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USACE / NAVFAC / AFCEA / NASA            UFGS-32 11 16.16 (April 2006)  
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Preparing Activity:    NAVFAC            Replacing without change  
   UFGS-02721 (August 2004)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 1 April 2006

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### SECTION 32 11 16.16

[BASE COURSE FOR RIGID] [AND SUBBASE COURSE FOR FLEXIBLE] PAVING  
04/06

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NOTE: This guide specification covers the requirements for select-material base course for rigid pavement and select-material subbase course for flexible pavement.

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.

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NOTE: The guide title must be edited to suit project requirements where the pavement structures so dictate.

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## PART 1   GENERAL

### 1.1   REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's

Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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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.

#### ASTM INTERNATIONAL (ASTM)

ASTM C 117	(2004) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 131	(2003) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(2005) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 29/C 29M	(1997; R 2003) Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2002e1) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 1883	(1999) CBR (California Bearing Ratio) of Laboratory-Compacted Soils
ASTM D 2922	(2004) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2940	(2003) Graded Aggregate Material for Bases or Subbases for Highways or Airports
ASTM D 3017	(2004) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(2000) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 75	(2003) Sampling Aggregates

#### 1.2 SUBMITTALS

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NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

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, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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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 01 33 00 SUBMITTAL PROCEDURES:

#### SD-05 Design Data

Gradation curve

#### SD-06 Test Reports

Bearing ratio

Liquid limit

Plasticity index

Dry weight of slag

Percentage of wear

Gradation tests

Density tests

## SD-07 Certificates

### Source

Location and name.

#### 1.3 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the site and store aggregates in a manner that will prevent segregation and contamination.

#### 1.4 CONSTRUCTION EQUIPMENT

Subject to approval of the Contracting Officer, special equipment as dictated by local conditions may be used. Calibrated equipment, such as scales, batching equipment, spreaders, and other similar equipment, shall have been calibrated by [a calibration laboratory approved by the Contracting Officer] [a state calibration laboratory] within [12] [\_\_\_\_\_] months of commencing work.

#### 1.5 ENVIRONMENTAL REQUIREMENTS

Do not construct course when atmospheric temperature is below 1.5 degrees C 35 degrees F or when weather conditions could detrimentally affect quality of finished course. When temperature falls below 1.5 degrees C 35 degrees F, protect areas of completed course against freezing.

## PART 2 PRODUCTS

### 2.1 MATERIALS

ASTM D 2940, except as modified herein. Material shall consist of natural, processed or blends of gravel, stone, slag, chert, caliche, limerock, coral, shell, quarry and mine waste, sand, or screenings, and soil or other similar binding or filler material. Obtain materials from sources approved by the Contracting Officer. Preliminary approval of pits shall not mean that material found in the deposit will be acceptable. Maximum dimensions of material particles shall not be greater than two-thirds the compacted thickness of the layer in which it is to be placed. Coarse aggregate shall have a percentage of wear of not more than 40 as determined by ASTM C 131. Material shall have a bearing ratio of at least [30] [\_\_\_\_\_] as determined by laboratory test on a four day soaked specimen in accordance with ASTM D 1883; compact the specimen in accordance with ASTM D 1557, Method B, C, or D. Material passing the 425 micrometers No. 40 sieve shall have a liquid limit of not more than 25 and a plasticity index of not more than 5 in accordance with ASTM D 4318. Slag shall be an air-cooled blast furnace product having a dry weight not less than 1041 kg per cubic meter 65 pounds per cubic foot when tested in accordance with ASTM C 29/C 29M and consisting of angular fragments uniform in density and quality and reasonably free from thin and elongated pieces, dirt, or other objectionable material. Gradation of the final composite mixture shall conform to the following size and shall be the basis of the gradation curve:

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**NOTE: The gradation shown in the following table is the minimum recommended to obtain a California Bearing Ratio (CBR) of 30. If a CBR greater than 30 is required, specify a gradation to suit. Where**

possible, select a gradation to suit local materials and project requirements. To provide adequate drainage under rigid pavements, the base course should contain little or no fines (material that passes the 75 micrometers No. 200 sieve).

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Sieve Size (Square Openings)	Design Range (Percent Passing)	Job Mix Tolerance (Percent)
50 mm	100	-3
38 mm	90-100	+5
4.75 mm	30-60	<u>+10</u>
75 mm	0-15	+5

  

Sieve Size (Square Openings)	Design Range (Percent Passing)	Job Mix Tolerance (Percent)
2 inch	100	-3
1 1/2 inch	90-100	+5
No. 4	30-60	<u>+10</u>
No. 200	0-15	+5

## 2.2 SOURCE QUALITY CONTROL

Prior to production and delivery of aggregates, take at least one initial sample in accordance with ASTM D 75. Collect each sample by taking three incremental samples at random from source material to make a composite sample of not less than 22 kg 50 pounds. Repeat sampling procedure when source of material is changed or when deficiencies or variations from specified grading of materials are found in testing.

## PART 3 EXECUTION

### 3.1 GRADE CONTROL

Provide line and grade stakes for control. Place grade stakes in lanes parallel to centerline of areas to be paved and space for string lining or other control methods.

### 3.2 PLACING AND MIXING

Clean underlying surface of foreign substances and ensure proper compaction and smoothness before placement of course. Recondition, reshape, and recompact areas damaged by freezing, rainfall, or other weather conditions. Mix and place materials to obtain a uniform course for the water content and gradation specified. Construct course in one or more layers. Make each layer between 75 and 200 mm 3 and 8 inches in compacted thickness.

### 3.3 COMPACTING AND FINISHING

Compact each layer to at least [100] [\_\_\_\_\_] percent of the maximum laboratory density determined in accordance with ASTM D 1557. Compact material inaccessible to rolling equipment by mechanical tamping. Finish surface of the layer by blading and rolling. Blade, roll, and tamp until surface is smooth and free from waves and irregularities. Aerate material excessively moistened by rain during construction. Aerate using blade graders, harrows, or other equipment until the moisture content is that

needed to obtain specified density. Place and compact earth at edges of course for at least 300 mm one foot of the shoulder.

### 3.4 FIELD QUALITY CONTROL

#### 3.4.1 Sampling During Construction

Take one random sample of each [1000] [\_\_\_\_\_] metric tons [1000] [\_\_\_\_\_] tons of material placed, but not less than one random sample per day's run. Take samples in accordance with ASTM D 75.

#### 3.4.2 Testing

##### 3.4.2.1 Material

Make gradation tests from each sample in accordance with ASTM C 136. Determine material passing the 75 micrometers No. 200 sieve in accordance with ASTM C 117.

##### 3.4.2.2 Smoothness Test

Test with a 3 m 10 foot straightedge applied parallel with and at right angles to centerline of the rolled area. Correct surface deviations in excess of [10] [\_\_\_\_\_] mm [3/8] [\_\_\_\_\_] inch by loosening, adding or removing material, reshaping, watering, and compacting. When course is constructed in more than one layer, smoothness requirements apply only to the top layer.

##### 3.4.2.3 Field Density Tests

ASTM D 1556 or ASTM D 2922, and ASTM D 3017. Take one field density test for each [400] [\_\_\_\_\_] square meters [500] [\_\_\_\_\_] square yards of each layer of course. When using ASTM D 2922 and ASTM D 3017 to test field compaction densities, verify the results of the tests by performing one test per day using ASTM D 1556 at locations previously tested by ASTM D 2922 and ASTM D 3017 and one additional test using ASTM D 1556 for every ten tests performed at locations previously tested by ASTM D 2922 and ASTM D 3017.

##### 3.4.2.4 Laboratory Density Tests

ASTM D 1557, Method B, C, or D, for all material.

##### 3.4.2.5 Thickness Test

Determine thickness of course from test holes not less than 75 mm 3 inches in diameter. Obtain a thickness test for each [400] [\_\_\_\_\_] square meters [500] [\_\_\_\_\_] square yards of course. Where course deficiency is more than 13 mm 1/2 inch, correct by scarifying, adding mixture of proper gradation, reblading, and recompacting. Where the measured thickness exceeds the indicated thickness by more than 13 mm 1/2 inch, consider the measured thickness as the indicated or specified thickness plus 13 mm 1/2 inch for determining the average. The average thickness shall be the average of the depth measurements and shall not underrun the thickness shown by more than 6 mm 1/4 inch.

### 3.5 MAINTENANCE

After construction is completed, protect and maintain all areas of course

against detrimental effects. Maintenance includes drainage, rolling, shaping, watering, or other action required to maintain course in proper condition. Maintain sufficient moisture by light sprinkling with water at the surface to prevent a dusty condition.

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