UNIFIED FACILITIES GUIDE SPECIFICATIONS

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DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 32 01 16.74

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05/18

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UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021

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SECTION 32 01 16.74

IN PLACE HOT REUSED ASPHALT PAVING
05/18

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NOTE: This guide specification covers the requirements for the hot in-place recycling of existing bituminous pavement using either single- or multiple-pass methods.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

****

PART 1 GENERAL

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NOTE: Experience and data indicate that scarifying is feasible only on existing asphalt pavements that are structurally sound but in need of surface leveling or exhibit superficial distresses. In the single-pass method, new asphalt mixture is placed over the recycled asphalt at the time of construction. When using a multiple-pass in-place recycling process, apply an asphalt overlay or surface treatment to the recycled pavement after construction of the in-place recycled mixture. Hot in-place recycling is a good method for roads in poor surface condition, but approval of the responsible government agency's member on the Pavements Discipline Working Group is required for

use on airfields.
****

1.1 UNIT PRICES

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NOTE: When other methods of measurement are desired or are necessary, this paragraph will be modified accordingly. Delete paragraph NEW ASPHALT MIXTURE when new asphalt is not added to the mixture. The term "recycling agent" is used in this section to mean any product used to decrease the viscosity of old asphalt binders as specified in ASTM D4552.
****

1.1.1 Measurement

1.1.1.1 In-Place Recycled Mixture

The quantity of hot in-place recycled mixture paid for will be the number of square meters yards completed and accepted as determined by the Contracting Officer. The number of square meters yards of planed pavement will be determined by measuring the length and width of the specified work area. Recycling agent will be paid for by the number of liters gallons of material used in the accepted work.

1.1.1.2 New Asphalt Mixture

New asphalt mixture will be paid for by the number of metric tons short tonsof material used in accepted work.

1.1.2 Payment

The quantities of recycled asphalt mixture, new asphalt mixture, and recycling agent as determined in paragraph IN-PLACE RECYCLED MIXTURE and paragraph NEW ASPHALT MIXTURE, will be paid for at contract unit prices per square meter yard for recycled mixture [and per metric ton short ton for new asphalt mixture] and per liter gallon for recycling agent. If deficiencies in the finished product exceed specified tolerances, no payment will be made for such areas of pavement until the defective areas are corrected and accepted by the Contracting Officer.

1.2 REFERENCES

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NOTE: Paragraph REFERENCES 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 paragraph REFERENCES 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.

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 D75/D75M	(2019) Standard Practice for Sampling Aggregates
ASTM D140/D140M	(2016) Standard Practice for Sampling Asphalt Materials
ASTM D979/D979M	(2015) Sampling Bituminous Paving Mixtures
ASTM D2041/D2041M	(2011) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D2170/D2170M	(2018) Standard Test Method for Kinematic Viscosity of Asphalts (Bitumens)
ASTM D2171/D2171M	(2018) Standard Test Method for Viscosity of Asphalts by Vacuum Capillary Viscometer
ASTM D2172/D2172M	(2017; E 2018) Standard Test Methods for Quantitative Extraction of Asphalt Binder from Asphalt Mixtures
ASTM D2726/D2726M	(2019) Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
ASTM D3665	(2012; R 2017) Standard Practice for Random Sampling of Construction Materials
ASTM D4552/D4552M	(2010; R 2016; E 2016) Standard Practice for Classifying Hot-Mix Recycling Agents
ASTM D5404/D5404M	(2012; R 2017) Standard Practice for Recovery of Asphalt from Solution Using the Rotary Evaporator
ASTM D6373	(2016) Standard Specification for Performance Graded Asphalt Binder

ASTM D6925	(2014) Standard Test Method for Preparation and Determination of the Relative Density of Hot Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor
ASTM D6926	(2020) Standard Practice for Preparation of Asphalt Mixture Specimens Using Marshall Apparatus

1.3 SUBMITTALS

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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.

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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

Job-Mix Formula; G[, [_____]]

SD-04 Samples

Samples

SD-06 Test Reports

Field Testing and Sampling

1.4 EQUIPMENT, TOOLS, AND MACHINES

Maintain equipment, tools, and machines used in the performance of the work in a satisfactory working condition at all times, and in conformance with applicable governing regulations for local air pollution controls. Provide equipment capable of performing recycling operations at a minimum rate of 600 square meters 720 square yards per hour to the depth required.

1.4.1 Heating Units

Provide heating units that use radiant heat with no flame directly on the pavement. Provide combustion chamber(s) that is(are) insulated and totally enclosed. Shield the heating units with an enclosed hood to hold in the heat and to protect workers and surrounding areas.

1.4.2 Scarifying/Milling Equipment

****

NOTE: The depth of scarification is approximately 25 mm 1 inch unless otherwise stated for a specific project. Never scarify deeper than 50 mm 2 inches. Do no scarify to a depth within 25 mm 1 inch of the underlying base course.

****

Provide scarifying or hot milling equipment that is able to penetrate the pavement surface and cut to the depth as shown on the plans, without fracturing the aggregate in the pavement. When used for this purpose, the scarifiers or hot milling heads have to be able to mix the recycled mixture with any material that is added as part of the recycling process. Provide equipment with height adjustments to clear obstacles in the pavement.

1.4.3 Distribution and Mixing Equipment

Provide at least one unit of the recycling equipment capable of uniformly distributing and thoroughly mixing the recycling agent [and new asphalt mixture] with the recycled material. The distribution system(s) of the added material is(are) required to have a positive feed and shut-off linked to the movement of the unit.

1.4.4 Vibratory Screed

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NOTE: Cross slope and grade can be adjusted when additional asphalt materials are added to the mixture. When only the recycling agent is added to the mixture, there is little opportunity to adjust the existing slope and grade.

****

Provide a unit with a vibratory screed capable of spreading, leveling, and finishing the recycled mixture uniformly across the processed width.

1.4.5 Straightedge

Provide and maintain at the site, in good condition, one 3.66 meter 12 foot straightedge for each finishing unit (paver) for testing the finished surface. Make straightedges available for Government use. Straightedges have to be constructed of aluminum or other lightweight metal, with blades of box or box-girder cross section with flat bottom, reinforced to insure rigidity and accuracy, and with handles to facilitate movement on the pavement.

1.5 QUALITY CONTROL

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NOTE: The amount of sampling and testing required depends upon the type of hot in-place recycling performed. Processes that do not add additional asphalt mixture only require testing for the amount of recycling agent added to the mixture. Processes that add additional asphalt material require gradation, asphalt content, and mixture volumetric testing.

****

1.5.1 Initial Sampling and Testing

Perform sampling and testing using a commercial testing laboratory or Contractor's facilities, upon approval by the Contracting Officer. Do not perform any work that requires testing until the testing facilities have been inspected and approved. The first inspection of the testing facilities will be at the expense of the Government. Cost incurred by the Government, for any subsequent inspection required because of failure of the facilities to pass the first inspection, will be charged to the Contractor.

1.5.2 Samples

Take samples of existing asphalt pavement from at least two locations to the expected depth of milling for laboratory tests in accordance with ASTM D979/D979M. Take samples of existing aggregate stockpiles in accordance with ASTM D75/D75M. Take samples of asphalt cement in accordance with ASTM D140/D140M and take samples of recycling agent in accordance with ASTM D140/D140M. Use the samples of asphalt pavement to determine the job-mix formula (JMF).

1.6 ENVIRONMENTAL REQUIREMENTS

Perform hot in-place recycling procedures only when the existing pavement is dry and the pavement surface temperature is above 15 degrees C 60 degrees F.

PART 2 PRODUCTS

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NOTE: Delete the inapplicable paragraphs. Develop a mix design or JMF containing the type and amount

of new aggregates and asphalt cement for processes requiring additional new asphalt mixture. The material requirements for the new aggregates and asphalt cement used to produce the new asphalt mixture have to be listed below. The requirements listed are as given in Section 32 12 15.13 HOT-MIX ASPHALT AIRFIELD PAVING or Section 32 01 13.62 ASPHALT SURFACE TREATMENT.

****

2.1 RECYCLING AGENTS

****

NOTE: Select the appropriate grade of recycling agent based upon the ability of the recycling agent to provide the desired asphalt binder properties in the designed mixture.

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Provide and use a hot-mix recycling agent of the appropriate grade conforming to ASTM D4552/D4552M.

2.2 JOB-MIX FORMULA

****

NOTE: When additional asphalt mixture is added to the mixture, the Government will have to sample and provide information concerning the material properties (asphalt content and gradation) of the existing pavement to the bidding parties. Add an edited version of either Section 32 12 16.16 ROAD-MIX ASPHALT PAVING or Section 32 12 15.13 HOT-MIX ASPHALT AIRFIELD PAVING to the project specifications in order to provide the material and mixture properties required in the JMF. The grade of asphalt specified ought to be that which is specified by the State DOT for that location.

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Furnish the JMF to the Contracting Officer for review at least 14 days prior to the start of recycling operations. Do not begin demolition or recycling operations until the mix design has been approved by the Contracting Officer.

a. No payment will be made for hot in-place recycled mixtures produced prior to the completion and acceptance of the JMF. Provide [the gradation of the aggregate] [and] [the percentage of [asphalt and] recycling agent to be added to the mixture] in the JMF submitted for approval. Also provide, with the JMF, the amount of [asphalt and] recycling agent given per square meter yard of recycled material.

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NOTE: Specify 50 gyrations for pavements designed for low tire pressures (less than or equal to 690 kPa 100 psi). Specify 75 gyrations for pavements designed for high tire pressures (greater than 690 kPa 100 psi).

****

b. Develop the JMF by combining various percentages of the selected recycling agent with the existing pavement material. Increase the amount of recycling agent in the recycled mixture until the void content of specimens made according to ASTM D6925 or ASTM D6926 using [50] [75] gyrations/blows reaches 3.5 percent. This reveals the maximum amount of recycling agent that can be added to the mixture. If the voids in the mixture are at 3.5 percent or lower with no recycling agent added, then no recycling agent will be used unless new asphalt mixture is added. At the selected amount of recycling agent and new asphalt mixture, if used, extract the asphalt cement from the samples made and recovered according to ASTM D2172/D2172M and ASTM D5404/D5404M, respectively.

c. Obtain the viscosity of the recovered asphalt cements in accordance with either ASTM D2170/D2170M or ASTM D2171/D2171M. The grade of recycling agent used in the recycled mixture has to be one that results in a dynamic shear rheometer measurement approaching the value indicated by ASTM D6373 for the high temperature PG grade requirements in the project location.

d. List the asphalt content tolerance as plus or minus 0.5% of the developed asphalt content target value in the JMF. [The in-place hot reused asphalt paving will be covered with hot mix asphalt meeting the requirements given in Section [32 12 16.16 ROAD-MIX ASPHALT PAVING] [32 12 15.13 HOT-MIX ASPHALT AIRFIELD PAVING]] [The in-place hot reused asphalt paving will be covered with surface treatment meeting the requirements given in Section 32 01 13.62 ASPHALT SURFACE TREATMENT].

PART 3 EXECUTION

3.1 PREPARATION OF SURFACE

Prior to recycling, clean the pavement surface of all loose and foreign or objectionable material with brooms or other suitable methods. Localized patching, structural corrections, and adjustments to existing structures (i.e., manhole covers) have to be completed prior to the recycling process.

3.2 HEATING

****

NOTE: Control the amount of heat applied to the pavement sufficiently to avoid damaging the heated pavement. Excess heat burns and therefore damages the asphalt binder. Experience has shown that a dense graded asphalt mix that is relatively lean in asphalt cement content is easiest to heat.

****

Provide heating units of sufficient number and size to heat the pavement surface as required for successful scarifying or hot milling to the required depth. Do not allow these units to overheat the existing pavement. Generate sufficient heat to result in a minimum recycled mixture temperature of 115 degrees C 240 degrees F as the mixture is being placed. Do not allow the maximum temperature of the recycled mixture to exceed 143 degrees C 300 degrees F at any time during the recycling process. Dispose of any recycled mixture that exceeds 143 degrees C 300 degrees F in accordance with approved waste disposal procedures and locations/facilities and replace the recycled mixture at no cost to the Government.

3.3 RECYCLING PROCEDURE

****

NOTE: Based on the requirements of the project, select either a single- or multiple-pass method of recycling. The single-pass method is further broken down into remix and repave procedures. The multiple-pass method requires a wearing surface that can be applied at any time from immediately prior to compaction of the recycled mixture to several weeks later.

Edit the following paragraphs according to the type of recycling to be accomplished.

****

3.3.1 Single-Pass Method

Perform the single-pass method using self-contained, self-propelled, automated units capable of heating, scarifying or hot rotary mixing, and redistributing the recycled mixture. The mixture consists of the existing pavement, recycling agent, [and new asphalt mixture] to the specified depth and design. Automatically feed the reclaimed material into a mixing unit. Add a recycling agent [and new asphalt mixture] to the reclaimed material in the mixer. Apply the recycling agent within the range required for the project and control the application within plus or minus 0.023 L/square meter 0.05 gallons/square yard. Heat the recycling agent, at the time of application, to within plus or minus 14 degrees C 25 degrees F of the temperature of the recycled mixture. Specify the [type and quantity of the new asphalt mixture as well as the proportion of new material and] reclaimed material in the JMF. Thoroughly mix all materials while maintaining the minimum temperature of 115 degrees C 240 degrees F. After [mixing, the combined bituminous material] [the addition of the recycling agent], gather the reclaimed material using a leveling device equipped with augers for mixing and placing to a uniform depth over the width being processed (Repaving). Place a layer of new hot mix asphalt conforming to the JMF over the recycled mix while it still has a residual minimum temperature of 107 degrees C 225 degrees F. Automatically feed the layer of new hot mix asphalt (meeting the requirements of Section 32 12 16.16 or Section 32 12 15.13) into a finishing unit (paver) that has automatic screed control for longitudinal leveling of the homogeneous recycled mixture to the required thickness in conformance with the specified cross-section.

3.3.2 Multiple-Pass Method

Perform the multiple-pass method consisting of self-contained, self-propelled or towed, automated units capable of heating, scarifying or hot rotary mixing, redistributing, and screeding. The equipment used in the method has to also provide for controlled leveling at the crown and across the screed to insure a cross-section that conforms to the pavement profile specified. Control the heating to provide a minimum recycled mixture temperature of 115 degrees C 240 degrees F behind the screed. The unit shall be able to uniformly distribute the specified amount of recycling agent throughout the recycled mixture. Apply the recycling agent within the range required for the project and control the application within plus or minus 0.023 L/square meter 0.05 gallons/square yard. Heat the recycling agent, at the time of application, to within

plus or minus 14 degrees C 25 degrees F of the temperature of the recycled mixture. Apply a wearing course meeting the requirements of Section [32 12 16.16 ROAD-MIX ASPHALT PAVING] [32 12 15.13 HOT-MIX ASPHALT AIRFIELD PAVING] [32 01 13.62 ASPHALT SURFACE TREATMENT] following completion of the recycling process.

3.4 JOINTS

Heat the existing pavement a minimum of 100 mm 4 inches beyond the width of the recycling. When recycling adjacent to an existing hot-mix recycled pavement mat, the heating has to extend 150 mm 6 inches into the existing mat and at least 100 mm 4 inches of the mat has to be recycled with the new mat.

3.5 COMPACTION

****

NOTE: The amount of compaction required for the in-place recycled asphalt mixture depends on the pavement application. Pavements subjected to high tire pressure (over 690 kPa 100 psi) vehicles, heavy loads, or numerous application of loads require a minimum density or degree of compaction of 93 percent of the theoretical maximum specific gravity of the recycled mixture. Pavements subjected to low tire pressure (equal to or less than 690 kPa 100 psi) vehicles, lighter loads, or fewer applications of loads will require a minimum density or degree of compaction of 92 percent of the theoretical maximum specific gravity of the recycled mixture.

****

Uniformly compact the in-place recycled asphalt mixture to a density of greater than or equal to [93] [92] percent of the theoretical maximum specific gravity but less than or equal to 96 percent of the theoretical maximum specific gravity as determined according to ASTM D2041/D2041M. Provide and utilize the type, size and number of rollers using the rolling pattern that produced the approved test section in production paving. Use a pneumatic-tire roller to seal the surface. Use additional rollers as required to remove any roller marks. Use only water or an approved release agent on rollers, tamps, and other compaction equipment. Operate rollers in vibratory mode only when doing so does not damage the pavement. Establish a new rolling pattern when changes occur in the recycled mix or placement conditions. Adjust or cease compaction when cracking or displacement occurs. Repair cracked pavement before sealing, overlaying or applying surface treatments. Ensure that pavement is fully compacted before allowing rollers to park on the pavement. Suspend operations when the density is found to be outside the specified range. Provide a written corrective action plan to the Contracting Officer that will ensure future operations will result in pavement densities within the specified range. Do no restart recycling operations until operations have been adjusted so that density requirements are met. Correct pavement with density lower than the minimum specified by either removing and replacing or reheating with an infrared heater with no open flame and recompacting at no additional cost to the Government. Pavement can only be reheated and recompacted once. If its density remains below the minimum specified, remove and replace the pavement mixture having inadequate density at no additional cost to the government.

3.6 TEST SECTION

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NOTE: Use of a test section is recommended for all hot in-place recycling projects, especially for single-pass methods of construction. Placement of test sections in two adjacent paving lanes is required for recycling of pavement areas where extensive longitudinal construction joints are required, i.e. parking lots.

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Prior to the start of the recycling, recycle a length of pavement at least 30 meters 100 feet long to the depth required in the project. If possible, at the direction of the Contracting Officer, place this test section in two adjacent paving lanes to demonstrate joint construction. In accordance with requirements specified in paragraph PREPARATION OF SURFACE, paragraph HEATING, paragraph RECYCLING PROCEDURE and paragraph COMPACTION, place or spread the recycled mixture and then roll the recycled mixture with the equipment to be used in the project. Test and evaluate this test section as a full day's production. The test section may be located in one of the less critical areas of the project pavement construction, as directed by the Contracting Officer. Begin full production if test results are satisfactory, and as approved by the Contracting Officer. If the test section was constructed within the project boundaries and demonstrates satisfactory test results, keep it in place as part of the completed pavement. If tests indicate that the pavement does not conform to specification requirements, make necessary adjustments to operations and procedures immediately and construct another test section, all at no additional cost to the Government. Construct additional test sections, as necessary and as directed by the Contracting Officer, to be sampled and tested for conformance with specification requirements. Do not start full production without test section approval by the Contracting Officer.

3.7 ACCEPTABILITY OF WORK

3.7.1 Field Testing and Sampling

Perform the tests described in paragraph MIXTURE PROPERTIES and paragraph DENSITY TESTING on one set of samples taken at the rates and times specified in these sub paragraphs. Submit copies of all test results within 24 hours of material sampling. Submit copies of test reports on material properties of existing asphalt pavement [and new asphalt mixture], not less than [30] [_____] days before the material is required in the work. Include with the test reports all of the information establishing compliance with the requirements detailed in this section and in referenced publications. Certified copies of the recycling agent manufacturer's test reports indicating compliance with applicable specified requirements, have to be received no less than [30] [_____] days before the material is required for the project. Perform sampling and testing using a commercial testing laboratory or Contractor's facilities, upon approval by the Contracting Officer.

3.7.1.1 Mixture Properties

****

NOTE: Select the information in the first set of brackets when the single-pass remix process is used

and select the information in the second set of brackets when the multiple-pass process is used. Sample and test the mixture twice a day, or once for every 4 hours, of production or placement.
****

[Obtain a sample of the recycled mixture for every [_____] hours of mix production. Extract the asphalt cement from the mix according to ASTM D2172/D2172M. The asphalt content of the recycled material has to be within the tolerance given in paragraph JOB-MIX FORMULA. Determine the gradation of the extracted aggregate according to ASTM C117 and ASTM C136/C136M. The extracted gradation has to meet the JMF and the corresponding tolerances.] [Record and report to the Contracting Officer the amount of recycling agent used per day along with the square meter yard area recycled. Use these values to verify that the correct amount of recycling agent is being added to the recycled mixture.]

3.7.1.2 Density Testing

****
NOTE: A 100 mm 4 inch core or 150 mm 6 inch core sample is required for each 1,700 to 5,000 square meters 2,000 to 6,000 square yards of hot in-place recycled mixture. Default area of sampling is 1,700 square meters 2,000 square yards.
****

Obtain one 100 or 150 mm 4 or 6-inch diameter core sample for each [_____] square meters yards of hot in-place recycled mixture. Determine the location of the core samples according to ASTM D3665. Determine the density of the cores in accordance with ASTM D2726/D2726M. Report the density as a percent of the theoretical maximum specific gravity, as determined by ASTM D2041/D2041M, of the cores. Correct pavement with density lower than the minimum specified by either removing and replacing or reheating with an infrared heater with no open flame and recompacting at no additional cost to the Government.

3.7.2 Grade Conformance

****
NOTE: Run lines of levels to determine elevation of the planed pavement longitudinally and transversely at intervals not exceeding 7.6 meters 25 feet for pavements subject to aircraft traffic, such as airfield runways and taxiways. Grade measurements for roads will be 7.6 m 25 feet longitudinally along centerline and as appropriate transversely.
****

Test the finished surface of the recycled pavement, for conformance with the plan-grade requirements and acceptance in the presence of the Contracting Officer, by running lines of levels at intervals of [_____] meters feet longitudinally and [_____] meters feet transversely to determine the elevation of the completed pavement. Correct the finished surface where it varies more than 15 mm 0.6 inch from the established plan-grade line and elevation. Correct the finished surfaces at junctures with other pavements where the surface does not coincide with the finished surfaces of abutting pavements.

3.7.3 Surface-Smoothness

During construction of the recycled pavement, the finished surface will be tested by the Contractor using a straightedge. The measurements of any deviations from the straightedge and the locations of those deviations will be recorded. Other approved devices may be used provided that, when satisfactorily and properly operated, such devices reveal all surface irregularities exceeding the tolerances specified. Correct surface irregularities that depart from the testing edge by more than 6 mm 1/4 inch as directed.

-- End of Section --