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USACE / NAVFAC / AFCEA / NASA UFGS-32 15 00 (April 2008)  
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Preparing Activity: USACE Superseding  
UFGS-32 15 00 (April 2006)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2012

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SECTION TABLE OF CONTENTS

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 32 15 00

AGGREGATE SURFACE COURSE

04/08

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 UNIT PRICES
  - 1.2.1 Measurement
  - 1.2.2 Payment
- 1.3 SUBMITTALS
- 1.4 QUALITY ASSURANCE
  - 1.4.1 Sampling
  - 1.4.2 Testing
    - 1.4.2.1 Gradation
    - 1.4.2.2 Liquid Limit and Plasticity Index
  - 1.4.3 Approval of Materials
  - 1.4.4 Equipment
- 1.5 ENVIRONMENTAL REQUIREMENTS

PART 2 PRODUCTS

- 2.1 AGGREGATES
  - 2.1.1 Coarse Aggregates
  - 2.1.2 Fine Aggregates
  - 2.1.3 Gradation Requirements
- 2.2 LIQUID LIMIT AND PLASTICITY INDEX REQUIREMENTS

PART 3 EXECUTION

- 3.1 OPERATION OF AGGREGATE SOURCES
- 3.2 STOCKPILING MATERIALS
- 3.3 COMPACTION
- 3.4 PREPARATION OF UNDERLYING COURSE SUBGRADE
- 3.5 GRADE CONTROL
- 3.6 MIXING AND PLACING MATERIALS
- 3.7 LAYER THICKNESS
- 3.8 PROOF ROLLING
- 3.9 EDGES OF AGGREGATE-SURFACED ROAD
- 3.10 SMOOTHNESS TEST

3.11 THICKNESS CONTROL  
3.12 DENSITY TESTS  
3.13 WEAR TEST  
3.14 MAINTENANCE

-- End of Section Table of Contents --

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### SECTION 32 15 00

#### AGGREGATE SURFACE COURSE 04/08

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NOTE: This guide specification covers the requirements for aggregate surfacing for roads, streets, and parking areas.

Adhere to [UFC 1-300-02](#) Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a [Criteria Change Request \(CCR\)](#).

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## PART 1 GENERAL

### 1.1 REFERENCES

\*\*\*\*\*

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.

\*\*\*\*\*

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 C117	(2004) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131	(2006) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D1556	(2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	(2009) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft <sup>3</sup> ) (2700 kN-m/m <sup>3</sup> )
ASTM D2167	(2008) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D3740	(2012) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D422	(1963; R 2007) Particle-Size Analysis of Soils
ASTM D4318	(2010) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D6938	(2010) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D75/D75M	(2009) Standard Practice for Sampling Aggregates
ASTM E11	(2009e1) Wire Cloth and Sieves for Testing Purposes

## 1.2 UNIT PRICES

\*\*\*\*\*  
NOTE: Delete this paragraph for lump-sum  
construction projects.  
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### 1.2.1 Measurement

The quantity of aggregate surface course completed and accepted as determined by the Contracting Officer shall be measured in [square] [cubic] meters yards. [The volume of aggregate surface course in place and accepted by the Contracting Officer shall be determined by the average job thickness obtained in accordance with paragraph THICKNESS CONTROL and the dimensions shown on approved drawings] [\_\_\_\_\_].

### 1.2.2 Payment

Quantities of aggregate surface course for roads and airfields, as measured above, will be paid for at the respective contract unit prices. Payment will constitute full compensation for the construction and completion of the aggregate surface course, including furnishing all labor and incidentals necessary to complete the work required by this section.

## 1.3 SUBMITTALS

\*\*\*\*\*  
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.

The Guide Specification technical editors have designated those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, 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.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment

SD-06 Test Reports

Sampling and Testing  
Density Tests

1.4 QUALITY ASSURANCE

\*\*\*\*\*  
NOTE: Field density tests and laboratory tests are generally performed at a frequency of one set of tests for every 1,000 square meters (yards) of completed area. Other frequency intervals may be specified when conditions warrant. It is important that both field density tests and laboratory tests be conducted on the same materials.  
\*\*\*\*\*

Sampling and testing is the responsibility of the Contractor. Submit calibration curves and related test results prior to using the device or equipment being calibrated. Submit copies of field test results within [24] [\_\_\_\_\_] hours after the tests are performed. Test results from samples, not less than [30] [\_\_\_\_\_] days before material is required for the work. Results of laboratory tests for quality control purposes, for approval, prior to using the material. Sampling and testing shall be performed by an approved commercial testing laboratory or by the Contractor, subject to approval. If the Contractor elects to establish its own testing facilities, approval of such facilities will be based on compliance with ASTM D3740. No work requiring testing will be permitted until the Contractor's facilities have been inspected and approved.

1.4.1 Sampling

Take samples for material gradation, liquid limit, and plastic limit tests in conformance with ASTM D75/D75M. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.4.2 Testing

1.4.2.1 Gradation

Make aggregate gradation in conformance with ASTM C117, ASTM C136, and ASTM D422. Sieves shall conform to ASTM E11.

1.4.2.2 Liquid Limit and Plasticity Index

Determine liquid limit and plasticity index in accordance with ASTM D4318.

### 1.4.3 Approval of Materials

Select the source of the material to be used for producing aggregates [\_\_\_\_\_] days prior to the time the material will be required in the work. Approval of sources not already approved by the Corps of Engineers will be based on an inspection by the Contracting Officer. Tentative approval of materials will be based on appropriate test results on the aggregate source. Final approval of the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and compacted surface course.

### 1.4.4 Equipment

\*\*\*\*\*  
**NOTE: If desirable, requirements for types of equipment applicable to methods of construction based on local conditions will be included.**  
\*\*\*\*\*

Submit a list of proposed equipment to be used in performance of construction work including descriptive data. All plant, equipment, and tools used in the performance of the work covered by this section will be subject to approval by the Contracting Officer before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, and meeting the grade controls, thickness controls, and smoothness requirements set forth herein.

## 1.5 ENVIRONMENTAL REQUIREMENTS

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**NOTE: The first sentence of this paragraph may be deleted in localities where freezing temperatures do not occur.**  
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Aggregate surface courses shall not be constructed when the ambient temperatures is below 2 degrees C 35 degrees F and on subgrades that are frozen or contain frost. It is the responsibility of the Contractor to protect, by approved method or methods, all areas of surfacing that have not been accepted by the Contracting Officer. Surfaces damaged by freeze, rainfall, or other weather conditions shall be brought to a satisfactory condition by the Contractor.

## PART 2 PRODUCTS

### 2.1 AGGREGATES

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**NOTE: As written, this paragraph applies to general conditions. Other materials such as disintegrated granite, volcanic ash or cinders, limerock, and caliche will be specified when supported by adequate performance data. The requirement for soundness and percentage of wear will be deleted when local experience indicates the material is satisfactory.**

The gradation or gradations applicable to the specific job will be specified. The gradations

shown are recommended, but others may be used where they have been used successfully. The liquid limit and plasticity index specified are normally used, but may be changed as required. Gradations No. 3 and No. 4 may be susceptible to frost damage.

When an aggregate surfacing is used in construction of Army Class IV airfields, paragraph PROOF ROLLING will be retained, and the extent of proof rolling will be precisely shown on the drawings. When using the specifications for an aggregate surface course subjected to highway vehicular traffic such as roads, streets, and parking areas or for Army Class I, II, and III airfields, references to proof rolling will be deleted in paragraph AGGREGATES, and paragraph PROOF ROLLING will be deleted.

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Provide aggregates consisting of clean, sound, durable particles of natural gravel, crushed gravel, crushed stone, sand, slag, soil, or other approved materials processed and blended or naturally combined. Provide aggregates free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign materials. The Contractor is responsible for obtaining materials that meet the specification and can be used to meet the grade and smoothness requirements specified herein after all compaction and proof rolling operations have been completed.

#### 2.1.1 Coarse Aggregates

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**NOTE:** A percentage of wear other than 50 may be specified where experience indicates that the material is satisfactory.

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The material retained on the 5 mm No. 4 sieve shall be known as coarse aggregate. Coarse aggregates shall be reasonably uniform in density and quality. The coarse aggregate shall have a percentage of wear not to exceed 50 percent after 500 revolutions as determined by ASTM C131. The amount of flat and/or elongated particles shall not exceed 20 percent. A flat particle is one having a ratio of width to thickness greater than three; an elongated particle is one having a ratio of length to width greater than three. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the requirements set forth herein.

#### 2.1.2 Fine Aggregates

The material passing the 5 mm No. 4 sieve shall be known as fine aggregate. Fine aggregate shall consist of screenings, sand, soil, or other finely divided mineral matter that is processed or naturally combined with the coarse aggregate.

#### 2.1.3 Gradation Requirements

Gradation requirements specified in TABLE I shall apply to the completed aggregate surface. It is the responsibility of the Contractor to obtain materials that will meet the gradation requirements after mixing, placing, compacting, and other operations. TABLE I shows permissible gradings for



granular material used in aggregate surface roads and airfields. Sieves shall conform to **ASTM E11**.

**TABLE I. GRADATION FOR AGGREGATE SURFACE COURSES**  
Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	No. 1	No. 2	No. 3	No. 4
25.0 mm	100	100	100	100
9.5 mm	50-85	60-100	--	--
4.7 mm	35-65	50-85	55-100	70-100
2.00 mm	25-50	40-70	40-100	55-100
0.425 mm	15-30	24-45	20-50	30-70
0.075 mm	8-15	8-15	8-15	8-15

**TABLE I. GRADATION FOR AGGREGATE SURFACE COURSES**  
Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	No. 1	No. 2	No. 3	No. 4
1 in.	100	100	100	100
3/8 in.	50-85	60-100	--	--
No. 4	35-65	50-85	55-100	70-100
No. 10	25-50	40-70	40-100	55-100
No. 40	15-30	24-45	20-50	30-70
No. 200	8-15	8-15	8-15	8-15

## 2.2 LIQUID LIMIT AND PLASTICITY INDEX REQUIREMENTS

The portion of the completed aggregate surface course passing the **0.425 mm No. 40** sieve shall have a maximum liquid limit of 35 and a plasticity index of 4 to 9.

## PART 3 EXECUTION

### 3.1 OPERATION OF AGGREGATE SOURCES

Perform clearing, stripping, and excavating. Operate the aggregate sources to produce the quantity and quality of materials meeting these specification requirements in the specified time limit. Upon completion of the work, the aggregate sources on Government property shall be finalized to drain readily and be left in a satisfactory condition. Finalize aggregate sources on private lands in agreement with local laws or authorities.

### 3.2 STOCKPILING MATERIALS

\*\*\*\*\*  
**NOTE:** In cases where material previously stockpiled under a separate contract is utilized in the construction of the aggregate surface course, this requirement will be included in the **SPECIAL CONTRACT REQUIREMENTS** of the specifications, and this paragraph will be modified as required.  
 \*\*\*\*\*

Prior to stockpiling the material, clear and level the storage sites. All

materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Stockpile aggregates in such a manner that will prevent segregation. Aggregates and binders obtained from different sources shall be stockpiled separately.

### 3.3 COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in [ASTM D1557](#) abbreviated herein as present laboratory maximum density. Compact each layer of the aggregate surface course with approved compaction equipment, as required in the following paragraphs. The water content during the compaction procedure shall be maintained at optimum or at the percentage specified by the Contracting Officer. In locations not accessible to the rollers, the mixture shall be compacted with mechanical tampers. Compaction shall continue until each layer through the full depth is compacted to at least 100 percent of laboratory maximum density. Remove any materials that are found to be unsatisfactory and replace them with satisfactory material or rework them to produce a satisfactory material.

### 3.4 PREPARATION OF UNDERLYING COURSE SUBGRADE

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**NOTE: The reference to the specification section that covers the preparation of the subgrade surface for the particular project will be included in this paragraph.**  
\*\*\*\*\*

Clean of all foreign substances the [underlying course] [subgrade], including shoulders. At the time of surface course construction, the [underlying course] [subgrade] shall contain no frozen material. Ruts or soft yielding spots in the [underlying course] [subgrade] areas having inadequate compaction and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade and recompact to density requirements specified in Section [32 11 16.16](#) SUBBASE COURSES. The completed [underlying course] [subgrade] shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the surface course is placed.

### 3.5 GRADE CONTROL

During construction, the lines and grades including crown and cross slope indicated for the aggregate surface course shall be maintained by means of line and grade stakes placed by the Contractor in accordance with the SPECIAL CONTRACT REQUIREMENTS.

### 3.6 MIXING AND PLACING MATERIALS

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**NOTE: More details of applicable methods of placing, mixing, and spreading will be included when appropriate.**  
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The materials shall be mixed and placed to obtain uniformity of the

material and a uniform optimum water content for compaction. Make adjustments in mixing, placing procedures, or in equipment to obtain the true grades, to minimize segregation and degradation, to obtain the desired water content, and to ensure a satisfactory surface course.

### 3.7 LAYER THICKNESS

Place the aggregate material on the [underlying course] [subgrade] in layers of uniform thickness. When a compacted layer of 150 mm 6 inches or less is specified, the material may be placed in a single layer; when a compacted thickness of more than 150 mm 6 inches is required, no layer shall exceed 150 mm 6 inches nor be less than 75 mm 3 inches when compacted.

### 3.8 PROOF ROLLING

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NOTE: When an aggregate surfacing is used in construction of Army Class IV airfields, this paragraph will be retained, and the extent of proof rolling will be precisely shown on the drawings. When using the specifications for an aggregate surface course subjected to highway vehicular traffic such as roads, streets, and parking areas or for Army Class I, II, and III airfields, references to proof rolling will be deleted in paragraph AGGREGATES, and this paragraph will be deleted.

\*\*\*\*\*

Proof rolling of the areas designated shall be in addition to compaction specified above and shall consist of application of 30 coverages with a heavy rubber-tired roller having four tires abreast with each tire loaded to 13,600 kg 30,000 pounds and tires inflated to 1000 kPa 150 psi. In the areas designated, proof rolling shall be applied to the top lift of layer on which surface course is laid and to each layer of the base course. Water content of the lift of the layer on which the surface course is placed and each layer of the aggregate surface course shall be maintained at optimum or at the percentage directed from the start of compaction to the completion of a proof rolling. Materials in the aggregate surface course or underlying materials indicated unacceptable by the proof rolling shall be removed and replaced, as directed, with acceptable materials.

### 3.9 EDGES OF AGGREGATE-SURFACED ROAD

Approved material shall be placed along the edges of the aggregate surface course in such quantity as to compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, at least 300 mm 1 foot of shoulder width shall be rolled and compacted simultaneously with the rolling and compacting of each layer of the surface course.

### 3.10 SMOOTHNESS TEST

The surface of each layer shall not show any deviations in excess of 10 mm 3/8 inch when tested with a 3 m 10 foot straightedge applied both parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding this amount shall be corrected by removing material, replacing with new material, or reworking existing material and compacting, as directed.

### 3.11 THICKNESS CONTROL

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NOTE: When gravel surface courses are constructed less than 150 mm (6 inches) in total thickness, a deficiency of 13 mm (1/2 inch) in the thickness of any area of such paving is considered excessive. Applicable to job conditions, the thickness tolerances provisions will therefore be modified as required, restricting all deficiencies to not more than 6 mm (1/4 inch).

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The completed thickness of the aggregate surface course shall be within 13 mm 1/2 inch, plus or minus, of the thickness indicated on plans. The thickness of the aggregate surface course shall be measured at intervals in such manner that there will be a thickness measurement for at least each 500 square meters yards of the aggregate surface course. The thickness measurement shall be made by test holes at least 75 mm 3 inches in diameter through the aggregate surface course. When the measured thickness of the aggregate surface course is more than 13 mm 1/2 inch deficient in thickness, correct such areas by scarifying, adding mixture of proper gradation, reblading, and recompact, as directed, at no additional expense to the Government. Where the measured thickness of the aggregate surface course is more than 13 mm 1/2 inch thicker than that indicated, it shall be considered as conforming with the specified thickness requirements plus 13 mm 1/2 inch. The average job thickness shall be the average of the job measurements determined as specified above, but shall be within 6 mm 1/4 inch of the thickness indicated. When the average job thickness fails to meet this criterion, make corrections by scarifying, adding or removing mixture of proper gradation, and reblading and recompact, as directed, at no additional expense to the Government.

### 3.12 DENSITY TESTS

Measure density in the field in accordance with [ASTM D1556] [ASTM D2167] [ASTM D6938]. [For the method presented in ASTM D1556 use the base plate as shown in the drawing.] [For the method presented in ASTM D6938 the calibration curves shall be checked and adjusted, if necessary, using only the sand cone method as described in paragraph Calibration of the ASTM publication.] Tests performed in accordance with ASTM D6938 result in a wet unit weight of soil and ASTM D6938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D6938. [The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration of ASTM D6938, on each different type of material being tested at the beginning of a job and at intervals, as directed.]

### 3.13 WEAR TEST

Perform wear tests in conformance with ASTM C131.

### 3.14 MAINTENANCE

Maintain the aggregate surface course in a condition that will meet all specification requirements until accepted.

-- End of Section --