
USACE / NAVFAC / AFCEA UFGS-02731 (August 2004)

Preparing Activity: USACE Superseding
UFGS-02731A (January 1998)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 23 June 2005

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08/04

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SECTION 02731

AGGREGATE SURFACE COURSE 08/04

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

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.

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.

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	(2004) Sieve Analysis of Fine and Coarse Aggregates
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 2167	(1994; R 2001) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2922	(2004) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(2004) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 3740	(2004) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D 422	(1963; R 2002) Particle-Size Analysis of Soils
ASTM D 4318	(2000) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 75	(2003) Sampling Aggregates
ASTM E 11	(2004) Wire Cloth and Sieves for Testing Purposes

1.2 UNIT PRICES

NOTE: Delete this paragraph for lump-sum construction projects.

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 DEGREE OF COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated herein as present laboratory maximum density.

1.4 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

Equipment

List of proposed equipment to be used in performance of construction work including descriptive data.

SD-06 Test Reports

Sampling and Testing
Density Tests

Calibration curves and related test results prior to using the device or equipment being calibrated. 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.

1.5 EQUIPMENT

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 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.

1.6 SAMPLING AND TESTING

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 shall be the responsibility of the Contractor. 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 D 3740. No work requiring testing will be permitted until the Contractor's facilities have been inspected and approved.

1.6.1 Sampling

Sampling for material gradation, liquid limit, and plastic limit tests shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.6.2 Testing

1.6.2.1 Gradation

Aggregate gradation shall be made in conformance with ASTM C 117, ASTM C 136, and ASTM D 422. Sieves shall conform to ASTM E 11.

1.6.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

1.6.3 Approval of Materials

The source of the material to be used for producing aggregates shall be selected [_____] 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.

1.7 WEATHER LIMITATIONS

NOTE: The first sentence of this paragraph may be
deleted in localities where freezing temperatures do
not occur.

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 shall be 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

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.

Aggregates shall consist 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. Aggregates shall be free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign materials. The Contractor shall be 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 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 C 131. 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 shall be 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 E 11.

TABLE I. GRADATION FOR AGGREGATE SURFACE COURSES

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

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

Clearing, stripping, and excavating shall be the responsibility of the Contractor. The aggregate sources shall be operated 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 conditioned to drain readily and be left in a satisfactory condition. Aggregate sources on private lands shall be conditioned 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, the storage sites shall be cleared and

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

The [underlying course] [subgrade], including shoulders, shall be cleaned of all foreign substances. 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 recompacting to density requirements specified in Section 02721 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.

3.4 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.

3.5 MIXING AND PLACING MATERIALS

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

The materials shall be mixed and placed to obtain uniformity of the material and a uniform optimum water content for compaction. The Contractor shall 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

The aggregate material shall be placed 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.

3.7 COMPACTION

Each layer of the aggregate surface course shall be compacted with approval compaction equipment. 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. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked 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 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). 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) 3/8 inch when tested with a 3 m (10 foot) 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 the Contractor by removing material, replacing with new material, or reworking existing material and compacting, as directed.

3.11 THICKNESS CONTROL

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).

The completed thickness of the aggregate surface course shall be within 13 mm (1/2 inch), 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) 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) 1/2 inch deficient in thickness, the Contractor, at no additional expense to the Government, shall correct such areas by scarifying, adding mixture of proper gradation, reblading, and recompacting, as directed. Where the measured thickness of the aggregate surface course is more than 13 mm (1/2 inch) 1/2 inch) thicker than that indicated, it shall be considered as conforming with the specified thickness requirements plus 13 mm (1/2 inch). 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) 1/4 inch of the thickness indicated. When the average job thickness fails to meet this criterion, the Contractor shall, at no additional expense to the Government, make corrections by scarifying, adding or removing mixture of proper gradation, and reblading and recompacting, as directed.

3.12 DENSITY TESTS

Density shall be measured in the field in accordance with [ASTM D 1556] [ASTM D 2167] [ASTM D 2922]. [For the method presented in ASTM D 1556 the base plate as shown in the drawing shall be used.] [For the method presented in ASTM D 2922 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 D 2922 result in a wet unit weight of soil and when using this method, ASTM D 3017 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 D 3017. [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 D 2922, on each different type of material being tested at the beginning of a job and at intervals, as directed.]

3.13 WEAR TEST

Wear tests shall be made in conformance with ASTM C 131.

3.14 MAINTENANCE

The aggregate surface course shall be maintained in a condition that will meet all specification requirements until accepted.

-- End of Section --