Preparing Activity: USACE Superseding
UFGS-32 11 27 (August 2008)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
****

SECTION TABLE OF CONTENTS

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 32 11 13.16

BITUMINOUS-STABILIZED SUBGRADE

05/20

PART 1 GENERAL

1.1 UNIT PRICES
1.1.1 Measurement for Payment
1.1.1.1 Bituminous Stabilization
1.1.1.2 Bituminous Material
1.1.2 Basis for Payment
1.1.3 Waybills and Delivery Tickets
1.2 REFERENCES
1.3 DEFINITION
1.4 SUBMITTALS
1.5 QUALITY CONTROL
1.5.1 Qualifications
1.5.2 Test Results
1.5.3 Bituminous Material
1.6 PROJECT/SITE CONDITIONS
1.6.1 Environmental Requirements
1.7 ACCEPTANCE
1.7.1 Tolerances
1.7.2 Test Section

PART 2 PRODUCTS

2.1 MATERIALS
2.1.1 Bituminous Material
2.1.1.1 Emulsified Asphalt
2.1.2 Material to be Stabilized
2.1.3 Water
2.2 MIX DESIGN
2.2.1 Mix Design Report
2.3 PLANT, EQUIPMENT, MACHINES, AND TOOLS
2.3.1 Mixer/Reclaimer
2.3.2 Traveling Plant
2.3.3 Bituminous Distributor

2.3.4 Rollers
2.3.5 Straightedge

PART 3 EXECUTION

3.1 PREPARATION OF AREAS TO BE STABILIZED
3.1.1 In-Place Material to be Stabilized
3.2 GRADE CONTROL
3.3 MIXING OF MATERIALS
3.3.1 Mixed-in-Place Method
3.3.1.1 Scarifying and Pulverizing of Soil
3.3.1.2 Application of Water
3.3.1.3 Application of Bituminous Material
3.3.2 Traveling-Plant Method
3.4 PLACEMENT AND COMPACTION
3.5 JOINTS
3.5.1 Longitudinal Joints
3.5.2 Transverse Joints
3.6 FINISHING
3.6.1 Thickness Control
3.7 FIELD QUALITY CONTROL
3.7.1 Sampling and Testing
3.7.2 Field Density
3.7.3 Sieve Analysis
3.7.4 Liquid Limit and Plasticity Index
3.7.5 Extraction Test
3.7.6 Grade Test
3.7.7 Smoothness Test
3.7.8 Thickness
3.7.9 Bituminous Material
3.8 MAINTENANCE
3.9 TRAFFIC

-- End of Section Table of Contents --

Preparing Activity: USACE

Superseding
UFGS-32 11 27 (August 2008)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023

SECTION 32 11 13.16

BITUMINOUS-STABILIZED SUBGRADE
05/20

NOTE: This guide specification covers the requirements for bituminous stabilization of subgrades for airfield pavements, roads, streets, and parking areas.

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).

The purposes of bituminous stabilization are to waterproof and improve the cohesive strength of non-cohesive granular soils and aggregates. This specification is limited to soils and aggregates with less than 30 percent passing the No. 200 sieve and a Plasticity Index equal to or less than 10. For bituminous base course or subbase stabilization, use UFGS 32 11 26.19.

PART 1 GENERAL

1.1 UNIT PRICES

NOTE: Delete these paragraphs when lump sum payment is desired.

****

1.1.1 Measurement for Payment

1.1.1.1 Bituminous Stabilization

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

1.1.1.2 Bituminous Material

Submit quantity of residual bituminous material used in the job. 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 D1250. Use a coefficient of 0.00025 per degree C F for asphalt emulsion.] [metric 2000 pound tons of the material used in the accepted work.]

1.1.2 Basis for Payment

Bituminous-stabilized mixture, constructed and accepted, [and the quantities of bituminous 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.

1.1.3 Waybills and Delivery Tickets

Submit copies of waybills and delivery tickets during the progress of the work. Before the final payment is allowed, furnish waybills and certified delivery tickets for all bituminous materials actually used in the construction.

1.2 REFERENCES

****

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

****

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by

the basic designation only.

ASPHALT RECYCLING AND RECLAIMING ASSOCIATION (ARRA)

ARRA FDR201A	(2018) Recommended Mix Design Guidelines for Full Depth Reclamation (FDR) Using Emulsified Asphalt Stabilizing Agent

ASTM INTERNATIONAL (ASTM)

ASTM C117	(2017) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D140/D140M	(2016) Standard Practice for Sampling Asphalt Materials
ASTM D977	(2019a; E 2019) Standard Specification for Emulsified Asphalt
ASTM D979/D979M	(2015) Sampling Bituminous Paving Mixtures
ASTM D1250	(2019; E 2020) Standard Guide for Use of the Joint API and ASTM Adjunct for Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils: API MPMS Chapter 11.1
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 D1883	(2016) Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils
ASTM D2172/D2172M	(2017; E 2018) Standard Test Methods for Quantitative Extraction of Asphalt Binder from Asphalt Mixtures
ASTM D2397/D2397M	(2019a) Standard Specification for Cationic Emulsified Asphalt
ASTM D2419	(2014) Sand Equivalent Value of Soils and Fine Aggregate
ASTM D2487	(2017; E 2020) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D2488	(2017; E 2018) Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
ASTM D3666	(2016) Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D4318	(2017; E 2018) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D6307	(2019) Standard Test Method for Asphalt Content of Asphalt Mixture by Ignition Method
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.3 DEFINITION

Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure in accordance with ASTM D1557, abbreviated in this specification as percent laboratory maximum density.

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

Mix Design; G[, [_____]]

Notification of the Selected Source

Waybills and Delivery Tickets

Plant, Equipment, Machines And Tools

SD-06 Test Reports

Sampling and Testing

SD-07 Certificates

Bituminous Material

1.5 QUALITY CONTROL

1.5.1 Qualifications

****

NOTE: Include bracketed sentence for Corps-managed projects.

****

Perform sampling and testing using an approved commercial testing laboratory or on-site facilities. Submit accreditation of the commercial laboratory by an independent evaluation authority, indicating conformance to ASTM D3666, including all applicable test procedures. Do not start work requiring testing until the facilities have been inspected and approved. Schedule and provide payment for laboratory inspections. Additional payment or a time extension due to failure to acquire the required laboratory validation is not allowed. Maintain this certification for the duration of the project. [In addition, all contractor quality control testing laboratories performing acceptance testing require USACE validation by the Material Testing Center (MTC) for both parent laboratory and on-site laboratory. Validation on all laboratories is required to remain current throughout the duration of the paving project. Contact the MTC manager listed at http://www.erdc.usace.army.mil/Media/FactSheets/FactSheetArticleView/tabid/9254/Articl for costs and scheduling.]

1.5.2 Test Results

Verify that materials comply with the specification. When an in-place material source materially changes, re-test the material for compliance with specification requirements. When deficiencies are found, repeat the initial analysis and retest the material already placed to determine the extent of unacceptable material.

1.5.3 Bituminous Material

Submit notification of the selected source of bituminous material within 15 days after the award of contract. Submit certified copies of the manufacturer's test reports indicating compliance with applicable specified requirements, not less than [30] [_____] days before the material is required in the work.

1.6 PROJECT/SITE CONDITIONS

1.6.1 Environmental Requirements

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

1.7 ACCEPTANCE

1.7.1 Tolerances

Acceptance of bituminous stabilized subgrade is based on compliance with the tolerances presented in Table 1. Remove and replace bituminous stabilized mixture represented by the failing tests or submit repair plan for approval.

TABLE 1	
Attribute	Tolerance
Field Density	minimum of 95 percent
Asphalt Content	plus/minus 0.5 percent of mix design
Grade	plus/minus 15 mm 0.05 foot
Smoothness	maximum of 13 mm 1/2 inch
Thickness (individual measurement)	maximum of 13 mm 1/2 inch
Thickness (average of all measurements)	minimum of 6 mm 1/4 inch

1.7.2 Test Section

[Place a test section of at least 2.5 by 30 m 8 by 100 feet, utilizing the equipment and procedures proposed for use, to demonstrate that bituminous stabilized mixture conforming to this specification can be produced. Acceptance of the test section is based on compliance with the tolerances

listed in Table 1.] [A test section is not required.]

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Bituminous Material

****
NOTE: Select asphalt emulsion type for the bituminous-stablized subgrade based on the soil classification of the subgrade soils evaluated during the site geotechnical investigation.

Subgrade Classification	Emulsion Type
GP	MS-1, HFMS-1, MS-2h, HFMS-2h, CMS-2, CMS-2h
GW	MS-2h, HFMS-2h, HFMS-2s, SS-1, SS-1h, CSS-1, CSS-1h
SW, SP	MS-2h, HFMS-2h, HFMS-2s, SS-1, SS-1h, CSS-1, CSS-1h
GM, SM	MS-2h, HFMS-2h, HFMS-2s, SS-1, SS-1h, CSS-1, CSS-1h
Combinations of above	MS-2h, HFMS-2h, HFMS-2s, SS-1, SS-1h, CSS-1, CSS-1h

****

2.1.1.1 Emulsified Asphalt

Provide bituminous material conforming to [ASTM D977 Type [MS-1] [MS-2h] [HFMS-1] [HFMS-2h] [HFMS-2s] [SS-1] [SS-1h]] [ASTM D2397/D2397M Type [CMS-2][CMS-2h][CSS-1][CSS-1h]].

2.1.2 Material to be Stabilized

****
NOTE: This specification is limited to in-place low-plasticity soils with less than 30 percent passing the 0.075 mm No. 200 sieve. If the in-place soils do not meet the listed requiremements, do not use this section. Consider lime or cement stabilization in accordance with UFC 3-250-11 and UFC 3-270-01.
****

In-place soil or aggregate conforming to soil classifications GW, GP, GM, SW, SP, SM, or combinations thereof. Soil classification in accordance with ASTM D2487 and ASTM D2488. Verify Plasticity Index equal to or less than 10 in accordance with ASTM D4318; sand equivalent percentage greater than 35 percent in accordance with ASTM D2419; and percent passing the No. 200 sieve less than 30 percent. Perform sieve analysis in accordance with ASTM C117 and ASTM C136/C136M.

2.1.3 Water

Furnish clean, fresh, and potable water.

2.2 MIX DESIGN

****

NOTE: Specify design subgrade CBR value to be verified during the mix design. Specify soaked condition and surcharge load. Default values are 24-hour soaked and 4.5 kg 10 lb surcharge load.

****

Develop and submit for approval a proposed mix design prior to stabilization work. Develop mix using samples of the material to be stabilized. Conduct mix design in accordance with ARRA FDR201A. Verify CBR bearing value of [_____] or greater in accordance with ASTM D1883 when tested in a [24-hour soaked] [unsoaked] condition under a surcharge load of 4.5 [_____] kg 10 [_____] lb.

2.2.1 Mix Design Report

Perform trial design batches, mixture proportioning studies, testing, and submit test results demonstrating that the proposed mixture proportions produce a bituminous-stabilized mixture of the qualities indicated. Submit test results in a mix design report to include:

a. Gradation, sand equivalent, and Plasticity Index of soil or aggregate.
b. Maximum dry density and optimum moisture content.
c. Density, maximum specific gravity, air void content, dry and moisture conditioned indirect tensile strength and level of saturation at each emulsified asphalt stabilizing agent content.
d. Optimum emulsified asphalt stabilizing agent content as a percentage of dry materials.
e. Density, air void content, dry and moisture conditioned indirect tensile strength and CBR value at recommended moisture and emulsified asphalt stabilizing content.
f. Emulsified asphalt stabilizing agent designation, supplier name and location.
g. Emulsified asphalt residue content and certificates of compliance.

2.3 PLANT, EQUIPMENT, MACHINES, AND TOOLS

Submit list of proposed plant, equipment, machines and tools to be used in performance of construction work, including descriptive data. Plant, equipment, machines, and tools used in the work are subject to approval. Maintain in a satisfactory working condition at all times. Provide equipment with the capability of producing the required compaction, meeting grade controls, thickness control and smoothness requirements indicated.

2.3.1 Mixer/Reclaimer

Provide a self-propelled, four-wheel drive rotary mixer/reclaimer, capable of pulverizing the soil in a single pass for the full depth to be stabilized and providing a mixing action capable of uniformly blending and mixing the required bituminous material content with the aggregate. Equip with a rotor capable of up or down cutting. Equip the mixer/reclaimer with an integrated additive injection system capable of introducing bituminous emulsion into the cutting drum during the mixing process. Provide a metering device capable of automatically adjusting the flow of the bituminous emulsion to compensate for any variation in the amount of reclaimed material introduced into the mixing chamber.

2.3.2 Traveling Plant

Provide a traveling plant capable of moving at a uniform rate of speed and accomplishing thorough mixing of the materials in one pass. Deliver water and bituminous material from supply trucks or bins at a predetermined rate. Construct windrows of prepared bituminous stablized mixture to cover a predetermined width to the indicated compacted thickness.

2.3.3 Bituminous Distributor

Provide a distributor with pneumatic tires that prevent rutting, shoving, or otherwise damaging other layers in the pavement structure. Design and equip the distributor 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 L/square meter 0.05 to 2.0 gallons/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. Provide capability to circulate and agitate the bituminous material during the heating process. The bituminous distributor is permitted only for applying tack, prime, and seal coats and not for applying bitumen to be mixed into the stabilized mixture.

2.3.4 Rollers

Compact the bituminous stabilized mixture using one or a combination of the following pieces of equipment: tamping or grid roller; steel-wheeled roller; vibratory roller; pneumatic-tire roller, and/or vibrating plate compactor (for areas inaccessible to rollers). Compact the bituminous stabilized mixture using the number, type, and weight of rollers and/or compactors sufficient to compact the mixture to the required density.

2.3.5 Straightedge

Furnish and maintain at the site, in good condition, one [3.05] [3.66] meter [10] [12] foot straightedge for use in the testing of the finished surface. Make straightedge available for government use. Construct straightedges of aluminum or other lightweight metal having blades of box or box-girder cross section with flat bottom reinforced to insure rigidity and accuracy. Provide handles to facilitate straightedge movement on the bituminous stabilized surface.

PART 3 EXECUTION

3.1 PREPARATION OF AREAS TO BE STABILIZED

Clean area of debris. Inspect area for adequate compaction and capability of withstanding, without displacement, compaction specified for the bituminous-stabilized mixture. Dispose of debris and removed unsatisfactory in-place material [as directed] [in waste disposal areas indicated]. Provide adequate drainage to prevent water from collecting or standing on the area during the duration of the bituminous-stabilization construction.

3.1.1 In-Place Material to be Stabilized

Grade and shape the entire area to conform to the lines, grades, and cross sections shown prior to being processed. Make soft or yielding areas

stable before construction is begun.

3.2 GRADE CONTROL

Excavate underlying material to sufficient depth for the required stabilized-course thickness so that the finish stabilized course and the subsequent surface course will meet the fixed grade. Provide line and grade stakes as necessary for control. Place grade stakes in lines parallel to the centerline of the area under construction and suitably spaced for string lining. Conform finished and completed stabilized area to the lines, grades, cross section, and dimensions indicated.

3.3 MIXING OF MATERIALS

****

NOTE: Both mix-in-place and traveling plant mixing methods are presented. Select one method or permit both as a contractor option.

****

3.3.1 Mixed-in-Place Method

3.3.1.1 Scarifying and Pulverizing of Soil

Prior to the application of bituminous materials, scarify and pulverize the soil [to the depth shown] [to a depth of [_____] mm inches]. Control scarification so that the layer beneath the layer to be stabilized is not disturbed. Do not permit the depth of pulverizing to exceed the depth of scarification. Unless otherwise permitted, limit the area scarified and pulverized not exceeding the area that can be completed in 2 working days.

3.3.1.2 Application of Water

Shape pulverized material to the cross section and grade indicated. Determine the moisture content. Add water in increments and partially incorporate each increment of water in the mix to avoid concentration of water near the surface. After the last increment of water has been added, continue mixing until the water is uniformly distributed throughout the mixture, including satisfactory moisture distribution along the edges of the section.

3.3.1.3 Application of Bituminous Material

Uniformly apply bituminous material, of the amount required for each application, by a spraybar integrated into the cutting drum of the mixer/reclaimer within a temperature range of 25 to 55 degrees C 75 to 130 degrees F. Uniformly mix bituminous material with the soil. If the bituminous material is applied in more than one increment, partially mix each application into the material. After the required amount of bituminous material has been added to the loose material, thoroughly mix the bituminous material and soil. After mixing is completed, verify the bituminous-stabilized mixture conforms to the mix design proportions and the moisture content is within 1 percent of the mix design. Include the water used to dilute the asphalt emulsion in the moisture content calculation. Do not permit equipment, except that used for spreading and mixing operations, to pass over the freshly spread bituminous material.

3.3.2 Traveling-Plant Method

Place the pulverized material in windrows of sufficient size to cover a predetermined width to the indicated compacted thickness. Advance the traveling plant at a uniform rate of speed and provide thorough mixing of the materials. Deliver water and bituminous material separately or together at a predetermined rate.

3.4 PLACEMENT AND COMPACTION

****

NOTE: Density will be based on the material being stabilized.

****

For mixed-in-place material, allow the bituminous-stabilized mixture an adequate amount of time to cure. After curing, shape the mixture approximately to the specified lines and grades and thoroughly loosened to its full depth and width. Begin compaction 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 the length of trips of the roller. Do not permit displacement of materials to occur. Compact mixture to a density at least [95] [_____] percent of laboratory maximum density. Compact areas inaccessible to rollers to the required density with mechanical tampers.

3.5 JOINTS

3.5.1 Longitudinal Joints

For the shoulders of the stabilized areas, place approved material 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. Simultaneously compact a minimum 300 mm 1 foot width of the shoulder or previously placed strip with the compacting of each layer of the stabilized course.

3.5.2 Transverse Joints

At the end of each day's construction, form a straight transverse construction joint by cutting back into the completed work to obtain a true vertical face free of loose or shattered material. Remove material along construction joints not properly compacted and replace with bituminous-stabilized mixture that is mixed, moistened, and compacted in accordance with this specification.

3.6 FINISHING

Finish the surface of the top layer to grade and cross section shown with a uniform texture. Light blading during compaction 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, scarify, rework, relay, or replace as directed. If any portion of the course, when laid, becomes saturated for any reason, immediately remove that portion, place in a windrow and aerate until a moisture content within the limits specified is obtained; and then spread, shape, and compact as specified.

3.6.1 Thickness Control

****

NOTE: Applicable to job conditions, the thickness tolerance provisions may be modified as required, restricting all deficiencies to not over 6 mm 1/4 inch.

****

Build the compacted thickness of the stabilized course within 13 mm 1/2 inch of the thickness indicated. Where measured thickness of the stabilized course is more than 13 mm 1/2 inch deficient, correct such areas by removing and replacing the bituminous-stabilized mixture and recompacting as directed. Where the measured thickness of the stabilized course is more than 13 mm 1/2 inch thicker than indicated, consider the course as conforming to the specified thickness requirements. Average job thickness is the average of all thickness measurements taken for the job, but within 6 mm 1/4 inch of the thickness indicated.

3.7 FIELD QUALITY CONTROL

3.7.1 Sampling and Testing

Perform sampling and testing in sufficient numbers and at the locations and times directed to ensure that materials and compaction meet specified tolerances in Table 1. Furnish certified copies of test results within 24 hours of completion of tests. Test for properties not listed in Table 1 are for Contractor Quality Control only.

3.7.2 Field Density

Express the compaction as a percentage of the laboratory maximum density. Prepare laboratory samples from an uncompacted mixture taken from the bituminous-stabilized material immediately prior to field compaction and compact the samples in accordance with ASTM D1557. Perform a minimum of one laboratory compaction test for each 4 hours of mixture placed. Determine field in-place density in accordance with [ASTM D1556/D1556M] [ASTM D6938. When ASTM D6938 is used, check the calibration curves and adjust if necessary, using the sand cone method as described in paragraph Calibration of the ASTM publication. ASTM D6938 results in a wet unit weight of soil and is used to determine the moisture content of the soil]. Check the calibration curves furnished with the moisture gauges along with density calibration checks as described in ASTM D6938. If ASTM D6938 is used, check the in-place densities by ASTM D1556/D1556M at least once per lift for each day's production of stabilized material. Furnish calibration curves and calibration test results within 24 hours of conclusion of the tests. Perform at least one field density test for each [200] [_____] square meters [250] [_____] square yards of each layer of stabilized material.

3.7.3 Sieve Analysis

Perform a minimum of 1 analysis for each [1000] [_____] metric tons tons of material to be stabilized, with a minimum of 3 analyses for each day's production until the course is completed. If the gradation varies by more than 10 percent on the No. 200 sieve from the mix design value, stop production and re-evaluate the mix design.

3.7.4 Liquid Limit and Plasticity Index

Perform one liquid limit and plasticity index for each sieve analysis in accordance with ASTM D4318.

3.7.5 Extraction Test

Conduct asphalt content tests in accordance with ASTM D2172/D2172M or ASTM D6307, to confirm the amount of bitumen and moisture in the mixture. Adjust operations as required to maintain the asphalt content within the tolerance of Table 1. Conduct one test [for every 4 hours of placement] [for every 275 metric tons 300 tons of mixture placed]. Take samples in accordance with ASTM D979/D979M.

3.7.6 Grade Test

Determine the grade by running lines of levels at intervals of 7.6 m 25 feet, or less, longitudinally and transversely, to determine the elevation of the completed pavement surface.

3.7.7 Smoothness Test

Take measurements for deviation from grade and cross section shown in successive positions parallel to the bituminous-stabilized lane, with a straightedge. Take measurements perpendicular to the bituminous-stabilized lane at [15] [_____] meter [50] [_____] foot intervals.

3.7.8 Thickness

Measure thickness of the stabilized course at intervals of 1 measurement for each [400] [_____] square meters [500] [_____] square yards of stabilized course. Take measurements in 75 mm 3 inch diameter test holes penetrating the stabilized course.

3.7.9 Bituminous Material

Sample the bituminous material used in accordance with ASTM D140/D140M.

3.8 MAINTENANCE

Maintain stabilized area in a satisfactory condition until accepted. Maintenance includes immediate repairs to any defects, repeated as often as necessary to keep the area intact. Correct defects as specified.

3.9 TRAFFIC

Completed portions of the bituminous-stabilized area may be opened to controlled traffic within 4 hours of completion of the course, if approved.

-- End of Section --