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**USACE / NAVFAC / AFCESA / NASA** **UFGS-32 01 22 (August 2008)**

**Preparing Activity: USACE** **Superseding UFGS-32 01 22 (April 2006)**

**UNIFIED FACILITIES GUIDE SPECIFICATIONS**

**References are in agreement with UMRL dated July 2008**
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BITUMINOUS REJUVENATION

**08/08**

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SECTION 32 01 22

BITUMINOUS REJUVENATION
**08/08**

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**NOTE: This guide specification covers the requirements for rejuvenation of bituminous pavements using a liquid rejuvenator material.**

**Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.**

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

**Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.**

**Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).**
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PART 1 GENERAL

1.1 UNIT PRICES

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**NOTE: Delete these paragraphs when lump-sum bidding is used.**
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1.1.1 Measurement

1.1.1.1 Quantity of Rejuvenator

The quantity of rejuvenator to be paid for will be the number of liters gallons used in the accepted work as determined by the Contracting Officer, corrected to liters at 15 degrees C gallons at 60 degrees F in accordance with ASTM D 1250, and provided that the measured quantities are not 20

percent over the approved application rate. Any amount of rejuvenator exceeding the approved application rate by more than 20 percent will be deducted from the measured quantities except for irregular areas where hand spraying of the rejuvenator is necessary. The actual application rate will be determined by the Contracting Officer by dividing the number of liters gallons of rejuvenator actually applied by the number of square meters square yards of pavement treated.

1.1.1.2 Treated Pavement

The quantity of pavement treated with rejuvenator to be paid for will be the number of square meters square yards completed and accepted as determined by the Contracting Officer. The number of square meters square yards of treated pavement will be determined by measuring the length and width of the specified work area. Measurements to determine the number of square meters square yards will be along the surface of the pavement and will be to the closest mm inch for width and the closest meter foot for length.

1.1.2 Payment

Quantities of rejuvenator and treated pavement will be paid for at respective unit prices. Payment will not be made for quantities of rejuvenator and treated pavement when actual application rate of rejuvenator is more than 20 percent below the approved application rate until deficiency is corrected in accordance with paragraph Insufficient Rejuvenator Material.

1.2 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 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.

ASTM INTERNATIONAL (ASTM)

ASTM D 1250 (2007) Standard Guide for Use of the Petroleum Measurement Tables

| | |
|---|---|
| ASTM D 140 | (2001; R 2007) Sampling Bituminous Materials |
| ASTM D 1856 | (1995a; R 2003) Recovery of Asphalt from Solution by Abson Method |
| ASTM D 2170 | (2007) Kinematic Viscosity of Asphalts (Bitumens) |
| ASTM D 2171 | (2007) Viscosity of Asphalts by Vacuum Capillary Viscometer |
| ASTM D 2172 | (2005) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures |
| ASTM D 244 | (2004) Emulsified Asphalts |
| ASTM D 2995 | (1999; R 2004) Determining Application Rate of Bituminous Distributors |
| ASTM D 92 | (2005a) Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester |

## 1.3 SYSTEM DESCRIPTION

Equipment, tools, and machines are subject to approval and shall be maintained in satisfactory working condition at all times.

### 1.3.1 Bituminous Storage Tanks

Provide bituminous storage tanks capable of heating the bituminous material under effective and positive control at all times to the required temperature. Accomplish heating by steam coils, hot oil, electricity, or other suitable method. Affix an armored thermometer to the tank so that the temperature of the bituminous material may be read at all times.

### 1.3.2 Bituminous Distributor

Provide a bituminous distributor designed and equipped to spray the bituminous material in a uniform double or triple lap at the temperature recommended by the manufacturer, at variable widths, and at readily determined and controlled rates from 0.10 to 1.0 L/square meter 0.04 to 0.2 gallon/square yard with an allowable variation from the specified rate of not more than plus or minus 5 percent. Include with the distributor equipment a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying bituminous material manually to areas inaccessible to the distributor. The distributor shall be equipped for circulation and agitation of the bituminous material during the heating process.

### 1.3.3 Brooms and Blowers

Furnish brooms and blowers of the power type, suitable for cleaning the surfaces of bituminous pavements.

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

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

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

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

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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.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-04 Samples

Bituminous Binder

Samples of sufficient size to provide enough bituminous binder for determination of viscosity.

1.5 QUALITY ASSURANCE

The rejuvenator will be applied so that the test properties of binder extracted from samples of the upper 9 mm 3/8 inch of the surface of the test section show that viscosities have decreased by at least 40 percent. Compute the percent decrease in viscosity as follows:

100 ((Viscosity of untreated sample) - (Viscosity of treated sample))/ (Viscosity of untreated samples)

## 1.6 DELIVERY, STORAGE, AND HANDLING

Protect rejuvenator material from excessively high or low temperatures. Store the rejuvenator at temperatures recommended by the manufacturer. Smoking, fire or flames other than heaters that are part of the equipment will not be permitted in the vicinity of heating, distributing or transferring operations for rejuvenators that are flammable.

## 1.7 ENVIRONMENTAL REQUIREMENTS

Apply the rejuvenator to a dry surface and only when the atmospheric temperature in the shade is 10 degrees C 50 degrees F or above. Delay application if rain appears imminent within 8 hours following planned time of application.

# PART 2 PRODUCTS

## 2.1 REJUVENATOR

Provide chemical rejuvenator having a proven record of satisfactory performance based on the ability of the material to decrease the viscosity of the binder material, to reduce the rate of loss of fines, and to retard crack propagation. Select a material that neither permanently damages nor obscures pavement markings. Specific application specifications shall be as recommended by the manufacturer and approved by the Contracting Officer. Sample the rejuvenating material according to ASTM D 140 the test results shall conform to the following requirements:

| Property | Requirement | Test Method |
|---|---|---|
| Residue, percent | 55 minimum | ASTM D 244 (1) |
| Viscosity at 60 degrees C, sq mm/sec (2) | 80-500 | ASTM D 2170 |
| Flash Point (3) Cleveland Open Cup (COC), degrees C | 177 minimum | ASTM D 92 |

| Property | Requirement | Test Method |
|---|---|---|
| Residue, percent | 55 minimum | ASTM D 244 (1) |
| Viscosity at 140 degrees F, centistokes (2) | 80-500 | ASTM D 2170 |
| Flash Point (3) Cleveland Open Cup (COC), degrees F | 350 minimum | ASTM D 92 |

(1) ASTM D 244 evaporation test for percent residue shall be modified by heating 50 gram samples to 150 degrees C 300 degrees F until foaming ceases, cooling immediately, and calculating the results.

(2) Viscosity on the residue obtained from evaporation test.

(3) Flash point on residue from evaporation test.

2.2 AGGREGATE

Gradation of mineral aggregate shall meet the following requirements:

| Sieve Designation | Percent by Weight Passing |
|---|---|
| 1.18 mm | 100 |
| 0.60 mm | 40-75 |
| 0.30 mm | 4-12 |
| 0.15 mm | 0-5 |

| Sieve Designation | Percent by Weight Passing |
|---|---|
| No. 16 | 100 |
| No. 30 | 40-75 |
| No. 50 | 4-12 |
| No. 100 | 0-5 |

PART 3 EXECUTION

3.1 PREPARATION OF SURFACE

Immediately before applying the rejuvenator, remove loose material, dirt, clay, or other objectionable material from the surface to be treated. After the cleaning operation and prior to application of the rejuvenator, the Contracting Officer will inspect the area to be treated to determine fitness of the area to receive the rejuvenator.

3.2 APPLICATION OF REJUVENATOR MATERIAL

Following preparation and subsequent inspection of the surface, uniformly apply the rejuvenator over the surface to be treated at the approved rate with an allowable variation from the approved rate of application of plus or minus 20 percent and at the temperature recommended by the supplier. To obtain uniform application of the rejuvenator on the surface treated at the junction of previous and subsequent applications, spread building paper on the surface at a sufficient distance back from the ends of each application so that the rejuvenator may be started and stopped on the paper. Immediately after application, remove the building paper and properly dispose of it. Areas missed by the distributor shall be properly treated with the hand spray. Following application of the rejuvenator, the surface shall not be disturbed for a period of at least 24 hours.

3.2.1 Excess Rejuvenator Material

Provide approved mineral aggregate for spreading, in sufficient quantity, to effectively blot up any excess rejuvenator material remaining on the treated pavement surface after 24 hours.

### 3.2.2 Ponding and Puddling of Rejuvenator Material

If low spots and depressions in the pavement surface cause ponding or puddling of the rejuvenating agent, broom the pavement surface with a broom drag. Continue brooming until the pavement surface is free of any pools of excess material.

### 3.2.3 Excess Runoff of Rejuvenator

Treat pavement surfaces, which have excessive runoff of rejuvenator due to surface grade, in 2 or more applications. Perform each additional application after the prior application of material has penetrated into the pavement.

### 3.2.4 Insufficient Rejuvenator Material

When it is determined by the Contracting Officer that the actual application rate of the rejuvenator is more than 20 percent below the approved application rate, make subsequent applications of rejuvenator to bring the actual application rate up to the approved rate; additional rejuvenator material shall penetrate into the pavement surface within 24 hours after application.

## 3.3 TEST SECTION

Prior to application of the rejuvenator, prepare representative test sections on the pavement to be treated. Treat the test sections with various amounts of rejuvenator, and conduct tests on samples obtained from the top 9 mm 3/8 inch of each of these treated areas to measure viscosity and thus determine desired application rate. Obtain the samples of treated material no sooner than 24 hours after application of rejuvenator. Select an application rate to obtain the specified reduction in asphalt viscosity and to ensure that all rejuvenator material penetrates into the pavement surface within 24 hours. The application rate shall not exceed that which the pavement can absorb within 24 hours. Do not begin application of the rejuvenator until the test sections have been evaluated and the required application rate has been approved.

## 3.4 SAMPLING AND TESTING

### 3.4.1 Sampling

Perform sampling of the test section before and after the pavement has been rejuvenated. The samples taken from the treated test section areas shall be taken no sooner than 24 hours after application of the rejuvenator.

### 3.4.2 Testing

Conduct tests to extract the bituminous binder according to ASTM D 2172 and recover according to ASTM D 1856. Measure viscosity of the bituminous material in accordance with ASTM D 2170 or ASTM D 2171, as applicable, and conducted at 60 degrees C140 degrees F unless otherwise specified. Determine the change in viscosity for each application rate of rejuvenator in the test section from tests conducted on samples taken before and samples taken after the pavement surface has been rejuvenated. Sampling and testing [are the responsibility of the Contractor] [will be by the Government].

### 3.4.3 Calibration Test

Furnish all equipment, materials and labor necessary to calibrate the bituminous distributor. Perform the calibration with approved job material, prior to applying the rejuvenator to the prepared surface, and in accordance with ASTM D 2995.

-- End of Section --