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USACE / NAVFAC / AFCEC / NASA **UFGS-32 12 17.19 (November 2020)**

Preparing Activity: USACE **NEW**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated October 2020

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DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 32 12 17.19

FUEL RESISTANT ASPHALT PAVING FOR AIRFIELDS - SURFACE COURSE

11/20

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SECTION 32 12 17.19

FUEL RESISTANT ASPHALT PAVING FOR AIRFIELDS - SURFACE COURSE
11/20

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NOTE: This guide specification covers the requirements for fuel resistant asphalt pavement - surface course (central-plant) for airfields using Marshall or Gyratory compaction method.

Adhere to UFC 1-300-02 **Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Do not edit or rewrite the unbracketed text without the express consent of the Corps of Engineers Transportation Systems Center (TSMCX), the Air Force Civil Engineer Center (AFCEC) pavement subject matter expert (SME), or the Naval Facilities Engineering Command (NAVFAC). Edit bracketed items by choose applicable items(s) or inserting appropriate text.**

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: Modifications must be made to this guide specification during conversion to a project specification in accordance with the NOTES which are located throughout the document. These NOTES are instructions to the designer, and will not appear in the project specification.

Specifications developed for Corps of Engineers managed projects must be edited in accordance with ER 1110-34-1 Engineering and Design Transportation Systems Mandatory Center of Expertise (Section 11, 12, App A, B, C).

This guide specification only pertains to the fuel resistant asphalt pavement for airfields - surface course aspects of the project and not to any surface

preparation requirements dealing with aggregate base courses, milling, or tack and prime coats. Cover surface preparation requirements by either including them in this guide specification or by adding pertinent sections to the project documents.

This specification utilizes a Quality Assurance and Quality Control (QA/QC) construction management philosophy. Quality Assurance refers to the actions performed by the Government or designated representative to assure the final product meets the job requirements. This specification has been developed for QC testing to be used as a basis of pay. It is recommended that the Government's QA testing should include a minimum of 5 percent of the Contractor's QC tests. Results of QC testing are the basis for pay unless there are discrepancies between QC and QA testing. Quality Control also refers to the actions of the Contractor to monitor the construction and production processes and to correct these processes when out of control. Results of QC testing are reported daily on the process control charts maintained by the Contractor. Quality Control is covered in paragraph CONTRACTOR QUALITY CONTROL STAFF and paragraph CONTRACTOR QUALITY CONTROL.

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1.1 FULL PAYMENT

1.1.1 Method of Measurement

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NOTE: For unit-price contracts, include first bracketed statements and delete the second set. For lump sum contracts, delete the first bracketed statements and include the second set.

Do not delete PART 1 for lump sum Contracts.

****

[The amount paid for will be the number of metric tons tons of fuel resistant asphalt pavement used in the accepted work. Weigh the fuel resistant asphalt pavement after mixing. No separate payment will be made for weight of asphalt binder material incorporated herein.] [Utilize the quantity of fuel resistant asphalt pavement, per ton placed and accepted, for the purposes of assessing the pay factors stipulated below.]

1.1.2 Basis of Payment

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NOTE: For unit-price contracts, include first bracketed statements and delete the second set. For lump sum contracts, delete the first bracketed statements and include the second set. Include prescriptive unit price based on the Government estimate for payment adjustment. Use unit prices when the job exceeds 1,000 metric tons tons.

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[Quantities of fuel resistant asphalt pavement, determined as specified above, will be paid for at respective Contract unit prices or at reduced prices adjusted in accordance with paragraphs PERCENT PAYMENT and ACCEPTANCE. Payment will constitute full compensation for furnishing all materials, equipment, plant, and tools; and for all labor and other incidentals necessary to complete work required by this section of the specification.] [The measured quantity of fuel resistant asphalt pavement will be paid for and included in the lump sum Contract price. If less than 100 percent payment is due based on the pay factors stipulated in paragraph PERCENT PAYMENT, a unit price of [_____] per metric tonton will be used for purposes of calculating the payment reduction.]

1.2 PERCENT PAYMENT

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NOTE: The basis of pay testing includes material tests to determine laboratory air voids, in-place density, smoothness and plan grade which are needed to determine percent payment.

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The lot pay factor is determined by taking the lowest computed pay factor based on either laboratory air voids, in-place density, smoothness, or grade (each discussed below). Remove and replace lots when the lowest computed pay factor requires rejection. At the end of the project calculate the average pay factor for all lots. If this average lot pay factor exceeds 95.0 percent and no individual lot has a pay factor less than 75.0 percent, then the percent payment for the entire project will be 100 percent of the unit bid price. If the average lot pay factor is less than 95.0 percent, then each lot will be paid for at the unit price multiplied by the lot pay factor. For any lots which are less than 2,000 metric tonstons, a weighted lot pay factor will be used to calculate the average lot pay factor. When work on a lot is required to be terminated before all four sublots are completed, the results from the completed sublots will be analyzed to determine the percent payment for the lot following the same procedures and requirements for full lots but with fewer or more test results as determined in paragraph PAVEMENT LOTS.

1.2.1 Payment Adjustment for Laboratory Air Voids

Laboratory air void calculations for each lot will use the average theoretical maximum density values obtained for the lot. Determine the average TMD in accordance with paragraph THEORETICAL MAXIMUM DENSITY (TMD). The mean absolute deviation of the laboratory air void contents (one from each sublot) from the JMF air void content will be evaluated as shown in the example below and a pay factor will be determined from Table 1. When 0 percent payment is determined, remove and replace the rejected lot at least 100 mm 4 inches into the cold (existing) lane adjacent to the longitudinal joint.

Table 1
Pay Factor Based on Laboratory Air Voids

Mean Absolute Deviation of Lab Air Voids from JMF	Pay Factor, percent
0.60 or less	100

Table 1 Pay Factor Based on Laboratory Air Voids	
Mean Absolute Deviation of Lab Air Voids from JMF	Pay Factor, percent
0.61 - 0.80	98
0.81 - 1.00	95
1.01 - 1.20	90
Above 1.20	reject (0)

1.2.1.1 Pay Factor Example for Laboratory Air Voids

An example of the computation of mean absolute deviation for laboratory air voids is as follows: Assume that the laboratory air voids are determined from 4 sublots where one set of laboratory compacted specimens is from a single sublot. The laboratory air voids for the 4 sublots are determined to be 2.0, 1.5, 2.5, and 2.2. Assume that the target air voids from the JMF is 2.5. The mean absolute deviation is then:

$$\text{Mean Absolute Deviation} = (|2.0 - 2.5| + |1.5 - 2.5| + |2.5 - 2.5| + |2.2 - 2.5|)/4$$

$$\text{Mean Absolute Deviation} = (0.5 + 1.0 + 0.0 + 0.3)/4 = (1.8)/4 = 0.45$$

The mean absolute deviation for laboratory air voids is determined to be 0.45. It can be seen from Table 1 that the lot pay factor based on laboratory air voids is 100 percent.

1.2.2 Payment Adjustment for In-place Densities

The average in-place mat and joint densities are expressed as a percentage of the average TMD for the lot. Determine the average TMD in accordance with paragraph THEORETICAL MAXIMUM DENSITY (TMD). The average in-place mat density and joint density for a lot are determined and compared with Table 2 to calculate a single pay factor per lot. Use the following process to determine the single pay factor for in-place density:

a. Step 1: Determine the pay factors for mat density and joint density using Table 2.

b. Step 2: Determine ratio of joint area to mat area. The area associated with the joint is considered to be 3 m 10 feet wide times the length of completed longitudinal construction joint in the lot. This joint area will not exceed the total lot size. The length of joint to be considered will be that length where a new lane has been placed against an adjacent lane of asphalt pavement, either any cold joint against another lot or any other existing asphalt paved previously. The area associated with the joint is expressed as a percentage of the total lot.

c. Step 3: Compute the weighted pay factor for the joint using the formula in the example shown in paragraph PAY FACTOR BASED ON IN-PLACE DENSITY.

d. Step 4: Where freshly placed fuel resistant asphalt pavement abuts old (not in contract) asphalt pavement, determine density at the tie-in longitudinal joint by taking one core per sublot at a random location for each lot of material placed adjacent to the joint. If Step 4 is not applicable, move to Step 5. The size of joint area is 3 m 10 feet wide by the length of the joint being paved. Locate the center of each of the four cores 150 mm 6 inches from the edge of the existing pavement. Take each core at a random location along the length of the joint. The requirements for joint density for this lot, adjacent to the existing asphalt joint, are the same as that for the mat density specified in Table 2. For freshly placed fuel resistant asphalt pavement-old asphalt (not in contract) joints at taxiways abutting runways, aprons, or other taxiways, take two additional randomly located cores along each taxiway intersection.

e. Step 5: Compare weighted pay factor for joint density to pay factor for mat density and select the lowest. This selected pay factor is the pay factor based on density for the lot. When the TMD on both sides of a longitudinal joint is different, the average of these two TMD will be used as the TMD needed to calculate the percent joint density.

When 0 percent payment is determined for mat density, remove and replace the rejected lot at least 100 mm 4 inches into the cold (existing) lane adjacent to the longitudinal joint. When 0 percent payment is determined for joint density, remove and replace the rejected longitudinal joint with a 3 m 10 feet wide paving lane that is centered over the joint.

Table 2
Pay Factor Based on In-place Density

Average Mat Density (4 cores) (Percent of TMD)	Pay Factor, percent	Average Joint Density (4 cores) (Percent of TMD)
95.0 - 98.0	100.0	Above 93.5
94.9	100.0	93.4
94.8 or 98.1	99.9	93.3
94.7	99.8	93.2
94.6 or 98.2	99.6	93.1
94.5	99.4	93.0
94.4 or 98.3	99.1	92.9
94.3	98.7	92.8
94.2 or 98.4	98.3	92.7
94.1	97.8	92.6
94.0 or 98.5	97.3	92.5
93.9	96.3	92.4
93.8 or 98.6	94.1	92.3
93.7	92.2	92.2
93.6 or 98.7	90.3	92.1
93.5	87.9	92.0
93.4 or 98.8	85.7	91.9
93.3	83.3	91.8
93.2 or 98.9	80.6	91.7
93.1	78.0	91.6

Table 2 Pay Factor Based on In-place Density		
Average Mat Density (4 cores) (Percent of TMD)	Pay Factor, percent	Average Joint Density (4 cores) (Percent of TMD)
93.0 or 99.0	75.0	91.5
below 93.0, above 99.0	0.0 (reject)	below 91.5

1.2.2.1 Pay Factor Based on In-place Density

An example of the computation of a pay factor (in I-P units only) based on in-place density, is as follows: Assume the following test results for field density made on the lot: (1) Average mat density = 94.2 percent (of lab TMD). (2) Average joint density = 92.5 percent (of lab TMD). (3) Total area of lot = 30,000 square feet. (4) Length of completed longitudinal construction joint = 2,000 feet.

a. Step 1: Determine pay factor based on mat density and on joint density, using Table 2:

   Mat density of 94.2 percent = 98.3 pay factor.

   Joint density of 92.5 percent = 97.3 pay factor.

b. Step 2: Determine ratio of joint area to mat area. Multiply the length of completed longitudinal construction joint by the specified 10 foot width and divide by the mat area (total paved area in the lot).

   Ratio = Ratio of joint area to mat area

   Ratio = (2,000 feet x 10 feet)/30,000 square feet

   Ratio = 0.6667

c. Step 3: Weighted pay factor (wpf) for joint is determined as indicated below:

   wpf = joint pay factor + (100 - joint pay factor) x (1 - ratio)

   wpf = 97.3 + (100-97.3) x (1-0.6667) = 98.2 percent

d. Step 4: Compare weighted pay factor for joint density to pay factor for mat density and select the smaller:

   Pay factor for mat density: 98.3 percent.

   Weighted pay factor for joint density: 98.2 percent

   Selected pay factor: 98.2 percent

1.2.3 Payment Adjustment for Smoothness (Final Wearing Surface Only)

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NOTE: When Profilograph testing is not required, delete the following paragraph for pay adjustment for smoothness. This paragraph may be deleted for projects where a profilograph cannot record 400 meters 0.10 of a mile in length. Profilograph testing is required for runway and applicable taxiway pavements.
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1.2.3.1 Profilograph Testing

Test the entire lot in the longitudinal direction per ASTM E1274. Perform the longitudinal testing at the centerline of each paving lot and 1/8th point from each side of the lot. Record the location and data from all profilograph measurements. Compute the profile index for each pass of the profilograph (3 per lot) in each 0.1 km0.1 mile segment. The profile index for each segment is the average of the profile indices for each pass in each segment. When the average Profile Indices of a lot exceeds the tolerance specified in paragraph SMOOTHNESS REQUIREMENTS determine pay factor using Table 3. Correct any small individual area with surface deviation which exceeds the tolerance specified in paragraph SMOOTHNESS REQUIREMENTS by more than 79 mm per km 5.0 inches per mile or more, by grinding to meet the specification requirements in Table 3 or remove and replace at no additional cost to the Government.

Table 3
Pay Factor for Smoothness

Average of Profile Indices Exceeding Tolerance (per lot)	Pay Factor, Percent
less than or equal to 16 mm km1.0 inch per mile	100.0
greater than 16 mm per km1.0 inch per mile but less than or equal to 32 mm per km2.0 inches per mile	95.0
greater than 32 mm per km2.0 inch per mile but less than 47 mm per km3.0 inches per mile	90.0
greater than 47 mm per km3.0 inch per mile but less than 63 mm per km4.0 inches per mile	75.0
greater than 63 mm per km4.0 inches per mile	Remove and Replace at no cost to the Government

1.2.4 Pay Factor Based on Plan Grade

Within 5 working days after completion of a particular lot incorporating the final wearing course, test the final wearing surface of the pavement for conformance with specified plan grade requirements. Provide a final wearing surface of pavement conforming to the elevations and cross sections shown and not vary more than 9 mm 0.03 foot for runways and landing zones or 15 mm 0.05 foot for taxiways, aprons, and shoulders from the plan grade established and approved at site of work. Match finished surfaces at juncture with other pavements with finished surfaces of abutting pavements. Deviation from the plan elevation will not be permitted in areas of pavements where closer conformance with planned elevation is required for the proper functioning of drainage and other appurtenant structures involved. The grade will be determined 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. Maintain detailed notes of the results of the testing and provide a copy to the Government immediately after each day's testing. In areas where the grade exceeds the tolerance by more than 50 percent, remove the surface lift full depth; and replace the lift with fuel resistant asphalt pavement to meet specification requirements, at no additional cost to the Government. Diamond grinding may be used to remove high spots to meet grade requirements. Skin patching for correcting low areas or planing or milling for correcting high areas will not be permitted.

Table 4
Pay Factor for Plan Grade

Percent of All Measurements Outside Tolerance	Pay Factor, percent
Greater than or equal to 5 but less than 10	90
Greater than or equal to 10 but less than 15	75
Greater than 15	Remove and replace the surface lift at no cost to the Government

1.3 REFERENCES

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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.

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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 156	(2013; R 2017) Standard Specification for Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
AASHTO R 30	(2002; R 2019) Standard Practice for Mixture Conditioning of Hot Mix Asphalt (HMA)

ASPHALT INSTITUTE (AI)

AI MS-2	(2015) Asphalt Mix Design Methods

ASTM INTERNATIONAL (ASTM)

ASTM C29/C29M	(2017a) Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C88	(2018) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	(2017) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C127	(2015) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C128	(2015) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
ASTM C131/C131M	(2020) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C142/C142M	(2017) Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C566	(2013) Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying
ASTM C1252	(2017) Standard Test Methods for Uncompacted Void Content of Fine Aggregate (as Influenced by Particle Shape, Surface Texture, and Grading)
ASTM D36/D36M	(2014; R 2020) Standard Test Method for

	Softening Point of Bitumen (Ring-and-Ball Apparatus)
ASTM D75/D75M	(2019) Standard Practice for Sampling Aggregates
ASTM D140/D140M	(2016) Standard Practice for Sampling Asphalt Materials
ASTM D242/D242M	(2009; R 2014) Mineral Filler for Bituminous Paving Mixtures
ASTM D979/D979M	(2015) Sampling Bituminous Paving Mixtures
ASTM D1461	(2017) Standard Test Method for Moisture or Volatile Distillates in Asphalt Mixtures
ASTM D2041/D2041M	(2011) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D2172/D2172M	(2017; E 2018) Standard Test Methods for Quantitative Extraction of Asphalt Binder from Asphalt Mixtures
ASTM D2419	(2014) Sand Equivalent Value of Soils and Fine Aggregate
ASTM D2489/D2489M	(2016) Standard Test Method for Estimating Degree of Particle Coating of Asphalt Mixtures
ASTM D2726/D2726M	(2019) Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
ASTM D3203/D3203M	(2017) Standard Test Method for Percent Air Voids in Compacted Asphalt Mixtures
ASTM D3665	(2012; R 2017) Standard Practice for Random Sampling of Construction Materials
ASTM D3666	(2016) Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D3699	(2019) Standard Specification for Kerosene
ASTM D4125/D4125M	(2010) Asphalt Content of Bituminous Mixtures by the Nuclear Method
ASTM D4791	(2019) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D4867/D4867M	(2009; R 2014) Effect of Moisture on Asphalt Concrete Paving Mixtures

ASTM D5361/D5361M	(2016) Standard Practice for Sampling Compacted Asphalt Mixtures for Laboratory Testing
ASTM D5444	(2015) Mechanical Size Analysis of Extracted Aggregate
ASTM D5821	(2013; R 2017) Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6084/D6084M	(2018) Standard Test Method for Elastic Recovery of Asphalt Materials by Ductilometer
ASTM D6307	(2019) Standard Test Method for Asphalt Content of Asphalt Mixture by Ignition Method
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
ASTM D6927	(2015) Standard Test Method for Marshall Stability and Flow of Bituminous Mixtures
ASTM D7173	(2020) Standard Practice for Determining the Separation Tendency of Polymer from Polymer Modified Asphalt
ASTM E1274	(2018) Standard Test Method for Measuring Pavement Roughness Using a Profilograph

1.4 SUBMITTALS

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NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

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

Use the "S" classification only in SD-11 Closeout Submittals. The "S" following a submittal item indicates that the submittal is required for the Sustainability Notebook to fulfill federally mandated sustainable requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

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

****

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Placement Plan; G[, [_____]]

SD-03 Product Data

Diamond Grinding Plan; G[, [_____]]
Mix Design; G[, [_____]]
Contractor Quality Control; G[, [_____]]

SD-04 Samples

Aggregates
Asphalt Binder

SD-06 Test Reports

Aggregates; G[, [_____]]
QC Monitoring
Resistance to Fuel; G[, [____]]

SD-07 Certificates

Asphalt Binder; G[, [_____]]

Testing Laboratory
Airfield Asphalt Pavement QC Manager

Airfield Asphalt Pavement Inspector

Airfield Asphalt Pavement Technician

1.5 CONTRACTOR QUALITY CONTROL STAFF

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NOTE: The airfield asphalt certification program is intended to increase quality of construction for work performed under this specification. The certification program will provide knowledge to the project team members as it relates to airfield asphalt. Intended audience is the Contractor and Government personnel. The below paragraph should be modified or the general provisions of the contract should be modified to require Title II inspectors or third party laboratory firms attend the certification program.

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Reference Section 01 45 00.10 QUALITY CONTROL for Contractor personnel qualification requirements along with the information included below. Submit certifications for Contractor Quality Control Staff in the following areas:

a. Airfield Asphalt Pavement QC Manager(1): The QC manager will oversee all QC testing and inspection, review asphalt pavement transmittals prior to submission to the Government, be responsible for making mix design adjustments, and in charge of all other activities related to performance. The QC manager will also ensure that daily reports and necessary transmittals arrive for Government review as specified.

b. Airfield Asphalt Pavement Inspector(1): The Inspector will be available on the project during all paving operations. The Inspector is responsible for identifying observed paving issues and ensuring these issues are addressed by the Contractor Quality Control staff.

c. Airfield Asphalt Pavement Technician(1): The Technician will be responsible for conducting laboratory tests. The Airfield Asphalt Pavement Technician will be present in the laboratory anytime laboratory testing is underway.

(1): Registration for the Airfield Asphalt Pavement Certification Program can be found at www.airfieldasphaltcert.com.

1.6 ACCEPTANCE

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NOTE: It is recommended that an independent material testing company be hired by the Contractor to provide the acceptance testing for the project. It is also recommended to keep the Government QA testing separate and distinct from the Contractor's QC testing for all airfield projects. (Generally, fuel resistant asphalt pavement will be used for

aprons or other areas where fuel spillage is expected.)

The acceptance testing program includes material tests to determine laboratory air voids and in-place density, which are needed to determine percent payment. The Contractors acceptance testing laboratory will also conduct tests to monitor aggregate gradation, asphalt content, and volumetric properties. These tests serve as a check to the Contractor's QC testing.

For projects with less than 2,000 total metric tons tons, the entire project can be considered as a single lot. In this case, sublot sampling could occur over several days' production, which could lead to higher sublot variability.
****

1.6.1 Acceptability of Work

Acquire the services of an independent commercial laboratory to perform acceptance testing. Acceptance of the plant produced mix and in-place requirements will be on a lot to lot basis. The materials and the pavement itself will be accepted on the basis of production testing. The Government may make check tests from split samples to validate the results of the production testing. Testing performed by the Government does not reduce the required testing of the independent commercial laboratory. Split samples will be taken for Government testing to reduce the variability between the independent commercial laboratory and the Government's test results. When the difference between the independent commercial laboratory and the Government's test results for split samples exceed the acceptable range of two results for multi-laboratory precision for the appropriate test method (i.e. ASTM) then at least one of the laboratories is determined to be in error. An evaluation of procedures and equipment in both laboratories will be made to determine the cause(s) for the differences. Develop steps to correct procedures and equipment to bring multi-laboratory precision to within acceptable limits.

1.6.2 Acceptance Requirements

Provide all sampling and testing required for acceptance and payment adjustment. Where appropriate, adjustments in payment for individual lots of asphalt pavement will be made based on laboratory air voids, in-place density, smoothness, and grade in accordance with the following paragraphs. Surface smoothness and grade determinations will be made on the lot as a whole. Exceptions or adjustments to this will be made in situations where the mix within one lot is placed as part of both the intermediate and surface courses, thus smoothness and grade measurements for the entire lot cannot be made.

1.6.3 Pavement Lots

A standard lot for all requirements is equal to one day's production or 2,000 metric tons short tons, whichever is smaller. Divide each lot into four equal sublots in order to evaluate laboratory air voids and in-place density. When operational conditions cause a lot to be terminated before the specified four sublots have been completed, use the following procedure to adjust the lot size and number of tests for the lot. Where three sublots have been completed, they constitute a lot. Where one or two sublots have been completed, incorporate them into the next lot and the total number of sublots (i.e. 5 or 6 sublots) is used for acceptance criteria. Include partial lots at the end of asphalt production into the previous lot. Complete and report all asphalt testing including but not limited to aggregate gradation, asphalt content, theoretical maximum density, laboratory air voids, and in-place density testing within 24 hours after construction of each lot.

1.6.4 Sublot Sampling

Obtain one random mixture sample from each sublot in accordance with ASTM D979/D979M from a loaded truck or another location for determining laboratory air voids, theoretical maximum density, Contractor Quality Control any additional testing as directed by the Government. Representative samples will be selected from random trucks using commonly recognized methods of assuring randomness conforming to ASTM D3665 and employing tables of random numbers or computer programs. Laboratory air voids will be determined from three laboratory compacted specimens of each sublot sample in accordance with ASTM D3203/D3203M. The specimens will be compacted within 2 hours of the time the mixture was loaded into trucks at the asphalt plant. Samples will not be reheated prior to compaction and insulated containers will be used as necessary to maintain the temperature.

1.6.4.1 Additional Sampling and Testing

The Government reserves the right to direct additional samples and tests for any area which appears to deviate from the specification requirements. The cost of any additional testing will be paid for by the Contractor. Testing in these areas will be treated as a separate lot. Payment will be made for the quantity of fuel resistant asphalt pavement represented by these tests in accordance with the provisions of this section.

1.6.4.2 Theoretical Maximum Density (TMD)

Measure theoretical maximum density one time for each sublot in accordance with ASTM D2041/D2041M for purposes of calculating laboratory air voids and determining in-place density. The average TMD for each lot will be determined as the average TMD of the random sublot samples. When the TMD on both sides of a longitudinal joint is different, the average of these two TMD values will be used as the TMD needed to calculate the percent joint density.

1.6.4.3 Laboratory Air Voids

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NOTE: Select the appropriate tailoring option for the Marshall or Superpave Methods.

****

[Prepare one set of laboratory compacted specimens for each sublot in accordance with ASTM D6926 using the hand-held hammer for the Marshall Method.][Prepare one set of laboratory compacted specimens for each sublot in accordance with ASTM D6925 using the Superpave gyratory compactor.] Provide three test specimens prepared from the same sample for each set of laboratory compacted specimens. Compact the specimens within 2 hours of the time the mixture was loaded into trucks at the asphalt plant. Do not reheat samples prior to compaction. Provide insulated containers as necessary to maintain the sample temperature. Measure the bulk density of laboratory compacted specimens in accordance with ASTM D2726/D2726M. Determine laboratory air voids from one set (three laboratory compacted specimens) for each sublot sample in accordance with ASTM D3203/D3203M.

1.6.5 In-place Density

Obtain one random 100 mm 4 inch or 150 mm 6 inch diameter core from the mat and joint of each sublot in accordance with ASTM D5361/D5361M for determining in-place density. Where different job mix formulas are required as part of the same project, and are adjacent to one another, follow the same joint density sampling and joint density testing instructions of this specification. Cut samples neatly with a diamond core drill bit. Obtain random cores that are the full thickness of the layer being placed. Select core locations randomly using the procedures contained in ASTM D3665. Locate cores for mat density no closer than 300 mm 12 inches from a transverse or longitudinal joint including the pavement edge. Center all cores for joint density on the joint. Discard samples that are clearly defective as a result of sampling and take an additional random core. When the random core is less than 25 mm 1 inch thick, it will not be included in the analysis. In this case, obtain another random core sample. Clean and tack coat dry core holes before filling with asphalt mixture. Fill all core holes with asphalt mixture and compact using a manual (hand-held) Marshall hammer to the density specified. Provide all tools, labor, and materials for cutting samples, cleaning, and filling the cored pavement. Measure in-place density in accordance with ASTM D2726/D2726M using each core obtained from the mat and joint.

1.6.6 Surface Smoothness

Use a straightedge and profilograph for measuring surface smoothness ofpavements. Use the profilograph method for all longitudinal testing, except for paving lanes less than 400 meters 0.10 miles in length. Use the straightedge method for transverse testing, for longitudinal testing where the length of each pavement lane is less than 400 meters 0.10 miles, and at the ends of the paving limits for the project. Use the straightedge to also perform smoothness checks for any localized areas that look suspicious, including localized areas that were already tested with the profilograph. Perform all testing in the presence of the Government. Maintain detailed notes of the testing results and provide a copy to the Government immediately after each day's testing. Where drawings show required deviations from a plane surface (for instance crowns, drainage inlets), finish the surface to meet the approval of the Government.

1.6.6.1 Smoothness Requirements

1.6.6.1.1 Straightedge Testing

Provide finished surfaces of the pavements with no abrupt change of 3 mm 1/8 inch or more, and all pavements within the tolerances specified in Table 5 when checked with an approved 4 m 12 foot straightedge.

Table 5 Straightedge Surface Smoothness		
Pavement Category	Direction of Testing	Tolerance, mm inch
Runways, taxiways, and landing zones	Longitudinal	31/8
	Transverse	61/4
Shoulders (outside edge stripe)	Longitudinal	61/4
	Transverse	61/4
Calibration hardstands and compass swinging bases	Longitudinal	31/8
	Transverse	31/8
All other airfield pavements (including overruns) and helicopter paved areas	Longitudinal	61/4
	Transverse	61/4

1.6.6.1.2 Profilograph Testing

Provide finished surfaces of runways, taxiways and landing zones with a Profile Index not greater than 110 mm per km 7 inches per mile when tested with an approved California-type profilograph per ASTM E1274. For pavements other than runways, provide finished surfaces with a Profile Index not greater than 140 mm per km 9 inches per mile when tested with an approved California-type profilograph per ASTM E1274.

1.6.6.2 Testing Method

After the final rolling, but not later than 24 hours after placement, test the surface of the pavement in each entire lot in a manner to reveal surface irregularities exceeding the tolerances specified above. If any pavement areas are diamond ground, retest these areas immediately after diamond grinding and submit results to the Government for evaluation. The maximum area allowed to be corrected by diamond grinding is 10 percent of the total area of the lot. Test the entire area of the pavement with a profilograph. Check a number of random locations along with any observed suspicious locations primarily at transverse and longitudinal joints with the straightedge.

1.6.6.2.1 Straightedge Testing

Hold the straightedge in contact with the pavement surface and measure the maximum distance between the straightedge and the pavement surface. Determine the amount of surface irregularity by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points. Use the straightedge to measure abrupt changes in surface grade.

1.6.6.2.2 Profilograph Testing

Perform profilograph testing using an approved California profilograph and procedures described in ASTM E1274. Provide equipment that utilizes electronic recording and automatic computerized reduction of data to indicate "must-grind" bumps and the Profile Index for the pavement. Use a "blanking band" that is 5 mm 0.2 inch wide and the "bump template" spanning 25 mm 1 inch with an offset of 10 mm 0.4 inch. Provide profilograph operated by an approved, factory-trained operator on the alignments specified above. Provide a copy of the reduced tapes to the Government at the end of each day's testing.

1.6.6.2.3 Bumps ("Must Grind" Areas)

Reduce any bumps ("must grind" areas) shown on the profilograph trace which exceed 10 mm 0.4 inch in height by diamond grinding until they do not exceed 7.5 mm 0.3 inch when retested. Taper diamond grinding in all directions to provide smooth transitions to areas not requiring diamond grinding. The following will not be permitted: (1) skin patching for correcting low areas, (2) planing or milling for correcting high areas. [At the Contractor's option, pavement areas, including diamond ground areas, can be rechecked with the profilograph in order to record a lower Profile Index.][Perform additional profilograph testing in all areas corrected by diamond grinding.]

1.6.7 Plan Grade

Within 5 working days after completion of a particular lot incorporating the final wearing course, test the final wearing surface of the pavement for conformance with specified plan grade requirements. Provide a final wearing surface of pavement conforming to the elevations and cross sections shown and not vary more than 15 mm 0.05 foot from the plan grade established and approved at site of work. Match finished surfaces at juncture with other pavements with finished surfaces of abutting pavements. Deviation from the plan elevation will not be permitted in areas of pavements where closer conformance with planned elevation is required for the proper functioning of drainage and other appurtenant structures involved. The grade will be determined by running lines of levels along the centerline at intervals of 7.6 m 25 feet or less longitudinally to determine the elevation of the completed pavement surface. Measure transverse grades at appropriate intervals. Diamond grinding can be used to remove high spots to meet grade requirements. Skin patching for correcting low areas or planing or milling for correcting high areas will not be permitted. Maintain detailed notes of the results of the testing and provide a copy to the Government immediately after each day's testing.

1.6.8 Laboratory Accreditation and Validation

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NOTE: For Army managed projects, keep the bracketed text. For Air Force, and Navy, managed projects, utilization of the USACE Materials Testing Center (MTC) is optional.

****

Provide laboratories used to develop the Job Mix Formula (JMF), perform acceptance testing, and Contractor Quality Control testing that meet the requirements of ASTM D3666. Provide laboratories with a masonry saw having a diamond blade for trimming pavement cores and samples. Perform all required test methods by an accredited laboratory. Schedule and provide payment for laboratory inspections. Additional payment or a time extension due to failure to acquire the required laboratory accreditation is not allowed. The Government will inspect the laboratory equipment and test procedures prior to the start of fuel resistant asphalt pavement operations for conformance with ASTM D3666. [In addition, all testing laboratories performing JMF, acceptance testing and Contractor Quality Control requires USACE validation by the Material Testing Center (MTC) for both parent laboratory and plant testing laboratory. Validation on all laboratories is required to remain current throughout the duration of the paving project. Contact the MTC manager listed at https://mtc.erdc.dren.mil/ for costs and scheduling.] Submit a certificate of compliance signed by the manager of the laboratory stating that it meets these requirements to the Government prior to the start of construction. At a minimum, include the following certifications:

a. Qualifications of personnel; laboratory manager, supervising technician, and testing technicians.

b. A listing of equipment, with calibration dates, to be used in developing the job mix.

c. A copy of the laboratory's quality control system.

1.7 ENVIRONMENTAL REQUIREMENTS

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NOTE: The temperature requirements below are included to avoid problems with the Contractor achieving density because the mix cools too fast. Waivers to these requirements, for isolated incidences during production, are applicable if the density requirements are still met.

****

Do not place the fuel resistant asphalt pavement upon a wet surface or when the surface temperature of the underlying course is less than specified. The temperature requirements may be waived by the Government, if requested; provided all other requirements, including compaction, are met. The surface temperature limitations of the underlying base course is 7 degrees C45 degrees F for a mat thickness of 50 mm 2 inches.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

This section is intended to stand alone for construction of asphalt pavement. However, where the construction covered herein interfaces with other sections, construct each interface to conform to the requirements of both this section and the other section, including tolerance for both.

Perform the work consisting of pavement courses composed of mineral aggregate and asphalt material heated and mixed in a central mixing plant and placed on a prepared course. Provide fuel resistant asphalt pavement designed and constructed in accordance with this section conforming to the lines, grades, thicknesses, and typical cross sections shown on the drawings. Construct each course to the depth, section, or elevation required by the drawings and rolled, finished, and approved before the placement of the next course. Submit proposed Placement Plan, indicating lane widths, longitudinal joints, and transverse joints for each course or lift.

2.1.1 Asphalt Mixing Plant

Provide plants used for the preparation of asphalt mixture conforming to the requirements of AASHTO M 156 with the following changes:

2.1.1.1 Truck Scales

Weigh the fuel resistant asphalt mixture on approved scales, or on certified public scales at no additional expense to the Government. Inspect and seal scales at least annually by an approved calibration laboratory.

2.1.1.2 Inspection of Plant

Provide access to the Contracting Officer at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant; verifying weights, proportions, and material properties; checking the temperatures maintained in the preparation of the mixtures and for taking samples. Provide assistance as requested, for the Government to procure any desired samples.

2.1.1.3 Storage Silos

The fuel resistant asphalt mixture may be stored in non-insulated storage silos for a period of time not exceeding 3 hours. The fuel resistant asphalt pavement may be stored in insulated storage silos for a period of time not exceeding 8 hours. No differences in the mix removed from silos and the mix loaded into trucks are allowed.

2.1.2 Hauling Equipment

Provide trucks used for hauling fuel resistant asphalt pavement that have tight, clean, and smooth metal beds. To prevent the mixture from adhering to them, lightly coat the truck beds with a minimum amount of paraffin oil, lime solution, or other approved material. Do not use petroleum based products as a release agent. Provide each truck with a suitable cover to protect the mixture from adverse weather. When necessary to ensure that the mixture is delivered to the site at the specified temperature, provide insulated or heated truck beds with covers (tarps) that are securely fastened.

2.1.3 Material Transfer Vehicle (MTV)

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NOTE: A Material Transfer Vehicle (MTV) is required for runway, taxiway, landing zone and apron construction.

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Provide Material Transfer Vehicles (MTV) for placement of the fuel resistantasphalt pavement. To transfer the material from the hauling equipment to the paver, use a self-propelled, material transfer vehicle with a swing conveyor that delivers material to the paver from outside the paving lane and without making contact with the paver. Provide MTV capable to move back and forth between the hauling equipment and the paver providing material transfer to the paver, while allowing the paver to operate at a constant speed. Provide MTV with remixing and storage capability to prevent physical and thermal segregation.

2.1.4   Asphalt Pavers

Provide mechanical spreading and finishing equipment consisting of a self-powered paver, capable of spreading and finishing the mixture to the specified line, grade, and cross section. Provide paver with vibrating screed capable of placing a uniform mixture to meet the specified thickness, smoothness, and grade without physical or temperature segregation, the full width of the material being placed.

2.1.4.1   Receiving Hopper

Provide paver with a receiving hopper of sufficient capacity to permit a uniform spreading operation and a distribution system to place the mixture uniformly in front of the screed without segregation. Provide a screed that effectively produces a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

[2.1.4.2   Automatic Grade Controls

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NOTE: Delete information on automatic grade control if not needed. Automatic grade control is needed when the design requires elevations for the fuel resistant asphalt pavement surface. Many maintenance and rehabilitation projects require an overlay thickness and do not specify actual grades.

****

If grade control is required, provide a paver equipped with a control system capable of maintaining the specified screed elevation. One of three methods can be used to control grade: stringline, laser, or computerized elevations along with GPS. For multiple layers it is acceptable to control grade in the underlying layer and control the grade of the surface layer by applying a constant thickness over the underlying layer which has been placed to the desired grade. Provide transverse slope controller capable of maintaining the screed at the desired slope within plus or minus 0.1 percent. Do not use the transverse slope controller to control grade. A ski-type device of not less than 9.14 m 30 ft can be used to provide improved smoothness. Use a shoe on one side of the paver to match an existing paved surface to provide a smooth joint.

]2.1.5   Rollers

Provide rollers in good condition and operated at slow speeds to avoid displacement of the fuel resistant asphalt pavement. Provide sufficient number, type, and weight of rollers to compact the mixture to the required density while it is still in a workable condition. Do not use equipment which causes excessive crushing of the aggregate.

2.1.6   Diamond Grinding

Those performing diamond grinding are required to have a minimum of three years experience in diamond grinding of airfield pavements. In areas not meeting the specified limits for surface smoothness and plan grade, reduce high areas to attain the required smoothness and grade, except as depth is limited below. Reduce high areas by diamond grinding the fuel resistant asphalt pavement with approved equipment after the fuel resistant asphalt pavement is at a minimum age of 14 days. Perform diamond grinding by sawing with saw blades impregnated with an industrial diamond abrasive. Assemble the saw blades in a cutting head mounted on a machine designed specifically for diamond grinding that produces the required texture and smoothness level without damage to the asphalt pavement. Provide diamond grinding equipment with saw blades that are 3 mm 1/8-inch wide, a minimum of 60 blades per 300 mm 12 inches of cutting head width, and capable of cutting a path a minimum of 0.9 m 3 feet wide. Diamond grinding equipment that causes raveling, fracturing of aggregate, or disturbance to the underlying material will not be allowed. The maximum depth of diamond grinding is 6 mm 1/4 inch. Provide diamond grinding machine equipped to flush and vacuum the pavement surface. Dispose of all debris from diamond grinding operations off Government property. Prior to diamond grinding, submit a Diamond Grinding Plan for review and approval. At a minimum, include the daily reports for the deficient areas, the location and extent of deficiencies, corrective actions, and equipment. Remove and replace all pavement areas requiring plan grade or surface smoothness corrections in excess of the limits specified.

Prior to production diamond grinding operations, perform a test section at the approved location, consisting of a minimum of two adjacent passes with a minimum length of 12 m 40 feet to allow evaluation of the finish and transition between adjacent passes. Production diamond grinding operations cannot be performed prior to approval.

2.2 AGGREGATES

****
For Design-Bid-Build projects, select the first bracketed text. For Design-Build projects, select the second bracketed text..
****

Sample aggregates in the presence of a Government Representative. Obtain samples in accordance with ASTM D75/D75M and be representative of the materials to be used for the project. Provide aggregates consisting of crushed stone, crushed gravel, crushed slag, screenings, and mineral filler, as required. Natural sand is not allowed in the fuel resistant asphalt pavement. The portion of material retained on the 4.75 mm No. 4 sieve is coarse aggregate. The portion of material passing the 4.75 mm No. 4 sieve and retained on the 0.075 mm No. 200 sieve is fine aggregate. The portion passing the 0.075 mm No. 200 sieve is defined as mineral filler. Submit sufficient materials to produce 90 kg 200 pounds 181 kg 400 pounds of blended mixture for mix design verification. Submit all aggregate test results and samples to the Government at least 14 days prior to start of construction. Aggregate tests can be no older than [6 months prior to contract award][6 months prior to test section].

2.2.1 Coarse Aggregate

****
NOTE: The requirement for sulfate soundness (requirement b., below) may be deleted in climates where freeze-thaw does not occur. However, in those areas where freeze-thaw does not occur, requirement b. must remain if experience has shown that this

test separates good performing aggregates from bad performing aggregates. Retain this requirement for all Navy projects.

Percentage of Wear (ASTM C131/C131M) must not exceed 40. Aggregates with a higher percentage of wear may be specified, provided a satisfactory record under similar conditions of service and exposure has been demonstrated.
****

Provide coarse aggregate consisting of sound, tough, durable particles, free from films of material that would prevent thorough coating and bonding with the asphalt material and free from organic matter and other deleterious substances. Provide coarse aggregate particles meeting the following requirements:

a. The percentage of loss not be greater than 40 percent after 500 revolutions when tested in accordance with ASTM C131/C131M.

b. The sodium sulfate soundness loss not exceeding 12 percent, or the magnesium sulfate soundness loss not exceeding 18 percent after five cycles when tested in accordance with ASTM C88.

c. At least 75 percent by weight of coarse aggregate contain at least two or more fractured faces when tested in accordance with ASTM D5821 with fractured faces produced by crushing.

d. The particle shape essentially cubical and the aggregate containing not more than 5 percent, by weight, of flat particles, elongated particles, or flat and elongated particles (5:1 ratio of maximum to minimum) when tested in accordance with ASTM D4791 Method A.

e. Slag consisting of air-cooled, blast furnace slag, with a compacted weight of not less than 1200 kg per cubic meter 75 pounds per cubic foot when tested in accordance with ASTM C29/C29M.

f. Clay lumps and friable particles not exceeding 0.3 percent, by weight, when tested in accordance with ASTM C142/C142M.

2.2.2 Fine Aggregate

****
NOTE: Set the lower limit for uncompacted void content (requirement c., below) at 45 for fine aggregate angularity unless local experiences indicate that a lower value can be used. There are some aggregates which have a good performance record and have an uncompacted void content less than 45. In no case set the limit at less than 43.
****

Provide fine aggregate consisting of clean, sound, tough, durable particles. Natural Sand is not allowed. Provide aggregate particles that are free from coatings of clay, silt, or any objectionable material, contain no clay balls, and meet the following requirements:

a. Individual fine aggregate sources with a sand equivalent value greater than 45 when tested in accordance with ASTM D2419.

b. Fine aggregate portion of the blended aggregate with an uncompacted void content greater than [45.0] percent when tested in accordance with ASTM C1252 Method A.

c. Clay lumps and friable particles not exceeding 0.3 percent, by weight, when tested in accordance with ASTM C142/C142M.

2.2.3 Mineral Filler

Provide mineral filler consisting of a nonplastic material meeting the requirements of ASTM D242/D242M.

2.2.4 Aggregate Gradation

Provide a combined aggregate gradation that conforms to gradations specified in Table 6, when tested in accordance with ASTM C136/C136M and ASTM C117, and does not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa, but grades uniformly from coarse to fine. Provide a JMF within the specification limits; however, the gradation can exceed the limits when the allowable deviation from the JMF shown in Tables 8 and 9 are applied.

Table 6
Aggregate Gradations

Sieve Size, mm inch	12.51/2 mix(1) Percent Passing by Mass
12.51/2	100
9.53/8	90-100
4.75No. 4	58-78
2.36No. 8	40-60
1.18No. 16	28-48
0.60No. 30	18-38
0.30No. 50	11-27
0.15No. 100	6-18
0.075No. 200	3- 6

(1) This mix is to be used only as a surface course. The allowable lift thickness is 50 mm2 inches.

2.3 ASPHALT BINDER

****
NOTE: Select binder grade based upon the PG lower temperature as dictated by the project environment.
****

Provide asphalt binder that conforms to ASTM D6373 for Performance Grade (PG) [82-28][88-22] and meeting the requirements annotated below.

a. Test the original binder according to ASTM D6084/D6084M Procedure A – Elastic
Recovery at 25 degrees C 77 degrees F with a minimum of 85 percent.

b. Test the original binder according to ASTM D7173 and meeting the maximum temperature difference of 4.0 degrees C7.2 degrees F when using the ASTM D36/D36M Ring-and-Ball apparatus.

c. Prepare the fuel resistant asphalt pavement specimens with the asphalt binder meeting the above requirements and the fuel resistance requirements when tested in accordance with paragraph TESTING REQUIREMENT FOR ASPHALT MIXTURE RESISTANCE TO FUEL. After passing the above requirements and those listed in Table 7, grade the asphalt binder as [PG 82-28FR][88-22FR].

Provide test data indicating grade certification by the supplier at the time of delivery of each load to the mix plant. Submit copies of these certifications to the Government. The supplier is defined as the last source of any modification to the binder. The Government may sample and test the binder at the mix plant at any time before or during mix production. [Obtain samples for verification testing in accordance with ASTM D140/D140M and in the presence of the Government. Provide these samples to the Government for verification testing, which will be performed at the Governments expense. Submit 20 L 5 gallon sample of the asphalt binder specified for mix design verification and approval not less than 14 days before start of the test section.]

2.4 MIX DESIGN

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NOTE: In areas subject to freeze/thaw, retain bracketed text.

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Develop the mix design. Provide results of the Job Mix Formula (JMF) and aggregate testing performed no earlier than 6 months prior to Contract award. Provide fuel resistant asphalt mixture composed of well-graded aggregate, mineral filler if required, and asphalt material. Provide aggregate fractions sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of Table 6. Do not produce fuel resistant asphalt pavement for payment until a JMF has been approved. Design the fuel resistant asphalt pavement using hand-held (manual) Marshall Hammer procedures contained in AI MS-2 and the criteria shown in Table 7. Design the fuel resistant asphalt mixture using the Superpave gyratory compactor using the procedures contained in AI MS-2 and the criteria shown in Table 7. Prepare samples at various asphalt contents and compacted in accordance with ASTM D6925 or ASTM D6926 as required by the Government. Use laboratory compaction temperatures for Polymer Modified Asphalts as recommended by the asphalt binder manufacturer. Adjust the compactive effort of the specimens, as required, to provide a Tensile Strength Ratio (TSR) with an air void content of 7 plus or minus 1 percent. [Use freeze/thaw conditioning in lieu of moisture conditioning per ASTM D4867/D4867M]. If the Tensile Strength Ratio (TSR) of the composite mixture, as determined by ASTM D4867/D4867M is less than 80, reject the aggregates or the asphalt mixture treated with an anti-stripping agent.

Add a sufficient amount of anti-stripping agent to produce a TSR of not less than 80. If an antistrip agent is required, provide it at no additional cost to the Government. Provide sufficient materials to produce 90 kg 200 pound of blended mixture to the Government for verification of mix design at least 14 days prior to construction of test section.

2.4.1 JMF Requirements

Submit the proposed JMF in writing, for approval, at least 14 days prior to the start of the test section, including as a minimum:

a. Percent passing each sieve size.

b. Optimum asphalt binder.

c. Percent of each aggregate and mineral filler to be used.

d. Asphalt performance grade and additional test requirements as specified in paragraph ASPHALT BINDER.

e. Number of blows of hammer per side of molded specimen.Number of Superpave gyratory compactor gyrations.

f. Laboratory mixing and compaction temperature.

g. Supplier-recommended field mixing and compaction temperatures.

h. Temperature of mix when discharged from mixer.

i. Plot of the combined gradation on the 0.45 power gradation chart, stating the nominal maximum size.

j. Graphical plots and summary tabulation of stability, air voids, voids in the mineral aggregate, and unit weight versus asphalt content as shown in AI MS-2. Include summary tabulation that includes individual specimen data for each specimen tested.

k. Specific gravity and absorption of each aggregate.

l. Percent manufactured sand.

m. Percent particles with two or more fractured faces (in coarse aggregate).

n. Fine aggregate angularity.

o. Percent flat or elongated particles (in coarse aggregate).

p. Tensile Strength Ratio and wet/dry specimen test results.

q. Type and amount of antistrip agent (if required).

r. Date the JMF was developed. Mix designs that are not dated or which are from a prior construction seasons may not be accepted.

s. Test results for asphalt resistance to fuel in accordance with paragraph TESTING REQUIREMENTS FOR ASPHALT MIXTURE RESISTANCE TO FUEL.

t. List of all modifiers.

Table 7 Marshall Design Criteria	
Test Property	50 Blow Mix
Stability, N pounds minimum	95602150[1]
Flow, 0.25 mm 0.01 inch	Waived[2]
Air voids, percent	2.5[4]
Percent Voids in mineral aggregate (minimum)	14
Dust Proportion[3]	0.8-1.2
TSR, minimum percent	80
TSR Conditioned Strength (minimum kPa psi)	41560
Weight loss by fuel Immersion, maximum percent	1.5[5]
(1) This is a minimum requirement. Provide significantly higher average during construction to ensure compliance with the specifications.	
(2) The flow requirement is not applicable for Polymer Modified Asphalts	
(3) Dust Proportion is calculated as the aggregate content, expressed as a percent of mass, passing the 0.075 mm No. 200 sieve, divided by the effective asphalt content, in percent of total mass of the mixture.	
(4) Select the JMF asphalt content corresponding to an air void content of 2.5 percent. Verify the other properties of Table 7 meet the specification requirements at this asphalt content.	
(5) Tested in accordance with paragraph TESTING REQUIREMENT FOR ASPHALT MIXTURE RESISTANCE TO FUEL	

Table 7 Superpave Gyratory Compaction Criteria	
Test Property	50 Gyration Mix
Air voids, percent	2.5[1]
Percent Voids in mineral aggregate (minimum)	14
Dust Proportion[2]	0.8-1.2
TSR, minimum percent	80
TSR Conditioned Strength (minimum kPa psi)	41560

Table 7 Superpave Gyratory Compaction Criteria	
Test Property	50 Gyration Mix
Weight loss by fuel Immersion, maximum percent	1.5[3]
(1) Select the JMF asphalt content corresponding to an air void content of 2.5 percent. Verify the other properties of Table 7 meet the specification requirements at this asphalt content.	
(2) Dust Proportion is calculated as the aggregate content, expressed as a percent of mass, passing the 0.075 mm No. 200 sieve, divided by the effective asphalt content, in percent of total mass of the mixture.	
(3) Tested in accordance with paragraph TESTING REQUIREMENT FOR ASPHALT MIXTURE RESISTANCE TO FUEL	

2.4.2 Testing Requirement for Asphalt Mixture Resistance to Fuel

Determine asphalt pavement resistance to fuel by the following procedures:

a. Prepare three test specimens in accordance with the Mix Design requirements at optimum asphalt binder content and 2.5 plus or minus 0.7 percent air voids. Short term age the mix prior to compaction in accordance to AASHTO R 30.

b. Determine the percent air voids in each specimen, if any do not meet the requirements above discard and replace them. Dry the specimens under a fan at room temperature (20C to 27C) (68F to 80F) for a minimum of 24 hours.

c. Totally immerse the sample in kerosene[1] at room temperature (20C to 27C) (68F to 80F).

d. After submersing for 2.0 minutes plus or minus 30 seconds, remove the sample and immediately surface dry with a clean paper towel. Then immediately determine the weight in air to the nearest 0.1 grams. Report this as weight ‘A’ (weight before).

e. Resubmerse the sample in kerosene for 24 hours.

f. After 24 hours plus or minus 10 minutes, carefully remove the sample from the kerosene and suspension container and place it on an absorptive cloth or paper towel. Dry the specimen under a fan at room temperature (20C to 27C) (68F to 80F) for 24 hours.

g. After drying for 24 hours plus or minus 10 minutes weigh the sample in air to the nearest 0.1 grams. Report this as weight ‘B’ (weight after immersion).

h. Calculations:

Percent of weight loss by fuel immersion = [(A – B) / A] x 100

Where: A = Weight before

B = Weight after

(1) Kerosene must meet the requirements of ASTM D3699.

2.4.3 Adjustments to JMF

The JMF for each mixture is in effect until a new formula is approved in writing by the Government. Should a change in sources of any material be made, perform a new mix design and a new JMF approved before the new material is used. Make minor adjustments within the specification limits to the JMF to optimize mix volumetric properties. Adjustments to the original JMF are limited to plus or minus 4 percent on the 4.75 mm No. 4 and coarser sieves; plus or minus 3 percent on the 2.36 mm No. 8 to 0.30 mm No. 50 sieves; and plus or minus 1 percent on the 0.15 mm No. 100 sieve. Adjustments to the JMF are limited to plus or minus 1.0 percent on the 0.075 mm No. 200 sieve. Asphalt content adjustments are limited to plus or minus 0.40 from the original JMF. If adjustments are needed that exceed these limits, develop a new mix design.

2.5 RECLAIMED ASPHALT PAVEMENT

Reclaimed asphalt pavement (RAP) or recycled asphalt shingles (RAS) is not allowed.

PART 3 EXECUTION

3.1 CONTRACTOR QUALITY CONTROL

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NOTE: The Contractor may be able to meet the specified quality control requirements with in-house capability or may have to use the independent commercial laboratory to provide the required quality control testing.

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3.1.1 General Quality Control Requirements

Submit the Quality Control Plan. The Quality Control Plan is specific to this specification section and supplements the overall Quality Control Plan required by the project. Do not produce asphalt pavement for payment until the quality control plan has been approved. In the quality control plan, address all elements which affect the quality of the pavement including, but not limited to:

a. Mix Design and unique JMF identification code

b. Aggregate Grading

c. Quality of Materials

d. Stockpile Management and procedures to prevent contamination

e. Proportioning

f. Mixing and Transportation

g. Mixture Volumetrics

h. Moisture Content of Mixtures

i. Placing and Finishing

j. Joints

k. Compaction, including Fuel Resistant Asphalt Pavement-Portland Cement Concrete joints

l. Surface Smoothness

m. Truck bed release agent

n. Correlation of mechanical hammer to hand hammer. Determine the number of blows of the mechanical hammer required to provide the same density of the JMF as provided by the hand hammer. Use the average of three specimens per trial blow application.

3.1.2 Testing Laboratory

Provide a fully equipped asphalt laboratory located at the plant or job site that is equipped with heating and air conditioning units to maintain a temperature of 24 plus or minus 2.3 degrees C 75 plus or minus 5 degrees F. Provide laboratory facilities that are kept clean and all equipment maintained in proper working condition. Provide the Government with unrestricted access to inspect the laboratory facility, to witness quality control activities, and to perform any check testing desired. The Government will advise in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to adversely affect test results, immediately suspend the incorporation of the materials into the work. Incorporation of the materials into the work will not be permitted to resume until the deficiencies are corrected.

3.1.3 Quality Control Testing

Perform all quality control tests applicable to these specifications and as set forth in the Quality Control Program. The quality control (QC) testing is separate and distinct from the acceptance testing in paragraph ACCEPTANCE. Use in-house capabilities or the independent commercial laboratory for quality control testing. Required elements of the testing program include, but are not limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, moisture in the asphalt mixture, laboratory air voids, stability, in-place density, grade and smoothness. Develop a Quality Control Testing Plan as part of the Quality Control Program.

3.1.3.1 Asphalt Content

Determine asphalt content a minimum of twice per lot (a lot is defined in paragraph PAVEMENT LOTS) by one of the following methods: extraction method in accordance with ASTM D2172/D2172M, Method A or B, the ignition method in accordance with the ASTM D6307, or the nuclear method in accordance with ASTM D4125/D4125M, provided each method is calibrated for the specific mix being used. For the extraction method, determine the weight of ash, as described in ASTM D2172/D2172M, as part of the first extraction test performed at the beginning of plant production; and as part of every tenth extraction test performed thereafter, for the duration of plant production. Use the last weight of ash value in the calculation of the asphalt content for the mixture. The asphalt content for the lot will be determined by averaging the test results.

3.1.3.2 Aggregate Properties

Determine aggregate gradations a minimum of twice per lot from mechanical analysis of recovered aggregate in accordance with ASTM D5444 or ASTM D6307. For batch plants, test aggregates in accordance with ASTM C136/C136M using actual batch weights to determine the combined aggregate gradation of the mixture. Determine the specific gravity of each aggregate size grouping for each 18,000 metric tons 20,000 tons in accordance with ASTM C127 or ASTM C128. Determine fractured faces for gravel sources for each 18,000 metric tons 20,000 tons in accordance with ASTM D5821. Determine the uncompacted void content of manufactured sand, and blended aggregate for each 18,000 metric tons 20,000 tons in accordance with ASTM C1252 Method A.

3.1.3.3 Temperatures

Check temperatures at least four times per lot, at necessary locations, to determine the temperature at the dryer, the asphalt binder in the storage tank, the fuel resistant asphalt mixture at the plant, and the fuel resistant asphalt mixture at the job site.

3.1.3.4 Moisture Content of Aggregate

Determine the moisture content of aggregate used for production a minimum of once per lot in accordance with ASTM C566.

3.1.3.5 Moisture Content of Mixture

Determine the moisture content of the mixture at least once per lot in accordance with ASTM D1461.

3.1.3.6 Laboratory Air Voids, TMD, and VMAVMA and Marshall Stability

Obtain mixture samples at least four times per lot. Measure theoretical maximum density in accordance with ASTM D2041/D2041M. Compact the remaining portion of the sample into specimens, using 50 blows per side with the Marshall hand-held hammer as described in ASTM D6926. using 50 gyrations of the Superpave gyratory compactor as described in ASTM D6925. After compaction, measure the bulk density of laboratory compacted specimens in accordance with ASTM D2726/D2726M. Determine laboratory air voids from one set (three laboratory compacted specimens) for each sample in accordance with ASTM D3203/D3203M. Also calculate the VMA of each specimen in accordance with AI MS-2 based on ASTM C127 and ASTM C128 bulk specific gravity for the aggregate, as well as the Marshall stability, as described in ASTM D6927. Provide VMA within the limits of Table 7.

3.1.3.7 In-Place Density

Conduct any necessary testing to ensure the specified density is achieved. A nuclear gauge or other non-destructive testing device may be used to monitor pavement density.

3.1.3.8 Grade and Smoothness

Conduct the necessary checks to ensure the grade and smoothness requirements are met in accordance with paragraph ACCEPTANCE.

3.1.3.9 Additional Testing

Perform any additional testing, deemed necessary to control the process.

3.1.3.10 QC Monitoring

Submit all QC test results to the Government on a daily basis as the tests are performed. The Government reserves the right to monitor any of the Contractor's quality control testing and to perform duplicate testing as a check to the Contractor's quality control testing.

3.1.4 Control Charts

For process control, establish and maintain linear control charts on both individual samples and the running average of last four samples for the parameters listed in Table 8, as a minimum. Post the control charts as directed by the Government and maintain current at all times. Identify the following on the control charts, the project number, the test parameter being plotted, the individual sample numbers, the Action and Suspension Limits listed in Table 8 applicable to the test parameter being plotted, and the test results. Also show target values (JMF) on the control charts as indicators of central tendency for the cumulative percent passing, asphalt content, and laboratory air voids parameters. When the test results exceed either applicable Action Limit, take immediate steps to bring the process back in control. When the test results exceed either applicable Suspension Limit, halt production until the problem is solved. When the Suspension Limit is exceeded for individual values or running average values, the Government Engineer has the option to require removal and replacement of the material represented by the samples or to leave in place and base acceptance on mixture volumetric properties and in place density. Use the control charts as part of the process control system for identifying trends so that potential problems can be corrected before they occur. Make decisions concerning mix modifications based on analysis of the results provided in the control charts. In the Quality Control Plan, indicate the appropriate action to be taken to bring the process into control when certain parameters exceed their Action Limits.

Table 8
Action and Suspension Limits for the Parameters to be Plotted on Individual and Running Average Control Charts

	Individual Samples		Running Average of Last Four Samples	
Parameter to be Plotted	Action Limit	Suspension Limit	Action Limit	Suspension Limit
4.75 mm No. 4 sieve, Cumulative Percent Passing, deviation from JMF target; plus or minus values	6	8	4	5
0.6 mm No. 30 sieve, Cumulative Percent Passing, deviation from JMF target; plus or minus values	4	6	3	4

Table 8
Action and Suspension Limits for the Parameters to be Plotted on Individual and Running Average Control Charts

	Individual Samples		Running Average of Last Four Samples	
Parameter to be Plotted	Action Limit	Suspension Limit	Action Limit	Suspension Limit
0.075 mm No. 200 sieve, Cumulative Percent Passing, deviation from JMF target; plus or minus values	1.4	2.0	1.1	1.5
Asphalt content, percent deviation from JMF target; plus or minus value	0.4	0.5	0.2	0.3
Laboratory Air Voids, percent deviation from JMF target value	No specific action and suspension limits set since this parameter is used to determine percent payment			
In-place Mat Density, percent of TMD	No specific action and suspension limits set since this parameter is used to determine percent payment			
In-place Joint Density, percent of TMD	No specific action and suspension limits set since this parameter is used to determine percent payment			
$P_{0.075}/P_{be}$ Ratio, deviation from 1.0; plus or minus values	0.7	0.8	0.3	0.4
VMA of Fuel Resistant Asphalt Pavement, percent deviation from JMF target	-0.5	-1.0	-0.25	-0.5
Table 8 cont'd. Marshall Compaction				
Stability, N pounds (minimum)				
50 blow JMF	78301760	72901640	95602150	90302030

3.2   PREPARATION OF ASPHALT BINDER MATERIAL

Heat the asphalt binder material while avoiding local overheating and providing a continuous supply of the asphalt material to the mixer at a uniform temperature. Maintain the temperature of unmodified asphalts to no more than 160 degrees C 325 degrees F when added to the aggregates. The temperature of modified asphalts is not to exceed 175 degrees C 350 degrees F. Performance Graded (PG) asphalts must be within the temperature range of 145 degrees C to 170 degrees C 290 degrees F to 340 degrees F when added to the aggregates and in accordance with the supplier's recommendations.

3.3   PREPARATION OF MINERAL AGGREGATE

Heat and dry the aggregate for the mixture prior to mixing. No damage to the aggregates due to the maximum temperature and rate of heating used is allowed. Maintain the temperature no lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

3.4   PREPARATION OF ASPHALT MIXTURE

Weigh or meter the aggregates and the asphalt binder and introduce into the mixer in the amount specified by the JMF. Limit the temperature of the asphalt mixture to 175 degrees C 350 degrees F when the asphalt binder is added. Mix the combined materials until the aggregate obtains a thorough and uniform coating of asphalt binder (testing in accordance with ASTM D2489/D2489M may be required by the Contracting Officer) and is thoroughly distributed throughout the mixture. The moisture content of all asphalt mixture upon discharge from the plant is not to exceed 0.5 percent by total weight of mixture as measured by ASTM D1461.

3.5   PREPARATION OF THE UNDERLYING SURFACE

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NOTE: If the underlying surface to be paved is an existing asphalt or concrete layer, use a tack coat to ensure an adequate bond between layers.

Tack and prime coat requirements will need to be covered in the Contract documents.

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Immediately before placing the fuel resistant asphalt pavement, clean the underlying course of dust and debris. Apply a tack coat in accordance with Section 32 12 13 BITUMINOUS TACK AND PRIME COATS.

3.6   TEST SECTION

Prior to full production, place a test section for each JMF used. Construct a test section 75 to 150 m 250 to 500 feet long and two paver passes wide with a longitudinal cold joint. Do not place the second lane of test section until the temperature of pavement edge is less than 80 degrees C 175 degrees F. Construct the test section with the same depth as the course which it represents. Ensure the underlying grade or pavement structure upon which the test section is to be constructed is the same or very similar to underlying layer for the project. Use the same equipment and procedures in construction of the test section as on the remainder of the course represented by the test section. Construct the test section as part of the project pavement as approved by the Government.

3.6.1 Sampling and Testing for Test Section

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NOTE: Table 9 applies only to the test section and localized areas appearing to deviate from the specification. The limits in Tables 1, 2, and 6, apply to the results of 4 full scale production testsrun from each lot. This is the reason the limits listed in Table 9 are different from those listed in Tables 1, 2, and 6.

****

Obtain one random sample at the plant, triplicate specimens compacted, and tested for stability, and laboratory air voids. Test a portion of the same sample for TMD, aggregate gradation and asphalt content. Test an additional portion of the sample to determine the TSR. Adjust the compactive effort as required to provide TSR specimens with an air void content of 7 plus or minus 1 percent. Obtain four randomly selected cores from the finished pavement mat, and four from the longitudinal joint, and tested for density. Perform random sampling in accordance with procedures contained in ASTM D3665. Construction may continue provided the test results are within the tolerances or exceed the minimum values shown in Table 7. If all test results meet the specified requirements, the test section may remain as part of the project pavement. If test results exceed the tolerances shown, remove and replace the test section and construct another test section at no additional cost to the Government.

Table 9 Test Section Requirements for Material and Mixture Properties	
Property	Specification Limit
Aggregate Gradation-Percent Passing (Individual Test Result)	
4.75 mm No. 4 and larger	JMF plus or minus 8
2.36, 1.18, 0.60, and 0.30 mmNo. 8, No. 16, No. 30, and No. 50	JMF plus or minus 6
0.15 and 0.075 mmNo. 100 and No. 200	JMF plus or minus 2.0
Asphalt Content, Percent (Individual Test Result)	JMF plus or minus 0.5
Laboratory Air Voids, Percent (Average of 3 specimens)	JMF plus or minus 1.0
VMA, Percent (Average of 3 specimens)	14 minimum
Tensile Strength Ratio (TSR) (At 7 percent plus or minus 1 percent air void content)	80 percent minimum
TSR Conditioned Strength	415 kPa 60 psi minimum
Mat Density, Percent of TMD (Average of 4 Random Cores)	See Table 2

Table 9 Test Section Requirements for Material and Mixture Properties	
Property	Specification Limit
Joint Density, Percent of TMD (Average of 4 Random Cores)	See Table 2

Table 9 cont - Marshall Compaction Requirements	
Property	Specification Limit
Stability, (Average of 3 specimens)	9560 N 2150 pounds minimum

3.6.2 Additional Test Sections

If the initial test section proves to be unacceptable, make the necessary adjustments to the JMF, plant operation, placing procedures, and rolling procedures before beginning construction of a second test section. Construct and evaluate additional test sections, as required, for conformance to the specifications. Full production paving is not allowed until an acceptable test section has been constructed and accepted.

3.7 TRANSPORTING AND PLACING

3.7.1 Transporting

Transport the fuel resistant asphalt mixture from the mixing plant to the site in clean, tight vehicles. Schedule deliveries so that placing and compacting of mixture is uniform with minimum stopping and starting of the paver. Provide adequate artificial lighting for night placements. Hauling over freshly placed material is not permitted until the material has been compacted as specified, and allowed to cool to 60 degrees C 140 degrees F.

3.7.2 Placing

Place the mix in lifts of adequate thickness and compacted at a temperature suitable for obtaining density, surface smoothness, and other specified requirements. At daily paving start-up, load the first truck and stage it near the paving operation. Process the second and third truck through the MTV and into the paver. After the third truck has processed through the MTV and paver, the first truck can be deposited into the MTV and paver. If internal temperature of the first truck drops below compaction temperatures, the asphalt mixture will be rejected. The method presented in the previous sentences also applies to when a stoppage or delay exceeds one hour. Upon arrival, place the mixture to the full width by an asphalt paver; strike off in a uniform layer of such depth that, when the work is completed, the required thickness and conform to the grade and contour indicated. Do not broadcast waste mixture onto the mat or recycle it into the paver hopper. Collect waste mixture and dispose off site. Regulate the speed of the paver to eliminate pulling and tearing of the asphalt mat. Begin placement of the mixture along the centerline of a crowned section or on the high side of areas with a one-way slope. Place the mixture in consecutive adjacent strips having a minimum width of 3 m 10 feet. Offset the longitudinal joint in one course from the longitudinal joint in the course immediately below by at least 300 mm 1 foot; however, locate the joint in the surface course at the centerline of the pavement. Offset transverse joints in one course by at least 3 m 10 feet from transverse joints in the previous course. Offset transverse joints in adjacent lanes a minimum of 3 m 10 feet. On isolated areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread and luted by hand tools. Construct the free edge of shoulder pavements following a guide (e.g. plumb-bob, stringline, etc.) to prevent various widths of the asphalt shoulder. Contractor may elect to cut-back the asphalt edge to maintain consistent shoulder dimensions shown on the plans.

3.8 COMPACTION OF MIXTURE

3.8.1 General

After placing, thoroughly and uniformly compact the mixture by rolling. Compact the surface as soon as possible without causing displacement, cracking or shoving. Determine the sequence of rolling operations and the type of rollers used, except as specified in paragraph FUEL RESISTANT ASPHALT PAVEMENT-PORTLAND CEMENT CONCRETE JOINTS and with the exception that application of more than three passes with a vibratory roller in the vibrating mode is prohibited. Maintain the speed of the roller, at all times, sufficiently slow to avoid displacement of the asphalt mixture and be effective in compaction. Correct at once any displacement occurring as a result of reversing the direction of the roller, or from any other cause.

Furnish sufficient rollers to handle the output of the plant. Continue rolling until the surface is of uniform texture, true to grade and cross section, and the required field density is obtained. To prevent adhesion of the mixture to the roller, keep the wheels properly moistened, but excessive water is not permitted. In areas not accessible to the roller, thoroughly compact the mixture with hand tampers. Remove the full depth of any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or is in any way defective, replace with fresh fuel resistant asphalt mixture and immediately compact to conform to the surrounding area. Perform this work at no expense to the Government. Skin patching is not allowed.

3.8.2 Segregation

Sample and test any material that looks deficient. When the in-place material appears to be segregated, the Government has the option to sample the material and have it tested and compared to the aggregate gradation, asphalt content, and in-place density requirements in Table 7. If the material fails to meet these specification requirements, remove and replace the extent of the segregated material the full depth of the layer of asphalt mixture at no additional cost to the Government. When segregation occurs in the mat, take appropriate action to correct the process so that additional segregation does not occur.

3.9 JOINTS

Construct joints to ensure a continuous bond between the courses and to obtain the required density. Provide all joints with the same texture as other sections of the course and meet the requirements for smoothness and grade.

3.9.1 Transverse Joints

Do not pass the roller over the unprotected end of the freshly laid mixture, except when necessary to form a transverse joint. When necessary to form a transverse joint, construct by means of placing a bulkhead or by tapering the course. Utilize a dry saw cut on the transverse joint full depth and width on a straight line to expose a vertical face prior to placing the adjacent lane. Cutting equipment that uses water as a cooling or cutting agent nor milling equipment is permitted. Remove the cutback material from the project. In both methods, provide a light tack coat of asphalt material to all contact surfaces before placing any fresh mixture against the joint.

3.9.2 Longitudinal Joints

Cut back longitudinal joints which are irregular, damaged, uncompacted, cold (less than 80 degrees C 175 degrees F at the time of placing the adjacent lane), or otherwise defective, a maximum of 75 mm 3 inches from the top edge of the lift with a cutting wheel to expose a clean, sound, near vertical surface for the full depth of the course. Remove all cutback material from the project. Attach the cutting wheel to a roller to perform the longitudinal joint cut back. Provide a light tack coat of asphalt material to all contact surfaces prior to placing any fresh mixture against the joint.

3.9.3 Fuel Resistant Asphalt Pavement-Portland Cement Concrete Joints

Joints between fuel resistant asphalt pavement and Portland Cement Concrete (PCC) require specific construction procedures for the fuel resistant asphalt pavement. The following criteria are applicable to the first 3 m 10 feet or paver width of fuel resistant asphalt pavement adjacent to the PCC.

a. Place the fuel resistant asphalt pavement side of the joint in a direction parallel to the joint.

b. Place the fuel resistant asphalt pavement side sufficiently high so that when fully compacted the fuel resistant asphalt pavement is greater than 3 mm 1/8 inch but less than 6 mm 1/4 inch higher than the PCC side of the joint.

c. Compact with steel wheel rollers and at least one rubber tire roller. Compact with a rubber tire roller that weights at least 18 metric tons 20 tons with tires inflated to at least 620 kPa 90 psi. Avoid spalling the PCC during placement and compaction of the fuel resistant asphalt pavement. Operate steel wheel rollers in a way that prevents spalling the PCC. Repair any damage to PCC edges or joints as directed by the Government. If damage to the PCC joint or panel edge exceeds a total of 1 m 3 feet, remove and replace the PCC panel at no additional expense to the Government.

d. After compaction is finished, diamond grind a minimum width of 1 m 3 feet of the fuel resistant asphalt pavement so that the fuel resistant asphalt pavement side is less than 3 mm 1/8 inch higher than the PCC side. Perform diamond grinding in accordance with subparagraph DIAMOND GRINDING above. The fuel resistant asphalt pavement immediately adjacent to the joint is not allowed to be lower than the PCC after the grinding operation. Transition the grinding into the fuel resistant asphalt pavement in a way that ensures good smoothness and provides drainage of water. The joint and adjacent materials when completed is required to meet all of the requirements for grade and smoothness. Measure smoothness across the fuel resistant asphalt pavement-PCC joint using a 4 m 12 feet straightedge. The acceptable tolerance is 3 mm 1/8 inch.

e. Consider the fuel resistant asphalt pavement next to the PCC as a separate pay factor associated with the lot being placed for evaluation. Lots are based on individual lifts. Do not comingle cores from different lifts for density evaluation purposes. Take four cores for each lot of material placed adjacent to the joint. The size of lot is 3 m 10 feet wide by the length of the joint being paved. Perform the same computation as displayed in paragraph PAY FACTOR BASED ON IN-PLACE DENSITY above to determine the weighted pay factor. Select the lowest computed pay factor for the lot. Locate the center of each of the four cores 150 mm 6 inches from the edge of the concrete. Take each core at a random location along the length of the joint. The requirements for joint density for this lot, adjacent to the PCC joint, are the same as that for the mat density specified in Table 2. For fuel resistant asphalt pavement-PCC joints at taxiways abutting runways, aprons, or other taxiways, take two additional randomly located cores along each taxiway intersection.

f. All procedures, including repair of damaged PCC, are required to be in accordance with the approved Quality Control Plan.

-- End of Section --