## ITEM P-626 EMULSIFIED ASPHALT SLURRY SEAL SURFACE TREATMENT

DESCRIPTION

**626-1.1** This item shall consist of a mixture of emulsified asphalt, polymer, mineral aggregate, and water properly proportioned, mixed, and spread on an asphalt pavement surface, including airport pavements serving airplanes of 12,500 lbs or less, roads, and other general applications. The application of the surface treatment shall be according to these Specifications and shall conform to the dimensions shown on the Plans or as directed by the Engineer.

**626-1.2 ACRONYMS.** Also see Subsection GCP-10-02.

ISSA International Slurry Surfacing Association, Washington, DC

MATERIALS

**626-2.1 AGGREGATE.** The aggregate shall consist of sound and durable manufactured sand, slag, crusher fines, crushed stone, or a combination thereof. The aggregate shall be clean and free from vegetable matter, dirt, and other deleterious substances. The aggregate shall have a sand equivalent of not less than 45 percent when tested according to ATM 307. The aggregate shall show a loss of not more than 35 percent when tested according to AASHTO T 96. The sodium sulfate soundness loss shall not exceed 12 percent, after 5 cycles when tested according to AASHTO T 104. Aggregates shall have a maximum Micro-Deval value of 15% when tested according to AASHTO T 327. Aggregate shall be 100% crushed.

The combined aggregate shall conform to the gradation shown in Table 626-1 when tested according to ATM 304. The specific aggregate gradation type will be designated in the Plans.

TABLE 626-1. GRADATION OF AGGREGATES

|  |  |  |  |
| --- | --- | --- | --- |
| **Sieve Size** | **Percent by Weight Passing Sieve** | | |
| Type I | Type II | Type III |
| 3/8 in. | 100 | 100 | 100 |
| No. 4 | 100 | 90 - 100 | 70 - 90 |
| No. 8 | 90 - 100 | 65 - 90 | 45 - 70 |
| No. 16 | 65 - 90 | 45 - 70 | 28 - 50 |
| No. 30 | 40 - 65 | 30 - 50 | 19 - 34 |
| No. 50 | 25 - 42 | 18 - 30 | 12 - 25 |
| No. 100 | 15 - 30 | 10 - 21 | 7 - 18 |
| No. 200 | 10 - 20 | 5 - 15 | 5 - 15 |
| Residual asphalt content, percent dry weight of aggregate | 10% - 16% | 7.5% - 13.5% | 6.5% - 12% |

The job mix design (JMD) shall be run using aggregate within the gradation band for the desired type shown in Table 626-1. Once the JMD has been submitted and approved by the Engineer, the aggregate used on the project shall not vary by more than the tolerances shown in Table 626-2. At no time shall the aggregate used go out of the gradation bands in Table 626-1.

The aggregate will be accepted at the job location or stockpile. The aggregate will be accepted based on five gradation test samples according to ATM 301. If the average of the five tests is within the gradation tolerances, the materials will be accepted by the Engineer. If the tests show the material to be out of tolerance, the Contractor has the choice either to remove the material or blend other aggregates with the stockpile material to bring it into specification. Materials used in blending shall meet the quality tests before blending and shall be blended in a manner to produce a consistent gradation. This blending may require a new JMD.

Screening shall be required at the project stockpile site if there are oversize materials in the mix. Precautions shall be taken to prevent segregation of the aggregate in storing and handling. The stockpile shall be kept in areas that drain readily.

1. **Aggregate Tolerance.** Once the JMD has been accepted, the aggregate gradation used on the project may vary from the aggregate gradation used in the JMD on each sieve by the percentages shown in Table 626-2. If the project aggregate fails to remain within this tolerance, a new JMD will be required by the Engineer at the expense of the Contractor.

TABLE 626-2. AGGREGATE TOLERANCE

|  |  |
| --- | --- |
| **Sieve Size** | **Tolerance, percent passing by weight** |
| 3/8 in. | ± 5 |
| No. 4 | ± 5 |
| No. 8 | ± 5 |
| No. 16 | ± 5 |
| No. 30 | ± 5 |
| No. 50 | ± 4 |
| No. 100 | ± 3 |
| No. 200 | ± 2 |
| Residual Asphalt, percent dry weight of aggregate | ± 1 |

**626-2.2 MINERAL FILLER.** If mineral filler, in addition to that naturally present in the aggregate, is necessary, it shall meet the requirements of AASHTO M 17 and shall be used in the amounts required by the JMD. The mineral filler shall be considered as part of the aggregate.

**626-2.3 EMULSIFIED ASPHALT.** The specific emulsified asphalt is designated in the Plans, and shall conform to the requirements of AASHTO R 5. The cement mixing test is waived for these slurry type emulsions. The type of emulsified asphalt shall be either anionic or cationic, whichever is best suited to the aggregate and job conditions to be encountered.

The Contractor shall provide samples of the emulsified material and a copy of the manufacturer’s Certificate of Analysis (COA) for each carload or equivalent of the asphalt material to the Engineer for review and acceptance before the emulsified asphalt material is applied. The furnishing of COA for the emulsified asphalt material shall not be interpreted as a basis for final acceptance. The manufacturer’s COA may be subject to verification by testing the material delivered for use on the project.

**626-2.4 POLYMER.** The Contractor shall submit manufacturer’s technical data, the manufacturer’s certification indicating that the polymer meets the requirements of the specification, and the asphalt material manufacturer’s approval of its use to the Engineer.

**626-2.4 WATER**. All water used in mixing or curing the slurry shall be from potable sources. Other sources shall be tested in accordance with ASTM C1602 prior to use.

COMPOSITION AND APPLICATION

**626-3.1 COMPOSITION.** The slurry seal shall consist of a mixture of emulsified asphalt, mineral aggregate, a minimum of 1% polymer (when specified), additives as necessary, and water.

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

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

The Contractor shall submit to the Engineer for approval a complete JMD on the materials proposed for use, prepared and certified by an approved laboratory. Compatibility of the aggregate, emulsion, mineral filler, and other additives shall be verified by the JMD. The JMD shall be made with the same aggregate and grade of emulsified asphalt that the Contractor will provide on the project. At a minimum the required tests and values needed are shown in Table 626-3:

TABLE 626-3. SLURRY MIX TESTS

|  |  |  |
| --- | --- | --- |
| **TEST** | **DESCRIPTION** | **SPECIFICATION** |
| ISSA TB-100 | Wet Track Abrasion of Slurry Surfacing Systems, One Hour Soak | 50 g/ft² Max |
| ISSA TB-115 | Determination of Slurry Seal Compatibility | Pass |

**626-3.3 APPLICATION RATE.** Unless otherwise specified, the slurry seal shall be applied to at the application rates shown in Table 626-4 for that gradation of material used. The rate of application shall not vary more than ± 2 lb/yd².

TABLE 626-4. SLURRY APPLICATION RATES

(Pounds of mixture per square yard)

|  |  |  |
| --- | --- | --- |
| **Type I** | **Type II** | **Type III** |
| 8 - 12 | 12 - 20 | 18 - 30 |

**626-3.4 CONTROL STRIPS.** Control Strips, of 60 yd2 each, shall be placed prior to the start of the slurry seal work in the presence of the Engineer. The test area will be designated by the Engineer and will be located on the existing pavement. Control strips shall be made by each machine after calibration. Samples of the slurry seal may be taken and the mix consistency verified by using ISSA TB-106 Slurry Seal Consistency test. In addition, the proportions of the individual materials may be verified by the Engineer by using the calibration information provided after machine calibration. If any test does not meet specification requirements, additional tests shall be made at the expense of the Contractor, until an acceptable control strip is placed.

CONSTRUCTION METHODS

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

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

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

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

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

The mixing machine shall be equipped with a water pressure system and fog-type spray bar adequate for complete fogging of the surface with an application of 0.05 to 0.10 gal/yd² preceding the spreading equipment.

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

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

A continuous spreading operation shall be maintained by means of a continuous charging operation so that a minimum of construction joints occur. Continuous operating is defined as one in which the spreading operation progresses prior to initial setting or breaking of the slurry mix, which starts within approximately 15 minutes.

Provide suitable storage facilities for the asphalt emulsion, using containers equipped to prevent water from entering the emulsion. If necessary, suitable heat shall be provided to prevent freezing.

1. **Auxiliary Equipment.** Other tools or equipment such as brushes, hand squeegees, hose equipment, tank trucks, water distributors and flushers, power blowers, barricades, etc., shall be provided as required.
2. **Roller.** The roller shall be a self-propelled pneumatic-tired roller capable of exerting a contact pressure during rolling of 50 psi. It shall be equipped with a water spray system, to be used if the slurry is picking up on the tires during rolling.
3. **Tack Coat and Distributor.** Normally a tack coat is not required unless the surface to be covered is extremely dry and raveled or is concrete or brick. If required, the tack coat should consist of one part emulsified asphalt and three parts water. The emulsified asphalt may be the same as that used in the mix. Pressure distributors used for application of the diluted asphalt emulsion tack coat shall be self-propelled, equipped with pneumatic tires, and capable of uniformly applying 0.05 to 0.15 gal/yd² of the diluted emulsion over the required width of application. Distributors shall be equipped with tachometers, pressure gages, and volume-measuring devices. The tack coat shall be applied at least 2 hours before the slurry seal but within the same day.

**626-4.3 EQUIPMENT CALIBRATION.** Each slurry mixing unit to be used on the project shall be calibrated in the presence of the Engineer prior to construction. Previous calibration documentation covering the exact materials to be used may be accepted by the Engineer provided they were made during the calendar year. The documentation shall include an individual calibration of each material at various settings, which can be related to the machine's metering devices. No machine will be allowed to work on the project until either the calibration has been completed or a previous calibration is accepted by the Engineer.

**626-4.4 PREPARATION OF EXISTING SURFACE.** Clean pavement surface immediately prior to placing the tack coat and slurry seal coat by sweeping, flushing well with water leaving no standing water, or a combination of both, so that the pavement surface is free of dust, dirt, grease, vegetation, oil or any type of objectionable surface film. Remove oil or grease that has not penetrated the asphalt pavement by scraping or by scrubbing with a detergent, then wash thoroughly with clean water. Water flushing will not be permitted in areas where considerable cracks are present in the pavement surface. After cleaning, treat these areas with an oil spot primer.

All painted stripes or markings on the surface to be treated, shall be removed according to Subsection P-620-3.3. Patch asphalt pavement surfaces that have been softened by petroleum derivatives or have failed due to any other cause. Remove damaged pavement to the full depth of the damage and replace with new asphalt pavement similar to that of the existing pavement. Materials and methods of construction shall comply with the applicable sections of these specifications. Remove all vegetation and debris from cracks to a minimum depth of 1-inch. If extensive vegetation exists, treat the specific area with a concentrated solution of a water-based herbicide approved by the Engineer. Fill all cracks greater than 1/4-inch (wide) with a crack sealant meeting ASTM D6690, Type IV. The crack sealant, preparation, and application shall be compatible with the surface treatment/overlay to be used. To minimize contamination of the asphalt with the crack sealant, underfill the crack sealant a minimum of 1/8-inch, not to exceed 1/4-inch. Any excess joint or crack sealant shall be removed from the pavement surface.

**626-4.5 APPLICATION OF SLURRY SEAL COAT.** Charge the mixture in the following order:

1. Water
2. Aggregate
3. Asphalt Emulsion

No violent mixing will be permitted. Maintain temperature range at the mixer between 90 and 120 °F. Mix until a uniform coating of the aggregate is obtained. Continue mixing until the mixture is discharged into the spreader box. Discard the entire batch if there is evidence that the emulsion has broken.

The surface shall be pre-wet by fogging ahead of the slurry spreader box. Water used in pre-wetting the surface shall be applied at such a rate that the entire surface is damp with no apparent flowing water in front of the slurry spreader box. The slurry mixture shall be of the desired consistency when deposited on the surface, and no additional elements shall be added. Total time of mixing shall not exceed 2 minutes. A sufficient amount of slurry shall be carried in all parts of the spreader box at all times so that complete coverage of all surface voids and cracks is obtained. Care shall be taken not to overload the spreader box which shall be towed at a slow and uniform rate not to exceed 5 mph. No lumping, balling, or unmixed aggregate shall be permitted. No segregation of the emulsion and fines from the coarse aggregate will be permitted. If the coarse aggregate settles to the bottom of the mix, the slurry shall be removed from the pavement surface. A sufficient amount of slurry shall be fed into the box to keep a full supply against the full width of the spreader box. The mixture shall not be permitted to overflow the sides of the spreader box. No breaking of the emulsion will be allowed in the spreader box.

Apply the slurry seal to form a film with a maximum thickness of 3/8 inch. Isolated depressions and cracks may have a thickness greater than 3/8 inch in order to obtain a smooth surface.

The finished surface shall have no more than 4 tear or drag marks greater than 1/2 inch wide and 4 inches long in any 12 foot by 22 foot section. It shall have no tear or drag marks greater than 1 inch wide and 3 inches long.

The finished surface shall have no transverse ripples of 1/4 inch or more in depth, as measured with a 12‑foot straight edge laid upon the surface.

Adjacent lanes shall be lapped at the edges a minimum of 2 inches with a maximum of 4 inches to provide complete sealing at the overlap. Construction longitudinal and transverse joints shall be neat and uniform without buildup, uncovered areas, or unsightly appearance. All joints shall have no more than 1/4 inch difference in elevation when measured across with a 12-foot straight edge.

After application of the slurry seal, the surface shall be rolled with a pneumatic-tired roller a minimum of 2 complete passes. The roller shall be operated at a tire pressure of approximately 50 psi.

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

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

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

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

METHOD OF MEASUREMENT

**626-5.1** The emulsified asphalt for slurry coat will be measured by the square yard.

**626-5.2** Aggregate will be measured by the ton of dry aggregate.

**626-5.3** Tack coat will be measured by the ton.

**626-5.4** Emulsified Asphalt Slurry Seal Surface Treatment will be measured according to Section 90 by the square yard, all preparation, materials, and application, completed and accepted. Liquid asphalt material, aggregate, blotter material, water used for emulsion and preparation, sweeping and dust control are subsidiary to the work. Any areas of emulsified asphalt slurry seal surface treatment found unacceptable by the Engineer shall be removed and reconstructed at the Contractor’s expense. The pay unit/payment is for all layers/full depth of slurry seal surface treatment.

BASIS OF PAYMENT

**626-6.1** Payment will be made at the contract unit price per square yard for the slurry coat and at the contract price per ton for aggregate and tack coat.

Payment will be made under:

Item P626.010.0000 Emulsified Asphalt for Slurry Coat - per square yard

Item P626.020.0000 Aggregate - per ton

Item P626.030.0000 Emulsified Asphalt for Tack Coat - per ton

Item P626.040.0000 Emulsified Asphalt Slurry Seal Surface Treatment – per square yard

REFERENCES

AASHTO M 17 Mineral Filler for Bituminous Paving Mixtures

AASHTO R 5 Selection and Use of Emulsified Asphalts

AASHTO T 96 Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

AASHTO T 104 Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

AASHTO T 327 Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus

ASTM C1602 Mixing Water Used in the Production of Hydraulic Cement Concrete

ASTM D6690 Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

ATM 301 WAQTC FOP for AASHTO T 2 Sampling of Aggregates

ATM 304 WAQTC FOP for AASHTO T 27/T 11 Sieve Analysis of Fine and Coarse Aggregates

ATM 307 WAQTC FOP for AASHTO T 176 Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test

ISSA TB-100 Wet Track Abrasion of Slurry Surfacing Systems

ISSA TB-106 Measurement of Slurry Seal Consistency

ISSA TB-115 Determination of Slurry System Compatibility