this sieve for 9.5 mm SMA mixes placed at spread rates greater than 135 lb/yd². For 9.5 mm SMA mixes placed at spread rates of 135 lb/yd² or less, 100 % passing is required on this sieve.

1. SMA mixtures shall be compacted at 50 gyrations with the Superpave Gyratory compactor or 50 blows with the Marshall compactor.
2. All SMA mixtures shall contain mineral filler and fiber stabilizing additives and shall meet the following requirements:
 - a. Asphalt cement grade PG-76-22 (specified in [Section 820](#)) is required in all SMA mixtures.
 - b. Aggregates for SMA shall meet the requirements of [Subsection 802.2.02.A.3](#).
 - c. Use **the approved** mineral filler ~~that meets requirements~~ **specified in the mix design and meeting the requirements** of [Section 883](#). Approved sources of mineral filler are listed in [QPL 81](#).

~~d. Do not use local sand in lieu of mineral filler.~~

~~e. —~~

Use **an the approved** Fiber Stabilizing Additive of the type (cellulose or mineral) specified in the mix design and meeting the requirements of [Section 819](#). Approved sources of Fiber Stabilizing Additive are listed in [QPL 77](#). The dosage rate will be as specified in the mix design and shall be sufficient to prevent drain-down exceeding the above tolerance.

B. Fabrication

See Section 400.

828.2.03 Requirements or Superpave Mixtures (except Parking Lot Mixtures) Superpave Asphalt Concrete Mixtures

Requirements for Superpave Mixtures (except Parking Lot Mixtures)

Produce the mixture according to an approved mix design and Job Mix Formula. Ensure that Superpave Asphalt Concrete mixtures meet the following mixture control tolerances and mix design limits:

1. All mixes are to be designed at a design gyration number (N_{des}) of 65 gyrations and an initial gyration number (N_{ini}) of 6 gyrations.

1. Gradation limits for Superpave mixtures are as follows:

Sieve Size	Mixture Control Tolerance	Design Gradation Limits, Percent Passing				
		9.5 mm Superpave Type I	9.5 mm Superpave Type II	12.5 mm Superpave Note 1	19 mm Superpave	25 mm Superpave
1½ in (37.5 mm)						100
1- in (25.0 mm)	± 8.0			100*	100*	90-100
¾ in (19.0 mm)	±8.0**	100*	100*	98-100****	90-100	55-89**
½ in (12.5 mm)	±6.0***	98-100****	98-100****	90-100	60-89***	50-70
3/8 in (9.5 mm)	±5.6	90-100	90-100	70-89	55-75	
No. 4 (4.75 mm) s	±5.6	65-85	55-75			
No. 8 (2.36 mm)	±4.6	48-55	42-47	38-46	32-36	30-36
No. 200 (75 µm)	±2.0	5.0-7.0	5.0-7.0	4.5-7.0	4.0-6.0	3.5-6.0

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

** Mixture control tolerance shall be ± 10.0% for this sieve for 25 mm Superpave.

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

****Mixture control tolerance shall be ± 2.0% for this sieve for 12.5 mm and 9.5 mm mixes.

Note1 : Use PG 76-22 in 12.5 mm Superpave, excluding shoulder construction, on all projects with ADT greater than 25,000.

2. The Mixture Control Tolerance for asphalt cement shall be ± 0.4% for all mix types.

3. Volumetric limits are as follows:

Design Parameter	Mix Type	Limits
% of Max. Specific Gravity (G_{mm}) at design gyrations, N_{des}	All	96%
% G_{mm} at the initial number of gyrations, N_i	All	91.5% maximum
% voids filled with asphalt (VFA) at N_{des}	9.5 mm Type I	Min. 72; Max. 80
	9.5 type 2 and 12.5 mm	Min. 72; Max. 76
	19 mm	Min. 71; Max 76
	25 mm	Min. 69; Max 76
Fines to effective asphalt binder ratio (F/P_{be})	9.5 mm Type I	0.6 to 1.4
	all other types	0.8 to 1.6
Minimum % Voids in Mineral Aggregate (VMA) Note: VMA shall be calculated using the effective specific gravity of the aggregate (G_{se}). See SOP-2SP.	25 mm	13.0
	19 mm	14.0
	12.5 mm	15.0
	9.5 Type I	16.0
	9.5 Type II	16.0

B. Requirements for Superpave Parking Lot Mixes (NOT FOR STANDARD HIGHWAY/STREET PAVING)

1. Surface Layers for parking facilities:

Sieve Size	Mixture Control Tolerance	Design Gradation Limits, Percent Passing		
		4.75 mm Mix	9.5 mm Superpave Type I	9.5 mm Superpave Type II
1- in (25.0 mm) sieve	± 8.0			
3/4 in (19.0 mm) sieve	±8.0**		100*	100*
1/2 in (12.5 mm) sieve	±6.0	100*	98-100****	98-100****
3/8 in (9.5 mm) sieve	±5.6	90-100	90-100	90-100
No. 4 (4.75 mm) sieve	±5.6	75-95	65-85	55-75
No. 8 (2.36 mm) sieve	±4.6	60-65	48-55	42-47
No. 50 (300 µm) sieve	±3.8	20-50		
No. 200 (75 µm) sieve	±2.0	4-12	5.0-7.0	5.0-7.0
Range for Total AC	± 0.4	6.00 - 7.50	5.50 - 7.25	5.25 - 7.00

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

****Mixture control tolerance shall be ± 2.0% for this sieve for 12.5 mm and 9.5 mm mixes.

2. Subsurface Layers for parking facilities:

Sieve Size	Mixture Control Tolerance	Design Gradation Limits, Percent Passing		
		12.5 mm Superpave Note 1	19 mm Superpave	25 mm Superpave
				100*
1- in (25.0 mm) sieve	± 8.0	100*	100*	90-100
3/4 in (19.0 mm) sieve	±8.0**	98-100****	90-100	55-89**
1/2 in (12.5 mm) sieve	±6.0***	90-100	60-89***	50-70
3/8 in (9.5 mm) sieve	±5.6	70-89	55-75	
No. 8 (2.36 mm) sieve	±4.6	38-46	32-36	30-36
No. 200 (75 µm) sieve	±2.0	4.5-7.0	4.0-6.0	3.5-6.0
Range for Total AC	± 0.4	5.00 - 6.25	4.25 - 5.75	4.00 - 5.50

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

**Mixture control tolerance shall be ±10.0% for this sieve for 25 mm Superpave mixes.

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

****Mixture control tolerance shall be ±2.0% for this sieve for 12.5 mm and 9.5 mm Superpave mixes.

Design Parameter	Mix Type	Limits
% of Max. Specific Gravity (G_{mm}) at design gyrations, N_{des}	All	96%
% G_{mm} at the initial number of gyrations, N_i	All	91.5% maximum
% voids filled with asphalt (VFA) at N_{des}	9.5 mm Type I	Min. 72; Max. 80
	9.5 Type II and 12.5 mm	Min. 72; Max. 78
	19 and 25 mm	Min. 71; Max 76
Fines to effective asphalt binder ratio (F/P_{be})	9.5 mm Type I	0.6 to 1.4
	all other types	0.8 to 1.6
Minimum % Voids in Mineral Aggregate (VMA) Note: VMA shall be calculated using the effective specific gravity of the aggregate (G_{sc}). See SOP-2.	25 mm	13.0
	19 mm	14.0
	12.5 mm	15.0
	9.5 mm Type I	16.0
	9.5 mm Type II	16.0

3. Volumetric limits for parking facilities are as follows:

C. Fabrication

See Section 400.

828.2.04 Fine-Graded Mixtures

A. Requirements

Design gyrations (N_{des}) for fine graded mixes shall be 50 gyrations. Produce the mixture according to an approved mix design and Job Mix Formula. Ensure that fine-graded mixtures meet the following mixture control tolerances and design limits:

ASPHALTIC CONCRETE - 4.75 mm Mix		
Sieve Size	Mixture Control Tolerance	Design Gradation Limits, % passing
1/2 in (12.5 mm) sieve*	±0.0	100*
3/8 in (9.5 mm) sieve	±5.6	90-100
No. 4 (4.75 mm) sieve	±5.7	75-95
No. 8 (2.36 mm) sieve	±4.6	60-65
No. 50 (300 μm) sieve	±3.8	20-50
No. 200 (75 μm) sieve	±2.0	4-12
Range for % AC	±0.4	6.00 – 7.50
Design optimum air voids (%)		4.0 – 7.0

= Change

% Aggregate voids filled with AC	60 - 80
----------------------------------	---------

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

B. Fabrication

See Section 400.