
USACE / NAVFAC / AFCEA UFGS-02710 (August 2004)

Preparing Activity: USACE Superseding
UFGS-02710A (December 1997)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMLR dated 22 December 2004

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SECTION 02710

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SECTION 02710

BITUMINOUS-STABILIZED BASE COURSE, SUBBASE, OR SUBGRADE
08/04

NOTE: This guide specification covers the requirements for bituminous stabilization of subgrades, subbases, and base courses for airfield pavements and 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.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 81	(1992; R 2000) Cut-Back Asphalt (Rapid-Curing Type)
AASHTO M 82	(1975; R 2000) Cut-Back Asphalt (Medium-Curing Type)
AASHTO T 193	(1999) The California Bearing Ratio
AASHTO T 40	(2002) Sampling Bituminous Materials

ASTM INTERNATIONAL (ASTM)

ASTM D 1250	(2004) Petroleum Measurement Tables
ASTM D 140	(2001) Sampling Bituminous Materials
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 1883	(1999) CBR (California Bearing Ratio) of Laboratory-Compacted Soils
ASTM D 2026	(1997; R 2004) Cutback Asphalt (Slow-Curing Type)
ASTM D 2027	(1997; R 2004) Cutback Asphalt (Medium-Curing Type)
ASTM D 2028	(1997; R 2004) Cutback Asphalt (Rapid-Curing Type)
ASTM D 2167	(1994; R 2001) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2172	(2001e1) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
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 4318	(2000) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 490	(1992; R 2001) Road Tar
ASTM D 633	(1997; R 2001) Volume Correction Table for Road Tar

ASTM D 75	(2003) Sampling Aggregates
ASTM D 977	(2003) Emulsified Asphalt
ASTM D 979	(2001) Sampling Bituminous Paving Mixtures

1.2 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

Plant, Equipment, Machines, and Tools
 Mix Design[; G][; G, [_____]]

List of proposed equipment to be used in performance of construction work, including descriptive data. Mix design at least [_____] days before it is to be used.

Source of Bituminous Material
Operation of Aggregate Sources

Notification upon selection of bituminous material and aggregate sources.

Waybills and delivery tickets

Copies of waybills and delivery tickets during the progress of the work. Certified waybills and delivery tickets for all materials actually used.

SD-04 Samples

Bituminous Material

Bituminous material used in the job.

SD-06 Test Reports

Sampling and Testing

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

1.3 UNIT PRICES

**NOTE: These paragraphs will be deleted when
lump-sum payment is desired. When payment basis is
square meters (yards) only, delete inapplicable
paragraphs.**

1.3.1 Waybills and Delivery Tickets

Copies of waybills or delivery tickets shall be submitted during the progress of the work. Before the final payment is allowed, waybills and certified delivery tickets shall be furnished for all bituminous materials [and select materials] used in the construction.

1.3.2 Measurement for Payment

1.3.2.1 Bituminous Stabilization

Measurement will be by the square meter yard of work completed and accepted.

1.3.2.2 Bituminous Material

Bituminous material to be paid for will be measured in the number of [liters gallons of the material used in the accepted work, corrected to liters at 15 degrees C gallons at 60 degrees F in accordance with [ASTM D 633] [ASTM D 1250]. A coefficient of 0.00025 per degree C F shall be used for asphalt emulsion.] [metric 2000 pound tons of the material used in the accepted work.]

1.3.2.3 Select Material

NOTE: Reference to select material will be deleted
when select material is not required from borrow
areas.

Select material will be measured by the [cubic meter yard] [metric 2000 pound ton] of material placed and used in the completed and accepted stabilization. Measurement will not be made for select material that is wasted or used in work determined to be defective.

1.3.3 Basis for Payment

NOTE: Reference to select material will be deleted
when select material is not required from borrow
areas.

The last sentence in brackets will be deleted if
sanding or dusting of the bituminous-primed surfaces
is not required or if bituminous-primed surfaces are
to receive bituminous surfacing under the contract.

Bituminous stabilization, constructed and accepted, [and the quantities of bituminous material] [and select material] will be paid for at the respective contract unit prices. Payment will not be made for any material wasted, used for the convenience of the Contractor, unused or rejected, or for water used. [Select material obtained from grading and excavation operations at the project site will not be paid for under this section but will be included for payment under other sections specifying grading and excavating.] [Separate payment will not be made for sanding or dusting the bituminous prime-coated surfaces. Costs for sanding or dusting will be included in the contract unit price for bituminous material.]

1.4 DEGREE OF COMPACTION

Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure in accordance with ASTM D 1557, abbreviated in this specification as percent laboratory maximum density.

1.5 STOCKPILING MATERIALS

NOTE: This paragraph will be deleted when select
material is not required or when small quantities do
not justify the inclusion of select materials.

Select material, including approved material available from excavation and grading shall be stockpiled in the manner and at the locations designated. Before stockpiling material, the storage sites shall be cleared, drained, and leveled. Materials obtained from different sources shall be stockpiled separately.

1.6 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.6.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times. The equipment shall have the capability of producing the required compaction, meeting grade controls, thickness control and smoothness requirements indicated.

1.6.2 Bituminous Distributor

Distributor shall have pneumatic tires that prevent rutting, shoving, or otherwise damaging base surface or other layers in the pavement structure. Distributor shall be designed and equipped to spray bituminous material in a uniform double or triple lap at the specified temperature, at variable widths, and at readily determined and controlled rates from 0.15 to 6.5 liters per square meter 0.05 to 2.0 gallons per square yard with an allowable variation from the specified rate of plus or minus 5 percent and with a pressure range of 175 to 515 kPa.25 to 75 psi. Distributor equipment shall include a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading temperature of tank contents, and a hand hose attachment suitable for applying bituminous material manually to areas inaccessible to the distributor. Distributor shall be equipped to circulate and agitate the bituminous material during the heating process.

1.6.3 Straightedge

The Contractor shall furnish and maintain at the site, in good condition, one [3.05] [3.66] meter ([10] [12] foot) [10] [12] foot straightedge for each bituminous paver, for use in the testing of the finished surface. Straightedge shall be made available for government use. Straightedges shall be constructed of aluminum or other lightweight metal and shall have blades of box or box-girder cross section with flat bottom reinforced to insure rigidity and accuracy. Straightedges shall have handles to facilitate movement on pavement.

1.7 WEATHER LIMITATIONS

Bituminous material shall not be applied when the atmospheric temperature is less than 10 degrees C.50 degrees F. Bituminous material shall not be applied to soils that are frozen or contain frost. If the temperature falls below 2 degrees C, 35 degrees F, completed bitumen-treated areas shall be protected against any detrimental effects of freezing.

1.8 SOURCE OF BITUMINOUS MATERIAL

Notification of the selected source of bituminous material shall be submitted to the Contracting Officer within 15 days after the award of contract.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Bituminous Material

NOTE: Tar or asphalt of one grade or type will be
specified.

Material used for bituminous seal, in the soil-bitumen mixture, and for
prime coat shall be the same [type] [grade] throughout and shall conform to
one of the following:

2.1.1.1 Liquid Asphalt

[ASTM D 2027] [ASTM D 2028] [ASTM D 2026] [AASHTO M 81] [AASHTO M 82] Grade
[RC-70] [RC-250] [RC-800] [MC-70] [MC-250] [MC-800] [MC-3000] [SC-250]
[SC-800].

2.1.1.2 Emulsified Asphalt

ASTM D 977 Type [SS-1] [MS-2].

2.1.1.3 Tar

ASTM D 490 Grade [RT-1] [RT-2] [RT-3] [RT-4] [RT-5] [RT-6].

2.1.2 Material to be Stabilized

NOTE: Inapplicable material will be deleted. A
select material gradation based on sound engineering
judgment, availability of materials, economics,
history of construction in the area, and type of
course to be constructed should be supplied in this
paragraph. Maximum size of stones should be less
than 1/3 the compacted thickness of the treated soil
layer. Maximum percent passing the 0.075 mm (No.
200 sieve) should be 30. Designer should refer to
TM 5-822-14 and TM 5-825-2 for further information,
including applicability of bituminous stabilization.

Material to be stabilized shall consist of [in-place material] [approved
select material].

Select material shall conform to the following gradation:

Sieve Designation	Percentage by Weight Passing Square-Mesh Sieve
75 mm	[]
[]	[]

Sieve Designation	Percentage by Weight Passing Square-Mesh Sieve
3 inch [_____]	[_____] [_____]

The liquid limit shall be less than 40 and the plasticity index shall be less than 10 when tested in accordance with ASTM D 4318 . The fine and coarse aggregates, or a composite mixture, shall not show stripping in excess of 5 percent. If stripping occurs, [the aggregate shall be rejected] [an approved method of treating shall be used to prevent stripping].

2.1.3 Water

Water shall be clean, fresh, and potable.

2.2 MIX DESIGN

NOTE: CBR bearing value can vary from 35 to 80, depending on soil type; see TM 5-822-14.

Contractor shall develop and submit for approval a proposed mix design prior to stabilization work. Mix shall be developed using samples of the material to be stabilized. Mix design shall be capable of producing a CBR bearing value of [50] [_____] CBR in accordance with [ASTM D 1883] [AASHTO T 193].

PART 3 EXECUTION

3.1 BITUMINOUS MATERIAL MIX

NOTE: The designer is reminded that in-situ materials to be stabilized with bituminous material must conform to the requirements of TM 5-822-4, paragraph 8. Application temperatures will be selected from the following table and inserted in the blanks:

Cutback asphalt:	Degrees C	Degrees F
RC-70, MC-70	40-80	105-180
RC-250, MC-250, SC-250	60-105	145-220
RC-800, MC-800, SC-800	80-125	180-255
MC-3000	100-145	215-290
Emulsified asphalt:		
SS-1	25-55	75-130
MS-2	20-70	100-160
Tar:		
RT-1	15-50	60-125

Tar:		
RT-2	15-50	60-125
RT-3/RT-4/RT-5/and RT-6	25-65	80-150

The moisture to be specified will be a function of the type of bituminous material used. The value will be selected from the following:

- a. Liquid asphalt: 2 percent
- b. Emulsified asphalt (including water in the emulsion):
 - (1) Granular soils, 5 percent
 - (2) Silty and plastic soils, 3 percent
- c. Tar: 5 percent

Bituminous material, of the amount required for each application, shall be uniformly applied by a bituminous distributor within a temperature range of [_____] to [_____] degrees C, [_____] to [_____] degrees F, as directed. Areas inaccessible to or missed by the distributor shall be properly treated with bituminous material, using the manually operated hose attachment. After mixing is completed, the proportions of the mixture shall be in accordance with the approved mix design. On the basis of dry weight, moisture shall be [_____] percent plus or minus 1 percent when mixing is complete. When the stabilized course is constructed in more than one layer, the previously constructed layer shall be cleaned 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. Adequate drainage shall be provided during the entire construction period to prevent water from collecting or standing on the area to be stabilized or on pulverized, mixed, or partially mixed material.

3.2 OPERATION OF AGGREGATE SOURCES

NOTE: This paragraph will be deleted when select material is not required or when small quantities do not justify the inclusion of select materials. Delete material in the first set of brackets when onsite material is not available.

Notification of the selected source of aggregate shall be submitted to the Contracting Officer within 15 days after the award of contract. Clearing, stripping, and excavating shall be the responsibility of the Contractor. The aggregate sources shall produce the quality of base course materials meeting these specification requirements in the specified time limits. [Upon completion of the work, aggregate sources on Government property shall be conditioned to drain readily and be left in a satisfactory condition.] [Aggregate material shall be obtained from off-site sources. Aggregate sources on private lands shall be conditioned in agreement with local laws or authorities.] Aggregate sampling for laboratory tests shall be taken in accordance with ASTM D 75.

3.3 PREPARATION OF AREAS TO BE STABILIZED

NOTE: Inapplicable subparagraph will be deleted.

Area shall be cleaned of debris. Area will be inspected for adequate compaction and shall be capable of withstanding, without displacement, compaction specified for the soil-bitumen mixture. Debris and removed unsatisfactory in-place material shall be disposed of [as directed] [in waste disposal areas indicated].

3.3.1 In-Place Material to be Stabilized

The entire area shall be graded and shaped to conform to the lines, grades, and cross sections shown prior to being processed. Soft or yielding areas shall be made stable before construction is begun.

3.3.2 In-Place Materials to Receive Stabilized Course

NOTE: Inapplicable sentences will be deleted.

[Soft, yielding areas and ruts or other irregularities in the surface shall be corrected. Material in the affected areas shall be loosened and unsatisfactory material removed. Approved select material shall be added where directed. The area shall then be shaped to line, grade, and cross section, and shall be compacted to the specified density.] [Subgrade shall conform to Section 02300 EARTHWORK.] [Subbase course shall conform to Section 02721 SUBBASE COURSES.] Entire surface shall then be sealed with bituminous material applied as specified. The seal shall be covered with sand and rolled lightly with a steel-wheel or rubber-tired roller.

3.3.3 Select Material

NOTE: Paragraph will be deleted if select material is not required.

Sufficient select material shall be utilized to provide the required thickness of the soil-bitumen layer after compaction and shall be processed to meet the requirements specified before bituminous stabilization is undertaken.

3.4 GRADE CONTROL

Underlying material shall be excavated to sufficient depth for the required stabilized-course thickness so that the finish stabilized course with the subsequent surface course will meet the fixed grade. Line and grade stakes shall be provided as necessary for control. Grade stakes shall be placed in lines parallel to the centerline of the area under construction and suitably spaced for string lining. Finished and completed stabilized area shall conform to the lines, grades, cross section, and dimensions indicated.

3.5 MIXING OF MATERIALS

3.5.1 Mixed-in-Place Method

NOTE: Mixing the materials by the mixed-in-place method should be considered for those jobs where the thickness of the stabilized layer is 150 mm (6 inches) or less. Because the maximum layer thickness is 150 mm (6 inches), constructing a thicker layer by this method would require removal of the top portion of material. The lower portion would then be mixed and compacted, and the top portion mixed, replaced and compacted. This paragraph should be deleted if select material is to be used.

Two different mixed-in-place methods are presented. One method of in-place mixing should be used and the appropriate paragraphs deleted.

3.5.1.1 Scarifying and Pulverizing of Soil

Prior to the application of bituminous materials, the soil shall be scarified and pulverized [to the depth shown] [to a depth of [_____] mm. inches.] Scarification shall be controlled so that the layer beneath the layer to be stabilized is not disturbed. Depth of pulverizing shall not exceed the depth of scarification. Unless otherwise permitted, area scarified and pulverized shall not exceed the area that can be completed in 2 working days.

3.5.1.2 Application of Water

Pulverized material shall be shaped to the cross section and grade indicated. Moisture content shall then be determined. Water shall be added in increments and each increment of water shall be partially incorporated in the mix to avoid concentration of water near the surface. After the last increment of water has been added, mixing shall be continued until the water is uniformly distributed throughout the mixture, including satisfactory moisture distribution along the edges of the section.

3.5.1.3 Application of Bituminous Material

Rate of application of bituminous material for the soil-bitumen mixture shall be sufficient to meet the mix design amount of bitumen. Bituminous material shall be uniformly mixed with the soil by means of a blade grader or rotary mixer. If the bituminous material is applied in more than one increment, each application shall be partially mixed into the material as directed. After the required amount of bituminous material has been added to the loose material, the bituminous material and soil shall be thoroughly mixed by blading with a blade grader, rotary mixer, or other equipment suitable for mixing the soil and bitumen. Equipment, except that used for spreading and mixing operations, shall not pass over the freshly spread bituminous material.

3.5.1.4 Traveling-Plant Method

The pulverized material shall be placed in windrows. The windrows shall be

of sufficient size to cover a predetermined width to the indicated compacted thickness. Traveling plant shall move at a uniform rate of speed and shall accomplish thorough mixing of the materials. Water and bituminous material may be delivered separately or together at a predetermined rate.

3.5.2 Central Plant Method

**NOTE: Central plant will be specified for mixing
select material for subbase or base course
construction.**

3.5.2.1 Mixing

Loading and hauling select material from pits or stockpiles shall result in a uniform grade of each material being delivered to the central-mixing plant. Properly batched or proportioned aggregate and soil binder materials shall be fed into the mixing unit together with the bituminous material and the quantity of water needed to obtain the required optimum moisture content. Mixing shall be continued until a homogeneous mixture is obtained. Mixture shall be hauled to the job in trucks equipped with protective covers. Mixture shall be placed with mechanical spreaders.

3.5.2.2 Placing

The mixed material shall be placed on the prepared subgrade or subbase in layers of uniform thickness with an approved spreader. When a compacted layer 150 mm 6 inches or less in thickness is required, the material shall be placed in a single layer. When a compacted layer in excess of 150 mm 6 inches is required, the material shall be placed in layers of equal thickness. No layer shall exceed 150 mm 6 inches or be less than 80 mm 3 inches when compacted. When compacted, the layers shall 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, the previously constructed layers shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Such adjustments in placing procedures or equipment shall be made as may be directed to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to ensure an acceptable base course.

3.6 PLACEMENT AND COMPACTION

**NOTE: If central plant is not specified, the first
sentence will be deleted. Density will be based on
the material being stabilized. In addition, the
correct compaction standard should be retained.**

[For plant-mixed, machine laid materials, compaction shall begin immediately following placement.] [For mixed-in-place material the soil-bitumen shall have been allowed an adequate amount of time to cure. After curing, the mixture shall be shaped approximately to the specified lines and grades and thoroughly loosened to its full depth and width.] Rolling shall begin 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. Alternate trips of the roller shall be slightly different lengths.

Displacement of materials shall not occur. Density of compacted mixture shall be at least [95] [_____] percent of laboratory maximum density. Areas inaccessible to rollers shall be compacted to the required density with mechanical tampers.

3.7 EDGES OF STABILIZED COURSE

For areas where plant-mixed stabilized material is placed in successive strips, 300 mm 1 foot of the material from the outside edge of the previously placed strip shall be removed prior to placing the adjacent strip. For the shoulders of the stabilized areas, approved material shall be placed along the edges of the stabilized course to compact to the thickness of the course being constructed, or to the thickness of each layer in a multiple-layer course. At minimum 300 mm (1 foot) 1 foot width of the shoulder or previously placed strip shall be rolled and compacted simultaneously with the rolling and compacting of each layer of the stabilized course, as directed.

3.8 FINISHING

The surface of the top layer shall be finished to grade and cross section shown. Finished surface shall be uniform texture. Light blading during rolling may be necessary for the finished surface to conform to the lines, grades, and cross sections. If the surface becomes rough, corrugated, uneven in texture, or traffic-marked prior to completion, such unsatisfactory portion shall be scarified, reworked, relaid, or replaced as directed. If any portion of the course, when laid, becomes watersoaked for any reason, that portion shall be removed immediately, and the mix placed in a windrow and aerated until a moisture content within the limits specified is obtained; and then spread, shaped, and rolled as specified.

3.8.1 Smoothness

NOTE: For subgrade and subbase stabilization, this paragraph should be deleted.

The surface of each layer shall show no deviations in excess of 10 mm (3/8 inch) 3/8 inch when tested with the straightedge. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting, as directed.

3.8.2 Thickness Control

NOTE: When subbase or base courses are constructed less than 150 mm (6 inches) in total thickness, a deficiency of 13 mm (1/2 inch) in thickness is considered excessive. Applicable to job conditions, the thickness tolerance provisions may be modified as required, restricting all deficiencies to not over 6 mm (1/4 inch).

Compacted thickness of the stabilized course shall be within 13 mm (1/2 inch) 1/2 inch of the thickness indicated. Where measured thickness of the stabilized course is more than 13 mm (1/2 inch) 1/2 inch deficient, such areas shall be corrected by scarifying, adding new material of proper

gradation, reblading, and recompacting as directed. Where the measured thickness of the stabilized course is more than 13 mm (1/2 inch) 1/2 inch thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 6 mm (1/4 inch) 1/4 inch of the thickness indicated.

3.9 CONSTRUCTION JOINTS

At the end of each day's construction, a straight transverse construction joint shall be formed by cutting back into the completed work to form a true vertical face free of loose or shattered material. Material along construction joints not properly compacted shall be removed and replaced with soil-bitumen that is mixed, moistened, and compacted in accordance with this specification.

3.10 PRIME COAT

**NOTE: Bracketed sentences will be deleted if
sanding or dusting of the bituminous-primed surfaces
is not required or if bituminous-primed surfaces are
to receive bituminous surfacing under the contract.**

Before dust settles on the area, a prime coat of bituminous material shall be applied to the finished surface. Bituminous material shall be uniformly applied at the rate of 0.22 to 0.91 liters per square meter. 0.05 to 0.20 gallons per square yard. [Bituminous material shall be protected by sanding or dusting the treated surface. Sand shall be uniformly applied at the rate of 3.5 to 4.5 kilograms per square meter. 6 to 8 pounds per square yard.]

3.11 Sampling and Testing

Sampling and testing shall be performed by an approved commercial testing laboratory or by facilities furnished by the Contractor. Work requiring testing will not be permitted until the facilities have been inspected and approved. The first inspection will be at the expense of the Government. Costs incurred for any subsequent inspection required because of failure of the facilities to pass the first inspection will be charged to the Contractor. Tests shall be performed in sufficient numbers and at the locations and times directed to ensure that materials and compaction meet specified requirements. Certified copies of test results shall be furnished to the Contracting Officer.

3.11.1 Field Density

Field in-place density shall be determined in accordance with [ASTM D 1556] [ASTM D 2167] [ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked, and adjusted if necessary, using the sand cone method as described in paragraph Calibration of the ASTM publication. ASTM D 2922 results 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 be checked along with density calibration checks as described in ASTM D 3017. If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 at least once per lift for each [_____] square meter yard of stabilized material. Calibration curves and calibration test results shall be furnished within

24 hours of conclusion of the tests. At least one field density test shall be performed for each [200] [_____] square meters [250] [_____] square yards of each layer of stabilized material.

3.11.2 Sieve Analysis

**NOTE: Delete the reference to source of materials
when select material is not required.**

A minimum of 1 analysis shall be performed for each [1000] [_____] metric tons tons of material to be stabilized, with a minimum of 3 analyses for each day's run until the course is completed. When [the source of materials is changed] [and] [deficiencies are found], the analysis shall be repeated and the material already placed shall be retested to determine the extent of unacceptable material. All in-place unacceptable material shall be replaced at no additional cost to the Government.

3.11.3 Liquid Limit and Plasticity Index

One liquid limit and plasticity index shall be performed for each sieve analysis. Liquid limit and plasticity index shall be in accordance with ASTM D 4318.

3.11.4 Extraction Test

Extraction tests shall be conducted in accordance with ASTM D 2172, to confirm the amount of bitumen and moisture in the mixture. One test shall be conducted [for every 4 hours of placement] [for every 275 metric tons 300 tons of mixture placed]. Sampling shall be taken in accordance with ASTM D 979.

3.11.5 Smoothness Test

**NOTE: For subgrade and subbase stabilization, this
paragraph should be deleted.**

Measurements for deviation from grade and cross section shown shall be taken in successive positions parallel to the road centerline, with a straightedge. Measurements shall also be taken perpendicular to the road centerline at [15] [_____] meter [50] [_____] foot intervals.

3.11.6 Thickness

Thickness of the stabilized course shall be measured at intervals which ensure 1 measurement for each [400] [_____] square meters [500] [_____] square yards of stabilized course. Measurements shall be made in 75 mm 3 inch diameter test holes penetrating the stabilized course.

3.11.7 Bituminous Material

A sample of the bituminous material used shall be taken in accordance with [ASTM D 140] [AASHTO T 40] under the supervision of the Contracting Officer. The sample will be retained by the Government.

3.12 MAINTENANCE

Stabilized area shall be maintained in a satisfactory condition until accepted by the Contracting Officer. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact. Defects shall be corrected as specified.

3.13 TRAFFIC

Completed portions of the soil-bitumen area may be opened to controlled traffic within 4 hours of completion of the course, if approved by the Contracting Officer.

-- End of Section --