Preparing Activity: USACE Superseding
UFGS-32 15 00 (April 2008)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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SECTION 32 15 00

AGGREGATE SURFACING
05/17

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

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 item(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).

PART 1 GENERAL

1.1 UNIT PRICES

NOTE: Delete this paragraph for lump sum construction projects.

1.1.1 Measurement

Measure the quantity of aggregate surface course completed and accepted, as determined by the Contracting Officer, in [square] [cubic] meters yards. The [volume] [area] of aggregate surface course in-place and accepted will be determined by the [average job thickness obtained in accordance with paragraph LAYER THICKNESS and the] dimensions shown on the drawings.

1.1.2 Payment

Quantities of aggregate surface course, determined as specified above, will be paid for at the respective contract unit prices, which will constitute full compensation for the construction and completion of the aggregate surface course.

1.1.3 Waybills and Delivery Tickets

Submit copies of waybills and delivery tickets during progress of the work. Before the final payment is allowed, file certified waybills and certified delivery tickets for all aggregates actually used.

1.2 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 Reference Identifier (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.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(2017) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
AASHTO T 224	(2010) Standard Method of Test for Correction for Coarse Particles in the Soil Compaction Test

ASTM INTERNATIONAL (ASTM)

ASTM C117	(2017) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131/C131M	(2020) Standard Test Method for Resistance

	to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D75/D75M	(2019) Standard Practice for Sampling Aggregates
ASTM D1556/D1556M	(2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D2167	(2015) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D4318	(2017; E 2018) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM E11	(2022) Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

1.3 DEGREE OF COMPACTION

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum laboratory dry density obtained by the test procedure presented in ASTM D1557 abbreviated as a percent of laboratory maximum dry density. Since ASTM D1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 9.0 mm 3/4 inch sieve, the degree of compaction for material having more than 30 percent by weight of their particles retained on the 9.0 mm 3/4 inch sieve will be expressed as a percentage of the laboratory maximum dry density in accordance with AASHTO T 180 Method D and corrected with AASHTO T 224.

1.4 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified 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 Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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

****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification 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

Plant, Equipment, and Tools; G[, [_____]]

Waybills And Delivery Tickets

SD-06 Test Reports

Initial Tests; G[, [_____]]

In-Place Tests; G[, [_____]]

1.5 EQUIPMENT, TOOLS, AND MACHINES

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

****

All plant, equipment, and tools used in the performance of the work will be subject to approval by the Contracting Officer before the work is started. Maintain all plant, equipment, and tools in satisfactory working condition at all times. Submit a list of proposed equipment, including descriptive data. Provide adequate equipment having the capability of

minimizing segregation, producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

1.6 QUALITY ASSURANCE

Sampling and testing are the responsibility of the Contractor. Perform sampling and testing using a laboratory approved in accordance with Section 01 45 0001 45 00.00 40 QUALITY CONTROL. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. Test the materials to establish compliance with the specified requirements and perform testing at the specified frequency. The Contracting Officer may specify the time and location of the tests. Furnish copies of test results to the Contracting Officer within 24 hours of completion of the tests.

1.6.1 Sampling

Take samples for laboratory testing in conformance with ASTM D75/D75M. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.6.2 Testing

1.6.2.1 Sieve Analysis

Perform sieve analysis in conformance with ASTM C117 and ASTM C136/C136M using sieves conforming to ASTM E11.

1.6.2.2 Liquid Limit and Plasticity Index

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

1.6.2.3 Moisture-Density Determinations

Determine the laboratory maximum dry density and optimum moisture content in accordance with paragraph DEGREE OF COMPACTION.

1.6.2.4 Field Density Tests

Measure field density in accordance with ASTM D1556/D1556M, ASTM D2167 or ASTM D6938. For the method presented in ASTM D1556/D1556M use the base plate as shown in the drawing. For the method presented in ASTM D6938 check the calibration curves and adjust them, 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 will be used to determine the moisture content of the soil. Also check the calibration curves furnished with the moisture gauges along with density calibration checks as described in ASTM D6938. Make the calibration checks of both the density and moisture gauges using 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. Submit calibration curves and related test results prior to using the device or equipment being calibrated.

1.6.2.5 Wear Test

Perform wear tests on aggregate surface course material in conformance with ASTM C131/C131M.

1.7 ENVIRONMENTAL REQUIREMENTS

****

NOTE: This paragraph may be deleted in localities where freezing temperatures do not occur, and elsewhere when it is definitely known that the work will not be carried on during periods when such temperatures are to be expected. Otherwise, this requirement will be retained, but the protective measures specified may be modified to suit local conditions and individual project requirements.

****

Perform construction when the atmospheric temperature is above 2 degrees C 35 degrees F. 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. Bring surfaces damaged by freeze, rainfall, or other weather conditions to a satisfactory condition.

PART 2 PRODUCTS

2.1 AGGREGATES

****

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.

****

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

****

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

****

The material retained on the 5 mm No. 4 sieve is known as coarse aggregate. Use only coarse aggregates that are reasonably uniform in density and quality. Use only coarse aggregate having a percentage of wear not exceeding 50 percent after 500 revolutions as determined by ASTM C131/C131M. The amount of flat and/or elongated particles must 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 must meet the requirements set forth herein.

2.1.2 Fine Aggregates

The material passing the 5 mm No. 4 sieve is known as fine aggregate. Fine aggregate consists 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 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. Use sieves conforming to ASTM E11.

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

Sieve Designation (mm)	No. 1	No. 2	No. 3	No. 4
25 1 inch	100	100	100	100
9.5 3/8 inch	50-85	60-100	--	--
4.7 No. 4	35-65	50-85	55-100	70-100
2.00 No. 10	25-50	40-70	40-100	55-100
0.425 No. 40	15-30	24-45	20-50	30-70
0.075 No. 200	8-15	8-15	8-15	8-15

2.2 LIQUID LIMIT AND PLASTICITY INDEX

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

2.3 TESTS, INSPECTIONS, AND VERIFICATIONS

2.3.1 Initial Tests

Perform one of each of the following tests, on the proposed material prior to commencing construction, to demonstrate that the proposed material meets all specified requirements when furnished. Complete this testing for each source if materials from more than one source are proposed.

a. Sieve Analysis.

b. Liquid limit and plasticity index.

c. Moisture-density relationship.

d. Wear.

Submit certified copies of test results for approval not less than [30] [_____] days before material is required for the work.

2.3.2 Approval of Material

Tentative approval of material will be based on initial test results.

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, leave aggregate sources on Government property in a satisfactory condition so that they readily drain.] [Finalize aggregate sources on private lands in agreement with local laws or authorities.]

3.2 STOCKPILING MATERIAL

****

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

3.3 PREPARATION OF UNDERLYING [COURSE] [SUBGRADE]

****

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 the [underlying course] [subgrade] and shoulders of all foreign substances. Do not construct the surface course on [underlying course] [subgrade] that is frozen material. Correct 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 by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade and recompacting to density requirements specified in [Section 31 00 00 EARTHWORK] [Section 32 11 20 [BASE COURSE FOR RIGID][AND][SUBBASE] [SELECT-MATERIAL] [FOR FLEXIBLE PAVING]]. Do not allow traffic or other operations to disturb the completed [underlying course] [subgrade] and maintain in a satisfactory condition until the surface course is placed.

3.4 GRADE CONTROL

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

3.5 MIXING AND PLACING MATERIALS

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NOTE: More details of applicable methods of placing, mixing, and spreading will be included when appropriate.

****

Mix and place the materials 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.

3.6 LAYER THICKNESS

****

NOTE: When gravel surfaces 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 tolerance provisions may be modified as required, restricting all deficiencies to not more than 6 mm (1/4 inch).

****

Place the aggregate material on the [underlying course] [subgrade] in layers of uniform thickness. Compact the completed aggregate surface course to the thickness indicated. No individual layer may be thicker than

150 mm 6 inches nor be thinner than 75 mm 3 inches in compacted thickness. Compact the aggregate surface course to a total thickness that is within 13 mm 1/2 inch of the thickness indicated. Where the measured thickness is more than 13 mm 1/2 inch deficient, correct such areas by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 13 mm 1/2 inch thicker than indicated, the course will be considered as conforming to the specified thickness requirements. The average job thickness will be the average of all thickness measurements taken for the job and must be within 6 mm 1/4 inch of the thickness indicated. Measure the total thickness of the aggregate surface course at intervals of one measurement for each [500] [_____] square meters yards of surface course. Measure total thickness using 75 mm 3 inch diameter test holes penetrating the aggregate surface course.

3.7 COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D1557 abbreviated herein as percent laboratory maximum density. Compact each layer of the aggregate surface course with approved compaction equipment, as required in the following paragraphs. Maintain the water content during the compaction procedure at optimum or at the percentage specified by the Contracting Officer. Compact the mixture with mechanical tampers in locations not accessible to rollers. Continue compaction 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.

3.8 PROOF ROLLING

****

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 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.

****

In addition to the compaction specified above, proof roll the designated areas by application of 30 coverages of 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 kPa150 psi. In the areas designated, proof roll the top lift of layer on which surface course is laid and to each layer of the surface course. Maintain the water content of the lift of the layer on which the surface course is placed and each layer of the aggregate surface course at optimum or at the percentage directed from the start of compaction to the completion of a proof rolling. Remove and replace materials in the aggregate surface course or underlying materials indicated to be unacceptable by the proof rolling with acceptable materials as directed.

3.9 EDGES OF AGGREGATE SURFACE COURSE

Place approved material along the edges of the aggregate surface course in such quantity as to compact to the thickness of the course being constructed. Simultaneously roll and compact at least 300 mm 1 foot of shoulder width with the rolling and compacting of each layer of the surface course when the course is being constructed in two or more layers.

3.10 SMOOTHNESS TEST

Construct each layer so that the surface shows no 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. Correct deviations exceeding this amount by removing material, replacing with new material, or reworking existing material and compacting, as directed.

3.11 FIELD QUALITY CONTROL

3.11.1 In-Place Tests

Perform each of the following tests on samples taken from the placed and compacted aggregate surface course. Take samples and test at the rates indicated.

a. Perform density tests on every lift of material placed and at a frequency of one set of tests for every 250 [_____] square meters square yards, or portion thereof, of completed area.

b. Perform sieve analysis on every lift of material placed and at a frequency of one sieve analysis for every 500 [_____] square meters square yards, or portion thereof, of material placed.

c. Perform liquid limit and plasticity index tests at the same frequency as the sieve analysis.

d. Measure the thickness of the aggregate surface course at intervals providing at least one measurement for each 500 [_____] square meters yards of base course or part thereof. Measure the thickness using test holes, at least 75 mm 3 inch in diameter through the aggregate surface course.

3.11.2 Approval of Material

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 full coompacted aggregate surface course.

3.12 MAINTENANCE

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

-- End of Section --