
USACE / NAVFAC / AFCEA UFGS-02741 (August 2004)

Preparing Activity: NAVFAC Superseding
UFGS-02741N (September 1999)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 25 June 2004

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE CONSTRUCTION

SECTION 02741

BITUMINOUS CONCRETE PAVEMENT

08/04

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 QUALITY ASSURANCE
 - 1.3.1 Regulatory Requirements
 - 1.3.2 Modification of References
 - 1.3.3 Mix Delivery Record Data
 - 1.3.4 Trial Batch
 - 1.3.5 Mix Design

PART 2 PRODUCTS

- 2.1 ASPHALT CONCRETE
- 2.2 SUBBASE
- 2.3 BASE COURSE
- 2.4 SURFACE COURSE
- 2.5 STRIPING
- 2.6 CURBS [AND GUTTERS]
- 2.7 GUARD (GUIDE) RAILS
- 2.8 MEDIAN BARRIERS
- 2.9 TRAFFIC SIGNS
- 2.10 PRECAST CAR STOPS
- 2.11 COMPOSITION OF MIXTURE REQUIREMENTS
 - 2.11.1 Mixture Properties
 - 2.11.2 Quantity of Bituminous Material

PART 3 EXECUTION

- 3.1 PREPARATION
 - 3.1.1 Excavation and Filling
- 3.2 CONSTRUCTION
 - 3.2.1 Subgrade
 - 3.2.2 Subbase
 - 3.2.3 Base Course
 - 3.2.4 Surface Course

- 3.2.5 Striping
- 3.2.6 Curbs [and Gutters]
- 3.2.7 Guard (Guide) Rails
- 3.2.8 Median Barrier
- 3.2.9 Traffic Signs
- 3.2.10 Precast Car Stops
- 3.3 FIELD QUALITY CONTROL
 - 3.3.1 Sample and Core Identification
 - 3.3.2 Testing
 - 3.3.2.1 Bituminous Mix Testing
 - 3.3.2.2 Testing of Pavement Course
 - 3.3.2.3 Alternate Testing Method for Pavement Courses

-- End of Section Table of Contents --

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SECTION 02741

BITUMINOUS CONCRETE PAVEMENT 08/04

NOTE: This guide specification covers the requirements for asphaltic concrete paving for vehicular traffic.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

NOTE: Do not be used for airfield paving.

NOTE: The designer shall verify that the application of the state specification is indeed appropriate for the facility being designed or constructed. The following information shall be shown on the project drawings:

1. Plan with dimensions of the various types of paving.
2. Typical cross sections indicating dimensions of components of various types of paving, shoulders, and ditches, if any.
3. Joints between new and existing paving and between different types of paving.

4. A longitudinal profile of paving. Transverse
profile will be shown in typical cross section.

PART 1 GENERAL

1.1 REFERENCES

NOTE: Issue (date) of references included in
project specifications need not be more current than
provided by the latest guide specification. Use of
SpecsIntact automated reference checking is
recommended for projects based on older guide
specifications.

The publications listed below form a part of this specification to the
extent referenced. The publications are referred to within the text by the
basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO T 230 (1968; R 2000) Determining Degree of
Pavement Compaction of Bituminous
Aggregate Mixtures

AASHTO T 30 (1993; R 1998) Mechanical Analysis of
Extracted Aggregate

ASTM INTERNATIONAL (ASTM)

ASTM D 1559 (1989) Resistance to Plastic Flow of
Bituminous Mixtures Using Marshall
Apparatus

ASTM D 2172 (2001e1) Quantitative Extraction of
Bitumen from Bituminous Paving Mixtures

ASTM D 2950 (1991; R 1997) Density of Bituminous
Concrete in Place by Nuclear Methods

U.S. DEPARTMENT OF TRANSPORTATION (DOT)

DOT D-6.1 (2000) Manual of Uniform Traffic Control
Devices

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-P-115 (Rev F) Paint, Traffic (Highway, White and
Yellow)

1.2 SUBMITTALS

NOTE: Submittals must be limited to those necessary
for adequate quality control. The importance of an
item in the project should be one of the primary

factors in determining if a submittal for the item should be required.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.] [for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Precast car stops

SD-04 Samples

Uncompacted mix

Pavement cores

SD-06 Test Reports

Trial batch reports

Mix design

Asphalt concrete

Density

Thickness

Straightedge test

Submit reports for testing specified under paragraph entitled "Field Quality Control."

SD-07 Certificates

Asphalt mix delivery record

Asphalt concrete and material sources

Obtain approval of the Contracting Officer for materials and material sources 2 days prior to the use of such material in the work.

Asphalt concrete

Curbs

Guard (Guide) rails

Median barriers

Traffic signs

Submit certificates, signed by the producer, that paving materials and incidental construction items conform to specification requirements.

1.3 QUALITY ASSURANCE

NOTE: Insert abbreviation for the state highway department document (SHS) appropriately throughout this specification.

NOTE: Use words in brackets or fill in blanks with correct terminology from the referenced state highway department document to identify specific portions of the referenced state highway department document.

1.3.1 Regulatory Requirements

Provide work and materials in accordance with applicable requirements of SHS [____]. [Divisions and Sections] [Sections and Paragraphs] [[____] and [____]] mentioned herein refer to those specifications. Paragraphs in SHS [____] entitled ["Quantity and Payment"] ["Method of Measurement" and "Basis of Payment"] ["____"] shall not apply.

1.3.2 Modification of References

Where term "Engineer" is used in SHS [____] it shall be construed to mean [Contracting Officer] [Contractor's Quality Control representative]. [Where term "state" is used, it shall mean "Federal Government"].

1.3.3 Mix Delivery Record Data

Record and submit the following information to each load of mix delivered to the job site. Submit within one day after delivery on Government-furnished forms:

- a. Truck No:
- b. Time In:
- c. Time Out:
- d. Tonnage and Discharge Temperature:
- e. Mix Type:
- f. Location:
- g. Stations Placed:

1.3.4 Trial Batch

Submit current bituminous design reports for all mix types proposed for use on the project.

1.3.5 Mix Design

Submit results of laboratory tests performed on each mix design. Testing shall have been accomplished not more than one year prior to date of material placement.

PART 2 PRODUCTS

2.1 ASPHALT CONCRETE

NOTE: Insert abbreviation for the state highway department document referenced above.

Provide asphalt concrete in accordance with the applicable requirements of the SHS [____], except where specified otherwise. [Recycled asphalt pavement material may be used as permitted by SHS [____].]

2.2 SUBBASE

NOTE: Use words in brackets or fill in blanks with correct terminology and insert appropriate numbers from referenced state highway department document. Be certain that terminology used in these paragraphs is identical to that used on drawings for same item.

SHS [____], materials for construction of the subbase shall be in accordance with [Division [____], Section [____]] [Section [____], paragraph [____]] [[____], [____]].

2.3 BASE COURSE

NOTE: Use words in brackets or fill in blanks with correct terminology and insert appropriate numbers from referenced state highway department document. Be certain that terminology used in these paragraphs is identical to that used on drawings for same item.

SHS [____], materials for construction of the base course shall be in accordance with [Division [____], Section [____]] [Section [____], paragraph [____]] [[____], [____]], [Type [____]] [Class [____]].

2.4 SURFACE COURSE

NOTE: Use words in brackets or fill in blanks with correct terminology and insert appropriate numbers from referenced state highway department document. Be certain that terminology used in these paragraphs is identical to that used on drawings for same item.

SHS [____], materials for construction of the surface course shall be in accordance with [Division [____], Section [____]] [Section [____], paragraph [____]] [Type [____]] [Class [____]].

2.5 STRIPING

NOTE: Select the first option when the referenced state highway department document includes paint and striping. Select the second option when the referenced state highway department document does not include paint and striping.

NOTE: Use words in brackets or fill in blanks with correct terminology and insert appropriate numbers from referenced state highway department document. Be certain that terminology used in these paragraphs is identical to that used on drawings for same item.

SHS [____], materials for paint striping shall be in accordance with [Division [____], Section [____]] [Section [____], paragraph [____]], [[____], [____]].

[Paint shall conform to FS TT-P-115, Types I, or II.]

2.6 CURBS [AND GUTTERS]

NOTE: Select the first option when the referenced state highway department document includes materials for curbs and gutters. Select the second option when the referenced state highway department

document does not include concrete materials for curbs and gutters and include Section 03300, "Cast-In-Place Concrete" in the project specification, as appropriate.

NOTE: Use words in brackets or fill in blanks with correct terminology and insert appropriate numbers from referenced state highway department document. Be certain that terminology used in these paragraphs is identical to that used on drawings for same item.

SHS [____], materials for construction of curbs [and gutters] shall be in accordance with [Division [____], Section [____]] [Section [____], paragraph [____]] [[____], [____]].

[Concrete is specified in Section 03300N CAST-IN-PLACE CONCRETE.]

2.7 GUARD (GUIDE) RAILS

NOTE: Use words in brackets or fill in blanks with correct terminology and insert appropriate numbers from referenced state highway department document. Be certain that terminology used in these paragraphs is identical to that used on drawings for same item.

SHS [____], materials for construction of the guard (guide) rails shall be in accordance with [Division [____], Section [____]] [Section [____], paragraph [____]] [[____], [____]].

2.8 MEDIAN BARRIERS

NOTE: Use words in brackets or fill in blanks with correct terminology and insert appropriate numbers from referenced state highway department document. Be certain that terminology used in these paragraphs is identical to that used on drawings for same item.

SHS [____], materials for construction of the median barriers shall be in accordance with [Division [____], Section [____]] [Section [____], paragraph [____]] [[____], [____]].

2.9 TRAFFIC SIGNS

NOTE: Use words in brackets or fill in blanks with correct terminology and insert appropriate numbers from referenced state highway department document. Be certain that terminology used in these paragraphs is identical to that used on drawings for same item.

SHS [____], provide traffic signs in accordance with [Division [____],

Section [____]] [Section [____], paragraph [____]] [[____], [____]].

2.10 PRECAST CAR STOPS

Provide car stops to the profile and size indicated. [Manufacture with air entrained concrete having a minimum compressive strength of 25 MPa 3,000 psi at 28 days, with two No. 4 reinforcing rods located at mid-point of its cross section and with two galvanized sleeves for anchoring.] [Manufacture with 100 percent recycled content level of plastic or rubber in accordance with DOT D-6.1].

2.11 COMPOSITION OF MIXTURE REQUIREMENTS

2.11.1 Mixture Properties

Gradation of mineral aggregate shall be as specified. Percentage of bituminous material provided in the bituminous mixtures shall be within the limits specified. Mixtures shall have the following physical properties:

<u>Test Property</u>	<u>Values</u>
Stability (50 Blows)	Not less than 454 kg
Flow (0.25 mm)	Not more than 20 nor less than 8
Percent Air Voids	Not less than 3 nor more than 8 for binder course; not less than 3 nor more than 5 for wearing course
Percent Voids in Mineral Aggregates	See Table I

<u>Test Property</u>	<u>Values</u>
Stability (50 Blows)	Not less than 1000 pounds
Flow (0.01 inch)	Not more than 20 nor less than 8
Percent Air Voids	Not less than 3 nor more than 8 for binder course; not less than 3 nor more than 5 for wearing course
Percent Voids in Mineral Aggregates	See Table I

TABLE I

MINIMUM PERCENT VOIDS IN MINERAL AGGREGATE (VMA)

<u>U.S.A. Standard Sieve Designation</u>	<u>Nominal Maximum Particle Size, mm</u>	<u>Minimum VMA Percent</u>
4.75 mm	4.75	18
9.5 mm	9.5	16
12.5 mm	12.5	15
19.0 mm	19.0	14
25.0 mm	25.0	13

TABLE I

MINIMUM PERCENT VOIDS IN MINERAL AGGREGATE (VMA)

<u>U.S.A. Standard Sieve Designation</u>	<u>Nominal Maximum Particle Size, Inch</u>	<u>Minimum VMA Percent</u>
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TABLE I

MINIMUM PERCENT VOIDS IN MINERAL AGGREGATE (VMA)

No. 4	0.187	18
3/8 inch	0.375	16
1/2 inch	0.500	15
3/4 inch	0.750	14
1 inch	1.000	13

2.11.2 Quantity of Bituminous Material

NOTE: If slag or any unusually porous aggregate is anticipated for possible use in the mix, the maximum asphalt cement percentages indicated may need to be increased. Check requirements of local materials and modify percentages as necessary.

Mix asphalt cement with aggregates of corresponding mixes in the following proportions:

ASPHALT CEMENT PERCENT BY WEIGHT OF TOTAL MIX

<u>Binder Course</u>	<u>Wearing Course</u>
4 to 8	5 to 9

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Excavation and Filling

Excavation and filling to establish elevation of subgrade is specified in Section 02300 EXCAVATION.

3.2 CONSTRUCTION

NOTE: Insert abbreviation for the state highway department document referenced above.

Provide construction in accordance with the applicable requirements of the SHS [____], except where indicated or specified otherwise.

3.2.1 Subgrade

NOTE: Use words in brackets or fill in blanks with correct terminology and insert appropriate numbers from referenced state highway department document. Be certain that terminology used in these paragraphs is identical to that used on drawings for same item.

SHS [____], preparation of subgrade shall be in accordance with [Division [____], Section [____]], [Section [____], paragraph [____]] [[____], [____]] [Section 02300 EXCAVATION.]

3.2.2 Subbase

NOTE: Use words in brackets or fill in blanks with correct terminology and insert appropriate numbers from referenced state highway department document. Be certain that terminology used in these paragraphs is identical to that used on drawings for same item.

SHS [____], methods of construction of the subbase shall be in accordance with [Division [____], Section [____]] [Section [____], paragraph [____]] [[____], [____]].

3.2.3 Base Course

NOTE: Use words in brackets or fill in blanks with correct terminology and insert appropriate numbers from referenced state highway department document. Be certain that terminology used in these paragraphs is identical to that used on drawings for same item.

SHS [____], methods of construction of the base course shall be in accordance with [Division [____], Section [____]] [Section [____], paragraph [____]] [[____], [____]].

3.2.4 Surface Course

NOTE: Use words in brackets or fill in blanks with correct terminology and insert appropriate numbers from referenced state highway department document. Be certain that terminology used in these paragraphs is identical to that used on drawings for same item.

SHS [____], methods of construction of the surface course shall be in accordance with [Division [____], Section [____]] [Section [____], paragraph [____]] [[____], [____]]. Placement will not be permitted unless the Contractor has a working asphalt thermometer on site.

3.2.5 Striping

NOTE: Include the bracketed portion (first sentence) when the referenced state highway department document includes paint and striping.

NOTE: Use words in brackets or fill in blanks with correct terminology and insert appropriate numbers from referenced state highway department document.

Be certain that terminology used in these paragraphs
is identical to that used on drawings for same item.

SHS [____], provide paint striping in accordance with [Division [____],
Section [____]] [Section [____], paragraph [____]] [[____], [____]].
Allow bituminous pavement to cure for at least 21 days before paint is
applied. Pavement shall be thoroughly clean and entirely free of loose
sand, stones, dust, oil, grease, water, and other substances that will be
deleterious to the paint or will adversely affect the adhesion of the
paint. Do not apply paint during high wind (over 24 km/h) (over 15 miles
per hour) or high humidity (over 70 percent). Apply paint only when
ambient temperature is 5 degrees C 40 degrees F or above and rising but not
more than 35 degrees C 95 degrees F. Dimensions and arrangement of
striping shall be as indicated. Apply paint to a wet film thickness of
0.38 mm 0.015 inch by means of conventional traffic line striping
equipment. Traffic shall not be permitted to use the painted areas for a
minimum of 30 minutes after painting of lines has been completed.

3.2.6 Curbs [and Gutters]

NOTE: Select the first option when the referenced
state highway department document includes materials
for curbs and gutters. Select the second option
when the referenced state highway department
document does not include concrete materials for
curbs and gutters and include Section 03300,
"Cast-In-Place Concrete" in the project
specification, as appropriate.

NOTE: Use words in brackets or fill in blanks with
correct terminology and insert appropriate numbers
from referenced state highway department document.
Be certain that terminology used in these paragraphs
is identical to that used on drawings for same item.

SHS [____], methods of construction of curbs [and gutters] shall be in
accordance with [Division [____], Section [____]] [Section [____],
paragraph [____]] [[____], [____]].

[Provide curbs [and gutters] as indicated. Provide concrete construction
as specified in Section 03300N CAST-IN-PLACE CONCRETE.]

3.2.7 Guard (Guide) Rails

NOTE: Use words in brackets or fill in blanks with
correct terminology and insert appropriate numbers
from referenced state highway department document.
Be certain that terminology used in these paragraphs
is identical to that used on drawings for same item.

SHS [____], methods of construction of the guard (guide) rails shall be in
accordance with [Division [____], Section [____]] [Section [____],

paragraph [_____] [[_____] , [_____]].

3.2.8 Median Barrier

NOTE: Use words in brackets or fill in blanks with
correct terminology and insert appropriate numbers
from referenced state highway department document.
Be certain that terminology used in these paragraphs
is identical to that used on drawings for same item.

SHS [_____] , methods of construction of the median barriers shall be in
accordance with [Division [_____] , Section [_____]] [Section [_____] ,
paragraph [_____]] [[_____] , [_____]].

3.2.9 Traffic Signs

NOTE: Use words in brackets or fill in blanks with
correct terminology and insert appropriate numbers
from referenced state highway department document.
Be certain that terminology used in these paragraphs
is identical to that used on drawings for same item.

SHS [_____] , install traffic signs in accordance with [Division [_____] ,
Section [_____]] [Section [_____] , paragraph [_____]] [[_____] , [_____]].

3.2.10 Precast Car Stops

Provide car stops where indicated. Install with an anchor rod driven
through each sleeve.

3.3 FIELD QUALITY CONTROL

Sample shall be taken by Contractor as specified herein. Contractor shall
replace pavement where sample cores have been removed. Submit [2] [_____]
pavement cores when using the in-place nuclear density method.

3.3.1 Sample and Core Identification

Place each sample and core in a container and securely seal to prevent loss
of material. Tag each sample for identification. Tag shall contain the
following information:

- a. Contract No.
- b. Sample No.
- c. Quantity
- d. Date of Sample
- e. Sample Description
- f. Source/Location/Stations Placed/depth below the finish grade
- g. Intended Use

h. Thicknesses of various lifts placed

3.3.2 Testing

3.3.2.1 Bituminous Mix Testing

Take two samples per day per mix type at plant or from truck. Test uncompacted mix for extraction in accordance with ASTM D 2172 and sieve analysis in accordance with AASHTO T 30. Test samples for stability and flow in accordance with ASTM D 1559. When two consecutive tests fail to meet requirements of specifications, cease placement operations and test a new trial batch prior to resumption of placement operations. Submit [2] [_____] per day of each mix type. When two tests on uncompacted mix fail submit new trial batch for approval.

3.3.2.2 Testing of Pavement Course

- a. Density: Determine density of pavement by testing cores obtained from the binder and wearing course in accordance with AASHTO T 230. Take three cores at location designated by Contracting Officer for each [18 metric tons] [200 tons] [_____] , or fraction thereof, of asphalt placed. Deliver cores undisturbed and undamaged to laboratory and provide test results within [48] [_____] hours of each day placement of paving materials.
- b. Thickness: Determine thickness of the binder and wearing course from cores taken for density test.
- c. Straightedge Test: Test compacted surface of binder course and wearing course with a straightedge as work progresses. Apply straightedge parallel with and at right angles to center line after final rolling. Variations in the binder course surface shall not be more than 6 [13] [3] mm 1/4 [1/2] [1/8] inches from the lower edge of the 3.0 m 10 foot straightedge; variations in wearing course surface shall not be more than 6 [13] [3] mm 1/4 [1/2] [1/8] from the lower edge of the 3.0 m 10 foot straightedge. Pavement showing irregularities greater than that specified shall be corrected as directed by Contracting Officer.

3.3.2.3 Alternate Testing Method for Pavement Courses

At Contractor's option the following in-place testing method may be used to determine density and thickness in lieu of testing specified above. Frequency of testing shall be the same. When in-place nuclear method to determine density is used, take two pavement cores at locations designated by Contracting Officer and turn over to Government to verify pavement thickness.

- a. Density: Determine density of pavement by in-place testing using Nuclear Method in accordance with ASTM D 2950.
- b. Thickness: Determine thickness of finished pavement by use of following equation:

$$t = \frac{W(1000)}{d}$$

Where t= pavement thickness, in mm.

W= average weight per square weight by kg per square meter of mixture
actually used in work.

d= compacted density as measured by nuclear density device, (psf) (kg/3

$$t = \frac{W}{0.75d}$$

Where t= pavement thickness, in inches.

W= average weight per square yard of mixture actually used in work.

d= compacted density as measured by nuclear density device.

-- End of Section --