
USACE / NAVFAC / AFCEA / NASA UFGS-32 11 16 (April 2006)

Preparing Activity: USACE Replacing without change
UFGS-02705 (September 2005)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMLR dated January 2008

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SECTION 32 11 16

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

NOTE: This guide specification covers the requirements for subbase, select-material subbase and rigid base courses for airfield pavements, roads and streets.

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 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).

PART 1 GENERAL

NOTE: This guide specification is applicable to subbase courses for airfield pavements, roads and streets including select-material subbase courses in the lower levels of the pavement structure. This specification will be used for any subbase course that has a design California bearing ratio (CBR) between 20 and 50 or any select-material with design CBR less than 20. Select material subbase will not require processing or blending.

This specification may also be used for:

a. The base course directly beneath the bituminous surface of a pavement design for Class E and F roads and streets where the required CBR value of the material is 50 or more and the material conforms to Gradation No. 1.

b. The base course beneath rigid pavements.

When this guide specification is used for aggregate base course under rigid pavement, section title of the project specification will be: BASE COURSE FOR RIGID PAVING and the words "rigid pavement base course" selected throughout. When this guide specification is used in combination for a subbase course under flexible pavements and a base course under rigid pavements, the section title will be: BASE COURSE FOR RIGID AND SUBBASES FOR FLEXIBLE PAVING and the words "or rigid pavement base course" will be included after "subbase" throughout.

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.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO T 180 (2001; R 2004) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 457-mm (18-in) Drop

AASHTO T 224 (2001; R 2004) Correction for Coarse Particles in the Soil Compaction Test

ASTM INTERNATIONAL (ASTM)

| | |
|-----------------|---|
| ASTM C 117 | (2004) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing |
| ASTM C 131 | (2006) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine |
| ASTM C 136 | (2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates |
| ASTM C 29/C 29M | (2007) Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate |
| ASTM D 1556 | (2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method |
| ASTM D 1557 | (2002e1) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³) (2700 kN-m/m ³) |
| ASTM D 2167 | (1994; R 2001) Density and Unit Weight of Soil in Place by the Rubber Balloon Method |
| ASTM D 2487 | (2006) Soils for Engineering Purposes (Unified Soil Classification System) |
| ASTM D 422 | (1963; R 2002e1) Particle-Size Analysis of Soils |
| ASTM D 4318 | (2005) Liquid Limit, Plastic Limit, and Plasticity Index of Soils |
| ASTM D 6938 | (2007a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) |
| ASTM D 75 | (2003) Standard Practice for Sampling Aggregates |
| ASTM E 11 | (2004) Wire Cloth and Sieves for Testing Purposes |

1.2 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. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the

submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

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

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.] The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment

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

Waybills and Delivery Tickets

Copies of waybills and delivery tickets during the progress of the work.

SD-06 Test Reports

Sampling and Testing

Field Density Tests

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

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.

1.3 UNIT PRICES

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

1.3.1 Measurement

NOTE: Delete the method of measurement paragraph not applicable to job conditions. The provision for placing in stockpiles will be retained or deleted as applicable.

1.3.1.1 Area

The quantity of [subbase] [and] [select-material subbase] [or] [rigid pavement base] course completed and accepted as determined by the Contracting Officer shall be measured in square ~~meters~~ yards.

1.3.1.2 Volume

The quantity of [subbase] [and] [select-material subbase] [or] [rigid pavement base] course completed and accepted as determined by the Contracting Officer shall be measured in cubic ~~meters~~ yards. The volume of material in-place and accepted shall be determined by the average job thickness obtained in accordance with paragraph THICKNESS CONTROL and the dimensions shown.

1.3.1.3 Weight

The tonnage of [subbase] [and] [select-material subbase] [or] [rigid pavement base] course material shall be the number of ~~metric tons~~ tons of aggregate, placed [and accepted in the completed course] [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.

1.3.2 Payment

1.3.2.1 Course Material

Quantities of [subbase] [and] [select-material subbase] [or] [rigid pavement base] course, determined as specified in paragraph Measurement, will be paid for at the respective contract unit prices, which shall constitute full compensation for the construction and completion of the [subbase] [and] [select-material subbase] [or] [rigid pavement base] course.

1.3.2.2 Stabilization

Cohesionless subgrades or select subbase courses to be stabilized, as specified in paragraph PREPARATION OF UNDERLYING MATERIAL, will be paid as a special item on the tonnage basis including extra manipulation as required.

1.3.3 Waybills and Delivery Tickets

Copies of waybills and delivery tickets shall be submitted during the progress of the work.

1.4 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 D 1557 abbreviated as a percent of laboratory maximum dry density. Since ASTM D 1557 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 shall 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.

1.5 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved testing laboratory in accordance with Section 01 45 01 USACE QUALITY CONTROL. Tests shall be performed at the specified frequency. No work requiring testing will be permitted until the testing laboratory has been inspected and approved. The materials shall be tested to establish compliance with the specified requirements.

1.5.1 Sampling

Samples for laboratory testing shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.5.2 Tests

1.5.2.1 Sieve Analysis

NOTE: Testing in accordance with ASTM D 422 will be required when the materials need to be tested for the 0.02 mm frost susceptibility requirements.

Sieve analysis shall be made in conformance with ASTM C 117 and ASTM C 136. [Particle-size analysis of the soils shall be completed in conformance with ASTM D 422]. Sieves shall conform to ASTM E 11.

1.5.2.2 Liquid Limit and Plasticity Index

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

1.5.2.3 Moisture-Density Determinations

NOTE: ASTM D 1557 will be used for maximum density determinations if the anticipated material gradation would contain less than 30% retained on the 19 mm

(3/4 inch) sieve. AASHTO T 180, Method D will be used for the maximum density determinations if the anticipated material gradation would contain more than 30% retained on the 19 mm (3/4 inch) sieve.

The laboratory maximum dry density and optimum moisture shall be determined in accordance with [ASTM D 1557] [AASHTO T 180, Method D and corrected with AASHTO T 224].

1.5.2.4 Field Density Tests

Density shall be field measured in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 6938. 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 6938, 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 6938 result in a wet unit weight of soil and ASTM D 6938 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 6938. 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, in ASTM D 6938, on each different type of material to be tested at the beginning of a job and at intervals as directed.

1.5.2.5 Wear Test

NOTE: This paragraph will be deleted only when select-material subbase course materials are specified.

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

1.5.2.6 Weight of Slag

NOTE: This paragraph will be deleted only when select-material subbase course materials are specified.

Weight per cubic meter foot of slag shall be determined in accordance with ASTM C 29/C 29M.

1.5.3 Testing Frequency

1.5.3.1 Initial Tests

One of each of the following tests shall be performed on the proposed material prior to commencing construction to demonstrate that the proposed material meets all specified requirements prior to installation.

- a. Sieve Analysis [including 0.02 mm size material]
- b. Liquid limit and plasticity index
- c. [Moisture-density relationship]

- d. [Wear]
- e. [Weight per cubic meter foot of Slag]
- f. [_____].

1.5.3.2 In-Place Tests

One of each of the following tests shall be performed on samples taken from the placed and compacted [subbase] [and] [select-material subbase] [or rigid pavement base] course. Samples shall be taken and tested at the rates indicated.

- a. Density tests shall be performed on every lift of material placed and at a frequency of one set of tests for every 500 [_____] square meters yards, or portion thereof, of completed area.
- b. Sieve Analysis [including 0.02 mm size material] shall be performed on every lift of material placed and at a frequency of one sieve analysis for every 1000 [_____] square meters yards, or portion thereof, of material placed.
- c. Liquid limit and plasticity index tests shall be performed at the same frequency as the sieve analysis.
- d. The thickness of each course shall be measured at intervals providing at least one measurement for each 500 [_____] square meters yards or part thereof. The thickness measurement shall be made by test holes, at least 75 mm 3 inches in diameter through the course.

1.5.4 Approval of Material

The source of the material shall be selected [30] [_____] days prior to the time the material will be required in the work. Tentative approval will be based on initial test results. 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 course.

1.6 WEATHER LIMITATIONS

 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.

Construction shall be done when the atmospheric temperature is above 2 degrees C 35 degrees F. When the temperature falls below 2 degrees C 35 degrees F, the Contractor shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

1.7 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 will be subject to approval 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, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Subbase Course

NOTE: As written, this paragraph applies to general conditions. Other materials such as disintegrated granite, volcanic ash or cinders, limerock, caliche, or asphalt millings will be specified when supported by adequate performance data. The requirement for percentage of wear will be deleted when local experience indicates the material is satisfactory. The material requirements from State or other local highway agency specifications may be incorporated in contract documents for constructing subbase course for roads, streets, or similar-use pavements if conditions a, b, c, and d below are met:

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

b. When local conditions dictate a nonfrost-susceptible material, particles having a diameter of less than 0.02 mm will not be in excess of 3 percent.

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

d. The project requires less than 600 cubic meters (750 cubic yards) of material and it is not an airfield pavement. (See item e below if project does not meet this requirement).

e. Approval from AFCESA, the Navy EFDs, or USACE TSMCX is required before state or other local highway specifications may be used for road or street projects requiring over 600 cubic meters (750 cubic yards) and/or airfield projects. Project specific information will be submitted to AFCESA, the Navy EFDs, or USACE TSMCX with the request for approval.

The desired maximum top size will be inserted in the

blank. The necessity for meeting grades dictates that maximum top size should not exceed 75 mm (3 inches).

| Gradation No. | Design CBR |
|-----------------|------------|
| 1 | 50 Max |
| 2 | 40 Max |
| 3 | 30 Max |
| Select Material | 20 Max |

Gradation band No. 1 or 2 may be used for lower design CBR values than specified above where no increase in price results. Gradation No. 1 will be used when a drainage layer will be placed above the subbase and the subbase is designed as a separation layer. Exceptions to the gradation requirements will be permitted when supported by adequate in-place CBR data. When this specification is to be used as base course for roads, streets, and parking areas, the maximum top size will not exceed 50 mm (2 inches) for a layer thickness of less than 150 mm (6 inches). The inapplicable gradation will be deleted.

Where local conditions dictate a nonfrost-susceptible material, retain the sentence in brackets requiring particles having a diameter of less than 0.02 mm not to exceed 3 percent by weight of the total aggregate, as determined in accordance with ASTM D 422.

When this specification is used for base course under rigid pavements, gradation band No. 4 will be used. The gradation will also meet the requirements in the applicable technical manual or engineering instruction for pavement design for frost conditions.

Aggregates shall consist of crushed stone or slag, gravel, shell, sand, or other sound, durable, approved materials processed and blended or naturally combined. Aggregates shall be durable and sound, free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign material. Material retained on the 4.75 mm No. 4 sieve shall have a percentage of wear not to exceed 50 percent after 500 revolutions when tested as specified in ASTM C 131. Aggregate shall be reasonably uniform in density and quality. Slag shall be an air-cooled, blast-furnace product having a dry weight of not less than 1050 kg/cubic meter 65 pcf. Aggregates shall have a maximum size of [_____] mm inch and shall be within the limits specified as follows:

Maximum Allowable Percentage by Weight
Passing Square-Mesh Sieve

| Sieve Designation | No. 1 | No. 2 | No. 3 |
|-------------------|-------|-------|-------|
| 2 mm | 50 | 80 | 100 |
| 0.075 mm | 8 | 8 | 8 |

Maximum Allowable Percentage by Weight
Passing Square-Mesh Sieve

| Sieve Designation | No. 1 | No.2 | No. 3 |
|-------------------|-------|------|-------|
| No. 10 | 50 | 80 | 100 |
| No. 200 | 8 | 8 | 8 |

[Particles having diameters less than 0.02 mm 0.0008 inches shall not be in excess of 3 percent by weight of the total sample tested as determined in accordance with ASTM D 422.] The portion of any blended component and of the completed course passing the 0.425 mm No. 40 sieve shall be either nonplastic or shall have a liquid limit not greater than 25 and a plasticity index not greater than 5.

2.1.2 Select-Material Subbase Course

NOTE: When used as material for embankment, the applicable specification will be used to determine the maximum size of particles. The requirement on the amount passing the 0.075 mm (No. 200) sieve may be increased for locally available materials but will not be relaxed to the point where materials with insufficient CBR under ASTM D 4429 will pass.

Where local conditions dictate a nonfrost-susceptible material, retain the sentence in brackets requiring particles having a diameter of less than 0.02 mm not exceed 3 percent by weight of the total aggregate, as determined in accordance with ASTM D 422.

Materials shall consist of selected soil or other materials from field excavation, stockpiles, or other sources. Material shall be free from lumps and balls of clay and from organic and other objectionable matter. Not more than 25 percent by weight shall pass the 0.075 mm No. 200 sieve. The portion of material passing the 0.425 mm No. 40 sieve shall have a liquid limit less than 35 and a plasticity index less than 12. The maximum particle size shall not exceed 75 mm 3 inches.[Particles having diameters less than 0.02 mm shall not be in excess of 3 percent by weight of the total sample tested as determined in accordance with ASTM D 422.]

2.1.3 Rigid Pavement Base Course

Aggregates shall consist of crushed stone or slag, gravel, shell, sand, or other sound, durable, approved materials processed and blended or naturally combined. Aggregates shall be durable and sound, free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign material. Material retained on the 4.75 mm No. 4 sieve shall have a percentage of wear not to exceed 50 percent after 500 revolutions when tested as specified in ASTM C 131. At least 50 percent by weight retained on each sieve shall have one freshly fractured face with the area at least equal to 75 percent of the smallest midsectional area of the piece. Aggregate shall be reasonably uniform in density and quality. Slag shall

be an air-cooled, blast-furnace product having a dry weight of not less than 1050 kg/cubic meter 65 pcf. Aggregates shall have a maximum size of 50 mm 2 inches and shall be within the limits specified as follows:

Maximum Allowable Percentage by Weight
Passing Square-Mesh Sieve

| Sieve Designation | Rigid Pavement Base Course |
|-------------------|-------------------------------|
| 2 mm | 85 |
| 0.075 mm | 8 |

Maximum Allowable Percentage by Weight
Passing Square-Mesh Sieve

| Sieve Designation | Rigid Pavement Base Course |
|-------------------|-------------------------------|
| No. 10 | 85 |
| No. 200 | 8 |

[Particles having diameters less than 0.02 mm shall not be in excess of 3 percent by weight of the total sample tested as determined in accordance with ASTM D 422.] The portion of any blended component and of the completed course passing the 0.425 mm No. 40 sieve shall be either nonplastic or shall have a liquid limit not greater than 25 and a plasticity index not greater than 8. The Contractor shall be responsible for any additional stability required to provide a working platform for construction equipment. If the Contractor can demonstrate with a test section that a material has adequate stability to support construction equipment, the fractured face requirement can be deleted, subject to the approval of the Contracting Officer.

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 specifications requirements in the specified time limit. [Upon completion of work, aggregate sources on Government property shall be conditioned to drain readily, and shall be left in a satisfactory condition.] Aggregate sources on private lands shall be conditioned in agreement with local laws and authorities.

3.2 STOCKPILING MATERIAL

NOTE: In cases where material previously stockpiled under a separate contract is utilized in the construction of the base course, this requirement will be included in the specifications. When applicable, a separate item of work will be shown in the bid schedule to provide for the use of previously stockpiled materials.

Prior to stockpiling of material, 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 on the cleared and leveled areas designated by the Contracting Officer to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.3 PREPARATION OF UNDERLYING MATERIAL

Prior to constructing the [subbase] [or] [select-material subbase] [or] [rigid pavement base] course, the underlying course or subgrade shall be cleaned of all foreign substances. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. Ruts, or soft yielding spots, in the underlying courses, subgrade areas having inadequate compaction, and deviations of the surface from the specified requirements, shall be corrected by loosening and removing soft or unsatisfactory material and by 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 D 2487](#), the surface shall be stabilized prior to placement of the overlying course. Stabilization shall be accomplished by mixing the overlying course material into the underlying course, and compacting by approved methods. [The stabilized material shall be considered as part of the underlying course and shall meet all requirements for the underlying course.] The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the overlying course is placed.

3.4 GRADE CONTROL

The finished and completed course shall conform to the lines, grades, and cross sections shown. The lines, grades, and cross sections shown shall be maintained by means of line and grade stakes placed by the Contractor at the work site.

3.5 MIXING AND PLACING MATERIALS

**NOTE: More details on applicable method for
placing, mixing, and spreading should be included
when appropriate.**

The materials shall be mixed and placed to obtain uniformity of the material at the water content specified. The Contractor shall make such adjustments in mixing or placing procedures or in equipment as may be directed to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to insure a satisfactory subbase course.

3.6 LAYER THICKNESS

The compacted thickness of the completed course shall be as indicated. When a compacted layer of [150 mm 6 inches](#) 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 be thicker than [150 mm 6 inches](#) nor be thinner than [75 mm 3 inches](#) when compacted.

3.7 COMPACTION

Each layer of the material shall be compacted as specified with approved compaction equipment. Water content shall be maintained during the compaction procedure to within plus or minus [2] [_____] percent of optimum water content, as determined from laboratory tests, as specified in paragraph SAMPLING AND TESTING. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. [Compaction of the subbase [or select-material subbase] shall continue until each layer is compacted through the full depth to at least 100 percent of laboratory maximum density.] [Compaction of the rigid base course shall continue until each layer is compacted through the full depth to at least 95 [_____] percent of laboratory maximum density.] The Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory subbase course. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

3.8 PROOF ROLLING

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

Air Force Bases: Proof roll the top of the completed subbase course of Type A traffic areas and the center 23 m (75 feet) of heavy, modified heavy, and medium load runways with 30 coverages.

Army Airfields: On Class IV airfields with runways greater than 1525 meters (5000 feet), proof roll the top of the completed subbase course in Type A traffic areas and center 23 meters (75 feet) of runways with 30 coverages.

Navy and Marine Corps Airfields: Proof roll top of completed subbase course on center 12 meters (40 feet) of taxiways and on center 30.5 meters (100 feet) of runways with 8 coverages. Apply 4 coverages to all other paved areas, exclusive of runway overrun and blast protection areas.

Areas designated on the drawings to be proof rolled shall receive an application of [_____] coverages with a heavy pneumatic-tired roller having four or more tires abreast, each tire loaded to a minimum of 13.6 metric tons 30,000 pounds and inflated to a minimum of 1.034 MPa 125 psi. A coverage is defined as the application of one tire print over the designated area. In the areas designated, proof rolling shall be applied to the top layer of the subbase course. Water content of the top layer of the subbase course shall be maintained such that the water content is within plus or minus [2] [_____] percent of optimum water content, as determined from laboratory tests, as specified in paragraph SAMPLING AND TESTING. Any material in the subbase courses or underlying materials indicated to be unsatisfactory by the proof rolling shall be removed, dried, and recompact, or removed and replaced with satisfactory materials.

3.9 EDGES

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

3.10 SMOOTHNESS TEST

The surface of the top layer shall show no deviations in excess of 10 mm 3/8 inch when tested with a 3.66 m 12 foot straightedge. Measurements shall be taken in successive positions parallel to the centerline of the area to be paved. Measurements shall also be taken perpendicular to the centerline at [15] [] meter [50] [] foot intervals. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

3.11 THICKNESS CONTROL

NOTE: When subbase or rigid pavement 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 will therefore be modified as required, restricting all deficiencies to less than 6 mm (1/4 inch).

The completed thickness of the course(s) shall be in accordance with the thickness and grade indicated on the drawings. The completed course shall not be more than 13 mm 1/2 inch deficient in thickness nor more than 13 mm 1/2 inch above or below the established grade. Where any of these tolerances are exceeded, the Contractor shall correct such areas by scarifying, adding new material of proper gradation or removing material, and compacting, as directed. Where the measured thickness is 13 mm 1/2 inch or more thicker than shown, the course will 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 as specified above but within 6 mm 1/4 inch of the thickness shown.

3.12 MAINTENANCE

The completed course shall be maintained in a satisfactory condition until accepted.

-- End of Section --