
USACE / NAVFAC / AFCEC UFGS-32 01 13.64 (November 2023)

Preparing Activity: USACE

Superseding
UFGS-32 01 13.64 (February 2017)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2024

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SECTION 32 01 13.64

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11/23

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SECTION 32 01 13.64

REJUVENATION OF ASPHALT PAVEMENT SURFACES 11/23

NOTE: This guide specification covers the requirements for applying a bituminous-based rejuvenator containing maltenes to the surface of asphalt pavements. Application is restricted to parking lots, storage yards, container handling facilities, and other similar low-speed pavements due to loss of skid resistance. Bituminous-based rejuvenators are applied with conventional liquid asphalt distributor trucks. Do not apply over DoD airfield pavements without approval of the Pavements Discipline Working Group or their designated representative.

Rejuvenators are applied to asphalt pavement surfaces that do not have structural defects or environmental block cracking. Surface rejuvenators penetrate up to about 9.5 millimeter 3/8 inch into the pavement. Rejuvenators restore asphalt pavement binder flexible properties at the molecular level and can delay the occurrence of load-induced structural distress.

Research suggests the best asphalt pavement longevity is accomplished with an initial treatment two to four years after paving to restore asphalt binder flexibility lost during hot plant production, and then a recurring treatment about every five years thereafter. However, that research was conducted prior to development of Superpave PG binders, therefore, the performance protocol timeframes may not be as stringent.

Surface rejuvenators can cause dangerous loss of friction for up to a year, therefore project selection and application rates require careful investigation. Research has shown that pavements with substantial oil or fuel spillage may negatively impact surface rejuvenation effectiveness.

Due to the many proprietary commercial products, this Section is written for pavement binder properties after application; do not modify to use a specified application rate.

Industry has developed bio-based rejuvenators that can improve a hot mix asphalt binder but in a chemically different process than the bituminous-based rejuvenators. This Section uses DoD researched and approved bituminous-based rejuvenators. Bio-based rejuvenators are applied with agricultural sprayers. Bio-based rejuvenators are not incorporated into this Section.

Alternative treatments to paved or unpaved surfaces are:

Section 32 12 36.13 BITUMINOUS FOG SEAL - A light spray application of asphalt emulsion to the surface of a chip seal, an open-graded mix, or a weathered asphalt surface. It is classified as a Preventive Maintenance process when nonstructural cracking or raveling first begins. Fog seals of asphalt emulsion slow the oxidation process of asphalt pavements but skid resistance is lowered.

Section 32 01 13.62 BITUMINOUS SURFACE TREATMENT [AND] [SAND SEAL] (BST) - used on existing unpaved or paved surface. BSTs are low-cost maintenance methods that produce all-weather surfaces, renew weathered pavement, improve skid resistance, improve lane demarcation, and seal pavement surfaces including small cracks. BSTs are also known as Chip Seals.

Sand Seals are addressed in Section 32 01 13.62 BITUMINOUS SURFACE TREATMENT [AND] [SAND SEAL] and are spray-applied liquid asphalt covered with sand, used to restore uniform cover, restore weathered pavement, and reduce raveling. The treated surface is rolled with a pneumatic roller. Do not apply over DoD airfield pavements without approval of the Pavements Discipline Working Group or their designated representative. The Federal Aviation Administration has a similar product known as Seal Coat.

Slurry Seal - A mixture of crushed, well-graded aggregate (e.g., fine sand, mineral filler) and asphalt emulsion that is spread over the entire pavement surface with either a squeegee or spreader box attached to the back of a truck. There is no UFGS for slurry seal. Application is restricted to parking lots, storage yards, container handling facilities, and other similar low-speed pavements due to loss of skid resistance. Do not apply over DoD airfield pavements without approval of the Pavements Discipline Working Group or their designated representative.

Micro-Surfacing - Applied in a process similar to slurry seals, micro-surfacing consists of a mixture of cationic quick set emulsified asphalt, mineral aggregate, mineral filler, water, and additives. Micro-surfacing provides a friction and rapid roadway surface correction. With a special mix design, it can fill ruts up to 19.5 mm 1.5 inches deep. Material is mixed in specialized, compartmentalized, self-powered trucks, and placed on the pavement using a screed box with auger. There is no UFGS for Micro-Surfacing. Application is restricted to parking lots, storage yards, container handling facilities, and other similar low-speed pavements due to loss of skid resistance. Do not apply over DoD airfield pavements without approval of the Pavements Discipline Working Group or their designated representative.

Cape Seal - An application of micro-surfacing a few days after construction of a BST; used to cover the aggregates and improve aggregate bonding. There is no UFGS for Cape Seal. Do not apply over DoD airfield pavements without approval of the Pavements Discipline Working Group or their designated representative.

Sandwich Seal - Process is to spread large aggregate, spray-apply emulsion, then cover with smaller aggregate to lock in larger aggregate. Requires the use of very clean aggregate. Used to improve skid resistance and seal pavements. There is no UFGS for Sandwich Seal. Do not apply over DoD airfield pavements without approval of the Pavements Discipline Working Group or their designated representative.

Rejuvenator, Spray-on - Rejuvenators are commercially available products (proprietary) designed to restore original properties to aged (oxidized) asphalt binders by restoring the original ratio of asphaltenes to maltenes. A rejuvenator will retard the loss of surface fines and reduce the formation of additional cracks. Rejuvenators will not fill or remove existing cracks unless cracking is very minor hairline cracking. There is no UFGS for bio-based rejuvenators.

Rejuvenator, Mix-in-Place - Designed to be used with advanced cold or hot in-place recycling of existing aged asphalt pavements which exhibit relatively high stiffness due to the aged binder. Proprietary chemical rejuvenators reduce the brittleness, but also affect the fatigue and thermal cracking properties of the recycled pavement. DoD provides a mix-in-place rejuvenator procedure in TM 5-822-10/AFM 88-6 Chapter 6. Section 32 01 16.70 COLD-MIX REUSED ASPHALT PAVING uses emulsion recycling agents and Section 32 01 16.74 IN PLACE

HOT REUSED ASPHALT PAVING uses ASTM D4552 recycling agents. Substantial testing and engineering is required to specify the correct rejuvenator or emulsion and resultant mixture properties. Do not apply over DoD airfield pavements without approval of the Pavements Discipline Working Group or their designated representative.

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

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

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

PART 1 GENERAL

1.1 UNIT PRICES

NOTE: Delete these paragraphs when lump sum bidding is used.

1.1.1 Measurement

1.1.1.1 Quantity of Rejuvenator

The quantity of rejuvenator to be paid for will be the measured quantities of **liters** **gallons** used in the accepted work as approved by the Contracting Officer, corrected to **liters at 15 degrees C** **gallons at 60 degrees F** in accordance with **ASTM D1250**, 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 pavement surface.

1.1.1.3 Waybills and Delivery Tickets

Submit waybills and delivery tickets during progress of the work. Before the final statement is allowed, file with the Contracting Officer certified waybills and certified delivery tickets for all bituminous materials used in the construction of the pavement covered by the Contract. Do not remove bituminous material from storage until the initial outage and temperature measurements have been taken. The delivery or storage units will not be released until the final outage has been taken.

1.1.2 Payment

Accepted measured quantities of rejuvenator and treated pavement will be paid for at respective unit prices. Payment will constitute full compensation for providing all materials, equipment, plant, test section, testing, and tools, and for all labor and other incidentals necessary to complete work.

1.2 REFERENCES

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

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

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

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

ASTM INTERNATIONAL (ASTM)

ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D75/D75M	(2019) Standard Practice for Sampling Aggregates
ASTM D92	(2012a) Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester
ASTM D140/D140M	(2016) Standard Practice for Sampling

Asphalt Materials

ASTM D244	(2009; R 2017) Standard Test Methods and Practices for Emulsified Asphalts
ASTM D1250	(2019; E 2020) Standard Guide for Use of the Joint API and ASTM Adjunct for Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils: API MPMS Chapter 11.1
ASTM D1856	(2009; R 2015) Recovery of Asphalt from Solution by Abson Method
ASTM D2170/D2170M	(2018) Standard Test Method for Kinematic Viscosity of Asphalts (Bitumens)
ASTM D2171/D2171M	(2018) Standard Test Method for Viscosity of Asphalts by Vacuum Capillary Viscometer
ASTM D2172/D2172M	(2017; E 2018) Standard Test Methods for Quantitative Extraction of Asphalt Binder from Asphalt Mixtures
ASTM D2995	(2023) Determining Application Rate of Bituminous Distributors

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST HB 44	(2018) Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices
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U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD	(2009; Rev 2012) Manual on Uniform Traffic Control Devices
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1.3 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the

Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy and Air Force projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Waybills And Delivery Tickets; G, [_____]

Distributor; G, [_____]

Scales; G, [_____]

Rejuvenator; G, [_____]

Recommended Temperature; G, [_____]

Mineral Aggregate; G, [_____]

SD-04 Samples

Bituminous-based Chemical Rejuvenator; G, [_____]

SD-06 Test Reports

Quality Control; G, [_____]

Surface Preparation; G, [_____]

Test Section; G, [_____]

Inspection Reports; G, [_____]

1.4 QUALITY CONTROL

NOTE: For projects where rejuvenator is the primary definable feature of work, the testing laboratory can be the Contractor's laboratory, the rejuvenator

manufacturer's laboratory, or an independent commercial laboratory. Frequently, the rejuvenator manufacturer is the most knowledgeable. What is important is the laboratory is accredited as referenced. Select the appropriate quality control section for the project and include with Contract. If rejuvenator is a minor part of a project, and an independent commercial laboratory is already part of the Contract, may select that option for continuity, provided accredited in the appropriate tests.

Sampling and testing is the responsibility of the Contractor. Perform sampling and testing using [a] [an independent commercial] testing laboratory accredited in the required tests in accordance with Section 01 45 00 QUALITY CONTROL approved by the Contracting Officer. Sampling must be in accordance with ASTM D75/D75M for aggregates and ASTM D140/D140M for bituminous material. Contracting Officer may inspect testing facilities. Perform tests in the numbers, and at the location and times indicated, to ensure that the materials meet specified requirements. Submit copies of test results within 24 hours after completion of each test.

1.4.1 Preconstruction Sampling and Testing

Conduct preconstruction sampling and testing of rejuvenator in PART 2 PRODUCTS. Submit initial test results of rejuvenator at least 30 days prior to starting work. Repeat sampling and testing when there is a change in source or material.

1.4.2 Equipment Calibration

Furnish all equipment, materials, and labor necessary to calibrate equipment in accordance with paragraph EQUIPMENT, TOOLS, AND MACHINES. Perform all calibrations with the approved job materials and prior to applying the specified coatings to the prepared surface. Inspect all equipment prior to start of work and at regular intervals as needed during work.

1.4.3 Construction Quality Control Testing

Conduct sampling and testing in accordance with paragraph FIELD QUALITY CONTROL. Conduct measurement and testing each application day to ensure rejuvenator application rates are satisfactory. Submit copies of test results within 24 hours after completion of each test.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver rejuvenator to the site in a homogenous and undamaged condition. Inspect the materials for contamination and damage. Unload and store the materials with minimal handling. If rejuvenator is stored on project site, it must be stored in a manner recommended by the supplier and not exceed storage life or temperature ranges. Do not allow rejuvenator material to freeze or boil. Replace defective or damaged materials.

1.5.1 Bituminous Delivery Tickets

For every distributor load of rejuvenator material brought to site, provide the following: manufacturer, manufacture date, lot number,

storage tank number, and total volume of rejuvenator material on truck.

1.5.2 Aggregate Delivery Tickets

For every load of mineral aggregate brought to site provide the aggregate source, supplier's aggregate size designation, and the weight of aggregate on the truck.

1.5.3 Safety Precautions

Smoking, or open flames (other than heaters that are part of the equipment) are not permitted within 8 meters 25 feet of heating, distributing, or transferring operations for rejuvenators that are flammable.

1.6 Environmental Requirements

Apply the rejuvenator when the existing surface is dry, and when the weather is not foggy, rainy, or when the wind velocity will prevent the uniform application. Apply the rejuvenator when the atmospheric temperature in the shade is 10 degrees C 50 degrees F and rising or when pavement temperature is above 15.5 degrees C 60 degrees F and rising, and the temperature has not been below 2 degrees C 35 degrees F for the 12 hours prior to application unless otherwise directed. Do not apply if wind disperses rejuvenator application. Delay application if rain appears imminent within 8 hours following time of application.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide bituminous-based rejuvenator on existing prepared asphalt pavement surface.

2.2 EQUIPMENT, TOOLS, AND MACHINES

Provide equipment for the purpose intended and properly maintained in satisfactory and safe operating condition at all times. Discontinue the use of equipment which fails to safely produce satisfactory work and replace with satisfactory equipment.

2.2.1 Scales

NOTE: For CONUS, select NIST 44 Class III L. For
OCONUS, select the local governing authority, note
the tolerances are the same as the NIST 44 Class III
L. For the scale divisions, 9 kg 20 lb is common
for manufacturers; e.g. 20 X 2000=40,000 lb capacity
for the lowest capacity Class III L scale.

Use standard truck scales of the beam type equipped with a weight-recording device. Use scales with sufficient size and capacity to accommodate the trucks used in hauling aggregates. Keep the necessary number of standard weights on hand, at all times, for testing the scales. Permanent or portable scales used for payment and application rates must be calibrated by a certified calibration agency before commencing work, following the method and calibration frequency [in accordance with

NIST HB 44 Class III L][recognized by governing local in which the project is located with the scale division 2 kg 5 lb for 2000 scale divisions and a maximum of 10,000 divisions. Scale acceptance tolerance is 2 kg 5 lb for 2000 scale divisions, and increases 1 kg 2.5 lb for each 500 increase in scale divisions. Example: for 5000 scale divisions, tolerance is 2 kg 5 lb + (6 x 1 kg 2.5 lb) = 8 kg 15 lb.] Conduct calibrations in presence of Contracting Officer. Provide certified calibration documentation. Recalibrate at 6 months from date of last approved calibration for permanent scales, and weekly for portable scales, for the duration of the Contract. Recalibrate scales if previous recognized calibration is outdated. Recalibrate scales or equipment if directed by the Contracting Officer. Provide adequate protection for the indicating and recording devices of the scales.

2.2.2 Distributor

Provide self-propelled distributors with pneumatic tires of such size and number to prevent rutting, shoving, or otherwise damaging the surface being sprayed. Clean distributor trucks and lines of all materials before loading for project; open inspection hatches when requested by the Contracting Officer. 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. Provide a distributor that is approved by the Contracting Officer and:

- a. Is capable of circulating and agitating the bituminous material during the heating process.
- b. Is capable of spraying in a triple overlap. Equip the spray bar with the appropriate nozzle sizes to achieve a uniform bituminous application across the pavement at the specified rate and acceptable distributor speed. Adjust all nozzles to 30 degrees from the spray bar long axis, or to the same angle between 15 and 30 degrees only as recommended by the manufacturer and Contractor will demonstrate that the specified application rate is achieved. Only use the calibrated wrench provided by manufacturer to adjust nozzle angle.
- c. Is designed and equipped to spray the bituminous material at variable widths at the specified temperature, at readily determined and controlled total liquid rates, from 0.14 to 4.5 liters per square meter 0.03 to 1.0 gallons per square yard. Operate the distributor within a pressure range of 172.4 to 517.1 kPa 25 to 75 psi and with an allowable variation from the specified rate of not more than plus or minus 5 percent.
- d. Each nozzle to be within 10 percent of the average flow rate for all the nozzles. Repair/replace out of tolerance nozzles.
- e. Provide certification of distributor radar calibration for equipment with mounted radar which monitors travel speed and distance, used for the project. The date of calibration is to be no more than 6 months prior to project application

2.2.2.1 Distributor Calibration

Verify the distributors application rate no more than 96 hours prior to the start of bituminous application following [ASTM D2995](#) Method B. For each day of application, validate using the dipstick method of volume applied divided by the applied area. Repeat [ASTM D2995](#) calibration after 7 calendar days after start of project application. Submit bituminous material application rate and the residual asphalt application rate (for emulsified asphalts and cutbacks) results to Government. Provide the [ASTM D2995](#) Method B calculations for transverse and longitudinal application rates.

2.2.3 Bituminous Storage Tank

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, or electricity. Provide steam heaters consisting of steam coils and equipment for producing steam, so designed that the steam cannot come in contact with the bituminous material. Affix an armored thermometer to the tank with a range appropriate for manufacturer recommended storage temperatures so that the temperature of the bituminous material may be determined at all times. Clean tanks and pipelines of all materials before loading for project; open inspection hatches if requested by the Contracting Officer.

2.2.4 Power Brooms and Power Blowers

Provide power brooms and power blowers capable of cleaning surfaces to be treated.

2.2.5 Broom Drag

Provide broom drag or hand broom for removing rejuvenator that ponds, pools, or is in excess.

2.2.6 Vacuum Sweepers

Provide self-propelled, vacuum pickup sweeper capable of removing loose sand, water, and debris from pavement surface.

2.3 MATERIALS

**NOTE: Recommend re-striping pavements treated with
rejuvenator.**

2.3.1 [Rejuvenator](#)

Provide [bituminous-based chemical rejuvenator](#) having a demonstrated record of performance based on the ability of the material to decrease the viscosity of the binder material, through molecular modification of the asphaltenes and maltenes, to reduce the rate of loss of fines, and to retard crack propagation. Select a material that neither permanently damages nor obscures pavement markings. Provide specific application specifications, rates, temperatures, and weather conditions recommended by the manufacturer to the Contracting Officer for review and approval. Sample the rejuvenating material according to [ASTM D140/D140M](#). Provide rejuvenator conforming to the following test requirements in Table I:

TABLE I: Rejuvenator Properties		
Property	Requirement	Test Method
Residue, percent	55 minimum	ASTM D244 (1)
Viscosity at 60 degrees C, sq mm/sec 140 degrees F, centistokes (2)	80-500	ASTM D2170/D2170M
Flash Point (3) Cleveland Open Cup (COC), degrees C degrees F	177 350 minimum	ASTM D92
(1) Modify ASTM D244 evaporation test for percent residue 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.		

2.3.2 Rejuvenator Application Rate

NOTE: Designer to determine if the pavement surface grades, transverse or longitudinal, are too steep for the rejuvenator to adhere in a single application. Typically, bituminous tack coat emulsion application rates of 0.45 liters per square meter 0.10 gallon per square yard do not have application issues with grade. If there is not a grade-related application issue, then delete the bracketed paragraph.

Determine the application rate from analysis of the applications in paragraph TEST SECTION. The application rate is that which reduces binder viscosities extracted from samples of the upper 9 mm 3/8 inch of the treated surfaces by at least 40 percent. Compute the percent decrease in viscosity as follows:

$$\frac{100 ((\text{Viscosity of untreated sample}) - (\text{Viscosity of treated sample}))}{(\text{Viscosity of untreated sample})}$$

[2.3.2.1 Multiple Rejuvenator Applications

Treat pavement surfaces in two or more applications. Perform each additional application after the prior application of material has penetrated into the pavement.

]2.3.3 Mineral Aggregate

Sample mineral aggregate sand for blotting in accordance with ASTM D75/D75M. Provide gradation of mineral aggregate sand in accordance with ASTM C136/C136M and meet the following gradation requirements in Table II:

TABLE II: Mineral Aggregate Gradation	
Sieve Designation (mm)	Percent by Weight Passing
1.18 No. 16	100
0.60 No. 30	40-75
0.30 No. 50	4-12
0.15 No. 100	0-5

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Site Protection

NOTE: Modify the bracketed sentence as appropriate for the project location. Public notices and signage 3 days prior is reasonable, unless local ordinance requires otherwise. Designer is to identify temporary parking for homes or business access that is interrupted by the work and curing. Delete paragraph if not needed.

[Provide public notices and post signage at least [3] [_____] days in advance of starting work. Plan detours as provided in the Contract prior to performing work at site.]During work, protect adjacent buildings, structures, vehicles, manhole covers, inlet grates, and trees to prevent splattering and marring. Protect manhole covers, inlet grates, electrical boxes, utility boxes, and other similar pavement penetrations with building paper cut to size to protect the entire casting size and opening. If the building paper becomes dislodged, replace with plywood, or other continuous board medium, cut to fit and of a thickness sufficient to remain in place during rejuvenator application. Open and remove debris from all covers, grates, and boxes after rejuvenator application.

3.1.2 Traffic Control

Provide warning signs and barricades for proper traffic control, in accordance with [MUTCD] [local governing traffic control authority].

3.1.3 Surface Preparation

NOTE: Rejuvenators are applied to pavements that exhibit no or very minor distresses. If a major distress is present, consider if the pavement is an appropriate candidate for a rejuvenator. Designer must first design appropriate repairs to existing pavements prior to rejuvenator application. If the pavement contains substantial areas of oil or fuel spill penetration, Designer must core and investigate the areas and determine depth of

penetration to determine if there is an appropriate repair prior to rejuvenator application. Otherwise, conventional mill and resurface, bituminous surface treatment, or similar operation may be appropriate.

Some rejuvenators do not require paint removal before application. For those that do, removal of paint and rubber deposits are generally accomplished by high pressure water blasting but care must be used to ensure that the water pressure does not significantly damage the asphalt pavement surface. Designer to consider use of Section 32 01 11.51 RUBBER AND PAINT REMOVAL FROM AIRFIELD PAVEMENTS for thermoplastic markings. Few approved chemicals are effective and sandblasting is not permitted by air pollution regulations at some locations. Mechanical abrasion generally causes damage to the pavement.

[[Complete repairs to existing pavement as specified in the Contract documents] [and] [remove existing oil and fuel penetration as specified in Contract documents].]Immediately before applying the rejuvenator, remove loose material, dirt, clay, or other objectionable material from the surface to be treated. Flush the surface with water when necessary to remove dirt or debris not removed by sweeping or brooming; allow the surface to dry after flushing. Paint bonded to the surface may remain. After the cleaning operation and prior to application of the rejuvenator, the Contracting Officer is to inspect the area to be treated to determine suitability of the area to receive the rejuvenator.

3.2 TEST SECTION

Determine the required application rates from test sections on the pavement to be treated.

3.2.1 Bituminous Distributor Temperature

Ensure bituminous material is at the recommended application temperature and has been thoroughly cycled through the distributor bar. Test the bituminous distributor under pressure by means of a test shot area (outside the project limits) to ensure there are no leaks or dripping from nozzles after shut-off.

3.2.2 Test Section Construction

Construct each test section 30 meters 100 feet in length. Treat each test section with a different application rate 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. Do not apply rejuvenator at a rate what exceeds that which the pavement can absorb within 24 hours after application. Do not begin application of the rejuvenator until the test section report has been evaluated and the required application rate has been approved by the Contracting Officer. Trial application rates may be modified as approved by the Contracting Officer.

3.2.3 Test Section Viscosity Testing

Conduct tests to extract the bituminous rejuvenator according to ASTM D2172/D2172M and recover according to ASTM D1856. Submit samples of sufficient size to provide enough bituminous binder for determination of viscosity. Measure viscosity of the bituminous material in accordance with ASTM D2170/D2170M or ASTM D2171/D2171M, as applicable, and conducted at 60 degrees C 140 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. Submit for approval a test report indicating each change in viscosity for each application rate in the test section. Summarize the report with the recommended application rate. Rejuvenating production work may proceed after the Contracting Officer approves the application rate.

3.3 REJUVENATOR MATERIAL APPLICATION

Apply rejuvenator material at the approved rate and at manufacturer's recommended temperature using triple overlap in such a manner that uniform distribution is obtained over all surfaces treated. Reduce spray to double overlap if wind disperses triple overlap and only if double overlap applies the specified coverage, otherwise discontinue work until acceptable coverage is obtainable. For double overlap, adjust distributor operation and settings to achieve target application rate. 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 from each end of each application so that application of the rejuvenator may be started and stopped on the paper. Remove the building paper immediately after application. Properly treat areas missed by the distributor with the hand spray. Protect the surface for a period of at least 24 hours following application of the rejuvenator.

3.4 FIELD QUALITY CONTROL

Inspect application uniformity and determine application rates of rejuvenator each day of application.

3.4.1 Ponding and Pooling of Rejuvenator Material

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

3.4.2 Blotting Excess Rejuvenator Material

Apply mineral aggregate sand for blotting, in sufficient quantity, to effectively blot up any excess rejuvenator material remaining on the treated pavement surface after 24 hours. Apply blotter sand by hand or mechanical spreader. After rejuvenator is absorbed by blotter sand, sweep, remove, and dispose of blotter sand.

3.4.3 Insufficient Rejuvenator Material

When 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 sum of the applied application rates up to but not exceeding the approved rate with penetration into the pavement surface occurring within 24 hours after application.

3.4.4 Inspection Reports

Furnish a written report each day of application citing air temperature and humidity during application of rejuvenator, rejuvenator temperature during application, rate of rejuvenator application, truck speed in meters per minute feet per minute, RPM of truck, digital wet (shot) rate, spray bar height, and pump setting. Include any observations.

3.5 SURFACE PROTECTION

**NOTE: Delete bracketed sentence if pavement
markings are not in Contract.**

Protect freshly placed coatings from damage by traffic. Provide sufficient warning signs and barricades to prevent traffic over freshly treated surfaces. Protect treated areas from traffic for at least 24 hours after final application of coatings, or for such time as necessary to prevent tracking.[Apply pavement markings as required in Contract after final brooming.]

-- End of Section --