

Georgia DOT Asphalt Pavement Selection Guidelines



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I. Scope

These guidelines present the recommended asphalt paving practices of the Georgia Department of Transportation (GDOT). They were developed in consultation with the paving and materials industries, through the Georgia Partnership for Transportation Quality.

Types of asphalt pavement covered include **Bituminous Surface Treatments (BST)** and **Hot Mix Asphalt (HMA)** composed of the Department's **4.75, 9.5 and 12.5 Superpave mixes**. These materials and their construction requirements are described in Sections 400, 424, 824, and 828 of the Standard Specifications, 2001 Edition, in Special Provisions 400 and 828 issued Feb. 24, 2006, and in Special Provisions 424 and 824 issued Mar. 6, 2006.

The guidelines do not address mix types for other purposes—open-graded mixes (PEM and OGFC) and structural mixes (Stone Matrix Asphalt and Types 19 and 25 Superpave). Likewise, different guidance may apply in paving off-road pavements such as parking areas and airport paving. Questions regarding these topics may be referred to the State Bituminous Construction Engineer at the GDOT Office of Materials and Research (see section VII).

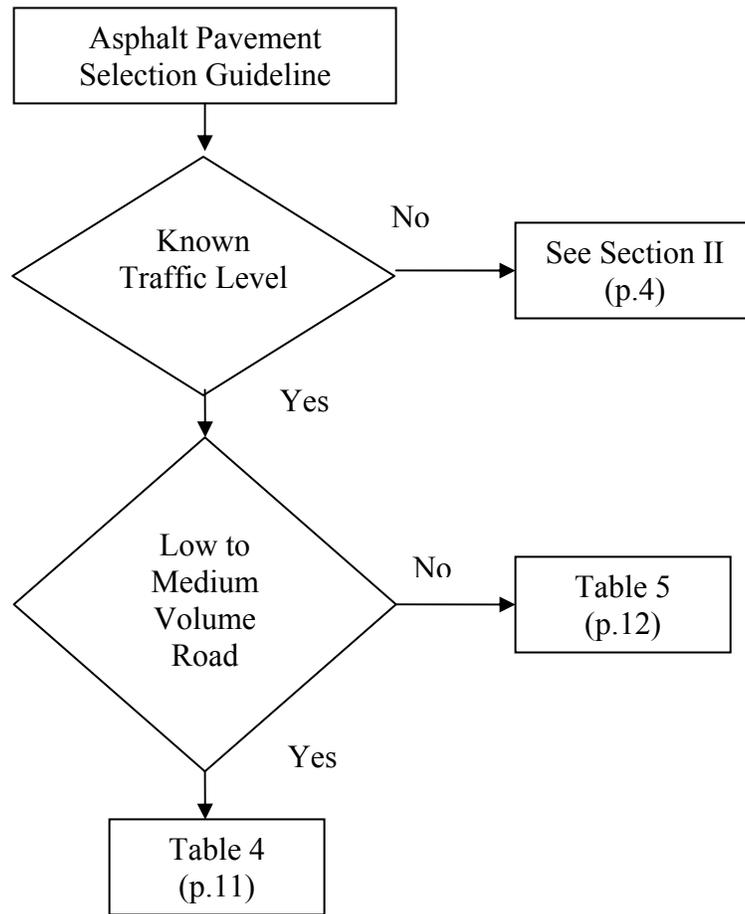
Designs and specifications should be based on a detailed assessment of each project and the availability and costs of materials. The tables in the following sections represent the applications and thicknesses normally specified, while providing flexibility to address unusual constraints and conditions.

Mix types are distinguished according to nominal maximum size of the aggregate in millimeters, i.e. 9.5 relates to an aggregate size of 9.5 millimeters, or 3/8 inch. Selection guidelines for asphalt pavement presented in two categories, Low to Medium Volume and Medium to High Volume:

Surface Mix Recommendations

Volume	Traffic Count	Surface Type
<i>Low to Medium</i>	TPD < 100 or ADT < 800	BST
	TPD < 100 or ADT < 1,000*	4.75 HMA
	TPD < 200 or ADT < 2,000*	9.5 Type I HMA
<i>Medium to High</i>	TPD < 200 and 2,000 < ADT < 10,000	9.5 Type II HMA
	TPD > 200 or ADT > 10,000	12.5 HMA
TPD = trucks per day ADT = average daily traffic *Note: ADT is conservative and can be exceeded with accurate information on TPD		

Figure 1



II. Traffic levels and classification

A key parameter for selecting an asphalt pavement alternative is Average Daily Traffic, or ADT. Equally important for most roads is the number and class of trucks measured as trucks per day (TPD). Traffic information is collected annually in all Georgia counties and is available on line at:

<http://www.dot.ga.gov/statistics/TrafficData/Pages/TrafficCounts.aspx>

The site includes important keys to the data in the tables, such as whether the ADT is directional or two-way and whether the data is measured or estimated. TPD can be estimated using the information of road classifications.

In the Selection Tables that follow, designers may select appropriate asphalt alternatives for the full range of traffic levels and distress conditions typically encountered. In some cases, traffic data, especially truck traffic, must be estimated from available information, including site inspections and data from adjoining roads.

III. Materials

A. Approved sources and mixtures

GDOT maintains Qualified Products Lists (QPL's) of approved producers of HMA and its constituent ingredients, and these approved sources are regularly monitored and tested. In

addition, mix designs used in state contracts must be produced by approved laboratories and reviewed by the Office of Materials and Research, as discussed in Part III.E below. Specifying GDOT-approved mix designs ensures that the materials are of good quality and formulated correctly and that each mixture has met appropriate criteria which can be monitored for quality assurance. The list of qualified HMA producers is QPL 45. Approved aggregate suppliers are listed on QPL1 and QPL2.

QPL's are accessible on the Department's web site:

<http://www.dot.ga.gov/doingbusiness/Materials/qpl/pages/default.aspx>

B. Bituminous material

Bituminous materials used in Georgia include asphalt cement and cationic asphalt emulsion. The types of bituminous material used for BST in Georgia are asphalt cement, grades PG58-22 and PG64-22 and cationic asphalt emulsion, grade CRS-2h.

The type of bituminous material used in the production of HMA in Georgia is asphalt cement, grades PG64-22, PG67-22 and PG76-22. PG67-22 is the most commonly used type of asphalt cement in Georgia for HMA. PG 76-22 is a polymer modified asphalt cement and is normally used for high traffic areas. The list of qualified bituminous materials is QPL-7. The type of asphalt binder for each mix will be included on the approved GDOT Job Mix Formula for each type of mix. Specifications for asphalt cement are located in Section 820 of the GDOT Specifications. Specifications for cationic asphalt emulsions are located in Section 824 of the GDOT Specifications.

C. Aggregate groups

Aggregates can be different sizes and from different geology. Aggregates produced in the northwest corner of Georgia consist of sedimentary rock (limestones and dolomites), which are classified as "Group I" aggregates. Use of these materials as a surface course is restricted according to traffic level. Granitic aggregates, classified as "Group II", should always be specified for surface mixes for roads with the highest volume of traffic, as noted in Table 1. Limits for Group I mixes are also shown in Table 1 below. (Although hauling costs normally preclude use of Group I aggregates outside of their source areas, specifying the aggregate group is advisable, even in South Georgia.)

Table 1 — Aggregate Groups by Traffic Level for Surface Courses

Type of Surface Course	ADT	Specify:	Explanation
Surface Treatment	Less than 800	Group I or Group II	100% Group I or 100% Group II
Hot Mix Asphalt	Up to 800	Group I, Group II, or Blend	Any group or blend
Hot Mix Asphalt	800 to 4000	Blend or Group II	Either Group II or blend of Groups I and II. The Group I fraction should not exceed 60% by weight of the total aggregate nor more than 50% of the coarse aggregate.
Hot Mix Asphalt	4000 and above	Group II only	100% Group II only

* Group I Aggregates may be used where the Surface Treatment is to be overlaid with Asphaltic Concrete.

D. Recycled Asphalt Pavement (RAP)

RAP is used routinely in both low-volume and high-volume mixes in Georgia. Like all materials used in GDOT-approved mixes, a contractor's RAP stockpile is tested, approved, and identified by a numerical source code. When RAP from the approved stockpile is used as an ingredient in a mix design, its source code and the percentage allowed in the mix are listed in the mix design document.

E. Specifying approved ingredients and mixtures.

Asphalt mixes should be formulated according to current, state-approved mix designs. A mix design is a unique recipe based on the characteristics of the particular ingredients to be used. It optimizes the properties of the mix through a series of standard tests. Contractors for state work maintain files of mix designs which meet the Department's specifications and are suitable for off-system as well as on-system projects. Specifying state-approved mixes ensures that the individual ingredients come from approved sources, that they are designed by a certified laboratory and approved by the Department, and that the mixture has been tested for strength, impermeability, and resistance to moisture damage. Above all, specifying approved mixes establishes a standard for competitive bidding and quality assurance.

Mix types designated by letters (e.g., “E”, “F”, and “G”) and other obsolete types are no longer valid designs, and the ingredients and properties of these old designs may have changed in critical ways. Current GDOT mix types are designated by their nominal maximum particle size – 4.75, 9.5, 12.5, 19, and 25 mm. An approved mix design of a given type is assigned an alpha-numeric code indicating the sources of the aggregate, the mix type and size, and the certified commercial lab which authored it. For example, a mix with the identifier 16-12.5SP-10-6 would be a 12.5mm mix consisting of aggregate from source number 16, designed by certified laboratory number 6. The 10 is a serial number to distinguish the design from others like it. The unique identifier helps to ensure that the mixture specified is the one laid down and that it is tested according to the correct criteria.

Figure 2



The Asphalt Pavement Analyzer measures a mix design's resistance to rutting

Figure 3



Permeability Test determines a mix design's permeability characteristics

IV. Low to Medium volume surface mixes (ADT <2000)

Bituminous surface treatment or hot mix asphalt can be used as surface mixes on low volume roads, such as subdivision streets. BST is beneficial to seal weathered pavements without major distresses and very low traffic. BST is composed of one or more alternating applications of bituminous material (either asphalt cement or asphalt emulsion) and cover aggregate. The aggregate used in each layer is of uniform size as practical and the maximum size aggregate for each successive layer is approximately one-half that of the previous layer. The two HMA mix types for low-volume pavements specified in Georgia are 4.75 and 9.5-Type I. These mixes are ideal for most local roads and off-road pavements and offer several advantages over coarser mixes in these applications. They excel in workability, smoothness, visual appeal, and imperviousness to surface water and are very durable when properly designed and constructed. These mixes also conform well to surface irregularities during compaction, thereby improving smoothness with less layer thickness than coarser mixes.

For surface courses under light to moderate traffic, properly designed 4.75 and 9.5-Type I mixes are generally more suitable and more economical than the high-volume mixes, and their use in these applications is encouraged. The economic advantage of the low-volume mix types is that they utilize ingredients such as local sand, Recycled Asphalt Pavement (RAP), and crushed aggregate screenings, which are more available than graded stone. In the coastal plain region, where quarry materials must be delivered over long distances, local sand is used in some state mixes to replace up to 20 percent of the aggregate, mainly the processed screenings.

A. Bituminous Surface Treatments (BST)

1. Recommended applications

a. Resurfacing - Best use. Surface treatment can be used to prevent surface water from penetrating old pavements that have become weathered or cracked and to restore skid resistance to pavements that have become slippery because of wear and polishing of the surface aggregates. The best candidate for BST would be a low volume (ADT < 200), low speed (≤ 55 mph) road with structurally sound pavement, either HMA or BST, and with proper cross section and adequate drainage (no leveling required).

b. Resurfacing - Alternate use. BST may be used with some minor rutting ($\leq 1/2$ "") if leveling is used; however, if the quantity of leveling exceeds approximately 35 lbs/sy, total cost may exceed that of an HMA overlay. BST may also be used where ADT ≤ 800 and TPD <100.

c. Crack-relief interlayer. This alternative is a single surface treatment application (No. 7 stone size) that is placed over an existing pavement prior to its being resurfaced with hot-mix asphaltic concrete. Its purpose is to interrupt propagation of reflective cracks into the new pavement surface. In this application, care must be taken to place the hot-mix overlay immediately after the crack-relief interlayer, as it is not intended to be left as a riding course.

2. Limitations

a. Strength BST cannot correct an irregular road section, nor does it add significant structure to the underlying pavement. Surface treatment has little resistance to shear and should not be used in locations where multiple intersections are present, particularly where truck traffic is significant.

b. Noise. BST has a coarse, open texture which provides good skid resistance but produces moderate noise levels. It is not suitable for in-town locations where traffic speeds exceed 25 mph.

c. Loose stone. BST can lead to loose stone hazards during early stages of service. If ADT exceeds 200, a sand seal application will provide additional protection against the hazards associated with loose stone.

B. HMA mixes

1. Recommended applications

a. Leveling. 4.75 and 9.5-Type I mixes are recommended for leveling courses up to $\frac{3}{4}$ inch thickness, as shown in Table 3 below (adapted from Section 400.3.03.B, Table 3, of the Standard Specifications). These mixes can be feathered to a thin edge to minimize any reflection into the surface layer. Thickness limits for 9.5-Type II leveling and 12.5 leveling mixes are also given in Table 3. See also Note 1 of Table 4 concerning leveling.

b. Overlays. 4.75 and 9.5 Type I mixes are recommended for paving low volume, low speed roads. They are suitable as thin overlays to protect a deteriorated surface and improve smoothness, especially where raising the grade of a pavement must be minimized and structural strength is already adequate. Minimum thicknesses shown in Table 3 may be appropriate where raising the grade should be minimized due to driveways, crossing streets, drainage structures, manholes, etc.

2. Limitations

a. Deformation. 4.75 and 9.5-Type I mixes have limited resistance to rutting and other deformation under heavy traffic, especially where heavy vehicles stand and move slowly at intersections. Their use should be avoided in facilities with signalized intersections or industrial activity involving many heavy trucks.

b. Maximum and minimum thicknesses. Observing the thickness limits shown in Table 4 will allow good compaction and optimum stability under traffic. For small, lightly traveled off-road pavements such as parking lots, where traffic is not channelized, lift thicknesses of 9.5-Type I mix up to $1\frac{1}{2}$ inches may be appropriate for practical reasons.

c. Minimum thicknesses. As overlays on relatively even surfaces, 4.75 mixes and 9.5-Type I mixes should not be placed thinner than the limits shown in Table 3. Greater thickness is needed for irregular and slightly rutted surfaces not requiring a leveling course. When placing thin lifts, the weather limitations provided in the Standard Specifications, subsection 400.3.05.E, should always be observed.

Table 2 — Leveling and Patching—All Mix Types

Thickness (in.)	Rate of Spread (lbs/yd ²)	Mix Type
Up to $\frac{3}{4}$	Up to 85	4.75 or 9.5-Type I
$\frac{3}{4}$ to $1\frac{1}{2}$	85 to 165	9.5-Type II
$1\frac{1}{2}$ to 2	165 to 220	12.5

Table 3 — Maximum and Minimum Layer Thicknesses – All Types

Mix Type	Minimum Layer Thickness		Recommended Layer Thickness		Maximum Layer Thickness		Maximum Total Thickness
	in.	lbs/yd ²	in.	lbs/yd ²	in.	lbs/yd ²	in.
4.75	3/4	85	7/8	90	1-1/8	125	2
9.5 Type I	7/8	90	1-1/8	125	1-1/4	135	4
9.5 Type II	1-1/8	125	1-1/4	135	1-1/2	165	4
12.5	1-3/8	155	1-1/2	165	2-1/2	275	8

* Allow up to 6 in. per lift on trench widening. Place 9.5 and 12.5 mixes up to 4 in. thick for driveway and side road transition

V. Medium to High volume surface mixes (ADT>2000)

9.5-Type II and Type 12.5 mixes should be specified for higher traffic volumes, as prescribed in Table 5, and for thick leveling layers, as provided in Table 4. Type 12.5 mixes are designed with either regular (grade PG 67-22) or polymer-modified (grade PG 76-22) asphalt cement. Designs with grade PG 67-22 asphalt cement are specified for roadways with ADT's of 10,000 to 25,000; for higher traffic volumes, designs with grade PG 76-22 (polymer modified) are required.

9.5-Type II mixes are designed with a coarser aggregate gradation than 9.5-Type I but the same nominal maximum particle size. They have excellent resistance to deformation and can be placed in thinner layers to minimize grade change.

VI. Selection Guide – Tables 4 and 5

Tables 4 and 5 present guidelines for selecting asphalt pavement alternatives based on traffic level and distress conditions in the existing layers. Georgia Department of Transportation uses “The Pavement Condition Evaluation System” (PACES) to determine the amount and type of surface distress on a roadway at the time the survey is made. The system standardizes the terminology for types of defects that can be found on a pavement in Georgia and defines the various levels of severity for the structural condition of the pavement surface. While GDOT conducts PACES evaluations on state routes only, local governments can obtain copies of the PACES manual through GDOT’s Maintenance Office. In the tables below, lettered footnotes in the table attach important stipulations to certain options. In addition, the numbered "Notes to Tables 4 and 5 following the tables discuss remedial measures to be applied for certain distress conditions.

Table 4- Bituminous Material Type Selection Guide

Low to Medium volume Mixes

Traffic Level / Distress Condition	Parameters	Surface Treatment	4.75	9.5-Type I
Average Daily Traffic, (% trucks should be considered)	< 200	Yes	Yes	Yes
	200 – 800	Yes	Yes	Yes
	800 – 1,000		Yes	Yes
	>1,000		Yes (D)	Yes (H)
Rutting See Note 1	< ¼"	Yes	Yes	Yes
	¼" – ½"	(A)	(A)	(A)
	½" – ¾"			
	> ¾"			
Transverse Cracking	Minor	Yes	Yes	Yes
	Major	(G)		(E)
Longitudinal Cracking	Minor	Yes	(C)	(C)
	Major	(G)		
Load Related Cracking See Notes 2 & 3	Minor			(C)
	Major			
Raveling	Minor	Yes	Yes	Yes
	Major			(B)

- A. Yes With Leveling
- B. Yes With Milling
- C. Yes With Crack-Seal
- D. Yes With TPD < 100
- E. Yes With Crack-Relief Interlayer
- F. Yes With Deep Patching
- G. Triple Surface Treatment (Stone Size 6, 7, & 89)
- H. Yes with 100 < TPD < 200

Table 5- Bituminous Material Type Selection Guide
Medium to High-volume Mixes

Traffic Level / Distress Condition	Parameters	9.5 Type II	12.5	
			Regular	Polymer-Modified AC
Average Daily Traffic, (% trucks should be considered)	1,000 – 2,000	Yes (H)	Yes	Yes
	2,000 – 10,000	Yes	Yes	Yes
	10,000 – 25,000	Yes	Yes	Yes
	> 25,000	Yes	Yes	Yes
Rutting See Note 1	< 1/4"	Yes	Yes	Yes
	1/4" – 1/2"	(A)	(A)	(A)
	1/2" – 3/4"	(B)	(B)	(B)
	> 3/4"	Yes	(B)	(B)
Transverse Cracking	Minor	Yes	Yes	Yes
	Major	(E)	(E)	(E)
Longitudinal Cracking	Minor	(C or E)	(C or E)	(C or E)
	Major	(E)	(E)	(E)
Load Related Cracking See Notes 2 & 3	Minor	(C or E)	(C or E)	(C or E)
	Major	(F)	(F)	(F)
Raveling	Minor	Yes	Yes	Yes
	Major	(B)	(B)	(B)

- A. Yes With Leveling
- B. Yes With Milling
- C. Yes With Crack-Seal
- D. Yes With Low Truck Volume Only
- E. Yes With Crack-Relief Interlayer
- F. Yes With Deep Patching
- G. Triple Surface Treatment (Stone Size 6, 7, & 89)
- H. Yes with 100 < TPD < 200

Notes to Tables 4 and 5:

Note 1. Leveling may be needed to correct roughness or rutting in the wheel paths. Roughness due to patches, settlement in utility or drainage cuts, and the like may be corrected by full-width spot leveling placed in a thin lift with a paving machine. Roughness due to rutting and washboarding at intersections should be removed by spot milling.

Continuous rutting in the wheel paths also may be corrected by milling. Alternatively, the wheel paths can be filled in by strip leveling placed with a motor grader. Full-width leveling is not recommended to correct rutting.

Note 2. "Load-related cracking" here refers to all distress caused by failure of the base or subgrade. Such failures may be continuous throughout a project or isolated, resulting from local defects. Isolated base failures must be corrected by full-depth patching (deep patching), which replaces both base and pavement in the small area affected. Continuous or widespread cracking in the wheel paths is clear evidence of inadequate structural strength. Overlaying such extensive distress is not cost-effective. As an alternative, reconstruction or full depth reclamation (FDR) can be performed when serviceability becomes unacceptable. Where the pavement itself is the deficient layer, a stress-relieving interlayer plus a heavy-duty overlay may be an effective alternative where heavy axle loads are infrequent.

Note 3. Construction-related cracking over a longitudinal joint, such as a widening joint, should be sealed prior to the overlay, using a hot-poured joint sealer meeting the requirements of Section 407 of the Standard Specifications for Type M joint filler.

VII. Additional Assistance

Users of this document are invited to contact the Office of Materials and Research, State Bituminous Construction Engineer, concerning particular materials and project conditions. The SBC Engineer can be reached at 404-363-7531 or by mail addressed to: State Bituminous Construction Engineer, Georgia DOT, Office of Materials and Research, 15 Kennedy Drive, Forest Park, GA 30297.