

PART VII - MISCELLANEOUS

ITEM P-602 BITUMINOUS PRIME COAT

DESCRIPTION

602-1.1 This item shall consist of an application of bituminous material on the prepared base course in accordance with these specifications and in reasonably close conformity to the lines shown on the plans.

MATERIALS

602-2.1 BITUMINOUS MATERIAL. The types, grades, controlling specifications, and application temperatures for the bituminous materials are given in Table 1. The Engineer shall designate the specific material to be used.

TABLE 1. BITUMINOUS MATERIAL

| Type and Grade | Specification | Application Temperatures \1\ | |
|--------------------|---------------|------------------------------|--------|
| | | Deg. F | Deg. C |
| Emulsified Asphalt | | | |
| SS-1, SS-1h | ASTM D 977 | 70-160 | 20-70 |
| MS-2, HFMS-1 | ASTM D 977 | 70-160 | 20-70 |
| CSS-1, CSS-1h | ASTM D 2397 | 70-160 | 20-70 |
| CMS-2 | ASTM D 2397 | 70-160 | 20-70 |
| Cutback Asphalt | | | |
| RC-30 | ASTM D 2028 | 80+ | 30+ |
| RC-70 | ASTM D 2028 | 120+ | 50+ |
| RC-250 | ASTM D 2028 | 165+ | 75+ |

\1\ The maximum temperature for cutback asphalt shall be that at which fogging occurs.

CONSTRUCTION METHODS

602-3.1 WEATHER LIMITATIONS. The prime coat shall be applied only when the existing surface is dry or contains sufficient moisture to get uniform distribution of the bituminous material, when the atmospheric temperature is above 60 F (15 C), and when the weather is not foggy or rainy. The temperature requirements may be waived, but only when so directed by the Engineer.

602-3.2 EQUIPMENT. The equipment used by the Contractor shall include a self-powered pressure bituminous material distributor and equipment for heating bituminous material.

The distributor shall be designed, equipped, maintained, and operated so that bituminous material at even heat may be applied uniformly on variable widths of surface at the specified rate. The allowable variation from the specified rate shall not exceed 10 percent. Distributor equipment shall include a tachometer, pressure gages, volume-measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. The distributor shall be self-powered and shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically.

If the distributor is not equipped with an operable quick shut off valve, the prime operations shall be started and stopped on building paper. The Contractor shall remove blotting sand prior to asphalt concrete lay down operations at no additional expense to the owner.

A power broom and/or blower shall be provided for any required cleaning of the surface to be treated.

602-3.3 APPLICATION OF BITUMINOUS MATERIAL. Immediately before applying the prime coat, the full width of the surface to be primed shall be swept with a power broom to remove all loose dirt and other objectionable material.

The bituminous material including solvent shall be uniformly applied with a bituminous distributor at the rate of 0.25 to 0.50 gallons per square yard (1.20 to 2.40 liters per square meter) depending on the base course surface texture. The type of bituminous material and application rate shall be approved by the Engineer prior to application.

Following the application, the primed surface shall be allowed to dry not less than 48 hours without being disturbed or for such additional time as may be necessary to permit the drying out of the prime until it will not be picked up by traffic or equipment. This period shall be determined by the Engineer. The surface shall then be maintained by the Contractor until the surfacing has been placed. Suitable precautions shall be taken by the Contractor to protect the primed surface against damage during this interval, including supplying and spreading any sand necessary to blot up excess bituminous material.

602-3.4 BITUMINOUS MATERIAL CONTRACTOR'S RESPONSIBILITY. Samples of the bituminous materials that the Contractor proposes to use, together with a statement as to their source and character, must be submitted and approved before use of such material begins. The Contractor shall require the manufacturer or producer of the bituminous materials to furnish material subject to this and all other pertinent requirements of the contract. Only satisfactory materials, so demonstrated by service tests, shall be acceptable.

The Contractor shall furnish vendor's certified test reports for each carload, or equivalent, of bituminous material shipped to the project. *The tests reports shall contain all the data required by the applicable specification. If the Contractor applies the prime material prior to receipt of the tests reports, payment for the material shall be withheld until they are received. If the material does not pass the specifications it shall be replaced at the contractor's expense.* The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall not be interpreted as basis for final acceptance. All such test reports shall be subject to verification by testing samples of materials received for use on the project.

602-3.5 FREIGHT AND WEIGH BILLS. Before the final estimate is allowed, the Contractor shall file with the Engineer receipted bills when railroad shipments are made, and certified weigh bills when materials are received in any other manner, of the bituminous materials actually used in the construction covered by the contract. The Contractor shall not remove bituminous material from the tank car or storage tank until the initial outage and temperature measurements have been taken by the Engineer, nor shall the car or tank be released until the final outage has been taken by the Engineer.

Copies of freight bills and weigh bills shall be furnished to the Engineer during the progress of the work.

METHOD OF MEASUREMENT

602-4.1 The bituminous material for prime coat shall be measured by the [gallon (liter)][ton(kg)]. Volume shall be corrected to the volume at 60 F (15 C) in accordance with ASTM D 1250 for cutback asphalt, and Table IV-3 of The Asphalt Institute's Manual MS-6 for emulsified asphalt.

BASIS OF PAYMENT

602-5.1 Payment shall be made at the contract unit price per [gallon (liter)][ton (kg)] for bituminous prime coat. This price shall be full compensation for furnishing all materials and for all preparation, delivering, and applying the materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

Payment will be made under:

Item P-602-5.1 Bituminous Prime Coat--per [gallon (liter)][ton (kg)]

MATERIAL REQUIREMENTS

ASTM D 977 Emulsified Asphalt

ASTM D 2028 *Cutback* Asphalt (Rapid Curing *Type*)

ASTM D 2397 Cationic Emulsified Asphalt

TESTING REQUIREMENTS

ASTM D 1250 Petroleum Measurement Tables

Asphalt Institute Manual MS-6 *Asphalt Pocketbook of Useful Information* (Temperature-Volume Corrections for Emulsified Asphalts)
Table IV-3

END OF ITEM P-602

ITEM P-603 BITUMINOUS TACK COAT

DESCRIPTION

603-1.1 This item shall consist of preparing and treating a bituminous or concrete surface with bituminous material in accordance with these specifications and in reasonably close conformity to the lines shown on the plans.

MATERIALS

603-2.1 BITUMINOUS MATERIALS. The bituminous material shall be either cutback asphalt, emulsified asphalt, or tar and shall conform to the requirements of Table 1. The type, grade, controlling specification, and application temperature of bituminous material to be used shall be specified by the Engineer.

TABLE 1. BITUMINOUS MATERIAL

| Type and Grade | Specification | Application Temperature | |
|--------------------|---------------|-------------------------|--------|
| | | Deg. F | Deg. C |
| Emulsified Asphalt | | | |
| SS-1, SS-1h | ASTM D 977 | 75-130 | 25-55 |
| CSS-1, CSS-1h | ASTM D 2397 | 75-130 | 25-55 |
| Cutback Asphalt | | | |
| RC-70 | ASTM D 2028 | 120-160 | 50-70 |
| Tar | | | |
| RTCB 5, RTCB 6 | AASHTO M 52 | 60-120 | 15-50 |

CONSTRUCTION METHODS

603-3.1 WEATHER LIMITATIONS. The tack coat shall be applied only when the existing surface is dry and the atmospheric temperature is above 60 F (15 C). The temperature requirements may be waived, but only when so directed by the Engineer.

603-3.2 EQUIPMENT. The Contractor shall provide equipment for heating and applying the bituminous material.

The distributor shall be designed, equipped, maintained, and operated so that bituminous material at even heat may be applied uniformly on variable widths of surface at the specified rate. The allowable variation from the specified rate shall not exceed 10 percent. Distributor equipment shall include a tachometer, pressure gages, volume-measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. The distributor shall be self-powered and shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically.

If the distributor is not equipped with an operable quick shut off valve, the tack operations shall be started and stopped on building paper. The Contractor shall remove blotting sand prior to asphalt concrete lay down operations at no additional expense to the owner.

A power broom and/or blower shall be provided for any required cleaning of the surface to be treated.

603-3.3 APPLICATION OF BITUMINOUS MATERIAL. Immediately before applying the tack coat, the full width of surface to be treated shall be swept with a power broom and/or airblast to remove all loose dirt and other objectionable material.

Emulsified asphalt shall be diluted by the addition of water when directed by the Engineer and shall be applied a sufficient time in advance of the paver to ensure that all water has evaporated before any of the overlying mixture is placed on the tacked surface.

The bituminous material including vehicle or solvent shall be uniformly applied with a bituminous distributor at the rate of 0.05 to 0.15 gallons per square yard (0.24 to 0.72 liters per square meter) depending on the condition of the existing surface. The type of bituminous material and application rate shall be approved by the Engineer prior to application.

Following the application, the surface shall be allowed to cure without being disturbed for such period of time as may be necessary to permit drying out and setting of the tack coat. This period shall be determined by the Engineer. The surface shall then be maintained by the Contractor until the next course has been placed. Suitable precautions shall be taken by the Contractor to protect the surface against damage during this interval.

603-3.4 BITUMINOUS MATERIAL-CONTRACTOR'S RESPONSIBILITY. Samples of the bituminous material that the Contractor proposes to use, together with a statement as to its source and character, must be submitted and approved before use of such material begins. The Contractor shall require the manufacturer or producer of the bituminous material to furnish material subject to this and all other pertinent requirements of the contract. Only satisfactory materials so demonstrated by service tests, shall be acceptable.

The Contractor shall furnish the vendor's certified test reports for each carload, or equivalent, of bituminous material shipped to the project. *The tests reports shall contain all the data required by the applicable specification. If the Contractor applies the material prior to receipt of the tests reports, payment for the material shall be withheld until they are received. If the material does not pass the specifications it shall be replaced at the contractor's expense.* The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall not be interpreted as a basis for final acceptance. All such test reports shall be subject to verification by testing samples of material received for use on the project.

603-3.5 FREIGHT AND WEIGH BILLS. Before the final estimate is allowed, the Contractor shall file with the Engineer receipted bills when railroad shipments are made, and certified weigh bills when materials are received in any other manner, of the bituminous materials actually used in the construction covered by the contract. The Contractor shall not remove bituminous material from the tank car or storage tank until the initial outage and temperature measurements have been taken by the Engineer, nor shall the car or tank be released until the final outage has been taken by the Engineer. Copies of freight bills and weigh bills shall be furnished to the Engineer during the progress of the work.

METHOD OF MEASUREMENT

603-4.1 The bituminous material for tack coat shall be measured by the [gallon (liter)] [ton (kg)]. Volume shall be corrected to the volume at 60 F (15 C) in accordance with ASTM D 1250 for cutback asphalt, ASTM D 633 for tar, and Table IV-3 of The Asphalt Institute's Manual MS-6 for emulsified asphalt. Water added to emulsified asphalt will not be measured for payment.

BASIS OF PAYMENT

603.5-1 Payment shall be made at the contract unit price per [gallon (liter)] [ton (kg)] of bituminous material. This price shall be full compensation for furnishing all materials, for all preparation, delivery, and application of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-603-5.1 Bituminous Tack Coat--per [gallon (liter)][ton (kg)]

MATERIAL REQUIREMENTS

ASTM D 633 Volume Correction Table for Road Tar

ASTM D 977 Emulsified Asphalt

ASTM D 1250 Petroleum Measurement Tables

ASTM D 2028 *Cutback* Asphalt (Rapid-Curing Type)

ASTM D 2397 Cationic Emulsified Asphalt

Asphalt Institute *Asphalt Pocketbook of Useful Information* (Temperature-Volume Corrections for Emulsified

Manual MS-6 Asphalts)

Table IV-3

END ITEM P-603

The following is an optional specification that can be used for long performance joint seals in concrete pavements:

ITEM P-604 Compression Joint Seals For Concrete Pavements

DESCRIPTION

604-1.1 This item shall consist of performed polychloroprene compression seals used for sealing joints of rigid pavements.

MATERIALS

604-2.1 PREFORMED SEALS. Preformed joint seal materials shall be a vulcanized elastomeric compound using polychloroprene as the only base polymer. The material and the manufactured seal itself shall conform to ASTM D 2628 [and CRD C 548]. The joint seal shall be a labyrinth type seal with the uncompressed depth of the seal greater than the uncompressed width of the seal, [except that for seals 1 inch or greater in width, the depth need be only 1 inch or greater]. The actual width of the uncompressed seal shall be 13/16 inch or 1 inch [or ____] within a tolerance of plus 1/8 inch and minus 1/16 inch.

In paragraph 604-2.1, the actual width of the joint seal should be 13/16 inch or 1 inch at the option of the Contractor. However, for unusual circumstances or for resealing joints in existing pavement that have to be sawed out to an extra width a wider seal should be specified. 1 inch should be used for slab greater than 20 feet and less than 25 foot.

604-2.2 LUBRICANT/ADHESIVE. Lubricant/adhesive used for the preformed elastomeric joint seal shall be a one-component compound conforming to ASTM D 2835.

604-2.3 DELIVERY AND STORAGE. Materials delivered to the job site shall be inspected for defects, unloaded, and stored with a minimum of handling to avoid damage. Storage facilities shall be provided at the job site to protect materials from weather and to maintain them at temperatures as recommended by the manufacturer.

604-2.4 SUBMITTALS. Certified copies of test results shall be provided [____] days prior to use of material on the project.

a. Construction Equipment List. List of proposed equipment to be used in the performance of construction work, including descriptive data shall be provided [____] days prior to use on the project.

b. Manufacturer's Instructions. Where installation procedures, or any part thereof, are required to be in accordance with the manufacturer's recommendations, printed copies of these recommendations shall be furnished [____] days prior to use on the project. Installation of the material will not be allowed until the recommendations are received. Failure to furnish these recommendations can be a cause for rejection of the material.

c. Samples. Regardless of testing responsibility, samples of the materials shall be submitted for approval [____] days prior to use on the project. Written or printed directions from the manufacturer giving recommended

criteria for installation shall be furnished at the same time, plus certification from the manufacturer that the seal selected is recommend for the installation involved on this project. No material will be allowed to be used until it has been approved.

The blank spaces for testing the materials will be filled in to allow ample time for sampling, testing, and shipping to the project. Normally, this will require a minimum of 60 days.

For the following paragraph optional wording is in brackets: Designer should select the applicable statement for testing and determining specification compliance and delete the inapplicable statement. The first statement will be selected for all projects except where the project is less than 4,000 linear feet of preformed joint seal material. When the project requires less than 4,000 linear feet of preformed joint seal material, the first statement can be deleted and the second statement used.

604-2.5 TEST REQUIREMENTS. Each lot of preformed joint seal and lubricant/adhesive produced for this project shall be sampled, adequately identified, and tested for conformance with the referenced applicable material specification. A lot of preformed seal shall consist of one day's production or 20,000 linear feet for each cross section, whichever is less. A lot of lubricant/adhesive shall consist of one day's production. [Samples of the preformed joint seal and lubricant/adhesive material shall be submitted and will be tested by the Engineer. No material shall be used at the project prior to receipt of written notice that the materials meet the laboratory requirements. The cost of testing the samples from each original lot supplied will be borne by the Engineer. If the sample fail to meet specification requirements, the materials represented by the sample shall be replaced and the new materials tested. A cost of [_____] for Engineer testing of each lot of replacement material will be charged to the Contractor.] [Testing of the preformed joint and lubricant/adhesive material shall be the responsibility of the Contractor and shall be performed in an approved independent laboratory and certified copies of the test reports shall be submitted for approval [_____] days prior to the use of the materials at the job site. Samples of each lot of material shall also be submitted and will be retained by the Engineer for possible future testing should the materials appear defective during or after application.] The Contractor shall furnish additional samples of materials, in sufficient quantity to be tested, upon request. Conformance with the requirements of the laboratory tests specified will not constitute final acceptance of the materials. Final acceptance will also be based on the performance of the in-place materials.

604-3.1 EQUIPMENT. Machines, tools, and equipment used in the performance of the work required by this section shall be approved before the work is started and shall be maintained in satisfactory condition at all times.

a. Joint Cleaning Equipment

1. Concrete Saw. A self-propelled power saw with water-cooled diamond or abrasive saw blades shall be provided for cutting joints to the depths and widths specified and for removing filler **[existing old joint seal]** or other material embedded in the joints or adhered to the joint faces.

2. Sandblasting Equipment. Sandblasting equipment shall include an air compressor, hose, and a long-wearing venturi-type nozzle of proper size, shape, and opening. The maximum nozzle opening should not exceed 1/4 inch. The air compressor shall be portable and shall be capable of furnishing not less than 150 cubic feet per minute and maintaining a line pressure of not less than 90 psi at the nozzle while in use. The compressor shall be equipped with traps that will maintain the compressed air free of oil and water. The nozzle shall have an adjustable guide that will hold the nozzle aligned with the joint about 1 inch above the pavement surface and will direct the blast to clean the joint walls. The height, angle of inclination, and the size of the nozzle shall be adjusted as necessary to ensure satisfactory results.

Sandblasting should be shown as an option to waterblasting for new pavement installations.

Sandblasting equipment with a 1/4-inch nozzle requires at least 137 cubic feet per minutes of air to function efficiently. A larger nozzle would not serve any useful purpose in cleaning a joint.

3. Waterblasting Equipment. Waterblasting equipment shall include a trailer-mounted water tank, pumps, high-pressure hose, a wand with safety release cutoff controls, nozzle, and auxiliary water resupply equipment. The water tank and auxiliary water resupply equipment shall be sufficient capacity to permit continuous operations. The pumps, hoses, wand, and nozzle shall be of sufficient capacity to permit the cleaning of both walls of the joint and the pavement surface for a width of at least 1/2 inch on either side of the joint. The pump shall be capable of supplying a pressure of at least 3,000 psi. A pressure gauge mounted at the pump shall show at all times the pressure in pounds per square inch at which the equipment is operating.

b. Sealing Equipment. Equipment used to install the preformed seal shall place the preformed seal to the prescribed depths within the specified tolerances without cutting, nicking, twisting, or otherwise damaging the seal. The equipment shall not stretch or compress the seal more than 3.0 percent longitudinally during installation. The machine shall be an automatic self-propelled joint seal application equipment and shall be engine powered. The machine shall include a reservoir for the lubricant/adhesive, a device for conveying the lubricant/adhesive in the proper quantities to the sides the preformed seal or the sidewalls of the joint, a reel capable of holding one full spool of preformed seal, and a power-driven apparatus for feeding the joint seal through a compression device and inserting the seal into the joint. The equipment shall also include a guide to maintain the proper course along the joint being sealed. The machine shall at all times be operated by an experienced operator.

Single-axle type seal application equipment should not be permitted; this tool tends to cause excessive stretching and may cut or distort the seal. The following subparagraph may be added only for pavements less than 500 square yards:

"The hand operated joint seal application equipment shall be a two-axle, four-wheel machine that shall include means for compressing and inserting the preformed seal into the joint and a reel capable of holding one full spool of preformed seal. Auxiliary equipment shall be provided to coat both sides the seal or the joint with lubricant/adhesive just prior to the installation of the preformed seal."

CONSTRUCTION METHODS

604-41 ENVIRONMENTAL CONDITIONS. The ambient temperature and the pavement temperature within the joint wall shall be at least 35 degrees F and rising at the time of installation of the materials. Sealant application will not be permitted if moisture or any foreign material is observed in the joint.

604-42 TRIAL JOINT SEAL AND LUBRICANT/ADHESIVE INSTALLATION. Prior to the cleaning and sealing of the joints for the entire project, a test section at least 200 feet long shall be prepared at a location directed in the project pavement using the specified materials and the approved equipment, so as to demonstrate the proposed joint preparation and sealing of all types of joints in the project. Following the completion of the trial length and before any other joint is sealed, the trial joints will be inspected by the Engineer to determine that the materials and installation meet the requirements specified. If materials or installation do not meet requirements the materials shall

be removed, and the joints shall be recleaned and resealed at no cost to the owner. No other joints shall be sealed until the test installation has been approved. If the trial section is approved, it may be incorporated into the permanent work and paid for at the contract unit prices per linear foot for sealing items scheduled. All other joints shall be sealed in the manner approved for sealing the trial joints.

604-4.3 PREPARATION OF JOINTS. Immediately before installation of the preformed joint seal, the joints shall be thoroughly cleaned to remove all laitance, filler, [old existing sealant,] foreign material and protrusions of hardened concrete from the sides and upper edges of the joint space to be sealed. Any irregularity in the joint face which would prevent uniform contact between the joint seal and the joint face shall be corrected prior to the installation of the joint seal.

Joint openings of uniform cross section are essential to satisfactory installation of performed polychloroprene joint seal. Openings must be sawed to provide smooth vertical faces of consistent width, within specified tolerances. Non-uniformity in width or roughness will cause variations in resistance of the joint seal to insertion and will result in irregular depth of insertion, stretching, and a tendency of the joint seal to twist so that the top of the seal is not at the surface.

The proper preparation of joints with respect to the size of joint opening, required cleanliness of vertical and parallel joint faces, and uniform contact between the seal and the joint face can not be overemphasized.

The neglect of any facet of these operations can result and has resulted in poor performance of joint seals.

a. Sawing. Joints shall be sawed to clean and to open them to the full specified width and depth. Immediately following the sawing operation, the joint faces and opening shall be thoroughly cleaned using a water jet to remove all saw cuttings or debris remaining on the faces or in the joint opening. Compression seal shall be installed within 3 calendar days of the time the individual joint cavity is sawed. Depth of sawing the cavity shall be between 3/4 and 1 inch deeper than the uncompressed depth of the seal (or otherwise recommended by the manufacture. The saw cut for the joint seal cavity shall at all locations be centered over the joint line. The nominal width of the sawed joint seal cavity shall be as follows; the actual width shall be within a tolerance of plus or minus 1/16 inch:

1. If a nominal 13/16 inch wide compression seal is furnished, the nominal width of the saw cut shall be [____]. However, this shall apply only when the pavement temperature at the time of sawing is between [____ and ____] degrees F. If the pavement temperature at the time of sawing is above this range, the nominal width of the saw cut shall be decreased 1/16 inch. If the pavement temperature at the time of sawing is below this range, the nominal width of the saw cut shall be increased 1/16 inch.

2. If a nominal 1 inch wide compression seal is furnished, the nominal width of the saw cut shall be [____]. However, this shall apply only when the pavement temperature at the time of sawing is between [____ and ____] degrees F. If the pavement temperature at the time of sawing is above this range, the nominal width of the saw cut shall be decreased 1/16 inch. If the pavement temperature at the time of sawing is below this range, the nominal width of the saw cut shall be increased 1/16 inch.

The pavement temperature shall be measured in the presence of the Engineer. Measurement shall be made each day before commencing sawing and at any other time during the day when the temperature appears to be moving out of the allowable sawing range.

In Par 604-3.1.a, the requirements are based on giving the Contractor the option of using either nominal 13/16 inch or 1-inch wide compression seal. The designer will select the required valves

to insert in the blanks for whatever geographical area in which the project is located based on the following table:

| Area | For insertion in blanks | | | Allowable Pavement Temperature Range for Sawing- Degrees F |
|---------------------------------|---|--|-------------------------------|---|
| | Expected Pavement Temperature Range in Service Degrees F | Nominal Uncompressed Sealant Width- Inches | Nominal Saw Cut- Inches | |
| Southwest Desert Area | +10 to +160 | 13/16 | 8/16 | +50 to +155 |
| | | 1" | 9/16 | +55 to +180 |
| Southern U.S. | 0 to +135 | 13/16 | 8/16 | +30 to +110 |
| | | 1" | 9/16 | +30 to +170 |
| Other Contiguous U.S. States | -30 to +135 | 13/16 | 8/16 | +25 to +80 |
| | | 1" | 9/16 | +25 to +140 |
| Alaska and Similar Areas | -70 to +110 | 13/16 | 7/16 | +50* to +105 |
| | | 1" | 8/16 | +60 to +160 |

* Put a note in the project specifications that this seal shall not be installed in a saw cut less than 7/16 and thus cannot be used in this area if sawing must be done at temperatures less than +50 degrees.

The above table is based on the following:

- a. Tolerance from nominal specified width of uncompressed seal - plus 1/8 inch and minus 0 inch.
- b. Tolerance from nominal saw cut width-plus or minus 1/16 inch.
- c. Compression seal must be compressed at least 20 percent of its uncompressed width at all times.
- d. Compression seal must never be compressed more than 60 percent of its uncompressed width at any time (narrowest opening in hot weather must be at least 40 percent of uncompressed seal width).
- e. Computations for slab (or joint) movement have been based on the formula:

$$dW = 0.001056 \times dT$$

dW = slab or joint movement in inches

dT = change in temperature in degrees F

(The coefficient 0.000528 was derived from the basic formula $dL = 12 \times c \times l (a \times dT + e)$. To arrive at 0.001056; a , the thermal coefficient of concrete was assumed to be 5.5E-6 inch/inch/degree Fahrenheit; e , the drying shrinkage coefficient of concrete was neglected for these calculations. A value of 0.5 to 2.5 x 10⁻⁴ in./in. can be used for new concrete, and C , the adjustment factor due to slab friction was assumed to be 0.80. Slab length is assumed to be 20 ft.

- f. **The values for insertion in the blanks are based on the greatest tolerance limit variation for both seal width and saw cut width.**

For unusual conditions and for resealing joints in existing pavements where the prepared joint is extra wide, the designer will have to compute values to insert in the blanks. (Before the compression seal is used for resealing joints in existing pavements, it is common practice to resaw the joints - which will give a wider joint cavity. Width of sawing should be held to the same tolerance as specified for new pavements.)

b. Sandblast Cleaning. The concrete joint faces and pavement surfaces extending at least 1/2 inch from the joint edges shall be sandblasted clean. A multiple pass technique shall be used until the surfaces are free of dust, direct curing compound, or any residue that might prevent ready insertion or uniform contact of the seal and bonding of the lubricant/adhesive to the concrete. After final cleaning and immediately prior to sealing, the joints shall be blown out with compressed air and left completely free of debris and water.

Sandblasting of joints may not be permitted under certain conditions. Blowing sand and dust may either violate atmospheric pollution statues, or may drift into areas where it would be objectionable. When sandblasting is prohibited, cleaning the joints with waterblasting equipment may be used and this paragraph deleted.

c. Waterblast Cleaning. The concrete joint faces and pavement surfaces extending at least 1/2 inch from the joint edges shall waterblasted clean. A multiple pass technique shall be used until the surfaces are free of dust, direct, curing compound, or any residue that might prevent ready insertion or uniform contact of the seal and bonding of the lubricant/adhesive to the concrete. After final cleaning and immediately prior to sealing, the joints shall be blown out with compressed air and left completely free of debris and water.

Waterblasting equipment varies considerably with respect to design of wand, nozzle, water pressure, and water volume depending upon the manufacturer. Consequently, the effectiveness of a particular set of equipment cannot be predicted. The joints may be waterblasted the previous day and cleaned with compressed air immediately prior to sealing. The joints should be inspected to insure no foreign debris remains in the joint before sealing.

d. Rate of Progress. The stages of joint preparation which includes sandblasting or waterblasting of the joint faces and air pressure cleaning of the joints shall be limited to only the linear footage of joint that can be sealed during the same workday.

604-4.4 INSTALLATION OF THE PREFORMED SEAL.

Temperatures of the pavement and the atmosphere are not as critical for the installation of preformed polychloroprene joint seals as they are for poured sealants. Therefore, lower temperatures are acceptable and under some conditions sealing can proceed satisfactorily at temperatures lower than 35 degrees F. However, joints should be dry to obtain maximum

cementing of the lubricant/adhesive to the concrete and manufacturers should be contacted for special instructions under cold conditions.

a. Time of Installation. Joints shall be sealed within 3 calendar days of sawing the joint seal cavity and immediately following concrete cure and the final cleaning of the joint walls. Open joints ready for sealing that cannot be sealed under the conditions specified herein shall be provided with an approved temporary seal to prevent infiltration of foreign material. When rain interrupts the sealing operations, the joints shall be washed, air pressure cleaned and allowed to dry prior to installing the lubricant/adhesive and preformed seal.

b. Sequence of Installation. Longitudinal joints shall be sealed first, followed by transverse joints and then all other joints. Seals in longitudinal joints shall be cut so that all transverse joint seals will be intact from edge to edge of the pavement. Intersections shall be made monolithic by use of joint seal adhesive and care in fitting the intersection parts together. Extender pieces of seal shall not be used at intersections. Any seal falling short of the intersection shall be removed and replaced with new seal at no additional cost to the owner.

604-4.5 SEALING OF JOINTS. The joint seal shall be installed using the equipment specified in paragraph EQUIPMENT. The sides of the joint seal or the sides of the joint shall be covered with a coating of lubricant/adhesive and the seal installed in such a manner as to conform to all requirements specified. Butt joints and seal intersections shall be coated with liberal applications of lubricant/adhesive. Lubricant/adhesive spilled on the pavement shall be removed immediately to prevent setting on the pavement. The in-place joint seal shall be in an upright position and free from twisting, distortion, cuts, and stretching or compression in excess of 3.0 percent. The joint seal shall be placed at a uniform depth within the tolerances specified. In-place joint seal which fails to meet the specified requirements shall be removed and replaced with new joint seal in a satisfactory manner at no additional cost to the owner. The preformed joint seal shall be placed to a depth of 3/16 inch, plus or minus 1/8 inch, below the pavement surface except when the joint is beveled or has a radius at the surface, or unless otherwise directed. For beveled joints or joints with a radius at the surface, the preformed joint seal shall be installed at a depth of 1/8 inch, plus or minus 1/8 inch, below the bottom of the edge of the bevel or radius. No part of the seal shall be allowed to project above the surface of the pavement or above the edge of the bevel or radius. The seal shall be installed in the longest practicable lengths in longitudinal joints and shall be cut at the joint intersections so as to provide continuous installation of the seal in the transverse joints. The lubricant/adhesive in the longitudinal shall be allowed to set for 1 hour prior to cutting at the joint intersections to reduce the possibility of shrinkage. For all transverse joints, the minimum length of the preformed joint seal shall be the pavement width from edge to edge.

Stretching of the preformed polychloroprene joint seal beyond the specified maximum must never be permitted, as breaks in the seal could occur later on. It is also possible that if the maximum is exceeded, when the longitudinal joints are cut to install the transverse joints that the joint seal material will return to its natural length leaving openings in the final product. Conversely, placing the seal so that the preformed seal is compressed longitudinally is also undesirable, as this practice tends to cause unsightly undulations and may exceed depth of installation tolerances.

On airfield pavements a depth of 3/16 inch is desired to reduce the accumulation of dust and debris on top of the preformed seal, which could be ingested by aircraft engines. For other pavements 1/4 inch can be specified. It is recommended when the preformed seal in the longitudinal intersections are being cut that a knife blade be used to reduce the possibility of damage to the preformed seal on either side of the intersection.

604-4.6 CLEAN-UP. Upon completion of the project, all unused materials shall be removed from the site, any lubricant/adhesive on the pavement surface shall be removed, and the pavement shall be left in clean condition.

604-5.1 QUALITY CONTROL PROVISIONS.

a. Equipment. The application equipment shall be inspected to assure uniform application of lubricant/adhesive to the sides of the preformed joint seal or the walls of the joint. If any equipment causes cutting, twisting, nicking, excessive stretching or compressing of the preformed seal, or improper application of the lubricant/adhesive the operation shall be suspended until causes of the deficiencies are determined and corrected.

b. Procedures.

1. Quality control provisions shall be provided during the joint cleaning process to prevent or correct improper equipment and cleaning techniques that damage the concrete in any manner. Cleaned joints shall be approved by the Engineer prior to installation of the lubricant/adhesive and performed joint seal.

2. Conformance to stretching and compression limitations shall be determined. After installation, the distance between the marks shall be measured on the pavement. If the stretching or compression exceeds the specified limit, the seal shall be removed and replaced with new joint seal at no additional cost to the owner. The seal shall be removed up to the last correct measurement. The seal shall be inspected a minimum of once per 100 feet of seal for compliance to the shrinkage or compression requirements. Measurements shall also be made as directed to determine conformance with depth and width installation requirements. All preformed seal that is not in conformance with specification requirements shall be removed and replaced with new joint seal at no additional cost to the owner.

c. Product. The joint sealing system (preformed seal and lubricant/adhesive) shall be inspected for proper rate of cure and bonding to the concrete, cuts, twists, nicks, and other deficiencies. Seals exhibiting any defects, at any time prior to final acceptance of the project, shall be removed from the joint, wasted, and replaced in a satisfactory manner.

METHOD OF MEASUREMENT

604-6.1 MEASUREMENT. The quantity of each sealing item to be paid for will be determined by actual measurement of the number of linear feet of in-place material that has been approved.

BASIS OF PAYMENT

604-7.1 PAYMENT. Payment will be made at the contract unit bid prices per linear foot for the sealing items scheduled. The unit bid prices shall include the cost of all labor, materials, the use of all equipment, and tools required to complete the work.

TESTING REQUIREMENTS

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

U.S. ARMY CORPS OF ENGINEERS

CRD C 548 Standard Specification for Jet-Fuel and Heat Resistant Preformed Polychloroprene Elastomeric Joint Seals for Rigid Pavements

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2628 Prefomed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

ASTM D 2835 Lubricant for Installation of Preformed Compression Seals in Concrete Pavements

ITEM P-605 JOINT SEALING FILLER

DESCRIPTION

605-1.1 This item shall consist of providing and installing a resilient and adhesive joint sealing filler capable of effectively sealing joints and cracks in pavements.

MATERIALS

605-2.1 JOINT SEALERS. Joint sealing materials shall meet the requirements of [].

[Each lot or batch of sealing compound shall be delivered to the jobsite in the manufacturer's original sealed container. Each container shall be marked with the manufacturer's name, batch or lot number, and the safe heating temperature and shall be accompanied by the manufacturer's certification stating that the compound meets the requirements of this specification.]

[Each lot of preformed joint sealer delivered to the jobsite shall be accompanied by the manufacturer's certification stating that it meets the requirements of this specification.]

The Engineer shall specify one or more of the following:

Fed. Spec. SS-S-200E(2) – *Sealants, Joint, Two-Component, Jet-Blast* Resistant, Cold Applied.

ASTM D 1854 - Jet-Fuel-Resistant Concrete Joint Sealer, Hot-Poured Elastic Type

ASTM D 2628 - Preformed Polychloroprene Elastomeric Joint Seats for Concrete Pavements

ASTM D 3406 - Joint Sealants, Hot-*Applied*, Elastometric-Type, for Portland Cement Concrete Pavements

ASTM D 3569 - Joint Sealants, Hot-*Applied*, Elastometric, Jet-Fuel-Resistant type, for Portland Cement Concrete Pavements

ASTM D 3581 - Joint Sealant, Hot-*Applied*, Jet-Fuel-Resistant Type, for Portland Cement Concrete and Tar-Concrete Pavements

ASTM D 5893 - Standard Specifications for Cold Applied, Single Component, Chemically Curing Silicon Joint Sealant for Portland Cement Concrete Pavements.

ASTM D 6690 - Joint and Crack Sealants, Hot-Applied, for Concrete and Asphalt Pavements

Additionally, if silicone sealants are elected, add the ASTM to the listing of Material Requirements.

If preformed joint sealer is specified, the manufacturer shall certify that the performed seal will exert a minimum pressure of 3.0 pounds per square inch (21 kPa) when compressed to 80 percent of nominal width and a maximum of 25.0 pounds per square inch (172 kPa) when compressed to 50 percent of nominal width.

Paragraph 2.2 applies only when preformed sealants are specified. Delete when not applicable.

605-2.2 LUBRICANT. Lubricant for installation of preformed joint seal shall be a one-component polychloroprene compound containing only soluble phenolic resins blended together with anti-oxidants and acid acceptors in aromatic hydrocarbon solvent mixture and shall meet the following requirements:

| | Requirements | ASTM |
|-----------------------------------|--------------|-----------------|
| Average weight per gallon, pounds | 7.8 | |
| Solids content, percent by weight | 22-28 | D1644, Method A |
| Film strength, psi | 2,300 min. | D412 |
| Elongation, percent | 750 min. | D412 |

Each shipment of lubricant shall be delivered to the jobsite in the manufacturer's original sealed container. Each container shall be marked with the manufacturer's name, batch or lot number, and the date of manufacture and shall be accompanied by the manufacturer's certification stating that the lubricant meets the requirements of the specification.

This lubricant shall be stored at a temperature between 50 F (10 C) and 80 F (30 C) and shall be used within 270 days of its manufacture.

CONSTRUCTION METHODS

605-3.1 TIME OF APPLICATION. Joints shall be sealed as soon after completion of the curing period as feasible and before the pavement is opened to traffic, including construction equipment. The pavement temperature shall be above [40 F (4 C)][(50 F (10 C))] at the time of installation of the [preformed joint seal][poured joint sealing material].

Specify 40 F (4 C) for preformed seal and 50 (10 C) F for poured seals.

If the pavement must be opened to traffic prior to placement of the sealant, this paragraph should be modified to require the Contractor to temporarily fill the joint with a jute or nylon rope immediately after the joint is sawed. The rope should be slightly larger than the joint and should be forced into the joint so that the top of the rope is 1/8 inch (3 mm) below the pavement surface. The rope shall be removed immediately prior to cleaning.

605-3.2 PREPARATION OF JOINTS.

a. Sawing. All joints shall be sawed in accordance with specifications and plan details. Immediately after sawing the joint, the resulting slurry shall be completely removed from joint and adjacent area by flushing with a jet of water, and by use of other tools as necessary.

b. Sealing. Immediately before sealing, the joints shall be thoroughly cleaned of all remaining laitance, curing compound, and other foreign material. Cleaning shall be accomplished by sandblasting. Sandblasting shall be accomplished in a minimum of two passes. One pass per joint face with the nozzle held at an angle directly toward the joint face and not more than 3 inches from it. Upon completion of cleaning, the joints shall be blown out with compressed air free of oil and water. Only air compressors with operable oil and water traps shall be used to prepare the joints for sealing. The joint faces shall be surface dry when the seal is applied.

605-3.3 INSTALLATION OF SEALANTS. Joints shall be inspected for proper width, depth, alignment, and preparation, and shall be approved by the Engineer before sealing is allowed. Sealants shall be installed in accordance with the following requirements:

[Hot Poured Sealants. The joint sealant shall be applied uniformly solid from bottom to top and shall be filled without formation of entrapped air or voids. A backing material shall be placed as shown on the plans and shall be nonadhesive to the concrete or the sealant material. The heating kettle shall be an indirect heating type, constructed as a double boiler. A positive temperature control and mechanical agitation shall be provided. The sealant shall not be heated to more than 20 F (11 C) below the safe heating temperature. The safe heating temperature can be obtained from the manufacturer's shipping container. A direct connecting pressure type extruding device with nozzles shaped for insertion into the joint shall be provided. Any sealant spilled on the surface of the pavement shall be removed immediately.]

[Cold Applied Sealants. Cold applied joint sealing compound shall be applied by means of pressure equipment that will force the sealing material to the bottom of the joint and completely fill the joint without spilling the material on the surface of the pavement. A backing material shall be placed as shown on the plans and shall be nonadhesive to the concrete or the sealant material. Sealant which does not bond to the concrete surface of the joint walls, contains voids, or fails to set to a tack-free condition will be rejected and replaced by the Contractor at no additional cost. Before sealing the joints, the Contractor shall demonstrate that the equipment and procedures for preparing, mixing, and placing the sealant will produce a satisfactory joint seal. This shall include the preparation of two small batches and the application of the resulting material.]

The use of a backup material or bond breaker in the bottom of the joint to be filled is recommended to control the depth of the sealant, to achieve the desired shape factor, and to support the sealant against indentation and sag. Backup materials and bond breakers should be compatible with the sealant, should not adhere to the sealant, should be compressible without extruding the sealant, and should recover to maintain contact with the joint faces when the joint is open.

Jute, paper, or other moisture absorbing material shall not be use for the backing material. The backing material shall be rubber, butyl rubber, or other approved material that will not react with the joint sealer and will not form a gas when the hot joint sealer is applied.

[Preformed Elastomeric Joint Seals. Preformed joint sealer shall be placed using equipment capable of installing the sealer in the upright position, without cutting, nicking, distorting, or otherwise damaging the seal. Lubricant shall be applied to the concrete or the preformed seal, or both, and the seal shall be installed in a substantially compressed condition and at the depth below the surface of the pavement as shown in the plans. The method of installation shall be such that the joint sealer will not be stretched more than 5 percent of the minimum theoretical length, or compressed more than 2 percent. The method of installation shall be checked for stretching or compression, using transverse joint sealer. The check shall consist of installing sealer in five joints of at least 25 feet (7.5 m) in length, removing the sealer immediately after installation, and checking the length. This check may be modified by premarking or precutting the sealer to length prior to installation if this is compatible with the equipment being used. If the measured length of any of these five sealers indicated that the sealer is stretched or compressed beyond these limits, the installation shall be modified to correct the situation. Once satisfactory sealing operations have started, one joint length per every hundred shall be removed and checked. If the limits are exceeded, the joint sealers on either side should be removed until the condition disappears. The affected joints shall be resealed in a satisfactory manner at no cost to the owner, and the method of installation shall be checked again

for satisfactory procedure. The seal shall be installed in the longest practicable lengths in longitudinal joints and shall be cut at the joint intersections for continuous installation of the seal in the transverse joints.]

The Engineer should select either hot poured, cold applied, or preformed sealant and include the appropriate paragraph in the specifications.

Insert:

"both non-reactive and..."

before:

"...non-adhesive to the concrete..." in the second sentence of each paragraph regarding hot poured and cold applied sealant.

METHOD OF MEASUREMENT

605-4.1 Joint sealing material shall be measured by the [gallon (liter)] [pound (kg)] [linear foot (meter)] of sealant in place, complete, and accepted.

BASIS OF PAYMENT

605-5.1 Payment for joint sealing material shall be made at the contract unit price per [gallon (liter)] [pound (kg)] [linear foot (meter)]. The price shall be full compensation for furnishing all materials, for all preparation, delivering, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

- Item P-605-5.1 Joint Sealing Filler — per gallon (liter)
- Item P-605-5.2 Joint Sealing Filler — per pound (kg)
- Item P-605-5.3 Preformed Sealer — per linear foot (meter)

TESTING REQUIREMENTS

- ASTM D 412 Test *Methods* for *Vulcanized Rubber and Thermoplastic Elastomers* – Tension
- ASTM D 1644 Test *Methods* for Nonvolatile Content of Varnishes

MATERIAL REQUIREMENTS

- ASTM D 1854 Jet-Fuel-Resistant Concrete Joint Sealer, Hot-*Applied* Elastic Type
- ASTM D 2628 Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
- ASTM D 3406 Joint Sealants, Hot-*Applied*, Elastomeric-Type, for Portland Cement Concrete Pavements
- ASTM D 3569 Joint Sealant, Hot-*Applied*, Elastometric, Jet-Fuel-Resistant Type, for Portland Cement Concrete Pavements

ASTM D 3581 Joint Sealant, Hot-*Applied*, Jet-Fuel-Resistant Type, for Portland Cement Concrete and Tar-Concrete Pavements

ASTM D 5893 Standard Specifications for Cold Applied, Single Component, Chemically Curing Silicon Joint Sealant for Portland Cement Concrete Pavements

ASTM D 6690 Joint and Crack Sealants, Hot-Applied, for Concrete and Asphalt Pavements

Fed. Spec. *Sealants, Joint, Two-Component, Jet-Blast* Resistant, Cold Applied
SS-S-200E(2)

END ITEM P-605

ITEM P-606 ADHESIVE COMPOUNDS, TWO-COMPONENT FOR SEALING WIRE AND LIGHTS IN PAVEMENT

DESCRIPTION

606-1.1 This specification covers two types of material; a liquid suitable for sealing electrical wire in saw cuts in pavement and for sealing light fixtures or bases in pavement, and a paste suitable for embedding light fixtures in the pavement. Both types of material are two-component filled formulas with the characteristics specified in paragraph 606-2.4. Materials supplied for use with bituminous concrete pavements must be formulated so they are compatible with the bituminous concrete.

If the material is to be used on bituminous concrete pavements and it is not formulated for this use, cracking and separation of the material from sawed wireway kerfs and around light fixtures may occur.

EQUIPMENT AND MATERIALS

606-2.1 CURING. When prewarmed to 77 F (25 C), mixed, and placed in accordance with manufacturer's directions, the materials shall cure at temperatures of 45 F (7 C) or above without the application of external heat.

606-2.2 STORAGE. The adhesive components shall not be stored at temperatures over 86 F (30 C).

606-2.3 CAUTION. Installation and use shall be in accordance with the manufacturer's recommended procedures. Avoid prolonged or repeated contact with skin. In case of contact, wash with soap and flush with water. If taken internally, call doctor. Keep away from heat or flame. Avoid vapor. Use in well-ventilated areas. Keep in cool place. Keep away from children.

606-2.4 CHARACTERISTICS. When mixed and cured in accordance with the manufacturer's directions, the materials shall have the following properties shown in Table 1.

SAMPLING, INSPECTION, AND TEST PROCEDURES

606-3.1 TENSILE PROPERTIES. Tests for tensile strength and elongation shall be conducted in accordance with ASTM D 638.

606-3.2 EXPANSION. Tests for coefficients of linear and cubical expansion shall be conducted in accordance with ASTM D 1168, Method B, except that mercury shall be used instead of glycerine. The test specimen(s) shall be mixed in the proportions specified by the manufacturer, and cured in a glass tub approximately 2 inches (50 mm) long by 3/8 inch (9 mm) in diameter. The interior of the tube shall be precoated with a silicone mold release agent. The hardened sample shall be removed from the tube and aged at room temperature for 1 week before conducting the test. The test temperature range shall be from 35 F (2 C) to 140 F (60 C).

606-3.3 TEST FOR DIELECTRIC STRENGTH. Test for dielectric strength shall be conducted in accordance with ASTM D 149 for sealing compounds to be furnished for sealing electrical wires in pavement.

TABLE 1. PROPERTY REQUIREMENTS

| Physical or Electrical Property | Minimum | Maximum | ASTM Method |
|---|----------------------------|---------|-------------|
| Tensile | | | |
| Portland Cement Concrete | 1,000 psi (70 kg/sq.cm) | | D 638 |
| Bituminous Concrete | 500 psi (35 kg/sq.cm) | | |
| Elongation | | | |
| Portland Cement Concrete | | | D 638 |
| Bituminous Concrete | 50% | | D 638 |
| Coef. of cub. exp. | | | |
| cu. cm/cu. cm/degree C | 0.00090 | 0.00120 | D 1168 |
| Coef. of lin. exp. | | | |
| cm/cm/degree C | 0.00030 | 0.00040 | D 1168 |
| Dielectric strength, | | | |
| short time test | 350 volts/mil. | | D 149 |
| Arc resistance | 125 secs. | | D 495 |
| Adhesion to steel | | | |
| | 1,000 psi (70 kg/sq.cm) | | |
| Adhesion to portland cement concrete | | | |
| | 200 psi (14 kg/sq.cm) | | |
| Adhesion to asphalt concrete | | | |
| | (no test available) | | |

\1\ 20% or more (without filler) for formulations to be supplied for areas subject to freezing.

606-3.4 TEST FOR ARC RESISTANCE. Test for arc resistance shall be conducted in accordance with ASTM D 495 for sealing compounds to be furnished for sealing electrical wires in pavement.

606-3.5 TEST FOR ADHESION TO STEEL. The ends of two smooth, clean, steel specimens of convenient size (1 inch by 1 inch by 6 inches) (25 by 25 by 150 mm) would be satisfactory) are bonded together with adhesive mixture and allowed to cure at room temperature for a period of time to meet formulation requirements and then tested to failure on a Riehle (or similar) tensile tester. The thickness of adhesive to be tested shall be 1/4 inch (6 mm).

606-3.6 ADHESION TO PORTLAND CEMENT CONCRETE

a. Concrete Test Block Preparation. The aggregate grading shall be as shown in Table 2.

The coarse aggregate shall consist of crushed rock having a minimum of 75% of the particles with at least one fractured face and having a water absorption of not more than 1.5%. The fine aggregate shall consist of crushed sand manufactured from the same parent rock as the coarse aggregate. The concrete shall have a water-cement ratio of 5.5 gallons (21 liters) of water per bag of cement, a cement factor of 6, plus or minus 0.5, bags of cement per cubic yard (0.76 cubic meter) of concrete, and a slump of 2-1/2 inches, plus or minus 1/2 inch (60 mm plus or minus 12 mm). The ratio of fine aggregate to total aggregate shall be approximately 40% by solid volume. The air content shall be 5.0%, plus or minus 0.5%, and it shall be obtained by the addition to the batch of an air-entraining admixture such as vinsol resin. The mold shall be of metal and shall be provided with a metal base plate. Means shall be provided for

securing the base plate to the mold. The assembled mold and base plate shall be watertight and shall be oiled with mineral oil before use. The inside measurement of the mold shall be such that several 1-inch by 2-inch by 3-inch (25 by 50 by 75 mm) test blocks can be cut from the specimen with a concrete saw having a diamond blade. The concrete shall be prepared and cured in accordance with ASTM C 192.

TABLE 2. AGGREGATE FOR BOND TEST BLOCKS

| Type | Sieve Size | Percent Passing |
|------------------|-----------------------|-----------------|
| Coarse Aggregate | 3/4 inch (19.0 mm) | 97 to 100 |
| | 1/2 inch (12.5 mm) | 63 to 69 |
| | 3/8 inch (9.5 mm) | 30 to 36 |
| | No. 4 (4.75 mm) | 0 to 3 |
| Fine Aggregate | No. 4 (4.75 mm) | 100 |
| | No. 8 (2.36 mm) | 82 to 88 |
| | No. 16 (1.18 mm) | 60 to 70 |
| | No. 30 (600 micro-m) | 40 to 50 |
| | No. 50 (300 micro-m) | 16 to 26 |
| | No. 100 (150 micro-m) | 5 to 9 |

b. Bond Test. Prior to use, oven-dry the test blocks to constant weight at a temperature of 220 to 230 F (104 to 110 C), cool to room temperature, 73.4 plus or minus 3 F (23 plus or minus 1.6 C), in a desiccator, and clean the surface of the blocks of film or powder by vigorous brushing with a stiff-bristled fiber brush. Two test blocks shall be bonded together on the 1-inch by 3-inch (25 by 75 mm) sawed face with the adhesive mixture and allowed to cure at room temperature for a period of time to meet formulation requirements and then tested to failure in a Riehle (or similar) tensile tester. The thickness of the adhesive to be tested shall be 1/4 inch (6 mm).

606-3.7 COMPATIBILITY WITH ASPHALT CONCRETE. Test for compatibility with asphalt in accordance with ASTM D 5329.

606-3.8 ADHESIVE COMPOUNDS - CONTRACTOR'S RESPONSIBILITY. The Contractor shall furnish the vendor's certified test reports for each batch of material delivered to the project. The report shall certify that the material meets specification requirements and is suitable for use with [portland cement concrete] [bituminous concrete] pavements. The report shall be delivered to the Engineer before permission is granted for use of the material. In addition the Contractor shall obtain a statement from the supplier or manufacturer which guarantees the material for one year. The supplier or manufacturer shall furnish evidence that the material has performed satisfactorily on other projects.

606-3.9 APPLICATION. Adhesive shall be applied on a dry, clean surface, free of grease, dust, and other loose particles. The method of mixing and application shall be in strict accordance with the manufacturer's recommendations.

Installation methods such as surface preparation, mixing ratios, and pot life are as important to satisfactory performance as the properties of the material itself. Therefore, the Engineer may wish to require a manufacturer's representative to be present during the initial installation of the material to ensure the installation procedures are in accordance with the manufacturer's directions.

METHOD OF MEASUREMENT

606-4.1 The adhesive compound shall be measured by the [pound (kg)] [gallon (l)] of adhesive as specified, in place, complete and accepted. When required in the installation of an in-runway lighting system or portion thereof, no measurement will be made for direct payment of adhesive, as the cost of furnishing and installing shall be considered as a subsidiary obligation in the completion of the installation.

BASIS OF PAYMENT

606-5.1 Payment shall be made, where applicable, at the contract unit price per [pound (kg)] [gallon (l)] for the adhesive. This price shall be full compensation for furnishing all materials, and for all preparation, delivering, and application of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Item P-606-5.1 Adhesive Compound - per [pound (kg)] [gallon (l)]

TESTING REQUIREMENTS

ASTM C 192 Making and Curing Concrete *Compression and Flexure* Test Specimens in the Laboratory.

ASTM D 149 Tests for Dielectric Breakdown Voltage and Dielectric Strength of Electrical Insulating Materials at Commercial Power Frequencies.

ASTM D 495 Test for High-Voltage, Low-Current, *Dry* Arc Resistance of Solid Electrical Insulation

ASTM D 638 Test for Tensile Properties of Plastics

ASTM D 1168 *Test for* Hydrocarbon Waxes Used for Electrical Insulation

ASTM D *5329* Sealants *and Fillers*, Hot-*Applied*, For *Joints and Cracks in* Asphalt *and Portland Cement Concrete* Pavements

END OF ITEM P-606

ITEM P-609 SEAL COATS AND BITUMINOUS SURFACE TREATMENTS

DESCRIPTION

GENERAL NOTE: Although this type of surface sealant is approved for use on general aviation airports, we remind the user that this method of treatment may leave excessive amounts of loose aggregate on the surface of the pavement.

609-1.1 This item shall consist of a bituminous surface treatment as a wearing course composed of [a single application][multiple applications] of bituminous material and aggregate cover placed on the prepared primed base or properly cured wearing surface, in accordance with these specifications, and shall conform to the dimensions and typical cross section shown on the plans.

609-1.2 QUANTITIES OF MATERIALS PER SQUARE YARD. The approximate amounts of materials per square yard (square meter) for the bituminous surface treatment shall be as provided in Table 1 for the treatment specified on the plans or in the special provision. The exact amounts to be used shall be determined by the Engineer.

TABLE 1. QUANTITIES OF MATERIALS

| Application No. | Quantity of Aggregate lb/sq yd (kg/sq m) | Quantity of Asphalt gal/sq yd (l/sq m) | Type of Asphalt ¹ |
|-----------------|--|--|------------------------------|
| 1 | 40-50 (21.7-27.1) | 0.35-0.45 (1.58-20.3) | Asphalt Cement |
| | | 0.40-0.50 (1.81-2.26) | Emulsified Asphalt |
| 2 | 20-25 (10.9-13.6) | 0.15-0.25 (0.68-1.13) | Asphalt Cement |
| | | 0.20-0.35 (0.90-1.58) | Emulsified Asphalt |
| 3 | 15-20 (8.1-10.9) | 0.15-0.20 (0.68-0.90) | Emulsified Asphalt |

¹ See Table 3 for grades of asphalt and spraying temperatures.

The quantities of asphalt shown in Table 1 cover the average range of conditions that include primed granular bases and old pavement surfaces. The quantities and types of materials should take into consideration local conditions and experience.

The lower application rates shown in Table 1 should be used for aggregate having gradations on the fine side of the specified limits. The higher application rates should be used for aggregate having gradations on the coarse side of the specified limits.

The asphalt content selected should reflect the condition of the pavement. If the pavement is highly oxidized, badly cracked, or coarse more asphalt should be used.

MATERIALS

609-2.1 AGGREGATE MATERIALS. The aggregate material shall be either crushed stone, crushed gravel, or crushed slag. The cover material shall be screenings; sand may be used when specified.

If the material is to be crushed stone, it shall be manufactured from sound, hard, durable rock of accepted quality and crushed to specification size. All strata, streaks, and pockets of clay, dirt, sandstone, soft rock, or other unsuitable material accompanying the sound rock shall be discarded and not allowed to enter the crusher.

If the material is to be crushed gravel, it shall consist of hard, durable, fragments of stone or gravel of accepted quality and crushed to specification size. All strata, streaks, and pockets of sand, excessively fine gravel, clay, or other unsuitable material including all stones, rocks, and boulders of inferior quality shall be discarded and not allowed to enter the crusher. The crushing of the gravel shall result in a product in which the material retained on the separate No. 4, 3/8 inch, and 1/2 inch (4.75 mm, 9 mm, and 12 mm) sieves shall have at least 75% of particles with at least one fractured face.

Crushed slag shall be air-cooled, blast furnace slag, reasonably uniform in density and quality, and shall weigh not less than 70 pounds per cubic foot (1.12 mg/cubic meter) as determined by ASTM C 29.

The crushed aggregate shall not contain more than 8%, by weight, of elongated or flat pieces and shall be free from wood, roots, vegetable, organic, or other extraneous matter. The crushed coarse aggregate shall have a percentage of wear not more than 40 at 500 revolutions, as determined by ASTM C 131.

The aggregate shall show no evidence of disintegration or show a total loss greater than 12% when subjected to five cycles of the sodium sulphate accelerated soundness test specified in ASTM C 88.

The crushed aggregate for the applications shall meet the requirements for gradation given in Table 2 when tested in accordance with ASTM C 136.

TABLE 2. REQUIREMENTS FOR GRADATION OF AGGREGATE

| Aggregate for first application | |
|--|--|
| Sieve Designation (square openings) | Percentage by Weight Passing Sieves |
| 1 inch (25.0 mm) | 100 |
| 3/4 inch (19.0 mm) | 90-100 |
| 1/2 inch (12.5 mm) | 20-55 |
| 3/8 inch (9.5 mm) | 0-15 |
| No. 4 (4.75 mm) | 0-5 |
| Aggregate for second application | |
| Sieve Designation (square openings) | Percentage by Weight Passing Sieves |
| 1/2 inch (12.5 mm) | 100 |
| 3/8 inch (9.5 mm) | 85-100 |
| No. 4 (4.75 mm) | 10-30 |
| No. 8 (2.36 mm) | 0-10 |
| No. 16 (1.18 mm) | 0-5 |

| Aggregate for third application | |
|--|--|
| Sieve Designation (square openings) | Percentage by Weight Passing Sieves |
| 3/8 inch (9.5 mm) | 100 |
| 1/4 inch (6.2 mm) | 90-100 |
| No. 4 (4.75 mm) | 60-85 |
| No. 8 (2.36 mm) | 0-25 |
| No. 16 (1.18 mm) | 0-5 |
| No. 200 (0.075 mm) | 0-2 |

The gradations in the table represent the limits which shall determine suitability of aggregate for use for the specified applications from the sources of supply. The final gradations decided on, within the limits designated in the table, shall be uniformly graded from coarse to fine.

The cover aggregate used in the third application shall be a light- colored material whose color and reflectivity shall be approved by the Engineer.

The aggregate to be used shall show no evidence of stripping or swell when tested in accordance with AASHTO T 182 and T 101. The use of antistripping agents for the control of stripping shall be used if necessary.

609-2.2 BITUMINOUS MATERIAL. The types, grades, controlling specifications, and application temperatures for the bituminous materials are shown in Table 3. The Engineer shall designate the specific material to be used.

TABLE 3. BITUMINOUS MATERIALS

| Type and Grade | Specification | Spraying Temperature ¹ | |
|--------------------|---------------|-----------------------------------|--------|
| | | Deg. F | Deg. C |
| Asphalt Cement | | | |
| AC 2.5, AC-5 | ASTM D 3381 | 275+ | 135+ |
| AR-1000, 2000 | ASTM D 3381 | 280+ | 140+ |
| 120-150, 200-300 | ASTM D 946 | 270+ | 130+ |
| Emulsified Asphalt | | | |
| RS-1 | ASTM D 977 | 70-140 | 20-60 |
| RS-2 | ASTM D 977 | 125-175 | 50-80 |
| MS-1, HFMS-1 | ASTM D 977 | 70-160 | 20-70 |
| CRS-1 | ASTM D 2397 | 125-175 | 50-80 |
| CRS-2 | ASTM D 2397 | 125-175 | 50-80 |

¹ The maximum temperature for asphalt cements shall be below that at which fogging occurs.

CONSTRUCTION METHODS

609-3.1 WEATHER LIMITATIONS. Bituminous material shall be applied only when the existing surface is dry and the atmospheric temperature is above 60 F (15 C). No material shall be applied when rain is imminent or when dust or sand is blowing.

609-3.2 OPERATION OF PITS AND QUARRIES. The aggregate material shall be obtained from approved sources. The Contractor shall make all necessary arrangements for obtaining the material, and all work involved in clearing and stripping pits or quarries and handling unsuitable material shall be performed by the Contractor at his/her own expense. The material in the pits shall be handled so that a uniform and satisfactory product shall be secured. Unless otherwise directed, pits shall be adequately drained and shall be left in a neat and presentable condition with all slopes dressed uniformly. Quarries shall be left as neat and presentable as practicable.

609-3.3 EQUIPMENT AND TOOLS. The Contractor shall furnish all equipment, tools, and machines necessary for the performance of the work.

a. Pressure Distributor. The distributor shall be designed, equipped, maintained, and operated so that bituminous material at even heat may be applied uniformly on variable widths of surface at the specified rate. The allowable variation from the specified rate shall not exceed 10 percent. Distributor equipment shall include a tachometer, pressure gages, volume-measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. The distributor shall be self-powered and shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically.

b. Aggregate Spreader. The aggregate spreader shall be a self-propelled mechanical spreader or truck-attached mechanical spreader capable of uniformly distributing aggregate at the specified rates.

c. Roller. The roller shall be a pneumatic-tired roller with an effective rolling width of at least 60 inches (152 cm) and capable of exerting a minimum contact pressure of 40 pounds per square inch (280 000 newtons per square meter).

d. Power Broom. A power broom and/or blower shall be provided for removing loose material from the surface to be treated.

609-3.4 PREPARING UNDERLYING COURSE. The surface of the underlying course shall be prepared, shaped, and conditioned to a uniform grade and section, as shown on the plans and as specified. Loose dirt and other objectionable material shall be removed from the surface.

On those type of bases where a prime coat is required and specified, the prime shall be applied and satisfactorily cured before starting the bituminous surface treatment.

When specified, the Contractor shall be required to patch, with premixed material, any holes or other malformations deviating from the true cross section and grade. The premixed material shall be made of the bituminous material specified in the proposal or plans and prepared by the method as directed by the Engineer. All small patches shall be thoroughly hand tamped while the large patches shall be rolled with a power or pneumatic roller.

609-3.5 APPLICATION OF BITUMINOUS MATERIAL. Bituminous material shall be applied upon the properly prepared surface at the rate and temperature specified using a pressure distributor to obtain uniform distribution at all points. To insure proper drainage, the strips shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope. During all applications, the surfaces of adjacent structures shall be protected in such manner as to prevent their being spattered or marred. Bituminous materials shall not be discharged into borrow pits or gutters or upon the airport area.

609-3.6 APPLICATION OF AGGREGATE MATERIAL. Immediately after the application of the bituminous material or when directed, the aggregates at the rate specified for each designated application shall be spread uniformly over the bituminous material. Trucks spreading aggregate shall be operated backward so that the bituminous material will be covered before the truck wheels pass over it. The aggregate shall be spread in the same width of application as the bituminous material and shall not be applied in such thickness as to cause blanketing. Back-spotting or sprinkling of additional aggregate material, and pouring additional bituminous material over areas that show up having insufficient cover or bitumen, shall be done by hand whenever necessary. Additional spreading of aggregate material shall be done by means of a motor-patrol grader equipped with broom moldboard, a broom drag, or a power broom, as directed by the Engineer.

Immediately after spreading each application, the aggregate shall be rolled. The rolling shall be continued until no more aggregate material can be worked into the surface. In the construction of the second and third application, blading with the wire-broom moldboard attachment or broom dragging shall begin as soon as possible after the rolling has started and after the surface has set sufficiently to prevent excessive marking. Further blading and rolling

on the strip being placed and on adjacent strips previously placed, shall be done as often as necessary to keep the aggregate material uniformly distributed. These operations shall be continued until the surface is evenly covered and cured to the satisfaction of the Engineer.

Succeeding applications shall not be applied until the preceding application has set and in no case until at least 24 hours have elapsed. If dust, dirt, or other foreign matter accumulates on the surface between the applications, the Contractor shall be required to sweep and clean the surface as specified herein. The bituminous material and the aggregate shall be spread upon the clean and properly cured surface and handled as required. Extreme care shall be taken in all applications to avoid brooming or tracking dirt or any foreign matter on any portion of the pavement surface under construction.

All surplus aggregate from the final application shall be swept off the surface and removed prior to final acceptance of the work.

609-3.7 CORRECTION OF DEFECTS. Any defects, such as raveling, low centers, lack of uniformity, or other imperfections caused by faulty workmanship, shall be corrected to the satisfaction of the Engineer.

All defective materials resulting from over-heating, improper handling, or application shall be removed by the Contractor and replaced with approved materials as provided for in these specifications.

609-3.8 BITUMINOUS MATERIAL CONTRACTOR'S RESPONSIBILITY. Samples of the bituminous materials that the Contractor proposes to use, together with a statement as to their source and character, shall be submitted and approval obtained before use of such materials begins.

The Contractor shall furnish vendor's certified test reports for each carload, or equivalent, of bitumen shipped to the project. The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall not be interpreted as a basis for final acceptance. All such test reports shall be subject to verification by testing sample materials as received for use on the project.

609-3.9 FREIGHT AND WEIGH BILLS. Before the final estimate is allowed the Contractor shall file with the Engineer receipted bills where railroad shipments are made, and certified weight bills when materials are received in any other manner, of the bituminous and covering materials actually used in the construction covered by the contract. The Contractor shall not remove bituminous material from the tank car or storage tank until the initial outage and temperature measurements have been taken by the Engineer, nor shall the car or tank be released until the final outage has been taken by the Engineer.

Copies of all freight bills and weigh bills shall be furnished to the Engineer during the progress of the work.

METHOD OF MEASUREMENT

609-4.1 The bituminous material shall be measured by the [gallon(liter)][ton (kg)]. Volume shall be corrected to the volume at 60 F (15 C) in accordance with ASTM D 1250 for cutback asphalt and Table IV-3 of The Asphalt Institute's Manual MS-6 for emulsified asphalt. Water added to emulsified asphalt will not be measured for payment.

609-4.2 The quantity of aggregate materials for the first application to be paid for shall be the number of tons (kg) of aggregate used for the accepted work.

609-4.3 The quantity of aggregate material for the second application to be paid for shall be the number of tons (kg) of aggregate used for the accepted work.

609-4.4 The tonnage of aggregate for the third application to be paid for shall be the number of tons (kg) of aggregate used for the accepted work.

BASIS OF PAYMENT

609-5.1 Payment shall be made at the contract unit price per [gallon][ton] for bituminous material for surface treatment and per ton for the first, second and third aggregate application. These prices shall be full compensation for furnishing all materials and for all preparation, hauling and application of the materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

| | |
|----------------|---|
| Item P-609-5.1 | Bituminous Material--per [gallon (liter)][ton (kg)] |
| Item P-609-5.2 | First Application Aggregate--per ton (kg) |
| Item P-609-5.3 | Second Application Aggregate--per ton (kg) |
| Item P-609-5.4 | Third Application Aggregate--per ton (kg) |

TESTING REQUIREMENTS

| | |
|---------------------|---|
| ASTM C 29 | Unit Weight of Aggregate |
| ASTM C 88 | Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate |
| ASTM C 131 | Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine |
| ASTM C 136 | Sieve Analysis of Fine and Coarse Aggregates |
| <i>AASHTO T 182</i> | <i>Coating and Stripping of Bitumen-Aggregate Mixtures</i> |
| <i>AASHTO T 101</i> | |

MATERIAL REQUIREMENTS

| | |
|--------------------------------------|--|
| ASTM D 946 | Penetration-Graded Asphalt-Cement for Use in Pavement Construction |
| ASTM D 977 | Emulsified Asphalt |
| ASTM D 1250 | Petroleum Measurement Tables |
| <i>ASTM D 2397</i> | <i>Cationic Emulsified Asphalt</i> |
| ASTM D 3381 | Viscosity-Graded Asphalt-Cement for Use in Pavement Construction |
| <i>Asphalt Institute Manual MS-6</i> | <i>Asphalt Pocketbook of Useful Information (Temperature-Volume Corrections for Emulsified Asphalts)</i> |
| Table IV-3 | |

END OF ITEM P-609

ITEM P-610 STRUCTURAL PORTLAND CEMENT CONCRETE

DESCRIPTION

610-1.1 This item shall consist of [plain][reinforced] structural portland cement concrete, prepared and constructed in accordance with these specifications, at the locations and of the form and dimensions shown on the plans.

MATERIALS

610-2.1 GENERAL. Only approved materials, conforming to the requirements of these specifications, shall be used in the work. They may be subjected to inspection and tests at any time during the progress of their preparation or use. The source of supply of each of the materials shall be approved by the Engineer before delivery or use is started. Representative preliminary samples of the materials shall be submitted by the Contractor, when required, for examination and test. Materials shall be scored and handled to insure the preservation of their quality and fitness for use and shall be located to facilitate prompt inspection. All equipment for handling and transporting materials and concrete must be clean before any material or concrete is placed therein.

In no case shall the use of pit-run or naturally mixed aggregates be permitted. Naturally mixed aggregate shall be screened and washed, and all fine and coarse aggregates shall be stored separately and kept clean. The mixing of different kinds of aggregates from different sources in one storage pile or alternating batches of different aggregates will not be permitted.

Aggregates shall be tested for deleterious reactivity with alkalis in the cement which may cause excessive expansion of the concrete. Acceptance of aggregates shall be based upon satisfactory evidence furnished by the Contractor that the aggregates, combined with other mixture constituents, do not produce excessive expansion in the concrete. This evidence shall include service records of concrete of comparable properties under similar conditions or exposure and certified records of tests by a testing laboratory that meets the requirements of ASTM C 1077. Tests shall be made in accordance with ASTM C 1260. Test specimens shall be produced using all components (e.g. coarse aggregate, fine aggregate, cement and fly ash...) to be included in the produced concrete. If the mean expansion of the test specimens, tested in accordance with ASTM C 1260, does not exceed 0.10 % at 16 days from casting the aggregates shall be accepted. If the mean expansion at 16 days is greater than 0.10% but less than 0.15%, the aggregate may be accepted based upon satisfactory service records and acceptance of the aggregate by a State Highway Department specifically addressing Alkali-Silica Reactivity. If the expansion is greater than 0.15%, the aggregate shall not be accepted for use.

610-2.2 COARSE AGGREGATE. The coarse aggregate for concrete shall meet the requirements of ASTM C 33. *Crushed stone aggregate shall have a durability factor, as determined by ASTM C 666, greater than or equal to 95. The Engineer may consider and reserves final approval of other State classification procedures addressing aggregate durability.*

Coarse aggregate shall be well graded from coarse to fine and shall meet one of the gradations shown in Table 1, using ASTM C 136.

610-2.3 FINE AGGREGATE. The fine aggregate for concrete shall meet the requirements of ASTM C 33.

The fine aggregate shall be well graded from fine to coarse and shall meet the requirements of Table 2, when tested in accordance with ASTM C 136:

TABLE 1. GRADATION FOR COARSE AGGREGATE

| Sieve Designation (square openings) | Percentage by Weight Passing Sieves | | | | | | |
|-------------------------------------|-------------------------------------|--------|--------|--------|-------|-------|------|
| | 2" | 1-1/2" | 1" | 3/4" | 1/2" | 3/8" | No.4 |
| No. 4 to 3/4 in. (4.75-19.0 mm) | | | 100 | 90-100 | | 20-55 | 0-10 |
| No. 4 to 1 in. (4.75-25.0 mm) | | 100 | 90-100 | | 25-60 | | 0-10 |
| No. 4 to 1-1/2 in. (4.75-38.1 mm) | 100 | 95-100 | | 35-70 | | 10-30 | 0-5 |

TABLE 2. GRADATION FOR FINE AGGREGATE

| Sieve Designation (square openings) | Percentage by Weight Passing Sieves |
|-------------------------------------|-------------------------------------|
| 3/8 inch (9.5 mm) | 100 |
| No. 4 (4.75 mm) | 95-100 |
| No. 16 (1.18 mm) | 45-80 |
| No. 30 (0.60 mm) | 25-55 |
| No. 50 (0.30 mm) | 10-30 |
| No. 100 (0.15 mm) | 2-10 |

Blending will be permitted, if necessary, in order to meet the gradation requirements for fine aggregate. Fine aggregate deficient in the percentage of material passing the No. 50 mesh sieve may be accepted, provided that such deficiency does not exceed 5% and is remedied by the addition of pozzolanic or cementitious materials other than portland cement, as specified in 610-2.6 on admixtures, in sufficient quantity to produce the required workability as approved by the Engineer.

610-2.4 CEMENT. Cement shall conform to the requirements of []Type [].

The Engineer shall specify one of the following: ASTM C 150 - Type I, IA, II, IIA, III, IIIA; ASTM C 595 - Type IP, IP-A, IS, IS -A.

The Contractor shall furnish vendors' certified test reports for each carload, or equivalent, of cement shipped to the project. The report shall be delivered to the Engineer before permission to use the cement is granted. All such test reports shall be subject to verification by testing sample materials received for use on the project.

610-2.5 WATER. The water used in concrete shall be free from sewage, oil, acid, strong alkalies, vegetable matter, and clay and loam. If the water is of questionable quality, it shall be tested in accordance with AASHTO T 26.

610-2.6 ADMIXTURES. The use of any material added to the concrete mix shall be approved by the Engineer. Before approval of any material, the Contractor shall be required to submit the results of complete physical and chemical analyses made by an acceptable testing laboratory. Subsequent tests shall be made of samples taken by the Engineer from the supply of the material being furnished or proposed for use on the work to determine whether the admixture is uniform in quality with that approved.

Pozzolanic admixtures shall be fly ash or raw or calcined natural pozzolons meeting the requirements of ASTM C 618.

Air-entraining admixtures shall meet the requirements of ASTM C 260. Air-entraining admixtures shall be added at the mixer in the amount necessary to produce the specified air content.

Water-reducing, set-controlling admixtures shall meet the requirements of ASTM C 494, Type A, water-reducing or Type D, water-reducing and retarding. Water-reducing admixtures shall be added at the mixer separately from air-entraining admixtures in accordance with the manufacturer's printed instructions.

610-2.7 PREMOLDED JOINT MATERIAL. Premolded joint material for expansion joints shall meet the requirements of ASTM [].

The Engineer shall designate either ASTM D 1751 or ASTM D 1752.

610-2.8 JOINT FILLER. The filler for joints shall meet the requirements of Item P-605, unless otherwise specified in the proposal.

610-2.9 STEEL REINFORCEMENT. Reinforcing shall consist of [] conforming to the requirements of [].

The Engineer shall designate one of the following:

- | | |
|-------------------------------------|----------------------------|
| Welded Steel Wire Fabric | ASTM A 185 |
| Welded Deformed Steel Fabric | ASTM A 497 |
| Bar Mats | ASTM A 184 or A 704 |

Delete this section when not applicable to the project.

610-2.10 COVER MATERIALS FOR CURING. Curing materials shall conform to one of the following specifications:

- | | |
|---|--------------------|
| Waterproof paper for curing concrete | ASTM C 171 |
| Polyethylene Sheeting for Curing Concrete | ASTM C 171 |
| Liquid Membrane-Forming Compounds for Curing Concrete | ASTM C 309, Type 2 |

CONSTRUCTION METHODS

610-3.1 GENERAL. The Contractor shall furnish all labor, materials, and services necessary for, and incidental to, the completion of all work as shown on the drawings and specified herein. All machinery and equipment owned or controlled by the Contractor, which he proposes to use on the work, shall be of sufficient size to meet the requirements of the work, and shall be such as to produce satisfactory work; all work shall be subject to the inspection and approval of the Engineer.

610-3.2 CONCRETE COMPOSITION. The concrete shall develop a compressive strength of [] psi in 28 days as determined by test cylinders made in accordance with ASTM C 31 and tested in accordance with ASTM C 39. The concrete shall contain not less than 470 pounds of cement per cubic yard (280 kg per cubic meter). The concrete shall

contain 5 percent of entrained air, plus or minus 1 percent, as determined by ASTM C 231 and shall have a slump of not more than 4 inches (10 cm) as determined by ASTM C 143.

The Engineer shall designate the compressive strength. The minimum allowable strength is 3000 psi (20670 kg).

610-3.3 ACCEPTANCE SAMPLING AND TESTING. Concrete for each structure will be accepted on the basis of the compressive strength specified in paragraph 3.2. The concrete shall be sampled in accordance with ASTM C 172. Compressive strength specimens shall be made in accordance with ASTM C 31 and tested in accordance with ASTM C 39.

Concrete cylindrical test specimens shall be made in accordance with ASTM C 31 and tested in accordance with ASTM C 39. The Contractor shall cure and store the test specimens under such conditions as directed. The Engineer will make the actual tests on the specimens at no expense to the Contractor.

Depending upon the project size and number of structures per day, it may be necessary to determine a Lot size and test frequency for acceptance of concrete under item P610.

610-3.4 PROPORTIONING AND MEASURING DEVICES. When package cement is used, the quantity for each batch shall be equal to one or more whole sacks of cement. The aggregates shall be measured separately by weight. If aggregates are delivered to the mixer in batch trucks, the exact amount for each mixer charge shall be contained in each batch compartment. Weighing boxes or hoppers shall be approved by the Engineer and shall provide means of regulating the flow of aggregates into the batch box so that the required and exact weight of aggregates can be readily obtained.

610-3.5 CONSISTENCY. The consistency of the concrete shall be checked by the slump test specified in ASTM C 143.

610-3.6 MIXING. Concrete may be mixed at the construction site, at a central point, or wholly or in part in truck mixers. The concrete shall be mixed and delivered in accordance with the requirements of ASTM C 94.

610-3.7 MIXING CONDITIONS. The concrete shall be mixed only in quantities required for immediate use. Concrete shall not be mixed while the air temperature is below 40 F (4 C) without permission of the Engineer. If permission is granted for mixing under such conditions, aggregates or water, or both, shall be heated and the concrete shall be placed at a temperature not less than 50 (10 C) nor more than 100 F (38 C). The Contractor shall be held responsible for any defective work, resulting from freezing or injury in any manner during placing and curing, and shall replace such work at his/her expense.

Retempering of concrete by adding water or any other material shall not be permitted.

The delivery of concrete to the job shall be in such a manner that batches of concrete will be deposited at uninterrupted intervals.

610-3.8 FORMS. Concrete shall not be placed until all the forms and reinforcements have been inspected and approved by the Engineer. Forms shall be of suitable material and shall be of the type, size, shape, quality, and

strength to build the structure as designed on the plans. The forms shall be true to line and grade and shall be mortar-tight and sufficiently rigid to prevent displacement and sagging between supports. The Contractor shall bear responsibility for their adequacy. The surfaces of forms shall be smooth and free from irregularities, dents, sags, and holes.

The internal ties shall be arranged so that, when the forms are removed, no metal will show in the concrete surface or discolor the surface when exposed to weathering. All forms shall be wetted with water or with a non-staining mineral oil which shall be applied shortly before the concrete is placed. Forms shall be constructed so that they can be removed without injuring the concrete or concrete surface. The forms shall not be removed before the expiration of at least 30 hours from vertical faces, walls, slender columns, and similar structures; forms supported by falsework under slabs, beams, girders, arches, and similar construction shall not be removed until tests indicate that at least 60% of the design strength of the concrete has developed.

610-3.9 PLACING REINFORCEMENT. All reinforcement shall be accurately placed, as shown on the plans, and shall be firmly held in position during concreting. Bars shall be fastened together at intersections. The reinforcement shall be supported by approved metal chairs. Shop drawings, lists, and bending details shall be supplied by the Contractor when required.

610-3.10 EMBEDDED ITEMS. Before placing concrete, any items that are to be embedded shall be firmly and securely fastened in place as indicated. All such items shall be clean and free from coating, rust, scale, oil, or any foreign matter. The embedding of wood shall be avoided. The concrete shall be spaded and consolidated around and against embedded items.

610-3.11 PLACING CONCRETE. All concrete shall be placed during daylight, unless otherwise approved. The concrete shall not be placed until the depth and character of foundation, the adequacy of forms and falsework, and the placing of the steel reinforcing have been approved. Concrete shall be placed as soon as practical after mixing and in no case later than 1 hour after water has been added to the mix. The method and manner of placing shall be such to avoid segregation and displacement of the reinforcement. Troughs, pipes, and chutes shall be used as an aid in placing concrete when necessary. Dropping the concrete a distance of more than 5 feet (1.5 m), or depositing a large quantity at one point, will not be permitted. Concrete shall be placed upon clean, damp surfaces, free from running water, or upon properly consolidated soil.

The concrete shall be compacted with suitable mechanical vibrators operating within the concrete. When necessary, vibrating shall be supplemented by hand spading with suitable tools to assure proper and adequate compaction. Vibrators shall be manipulated so as to work the concrete thoroughly around the reinforcement and embedded fixtures and into corners and angles of the forms. The vibration at any joint shall be of sufficient duration to accomplish compaction but shall not be prolonged to the point where segregation occurs. Concrete deposited under water shall be carefully placed in a compact mass in its final position by means of a tremie, a closed bottom dump bucket, or other approved method and shall not be disturbed after being deposited.

610-3.12 CONSTRUCTION JOINTS. When the placing of concrete is suspended, necessary provisions shall be made for joining future work before the placed concrete takes its initial set. For the proper bonding of old and new concrete, such provisions shall be made for grooves, steps, keys, dovetails, reinforcing bars or other devices as may be prescribed. The work shall be arranged so that a section begun on any day shall be finished during daylight of the same day. Before depositing new concrete on or against concrete which has hardened, the surface of the hardened concrete shall be cleaned by a heavy steel broom, roughened slightly, wetted, and covered with a neat coating of cement paste or grout.

610-3.13 EXPANSION JOINTS. Expansion joints shall be constructed at such points and of such dimensions as may be indicated on the drawings. The premolded filler shall be cut to the same shape as that of the surfaces being joined. The filler shall be fixed firmly against the surface of the concrete already in place in such manner that it will not be displaced when concrete is deposited against it.

610-3.14 DEFECTIVE WORK. Any defective work disclosed after the forms have been removed shall be immediately removed and replaced. If any dimensions are deficient, or if the surface of the concrete is bulged, uneven, or shows honeycomb, which in the opinion of the Engineer cannot be repaired satisfactorily, the entire section shall be removed and replaced at the expense of the Contractor.

610-3.15 SURFACE FINISH. All exposed concrete surfaces shall be true, smooth, free from open or rough spaces, depressions, or projections. The concrete in horizontal plane surfaces shall be brought flush with the finished top surface at the proper elevation and shall be struck-off with a straightedge and floated. Mortar finishing shall not be permitted, nor shall dry cement or sand-cement mortar be spread over the concrete during the finishing of horizontal plane surfaces.

When directed, the surface finish of exposed concrete shall be a rubbed finish. If forms can be removed while the concrete is still green, the surface shall be pointed and wetted and then rubbed with a wooden float until all irregularities are removed. If the concrete has hardened before being rubbed, a carborundum stone shall be used to finish the surface. When approved, the finishing can be done with a rubbing machine.

610-3.16 CURING AND PROTECTION. All concrete shall be properly cured and protected by the Contractor. The work shall be protected from the elements, flowing water, and from defacement of any nature during the building operations. The concrete shall be cured as soon as it has sufficiently hardened by covering with an approved material. Water-absorptive coverings shall be thoroughly saturated when placed and kept saturated for a period of at least 3 days. All curing mats or blankets shall be sufficiently weighted or tied down to keep the concrete surface covered and to prevent the surface from being exposed to currents of air. Where wooden forms are used, they shall be kept wet at all times until removed to prevent the opening of joints and drying out of the concrete. Traffic shall not be allowed on concrete surfaces for 7 days after the concrete has been placed.

610-3.17 DRAINS OR DUCTS. Drainage pipes, conduits, and ducts that are to be encased in concrete shall be installed by the Contractor before the concrete is placed. The pipe shall be held rigidly so that it will not be displaced or moved during the placing of the concrete.

610-3.18 COLD WEATHER PROTECTION. When concrete is placed at temperatures below 40 F (4 C), the Contractor shall provide satisfactory methods and means to protect the mix from injury by freezing. The aggregates, or water, or both, shall be heated in order to place the concrete at temperatures between 50 and 100 F (10 and 38 C).

Calcium chloride may be incorporated in the mixing water when directed by the Engineer. Not more than 2 pounds (908 grams) of Type 1 nor more than 1.6 pounds (726 grams) of Type 2 shall be added per bag of cement. After the concrete has been placed, the Contractor shall provide sufficient protection such as cover, canvas, framework, heating apparatus, etc., to enclose and protect the structure and maintain the temperature of the mix at not less than 50 F (10 C) until at least 60% of the designed strength has been attained.

610-3.19 FILLING JOINTS. All joints which require filling shall be thoroughly cleaned, and any excess mortar or concrete shall be cut out with proper tools. Joint filling shall not be started until after final curing and shall be done only when the concrete is completely dry. The cleaning and filling shall be carefully done with proper equipment and in a manner to obtain a neat looking joint free from excess filler.

METHOD OF MEASUREMENT

610-4.1 Portland cement concrete shall be measured by the number of cubic yards (cubic meters) of concrete complete in place and accepted. In computing the yardage of concrete for payment, the dimensions used shall be those shown on the plans or ordered by the Engineer. No measurements or other allowances shall be made for forms, falsework, cofferdams, pumping, bracing, expansion joints, or finishing of the concrete. No deductions in yardage shall be made for the volumes of reinforcing steel or embedded items.

610-4.2 Reinforcing steel shall be measured by the calculated theoretical number of pounds (kg) placed, as shown on the plans, complete in place and accepted. The unit weight used for deformed bars shall be the weight of plain square or round bars of equal nominal size. If so indicated on the plans, the poundage to be paid for shall include the weight of metal pipes and drains, metal conduits and ducts, or similar materials indicated and included.

BASIS OF PAYMENT

610-5.1 Payment shall be made at the contract unit price per cubic yard (cubic meter) for structural portland cement concrete and per pound (kg) for reinforcing steel. These prices shall be full compensation for furnishing all materials and for all preparation, delivery and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

- | | |
|----------------|--|
| Item P-610-5.1 | Structural Portland Cement Concrete --- per cubic yard (cubic meter) |
| Item P-610-5.1 | Steel Reinforcement --- -per pound (kg) |

TESTING REQUIREMENTS

- | | |
|--------------------|---|
| ASTM C 31 | Making and Curing Test Specimens in the Field |
| ASTM C 39 | Compressive Strength of Cylindrical Concrete Specimens |
| ASTM C 136 | Sieve Analysis of Fine and Coarse Aggregates |
| ASTM C 138 | <i>Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete</i> |
| ASTM C 143 | Slump of Hydraulic Cement Concrete |
| ASTM C 231 | Air Content of Freshly Mixed Concrete by the Pressure Method |
| <i>ASTM C 666</i> | <i>Resistance of Concrete to Rapid Freezing and Thawing</i> |
| <i>ASTM C 1077</i> | <i>Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation</i> |
| <i>ASTM C 1260</i> | <i>Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)</i> |

MATERIAL REQUIREMENTS

- | | |
|-------------------|--|
| ASTM A 184 | Specification for Fabricated Deformed Steel Bar or Rod Mats for Concrete Reinforcement |
| ASTM A 185 | Steel Welded Wire Fabric, Plain, for Concrete Reinforcement |
| ASTM A 497 | <i>Steel</i> Welded <i>Wire Fabric</i> , Deformed, for Concrete Reinforcement |
| ASTM A 615 | Deformed and Plain Billet-Steel Bars for Concrete Reinforcement |
| <i>ASTM A 704</i> | <i>Welded Steel Plain Bars or Rod Mats for Concrete Reinforcement</i> |

| | |
|--------------------|---|
| ASTM C 33 | Concrete Aggregates |
| ASTM C 94 | Ready-Mixed Concrete |
| ASTM C 150 | Portland Cement |
| ASTM C 171 | Sheet Materials for Curing Concrete |
| <i>ASTM C 172</i> | <i>Sampling Freshly Mixed Concrete</i> |
| ASTM C 260 | Air-Entraining Admixtures for Concrete |
| ASTM C 309 | Liquid Membrane-Forming Compounds for Curing Concrete |
| <i>ASTM C 494</i> | <i>Chemical Admixtures for Concrete</i> |
| ASTM C 595 | Blended Hydraulic Cements |
| ASTM C 618 | <i>Coal</i> Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete |
| ASTM D 1751 | Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (<i>Non-extruding and Resilient Bituminous Types</i>) |
| ASTM D 1752 | Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction |
| <i>AASHTO T 26</i> | <i>Quality of Water to be Used in Concrete</i> |

END OF ITEM P-610

ITEM P-626 EMULSIFIED ASPHALT SLURRY SEAL SURFACE TREATMENT

DESCRIPTION

626-1.1 This item shall consist of a mixture of emulsified asphalt, mineral aggregate, and water properly proportioned, mixed, and spread on an asphalt prepared underlying course or existing wearing course in accordance with these specifications and shall conform to the dimensions shown on the plans or as directed by the Engineer.

MATERIALS

626-2.1 AGGREGATE. The aggregate shall consist of sound and durable manufactured sand, slag, crusher fines, crushed stone, or a combination thereof. The aggregate shall be clean and free from vegetable matter, dirt, and other deleterious substances. The aggregate shall have a sand equivalent of not less than [45] percent when tested in accordance with ASTM D 2419. The aggregate shall show a loss of not more than [35] percent when tested in accordance with ASTM C 131. The sodium sulfate soundness loss shall not exceed [12] percent, or the magnesium soundness loss shall not exceed [20] percent after 5 cycles when tested in accordance with ASTM C 88. Aggregate shall be 100 percent crushed.

The sand equivalent should not be less than 45. The percent loss when tested under ASTM C 131 should not exceed 35. The sodium sulfate loss should not exceed 12 percent; the magnesium sulfate loss should not exceed 20 percent. In certain specific cases, where aggregates complying with these requirements cannot be economically obtained, aggregates with a higher percentage loss (15 percent using sodium sulfate and 25 percent using magnesium sulfate has been used) or wear may be specified, provided a satisfactory service record under similar conditions of service and exposure has been demonstrated.

The combined aggregate shall conform to the gradation shown in Table 1 when tested in accordance with ASTM C 136 and ASTM C 117.

TABLE 1. GRADATION OF AGGREGATES

| Sieve Size | Percent by Weight Passing Sieve | | |
|---|---------------------------------|--------------|------------|
| | Type I | Type II | Type III |
| 3/8 in. (9.5 mm) | 100 | 100 | 100 |
| No. 4 (4.75 mm) | 100 | 90 - 100 | 70 - 90 |
| No. 8 (2.36 mm) | 90 - 100 | 65 - 90 | 45 - 70 |
| No. 16 (1.18 mm) | 65 - 90 | 45 - 70 | 28 - 50 |
| No. 30 (600 micro m) | 40 - 65 | 30 - 50 | 19 - 34 |
| No. 50 (300 micro m) | 25 - 42 | 18 - 30 | 12 - 25 |
| No. 100 (150 micro m) | 15 - 30 | 10 - 21 | 7 - 18 |
| No. 200 (75 micro m) | 10 - 20 | 5 - 15 | 5 - 15 |
| Residual asphalt content percent dry weight of | 10% - 16% | 7.5% - 13.5% | 6.5% - 12% |

aggregate

Table 1 – Gradation of Aggregates. Projects that have specified coarser aggregate gradations have reported problems with excessive tire wear. A coarser Type I gradation will provide considerable skid resistance and may be considered for most projects. A finer Type II gradation will provide sufficient friction and will not cause excessive tire wear. Tire wear appears to be related to the amount a material passing the #4 and retained on the #8 sieve. We recommend that no more than 10-15% be retained on the #8 sieve.

The job mix formula (mix design) shall be run using aggregate within the gradation band for the desired type shown in Table 1. Once the mix design has been submitted and approved, the aggregate used on the project shall not vary by more than the tolerances shown in Table 2. At no time shall the aggregate used go out of the gradation bands in Table 1.

The aggregate will be accepted at the job location or stockpile. The stockpile will be accepted based on five gradation tests samples in accordance with ASTM D 75. If the average of the five tests is within the gradation tolerances, then the materials will be accepted. If the tests show the material to be out of tolerance, the Contractor will be given the choice either to remove the material or blend other aggregates with the stockpile material to bring it into specification. Materials used in blending shall meet the quality tests before blending and shall be blended in a manner to produce a consistent gradation. This blending may require a new mix design.

Screening shall be required at the project stockpile site if there are any problems created by having oversize materials in the mix.

Precautions shall be taken to prevent segregation of the aggregate in storing and handling. The stockpile shall be kept in areas that drain readily.

The aggregate gradation band applicable to a project shall be specified by the Engineer from the gradations shown in Table 1. The appropriate gradation shall be shown on the plans. Type I gradation is used for maximum crack penetration and is usually used in low density traffic areas where the primary objective is sealing. Type II and Type III gradations are used to seal and improve skid resistance. Type III gradation is not recommended for runway use by the ISSA.

a. Aggregate Tolerance. Once the mix design has been accepted, the aggregate gradation used on the project may vary from the aggregate gradation used in the mix design on each sieve by the percentages shown in Table 2. If the project aggregate fails to remain within this tolerance, a new mix design will be required by the Engineer at the expense of the Contractor.

| Sieve Size | Tolerance, percent by weight passing sieve |
|------------------|--|
| 3/8 in. (9.5 mm) | + or - 5% |
| No. 4 (4.75 mm) | + or - 5% |
| No. 8 (2.36 mm) | + or - 5% |
| No. 16 (1.18 mm) | + or - 5% |

| | |
|--|-----------|
| No. 30 (600 micro m) | + or - 5% |
| No. 50 (300 micro m) | + or - 4% |
| No. 100 (150 micro m) | + or - 3% |
| No. 200 (75 micro m) | + or - 2% |
| <hr/> | |
| Residual Asphalt, percent dry weight of aggregate | + or - 1% |

626-2.2 MINERAL FILLER. If mineral filler, in addition to that naturally present in the aggregate, is necessary, it shall meet the requirements of ASTM D 242 and shall be used in the amounts required by the mix design. The mineral filler shall be considered as part of the aggregate.

626-2.3 EMULSIFIED ASPHALT. The emulsified asphalt shall conform to the requirements of ASTM D [977 and/or 2397] and shall be SS, CSS, CQS, or QS type emulsions.

The cement mixing test is waived for these slurry type emulsions. The emulsified asphalt shall be either anionic or cationic, whichever is best suited to the aggregate and job conditions to be encountered. The type of emulsified asphalt to use will be determined by the mix design. The Engineer shall specify the type of emulsion and the controlling specification, which shall be from ASTM D 977 or ASTM D 2397, and the material shall be SS, CSS, CQS, or QS.

626-2.4 WATER. All water used in making the slurry shall be potable and free from harmful soluble salts and chemicals.

COMPOSITION AND APPLICATION

626-3.1 COMPOSITION. The slurry seal shall consist of a mixture of emulsified asphalt, mineral aggregate, and water.

626-3.2 JOB MIX FORMULA. No slurry seal for payment shall be placed until a mix design has been approved by the Engineer. The mix design shall be developed by a laboratory with experience in designing slurry seal mixes and a signed copy shall be submitted in writing by the Contractor to the Engineer at least 10 days prior to the start of operations.

The laboratory report (mix design) shall indicate the proportions of aggregates, mineral filler (min. and max.), water (min. and max.) and asphalt emulsion based on the dry aggregate weight. It shall also report the quantitative effects of moisture content on the unit weight of the aggregate (bulking effects). The mix design shall be in effect until modified in writing by the Engineer. Should a change in sources of materials be made, a new mix design shall be established before the new material is used.

The main items of design in emulsified asphalt slurry seals are aggregate gradation, emulsified asphalt content, and consistency of the mixture. The aggregates, emulsified asphalt, and water should form a creamy-textured slurry that, when spread, will flow ahead of the strike-off squeegee. This will allow the slurry to flow down into the cracks in the pavement and fill them before the strike-off passes over. Technical Bulletin No. 111, Outline Guide Design Procedure for Slurry Seal, and publication A 105 Recommended Performance Guidelines published by the

International Slurry Surfacing Association (ISSA) contains information to aid designers of slurry mixes.

The Contractor shall submit to the Engineer for approval a complete mix design on the materials proposed for use, prepared and certified by an approved laboratory. Compatibility of the aggregate, emulsion, mineral filler, and other additives shall be verified by the mix design. The mix design shall be made with the same aggregate and grade of emulsified asphalt that the Contractor will provide on the project. At a minimum the required tests and values needed are as follows:

| | DESCRIPTION | SPECIFICATION |
|-------------|---|---|
| ISSA TB-100 | Wet Track Abrasion Loss One Hour Soak | 50 g/ft ² Max (538 g/m ²) |
| ISSA TB-115 | Determination of Slurry Seal Compatibility | Pass |

626-3.3 APPLICATION RATE. Unless otherwise specified, the slurry seal shall be applied to at the application rates shown in Table 3 for that gradation of material used.

TABLE 3. APPLICATION RATES

| | Type I | Type II | Type III |
|---------------------------------------|---------------|----------------|-----------------|
| Pounds of mixture per square yard | 8 - 12 | 12 - 20 | 18 - 30 |
| Kilograms of mixture per square meter | 4.3 - 6.5 | 6.5 - 10.9 | 9.8 - 16.3 |

The rate of application shall not vary more than +/- 2 pounds per square yard (+/-1.1 kilograms per square meter).

626-3.4 TEST SECTIONS. Test sections shall be placed prior to the start of the slurry seal work in the presence of the Engineer. The test area will be designated by the Engineer and will be located on the existing pavement. Test strips shall be made by each machine after calibration. Samples of the slurry seal may be taken and the mix consistency verified by using ISSA TB-106 Slurry Seal Consistency test. In addition, the proportions of the individual materials may be verified by the Engineer by using the calibration information provided after machine calibration. If any test does not meet specification requirements, additional tests shall be made at the expense of the Contractor, until an acceptable test strip is placed.

CONSTRUCTION METHODS

626-4.1 WEATHER LIMITATIONS. The slurry seal shall not be applied if either the pavement or air temperature is below 50 °F (10 °C) and falling but may be applied when both pavement and air temperature are above 45 °F (7 °C) and rising. No slurry seal shall be applied when there is danger that the finished product will freeze before 24 hours. The mixture shall not be applied when weather conditions prolong opening to traffic beyond a reasonable time.

The Engineer should not specify a lower permissible temperature range than that stated in 626-4.1, since slurry placed at lower temperatures usually will not cure properly due to poor dehydration and poor asphalt coalescence.

626-4.2 EQUIPMENT AND TOOLS. The Contractor shall furnish all equipment, tools, and machinery necessary for the performance of this work.

a. Slurry Mixing Equipment. The machine shall be specifically designed and manufactured to lay slurry seal. The material shall be mixed by a self-propelled slurry seal mixing machine of either truck mounted or continuous run design. Either type machine shall be able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, and water to a revolving mixer and discharge the mixed product on a continuous flow basis. The machine shall have sufficient storage capacity for materials to maintain an adequate supply to the proportioning controls.

If continuous run equipment is used, the machine shall be equipped to allow the operator to have full control of the forward and reverse speed of the machine during application of the slurry seal, with a self-loading device, with opposite side driver stations, all part of original equipment manufacturer design.

The aggregate shall be prewetted immediately prior to mixing with the emulsion. The mixing unit of the mixing chamber shall be capable of thoroughly blending all ingredients. No excessive mixing shall be permitted. The mixing machine shall be equipped with a fines feeder that provides an accurate metering device or method to introduce a predetermined proportion of mineral filler into the mixer at the same time and location that the aggregate is fed into the mixer.

The mixing machine shall be equipped with a water pressure system and fog-type spray bar adequate for complete fogging of the surface with an application of 0.05 to 0.10 gallon per square yard (0.23 to 0.45 liter per square meter) preceding the spreading equipment.

Sufficient machine storage capacity to mix properly and apply a minimum of 5 tons (4 500 kg) of the slurry shall be provided. Proportioning devices shall be calibrated prior to placing the slurry seal.

b. Slurry Spreading Equipment. The mixture shall be spread uniformly by means of a conventional surfacing spreader box attached to the mixer and equipped to agitate and spread the material evenly throughout the box. A front seal shall be provided to insure no loss of the mixture at the surface contact point. The rear seal shall act as the final strike-off and shall be adjustable. The spreader box and rear strike-off shall be so designed and operated that a uniform consistency is achieved to produce a free flow of material to the rear strike-off. The spreader box shall have suitable means provided to side shift the box to compensate for variations in the pavement geometry. A burlap drag or other approved screed may be attached to the rear of the spreader box to provide a uniform mat.

c. Auxiliary Equipment. Other tools or equipment such as brushes, hand squeegees, hose equipment, tank trucks, water distributors and flushers, power blowers, barricades, etc., shall be provided as required.

d. Roller. The roller, if required, shall be a self-propelled pneumatic-tired roller capable of exerting a contact pressure during rolling of 50 pounds per square inch (350 000 Newton's per square meter). It shall be equipped with a water spray system, to be used if the slurry is picking up on the tires during rolling.

e. Tack Coat and Distributor. Normally a tack coat is not required unless the surface to be covered is extremely dry and raveled or is concrete or brick. If required, the tack coat should consist of one part emulsified asphalt and three parts water. The emulsified asphalt may be the same as that used in the mix. Pressure distributors used for application of the diluted asphalt emulsion tack coat shall be self-propelled, equipped with pneumatic tires, and capable of uniformly applying 0.05 to 0.15 gallon per square yard (0.23 to 0.68 liter per square meter) of the diluted emulsion over the required width of application. Distributors shall be equipped with tachometers, pressure gages, and volume-measuring devices. The tack coat shall be applied at least 2 hours before the slurry seal but within the same day.

626-4.3 EQUIPMENT CALIBRATION. Each slurry mixing unit to be used on the project shall be calibrated in the

presence of the Engineer prior to construction. Previous calibration documentation covering the exact materials to be used may be accepted by the Engineer provided they were made during the calendar year. The documentation shall include an individual calibration of each material at various settings, which can be related to the machine's metering devices. No machine will be allowed to work on the project until the calibration has been completed and/or accepted.

626-4.4 PREPARATION OF EXISTING SURFACE. Prior to placing the tack coat and slurry seal coat, unsatisfactory areas shall be repaired and the surface shall be cleaned of dust, dirt, or other loose foreign matter, grease, oil, excessive rubber accumulation, or any type of objectionable surface film. Any standard cleaning method will be acceptable except that water flushing will not be permitted in areas where considerable cracks are present in the pavement surface.

Any painted stripes or markings on the surface of the runways or taxiways to be treated, shall be removed.

Cracks wider than 1/4 inch (6 mm) shall be cleaned with compressed air, and sealed with a compatible crack sealer prior to applying the slurry seal. Cracks wider than 3/4 inch (19 mm) should be pre-filled and sealed with the slurry mixture prior to surfacing. Cracks that show evidence of vegetation shall be cleaned and treated with an approved herbicide.

626-4.5 APPLICATION OF SLURRY SEAL COAT. The surface shall be prewet by fogging ahead of the slurry spreader box. Water used in prewetting the surface shall be applied at such a rate that the entire surface is damp with no apparent flowing water in front of the slurry spreader box. The slurry mixture shall be of the desired consistency when deposited on the surface, and no additional elements shall be added. Total time of mixing shall not exceed 2 minutes. A sufficient amount of slurry shall be carried in all parts of the spreader box at all times so that complete coverage of all surface voids and cracks is obtained. Care shall be taken not to overload the spreader box which shall be towed at a slow and uniform rate not to exceed 5 miles per hour (8 kilometers per hour). No lumping, balling, or unmixed aggregate shall be permitted. No segregation of the emulsion and fines from the coarse aggregate will be permitted. If the coarse aggregate settles to the bottom of the mix, the slurry shall be removed from the pavement surface. A sufficient amount of slurry shall be fed into the box to keep a full supply against the full width of the spreader box. The mixture shall not be permitted to overflow the sides of the spreader box. No breaking of the emulsion will be allowed in the spreader box. The finished surface shall have no more than four (4) tear or drag marks greater than 1/2 inch (13 mm) wide and 4 inches (100 mm) long in any 12 foot by 22 foot (25 sq. meter) section. It shall have no tear or drag marks greater than 1 inch (25 mm) wide and 3 inches (15 mm) long.

The finished surface shall have no transverse ripples of 1/4 inch (6 mm) or more in depth, as measured with a 10-foot (3 meter) straight edge laid upon the surface.

Adjacent lanes shall be lapped at the edges a minimum of 2 inches (50 mm) with a maximum of 4 inches (100 mm) to provide complete sealing at the overlap. Construction longitudinal and transverse joints shall be neat and uniform without buildup, uncovered areas, or unsightly appearance. All joints shall have no more than 1/4 inch (6 mm) difference in elevation when measured across with a 10 foot (3 meter) straight edge.

Generally, where normal traffic will iron out the slurry and close any hairline cracks of dehydration, it is not necessary to roll a normal thickness, 1/4 inch (6 mm) or less, slurry seal. However, in some instances the, somewhat lattice-like structure of the slurry should be densified by pneumatic-tire rolling to improve durability, such as areas subjected to severe braking or acceleration. Rolling of the slurry seal is at the option of the Engineer and, if required, shall be designated in the plans.

If rolling is required by the Engineer, the surface shall be subjected to a minimum of two full coverage passes by the roller. These rolling passes are to be done as soon as the slurry mixture will support the roller without damage. When the surface of the existing pavement is irregular or broken, it shall be repaired or brought to uniform grade and cross section by patching as directed

in the project plans. With the exception of standard debris cleaning, all other repairs, crack sealing, and required removal of materials shall be a line item in the bid and noted in the plans.

The fresh slurry seal application shall be protected by barricades and markers and permitted to dry for 4 to 24 hours, depending on weather conditions. Any damage to uncured slurry shall be repaired at the expense of the Contractor.

In areas where the spreader box cannot be used, the slurry shall be applied by means of a hand squeegee. Upon completion of the work, the seal coat shall have no holes, bare spots, or cracks through which liquids or foreign matter could penetrate to the underlying pavement. The finished surface shall present a uniform and skid resistant texture satisfactory to the Engineer. All wasted and unused material and all debris shall be removed from the site prior to final acceptance.

Upon completion of the project, the Contractor shall sweep the finished surface with a conventional power rotary broom, to remove any potential loose material from the surface. The material removed by sweeping shall be disposed of in a manner satisfactory to the Engineer.

The cured slurry shall have a homogeneous appearance, fill all cracks, adhere firmly to the surface and have a skid resistant texture. The slurry seal will not stop shrinkage and other large thermal cracks from reflecting back through the new slurry surface.

626-4.6 EMULSION MATERIAL (CONTRACTORS RESPONSIBILITY). Samples of the emulsion that the Contractor proposes to use, together with a statement as to its source, shall be submitted, and approval shall be obtained before using such material. The Contractor shall submit to the Engineer a manufacturer's certified report for each consignment of the emulsion. The manufacturer's certified report shall not be interpreted as a basis for final acceptance. All such reports shall be subject to verification by testing samples of the emulsion as received for use on the project.

METHOD OF MEASUREMENT

626-5.1 The emulsified asphalt shall be measured by the [gallon (liter)] [ton (kg)]. Only the actual quantity of undiluted emulsified asphalt will be measured for payment.

626-5.2 Aggregate shall be measured by the ton (kg) of dry aggregate.

[626-5.3 Crack sealing shall be measured by the lineal foot (meter) of cracks sealed.]

[626-5.4 Surface repair shall be measured by the ton (kg) or square measurement of material placed.]

[626-5.5 Paint and rubber removal shall be measured by the lineal foot (meter) or square measurement.]

BASIS OF PAYMENT

626-6.1 Payment shall be made at the contract unit price per [gallon (liter)] (ton (kg)) for the emulsified asphalt and at the contract price per ton (kg) for aggregate [and the contract unit price for crack sealing per lineal foot] [and the

contract unit price for surface repair per ton (kg) or square measurement] [and the contract unit price for paint and rubber removal per lineal foot (meter) or square measurement].

These prices shall be full compensation for furnishing all materials, for preparing, mixing, and applying these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

| | |
|------------------------|---|
| Item P-626-6.1 | Emulsified Asphalt for Slurry Coat--per [gallon (liter)] [ton (kg)] |
| Item P-626-6.2 | Aggregate--per ton (kg) of dry aggregate. |
| [Item P-626-6.3 | Emulsified Asphalt for Tack Coat--per [gallon (liter)] [ton (kg)]] |
| [Item P-626-6.4 | Crack sealing -- per lineal [feet] (meter)] |
| [Item P-626-6.5 | Surface Repair -- per [ton] (kg) or square measurement] |
| [Item P-626-6.6 | Paint and Rubber removal -- per lineal foot (meter) or square measurement (meter)] |

TESTING REQUIREMENTS

| | |
|-------------|--|
| ASTM C 88 | Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate |
| ASTM C 117 | Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing |
| ASTM C 128 | <i>Density, Relative Density</i> (Specific Gravity), and Absorption of Fine Aggregate |
| ASTM C 131 | Resistance to <i>Degradation</i> of Small Size Coarse Aggregate by <i>Abrasion and Impact in</i> the Los Angeles Machine |
| ASTM C 136 | Sieve or Screen Analysis of Fine and Coarse Aggregates |
| ASTM D 75 | Sampling Aggregates |
| ASTM D 2419 | Sand Equivalent Value of Soils and Fine Aggregate |
| ISSA A 105 | Recommended Performance Guidelines |
| ISSA TB-100 | Wet Track Abrasion Loss |
| ISSA TB-106 | Slurry Seal Consistency |
| ISSA TB 111 | Outline Guide Design Procedure for Slurry Seal |
| ISSA TB-115 | Determination of Slurry Seal Compatibility |

MATERIAL REQUIREMENTS

| | |
|-------------|---|
| ASTM D 242 | Mineral Filler for Bituminous Paving Mixtures |
| ASTM D 977 | Emulsified Asphalt |
| ASTM D 2397 | Cationic Emulsified Asphalt |

END OF ITEM P-626