UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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SECTION 32 11 23

AGGREGATE BASE COURSES
08/17

****
NOTE: This guide specification covers the requirements for base course to be used directly under bituminous pavement courses.

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

****
NOTE: This guide specification is applicable to base courses placed directly beneath bituminous surface courses. The following must be taken into consideration when editing this specification.

a. The material in this specification and on the drawings should be referred to as "aggregate base course (ABC)" whenever a base course material with a California Bearing Ratio (CBR) of 80 is required. "Aggregate Base Course" should be retained in the title and the rest of the specification should be edited accordingly to retain the information necessary for this material.

b. The material in this specification and on the

drawings should be referred to as "graded-crushed aggregate base course (GCA)" wherever a base material with a CBR of 100 is required. "Graded-Crushed Aggregate Base Course" should be retained in the title and the rest of the specification should be edited accordingly to retain the information necessary for this material.

c. When this specification is to be used in projects that require both types of materials, the title of this specification should be "Aggregate and/or Graded-Crushed Aggregate Base Course". Care must then be taken to assure that the drawings clearly call out which material is being used in any particular place and that this specification is edited to retain the information for both types of materials. If only a small amount of one of these types of materials is needed for the project, consideration should be made to determine if only one of these materials should be specified and the design adjusted.

****

1.1 UNIT PRICES

****

NOTE: Delete unit price paragraphs when the work is covered by a lump-sum contract price.

****

1.1.1 Measurement

****

NOTE: Delete the method of measurement paragraph not applicable to job conditions. The provision for stockpiling should be retained or deleted, as applicable.

****

1.1.1.1 Area

Measure the quantity of [___] mm inch thick [ABC] [and] [GCA] completed and accepted, as determined by the Contracting Officer, in square meters yards.

1.1.1.2 Volume

Measure the quantity of [ABC] [and] [GCA] completed and accepted, as determined by the Contracting Officer, in cubic meters yards. The volume of material 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.

1.1.1.3 Weight

The tonnage of [ABC] [and] [GCA] material will be the number of metric tons tons of aggregate, [placed and accepted in the completed course] [plus the amount] [placed in authorized stockpiles], as determined by the Contracting Officer. Deductions will be made for any material wasted,

unused, rejected, or used for convenience of the Contractor, and for water exceeding specified amount at time of weighing.

1.1.2 Payment

1.1.2.1 Base Course Material

Quantities of [ABC] [and] [GCA], 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 [ABC] [and] [GCA].

1.1.2.2 Stabilization

Cohesionless subgrade or subbase courses to be stabilized, as specified in paragraph PREPARATION OF UNDERLYING COURSE OR SUBGRADE, will be paid for as a special item on a tonnage basis including extra manipulation as required.

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 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 in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 88 (2013) Standard Method of Test for

	Particle Size Analysis of Soils
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 C29/C29M	(2017a) Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C88	(2018) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	(2017) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C127	(2015) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C128	(2015) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
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 D2487	(2017; E 2020) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification

	System)
ASTM D4318	(2017; E 2018) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D5821	(2013; R 2017) Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
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	(2020) Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

1.3 DEFINITIONS

For the purposes of this specification, the following definitions apply.

1.3.1 Aggregate Base Course

Aggregate base course (ABC) is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.3.2 Graded-Crushed Aggregate Base Course

Graded-crushed aggregate (GCA) base course is well graded, crushed, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.3.3 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 19.0 mm 3/4 inch sieve, the degree of compaction for material having more than 30 percent by weight of their particles retained on the 19.0 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

****

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. Use equipment capable 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 00.00 1001 45 00.00 2001 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 Tests

1.6.2.1 Sieve Analysis

****

NOTE: Testing in accordance with AASHTO T 88 will be required when the materials need to be tested for the percentage passing the 0.02 mm particle size. See paragraph Gradation Requirements.

****

Perform sieve analysis in conformance with ASTM C117 and ASTM C136/C136M using sieves conforming to ASTM E11. [Perform particle-size analysis of the soils in conformance with AASHTO T 88].

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 [ABC] [and] [GCA] course material in conformance with ASTM C131/C131M.

1.6.2.6 Soundness

****
NOTE: Retain this paragraph only for graded-crushed aggregate base course.
****

Perform soundness tests on GCA in accordance with ASTM C88.

1.6.2.7 Weight of Slag

****
NOTE: This paragraph will be omitted when it is highly unlikely that slag will be supplied as base course material.
****

Determine weight per cubic meter foot of slag in accordance with ASTM C29/C29M on the [ABC] [and] [GCA] course material.

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. When the temperature falls below 2 degrees C 35 degrees F, protect all completed areas by approved methods against detrimental effects of freezing. Correct completed areas damaged by freezing, rainfall, or other weather conditions to meet specified requirements.

PART 2 PRODUCTS

2.1 AGGREGATES

****
NOTE: Material requirements from State or other

local highway agency specifications may be incorporated in contract documents for constructing aggregate base course for roads, streets, or similar use pavements if the following conditions are met:

a. Percentage of material by weight passing the 0.075 mm (No. 200) sieve will not exceed 8.

b. Where local conditions dictate a non-frost-susceptible material, particles passing the 0.02 mm particle size will not exceed 3 percent.

c. Portion of the material passing the 0.425 mm (No. 40) sieve must have a liquid limit not greater than 25 and a plasticity index not greater than 5.

d. Projects requiring not more than 600 cubic meters (750 cubic yards) of material must be approved by the Division Engineer.

e. Projects requiring more than 600 cubic meters (750 cubic yards) must be approved by AFCEC, Navy EFD, or TSMCX prior to incorporation in the contract documents. A copy of the specifications or proper reference thereto and information regarding traffic conditions and facilities to be paved will be submitted to the AFCEC, Navy EFD or TSMCX, with the request for approval.

f. Materials to be used for GCA must also meet the specified L.A. Abrasion and Sulfate Soundness requirements.

g. Rounded aggregates (such as river-run gravel) will not be allowed since they do not provide sufficient interlocking action to produce the desired strengths and durability.

****

Provide [ABC] [and] [GCA] consisting of clean, sound, durable particles of crushed stone, [crushed slag,] crushed gravel, [crushed recycled concrete,] angular sand, or other approved material. [Provide ABC that is free of lumps of clay, organic matter, and other objectionable materials or coatings.] [Provide GCA that is free of silt and clay as defined by ASTM D2487, organic matter, and other objectionable materials or coatings.] The portion retained on the 4.75 mm No. 4 sieve is known as coarse aggregate; that portion passing the 4.75 mm No. 4 sieve is known as fine aggregate. When the coarse and fine aggregate is supplied form more than one source, provide aggregate from each source that meets the specified requirements.

2.1.1 Coarse Aggregate

Provide coarse aggregates with angular particles of uniform density. Separately stockpile coarse aggregate supplied from more than one source.

a. Crushed Gravel: Provide crushed gravel that has been manufactured by crushing gravels and that meets all the requirements specified below.

b. Crushed Stone: Provide crushed stone consisting of freshly mined quarry rock, meeting all the requirements specified below.

****

NOTE: Verify the subgrade soil contains less than 0.3 percent of sulfates, to prevent expansive ettringite reaction with the recycled concrete. See UFC 3-250-11, Appendix C for testing procedure. Otherwise, delete recycled concrete option.

Do not permit recycled concrete aggregate (RCA) to be used in a airfield pavement section without evaluating for Alkali-Silica Reactivity (ASR). See IPRF-01-G-002-03-5, "Evaluation, Design and Construction Techniques for Airfield Concrete Pavement Used as Recycled Material for Base." For Air Force projects, perform risk assessment in accordance with ETL 07-06, "Risk Assessment Procedures for Recycling Portland Cement Concrete (PCC) Suffering From Alkali-Silica Reaction (ASR) in Airfield Pavement Structures."

****

c. Crushed Recycled Concrete: Provide crushed recycled concrete consisting of previously hardened portland cement concrete or other concrete containing pozzolanic binder material. Provide recycled concrete that is free of all reinforcing steel, bituminous concrete surfacing, and any other foreign material and that has been crushed and processed to meet the required gradations for coarse aggregate. Reject recycled concrete aggregate exceeding this value. Provide crushed recycled concrete that meets all other applicable requirements specified below.

d. Crushed Slag: Provide crushed slag that is an air-cooled blast-furnace product having an air dry unit weight of not less than 1120 kg/cubic meter 70 pcf as determined by ASTM C29/C29M, and meets all the requirements specified below.

2.1.1.1 Aggregate Base Course

The percentage of loss of ABC coarse aggregate must not exceed 50 percent when tested in accordance with ASTM C131/C131M. Provide aggregate that contains no more than 30 percent flat and elongated particles. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregates must contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces determined in accordance with ASTM D5821. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Manufacture crushed gravel from gravel particles 50 percent of which, by weight, are retained on the maximum size sieve listed in TABLE 1.

2.1.1.2 Graded-Crushed Aggregate Base Course

****

NOTE: The percentages of wear and soundness

applicable to the specific job will be specified. A wear value of 40 will be used except that a value up to 50 percent may be used where local experience indicates that the material is satisfactory.
****

The percentage of loss of GCA coarse aggregate must not exceed [40] [50] percent loss when tested in accordance with ASTM C131/C131M. Provide GCA coarse aggregate that does not exhibit a loss greater than 18 percent weighted average, at five cycles, when tested for soundness in magnesium sulfate, or 12 percent weighted average, at five cycles, when tested in sodium sulfate in accordance with ASTM C88. Provide aggregate that contains no more than 20 percent flat and elongated particles for the fraction retained on the 12.5 mm 1/2 inch sieve nor 20 percent for the fraction passing the 12.5 mm 1/2 inch sieve. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregate must contain at least 90 percent by weight of crushed pieces having two or more freshly fractured faces determined in accordance with ASTM D5821. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Manufacture crushed gravel from gravel particles 90 percent of which by weight are retained on the maximum size sieve listed in TABLE 1.

2.1.2 Fine Aggregate

Provide fine aggregates consisting of angular particles of uniform density.

2.1.2.1 Aggregate Base Course

Provide ABC fine aggregate that consists of screenings, angular sand, crushed recycled concrete fines, or other finely divided mineral matter processed or naturally combined with the coarse aggregate.

2.1.2.2 Graded-Crushed Aggregate Base Course

****
NOTE: The GCA fine aggregate will be entirely the product of crushing, but need not be of the same material crushed for the coarse aggregate. Retain only the statement describing the method of crushing desired.
****

Provide GCA fine aggregate consisting of angular particles produced by crushing stone, slag, [recycled concrete,] or gravel that meets the requirements for wear and soundness specified for GCA coarse aggregate. [Produce fine aggregate by crushing only particles larger than 4.75 mm No. 4 sieve in size. Provide fine aggregate that contains at least 90 percent by weight of particles having two or more freshly fractured faces in the portion passing the 4.75 mm No. 4 sieve and retained on the 2 mm No. 10 sieve, and in the portion passing the 2 mm No. 10 sieve and retained on the 0.425 mm No. 40 sieve.] [Manufacture fine aggregate from gravel particles 95 percent of which by weight are retained on the 12.5 mm 1/2 inch sieve.]

2.1.3 Gradation Requirements

****

NOTE: Specify the gradation or gradations applicable to the specific job. The frost susceptibility requirement will be deleted in areas where the material is not subject to frost action. On the basis of local conditions, the percentage passing the 0.075 mm (No. 200) sieve may be further restricted to help control the amount of particles passing the 0.02 mm particle size. However, the cleaner gradations can have reduced stability. If more than one gradation is maintained, the designer must edit this specification and/or the project drawings to make sure it is evident where these different gradations are to be used.

****

Apply the specified gradation requirements to the completed base course. Provide aggregates that are continuously well graded within the limits specified in TABLE 1. Use sieves that conform to ASTM E11.

TABLE 1. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	No. 1	No. 2	No. 3
50.0 mm	100	----	----
37.5 mm	70-100	100	----
25.0 mm	45-80	60-100	100
12.5 mm	30-60	30-65	40-70
4.75 mm	20-50	20-50	20-50
2.00 mm	15-40	15-40	15-40
0.425 mm	5-25	5-25	5-25
0.075 mm	0-8	0-8	0-8

TABLE 1. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	No. 1	No. 2	No. 3
2 inch	100	----	----
1-1/2 inch	70-100	100	----
1 inch	45-80	60-100	100
1/2 inch	30-60	30-65	40-70
No. 4	20-50	20-50	20-50
No. 10	15-40	15-40	15-40
No. 40	5-25	5-25	5-25
No. 200	0-8	0-8	0-8

NOTE 1: Particles having diameters less than 0.02 mm must not be in excess of 3 percent by weight of the total sample tested as determined in accordance with AASHTO T 88.

NOTE 2: The values are based on aggregates of uniform specific gravity. If materials from different sources are used for the coarse and fine aggregates, test the materials in accordance with ASTM C127 and ASTM C128 to determine their specific gravities. Correct the percentages passing the various sieves as directed by the Contracting Officer if the specific gravities vary by more than 10 percent.

2.2 LIQUID LIMIT AND PLASTICITY INDEX

****

NOTE: Aggregate should be nonplastic or as nearly so as possible. Values shown are the absolute maximum allowable values for liquid limit and plasticity index.

****

Apply liquid limit and plasticity index requirements to the completed course and to any component that is blended to meet the required gradation. The portion of any component or of the completed course passing the 0.425 mm No. 40 sieve must be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

2.3 TESTS, INSPECTIONS, AND VERIFICATIONS

2.3.1 Initial Tests

****

NOTE: The 0.02 mm sieve analysis requirements will be included when frost susceptibility concerns exist.

****

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 [including 0.02 mm material].

b. Liquid limit and plasticity index.

c. Moisture-density relationship.

d. Wear.

e. [Soundness].

f. [Weight per cubic meter foot of Slag].

g. [_____].

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 GENERAL REQUIREMENTS

When the [ABC] [or] [GCA] is constructed in more than one layer, clean the previously constructed layer of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Provide adequate drainage during the entire period of construction to prevent water from collecting or standing on the working area.

3.2 OPERATION OF AGGREGATE SOURCES

****

NOTE: Retain the first sentence in brackets for aggregate sources on private lands. Retain the second sentences in brackets for aggregate sources on Government-owned land.

****

[Condition aggregate sources on private lands in accordance with local laws or authorities.] [Clearing, stripping, and excavating are the responsibility of the Contractor. Condition aggregate sources on Government property to readily drain and leave in a satisfactory condition upon completion of the work.]

3.3 STOCKPILING MATERIAL

Clear and level storage sites prior to stockpiling of material. Stockpile all materials, including approved material available from excavation and grading, in the manner and at the locations designated. Stockpile aggregates on the cleared and leveled areas designated by the Contracting Officer to prevent segregation. Stockpile materials obtained from different sources separately.

3.4 PREPARATION OF UNDERLYING COURSE OR SUBGRADE

****

NOTE: The surface of a cohesionless subgrade or subbase may require stabilization prior to placement of the base course. This may be accomplished by compacting a layer of crushed aggregate into the surface. It may also be obtained by methods based on local experience. The additional crushed aggregate will be considered as part of the underlying course and may be paid for or included in the specification section that covers the preparation of subgrade or subbase for the particular project.

****

Clean the underlying course or subgrade of all foreign substances prior to constructing the base course(s). Do not construct base course(s) on underlying course or subgrade that is frozen. Construct the surface of the underlying course or subgrade to meet specified compaction and surface tolerances. Correct ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the specified requirements set forth herein by loosening and removing soft or unsatisfactory material and adding approved material, reshaping to

line and grade, and recompacting to specified density requirements. For cohesionless underlying courses or subgrades containing sands or gravels, as defined in ASTM D2487, stabilize the surface prior to placement of the base course(s). Stabilize by mixing [ABC] [or] [GCA] into the underlying course and compacting by approved methods. Consider the stabilized material as part of the underlying course and meet all requirements of the underlying course. Do not allow traffic or other operations to disturb the finished underlying course and maintain in a satisfactory condition until the base course is placed.

3.5 GRADE CONTROL

Provide a finished and completed base course conforming to the lines, grades, and cross sections shown. Place line and grade stakes as necessary for control.

3.6 MIXING AND PLACING MATERIALS

****

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

NOTE: Course and fine aggregates should normally be mixed in a stationary plant to provide uniformity of the material.

****

Mix the coarse and fine aggregates in a stationary plant[, or in a traveling plant or bucket loader on an approved paved working area]. Make adjustments in mixing procedures or in equipment, as directed, to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory base course meeting all requirements of this specification. Place the mixed material on the prepared subgrade or subbase in layers of uniform thickness with an approved spreader. Place the layers so that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the base course is placed in more than one layer, clean the previously constructed layers of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Make adjustments in placing procedures or equipment as may be directed by the Contracting Officer to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to insure an acceptable base course.

3.7 LAYER THICKNESS

****

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

****

Compact the completed base 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 base course(s) 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 base course at intervals of one measurement for each [500] [_____] square meters yards of base course. Measure total thickness using 75 mm 3 inch diameter test holes penetrating the base course.

3.8 COMPACTION

****

NOTE: Cohesionless materials are often free-draining; as such, the optimum water content is normally limited to the maximum water content the material will retain. This is usually evidenced by free water running from the mold during compaction testing.

****

Compact each layer of the base course, as specified, with approved compaction equipment. Maintain water content during the compaction procedure to within plus or minus [2] [_____] percent of the optimum water content determined from laboratory tests as specified in this Section. Begin rolling at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Slightly vary the length of alternate trips of the roller. Adjust speed of the roller as needed so that displacement of the aggregate does not occur. Compact mixture with hand-operated power tampers in all places not accessible to the rollers. Continue compaction until each layer is compacted through the full depth to at least [100] [_____] percent of laboratory maximum density. Make such adjustments in compacting or finishing procedures as may be directed by the Contracting Officer to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory base course. Remove any materials found to be unsatisfactory and replace with satisfactory material or rework, as directed, to meet the requirements of this specification.

3.9 PROOF ROLLING

****

NOTE: Drawings should be checked to ensure that any supplementary information required by this paragraph has been shown and that there is no conflict between the drawings and the specifications.

Proof rolling is only required when a base course is used under a flexible airfield pavement with the following conditions:

Proof roll the top of each layer of base course of Type A traffic areas (primary taxiways) and the center 23 m (75 feet) of runways with 30 coverages

for Class IV as well as heavy, modified heavy, and medium load runways. Proof roll top of each layer of base course on center 30.5 meters (100 feet) of runways that support fighter aircraft only (no P-8 or heavier aircraft) with 8 coverages. Proof roll top of completed subbase course on center 12 meters (40 feet) of taxiways that are not Type A traffic. Apply 4 coverages to all other paved areas, exclusive of runway overrun and blast protection areas.

The required proof roller is a rubber-tired roller ballasted to 13,600 kg (30,000 pounds) per tire with a tire inflation pressure of at least 862 kPa (125 psi). Typical commercial models have four wheels abreast and a gross load of 54,430 kg (60 tons).

****

In addition to the compaction specified, proof roll areas designated on the drawings by application of [_____] coverages of a heavy pneumatic-tired roller having four or more tires abreast, each tire loaded to a minimum of 13,600 kg 30,000 pounds and inflated to a minimum of 862 kPa 125 psi. A coverage is defined as the application of one tire print over the designated area. In the areas designated, apply proof rolling to the top of the underlying material on which the base course is laid and to the top of [each layer of] [the completed] base course. Maintain water content of the underlying material and each layer of the base course as specified in Paragraph COMPACTION from start of compaction to completion of proof rolling of that layer. Remove any base course materials or any underlying materials that produce unsatisfactory results by proof rolling and replace with satisfactory materials. Then recompact and proof roll to meet these specifications.

3.10 EDGES OF BASE COURSE

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NOTE: Coordinate the first sentence with the typical pavement sections shown on the drawings. The extra width of material is provided for a working platform during construction. This will provide the paving equipment a solid surface to track on and will help ensure a smoother pavement.

****

[Place the base course(s) so that the completed section will be a minimum of [600] [_____] mm [2] [_____] feet wider, on all sides, than the next layer that will be placed above it.] Place approved material along the outer edges of the base course in sufficient quantity to compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, simultaneously roll and compact at least a 600 mm 2 foot width of this shoulder material with the rolling and compacting of each layer of the base course, as directed.

3.11 FINISHING

Finish the surface of the top layer of base course after [final compaction] [and] [proof rolling] by cutting any overbuild to grade and rolling with a steel-wheeled roller. Do not add thin layers of material to the top layer of base course to meet grade. If the elevation of the

top layer of base course is 13 mm 1/2 inch or more below grade, scarify the top layer to a depth of at least 75 mm 3 inches and blend new material in and compact [and proof roll] to bring to grade. Make adjustments to rolling and finishing procedures as directed by the Contracting Officer to minimize segregation and degradation, obtain grades, maintain moisture content, and insure an acceptable base course. Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, scarify the unsatisfactory portion and rework and recompact it or replace as directed.

3.12 SMOOTHNESS TEST

Construct the top layer so that the surface shows no deviations in excess of 10 mm 3/8 inch when tested with a 3.66 meter 12 foot straightedge. Take measurements in successive positions parallel to the centerline of the area to be paved. Also take measurements perpendicular to the centerline at [15] [_____] meter [50] [_____] foot intervals. Correct deviations exceeding this amount by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

3.13 FIELD QUALITY CONTROL

3.13.1 In-Place Tests

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NOTE: If recycled concrete aggregate (RCA) is proposed as an aggregate source, include the last bracketed sentence
****

Perform each of the following tests on samples taken from the placed and compacted [ABC] [and] [GCA]. Take samples and test at the rates indicated. [Perform sampling and testing of recycled concrete aggregate at twice the specified frequency until the material uniformity is established.]

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 [including 0.02 mm size material] 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 base 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 base course.

3.13.2 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 fully compacted course(s).

3.14 TRAFFIC

****

NOTE: Traffic will not be allowed on any base course placed for airfield pavements. For roads, traffic should only be allowed on the base courses when it cannot be diverted elsewhere; but precautions should be taken to limit the traffic and keep heavy equipment off. Any damage caused by traffic should be repaired to meet these specification requirements. Designer will choose the appropriate bracketed information.

****

[Do not allow traffic on the completed base course.] [Completed portions of the base course may be opened to limited traffic, provided there is no marring or distorting of the surface by the traffic. Do not allow heavy equipment on the completed base course except when necessary for construction. When it is necessary for heavy equipment to travel on the completed base course, protect the area against marring or damage to the completed work.]

3.15 MAINTENANCE

Maintain the base course in a satisfactory condition until the full pavement section is completed and accepted. Immediately repair any defects and repeat repairs as often as necessary to keep the area intact. Retest any base course that was not paved over prior to the onset of winter to verify that it still complies with the requirements of this specification. Rework or replace any area of base course that is damaged as necessary to comply with this specification.

3.16 DISPOSAL OF UNSATISFACTORY MATERIALS

Dispose of any unsuitable materials that have been removed [outside the limits of Government-controlled land] [as directed] [in waste disposal areas indicated]. No additional payments will be made for materials that have to be replaced.

-- End of Section --