

SPECIFICATION P-602. BITUMINOUS PRIME COAT

DESCRIPTION

602-1.1 This Work consists 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. Provide Type SS-1 or Type SS-1h emulsified asphalt in accordance with ASTM D 977. The application temperature shall be 70 to 160°F (20° to 70°C).

NOTE TO SPECIFIER:

TABLE 1. BITUMINOUS MATERIAL

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

The FAA allows use of materials listed in Table 1. Highways recommends Type SS-1 or SS1h. If cutbacks are specified in the Special Provisions, their use is limited.

Prime coats are only applied to untreated aggregate base prior to placing bituminous concrete. The benefit of prime coat is questionable and is generally used as a dust palliative in Wisconsin.

CONSTRUCTION METHODS

602-3.1 WEATHER LIMITATIONS. Apply prime coat 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.

NOTE TO SPECIFIER:

The FAA specification allows the Engineer to waive the 60°F temperature requirement. WDOT allows applying prime coat at temperatures above 40°F.

602-3.2 EQUIPMENT. Provide a self-powered pressure bituminous material distributor and equipment for heating bituminous material.

Design, equip, maintain, and operate the distributor 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.

Provide a power broom and/or blower for any required cleaning of the surface to be treated.

602-3.3 APPLICATION OF BITUMINOUS MATERIAL. Remove all loose dirt and other objectionable material immediately before applying the prime coat.

Uniformly apply the bituminous material, including solvent, 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 Engineer will approve the type of bituminous material and application rate prior to application.

Following the application, allow the primed surface to dry more than 48 hours without being disturbed or for additional time as necessary to permit drying of the prime until it will not be picked up by traffic or equipment. The Engineer will approve this period. Maintain the surface until placement of the prime coat. Take suitable precautions 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. Submit samples of the bituminous materials with a statement documenting their source and character. Obtain approval before applying material. 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, demonstrated by service tests, will be acceptable.

Furnish vendor's certified test reports for each carload, or equivalent, of bituminous material shipped to the project. Deliver the report to the Engineer before permission is granted for use of the material. Furnishing the vendor's certified test report for the bituminous material shall not be interpreted as basis for final acceptance. All of these test reports are 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, file receipted bills with the Engineer when railroad shipments are made, and certified weigh bills when materials are otherwise received, of the bituminous materials actually used in the construction covered by the Contract. Do not remove bituminous material from the tank car or storage tank until the initial outage and temperature measurements have been taken by the Engineer. Do not release the car or tank until the final outage has been taken by the Engineer.

Furnish copies of freight bills and weigh bills to the Engineer during the progress of the Work.

METHOD OF MEASUREMENT

602-4.1 The bituminous material for prime coat will be measured by the gallon or ton. Volume shall be corrected to the volume at 60°F (15°C) in accordance with Table IV-3 of The Asphalt Institute's Manual MS-6 for emulsified asphalt.

BASIS OF PAYMENT

NOTE TO SPECIFIER:

If cutback asphalt is allowed by Special Provision, add a provision requiring volume correction in accordance with ASTM D 1250.

602-5.1 Payment will be made at the Contract unit price per gallon or ton for Bituminous Prime Coat. This price will be full compensation for furnishing all materials, for all preparation, delivering, and applying the materials, and for all labor, equipment, tools, and incidentals necessary to complete this Work.

Standard Pay Items for Work covered by this Specification are as follows:

Pay Item P60201	Bituminous Prime Coat, per gallon
Pay Item P60202	Bituminous Prime Coat, per ton

Measurement and payment will only be made for Pay Items listed in the Schedule of Prices. The cost of all Work required by the Contract Documents will be included in the Pay Items contained in the Schedule of Prices.

MATERIAL REQUIREMENTS

ASTM D 977	Emulsified Asphalt
ASTM D 2028	Asphalt, Cutback (Rapid Curing Grade)
ASTM D 2397	Cationic Emulsified Asphalt

TESTING REQUIREMENTS

ASTM D 1250	Petroleum Measurement Tables
Asphalt Institute	Temperature-Volume Corrections for Emulsified Asphalts
Manual MS-6 Table IV-3	

SPECIFICATION P-603. BITUMINOUS TACK COAT

DESCRIPTION

603-1.1 This Work consists 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. Provide Type SS-1 or Type SS-1h emulsified asphalt in accordance with ASTM D 977. The application temperature shall be 70° to 130°F (20° to 55°C).

NOTE TO SPECIFIER:

TABLE 1. BITUMINOUS MATERIAL

The FAA allows use of the materials listed in Table 1. Highways recommends Type SS-1 or SS-1h, which has been incorporated into the Standard Specifications.

Tack coats are used to bond overlays to existing bituminous or P.C. pavement. The benefit of tack coats have been questioned; therefore, whether to use the tack coat or not is left to the Engineer's judgment.

CONSTRUCTION METHODS

603-3.1 WEATHER LIMITATIONS. Apply tack coat only when the existing surface is dry and the atmospheric temperature is above 60°F (15°C).

NOTE TO SPECIFIER:

The FAA allows the Engineer to waive the temperature requirement. WDOT allows applying tack above 40°F (4°C).

603-3.2 EQUIPMENT. 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 equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically.

Provide a power broom and/or blower for required cleaning of the surface to be treated.

603-3.3 APPLICATION OF BITUMINOUS MATERIAL. Remove all loose dirt and other objectionable material immediately before applying the tack coat.

Dilute emulsified asphalt by the addition of water when directed by the Engineer and apply a sufficient time in advance of the paver to ensure that all water has evaporated before the overlying mixture is placed on the tacked surface.

Uniformly apply the bituminous material including vehicle or solvent with a bituminous distributor at the rate of 0.025 to 0.15 gallons per square yard (0.11 to 0.68 liters per square meter) depending on the condition of the existing surface. The Engineer will approve the type of bituminous material and application rate prior to application.

Following the application, allow the surface to cure without being disturbed for a period of time to permit drying and setting of the tack coat. The Engineer will approve this period. Maintain the surface until placement of the next course. Take precautions to protect the surface against damage during this interval.

603-3.4 BITUMINOUS MATERIAL-CONTRACTOR'S RESPONSIBILITY. Submit samples of the bituminous material with documentation of its source and character. Obtain approval before applying material. 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 that are demonstrated by service tests will be acceptable.

Furnish the vendor's certified test reports for each carload, or equivalent, of bituminous material shipped to the project. Deliver the report to the Engineer before permission is granted for use of the material. Furnishing the vendor's certified test report for the bituminous material shall not be interpreted as a basis for final acceptance. Test reports are 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, file receipted bills with the Engineer when railroad shipments are made, and certified weigh bills when materials are otherwise received, of the bituminous materials actually used in the construction covered by the Contract. Do not remove bituminous material from the tank car or storage tank until the Engineer has taken initial outage and temperature measurements. Do not release the car or tank until the final outage has been taken by the Engineer. Furnish copies of freight bills and weigh bills to the Engineer during the progress of the Work.

METHOD OF MEASUREMENT

603-4.1 The bituminous material for tack coat will be measured by the gallon or ton. Volume will be corrected to the volume at 60°F (15°C) in accordance with 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.

NOTE TO SPECIFIER:

If cutback asphalt is allowed by Special Provision, add a provision requiring volume correction in accordance with ASTM D 1250.

Normally, Tack Coat will be measured by the gallon.

BASIS OF PAYMENT

603.5-1 Payment will be made at the Contract unit price per gallon or ton of bituminous material. This price will 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 Work.

Standard Pay Items for Work covered by this Specification are as follows:

Pay Item P60301	Bituminous Tack Coat, per gallon
Pay Item P60302	Bituminous Prime Coat, per ton

Measurement and payment will only be made for Pay Items listed in the Schedule of Prices. If Tack Coat is required in the Contract Documents and a Pay Item for Tack Coat is not included in the Schedule of Prices, this Work will be considered incidental. The cost of all Work required by the Contract Documents will be included in the Pay Items contained in the Schedule of Prices.

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	Liquid Asphalt (Rapid-Curing Type)
ASTM D 2397	Cationic Emulsified Asphalt
AASHTO M 52	Tar for Use in Road Construction
Asphalt Institute	Temperature-Volume Corrections for Emulsified Asphalts

Manual MS-6 Table IV-3

SPECIFICATION P-605. JOINT SEALING FILLER

DESCRIPTION

605-1.1 This Work consists 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 the Specifications indicated below.

Deliver each lot or batch of sealing compound to the job site in the manufacturer's original sealed container. Mark each container with the manufacturer's name, batch or lot number, and the safe heating temperature, and accompany it with the manufacturer's certification stating that the compound meets the requirements of this Specification.

Accompanying each lot of preformed joint sealer delivered to the job with the manufacturer's certification stating that it meets the requirements of this Specification.

Provide the type of sealer indicated in the Schedule of Prices, Special Provisions, or Plans.

NOTE TO SPECIFIER:
The standard Joint Sealing Filler utilized in Wisconsin for aprons and other areas requiring jet fuel resistance is Type 1. Type 4 is commonly used for runways and taxiways. Types 2, 6, and 7 can be hazardous.

If a particular type of sealant is not specified, indicate the type required on the Plans or by Special Provision.

Type 1: Fed. Spec. SS-S-200 – Sealing Compounds, Two-Component, Elastomeric, Polymer Type, Jet-Fuel-Resistant, Cold Applied.

Type 2: ASTM D 1854 – Jet-Fuel-Resistant Concrete Joint Sealer, Hot-Poured Elastic Type

Type 3: ASTM D 2628 – Preformed Polychloroprene Elastomeric Joint Seats for Concrete Pavements

Type 4: ASTM D 3405 – Joint Sealants, Hot-Poured, for Concrete and Asphalt Pavements

Type 5: ASTM D 3406 – Joint Sealants, Hot-Poured, Elastomeric-Type, for Portland Cement Concrete Pavements

Type 6: ASTM D 3569 – Joint Sealants, Hot-Poured, Elastomeric, Jet-Fuel-Resistant type, for Portland Cement Concrete Pavements

Type 7: ASTM D 3581 – Joint Sealant, Hot-Poured, Jet-Fuel-Resistant Type, for Portland Cement Concrete and Tar-Concrete Pavements

If preformed joint sealer is specified, the manufacturer shall certify that the preformed 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.

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 lbs/gal (kg/m ³)	7.8 (934)	
Solids content, percent by weight	22-28	D1644, Method A
Film strength, psi	2,300 min.	D412
Elongation, percent	750 min.	D412

Deliver each shipment of lubricant to the job site in the manufacturer's original sealed container. Mark each container with the manufacturer's name, batch or lot number, and the date of manufacture, and accompany with it the manufacturer's certification stating that the lubricant meets the requirements of the Specification.

Store this lubricant at a temperature between 50°F (10°C) and 80°F (30°C) and use it within 270 days of its manufacture.

CONSTRUCTION METHODS

605–3.1 TIME OF APPLICATION. Seal joints 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) at the time of installation of preformed joint seal or above 50°F (10°C) at the time of installation of poured joint sealing material, unless manufacturer's recommendations state otherwise.

If the pavement must be opened to traffic prior to placement of the sealant, temporarily fill the joint with a polyethylene closed cell backer rod or 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 1/4 inch (6 mm) below the pavement surface. Remove the rope immediately prior to cleaning.

605–3.2 PREPARATION OF JOINTS. Immediately before sealing, thoroughly clean the joints of all laitance, curing compound, and other foreign material. Accomplish cleaning by sand blasting or high pressure water blast. Upon completion of cleaning, blow out the joints with compressed air. The joint faces must be surface dry when the seal is applied.

Prior to resealing joints, remove the existing joint material to the depth as shown on the Plans. If joint sealer other than that originally used is specified, remove all existing joint sealer.

NOTE TO SPECIFIER:

Sandblasting or wire brushing is the recommended method of cleaning since the joints can be primed immediately after the cleaning. High pressure water blast is included in the WBOA Standard Specifications.

605–3.3 INSTALLATION OF SEALANTS. Joints will be inspected for proper width, depth, alignment, and preparation and will be approved by the Engineer before sealing is allowed. Install sealants in accordance with the following requirements:

Hot Poured Sealants. Apply the joint sealant uniformly solid from bottom to top and fill without formation of entrapped air or voids. Place a backing material as shown on the Plans that is nonadhesive to the concrete or the sealant material. Use an indirect heating type heating kettle, constructed as a double boiler. Provide a positive temperature control and mechanical agitation. Do not heat the sealant 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. Provide a direct connecting pressure type extruding device with nozzles shaped for insertion into the joint. Remove sealant spilled on the surface of the pavement.

Cold Applied Sealants. Apply cold applied joint sealing compound 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. Place a backing material as shown on the Plans that is nonadhesive to the concrete or the sealant material. Sealant that 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, demonstrate that the equipment and procedures for preparing, mixing, and placing the sealant will produce a satisfactory joint seal. This includes the preparation of two small batches and the application of the resulting material.

Provide backup material or bond breaker in the bottom of the joint to be filled to control the depth of the sealant, to achieve the desired shape factor, and to support the sealant against indentation and sag. Use backup materials and bond breakers that are compatible with the sealant, will not adhere to the sealant, will be compressible without extruding the sealant, and will recover to maintain contact with the joint faces when the joint is open.

Preformed Elastomeric Joint Seals. Place preformed joint sealer using equipment capable of installing the sealer in the upright position, without cutting, nicking, distorting, or otherwise damaging the seal. Apply lubricant to the concrete or the preformed seal, or both, and install the seal in a substantially compressed condition and at the depth below the surface of the pavement as shown in the Plans. When installing the joint sealer do not stretch the sealer more than 5 percent of the minimum theoretical length, or compress it more than 2 percent. Check the method of installation for stretching or compression when 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, modify the installation to correct the situation. Once satisfactory sealing operations have started, remove and check one joint length per every hundred. If the limits are exceeded, the joint sealers on either side should be removed until the condition disappears. Reseal the affected joints in a satisfactory manner at no cost to the Department, and check the method of installation again for satisfactory procedure. Install the seal in the longest practicable lengths in longitudinal joints and cut at the joint intersections for continuous installation of the seal in the transverse joints.

METHOD OF MEASUREMENT

605–4.1 Joint sealing material will be measured by the gallon, pound, or linear foot of sealant in place, complete, and accepted.

BASIS OF PAYMENT

605-5.1 Payment for joint sealing material will be made at the Contract unit price per gallon, pound, or linear foot. The price will 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 Work.

Standard Pay Items for Work covered by this Specification are as follows:

Pay Item P60501 through P60510	Joint Sealing Filler, Type ____, per gallon
Pay Item P60511 through P60520	Joint Sealing Filler, Type ____, per pound
Pay Item P60521 through P60530	Joint Sealing Filler, Type ____, per linear foot

Measurement and Payment will only be made for Pay Items included in the Schedule of Prices. If a Pay Item is not included in the Schedule of Prices, the Work specified herein shall be considered incidental and the cost included in prices Bid for Portland Cement Concrete Pavement.

TESTING REQUIREMENTS

ASTM D 412	Tests for Rubber Properties in Tension
ASTM D 1644	Tests for Nonvolatile Content of Varnishes

MATERIAL REQUIREMENTS

ASTM D 1854	Jet-Fuel-Resistant Concrete Joint Sealer, Hot-Poured Elastic Type
ASTM D 2628	Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
ASTM D 3405	Joint Sealants, Hot-Poured, for Concrete and Asphalt Pavements
ASTM D 3406	Joint Sealants, Hot-Poured, Elastomeric-Type, for Portland Cement Concrete Pavements
ASTM D 3569	Joint Sealant, Hot-Poured, Elastomeric, Jet-Fuel-Resistant Type, for Portland Cement Concrete Pavements
ASTM D 3581	Joint Sealant, Hot-Poured, Jet-Fuel-Resistant Type, for Portland Cement Concrete and Tar-Concrete Pavement
Fed. Spec. SS-S-200	Sealing Compounds, Two Component, Elastomeric, Polymer Type, Jet-Fuel Resistant, Cold Applied

SPECIFICATION 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.

NOTE TO SPECIFIER:

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. Do not store the adhesive components at temperatures over 86°F (30°C).

606-2.3 MANUFACTURER'S RECOMMENDATION. Install and use in accordance with the manufacturer's recommended procedures.

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

SAMPLING, INSPECTION, AND TEST PROCEDURES

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

606-3.2 EXPANSION. Manufacturer's 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 glycerin. 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. Manufacturer's test for dielectric strength will be conducted in accordance with ASTM D 149 for sealing compounds to be furnished for sealing electrical wires in pavement.

TABLE 1. PROPERTY REQUIREMENTS

<i>Physical or Electrical Property</i>	<i>Minimum</i>	<i>Maximum</i>	<i>ASTM Method</i>
Tensile			
Portland Cement Concrete.....	1,000 psi (6895 kPa)		D 638
Bituminous Concrete	500 psi (3448 kPa)		
Elongation			
Portland Cement Concrete.....	8% ¹		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 (6895 kPa)		
Adhesion to portland cement concrete.....	200 psi (1380 kPa)		
Adhesion to asphalt concrete	(no test available)		

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

606-3.4 TEST FOR ARC RESISTANCE. Manufacturer’s 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 manufacturer’s test for adhesion to steel by using 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) and bond together with adhesive mixture and allow to cure at room temperature for a period of time to meet formulation requirements and then test 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 concrete test block for the manufacturer’s test for adhesion to Portland cement concrete shall have an aggregate grade as shown in Table 2.

The coarse aggregate shall consist of crushed rock having a minimum of 75 percent of the particles with at least one fractured face and having a water absorption of not more than 1.5 percent. 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 (±0.5) bags of cement per cubic yard (0.76 cubic meter) of concrete, and a slump of 2–1/2 inches. The ratio of fine aggregate to total aggregate shall be approximately 40 percent by solid volume. The air content shall be 5 percent (±0.5%) and it shall be obtained by the addition to the batch of an air–entraining admixture such as vinsol resin. Provide metal mold with a metal base plate. Provide means for securing the base plate to the mold. The assembled mold and base plate must be watertight and should 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. Prepare and cure the concrete in accordance with ASTM C 192.

TABLE 2. AGGREGATE FOR BOND TEST BLOCKS

<i>Type</i>	<i>Sieve Size</i>	<i>Percent Passing</i>
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. The manufacturer shall test for compatibility with asphalt in accordance with ASTM D 3407.

606-3.8 ADHESIVE COMPOUNDS – CONTRACTOR'S RESPONSIBILITY. Furnish the vendor's certified test reports for each batch of material delivered to the project. The report must certify that the material meets Specification requirements and is suitable for use with the type of pavement to be installed under this Contract. Deliver the report to the Engineer before permission is granted for use of the material. In addition obtain a statement from the supplier or manufacturer that 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. Apply adhesive 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.

NOTE TO SPECIFIER:

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. This requirement, if needed, should be added by Special Provision.

METHOD OF MEASUREMENT

606-4.1 The adhesive compound will be measured by the pound or gallon 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 will be considered as a subsidiary obligation in the completion of the installation.

BASIS OF PAYMENT

606-5.1 Payment will be made, where applicable, at the Contract unit price per pound or gallon for the adhesive. This price will 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 Work.

Standard Bid Items for Work covered by the Specification are as follows:

Pay Item P60601	Adhesive Compound, per pound
Pay Item P60602	Adhesive Compound, per gallon

Measurement and Payment will only be made for Pay Items included in the Schedule of Prices. The cost of all Work required by the Contract Documents will be included in the Pay Items contained in the Schedule of Prices.

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, Arc Resistance of Solid Electrical Insulating Materials
ASTM D 638	Test for Tensile Properties of Plastics
ASTM D 1168	Testing Hydrocarbon Waxes Used for Electrical Insulation
ASTM D 3407	Joint Sealants, Hot-Poured, For Concrete and Asphalt Pavements

SPECIFICATION P-610. STRUCTURAL PORTLAND CEMENT CONCRETE

DESCRIPTION

610-1.1 This Work consists of plain or 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. Use only approved materials, conforming to the requirements of these Specifications. They may be subjected to inspection and tests at any time during the progress of their preparation or use. The Engineer must approve the source of supply of each of the materials before delivery or use is started. Submit representative preliminary samples of the materials, when required, for examination and test. Store and handle materials to insure the preservation of their quality and fitness for use and locate the materials to facilitate prompt inspection. Equipment for handling and transporting materials and concrete must be clean before any material or concrete is placed.

Using pit-run naturally mixed aggregates is not permitted. Screen and wash naturally mixed aggregate. Fine and coarse aggregates shall be stored separately and kept clean. Mixing different kinds of aggregates from different sources in one storage pile or alternating batches of different aggregates will not be permitted.

610-2.2 COARSE AGGREGATE. Coarse aggregate meeting the requirements of ASTM C 33 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. Fine aggregate meeting the requirements of ASTM C 33 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

<i>Sieve Designation (square openings)</i>	<i>Percentage by Weight Passing Sieves</i>						
	<i>2"</i>	<i>1 1/2"</i>	<i>1"</i>	<i>3/4"</i>	<i>1/2"</i>	<i>3/8"</i>	<i>No. 4</i>
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

<i>Sieve Designation (square openings)</i>	<i>Percentage by Weight Passing Sieves</i>
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 that is deficient in the percentage of material passing the No. 50 mesh sieve may be accepted, provided that such deficiency does not exceed 5 percent and is remedied by the addition of pozzolanic or cementitious materials other than Portland cement, as specified in Subsection 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 ASTM C 150 Type I, IA, II, IIA, III, or IIIA.

NOTE TO SPECIFIER:
 The FAA Advisory Circular allows the Engineer to 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 for FAA projects.

The WBOA Standard Specification lists the following cement types as options:

1. I – General Use
2. IA – General Use, Air-entrained
3. II – Sulfate resistant
4. IIA – Sulfate resistant, Air-entrained
5. III – High early strength
6. IIIA – High early strength, air-entrained

If ASTM C 595 cement will be allowed, a Special Provision should be written.

Furnish vendors' certified test reports for each carload, or equivalent, of cement shipped to the project. Deliver the report to the Engineer before permission to use the cement is granted. Test reports will be subject to verification by testing sample materials received for use on the project.

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

610-2.6 ADMIXTURES. The use of material added to the concrete mix must be approved by the Engineer. Before approval of material, submit the results of complete physical and chemical analyses made by an acceptable testing laboratory. Subsequent tests may be made on 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 pozzolans meeting the requirements of ASTM C 618.

Air-entraining admixtures shall meet the requirements of ASTM C 260. Add air-entraining admixtures 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. Add Water-reducing admixtures 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 D 1751 or D 1752.

NOTE TO SPECIFIER:

The FAA allows the Engineer to designate either ASTM D 1751 or ASTM D 1752. The Standard Specifications allows use of either type of material; however, either option can be deleted by Special Provision.

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

610-2.9 STEEL REINFORCEMENT. Provide reinforcing in accordance with the Plans and the following Specifications:

- a. Welded steel wire fabric shall conform to the requirements of ASTM A 185,
- b. Welded deformed steel fabric shall conform to requirements of ASTM A 497,
- c. Bar mats shall conform to requirements of ASTM A 184.

NOTE TO SPECIFIER:

The Engineer shall designate one of the following on the Plans:

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

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

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

CONSTRUCTION METHODS

610-3.1 GENERAL. Furnish all labor, materials, and services necessary for, and incidental to, the completion of all Work as shown on the Drawings and specified herein. Machinery and equipment owned or controlled by the Contractor, that is proposed to be used 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 is subject to the inspection and approval of the Engineer.

610-3.2 CONCRETE COMPOSITION. The concrete shall develop a compressive strength of 3,500 psi (24,130 kPa) 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 (100 mm) as determined by ASTM C 143.

NOTE TO SPECIFIER:

The Engineer shall designate the compressive strength in the Special Provision if a value other than 3500 psi (24130 kPa) is required. The minimum allowable strength is 3000 psi (20680 kPa).

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 will be sampled in accordance with ASTM C 172. Compressive strength specimens will be made in accordance with ASTM C 31 and tested in accordance with ASTM C 39.

Concrete cylindrical test specimens will be made in accordance with ASTM C 31 and tested in accordance with ASTM C 39. 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.

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 will 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. Check 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. Mix and deliver the concrete in accordance with the requirements of ASTM C 94.

610-3.7 MIXING CONDITIONS. Mix concrete only in quantities required for immediate use. Do not mix concrete while the air temperature is below 40°F (4°C) without permission of the Engineer. If permission is granted for mixing under such conditions, heat aggregates or water, or both, and place the concrete at a temperature not less than 50°F (10°C) nor more than 100°F (38°C). The Contractor is responsible for any defective Work, resulting from freezing or injury during placing and curing, and shall replace the Work at Contractor's expense.

Do not retemper concrete by adding water or other materials.

Schedule concrete delivery to the job to assure batches of concrete will be deposited at uninterrupted intervals.

610-3.8 FORMS. Do not place concrete until all the forms and reinforcements have been inspected and approved by the Engineer. Use forms of suitable material and of the type, size, shape, quality, and strength to build the structure as designed on the Plans. Forms shall be true to line and grade, 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.

Arrange the internal ties so that, when the forms are removed, no metal will show in the concrete surface or discolor the surface when exposed to weathering. Wet the forms with water or with a nonstaining mineral oil that is applied shortly before the concrete is placed. Construct forms to allow removal without injuring the concrete or concrete surface. Do not remove forms 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. Do not remove similar construction until tests indicate that at least 60 percent of the design strength of the concrete has developed.

610-3.9 PLACING REINFORCEMENT. Place reinforcement accurately, as shown on the Plans, and fasten it firmly to hold its position during placement of concrete. Fasten bars together at intersections. Support reinforcement by approved metal chairs. Supply shop drawings, lists, and bending details..

610-3.10 EMBEDDED ITEMS. Before placing concrete, firmly embed items and securely fasten them in place as indicated. Items must be clean and free from coating, rust, scale, oil, or foreign matter. Avoid embedding wood. Spade and consolidate concrete around and against embedded items.

610-3.11 PLACING CONCRETE. Place concrete during daylight, unless otherwise approved. Do not place concrete until the depth and character of foundation, the adequacy of forms and falsework, and the placing of the steel reinforcing have been approved. Place concrete as

soon as practical after mixing and in no case later than 1 hour after water has been added to the mix. Place concrete to avoid segregation and displacement of the reinforcement. Use troughs, pipes, and chutes as an aid in placing concrete. Dropping the concrete a distance of more than 5 feet (1.5 m), or depositing a large quantity at one point, is not permitted. Place concrete upon clean, damp surfaces, free from running water, or upon properly consolidated soil.

Compact concrete with suitable mechanical vibrators operating within the concrete. When necessary, supplement vibrating by hand spading with suitable tools to assure proper and adequate compaction. Manipulate vibrators to work the concrete thoroughly around the reinforcement and embedded fixtures and into corners and angles of the forms. Vibration must be of sufficient duration to accomplish compaction but not to the point where segregation occurs. Concrete deposited under water must 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 should not be disturbed after being deposited.

610-3.12 CONSTRUCTION JOINTS. When the placing of concrete is suspended, make necessary provisions for joining future Work before the placed concrete takes its initial set. Make provisions for proper bonding of old and new concrete by constructing grooves, steps, keys, dovetails, reinforcing bars or other devices. Schedule Work to assure that a section begun will be finished during daylight of the same day. Before depositing new concrete on or against concrete that has hardened, clean the surface of the hardened concrete with a heavy steel broom, roughened slightly, wetted, and covered with a neat coating of cement paste or grout.

610-3.13 EXPANSION JOINTS. Construct expansion joints at locations and dimensions indicated on the drawings. Cut premolded filler to the same shape as the surfaces being joined. Firmly fix filler against the surface of the concrete already in place in a manner to prevent displacement when concrete is deposited.

610-3.14 DEFECTIVE WORK. Immediately remove and replace defective Work disclosed after the forms have been removed. If 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, remove and replace the entire section at the expense of the Contractor.

610-3.15 SURFACE FINISH. Exposed concrete surfaces shall be true, smooth, free from open or rough spaces, depressions, or projections. Bring concrete in horizontal plane surfaces flush with the finished top surface at the proper elevation and strike-off with a straightedge and float. Mortar finishing is not permitted, and do not spread dry cement or sand-cement mortar over the concrete during the finishing of horizontal plane surfaces.

When required on Plans, the surface finish of exposed concrete shall be a rubbed finish. If forms can be removed while the concrete is still green, point and wet the surface and then rub it with a wooden float until all irregularities are removed. If the concrete has hardened before being rubbed, use a carborundum stone to finish the surface. When approved, the finishing can be done with a rubbing machine.

610-3.16 CURING AND PROTECTION. Properly cure and protect the concrete. Protect the Work from the elements, flowing water, and from defacement of any nature during the building operations. Cure concrete when it has sufficiently hardened by covering with an approved material. Thoroughly saturate water-absorptive coverings when placed and keep saturated for a period of at least 3 days. Weight or sufficiently tie down curing mats or blankets to keep the concrete surface covered and to prevent the surface from being exposed to currents of air. Where wooden forms are used, keep them wet at all times until removed to prevent the opening of joints and drying out of the concrete. Do not allow traffic on concrete surfaces for 7 days after the concrete has been placed.

610-3.17 DRAINS OR DUCTS. Install drainage pipes, conduits, and ducts that are to be encased in concrete before the concrete is placed. Hold drains or ducts rigidly and do not displace or move them during placing of concrete.

610-3.18 COLD WEATHER PROTECTION. When concrete is placed at temperatures below 40°F (4°C), provide satisfactory methods and means to protect the mix from injury by freezing. Heat the aggregates, or water, or both, 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 approved by the Engineer. Do not add more than 2 pounds (908 grams) of Type 1 or more than 1.6 pounds (726 grams) of Type 2 per bag of cement. After the concrete has been placed, provide sufficient protection such as cover, canvas, framework, and heating apparatus, 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 percent of the designed strength has been attained.

610-3.19 FILLING JOINTS. Thoroughly clean joints which require filling, and cut out excess mortar or concrete with proper tools. Do not start joint filling until after final curing and only when the concrete is completely dry. Do cleaning and filling carefully with proper equipment and in a manner to obtain a neat looking joint free from excess filler.

METHOD OF MEASUREMENT

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

610-4.2 Steel Reinforcement will be measured by the calculated theoretical number of pounds placed, as shown on the Plans, complete in place and accepted. The unit weight used for deformed bars will 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 will 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 will be made at the Contract unit price per cubic yard for Structural Portland Cement Concrete and per pound for Steel Reinforcement. These prices will be full compensation for furnishing all materials and for all preparation, delivering and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the Work. If Steel Reinforcement is required on the Plans and a Pay Item is not included in the Schedule of Prices, the cost of furnishing and placing the Steel Reinforcement will be included in the prices for Structural Portland Cement Concrete.

Standard Pay Items for Work specified covered by this Specification are as follows:

Pay Item P61001	Structural Portland Cement Concrete, per cubic yard
Pay Item P61002	Steel Reinforcement, per pound

Measurement and Payment will only be made for Pay Items included in the Schedule of Prices. When Portland Cement Concrete (PCC) and steel reinforcement are specified under other Specifications, furnishing and constructing the PVC and steel reinforcement will be incidental and the cost included in the Pay Item of Work included in that Specification. The cost of all Work required by the Contract Documents will be included in the Pay Items contained in the Schedule of Prices.

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 or Screen Analysis of Fine and Coarse Aggregate
ASTM C 138	Unit Weight, Yield, and Air Content of Concrete
ASTM C 143	Slump of Portland Cement Concrete
ASTM C 231	Air Content of Freshly Mixed Concrete by the Pressure Method

MATERIAL REQUIREMENTS

ASTM A 184	Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 185	Welded Steel Wire Fabric for Concrete Reinforcement
ASTM A 497	Specification for Welded Deformed Steel Wire Fabric for Concrete Pavement
ASTM A 615	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 33	Concrete Aggregates
ASTM C 94	Ready-Mixed Concrete
ASTM C 150	Portland Cement
ASTM C 171	Sheet Materials for Curing Concrete
ASTM C 260	Air-Entraining Admixtures for Concrete
ASTM C 309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 595	Blended Hydraulic Cements
ASTM C 618	Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
ASTM D 1751	Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 1752	Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

SPECIFICATION P-620. RUNWAY AND TAXIWAY PAINTING

DESCRIPTION

620-1.1 This Work consists of painting numbers, markings, and stripes, which are referred to as markings, on the surface of runways, taxiways, taxilanes, and aprons, in accordance with these Specifications and at the locations shown on the Plans, or as directed by the Engineer.

MATERIALS

620-2.1 MATERIALS ACCEPTANCE. Furnish manufacturer's certified test reports for materials shipped to the project. The certified test reports shall include a statement that the materials meet the Specification requirements. The reports may be used for material acceptance or the Engineer may perform verification testing. The reports shall not be interpreted as a basis for payment. Notify the Engineer upon arrival of a shipment of materials to the site.

620-2.2 PAINT. Provide waterborne, epoxy, methacrylate, or solvent base paint in accordance with the requirements of this Specification. Furnish Type I for Standard drying time or Type II for Fast drying time in accordance with ASTM D 711. Supply paint colors in accordance with Federal Standard No. 595 and the following list:

-	White	37925
-	Yellow	33538 or 33655
-	Red	31136
-	Black	7038

NOTE TO SPECIFIER:

The Engineer shall specify paint type(s) and appropriate paragraph number(s).

The Engineer shall insert the colors to be used on a project from the following list:

White - 37925	Red - 31136
Yellow - 33538 or 33655	Black - 37038
Pink - 2 parts Red - 31136 to 1 part White - 37925	

Waterborne or solvent base black paint can be used to outline a border at least 6 inches (150 mm) wide around markings on light colored pavements.

Type I is intended for those locations where slower tracking is not an inconvenience.

Type II is intended for striping locations where faster curing is desirable.

The color pink, for geographic position markings, shall be 2 parts red and one part white paint.

a. WATERBORNE. Provide waterborne paint meeting the requirements of Federal Specification TT-P-1952.

b. EPOXY. Provide a two component paint with a minimum 99 percent solids type system conforming to the following:

(1) Pigments. Component A. Percent by weight.

(a) White:

Titanium Dioxide, ASTM D 476, type II shall be 18 percent minimum
(16.5 percent minimum at 100 percent purity).

(b) Yellow and Colors:

Titanium Dioxide, ASTM D 476, type II shall be 14 to 17 percent.
Organic yellow, other colors, and tinting as required to meet color standard.
Epoxy resin shall be 75 to 79 percent.

(2) Epoxy Content. Component A. The weight per epoxy equivalent, when tested in accordance with ASTM D 1652 shall be the manufacturer's target plus or minus 50.

(3) Amine Number. Component B. When tested in accordance with ASTM D 2074 shall be the manufacturer's target plus or minus 50.

(4) **Prohibited Materials.** The manufacturer shall certify that the product does not contain mercury, lead, hexavalent chromium, halogenated solvents, nor any carcinogen, as defined in 29 CFR 1910.1200.

(5) **Daylight Directional Reflectance:**

(a) **White:** The daylight directional reflectance of the white paint shall not be less than 75 percent (relative to magnesium oxide), when tested in accordance with Federal Test Method Standard No. 141, Method 6121.

(b) **Yellow:** The daylight directional reflectance of the yellow paint shall not be less than 38 percent (relative to magnesium oxide), when tested in accordance with Federal Test Method Standard No. 141. The x and y values shall be consistent with the Federal Hegman yellow color standard chart for traffic yellow standard 33538, or shall be consistent with the tolerance listed below:

x	.462	x	.470	x	.479	x	.501
y	.438	y	.455	y	.428	y	.452

(6) **Accelerated weathering.**

(a) **Sample preparation.** Apply the paint at a wet film thickness of 0.013 inch (0.33 mm) to four 3 by 6 inch (8 by 15 cm) aluminum panels prepared as described in Federal Test Method Standard No. 141, Method 2013. Air dry the sample 48 hours under standard conditions.

(b) **Testing conditions.** Test in accordance with ASTM G 53 using both Ultra Violet (UV-B) Light and condensate exposure, 72 hours total, alternating 4 hour UV exposure at 60 degree C, and 4 hours condensate exposure at 40 degrees C.

(c) **Evaluation.** Remove the samples and condition for 24 hours under standard conditions. Determine the directional reflectance and color match using the procedures in Paragraph 620-2.2b(5) above. Evaluate for conformance with the color requirements.

(7) **Volatile Organic Content.** Determine the volatile organic content in accordance with 40 CFR Part 60 Appendix A, Method 24.

(8) **Dry opacity.** Use Procedure B, Method B of Method 4121 of Federal Test Method Standard No. 141. The wet film thickness shall be 0.015 inch (0.12 mm). The minimum opacity for white and colors shall be 0.92.

(9) **Abrasion resistance.** Subject the panels prepared in Paragraph 620-2.2b(6) to the abrasion test in accordance with ASTM D 968, Method A, except that the inside diameter of the metal guide tube shall be from 0.747 to 0.750 inch (18.97 to 19.05 mm). Use 5 liters of unused sand for each test panel. Run the test on two test panels. [Note: 5 liters of sand weighs 17.5 lb. (7.94 kg).] Both baked and weathered paint films shall require not less than 150 liters of sand for the removal of the paint films.

(10) **Hardness, Shore.** Hardness shall be at least 80 when tested in accordance with ASTM D 2240.

c. **METHACRYLATE.** Paint shall be a two component, minimum 99 percent solids type system conforming to the following:

(1) **Pigments.** Component A. Percent by weight.

(a) **White:**

Titanium Dioxide, ASTM D 476, type II shall be 6 percent minimum.
Methacrylate resin shall be 18 percent minimum.

(b) **Yellow and Colors:**

Titanium Dioxide, ASTM D 476, type II shall be 6 percent minimum.
Organic yellow, other colors, and tinting as required to meet color standard.
Methacrylate resin shall be 18 percent minimum.

(2) **Prohibited Materials.** The manufacturer shall certify that the product does not contain mercury, lead, hexavalent chromium, halogenated solvents, nor any carcinogen, as defined in 29 CFR 1910.1200.

(3) **Daylight Directional Reflectance:**

(a) White: The daylight directional reflectance of the white paint shall not be less than 80 percent (relative to magnesium oxide), when tested in accordance with Federal Test Method Standard No. 141, Method 6121.

(b) Yellow: The daylight directional reflectance of the yellow paint shall not be less than 55 percent (relative to magnesium oxide), when tested in accordance with Federal Test Method Standard No. 141. The x and y values shall be consistent with the Federal Hegman yellow color standard chart for traffic yellow standard 33538, or shall be consistent with the tolerance listed below:

x .462 x .470 x .479 x .501
 y .438 y .455 y .428 y .452

(4) Accelerated weathering.

(a) Sample preparation. Apply the paint at a wet film thickness of 0.013 inch (0.33 mm) to four 3 by 6 inch (8 by 15 cm) aluminum panels prepared as described in Method 2013 of Federal Test Method Standard No. 141. Air dry the sample 48 hours under standard conditions.

(b) Testing conditions. Test in accordance with ASTM G 53 using both Ultra Violet (UV-B) Light and condensate exposure, 72 hours total, alternating 4 hours UV exposure at 60 degree C, and 4 hours condensate exposure at 40 degrees C.

(c) Evaluation. Remove the samples and condition for 24 hours under standard conditions. Determine the directional reflectance and color match using the procedures in Paragraph 620-2.2c(3) above. Evaluate for conformance with the color requirements.

(5) Volatile Organic Content. Determine the volatile organic content in accordance with 40 CFR Part 60 Appendix A, Method 24.

(6) Dry opacity. Use Procedure B, Method B of Method 4121 of Federal Test Method Standard No. 141. The wet film thickness shall be 0.015 inch (0.12 mm). The minimum opacity for white and colors shall be 0.92.

(7) Abrasion resistance. Subject the panels prepared in Paragraph 620-2.2c(4) to the abrasion test in accordance with ASTM D 968, Method A, except that the inside diameter of the metal guide tube shall be from 0.747 to 0.750 inch (18.97 to 19.05 mm). Five liters of unused sand shall be used for each test panel. The test shall be run on two test panels. [Note: 5 liters of sand weighs 17.5 lb. (7.94 kg).] Both baked and weathered paint films shall require not less than 150 liters of sand for the removal of the paint films.

(8) Hardness, Shore. Hardness shall be at least 80 when tested in accordance with ASTM D 2240.

d. SOLVENT BASE. Provide solvent based paint meeting the requirements of Federal Specification TT-P-85, or TT-P-110.

620-2.3 REFLECTIVE MEDIA. Glass beads shall meet the requirements of Fed. Spec. TT-B-1325, Type I, Gradation A, or Type III. Treat glass beads with adhesion promoting and/or flotation coatings as specified by the manufacturer of the paint.

NOTE TO SPECIFIER:

Glass beads improve the conspicuity and the friction characteristics of markings. Where beads are used, the Engineer shall specify: Type I--gradation A or Type III.

620-2.4 SILICA SAND. Provide foundry grade silica sand composed of at least 99.5 percent silicon dioxide when tested in accordance with ASTM C 146. The gradation of the silica sand shall meet the paint manufacturer's recommendations and shall approximate a 50/60 graded sand when tested in accordance with ASTM C-136.]

NOTE TO SPECIFIER:

Silica sand improves the friction characteristics of markings and may reduce the rate of accumulation of rubber deposits. The Engineer shall specify glass beads or silica sand in all epoxy and methacrylate paints to improve friction characteristics of the paint.

CONSTRUCTION METHODS

620-3.1 WEATHER LIMITATIONS. Perform the painting only when the surface is dry and when the surface temperature is at least 45 degrees F (7 degrees C) and rising.

NOTE TO SPECIFIER:

The Engineer may specify a lower temperature based on paint manufacturer's recommendations.

620-3.2 EQUIPMENT. Equipment shall include the apparatus necessary to properly clean the existing surface, a mechanical marking machine, a bead and/or silica sand dispensing machine, and such auxiliary hand-painting equipment as may be necessary to satisfactorily complete the job.

The mechanical marker shall be an atomizing spray-type marking machine suitable for application of traffic paint. It shall produce an even and uniform film thickness at the required coverage and shall apply markings of uniform cross sections and clear-cut edges without running or spattering and without over spray.

620-3.3 PREPARATION OF SURFACE. Immediately before application of the paint, dry the surface and free the area from dirt, grease, oil, laitance, or other foreign material that would reduce the bond between the paint and the pavement. Clean the area to be painted by sweeping and blowing or by other methods as required to remove all dirt, laitance, and loose materials.

Do not apply paint to Portland cement concrete pavement until the areas to be painted are clean of curing material. Use sandblasting or high pressure water to remove curing materials.

NOTE TO SPECIFIER:

The Engineer should specify any additional surface preparation required and should specify the type of surface preparation to be used when existing markings interfere with or would cause adhesion problems with new markings.

620-3.4 LAYOUT OF MARKINGS. Lay out proposed markings in advance of the paint application. Incorporate glass beads and silica sand where shown on the Plans. The locations of markings to receive silica sand are shown on the Plans.

620-3.5 APPLICATION. Apply paint at the locations and to the dimensions and spacing shown on the Plans. Do not apply paint until the layout and condition of the surface have been approved by the Engineer.

Mix the paint in accordance with the manufacturer's instructions and apply it to the pavement with a marking machine at the rate(s) shown in Table 1. The addition of thinner will not be permitted. A period of 30 days shall elapse between placement of a bituminous surface course or seal coat and application of the paint.

TABLE 1. APPLICATION RATES FOR PAINT, GLASS BEADS, AND SILICA SAND

Paint Type	Paint Square feet per gallon, ft ² /gal (Square meters per liter, m ² /l)	Glass Beads, Type I, Gradation A Pounds per gallon of paint--lb./gal. (Kilograms per liter of paint--kg/l)	Glass Beads, Type III Pounds per gallon of paint--lb./gal. (Kilograms per liter of paint--kg/l)	Silica Sand Pounds per gallon of paint--lb./gal. (Kilograms per liter of paint--kg/l)
Waterborne	115 ft ² /gal. maximum (2.8 m ² /l)	7 lb./gal. Minimum (0.85 kg/l)	12 lb./gal. minimum (1.45 kg/l)	4 lb./gal. minimum (0.5 kg/l)
Solvent Base	115 ft ² /gal. maximum (2.8 m ² /l)	7 lb./gal. Minimum (0.85 kg/l)	12 lb./gal. minimum (1.45 kg/l)	4 lb./gal. minimum (0.5 kg/l)
Epoxy	90 ft ² /gal. maximum (2.2 m ² /l)	15 lb./gal. Minimum (1.8 kg/l)	24 lb./gal. minimum (2.9 kg/l)	8 lb./gal. minimum (1.0 kg/l)
Methacrylate	45 ft ² /gal. maximum (1.1 m ² /l)	15 lb./gal. minimum (1.8 kg/l)	24 lb./gal. minimum (2.9 kg/l)	8 lb./gal. minimum (1.0 kg/l)

NOTE TO SPECIFIER:

The Engineer should select the application rates for paint, glass beads, and silica sand from the following table.

APPLICATION RATES FOR PAINT, GLASS BEADS, AND SILICA SAND FOR TABLE 1

The Engineer shall specify the time period in order to allow adequate curing of the pavement surface. The Engineer should contact the paint manufacturer to determine the wait period.

Due to the increased surface area to cover, the following should be substituted when painting P-402 Porous Friction Course with waterborne or solvent based paints: "The paint shall be mixed in accordance with the manufacturer's instructions and applied to the pavement with a marking machine from two directions at 75 percent of the rate(s) shown in Table 1 from each direction."

Markings may be required before paving operations are complete. The Engineer may wish to include a Special Provisions marking at 50 percent of the specified application rates.

The edges of the markings shall not vary from a straight line more than 1/2 inch (12 mm) in 50 feet (15 m), and the dimensions shall be within a tolerance of plus or minus 5 percent.

Distribute glass beads, when required, upon the marked areas at the locations shown on the Plans immediately after application of the paint. Furnish a dispenser which is properly designed for attachment to the marking machine and suitable for dispensing glass beads. Apply glass beads at the rate(s) shown in Table 1. Do not apply glass beads to black paint. Distribute silica sand, when required, upon the marked areas at the locations shown on the Plans immediately after application of the paint. Furnish a dispenser that is properly designed for attachment to the marking machine and suitable for dispensing silica sand. Apply silica sand at the rate(s) shown in Table 1. Glass beads and silica sand shall adhere to the cured paint or all marking operations shall cease until corrections are made.

Return all emptied containers to the paint storage area. Do not remove or destroy the containers from the airport until authorized by the Engineer.

620-3.6 OBLITERATE EXISTING MARKING. Obliterate existing markings, when included in the Contract Documents, by application of gray paint mixed to match existing pavement color. Blend gray paint by mixing white and black paint meeting the requirements of Federal Specification TT-P-1952.

620-3.7 PROTECTION. After application of the paint, protect markings from damage until the paint is dry. Protect surfaces from disfiguration by spatter, splashes, spillage, or drippings of paint.

METHOD OF MEASUREMENT

620-4.1 Quantities to be measured for payment will be the number of square feet of painting, the number of pounds of silica sand, and the number of pounds of reflective media performed in accordance with the Contract Documents and accepted by the Engineer.

BASIS OF PAYMENT

620-5.1 Payment will be made at the respective Contract price per square foot for the various colors and types of painting, price per pound for silica sand, and price per pound for the various types of reflective media. This price will be full compensation for furnishing all materials and for all labor, equipment, tools, and incidentals necessary to complete the Work.

Standard Pay Items for Work covered by this Specification are as follows:

Pay Item P62001	Painting, White, Waterborne, Type I, per square foot
Pay Item P62002	Painting, White, Epoxy, Type I, per square foot
Pay Item P62003	Painting, White, Methacrylate, Type I, per square foot
Pay Item P62004	Painting, White, Solvent Base, Type I, per square foot
Pay Item P62005	Painting, White, Waterborne, Type II, per square foot
Pay Item P62006	Painting, White, Epoxy, Type II, per square foot
Pay Item P62007	Painting, White, Methacrylate, Type II, per square foot
Pay Item P62008	Painting, White, Solvent Base, Type II, per square foot
Pay Item P62009	Painting, Yellow, Waterborne, Type I, per square foot
Pay Item P62010	Painting, Yellow, Epoxy, Type I, per square foot
Pay Item P62011	Painting, Yellow, Methacrylate, Type I, per square foot
Pay Item P62012	Painting, Yellow, Solvent Base, Type I, per square foot
Pay Item P62013	Painting, Yellow, Waterborne, Type II, per square foot
Pay Item P62014	Painting, Yellow, Epoxy, Type II, per square foot
Pay Item P62015	Painting, Yellow, Methacrylate, Type II, per square foot
Pay Item P62016	Painting, Yellow, Solvent Base, Type II, per square foot
Pay Item P62017	Painting, Red, Waterborne, Type I, per square foot
Pay Item P62018	Painting, Red, Epoxy, Type I, per square foot
Pay Item P62019	Painting, Red, Methacrylate, Type I, per square foot
Pay Item P62020	Painting, Red, Solvent Base, Type I, per square foot
Pay Item P62021	Painting, Red, Waterborne, Type II, per square foot
Pay Item P62022	Painting, Red, Epoxy, Type II, per square foot
Pay Item P62023	Painting, Red, Methacrylate, Type II, per square foot
Pay Item P62024	Painting, Red, Solvent Base, Type II, per square foot
Pay Item P62025	Painting, Black, Waterborne, Type I, per square foot
Pay Item P62026	Painting, Black, Epoxy, Type I, per square foot
Pay Item P62027	Painting, Black, Methacrylate, Type I, per square foot
Pay Item P62028	Painting, Black, Solvent Base, Type I, per square foot
Pay Item P62029	Painting, Black, Waterborne, Type II, per square foot
Pay Item P62030	Painting, Black, Epoxy, Type II, per square foot
Pay Item P62031	Painting, Black, Methacrylate, Type II, per square foot
Pay Item P62032	Painting, Black, Solvent Base, Type II, per square foot
Pay Item P62041	Reflective Media, Type I, Gradation A, per pound
Pay Item P62042	Reflective Media, Type III, per pound
Pay Item P62043	Silica Sand, per pound
Pay Item P62050	Obliterate Existing Marking, per square foot

Measurement and Payment will only be made for Pay Items contained in the Schedule of Prices.

TESTING REQUIREMENTS

ASTM C-146	Chemical Analysis of Glass Sand
ASTM C 371	Wire-Cloth Sieve Analysis of Nonplastic Ceramic Powders
ASTM D 92	Test Method for Flash and Fire Points by Cleveland Open Cup
ASTM D 711	No-Pick-Up Time of Traffic Paint
ASTM D 968	Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D 1652	Test Method for Epoxy Content of Epoxy Resins
ASTM D 207	Test Method for Total Primary, Secondary, and Tertiary Amine Values of Fatty Amines by Alternative Indicator Method
ASTM D 2240	Test Method for Rubber Products-Durometer Hardness
ASTM G 53	Operating Light and Water-Exposure Apparatus (Florescent UV-Condensation Type) for Exposure of Nonmetallic Materials.
Federal Test Method	Paint, Varnish, Lacquer and Related Materials; Methods of Inspection,

SPECIFICATION P-625. RUBBERIZED COAL TAR PITCH EMULSION SEAL COAT

DESCRIPTION

625-1.1 This Work consists of an application of a rubberized coal tar emulsion seal coat, with mineral aggregate, and with the use of a latex rubber applied on an existing, previously prepared bituminous surface, in accordance with these Specifications for the area shown on the Plans or as designated by the Engineer. The material is intended for use as a fuel resistant sealer and to even out small irregularities in the pavement.

MATERIALS

625-2.1 AGGREGATE. The aggregate shall either be a natural or manufactured angular aggregate and shall be composed of clean, hard, durable, uncoated particles, free from lumps of clay and all organic matter. The aggregate shall meet the gradation in Table 1, when tested in accordance with ASTM C 136. When applied to runways and taxiways, provide aggregate with 90 percent angular particles by count.

TABLE 1. GRADATION OF AGGREGATES

<i>Sieve Size</i>	<i>Percentage by Weight Passing Sieves</i>
No. 8 (2.36 mm)	100
No. 16 (1.18 mm)	97 – 100
No. 20 (0.85 mm)	85 – 100
No. 30 (0.60 mm)	15 – 85
No. 40 (0.40 mm)	2 – 15
No. 50 (0.30 mm)	–
No. 100 (0.15 mm)	0 – 2

When applied to aprons, tiedowns, fueling areas, or other low speed operation areas, the gradation shown in Table 1 may be varied to conform with the recommendations of the latex supplier.

625-2.2 BITUMINOUS MATERIALS. The bituminous material shall be a milled coal tar pitch emulsion prepared from a high temperature, coal tar pitch conforming to the requirements of ASTM D 490, grade 11/12. Do not use oil and water gas tar even though they comply with ASTM D 490. The coal tar pitch emulsion shall conform to all requirements of Federal Specification R-P-355 except that the water content shall not exceed 50 percent.

625-2.3 WATER. Use potable water, free from harmful soluble salts, in mixing. The temperature of the water added during mixing shall be at least 50°F (10°C). The pH of the water added during mixing shall conform to the requirements of the coal tar emulsion manufacturer.

625-2.4 LATEX RUBBER. Use copolymer rubber latex containing 51–70 parts butadiene and 30–49 parts acrylonitrile or styrene with a minimum solids content of 40 percent with a particle size less than 80 nanometers and silicones at 4 percent of the rubber content. The rubber shall be compatible with the coal tar pitch emulsion used by the Contractor and must mix homogeneously with the coal tar emulsion, water, and sand in the proportions specified to produce a mixture that will adequately suspend the aggregate during mixing and application.

COMPOSITION AND APPLICATION

625-3.1 COMPOSITION. The rubberized coal tar pitch emulsion seal coat shall consist of a mixture of coal tar pitch emulsion, water, latex rubber, and aggregate in proportions that fall within the ranges shown in Table 2.

625-3.2 JOB MIX FORMULA. Submit the supplier's recommended formulation and application rate to a testing laboratory together with sufficient materials to verify the formulation. The laboratory shall verify the proportions of emulsion, water, aggregate and rubber using the mix design procedures contained at the end of this Specification. The mix design shall be within the range shown in Table 2 and meet the requirements of Table 3. Submit a copy of the mix design and test data to the Engineer for approval at least 14 days prior to the start of operations and include as a minimum:

- a. Water (gal/gal of emulsion)
- b. Aggregate (lbs/gal of emulsion)

- c. Rubber (gal/gal of emulsion)
- d. Viscosity of total liquid
- e. Viscosity of composite mix
- f. pH of water
- g. Mixing sequence of materials
- h. Scuff resistance, freeze-thaw, adhesion, and fuel resistance.

No seal coat shall be produced for payment until a job mix formula has been approved by the Engineer.

Rubberized coal tar emulsion seal coat formulations are sensitive to the characteristics of individual latex additives. Not all products will provide satisfactory seal coat formulations for all combinations of coal tar emulsion, water, aggregate and rubber additive.

Water used in the job mix design should be obtained from the source the Contractor proposes to use in the field.

The job mix formula for each mixture shall be in effect until modified in writing by the Engineer.

NOTE TO SPECIFIER:
Improper formulations of coal-tar pitch emulsion seal produce coatings that crack prematurely or do not adhere properly to the pavement surface.

The mix design procedure may be deleted by Special Provision for State Aid Projects.

TABLE 2. COMPOSITION OF MIXTURE

<i>Type of Seal Coat</i>	<i>Composition and Quantities</i>			
	<i>Water gal./gal. of emul.</i>	<i>Aggregate lbs/ga. of emul.</i>	<i>Rubber gal./gal. of emul.</i>	<i>Application Rate gal./sq.yd. (per application)</i>
Tack	3	–	–	0.05–0.10
Rubberized Sand Slurry	0.80(max)	16–20	0.10-0.14	0.35-0.55
Rubberized Emulsion	0.80(max)	–	0.03–0.05	0.20-0.25

TABLE 3. DESIGN CRITERIA

<i>Test Property</i>	<i>Purpose</i>	<i>Criterion</i>
Brookfield Viscosity posies @ 77°F	Incompatibility between latex and coal tar	10–90
Brookfield Viscosity poises @ 77°F	Workability of composite mix	10–90
Scuff Resistance torque @ 8 hours	Rate of set	>100 in-lbs
Scuff Resistance torque @ 24 hours	Final scuff	>8 hr. torque
Freeze–Thaw @ 5 cycles @ 10 cycles	Cracking	<1 <3
Adhesion	Loss of adhesion	Rating = 5A
Fuel Resistance	Fuel penetration Loss of adhesion	No penetration or loss of adhesion

NOTE TO SPECIFIER:

Table 3 may be deleted if a non–rubberized seal coat is specified. However, rubberized sealer is standard in Wisconsin and is specified throughout this Specification.

625–3.3 APPLICATION RATE. Apply the rubberized coal tar emulsion seal coat in three coats. The first and second coats shall consist of a rubberized sand slurry; the third coat shall consist of a rubberized emulsion. Verify that the application rate submitted with the job mix formula during placement of the test section falls within the limits shown in Table 2.

625–3.4 TEST SECTION. Prior to full production, prepare a quantity of mixture in the proportions shown in the approved mix design. The amount of mixture shall be sufficient to place a test section a minimum of 250 square yards (209 square meters) at the rate specified in the job mix formula. The area to be tested will be designated by the Engineer and will be located on a representative section of the pavement to be sealcoated.

NOTE TO SPECIFIER:

On State Aid Projects, the test section can be eliminated by Special Provision or the entire area to be sealcoated can be considered the same as the test section.

The test section will be used to verify the adequacy of the mix design. The same equipment and method of operations shall be used on the test section as will be used on the remainder of the Work.

Two viscosity tests each will be made on the total liquid and the composite mix. The average viscosity shall be within ± 15 poises of the job mix viscosity determined in the job mix formula. Test results will be available within 2 days.

If the test section should prove to be unsatisfactory, the necessary adjustments to the mix composition, application rate, placement operations, and equipment shall be made. Additional test sections shall be placed and evaluated, if required. Do not begin full production without the Engineer's approval. Acceptable test sections will be paid for in accordance with Paragraph 625–7.1.

NOTE TO SPECIFIER:

The test section affords the Contractor and the Engineer an opportunity to determine the quality of the mixture in place as well as the performance of the equipment.

**If operational conditions preclude placement of a test section
on the pavement to be sealed, it may be applied on a
pavement with similar surface texture.**

CONSTRUCTION METHODS

625-4.1 WEATHER LIMITATIONS. Do not apply the seal coat when the surface is wet or when the humidity or impending weather conditions will not allow proper curing. Apply the seal coat only when the atmospheric or pavement temperature is 50 degrees F (10 degrees C) and rising and is expected to remain above 50 degrees F (10 degrees C) for 24 hours, unless otherwise directed by the Engineer.

625-4.2 EQUIPMENT AND TOOLS. Furnish all equipment, tools, and machinery necessary for the performance of the Work.

a. Distributors. Spray distributors or spray units used for the spray application of the seal coat shall be self-propelled and capable of uniformly applying material over the required width of application at the rate required in Table 2. Equip distributors with removable manhole covers, tachometers, pressure gauges, and volume-measuring devices.

Use a mix tank that is a mechanically powered, full-sweep, mixer with sufficient power to move and homogeneously mix the entire contents of the tank.

Equip the distributor with a positive placement pump so that a constant pressure can be maintained on the mixture to the spray nozzles.

b. Mixing Equipment. Use a mixing machine that has a continuous flow mixing unit capable of accurately delivering a predetermined proportion of aggregate, water, emulsion and rubber and of discharging the thoroughly mixed product on a continuous basis. The mixing unit shall be capable of thoroughly blending all ingredients together and discharging the material to box without segregation.

c. Spreading Equipment. Spreader box and squeegee are not permitted.

d. Calibration. Furnish all equipment and materials and labor necessary to calibrate the equipment. Calibrate it to assure that it will produce and apply a mix that conforms to the job mix design. Provide commercial equipment with a method of calibration by the manufacturer. Make all calibrations with the approved job materials prior to applying the seal coat to the pavement. Furnish a copy of the calibration test results to the Engineer.

625-4.3 PREPARATION OF PAVEMENT SURFACE. Remove bituminous pavement surfaces, which have been softened by petroleum derivatives or have otherwise failed, to the full depth of the damage and replace with new bituminous concrete similar to that of the existing pavement. The Work will be considered Extra Work in accordance with Section 90, unless otherwise provided for in the Contract Documents. Areas of the pavement surface to be treated shall be in a firm consolidated condition. The area shall be sufficiently cured so that there is no concentration of oils on the surface.

A period of 90 days shall elapse between the placement of a bituminous surface course and the application of the seal coat.

NOTE TO SPECIFIER:

The engineer may change the time period by Special Provision. In order to ensure adequate adhesion and minimize cracking and curling, the pavement surface must be sufficiently cured prior to applying the seal coat. Experience in Wisconsin has shown that 30 90 days is sufficient, provided the daytime temperature reaches 70 degrees F.

One means of determining if the pavement cured adequately is to pour a cup of water on the pavement surface and observe if any oils appear in the standing water. If oils appear, the surface is not sufficiently cured to accept a seal coat.

625-4.4 CLEANING EXISTING SURFACE. Prior to placing the seal coat, clean the surface of the pavement and free it from dust, dirt, or other loose foreign matter, grease, oil, or any type of objectionable surface film. When directed by the Engineer, clean the existing surface with wire brushes and a power blower.

Remove vegetation that exists in cracks. Wire brush areas that have been subjected to fuel or oil spillage to remove any dirt accumulations. Then prime the area with shellac or a synthetic resin to prevent the seal coat from debonding.

NOTE TO SPECIFIER:

The Engineer shall specify the appropriate method of treating cracks. Use of the WBOA specification is normal practice for Wisconsin. This includes routing and filling with a compatible crack filler. Include separate Pay Items for maintenance and repair work.

625-4.5 TACK COAT. After the surface has been prepared, apply a tack coat of 3 parts water to 1 part emulsified binder, as specified in Paragraph 625-2.2, at the rate specified in Table 2..

625-4.6 APPLICATION OF RUBBERIZED SAND SLURRY. Apply the rubberized sand slurry at a uniform rate with a spray distributor or spray unit at the rate submitted with the JMF. When the emulsion, water, aggregate, and rubber are blended, premix the material to produce a homogeneous mixture of uniform consistency. The quantities of materials to be combined in each batch must be in accordance with the approved mix design.

Use the same mixing sequence of the various components as is indicated in the job mix formula. After all constituents are in the mixer, continue the mixing for approximately 5 minutes or longer, if necessary. The mixing should produce a smooth, free flowing homogeneous mixture of uniform consistency. Continue slow mixing from the time the emulsion is placed into the mixer until the slurry is applied by distributor truck. During the entire mixing process, breaking, segregating, or hardening of the emulsion, balling, lumping, or swelling of the aggregate is not permitted. Apply the slurry at a uniform rate to provide the quantity determined in the JMF and verified during placement of the test strip.

Follow manufacturer's recommendations regarding spray application. In areas inaccessible to equipment, the slurry may be applied by means of a hand spray unit.

Upon completion of the Work, there should be no pin holes, bare spots, or cracks in the seal coat through which liquids or foreign matter could penetrate to the underlying pavement. The finished surface shall present a uniform texture.

Allow each application to dry thoroughly before the next coat is applied.

625-4.7 CURING. Permit the mixture to dry for a minimum of 24 hours after the final application before opening to traffic and sufficiently cure it to drive over without damage to the seal coat. Repair damage to the uncured mixture at no additional cost.

625-4.8 HANDLING. Continuously agitate the mixture from the initial mixing until its application on the pavement surface. Maintain the distributor or applicator, pumps, and all tools in satisfactory working condition.

QUALITY CONTROL

625-5.1 CONTRACTOR'S CERTIFICATION. Furnish the manufacturer's certification that each consignment of emulsion shipped to the project meets the requirements of Federal Specification R-P-355, except that the water content shall not exceed 50 percent. The certification shall also indicate the solids and ash content of the emulsion and the date the tests were conducted.

Furnish the manufacturer's certification to the Engineer that the latex rubber shipped to the project meets the requirements or the material specified in Paragraph 2.4. The certificate shall also indicate that the latex and coal tar emulsion proposed for use are compatible and that the latex is recommended for combining with the coal tar emulsion, water, and aggregate. Deliver the certifications to the Engineer at least 5 days prior to the beginning of Work. The manufacturer's certification for the emulsion and rubber shall not be interpreted as a basis for final acceptance. Certifications received will be subject to verification by testing samples received for project use.

Furnish a manufacturer's certification that the combination of latex and coal tar emulsion proposed for use has been successfully used in coal tar emulsion seal coat mixtures for a minimum of 3 years. Furnish a certification demonstrating their experience in the application of a rubberized coal tar emulsion seal coat for a minimum of 3 years.

625-5.2 QUALITY CONTROL. When a Pay Item for Independent Consultant Services is included in the Schedule of Prices, have an independent technical consultant on the job site at the beginning of operations for application of rubberized seal coats. The consultant shall have knowledge of the materials, procedures, and equipment described in this Specification and shall assist the Contractor regarding proper mixing of the component materials and application of the seal coat. The consultant shall have a minimum of 3 years experience in the use of rubberized coal tar seal coats. Furnish documentation of this experience to the Engineer prior to the start of operations.

Prior to the start of operations, the independent technical consultant shall perform the viscosity tests in Table 3. The results shall be within ± 15 poises of the job mix viscosity.

NOTE TO SPECIFIER:

Include a Pay Item for Independent Consultant Services in the Schedule of Prices on FAA funded work and on larger projects funded by the WBOA. Independent Consultant Services are not required on smaller WBOA funded projects.

625-5.3 SAMPLING. Two random samples of the composite rubberized mix, from each day's production, will be tested for viscosity to determine conformance with the requirements of the job mix formula viscosity for the composite mix, ± 15 poises. One sample per day may be tested for the other properties of Table 3. In addition, a one-quart sample will be obtained daily and stored in a glass container. The container

will be sealed against contamination and retained in storage by the Department for a period of 6 months. Samples will be stored at room temperature and will not be subjected to freezing temperatures.

A sample of undiluted coal tar emulsion and latex will be sampled from each consignment shipped to the job.

**NOTE TO SPECIFIER:
ENGINEER'S RECORDS. The Engineer should keep an
accurate record of each batch of materials used in the
formulation of the seal coat.**

METHOD OF MEASUREMENT

625-6.1 COAL TAR PITCH EMULSION. Measurement of the Rubberized Coal Tar Pitch Emulsion Seal Coat will be by the square yard in place in accordance with this Specification. A tack coat, two coats of rubberized sand slurry, and a final coat of rubberized emulsion will be applied to each square yard measured for payment. Payment at the Contract unit price will be full compensation for all testing, materials, equipment, and labor necessary to construct the Rubberized Coal Tar Pitch Emulsion Seal Coat as detailed in these Specifications.

625-6.2 INDEPENDENT CONSULTANT SERVICES. Independent Consultant Services will be measured by the day. In order to receive payment for one day, the Consultant is required to spend a minimum of 8 hours on site. Measurement and payment in excess of the Plan quantity will not be made unless ordered in writing by the Department.

BASIS OF PAYMENT

625-7.1 Payment at the Contract unit price will fully compensate the Contractor for furnishing all materials; and for all labor, equipment, tools, and incidentals necessary to complete the Work.

Standard Pay Items for Work covered by this Specification are as follows:

Pay Item P62501	Rubberized Coal Tar Pitch Emulsion Seal Coat, per square yard
Pay Item P62502	Independent Consultant Services, per day

Measurement and Payment will only be made for Items contained in the Schedule of Prices. The cost of all Work required by the Contract Documents shall be included in the Pay Items contained in the Schedule of Prices.

TESTING REQUIREMENTS

ASTM C 136	Standard Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM D 693	Crushed Stone, Crushed Slag, and Crushed Gravel for Dry- or Water-Bound Macadam Base Courses and Bituminous Macadam Base and Surface Courses of Pavements

MATERIAL REQUIREMENTS

Fed. Spec. R-P-355	Pitch, Coal Tar Emulsion (Coating for Bituminous Pavements)
ASTM D 490	Tars, (For Use In Road Construction)

MIX DESIGN PROCEDURE

Specification P-625
MIX DESIGN PROCEDURE Specification P-625
TEST METHODS
CRITERION

This procedure shall be used to determine the capability of the materials furnished by the Contractor to produce a seal coat mix within the range of TABLE 2 and meeting the requirements of TABLE 3.

The formulation is a combination of coal tar pitch emulsion, water, sand, and latex rubber. The samples furnished by the Contractor shall be combined in the proportions recommended by the supplier and subjected to a sequence of six tests designed to eliminate materials or

combination of materials which do not meet the test criteria. Unacceptable materials in the formulation will be eliminated from further consideration.

BROOKFIELD VISCOSITY

Step 1 & Step 2

1. Scope

This method covers the determination of the Brookfield viscosity, using materials and recommended formulations provided by the Contractor. It is designed to detect formulations that have incompatible quantities of latex and coal tar emulsion, that might flocculate, that have viscosities too low to suspend sand, and to identify any incompatibilities created by introducing sand.

2. Definitions

- 2.1 Brookfield viscosity – the viscosity determined by this method. The viscosity is expressed in centipoises (100 centipoises = 1 poise). Its value may vary with the spindle speed (shear rate) due to the non-Newtonian behavior of the coal tar emulsion, additive, and the water added. 2.2 Total liquids – coal tar emulsion, additive, and water. 2.3 Composite system – total liquids and sand.
- 2.2 Total liquids – coal tar emulsion, additive, and water.
- 2.3 Composite system – total liquids and sand.

3. Apparatus

- 3.1 Brookfield digital viscometer (model DV-II) and stand.
- 3.2 Number 1 and 3 HB spindles for DV-II viscometer.
- 3.3 Paint cans
 - 3.3.1 quart capacity.
 - 3.3.2 gallon capacity.

4. Sample Preparation for Step 1 (4.1–4.3) and Step 2(4.1–4.4)

- 4.1 Allow components (coal tar emulsion, water, sand, and additive) to reach 77°F (25°C). This should take approximately 24 hours.
- 4.2 Mix coal tar emulsion and water in container specified in 3.3.2 with 50 strokes of a large laboratory mixing spoon.
- 4.3 Introduce additive to the mixture with an additional 50 strokes of the laboratory mixing spoon. Proceed to Step 1.
- 4.4 Add sand to total liquids with 50 strokes of a large laboratory mixing spoon, for composite mixture. Sand must be added slowly to avoid trapping air in the mixture. Stir composite mixture for 5 minutes and immediately proceed to Step 2.

5. Procedure

Step 1

- 5.1 Fill quart paint can specified in 3.3.1 to within one inch of the top with the material prepared in accordance with 4.1 through 4.3.
- 5.2 Insert spindle No. 3 HB in the material until the mixture level coincides with the immersion groove on the spindle shaft.
- 5.3 Avoid trapping air bubbles underneath the spindle.
- 5.4 Adjust rotational speed on the Brookfield viscometer to 50 revolutions per minute (rpm).
- 5.5 Start motor and record viscosity value in centipoises after 5 seconds of rotation. If the viscosity reading is too low for spindle 3, repeat procedure 5.1 through 5. 5, using spindle No. 1.

Step 2

- 5.6 Repeat 5.1 – 5.5 with the composite mixture prepared in accordance with 4.1 through 4.4.
- 5.7 If the composite mixture does not fall within the acceptance criterion of 10 to 90 poises the following procedure for combining materials shall be used.
 - 5.7.1 Discard materials from Step 1.
 - 5.7.2 Mix coal tar emulsion and water in container specified in 3.3.2 with 50 strokes of a large laboratory mixing spoon.
 - 5.7.3 Add sand to the mixture with 50 strokes of the laboratory mixing spoon.
 - 5.7.4 Introduce additive to the mixture with 50 strokes of the laboratory mixing spoon, for composite mixture. Stir composite mixture for 5 minutes and immediately proceed to Step 1.

6. Report

- 6.1 The report should include:
 - 6.1.1 Date of test and complete identification of the coal tar formulation tested.
 - 6.1.2 Spindle number and rpm setting.
 - 6.1.3 Temperature of the sample tested.
 - 6.1.4 Viscosity of total liquids in poises. (Step 1)
 - 6.1.5 Viscosity of composite system in poises. (Step 2)

Step 1 Criterion: Viscosities between 10 and 90 poises are acceptable

Step 2 Criterion: Viscosities between 10 and 90 poises are acceptable

For materials to move into Step 2 testing the viscosity range must be met in Step 1. Likewise Step 3 will not be continued until viscosity range is met in Step 2 testing. If a material fails to meet testing criteria in any step it will be eliminated from further testing.

SCUFF RESISTANCE TEST

Step 3

1. Scope

This method covers the determination of the initial set and final scuff resistance characteristics of coal tar emulsion seal coat.

2. Definitions

- 2.1 Initial set - torque reading at 8 hours of curing.
- 2.2 Final scuff resistance - torque reading at 24 hours of curing.

3. Apparatus

- 3.1 "Scuff" resistance tester similar to the cohesion tester in ASTM D 3910-80a, but modified as follows:
 - 3.1.1 Proving ring used to measure applied load.
 - 3.1.2 Screw jack used to apply load.
 - 3.1.3 5" x 3/4" ID 1 7/32" OD reinforced rubber hose (two braid, 300 psi, green, oil resistant cover) for use in abrasion head.
- 3.2 Torque wrench with 300 inch pound capacity.
- 3.3 6" x 6" square 16 gauge sheet metal mask with 4" x 4" square center removed.
- 3.4 6" x 6" square aluminum panel.

4. Procedure

- 4.1 Using mask described in 3.3, apply uniform thickness of coal tar emulsion mixture to two panels as described in 3.4.
- 4.2 Allow the sample to cure at 77 degrees F and 50-10 percent relative humidity.
- 4.3 Test the first panel after 8 hours of curing.
- 4.4 Place panel on lower platen and secure with "c" clamps.
- 4.5 Raise platen with screw jack until sample comes in contact with the rubber abrasion head.
- 4.6 Continue raising the platen until a normal load of 28 psi, as measured through the dial gage, is applied to the sample.
- 4.7 Tap platen to ensure proper load is applied to the sample.
- 4.8 Pull the torque wrench through an arc of 180 degrees in 1-2 seconds.
- 4.9 Record torque reading in inch-pounds.
- 4.10 Repeat procedures 4.4 through 4.9 on second sample after 24 hours of curing and record the torque reading in inch-pounds.

5. Report

- 5.1 Report the following information
 - 5.1.1 Date and material tested.
 - 5.1.2 Initial set as the torque reading at 8 hours of curing.
 - 5.1.3 Final scuff resistance as the torque reading at 24 hours of curing.

CYCLIC FREEZE THAW CONDITIONING

Step 4

1. Scope

This method covers the analysis of crack development in a composite rubberized coal tar emulsion seal coat when exposed to multiple cycles of freezing and thawing.

2. Apparatus

- 2.1 12" x 12" square 16 gauge sheet metal mask with an 11" x 11" square center removed.
- 2.2 12" x 12" square section of aluminum panel 3/16" thick.
- 2.3 Oven capable of maintaining 140°F (60°C).
- 2.4 Freezer capable of maintaining 10°F (-12°C).

3. Procedure

- 3.1 Using mask described in 2.1, apply uniform thickness of the composite rubberized coal tar emulsion mixture to a panel as described in 2.2.
- 3.2 Allow material to cure at 77 ±2°F and 50 ±10 percent relative humidity for 24 hours.
- 3.3 Place sample in the 140°F (60°C) oven for 24 hours.
- 3.4 Remove sample and record crack development.
- 3.5 Place sample in 10°F (-12°C) freezer for 24 hours.
- 3.6 Remove from freezer; this constitutes one freeze-thaw cycle.
- 3.7 Repeat procedures 3.3 through 3.6 for a total of 10 cycles.
- 3.8 Inspect the samples after 5 and 10 cycles and rate the cracking in accordance with Table 2 and the following procedure.

- 3.8.1 Using a commercially available thickness gauge, estimate the width of the largest crack appearing on the surface.
- 3.8.2 Next, please a grid frame over the coal tar seal coated shingle (after freeze/thaw conditioning). The grid is a wood frame with an inside diameter of 12x12-inches. A grid is formed across the inside opening of the frame by subdividing the opening into 10 equal divisions both horizontally and vertically with twine anchored to the frame. This will provide 100 equally sized squares.
- 3.8.3 Count the number of squares in which a crack occurs. The percent cracking is equal to the number of squares.
- 3.8.4 Compare the results to Table 1 below:

TABLE 1.

Severity of Cracking	Width of Widest Crack	Percent of Cracking
Hairline	0.010 mm	NA-Cracks are barely visible
Slight Cracking	0.015 mm	<25%
Moderate Cracking	0.020 mm	>25%
Severe Cracking	0.020 mm or greater	>50%

TABLE 2.

0	No cracking
1	Hairline cracking
2	Slight cracking
4	Moderate cracking
5	Severe cracking

4. Report

- 4.1 Report the crack rating at 5 and 10 cycles.

Step 4 Criterion: Rating of 1 or less at 5 cycles is required.

Rating of 3 or less at 10 cycles is required.

Materials not meeting this requirement shall be eliminated from Step 4.

ADHESION

Step 4

1. Scope

This method covers the determination of adhesion of a composite rubberized coal tar emulsion seal coat and retention of sand by applying pressure sensitive tape.

2. Apparatus

- 2.1 12" X 12" square 16 gauge sheet metal with 3" X 6" rectangular center removed.
- 2.2 12" X 12" aluminum panel 3/16" (5 mm) thick.
- 2.3 Razor sharp blade, scalpel, or other cutting device with cutting edge in good condition.
- 2.4 Steel straight edge.
- 2.5 One inch wide semi-transparent pressure sensitive tape with an adhesion strength of 38 + 5 oz./in. when tested in accordance with ASTM D 3330. The backing of the tape may consist of fiber-reinforced cellulose acetate, unplasticized polyvinyl chloride, or polyester film.
- 2.6 Hard, small head rubber eraser.
- 2.7 Table lamp.

3. Procedure

- 3.1 Using the mask described in 2.1, apply a uniform thickness of the composite mixture to the aluminum panel as described in 2.2.
- 3.2 Allow mix to cure at 77 ±2°F at 50 ±10 percent relative humidity for 24 hours.
- 3.3 Select a representative area.
- 3.4 Make a horizontal cut of about 1.5 inches (38 mm). Then make another cut of 1.5 inches (38 mm) about 40 degrees to the horizontal cut. The cuts should intersect each other at their centers. When making the cuts, use the straight edge and cut through the coating to the substrate in on steady motion. Brush off dislodged materials.
- 3.5 Inspect the cuts for reflection of light from the metal substrate to establish that the coating has been cut through completely. If the substrate has not been reached, do not attempt to deepen the cut. Instead, make another "X" in a different location. Remove the dislodged materials by brushing lightly.
- 3.6 Remove two laps of the pressure sensitive tape from the roll and discard. Remove an additional length at a steady rate and cut a piece about 3 inches long.

- 3.7 Place the center of the tape at the intersection of the cuts with the tape running in the same direction as the smaller angles. Smooth out the tape in the area of the cuts and then rub firmly with the eraser.
- 3.8 Wait for 60 seconds, then rapidly pull one end of the tape back on itself with the non-stick surfaces touching and running parallel to each other.
- 3.9 Inspect the "X" cut area for removal of the coating from the substrate and rate the adhesion in accordance with the following scale:
- 5A No Peeling or removal
 - 4A Trace peeling or removal along incisions
 - 3A Jagged removal along incisions up to 1/16 inch (1.6 mm) either side to 1/8 inch (3 mm)
 - 2A Jagged removal along most incisions Up to 1/8 inch (3 mm) on either side
 - 1A Removal from most of the area of the "X" under the tape
 - 0A Removal beyond the area of the "X"
- 3.10 Inspect the tape for adhesion of sand.
- 3.11 Repeat the test in two other locations on the test panel

4. Report

- 4.1 Report the number of tests, their mean value and range.
- 4.2 Report whether sand adhered to the tape as yes or no.

Step 5 Criterion: No sand can adhere to the tape. No debonding of the seal coat or the test medium is allowed (adhesion rating of 5A is required).

Materials not meeting this requirement shall be eliminated from being tested in Step 5.

FUEL RESISTANCE

Step 5

1. Scope

This method determines the resistance of the composite rubberized coal tar emulsion seal coat to kerosene.

2. Apparatus

- 2.1 6 inch X 6 inch square 16 gauge sheet metal masks with a 4 inch by 4 inch square center removed.
- 2.2 6 inch X 6 inch unglazed white ceramic tile with an absorption rate of 10–18 percent (determined in accordance with ASTM C 67).
- 2.3 Brass ring, 2 inch diameter and 2 inches high.
- 2.4 Kerosene meeting requirements of ASTM D 3699.
- 2.5 Silicone rubber sealant.

3. Procedure

- 3.1 Immerse the ceramic tile in distilled water for a minimum of 10 minutes.
- 3.2 Remove excess water from the tile to produce a damp surface before applying the seal coat.
- 3.3 Using the mask described in 2.1 apply one layer of the composite coal tar emulsion mixture to the tile. Spread even with the top of the mask using a spatula or other straight edge.
- 3.4 Allow the sample to cure for 96 hours at $77 \pm 2^\circ\text{F}$ and 50 ± 10 percent relative humidity.
- 3.5 After curing, affix the brass ring to the seal coat on the tile with silicone rubber.
- 3.6 Fill the brass ring with kerosene.
- 3.7 After 24 hours, remove the kerosene from the brass ring, blot dry and immediately examine the film for softness and loss of adhesion. Immediately after the film is examined, break the tile in half, exposing that part of the tile whose film was subjected to the kerosene.
- 3.8 Evaluate for penetration of kerosene through the sealer and loss of adhesion.

4. Report

- 4.1 Report the results as pass or fail. Visible evidence of leakage or discoloration shall constitute failure of the test.

Step 6 Criterion: A "pass" rating in the fuel resistance test is required.

SPECIFICATION P-626. EMULSIFIED ASPHALT SLURRY SEAL SURFACE TREATMENT

DESCRIPTION

626-1.1 This Work consists of a mixture of emulsified asphalt, mineral aggregate, and water, properly proportioned, mixed, and spread evenly on a 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 natural or manufactured sand, slag, crusher fines, crushed stone, or crushed stone and rock dust, or a combination thereof. Wet bottom boiler slag shall constitute 40 to 65 percent by weight of the aggregate mixture. Smooth-textured sand of less than 1.25 percent water absorption, as tested by ASTM C 128, shall not exceed 50 percent of the total combined aggregate. The aggregate shall be clean and free from vegetable matter, dirt, dust, and other deleterious substances. The aggregate blend shall have a sand equivalent of not less than 45 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 9 percent, or the magnesium soundness loss shall not exceed 12 percent after five cycles when tested in accordance with ASTM C 88. Aggregate retained on the No. 50 sieve (300 micro m) shall be 100 percent crushed.

NOTE TO SPECIFIER:
The following FAA requirements were incorporated into the standard specification. The percent loss when tested under ASTM C131 should not exceed 35. The sodium sulfate loss should not exceed 9 percent; the magnesium sulfate loss should not exceed 12 percent. In certain specific cases, where aggregates complying with those maximums cannot be economically obtained, aggregates with a higher percentage loss 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.

TABLE 1. GRADATION OF AGGREGATES

<i>Sieve Size</i>	<i>Percentage by Weight Passing Sieves Type II</i>
3/8 in. (9.5 mm)	100
No. 4 (4.75 mm)	98 – 100
No. 8 (2.36 mm)	75 – 90
No. 16 (1.18 mm)	50–75
No. 30 (600 micro m)	30 – 50
No. 50 (300 micro m)	18 – 35
No. 100 (150 micro m)	10 – 21
No. 200 (75 micro m)	5 – 15
Residual asphalt content Percent dry aggregate	7.5 – 13.5
Pounds of aggregate per square yard	17 ±2

The aggregate, as finally selected, shall have a gradation within the limits designated in Table 1, and should not vary from the low limit on one sieve to the high-limit on the adjacent sieve and vice versa.

NOTE TO SPECIFIER:
The aggregate gradation bands allowed by the FAA are shown in this note. Gradation II was inserted in Table 1 of the Standard Specification.

The Type I gradation is used for maximum crack penetration and is usually used in low density traffic areas where the primary objective is sealing.

The Type II gradation is used to seal and improve skid resistance.

The Type III gradation is used to correct surface conditions and provide skid resistance.

GRADATION OF AGGREGATES

Sieve Size	Percentage by Weight Passing Sieves	
	Type I	Type III
3/8 in. (9.5 mm)	—	100
No. 4 (4.75 mm)	100	70–90
No. 8 (2.36 mm)	90–100	45–70
No. 16 (1.18 mm)	65–90	28–50
No. 30 (600 micro m)	40–60	19–34
No. 50 (300 micro m)	25–42	12–25
No. 100 (150 micro m)	15–30	7–18
No. 200 (75 micro m)	10–20	5–15
Residual asphalt content		
Percent dry aggregate	10–16	6.5–12
Pounds of aggregate per square yard	6–10	15–20
Kilograms of aggregate per square meter	3.2–5.4	8.1–10.8

Take precautions to prevent segregation of the aggregate in storing and handling. Keep the stockpile in areas that drain readily.

Deliver samples of the aggregate to be furnished to the Engineer 14 days prior to beginning construction.

626–2.2 FILLER. If 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 minimum amounts required. Mineral filler shall only be used if needed to improve the workability of the mix or to improve the gradation of the aggregate. The filler shall be considered as part of the blended aggregate.

626–2.3 EMULSIFIED ASPHALT. The emulsified asphalt shall conform to the requirements of ASTM D 2397 for type CSS–1h emulsion.

626–2.4 WATER. Use potable water, free from harmful soluble salts, in making the slurry.

626–2.5 TACK COAT. The tack coat shall be a diluted asphalt emulsion of the same type specified for the slurry mix. The ratio of asphalt emulsion to water shall be 1 to 3 applied by approved pressure distribution. Tack coat all areas to be seal coated.

CONSTRUCTION METHODS

626–3.1 WEATHER LIMITATIONS. The slurry seal shall not be applied if either the pavement or the air temperature is 55°F (13°C) or below or when rain is imminent.

NOTE TO SPECIFIER:
The Engineer should not specify a lower permissible temperature since slurry placed at lower temperatures usually will not cure properly due to poor dehydration and poor asphalt coalescence.

626–3.2 EQUIPMENT AND TOOLS. Maintain all equipment, tools, and machines used in the performance of this Work in satisfactory working order at all times. Submit descriptive information on the slurry mixing and applying equipment to be used to the Engineer for approval not less than 10 days before Work starts.

a. Pressure Distributors. 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.

b. Slurry Mixing Equipment. Use a slurry mixing machine with a continuous flow mixing unit capable of accurately delivering a predetermined proportion of aggregate, water, and asphalt emulsion to the mixing chamber and of discharging the thoroughly mixed product on

a continuous basis. Prewet the aggregate immediately prior to mixing with the emulsion. The mixing unit of the mixing chamber shall be capable of thoroughly blending all ingredients together. Excessive mixing is not permitted. Equip the mixing machine with an approved 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. Use the fines feeder whenever added mineral filler is part of the aggregate blend.

Equip the mixing machine 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.

Provide sufficient machine storage capacity to mix properly and apply a minimum of 5 tons (4,500 kg) of the slurry. Calibrate proportioning devices prior to placing the slurry seal.

c. Slurry Spreading Equipment. Attach to the mixing machine a mechanical-type squeegee distributor equipped with flexible material in contact with the surface to prevent loss of slurry from the distributor. Maintain it to prevent loss of slurry on varying grades and crown by adjustments to assure uniform spread. There shall be a lateral control device and a flexible strike-off capable of being adjusted to lay the slurry at the specified rate of application. The spreader box shall have an adjustable width. Keep the box clean. Built-up asphalt and aggregate on the box is not be permitted. The Engineer will approve the use of burlap drags or other drags.

d. Auxiliary Equipment. Provide other tools or equipment such as brushes, hand squeegees, hose equipment, tank trucks, water distributors and flushers, power blowers, and barricades as required.

626-3.3 EQUIPMENT CALIBRATION. Calibrate each slurry mixing unit to be used on the project 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. Include in the documentation an individual calibration of each material at various settings, which can be related to the machines metering devices. No machine will be allowed to work on the project until the calibration has been completed and/or accepted.

626-3.4 CLEANING EXISTING SURFACE. Prior to placing the tack coat and slurry seal coat, repair unsatisfactory areas and clean the surface of dust, dirt, or other loose foreign matter, grease, oil, or any type of objectionable surface film. Clean the surface with power broom.

Remove loose paint on the surface to be treated before applying the tack coat.

NOTE TO SPECIFIER:

Existing pavement that is irregular or broken should be repaired. Cracks wider than 3/8 inch should be sealed. Repairs to portions of pavement that are in poor condition should be completed and paid under other Contract Pay Items.

Prior to applying Slurry Seal Surface Treatment, route and seal cracks under the Specification for crackfilling asphalt pavement.

626-3.5 APPLICATION OF BITUMINOUS TACK COAT Following the preparation for sealing, apply the diluted emulsion tack coat by means of a pressure distributor in amounts between 0.05 and 0.15 gallon per square yard (0.23 to 0.68 liter per square meter) as directed by the Engineer. Apply the tack coat at least 2 hours before the slurry seal, but within the same day.

626-3.6 COMPOSITION OF SLURRY MIX. Apply 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 submitted in writing by the Contractor to the Engineer at least 10 days prior to the start of operations.

The laboratory report must indicate the proportions of aggregates, mineral filler (minimum and maximum), water (minimum and maximum) and asphalt 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 design mix shall be established before the new material is used.

The percent of aggregate passing each sieve shall not vary more than +/-4.0 percent from the mix design formula. The residual asphalt content shall not vary more than +/-1.0 percent from the mix design quantity.

NOTE TO SPECIFIER:

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 in a wave 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," published by the International Slurry Seal Association contains information to aid designers of slurry mixes.

626–3.7 TEST SECTIONS. Place test sections 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 will be taken and the mix consistency and proportions verified. The rate of application will also be verified. If tests do not meet Specification requirements, additional tests will be made at the Contractor's cost until an acceptable test strip is placed.

626–3.8 APPLICATION OF SLURRY SEAL COAT. Prewet the surface by fogging ahead of the slurry spreader box. Apply water used in prewetting the surface 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. Do not exceed a total mixing time of 5 minutes. Carry a sufficient amount of slurry in all parts of the spreader box at all times so that complete coverage of all surface voids and cracks is obtained. Take care not to overload the spreader box which should be towed at a slow and uniform rate not to exceed 5 miles per hour (8 kilometers per hour). Lumping, balling, or unmixed aggregate is not permitted. No segregation of the emulsion and aggregate fines from the coarse aggregate will be permitted. If the coarse aggregate settles to the bottom of the mix, remove the slurry from the pavement surface. Feed a sufficient amount of slurry in the box to keep a full supply against the full width of the squeegee. Do not allow the mixture to overflow the front sides of the spreader box. No excessive breaking of the emulsion will be allowed in the spreader box. No streaks such as caused by oversized aggregate will be left in the finished pavement.

Lap adjacent lanes at the edges a minimum of 2 inches (50 mm) to provide complete sealing at the overlap. Feather all edges.

After application of the slurry seal, roll the surface with a pneumatic-tired roller a minimum of 4 coverages.

NOTE TO SPECIFIER:

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) of slurry seal.

However, in some instances the somewhat lattice-like structure of the slurry should probably 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, but if desired, it will need to be added by Special Provision since it is not the practice of the WBOA and is not included in the Standard Specification.

Example Special Provision:

“After application of the slurry seal, the surface shall be rolled with a pneumatic-tired roller a minimum of 4 coverages.”

Protect the fresh slurry seal application by barricades and markers and allow it to dry for 4 to 24 hours, depending on weather conditions. Damage to uncured slurry shall be repaired at the Contractor's expense.

In areas where the spreader box cannot be used, apply the slurry by means of a hand squeegee. Fill joints or cracks that are not filled by the slurry mixture by using hand squeegees. Do not allow excessive buildup or unsightly appearance on longitudinal or transverse joints. Upon completion of the Work, the seal coat cannot have holes, bare spots, or cracks through which liquids or foreign matter could penetrate to the underlying pavement. The finished surface must present a uniform and skid resistant texture satisfactory to the Engineer. Remove all wasted and unused material and all debris from the site prior to final acceptance.

NOTE TO SPECIFIER:

The cured slurry shall have a homogeneous appearance, fill all cracks, adhere firmly to the surface, and have skid resistant texture.

626–3.9 EMULSION MATERIAL (CONTRACTOR'S RESPONSIBILITY). Samples of the emulsion that the Contractor proposes to use, together with a statement as to its source, must be submitted, and approval must be obtained before using such material. Furnish the Engineer a manufacturer's certified report for each consignment of the emulsion. The manufacturer's certified report cannot be interpreted as a basis for final acceptance. All these reports may be subject to verification by testing samples of the emulsion as received for use on the project.

METHOD OF MEASUREMENT

626–4.1 Emulsified Asphalt Slurry Seal (including emulsified asphalt tack coat) will be measured by the square yard based on the actual quantity of Work shown on the Plans or ordered by the Engineer.

BASIS OF PAYMENT

626-5.1 Payment will be made at the Contract unit price per square yard for Emulsified Asphalt Slurry Seal Coat. This price will 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 Work. The test strip will be included in the prices for Emulsified Asphalt Slurry Seal Coat.

Standard Pay items for Work covered by this Specification are as follows:

Pay Item P62601	Emulsified Asphalt Slurry Seal Coat, per square yard
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Measurement and payment will only be made for Pay Items included in the Schedule of Prices. The cost of all Work required by the Contract Documents will be included in the Pay Items contained in the Schedule of Prices.

TESTING REQUIREMENTS

ASTM C 88	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 128	Specific Gravity and Absorption of Fine Aggregate
ASTM C 131	Resistance to Abrasion of Small Size Course Aggregate by Use of the Los Angeles Machine
ASTM C 136	Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM D 2419	Sand Equivalent Value of Soils and Fine Aggregate

MATERIAL REQUIREMENTS

The Asphalt Institute Manual MS-6 Table IV-3	Temperature-Volume Corrections for Emulsified Asphalts
ASTM D 242	Mineral Filler for Bituminous Paving Mixtures
ASTM D 977	Emulsified Asphalt
ASTM D 2397	Cationic Emulsified Asphalt

SPECIFICATION P-628. CRACK SEALING ASPHALT PAVEMENT

DESCRIPTION

628-1.1 This Work consists of routing, cleaning, preparing and sealing 1/4 inch (6 mm) wide or wider cracks in existing bituminous pavement. Seal cracks with a petroleum-based crack sealant.

628-1.2 EXPERIENCE. The Department will only allow crack sealing work to be performed by a Contractor (whether a subcontractor or a prime contractor) who has demonstrated the ability to successfully perform crack sealing work. Successful performance is defined as having sealed cracks on runways or taxiways (40,000 S.Y. (33440 m²) total) at one airport in Wisconsin, Minnesota, or upper Michigan utilizing similar methods and materials as required on this project. This crack sealing work must have survived one winter with no more than 10 percent cumulative failure of the sealant during the winter.

MATERIALS

628-2.1 Crack sealing materials shall be a high performance Specification petroleum-based polymeric hot pour sealant. The sealant shall meet the requirements of ASTM D 3405. Submit a sample of sealant material to be used to the Engineer.

Deliver each lot or batch of sealing compound 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, present the manufacturer's certification stating that the compound meets the requirements of this Specification.

CONSTRUCTION METHODS

628-3.1 EQUIPMENT. Furnish all equipment necessary to complete the routing, cleaning, preparing and sealing of cracks in accordance with the requirements specified. Equipment required for this operation include the following:

- a. Mechanical router capable of routing the bituminous pavement to provide a depth to width ratio of all routed cracks of 1.0:1.0.
- b. High pressure air equipment capable of blowing sand and other foreign materials from a crack.
- c. Air chisel or hand tools to remove loose or spalled material adjacent to cracks.
- d. Pressure distributor for applying sealing material through a hand-operated wand or nozzle in accordance with sealant manufacturer's instructions.

628-3.2 CONSTRUCTION. Existing cracks to be sealed will be marked by the Engineer. Route cracks to be sealed to a minimum width of 3/4 inch (19 mm) and a minimum depth of 3/4 inch (19 mm). Where existing cracks have been previously sealed, remove failed sealant to the depth of the route, and overbond.

At locations where water jetting does not remove broken or spalled material adjacent to the crack, use an air chisel or hand tools to remove the material. Remove vegetation from cracks.

Provide a power vacuum or equivalent to immediately remove all debris, including failed sealant, as soon as the cracks are cleaned.

Prior to sealing, dry the cleaned cracks, either by air drying or a high capacity torch. Immediately prior to sealing, blow out the dried crack with compressed air, 80 psi (550 kPa) minimum.

Apply crack sealant as per manufacturer's instructions and as outlined in Specification P-605. Overfill the crack to approximately three times the width of the routed crack and approximately 1/8 inch (3 mm) thick on adjacent pavement surfaces.

In wide cracks, insert closed cell backer rod material, rope, or other pliable fill material approved by the Engineer in the bottom of the crack in order to maintain the 1.0 to 1.0 depth to width ratio of the sealant and to reduce the amount of material used. Install backer rod as necessary to limit the amount of sealing material on average (for the project) to 0.5 lbs. per linear foot (.74 kg/m) of cracks sealed.

At locations where crack sealant settles into the crack opening more than 1/4 inch (9 mm) below adjacent pavement, apply additional material to meet filling Specifications.

Hot Poured Sealants. Apply the joint sealant uniformly from bottom to top and seal it without formation of entrapped air or voids. Place backing material as required above. Use an indirect heating type heating kettle, constructed as a double boiler. Provide a positive temperature

control and mechanical agitation. Do not heat the sealant to more than 20°F (7°C) below the safe heating temperature. The safe heating temperature can be obtained from the manufacturer's shipping container. Provide a direct connecting pressure type extruding device with nozzles shaped for insertion into the joint. Immediately remove sealant spilled on the surface of the pavement.

628-3.3 GUARANTEE OF WORK. Guarantee crack repairs for a period of 2 years following acceptance of the Work. Not more than 5 percent of the footage of cracks shall have material pulled away from the side of the crack; shall have cracks within the material; shall be missing sealant from the crack; or shall allow entrance of water into the crack. If more than 5 percent of the footage of cracks is judged to have failed, repair the failed cracks to the Engineer's satisfaction. If less than 5 percent of the cracks have failed, repairs will not be necessary. The Engineer will determine which cracks have failed.

Return to the project site each of the following two summers and repair sealed cracks that have failed in accordance with the above guarantee. Crack repair shall be done at no additional cost.

METHOD OF MEASUREMENT

628-4.1 METHOD OF MEASUREMENT. Crack Sealing Asphalt Pavement will be measured by the pound of sealant installed and accepted.

BASIS OF PAYMENT

628-5.1 BASIS OF PAYMENT. Crack Sealing Asphalt Pavement will be paid for at the Contract unit price per pound of crack sealant used. The price bid will be full compensation for labor, materials, equipment required to rout cracks, clean and dry, install sealant, and appurtenant Work.

Standard Pay Items for Work covered by this Specification are as follows:

Pay Item P62801	Crack Sealing Asphalt Pavement, per pound.
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Measurement and payment will only be made for Pay Items included in the Schedule of Prices. The cost of all Work required by the Contract Documents will be included in the Pay Items contained in the Schedule of Prices.

MATERIAL REQUIREMENTS

ASTM D 3405	Joint Sealants, Hot-Poured, for Concrete and Asphalt Pavements
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SPECIFICATION P-630. SAW CUTTING BITUMINOUS PAVEMENT

DESCRIPTION

630-1.1 DESCRIPTION. Work under this Specification includes sawing existing bituminous pavement at locations shown on Plans or directed by the Engineer. Make saw cuts to the full depth of the bituminous surface. Remove and dispose of waste material resulting from saw cutting operations.

METHOD OF MEASUREMENT

NOTE TO SPECIFIER:

When saw cutting existing pavement is required, the location should be shown on the Plans and a Pay Item included in the Schedule of Prices.

630-2.1 METHOD OF MEASUREMENT. Saw Cutting Bituminous Pavement will be measured by the linear foot of complete Work. Saw cuts beyond the limits shown on the Plans or directed by the Engineer will not be measured for payment.

BASIS OF PAYMENT

630-3.1 BASIS OF PAYMENT. Saw Cutting Bituminous Pavement, measured as provided above, will be paid for at the Contract unit price per linear foot, which price will be payment in full for all sawcuts and furnishing all labor, tools, equipment, and incidentals necessary to complete the Work.

Standard Pay Items for Work covered by this Specification are as follows:

Pay Item P63001	Saw Cutting Bituminous Pavement, per lineal foot.
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Measurement and payment will only be made for Pay Items included in the Schedule of Prices. The cost of all Work required by the Contract Documents will be included in the Pay Items contained in the Schedule of Prices.

SPECIFICATION P-631. MILLING BITUMINOUS PAVEMENT

DESCRIPTION

631-1.1 DESCRIPTION. This Work consists of removing existing bituminous pavement by milling at the location and to the thickness indicated on the Plans, and includes hauling and disposing of the salvaged material. Milling may be required to construct butt joints, to restore pavement cross slopes, or for other purposes indicated on the Plans.

CONSTRUCTION METHODS

631-2.1 EQUIPMENT. Use a self-propelled milling machine that is especially designed and constructed for milling pavements. Mill without tearing or gouging the underlying surface. The machine shall consist of a cutting drum with carbide or diamond tip teeth. Space the teeth on the drum to mill a uniform surface free of large detrimental scarification marks. Shroud the drum to prevent discharge of loosened material into adjacent Work areas.

Furnish a dust control system. Equip the machine with electronic devices that will provide accurate depth, grade, and slope control.

631-2.2 CONSTRUCTION. Perform the milling operation in a manner to preclude damage to the remaining pavement intended to remain in place, which should result in a reasonably uniform plane surface, free of excessively large scarification marks, having a uniform transverse slope. Milling locations are shown on the Plans.

METHOD OF MEASUREMENT

631-3.1 METHOD OF MEASUREMENT. This Pay Item will be measured by area in square yards. The quantity to be measured for payment will be the area of pavement removed in accordance with the Plans.

BASIS OF PAYMENT

631-4.1 BASIS OF PAYMENT. Milling Bituminous Pavement, measured as provided herein, will be paid for at the Contract unit price per square yard, which price will be full compensation for milling, hauling, and disposing of milled bituminous pavement, and for furnishing all labor, equipment, tools, and incidentals necessary to complete the Work.

Standard Pay Items for the Work covered by this Specification are as follows:

Pay Item P63101	Milling Bituminous Pavement, per square yard.
Pay Item P63102	Milling Bituminous Pavement, Butt Joints, per square yard.

Measurement and Payment will only be made for Pay Items included in the Schedule of Prices. The cost of all Work required by the Contract Documents will be included in the Pay Items contained in the Schedule of Prices.

SPECIFICATION P-632. CONSTRUCTION FIELD FACILITIES

DESCRIPTION

632-1.1 DESCRIPTION. This Work consists of furnishing, placing or erecting, equipping, and maintaining field offices and field laboratories during the life of the Contract.

Furnish a field office when required by the Contract. The field office shall be of the type designated in the Contract.

Furnish a field laboratory when required by the Contract.

The Engineer will have sole use of the field facilities, and upon completion of the Contract the field facilities shall remain the property of the Contractor.

MATERIALS

632-2.1 GENERAL. Field offices and laboratories shall consist of mobile, house-type trailers or houses or other approved types that are floored, roofed and weatherproofed with a minimum ceiling height of 6 feet 9 inches. Equip them with suitable artificial lighting and adequate heating equipment with the necessary fuel to maintain a minimum temperature of 68°F (20°C) during the hours of occupancy. Maintain an adequate supply of potable water.

Provide and maintain suitable interior or exterior sanitary facilities meeting State and local health requirements in clean and good working condition and stocked with sanitary supplies at all times during the life of the Contract.

Provide a first aid kit in each field office and field laboratory provided under the Contract. The kits shall be readily accessible to project personnel. Check the contents of each kit at least once each week and replenish expended items. Each kit shall contain, at a minimum, a supply of latex or nitrile gloves, CPR masks, adhesive tape, pressure and cling bandages, antiseptic wipes, bite/sting swabs, cold packs, and safety goggles.

In situations where the eyes or body of a worker may be exposed to corrosive or potentially harmful materials, provide emergency use facilities capable of flushing the eyes or drenching the body of an exposed worker with water for 15 minutes.

632-2.2 FIELD OFFICE. Provide the field office with two telephones and two exchange services at no cost to the Department. One telephone must include a suitable answering device. The Department staff will have sole use of the telephone. The cost of toll service incurred by the Department staff is not the responsibility of the Contractor.

Air Condition all field offices.

Equip the outside doors of field offices with heavy duty hasps bolted through the door and jamb and with heavy duty padlocks.

Securely fasten heavy screening over all windows. The screening shall be No. 2 mesh, 14 gauge or heavier steel wire cloth galvanized after weaving.

Field Office, Type A, shall have minimum exterior dimensions of 8 feet (2.4 m) in width and 12 feet (3.7 m) in length, excluding hitch, and shall be equipped with the following: Minimum electrical service of 60 amperes and 120 volts AC, one air conditioner, at least two windows with provision for cross-ventilation and equipped with adequate locks and screens, an outside door with an adequate lock and screen, a suitable work table, an office chair, a drafter's stool and a 6 pound or larger fire extinguisher meeting the requirements for Classes A, B, and C of the National Fire Protection Association (NFPA) Code.

Field Office, Type B, shall have minimum exterior dimensions of 8 feet (2.4 m) in width and 20 feet (6.1 m) in length, excluding hitch, and shall be equipped with the following: Minimum electrical service of 60 amperes and 120 volts AC, two rooms, an interior door and padlock, at least four windows with provision for cross-ventilation and equipped with adequate locks and screens, at least one outside door with required lock and screen, one suitable drafting table, two suitable office desks with drawers and locks, two office chairs, one drafter's stool and a 6 pound or larger fire extinguisher meeting the requirements for Classes A, B, and C of the NFPA Code.

Field Office, Type C, shall have minimum exterior dimensions of 10 feet (3.0 m) in width and 30 feet (9.1 m) in length, excluding hitch, and shall be equipped with the following: Minimum electrical service of 100 amperes and 120 volts AC, two rooms each with an air conditioner and an exterior door with required lock and screen, an interior door with padlock, at least four windows with provision for cross-ventilation and equipped with adequate locks and screens, one suitable drafting table, two suitable office desks with drawers and locks, two office chairs, one drafter's stool and a 6 pound or larger fire extinguisher meeting the requirements for Classes A, B and C of the NFPA Code.

632-2.3 FIELD LABORATORY. The Field Laboratory shall have minimum interior dimensions of 8 feet (2.4 m) in width and 16 feet (4.9 m) in length, excluding hitch, and shall be equipped with the following: At least four windows with provision for cross ventilation and equipped with required locks and screens, an outside door with required lock and screen, a suitable work bench, a minimum of 15 linear feet (4.6 m) of shelving approximately 14 inches (360 mm) wide, an adequate water supply for testing purposes, and a 6 pound or larger fire extinguisher meeting the requirements for Class A, B and C of the NFPA code.

Equip the outside doors of field laboratories with heavy duty hasps bolted through the door and jamb and with heavy duty padlocks.

Fasten securely heavy screening over all windows. The screening shall be No. 2 mesh, 14 gage or heavier steel wire cloth galvanized after weaving.

Equip the laboratory with a suitable fan having a minimum capacity of 1,000 cubic feet (28.3 m³) per minute, in good working condition. The fan should be installed in an outside wall above the work bench used for asphaltic extraction testing. Enclose the fan inlet and work bench top in a suitable hood or enclosure that will permit effective exhaustion by the fan of the fumes from the extraction testing.

CONSTRUCTION METHODS

632-3.1 CONSTRUCTION METHODS. Do not combine field offices and field laboratories, together or attach them to any buildings used by the Contractor, unless permitted by the Engineer in writing. Anchor or secure field offices and field laboratories to preclude overturning caused by high velocity winds. Locate the field office in a dust-reduced and vibration-free environment.

Do not start construction operations until the required field office and laboratory are furnished, leveled, secured, and made ready for use at locations directed by the Engineer.

The Contractor may elect, when permitted by the Contract, to furnish field office and field laboratory facilities jointly in cooperation with other contractors on designated projects.

Upon completion of the Contract, remove construction field facilities and restore the site to the condition that existed prior to Construction.

METHOD OF MEASUREMENT

632-4.1 FIELD OFFICE. Field Office of the type designated will be measured for payment as a single complete unit of work, per lump sum furnished, equipped and satisfactorily maintained.

632-4.2 FIELD LABORATORY. Field Laboratory will be measured for payment as a single complete unit of work per lump sum furnished, equipped and satisfactorily maintained.

BASIS OF PAYMENT

632-5.1 BASIS OF PAYMENT. These Pay Items, measured as provided above, will be paid for at the Contract lump sum price for Field Office or Field Laboratory, which price will be payment in full for furnishing, equipping, securing and maintaining the facility; for furnishing utilities, fuel, ventilation and toilet facilities as required, equipment, telephone and telephone exchange service for the life of the Contract; and for removing the facility and restoring the site. The cost of telephone toll service incurred by the Engineer will not be chargeable to the Contractor.

Standard Pay Items for Work covered by this Specification are as follows:

Pay Item P63201	Field Office, Type A, per lump sum.
Pay Item P63202	Field Office, Type B, per lump sum.
Pay Item P63203	Field Office, Type C, per lump sum.
Pay Item P63204	Field Laboratory, per lump sum.

Measurement and Payment will only be made for Pay Items included in the Schedule of Prices. The cost of all Work required by the Contract Documents shall be included in the Pay Items contained in the Schedule of Prices.

SPECIFICATION P-634. TRAFFIC CONTROL

DESCRIPTION

634-1.1 DESCRIPTION. This Work consists of furnishing, erecting, maintaining and removing traffic signs, drums, barricades, lights and signals, and shall include flagging and guidance of traffic as required for the Contractor to conduct construction operations. Do this Work in accordance with requirements shown on the Construction Operations Sheet and the latest revision of Part VI, Traffic Controls for Construction and Maintenance Operations of the Wisconsin Manual of Traffic Control Devices. Do not use sign sizes smaller than the standard sizes described in the manual.

NOTE TO SPECIFIER:

The WBOA provisions for operations on the Airport, the requirements of AC 150/5370-3C, and project phasing should be coordinated with this Specification and the Construction Operations Sheet contained in the Plans. A scope of the Work required under the Pay Item for Traffic Control should be included on the Construction Operations Sheet or in the Special Provisions.

MATERIALS

634-2.1 GENERAL. Materials used in the Work shall conform to the requirements specified in the Manual of Traffic Control Devices and the following:

Traffic Control shall be in accordance with the FHWA's Manual of Standard Highway Signs and the Construction Operations Sheet.

The materials and methods of manufacture and assembly of all signs shall be in accordance with the requirements for Type II Signs as specified in Section 637 of the State of Wisconsin, Department of Transportation Standard Specifications for Road and Bridge Construction (State Highway Specifications), except that a good exterior Grade A-B plywood with a 1/2 inch minimum thickness will be acceptable as a sign base alternate and the sign face colors shall include the color orange described in the Manual of Traffic Control Devices.

The sign face material for signs R1-1 (STOP), R1-2 (YIELD), R5-1 (DO NOT ENTER), and R5-1a (or R5-9) (WRONG WAY) shall conform to the requirements of Subsection 637.2.2.2 of the State Highway Specifications, Type H Reflective Sheeting. All other sign face material shall conform to the requirements of Subsection 637.2.2.1 of the State Highway Specifications, Standard Reflective Sheeting, unless otherwise provided.

Keep retroreflective sheeting on signs, drums, barricades, and other devices clean. Promptly correct scratches, rips, and tears in the sheeting.

Maintain the retroreflectance of all orange signs and all drums, posts and barricades at a level not less than 75 percent of the minimum value required in Subsection 637.2.2.1 of the State Highway Specifications for Standard Reflective Sheeting and not less than 50 percent of the minimum value required in Subsection 637.2.2.2 of the State Highway Specifications for Type H Reflective Sheeting.

634-2.2 DRUMS. Make drums for traffic control of nonmetallic material. Fabricate each drum to accept, and equip with a Type C Steady Burn or Type A Low Intensity Flashing Warning Light securely attached to the drum. Weight each drum sufficiently with sand bags or other approved material to keep the drum in its intended location.

The material used for reflectorization shall conform to the requirements of Subsection 637.2.2.2 of the State Highway Specifications, Type H Reflective Sheeting and shall be suitable for use on reboundable traffic control devices.

634-2.3 BARRICADES. The reflective sheeting for all barricades shall conform to the requirements of Subsection 637.2.2.2 of the State Highway Specifications, Type H reflective sheeting, designed specifically for use on rigid traffic control devices.

634-2.4 HAND SIGNALING DEVICES. Use a sign paddle as the primary hand-signaling device. Limit flag use to emergency situations.

CONSTRUCTION METHODS

634-3.1 GENERAL. Review all traffic signs and control devices furnished for location, position, visibility, adequacy and manner of use under specific job conditions at least once every 24 hours and more frequently as necessary to assure that all such signs and control devices are continuously in compliance with the requirements of this Section.

Provide equipment, forces and materials to promptly restore traffic control devices that are damaged or disturbed. The cost of maintaining and restoring these devices shall be considered incidental and no additional or separate payment will be made.

All traffic control devices are the property of the Contractor upon completion of the Work.

Show the name and telephone number of the agency, Contractor, supplier or person responsible for 24-hour emergency service on the back face of each sign, a rail of each barricade and on each drum in letters at least 3/4 inch (19 mm) in height.

When the Plans or Special Provisions contain specific sign details, sequence of erection or special instructions for handling traffic, do the Work accordingly, unless otherwise directed by the Engineer.

Properly place and have in operation signs and control devices before construction Work affected by such signs or devices can begin. When Work is phased, perform necessary relocation of signs as required.

634-3.2 SIGNS. When the sign message is not pertinent, promptly remove the sign or completely cover the sign face so the reflectivity of the sign face is not evident.

634-3.3 WARNING LIGHTS.

Type B. Mount each Type B light installed in conjunction with a warning sign on the back of the sign. Position the light so the lens is outside the edge of the sign, to the traffic side of the sign and between the midpoint and the top of the sign. Use a one-way or lens-directed light to be visible only to traffic approaching the message side of the sign, unless otherwise ordered by the Engineer.

Types A and C. Mount each Type A (flashing) light installed in conjunction with a warning sign on the back of the sign. Position the light so the lens is outside the edge of the sign, to the traffic side of the sign and between the midpoint and the top of the sign. The light shall be one-way or lens-directed to be visible only to traffic approaching the message side of the sign, unless otherwise ordered by the Engineer.

634-3.4 RUNWAY AND TAXIWAY CLOSED CROSSES. Provide temporary runway and taxiway closed crosses in accordance with the Construction Operations Sheet and detail shown on the Plans. Coordinate temporary runway and taxiway closings with the Airport Manager and place, maintain, remove, and replace as required to construct the Work.

METHOD OF MEASUREMENT

634-4.1 TRAFFIC CONTROL. Traffic Control will be measured as a single complete unit of Work per lump sum, acceptably performed.

BASIS OF PAYMENT

634-5.1 BASIS OF PAYMENT. Traffic Control, measured as provided above, will be paid for at the Contract lump sum price for Traffic Control, which price will be full compensation for constructing, assembling, painting, hauling, erecting, re-erecting, maintaining and removing traffic signs, drums, barricades and similar control devices; for furnishing, placing and maintaining lights and signals; for supplying and performing all flagging and guidance services; and for all labor, tools, equipment, services and incidentals necessary to complete the Work.

Standard Pay Items for Work covered by this Specification are as follows:

Pay Item P63401	Traffic Control, per lump sum
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Measurement and Payment will only be made for Pay Items included in the Schedule of Prices. The cost of all Work required by the Contract Documents will be included in the Pay Items contained in the Schedule of Prices.

SPECIFICATION P-635. GEOTEXTILE FABRICS

DESCRIPTION

635-1.1 DESCRIPTION. This Work consists of furnishing and installing geotextile fabrics for subgrade separation and stabilization, drainage filtration, subgrade reinforcement, and under culverts and riprap in accordance with the Contract Documents.

MATERIALS

635-2.1 GENERAL. The geotextile fabric shall consist of either woven or nonwoven polyester, polypropylene, stabilized nylon, polyethylene or polyvinylidene chloride. All fabric shall have the minimum strength values in the weakest principle direction. Nonwoven fabric may be needle punched, heat bonded, resin bonded, or combinations thereof.

The geotextile fabric shall be insect, rodent, mildew, and rot resistant.

Furnish the geotextile fabric in a wrapping that will protect the fabric from ultraviolet radiation and from abrasion due to shipping and hauling. The geotextile is to be kept dry until installed.

Clearly mark the geotextile fabric rolls showing the type of fabric.

Samples of fabric for testing may be obtained from the job site as specified herein or as determined by the Engineer.

If sewn seams are used, furnish a field sewn seam sample produced from the geotextile fabric and thread and with the equipment to be used on the project, prior to its incorporation into the Work.

Minimum values when not specified herein shall be as specified in the Special Provisions.

In the following tables, numerical values (1) represent minimum/maximum average roll values (i.e., the average of minimum test results on rolls in a lot should meet or exceed the minimum specified values).

635-2.2 GEOTEXTILE FABRIC, TYPE SAS (Subgrade Aggregate Separation). The fabric shall comply with the following physical properties

TABLE 1. GEOTEXTILE FABRIC, TYPE SAS

<i>Test</i>	<i>Method</i>	<i>Value₍₁₎</i>
Grab Tensile Strength, N	ASTM D-4632	750 minimum
Puncture Strength, N	ASTM D 4833	300 minimum
Apparent Opening Size, μm (U.S. Standard Sieve)	ASTM D 4751	212 maximum
Permittivity, S-1	ASTM D 4491	0.35 minimum

For quantities over 20,000 square yards (17,000 m²), furnish to the Engineer at least 10 days prior to use in the Work a manufacturer's Certified Report of Test or Analysis that the geotextile fabric delivered for use in the Work meets the above requirements. The delivered geotextile fabric shall bear markings to clearly identify it with the applicable test report furnished to the Engineer. Samples of fabric for testing will be obtained from the job site for each 20,000 square yards (17,000 m²) or portion thereof used in the Work.

635-2.3 GEOTEXTILE FABRIC, TYPE MS (Marsh Stabilization). The following test methods will be used to confirm the values shown in the Special Provisions or shown on the Plans.

TABLE 2. GEOTEXTILE FABRIC, TYPE MS

<i>Test</i>	<i>Method</i>	<i>Value₍₁₎</i>
Tensile Strength (N/m) machine direction	ASTM D 4595	___ minimum
Tensile Strength (N/m) cross direction	ASTM D 4595	___ minimum
Elongation at Required Strength (%)	ASTM D 4595	___ maximum
Puncture, (N)	ASTM D 4833	___ minimum
Apparent Opening Size, μm	ASTM D 4751	___ maximum
Permittivity, S-1	ASTM D 4491	___ minimum

Deliver to the Engineer a sample of the geotextile material at least 15 days prior to its incorporation into the Work. At the same time, also furnish a sewn seam sample using the same geotextile fabric, thread, seam spacing and number, and overlap distance as are intended or required for use in the Work.

Furnish to the Engineer at least 15 days prior to use in the Work a Manufacturer's Certified Report of Test or Analysis that the geotextile fabric delivered for use in the Work meets the above requirements. The delivered geotextile fabric shall bear markings to clearly identify it with the applicable test report furnished to the Engineer. Samples of fabric for testing will be obtained from the job site for each 10,000 square yards (8500 m²) or portion thereof used on the Contract.

635-2.4 GEOTEXTILE FABRIC, TYPE DF (Drainage Filtration). The fabric shall comply with the physical requirements of Table 3A unless Table 3B (Schedule B) is indicated on the Plans or in the Special Provisions.

TABLE 3A. GEOTEXTILE FABRIC, TYPE DF, SCHEDULE A

<i>Test</i>	<i>Method</i>	<i>Value₍₁₎</i>
Grab Tensile Strength, N	ASTM D 4632	500 minimum
Puncture Strength, N	ASTM D 4833	200 minimum
Apparent Breaking Elongation (%)	ASTM D 4632	30 minimum
Apparent Opening Size, μm	ASTM D 4751	300 maximum
Permittivity, S-1	ASTM D 4491	0.72 minimum

TABLE 3B. GEOTEXTILE FABRIC, TYPE DF, SCHEDULE B

<i>Test</i>	<i>Method</i>	<i>Value₍₁₎</i>
Grab Tensile Strength, N	ASTM D 4632	800 minimum
Puncture Strength, N	ASTM D 4833	300 minimum
Apparent Breaking Elongation (%)	ASTM D 4632	30 minimum
Apparent Opening Size, μm	ASTM D 4751	300 maximum
Permittivity, S-1	ASTM D 4491	1.35 minimum

Slit film woven fabric shall not be used for this Work.

For quantities over 2,000 square yards (1700 m²), furnish to the Engineer at least 10 days prior to use in the Work a manufacturer's Certified Report of Test or Analysis that the geotextile fabric delivered for use in the Work meets the above requirements. The delivered geotextile fabric shall bear markings to clearly identify it with the applicable test report furnished to the Engineer. Samples of fabric for testing will be obtained from the job site for each 2,000 square yards (1700 m²) or portion thereof used in the Work.

635-2.5 GEOTEXTILE FABRIC, TYPE SR (Subgrade Reinforcement). The following test methods will be used to confirm the values shown in the Special Provisions or shown on the Plans.

TABLE 4. GEOTEXTILE FABRIC, TYPE SR

<i>Test</i>	<i>Method</i>	<i>Value₍₁₎</i>
Tensile Strength, N/m	ASTM D 4595	minimum
Puncture Strength, N	ASTM D 4833	minimum
Elongation at Required Strength (%)	ASTM D 4595	maximum
Apparent Opening Size, μm	ASTM D 4751	maximum
Permittivity, S-1	ASTM D 4491	minimum

For quantities over 10,000 square yards (8500 m²), furnish to the Engineer at least 10 days prior to use in the Work a Manufacturer's Certified Report of Test or Analysis that the geotextile fabric delivered for use in the Work meets the above requirements. The delivered geotextile fabric shall bear markings to clearly identify it with the applicable test report furnished to the Engineer. Samples of fabric for testing will be obtained from the job site for each 10,000 square yards (8500 m²) or portion thereof used on this Contract.

635-2.6 GEOTEXTILE FABRIC, TYPE R (Riprap). The fabric shall comply with the following physical properties:

TABLE 5. GEOTEXTILE FABRIC, TYPE R

<i>Test</i>	<i>Method</i>	<i>Value₍₁₎</i>
Grab Tensile Strength, N	ASTM D 4632	900 minimum
Puncture Strength, N	ASTM D 4833	350 minimum
Apparent Breaking Elongation (%)	ASTM D 4632	20 minimum
Apparent Opening Size, μm	ASTM D 4751	600 maximum
Permittivity, S-1	ASTM D 4491	0.12 minimum

635-2.7 GEOTEXTILE FABRIC, TYPE HR (Heavy Riprap). The fabric shall comply with the following physical properties:

TABLE 6. GEOTEXTILE FABRIC, TYPE HR

<i>Test</i>	<i>Method</i>	<i>Value₍₁₎</i>
Grab Tensile Strength, N	ASTM D 4632	1350 minimum
Puncture Strength, N	ASTM D 4833	450 minimum
Apparent Breaking Elongation (%)	ASTM D 4632	20 minimum
Apparent Opening Size, μm	ASTM D 4751	600 maximum
Permittivity, S-1	ASTM D 4491	0.40 minimum

635-2.8 GEOTEXTILE FABRIC, TYPE C (Modified SAS). The fabric shall comply with the following physical properties:

TABLE 7. GEOTEXTILE FABRIC, TYPE C

<i>Test</i>	<i>Method</i>	<i>Value₍₁₎</i>
Grab Tensile Strength, N	ASTM D 4632	900 minimum
Puncture Strength, N	ASTM D 4833	300 minimum
Apparent Opening Size, μm	ASTM D 4751	300 maximum
Permittivity, S-1	ASTM D 4491	0.12 minimum

635-2.9 GEOTEXTILE FABRIC, TYPE ES (Embankment Stabilization). The following test methods shall be used to confirm the values required in the Contract Document..

TABLE 8. GEOTEXTILE FABRIC, TYPE ES

<i>Test</i>	<i>Method</i>	<i>Value₍₁₎</i>
Tensile Strength, N/m Machine Direction	ASTM D 4595	___ minimum
Tensile Strength, N/m Cross Direction	ASTM D 4595	___ minimum
Elongation at Required Strength, Percent	ASTM D 4595	___ maximum
Apparent Opening Size, μm	ASTM D 4751	___ maximum
Permittivity, S-1	ASTM D 4491	___ minimum

Deliver to the Engineer a sample of the geotextile material at least 15 days prior to its incorporation into the Work. At the same time, also furnish a sewn seam sample using the same geotextile fabric, thread, seam spacing and number, and overlap distance as are intended or required for use in the Work.

Furnish to the Engineer at least 15 days prior to use in the Work a manufacturer’s Certified Report of Test or Analysis that the geotextile fabric delivered for use in the Work meets the above requirements. The delivered geotextile fabric shall bear markings to clearly identify it with the applicable test report furnished to the Engineer. Samples of fabric for testing will be obtained from the job site for each 10,000 m² or portion thereof used on the Contract.

CONSTRUCTION METHODS

635-3.1 SEWING. Sew all factory and field seams with a thread having the same or greater durability as the material in the fabric. Use a 401 stitch conforming to Federal Standard No. 751a for all seams. All seams should develop a tensile strength equal to or greater than 60 percent of the specified grab tensile strength of the fabric, unless otherwise specified.

635-3.2 GEOTEXTILE FABRIC, TYPE SAS. Smooth, shape, and compact the subgrade to the required grade, section, and density prior to the placement of the geotextile fabric. After the fabric has been placed on the subgrade area, no traffic or construction equipment will be permitted to travel directly on the fabric.

Roll out the fabric on the subgrade and pull taut manually to remove wrinkles. Join separate pieces of fabric by overlapping or sewing. Place the fabric in the overlapped joints with a minimum overlap of 18 inches (460 mm).

Weight or pins may be required to prevent lifting of the fabric by wind.

After placement, expose the fabric no longer than 48 hours prior to covering.

Place the base course material over the fabric by back dumping with trucks and leveling with a crawler dozer. Construction equipment shall be such that ruts do not exceed 3 inches in depth. Fill all ruts with additional material. The smoothing of ruts without adding additional material will not be permitted. Cover damaged areas with a patch of fabric using a 3 foot (0.9 m) overlap in all directions.

635-3.3 GEOTEXTILE FABRIC, TYPE MS. Complete clearing operations prior to placement of the fabric. Within the area to be covered by fabric, cut off level with the ground surface all stumps and sharp objects. Do not remove sod, grass, and roots that extend beneath the ground surface. Carefully place the geotextile fabric on the existing ground using hand methods to avoid disturbing the existing root mat and vegetation. Roll out the fabric as smoothly as possible and pull taut manually to remove wrinkles. Weight or pins may be required to prevent lifting of the fabric by wind. After placement, expose the fabric no longer than 48 hours prior to covering. If defects are observed, replace the section of the fabric containing the defect with a new section of fabric containing no defects.

Place the geotextile fabric with the machine direction of fabric perpendicular to the centerline alignment. Sew all seams with a minimum lap of 3 inches (75 mm) using two parallel stitch lines. The parallel stitching should be spaced no more than 1 inch apart. Orient all seams perpendicular to the centerline alignment and shall be placed facing upward. The seams shall develop at least 80 percent of the specified cross direction tensile strength of the fabric, as determined by the same testing methods. No butt splices between individual roll ends will be allowed. Do not cross stitch lines. Repair all breaks or faults in any seam as directed by the Engineer.

Carefully bend, dump, and push on to the fabric, the initial fill layer to a nominal 2-foot depth (610 mm) depth. Construction equipment will be such that ruts do not exceed 3 inches (75 mm) in depth and excessive deformation of the marsh surface does not occur. Do not allow vehicles to drive on the fabric. Complete the initial 2 foot (610 mm) lift and install all instrumentation before any additional material is placed. After the initial 2 foot (610 mm) lift, all subsequent lifts shall be of a nominal 1 foot (305 mm) depth. Do not start a lift until the preceding lift is completed and approval of the Engineer is obtained. Conduct spreading operations so that damage to the fabric does not occur. Unless otherwise directed by the Engineer, place and spread lifts by expanding outward from the center line of the fill. If the fabric is damaged during fill placement, remove the fill material around the damaged area and cover that area with a patch of fabric having a 3 foot (0.9 m) overlap in all directions.

635-3.4 GEOTEXTILE FABRIC, TYPE DF. Before placement of the geotextile fabric in trench drains, bring the trench to the grades and dimensions shown on the Plans. Remove protruding stones and other items that may damage the geotextile fabric from the trench walls and base prior to placement of the fabric. Place the geotextile fabric in the trench in such a manner as to conform to the trench walls and remain in proper position during drain construction and backfilling. Separate pieces of fabric may be joined by overlapping or sewing. Place the fabric in overlap joints with a minimum overlap of 1.5 feet (450 mm) in the direction of drain flow. Correct misaligned fabric. Damaged fabric areas shall be treated as directed by the Engineer, by either:

a. Placing an additional section of fabric extending at least 2.0 feet (600 mm) beyond any point of the damaged area and positioned between the trench walls and the damaged fabric; or

b. Removing the section of fabric containing the damaged area and replacing it with a new section of fabric. After placement, the fabric shall remain exposed no longer than 48 hours prior to covering.

For applications other than trench drains, bring to the grades and dimension shown on the Plan the surface upon which the fabric is to be located. Prepare the application surface by removing or covering all objects that may damage the fabric. Carefully place the fabric to prevent damage and secure it in position. Conduct backfilling or covering operations in such a manner so as to prevent damage or misalignment of the fabric. Treat damage or misalignment of the fabric as described previously in this Subsection. After placement, expose the fabric no longer than 48 hours prior to covering or backfilling.

635-3.5 GEOTEXTILE FABRIC, TYPE SR. Prior to placement of the fabric, smooth and shape the earth grade to the required grade and section, and when required, compact it to the specified density. After the fabric has been placed on the earth grade, no traffic or construction equipment will be permitted to travel directly on the fabric.

Roll the fabric out on the earth and pull it taut manually to remove wrinkles. Join parallel strips of fabric by overlapping or sewing. Sewn seams shall comply with the requirements of Subsection 635-3.1, but shall develop a tensile strength equal to or greater than 60 percent of the specified directional tensile strength of the fabric. Place the fabric in the overlapped joints with a minimum overlap of 24 inches (610 mm).

Lapp butt splices between fabric rolls a minimum of 36 inches (0.9 m). After the fabric has been placed on the prepared surface, make provisions to prevent the fabric from being lifted or moved by the wind.

Cover tears, holes, or rips in the fabric with a patch of fabric overlapping the defect 3 feet (0.9 m) in all directions.

Cover all fabric within 72 hours of the time of placement.

Place the backfill material with an initial lift of 12 inches (305 mm). Do not exceed 12 inches (305 mm) in thickness for subsequent lifts. Spread each lift with a crawler type tractor and compact it with suitable compaction equipment. Do not exceed 4 inches for the maximum wheel or tread rut depth caused by the operation of construction equipment on backfill lifts. No turning movements for hauling or spreading equipment will be allowed over the fabric until at least two lifts of backfill with a minimum total depth of 18 inches (460 mm) have been placed and compacted. Subsequent lifts may not be started until at least 1,000 feet (305 m) of the previous lift has been spread and compacted. A 1,000 foot (305 m) interval shall be maintained between subsequent lifts until each lift is completed. If ruts greater than 4 inches (100 mm) develop during construction operations, the Engineer reserves the right to require the Contractor to use lighter equipment, equipment with lower contact pressure, or smaller loads on existing equipment.

Fill all ruts in the surface of each lift of backfill with additional material. Smoothing of ruts without adding additional backfill will not be permitted.

635-3.6 GEOTEXTILE FABRIC, TYPE R. Grade the area smooth and remove all stones, roots, sticks, or other foreign material that would interfere with the fabric being completely in contact with the soil prior to placing the fabric.

Place the fabric loosely and lay it parallel to the direction of water movement. Pinning or stapling may be required to hold the geotextile in place. Join separate pieces of fabric by overlapping or sewing. Place the fabric in the overlapped joints with a minimum overlap of 24 inches (610 mm) in the direction of flow. After placement, do not expose the fabric longer than 48 hours prior to covering.

Cover damaged areas with a patch of fabric using a 3 foot (0.9 m) overlap in all directions.

Placement of riprap shall be from the base of the slope upward. Height of freefall of riprap shall be determined by the Engineer but in no case shall this height exceed 1 foot (305 mm).

635-3.7 GEOTEXTILE FABRIC, TYPE HR. The construction methods for Type HR fabric shall conform to the requirements of Subsection 635-3.6, except that the height of freefall of riprap shall not exceed 6 inches (150 mm).

635-3.8 GEOTEXTILE FABRIC, TYPE C. Prior to the placement of geotextile fabric, grade the earth smooth and shape it to the required grade and section. After the fabric has been placed, no traffic or construction equipment will be permitted to travel directly on the fabric.

Roll out the fabric on the excavation and manually pull it taut to remove wrinkles. Join separate pieces of fabric by overlapping or sewing. Place the fabric in the overlapped joints with a minimum overlap of 18 inches (460 mm). Weights or pins may be required to prevent lifting of the fabric by wind.

After placement, do not expose the fabric longer than 48 hours prior to covering.

Place the granular material over the fabric. Construction equipment shall be such that ruts do not exceed 3 inches (75 mm) in depth. Fill all ruts with additional material. The smoothing of ruts without adding additional material will not be permitted.

Cover damaged areas with a patch of fabric using a 3 foot (0.9 m) overlap in all directions.

635-3.9 GEOTEXTILE FABRIC, TYPE ES. Prior to placing the geotextile fabric, bring the embankment to the required elevation and make the surface nominally smooth and level. Place the fabric on the prepared surface to the limits shown on the Plan with the machine direction of the fabric oriented in the direction or directions shown on the Plan. Roll out the fabric as smoothly as possible and manually pull it taut to remove wrinkles. Restrain the fabric as needed to prevent lifting and displacement due to wind. After placement, expose the fabric no longer than 48 hours prior to covering. If defects or damage to the fabric are observed, remove the section of fabric containing the defect or damage and replace it with a new section of fabric without defects or damage.

Sew all seams between fabric strips with two parallel stitch lines spaced no more than 25 mm apart in accordance with the details shown on the Plan. Orient all seams parallel to the roadway alignment and face upward. Sew all seams with a thread having the same or greater durability as the material in the fabric. Use a 401 stitch conforming to Federal Standard No 751a for all seams. All seams shall develop a tensile strength equal to or greater than 50 percent of the specified cross direction tensile strength of the fabric. Repair all sewing defects in any seam as directed by the Engineer. Butt splices between individual roll ends will not be allowed.

The initial fill layer over fabric layers shall not be less than 8 inches (200 mm) or more than 12 inches (300 mm). Carefully end dump and push this lift on to the fabric. Spreading operations and equipment shall not cause displacement and damage to the fabric. Sharp turning movements

are not permitted while placing the initial lift over individual fabric layers. Vehicles are not allowed to drive on the fabric. No lift may be started until the preceding lift is completed. Place and compact additional lifts in accordance with Section P-152 of the Standard Specifications.

Unless otherwise specified, all fill material placed in the zone from at least 8 inches (200 mm) below to at least 8 inches (200 mm) above any single or multiple layer geotextile installation shall be a granular material meeting the requirements as presented in the Plans and Special Provisions of the project.

METHOD OF MEASUREMENT

635-4.1 METHOD OF MEASUREMENT. Geotextile Fabric, Type SAS; Geotextile Fabric, Type MS; Geotextile Fabric, Type DF; Geotextile Fabric, Type SR; Geotextile Fabric, Type R; Geotextile Fabric, Type HR; and Geotextile Fabric, Type C; will each be measured by the square yard of surface area upon which the fabric has been placed and accepted in accordance with the Contract.

BASIS OF PAYMENT

635-5.1 BASIS OF PAYMENT. Geotextile Fabric, Type SAS; Geotextile Fabric, Type DF; and Geotextile Fabric, Type SR; and Geotextile Fabric, Type C; measured as provided above, will each be paid for at the Contract unit price per square yard, which price will be full compensation for furnishing, transporting, and installing the fabric; and for furnishing all labor, tools and equipment necessary to complete the Work.

Geotextile Fabric, Type MS; Geotextile Fabric, Type ES; Geotextile Fabric, Type R; and Geotextile Fabric, Type HR, measured as provided above, will each be paid for at the Contract unit price per square yard, which price will be full compensation for preparing the marsh area or foundation; for furnishing, transporting, and placing the fabric; and for furnishing all labor, tools and equipment necessary to complete the Work.

Standard Pay Items for Work covered by this Specification are as follows:

Pay Item P63501	Geotextile Fabric, Type SAS, per square yard
Pay Item P63502	Geotextile Fabric, Type MS, per square yard
Pay Item P63503	Geotextile Fabric, Type DF, per square yard
Pay Item P63504	Geotextile Fabric, Type SR, per square yard
Pay Item P63505	Geotextile Fabric, Type R, per square yard
Pay Item P63506	Geotextile Fabric, Type HR, per square yard
Pay Item P63507	Geotextile Fabric, Type C, per square yard
Pay Item P63508	Geotextile Fabric, Type ES, per square yard

Measurement and Payment will only be made for Pay Items included in the Schedule of Prices. The cost of all Work required by the Contract Documents will be included in the Pay Items contained in the Schedule of Prices.

TESTING REQUIREMENTS

ASTM D 4595	Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
ASTM D 4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
ASTM D 4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D 4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile
ASTM D 4833	

SPECIFICATION P-638. RIPRAP

DESCRIPTION

638-1 DESCRIPTION. This Work consists of furnishing and placing riprap, (with or without grout), medium random riprap or heavy riprap, as the case may be, in accordance with the requirements of the Plans and Specifications.

MATERIALS

638-2.1 MATERIALS. Stone used for Riprap Materials under this Specification shall meet the requirements for the class of material specified.

Stone for riprap shall be durable field or quarry stone of approved quality. It shall be sound, hard, dense, resistant to the action of air and water, and free from seams, cracks or other structural defects.

Stone pieces for Riprap shall be of a size and shape approved by the Engineer and, except for those used for chinking, shall range in weight from approximately 25 to 150 pounds (11 to 68 Kg), with not less than approximately 50 percent of the pieces weighing more than 60 pounds (27 Kg).

Stone pieces for Medium Random Riprap shall be well graded ranging in weight up to 200 pounds (90 Kg) or more. Not less than approximately 50 percent of the total volume shall consist of pieces weighing 80 pounds (36 Kg) or more with not less than 80 percent weighing 15 pounds (7 Kg) or more.

Stone pieces for Heavy Riprap shall be of a size and shape approved by the Engineer and shall be well graded, ranging in weight up to 400 pounds (181 Kg) or more. Not less than approximately 50 percent of the total volume shall consist of pieces weighing 150 pounds (68 Kg) or more, and not less than approximately 80 percent of the total volume shall consist of pieces weighing 40 pounds (18 Kg) or more.

When provided, waste concrete slabs may be substituted for the above-designated stone. In this case, the concrete shall be sound, and free of reinforcement and the slabs shall meet the size requirements as specified for stone.

638-2.2 MORTAR FOR GROUTED RIPRAP. General. Materials used in the Work shall meet the requirements specified for the class of material named.

Portland cement and water shall meet the requirements of Specification P-610.

Unless otherwise directed, Portland cement may be either Type I or Type IA.

Masonry cement shall conform to the requirements for Masonry Cement, ASTM Designation: C 91, Type S.

Hydrated lime shall conform to the requirements of Type S, Special Hydrated Lime for Masonry Purposes, ASTM Designation: C 207.

Sand for Mortar. Sand furnished for mortar shall conform to the pertinent requirements of ASTM C-144, except as modified herein. It shall consist of sand composed of clean, hard, tough, durable grains of approved inert materials from natural deposits and meet the gradations given below.

Mortar Strength. Sand for mortar, when subjected to the mortar strength test, shall have a tensile or compressive strength at the age of 3 days and 7 days of not less than 85 percent of that developed by mortar of the same proportions and consistency, made of the same cement and standard Ottawa sand.

Size Requirements. Sand shall be uniformly graded from coarse to fine and shall conform to the following gradation requirements:

	Percent
Passing a No. 8 sieve	95-100
Passing a No. 100 sieve	25 max.
Passing a No. 200 sieve	10 max.

Mortar. Unless otherwise provided, mortar for laying the stone and pointing shall be composed of three parts of sand for mortar and one part of any one of the following materials, by volume: masonry cement, a mixture of 50 percent Portland cement and 50 percent masonry cement or a mixture of 50 percent Portland cement and 50 percent hydrated lime.

Machine mix mortar unless otherwise permitted by the Engineer. Prepare machine mixed mortar in an approved mixer and do not mix for less than 1-1/2 minutes. In the preparation of hand-mixed mortar, thoroughly mix the sand and cement in a clean, tight mortar box until the mixture is of uniform color, after which add clean water to form a stiff paste. Do not use mortar that has been mixed longer than 30 minutes or which has developed its initial set.

CONSTRUCTION METHODS

638-3.1 EXCAVATION. Properly trim and shape the bed for the riprap.

638-3.2 PLACING RIPRAP. Hand place stone placed above the waterline. Lay it with close, broken joints and firmly embed it in the slope and against the adjoining stones. Lay the stones perpendicular to the slope with ends in contact. Compact the riprap thoroughly as construction progresses to that the finished surface presents an even, tight surface. Place the larger stone in the lower courses. Chink interstices between stones with spalls firmly rammed into place.

Unless otherwise provided, riprap shall be at least 12 inches (305 mm) thick, measured perpendicular to the slope.

Do not place riprap against or in contact with any concrete masonry surface prior to the expiration of the curing and protection period therefor.

638-3.3 PLACING MEDIUM RANDOM AND HEAVY RIPRAP. Medium random and heavy riprap may be placed by mechanical means that will produce a completed job within reasonable tolerances of the typical section shown on the Plans. Unless otherwise provided on the Plans, heavy riprap cannot be not less than 24 inches (610 mm) thick and medium random riprap cannot be not less than 18 inches thick (460 mm). Limit hand work to the amount necessary to fill large voids or to correct segregated areas. Place riprap from the base of the slope upward. Riprap freefall shall not exceed 6 inches.

638-3.4 GROUTED RIPRAP. When grouted riprap is specified, lay the stone as set forth above for riprap placed above the water line. Fill the spaces between the stones with cement mortar. Use sufficient mortar to completely fill all voids, except leave the face surface of the stone exposed.

Place grout from bottom to top and sweep the surface with a stiff broom. After grouting is completed, cure the surface in accordance with Specification P-501.

METHOD OF MEASUREMENT

638-4 METHOD OF MEASUREMENT. Riprap will be measured by the cubic yard in place in the completed Work, and the quantity to be paid will be the summation of cubic yards of such riprap incorporated in the Work in accordance with the Contract. Only accepted Work will be measured for payment and the computation of the quantity will be based on the volume within the limiting dimensions designated on the Plans, in the Contract or established by the Engineer.

BASIS OF PAYMENT

638-5.1 MEDIUM RANDOM RIPRAP AND HEAVY RIPRAP These Pay Items, measured as provided above, will be paid for at the Contract unit price per cubic yard for Riprap, Medium Random Riprap or Heavy Riprap, as the case may be, and that Contract unit price will be payment in full for excavation and preparation of the bed, including backfilling and disposal of surplus material; for furnishing and placing riprap; for restoring the site of the Work; and for furnishing all equipment, tools, labor and incidentals necessary to complete the Work in accordance with the Contract.

638-5.2 GROUTED RIPRAP. This Pay Item, measured as provided above, will be paid for at the Contract Unit Price per cubic yard for Grouted Riprap, and that Contract unit price will be payment in full for excavation and preparation of the bed, including backfilling and disposal of surplus material; for furnishing and placing riprap; for furnishing, placing and curing mortar; for restoring the site of the Work; and for furnishing all equipment, tools, labor and incidentals necessary to complete the Work in accordance with the Contract.

Standard Pay Items for Work covered by this Specification are as follows:

Pay Item P63801	Riprap, per cubic yard
Pay Item P63802	Heavy Riprap, per cubic yard
Pay Item P63803	Grouted Riprap, per cubic yard
Pay Item P63804	Medium Random Riprap, per cubic yard

Measurement and Payment will only be made for Pay Items included in the Schedule of Prices. The cost of all Work required by the Contract Documents will be included in the Pay Items contained in the Schedule of Prices.

MATERIAL REQUIREMENTS

ASTM C 144

Aggregate for Masonry Mortar

SPECIFICATION P-640. MOBILIZATION

DESCRIPTION

640-1.1 DESCRIPTION. This Work consists of operations necessary for the movement of personnel, equipment, supplies and incidentals to the project site and for establishment of all Contractor's offices, buildings, sanitary and other facilities necessary for Work on the Project; and of all other Work and operations that must be performed or for which costs must be incurred before beginning Work on the Project.

METHOD OF MEASUREMENT

640-2.1 METHOD OF MEASUREMENT. Mobilization will be measured for payment as a single complete unit of Work, acceptably performed.

BASIS OF PAYMENT

640-3.1 BASIS OF PAYMENT. This Pay Item, measured as provided above, will be paid for at the Contract lump sum price for Mobilization, which price will be full compensation for supplying and furnishing all materials, facilities and services, and for performing all work necessary for the completion of this Work.

The Contract lump sum will be payable to the Contractor in accordance with the following schedule:

When 5 percent or more of the original Contract amount is earned, 25 percent of the amount bid for Mobilization will be paid.

When 25 percent or more of the original Contract amount is earned, 50 percent of the amount bid for Mobilization will be paid.

When 50 percent or more of the original Contract amount is earned, 75 percent of the amount bid for Mobilization will be paid.

When 75 percent or more of the original Contract amount is earned, 100 percent of the amount bid for Mobilization will be paid.

When the Contract does not include a separate Contract Pay Item for Mobilization, necessary Mobilization will be construed to be subsidiary work and the cost included under other Contract Pay Items contained in the Schedule of Prices and will not be paid for directly.

Standard Pay Items for Work covered by this Specification are as follows:

Pay Item P64001	Mobilization, per lump sum
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Measurement and Payment will only be made for Pay Items included in the Schedule of Prices. The cost of all Work required by the Contract Documents will be included in the Pay Items contained in the Schedule of Prices.

SPECIFICATION P-642. MAINTENANCE AND REPAIR OF HAUL ROADS

DESCRIPTION

642-1 DESCRIPTION. This Work consists of maintaining, repairing and restoring all public roads not a part of the State Trunk Highway System and streets, and all Airport roads, and other routes utilized to access the Work, including drainage facilities and appurtenances, over which materials are hauled by the Contractor, subcontractors, or suppliers of the Contractor, hereinafter called haul roads, to a condition equivalent to that which would have existed had such hauling not occurred.

The Contractor's obligation under this Pay Item does not authorize the use of haul roads for transporting loads exceeding statutory size and weight limitations.

MATERIALS

642-2 MATERIALS. Materials required and used in the maintenance and repair of haul roads shall be of the quality and serviceability at least equivalent to those existing prior to use as a haul road. Submit for review to the Engineer the amount and quality of all materials to be used prior to being incorporated into the Work

CONSTRUCTION METHODS

642-3.1 GENERAL. The Engineer will determine the type and quality of maintenance and repair required, including the quality of materials to be used, based upon review and logging of the haul road condition prior to construction. Provide 7 days notice to the Engineer prior to use of the haul road for construction operations and accompany the Engineer during logging of the condition, or accept the Engineer's determination of the prior condition of the haul road. In the event two or more contractors having contracts with the Department engage in transport of materials over the same haul road at the same time or at about the same time, the Engineer will determine the repair and restoration obligations of the respective contractors.

642-3.2 MAINTENANCE. Maintain and repair haul roads, including dust alleviation, as necessary to insure reasonable service to other users of the road.

To prevent or minimize damage to haul roads the Contractor may stabilize, reinforce, or strengthen existing facilities before hauling starts, and condition the surface and perform repairs during hauling operations.

642-3.3 RESTORATION. Upon termination of hauling operations and before final acceptance of the Work under the Contract, restore all haul roads, including drainage facilities, to the condition equivalent to that which would have existed had such hauling of material not occurred.

The final repair of a haul road shall meet the Engineer's approval.

METHOD OF MEASUREMENT

642-4.1 METHOD OF MEASUREMENT. Maintenance and Repair of Haul Roads will be measured for payment as a single complete unit of Work per lump sum for all haul roads maintained and repaired that are located off the Airport Site. Maintenance and Repair of Airport Haul Roads will be measured as a single complete unit of Work per lump sum for all haul roads maintained and repaired on the Airport.

BASIS OF PAYMENT

642-5.1 BASIS OF PAYMENT. These Pay Items, measured as provided above, will be paid for at the Contract lump sum price for Maintenance and Repair of Haul Roads or for Maintenance and Repair of Airport Haul Roads, which price will be payment in full for furnishing, hauling and placing required materials; for all labor, tools, equipment and all other costs necessary to complete the Work to the satisfaction of the Engineer; and for other costs incurred by the Contractor to prevent or minimize damage to the haul road.

Payment will be made upon completion of all Work under the Contract, except that, as determined by the Engineer, partial payments for these Pay Items may be allowed in amounts that are approximately proportional to the completion of the portions of the Contract for which haul roads are used.

If one or both of these Pay Items are not included in the Schedule of Prices, the corresponding Work shall be considered incidental and the cost included in the other Pay Items contained in the Schedule of Prices.

Standard Pay Items for Work covered by this Specification are as follows:

Pay Item P64201	Maintenance and Repair of Haul Roads, per lump sum.
Pay Item P64202	Maintenance and Repair of Airport Haul Roads, per lump sum.

Measurement and Payment will only be made for Pay Items included in the Schedule of Prices. The cost of all Work required by the Contract Documents shall be included in the Pay Items contained in the Schedule of Prices.

SPECIFICATION P-644. AIRCRAFT TIE DOWN

DESCRIPTION

644-1.1 DESCRIPTION. This Work includes construction of tie downs for aircraft at the locations and in accordance with the details shown on the Plans.

CONSTRUCTION METHODS

644-2.1 Materials and installation shall conform to location and details shown on the Plans.

644-2.2 When the Plans show installation of anchors that are required to be augured into place, augur them in a manner that will not loosen or displace the soil in contact with the anchor.

METHOD OF MEASUREMENT

644-3.1 METHOD OF MEASUREMENT. Aircraft Tie Downs will be measured for payment on a unit price basis per set. A set includes three anchors unless shown otherwise on the Plans.

BASIS OF PAYMENT

644-4.1 BASIS OF PAVEMENT. Payment will be made at the Contract unit price per set for the various types of Aircraft Tie Downs constructed in accordance with the Contract Documents. This price will be full compensation for furnishing all materials and for preparation and installation of tie downs, including restoration of existing surfaces, and all labor, equipment, tools and incidentals necessary to complete the Work. Pavement marking will be measured and paid under the Pay Item for Painting (Specification P-620) when Pay Items for Painting are included in the Schedule of Prices; otherwise, pavement marking shall be incidental and the cost included in the Pay Item for Aircraft Tie Downs.

Standard Pay Items for Work covered by this Specification are as follows:

Pay Item P64401	Aircraft Tie Down, per set.
Pay Item P64402 through P64410	Aircraft Tie Down, Type ____, per set.

Measurement and Payment will only be made for Pay Items included in the Schedule of Prices. The cost of all Work required by the Contract Documents shall be included in Pay Items contained in the Schedule of Prices.

SPECIFICATION P-646. BITUMINOUS PAVEMENT JOINTS

DESCRIPTION

646-1.1 DESCRIPTION. This Work includes sawing pavement joints in new bituminous pavement at locations shown on Plans or where directed by the Engineer, routing upper portion of the sawed joint to the size and shape detailed on the Plans, cleaning the joints of dust and debris with compressed air, and filling the joint with sealant.

NOTE TO SPECIFIER:

It is currently the policy of Aeronautics to construct Bituminous Pavement Joints on new runways and taxiways having bituminous pavements. The location of the joints and a joint detail should be shown on the plans for the project. Joint spacing should not exceed 75 feet. If the subgrade is sand, the joint spacing should not exceed 50 feet. The spacing may vary between 50 and 75 feet. Check existing pavements for crack spacing. Spacing on taxiways may be less than 50 feet. The joint detail is posted on the BOA BBS (filename: pavjoint.zip).

MATERIALS

646-2.1 Joint sealant shall meet ASTM D3405 - Joint Sealants, Hot-Poured, for Concrete and Asphalt Pavements as manufactured by Meadows "High Spec" or equal material approved by the Engineer. "High Spec" is manufactured by W.R. Meadows, Inc., Elgin, Illinois.

CONSTRUCTION METHODS

646-3.1 Saw joints in pavement to the dimensions and at the locations shown on the Plans. Do not vary joints more than 1 inch in 30 feet from a straight line and they shall be perpendicular to the pavement centerline unless shown otherwise on Plans.

646-3.2 Clean joints with compressed air. Compressed air equipment shall deliver at least 80 psi to the joint for cleaning. Remove loose material from joints.

646-3.3 Pressure pump sealant into the joint from an oil jacketed double boiler type material heater using nozzles designed for the purpose. Push a V-shaped rubber squeegee over the joint immediately following placement of the material.

646-3.4 Guarantee pavement joints for a period of 2 years following acceptance of the Work. Not more than 5 percent of the footage of joints shall have material pulled away from the side of the joint, shall have cracks within the materials, shall be missing from the joint or shall in any way allow entrance of water into the joint. If more than 5 percent of the footage of joints is judged to have failed, repair these joints to Department satisfaction. If less than 5 percent of the joints have failed, repairs to joints will not be necessary. The Department will be the sole judge as to which joints have failed.

METHOD OF MEASUREMENT

646-4.1 METHOD OF MEASUREMENT. Bituminous Pavement Joints will be measured on a unit basis per linear foot of joint, constructed and accepted in accordance with the requirements of the Contract Documents.

BASIS OF PAYMENT

646-5.1 BASIS OF PAVEMENT. Payment will be made at the Contract unit price per linear foot for Bituminous Pavement Joints. This price will be full compensation for furnishing all materials for preparation, saw cutting, routing, cleaning and sealing joints, including all labor, tools, equipment, and incidentals necessary to complete the Work.

Standard Pay Items for Work covered by this Specification are as follows:

Pay Item P64601	Bituminous Pavement Joints, per linear foot.
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