**Delete Section 409 of the Standard Specifications for this project and replace with the following:**

**DESCRIPTION**

**409.01** This work consists of furnishing and placing a micro-surfacing seal coat which is a mixture of cationic polymer modified asphalt emulsion, mineral aggregate, mineral filler, water, and other additives proportioned, mixed and spread on the paved surface per these specifications and to the dimensions as shown on the plans.

**MATERIALS**

**409.02** Materials for the micro-surfacing seal coat shall meet the following requirements*:*

(a) *Emulsified Asphalt.* The emulsion shall be Emulsified Asphalt (CQS-1hP) conforming to the requirements in subsection 702.02(c) Table 702-4.

The modified asphalt shall be formulated such that when the paving mixture is applied, it will cure sufficiently that traffic can be allowed on the roadway at the time designated in the Contract, without any damage to the micro-surfacing. Any damage to the micro-surfacing seal coat caused by early traffic shall be repaired by the Contractor, at no additional cost to the Department.

(b) *Mineral Aggregate.*  The mineral aggregate shall be 100 percent crushed, natural aggregate from a sand and gravel or quarry source and shall conform to the gradation and stockpile tolerance ranges given in Table 409-1 and meet the following requirements:

The job mix (target) gradation (including the mineral filler) shall be within the specified gradation band. The mix design gradation shall not vary by more than the stockpile tolerance and shall also remain within the gradation band.

Acceptance of the aggregate will be determined at the job location stockpile. The aggregate shall be available for testing two full working days before use. The aggregate shall be tested according to the schedule in the Field Materials Manual for Item 409 and acceptance will be determined per Section 105. If tests show the aggregate does not conform to the gradation requirements, the material shall not be used.

(c) *Stockpiling and Storage.* The mineral aggregate shall be stored or stockpiled at a site acceptable to the Engineer in such a manner as to prevent segregation and contamination. The aggregate shall be sieved on a 3/8 inch scalping screen immediately before transfer to the micro-surfacing mixing machine.

**Table 409-1**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sieve**  **Size** | **Type II**  **Percent**  **Passing** | **Type III**  **Percent**  **Passing** | **Stockpile**  **Tolerance** |
| 9.5 mm (3/8") | 100 | 100 |  |
| 4.75 mm (#4) | 90 – 100 | 70 – 90 | ±5% |
| 2.36 mm (#8) | 65 – 90 | 45 – 70 | ±5% |
| 1.18 mm (#16) | 45 – 70 | 28 – 50 | ±5% |
| 600 μm (#30) | 30 – 50 | 19 – 34 | ±5% |
| 300 μm (#50) | 18 – 30 | 12 – 25 | ±4% |
| 150 μm (#100) | 10 – 21 | 7 – 18 | ±3% |
| 75 μm (#200) | 5 – 15 | 5 – 15 | ±2% |

The mineral aggregate shall meet the quality test requirements as indicated in Table 409-2:

**Table 409-2**

|  |  |  |
| --- | --- | --- |
| **Property** | **Test** | **Specification** |
| Sand Equivalent, % minimum | CP-37 | 65 |
| Soundness, % maximum | AASHTO T104 using Sodium Sulfate and 5 cycles | 15 |
| Abrasion (before crushing), % maximum | AASHTO T96 | 30 |
| Methylene Blue Value, max | ISSA, TB 145 | 15 |
| Note: ISSA TB = International Slurry Surfacing Association Technical Bulletin | | |

(d) *Water.* The water shall be potable and shall be free of harmful soluble salts.

(e) *Mineral Filler.*  A mineral filler shall be introduced into the mineral aggregate and shall be a non-air entrained portland cement or hydrated lime that is free of lumps. It may be accepted upon supplier certification and visual inspection to ensure the filler is free of lumps. Hydrated lime shall conform to subsection 712.03. Portland cement shall conform to subsection 701.01. The amount of mineral filler needed shall be determined by the laboratory mix design and will be considered as part of the material gradation requirement and, as such, shall not be used as a field control for reaction retardant.

(f) *Micro-surfacing Mix Stability and Field Control Additive.* The micro-surfacing mixture shall be homogeneous during mixing and spreading. The micro-surfacing mix shall be sufficiently stable so that premature breaking of the material in the spreader box does not occur. To maintain proper mixture stability, a field control additive may be introduced to provide effective control of the required quick-set properties. If used, this additive shall be included as part of the mix design and a sample shall be provided by the chemical supplier or emulsion manufacturer and certified as being compatible with the mixture.

**409.03 Mix Design.** A minimum of two weeks before work commences, the Contractor shall submit a complete mix design using the materials (aggregates, emulsion, and mineral fillers) to be supplied on the project to the Engineer. Construction shall not commence until a job mix formula (Form 43) is issued. This mix design shall be performed by a qualified laboratory acceptable to the Engineer. The mix design shall be made with the same aggregate and gradation that the Contractor will provide on the project. Once materials are approved, no substitutions will be permitted unless first tested by the laboratory preparing the mix design and approved by the Engineer.

The mix design shall determine optimum asphalt content and confirm compatibility of all the ingredients.

The complete mix design shall include all the requirements of Tables 409-1, 409-2, and 409-3 and shall include Certified Test Reports (CTR) for all properties in these tables.

**Table 409-3**

|  |  |  |
| --- | --- | --- |
| **Property** | **Test** | **Specification** |
| Wet Stripping Test, min. | ISSA TB-114 | 90% |
| Lateral Displacement by LWT, max. | ISSA TB-147  Method A | 5% |
| Wet Cohesion, minimum  @ 30 minutes, min. (set)  @ 60 minutes, min. (traffic) | ISSA TB-139 | 12 kg-cm cohesion torque  20 kg-cm cohesion torque |
| Excess Asphalt by LWT, max. | ISSA TB-109 | 50 g/sq. ft. |
| Wet Track Abrasion Loss, maximum  One hour soak | ISSA TB-100 | 50g/ft2 |
| Wet Track Abrasion Loss, maximum  Six day soak | ISSA TB-100 | 75g/ft2 |
| Classification Compatibility, min. | ISSA TB-144 | 11 points |
| Mix Time @ 25 ºC (77 ºF), min. | ISSA TB-113 | 120 seconds |
| Boiling Compatibility | ISSA TB 149 | Report |
| Note: ISSA TB = International Slurry Surfacing Association Technical Bulletin | | |

The percentages of each material used in the mix design shall be shown in the laboratory report. Adjustments may be required during construction based on field conditions and are subject to approval by the Engineer. The approximate range of water and control additives shall be shown on the mix design. The maximum limits of these ingredients shall also be listed.

(a) *Quality Assurance Training.* The Contractor shall provide a minimum two**-**hour orientation session for project personnel, covering the construction process, materials control, and materials measurement by truck weight delivered vs. machine dial gauge readings.

The Contractor shall provide to the Engineer, on a daily basis, the quantity of material delivered versus material placed through the micro-surfacing mixer based on dial gauge readings. The Engineer will independently verify all dial gauge readings, and material weights delivered. This information will be used for a check against the mix design proportions.

**CONSTRUCTION REQUIREMENTS**

**409.04** Micro-surfacing Seal Coat shall be constructed per the following requirements;

1. *Test Strip.* The Contractor shall construct a test strip 1,000 feet long, and it shall consist of all the application courses specified. It will be considered as part of the project. The test strip shall be constructed at the same time of day or night as the full production will be applied. For a wearing course, the Engineer will evaluate the completed test strip after 1 hour of traffic to determine acceptability of the mix and the Contractor’s operation. Full production may begin after the Engineer accepts the test strip.
2. *Weather Limitations.* The material shall be spread only when the road surface and ambient temperatures are at least 50 ºF and rising, the weather is not foggy or rainy, and there is no forecast of temperatures below 40 ºF within 24 hours from the time of placement of the mixture. The Contractor shall complete work for each day in sufficient time for the material to cure before traffic is restored per the requirements of the Traffic Control Plan.

**409.05 Mixing Equipment.** All equipment for the handling of all materials and mixing and placing of the mixture shall be maintained in good repair and operating condition and subject to approval of the Engineer. Any equipment found to be defective or potentially detrimental to the quality of the paving mixture shall be replaced.

The material shall be mixed by a self-propelled, self-contained micro-surfacing mixing machine. This machine shall be a continuous flow mixing unit able to accurately proportion the aggregate, emulsified asphalt, mineral filler and water and deliver these ingredients to a revolving multi-blade mixer and discharge the mixed product on a continuous flow basis.

The mixing machine shall have sufficient storage capacity for aggregate, emulsified asphalt, mineral filler and water to maintain an adequate supply to the proportioning devices. The machine shall be equipped to allow the operator to have full control of the forward and reverse speed during the application of the micro-surfacing material.

The mixing machine shall be equipped with self-loading devices which provide for the loading of all materials while continuing to place micro-surfacing, thereby minimizing construction joints. The machine shall be equipped with opposite side driving stations to optimize longitudinal alignment.

The mixing machine shall be equipped with individual volume or weight controls for proportioning each material in the mix. Each material control device shall be calibrated and properly marked.

The aggregate feed to the mixer shall be equipped with a revolution counter or similar device so the amount of aggregate used may be determined at any time.

The emulsion pump shall be a positive displacement type and shall be equipped with a revolution counter or similar device so that the amount of emulsion used may be determined at any time.

The mixing machine shall be equipped with a water pressure system and nozzle type spray bar to provide a water spray immediately ahead of and outside the spreader box to moisten the pavement.

The mixing machine shall be equipped with an approved fines feeder that shall provide a uniform, accurately metered, predetermined amount of the specified mineral filler.

**409.06 Spreading Equipment.** The paving mixture shall be spread uniformly by means of a mechanical type spreader box attached to the paver, equipped with auger paddles to agitate and spread the materials throughout the box. A front seal shall be provided to insure no loss of the mixture at the road contact surface. The rear seal shall act as a final strike off and shall be adjustable. The mixture shall be spread to fill cracks and minor surface irregularities and to leave a uniform skid resistant application of micro-surfacing on the surface. The spreader box and rear strike-off shall be so designed and operated that a uniform consistency is achieved to produce a free flow of material to the rear strike-off. The seam where two spreads meet, shall be neat and uniform. A secondary strike-off shall be attached to the spreader box when the surface course is applied.

At the direction of the Engineer, before the final surface course is placed, preliminary micro-surfacing material shall be placed to fill ruts and depressions in the existing surface. Ruts shall be filled independently with a special rut filling spreader box of 5 to 6 feet in width.

Ruts over 1-¼ inch in depth shall be filled using multiple passes of the rut box with no more than a ¾ inch lift thickness in a single pass.

**409.07 Machine Calibration.** Each mixing unit to be used in performance of the work shall be calibrated in the presence of the Engineer, before construction. Calibration shall include the individual calibration of aggregate, mineral filler, and emulsion at various settings, which can be related to the machine proportioning devices to verify the application rate and mix design compliance.

**409.08 Workmanship.** Excessive build-up, uncovered areas or unsightly appearance will not be permitted on longitudinal or transverse joints.

(a) *Longitudinal Joints.* Longitudinal joints shall be placed on lane lines where possible. Where not possible, longitudinal joint placement shall be per the Engineer’s approval. Excessive overlap will not be permitted. Care shall be taken to insure straight lines along the roadway centerline, lane lines, shoulder or curb lines. The edge shall not vary by more than 3 inches in a 100 foot section.

(b) *Scratch Marks.* The finished micro-surfacing shall have a uniform texture free from excessive scratch marks. Excessive scratch marks are defined as 4 or more marks that are at least 1/2 inch wide and at least 6 inches in length per 40 square yards, or any mark 1 inch wide or wider and at least 4 inches in length. The micro-surfacing shall adhere fully to the underlying pavement before placing traffic on it. The cured mixture shall provide a uniform skid resistant surface.

(c) *Surface Preparation.* The area to be micro-surfaced shall be thoroughly cleaned to the Engineer’s approval.

(d) *Manholes and Valves*. All manholes and valves shall be clean when work is completed. They shall be covered in a suitable manner before micro-surfacing, and the covering shall be removed immediately after micro-surfacing.

(e) *Handwork.* Areas which cannot be reached with a mixing machine shall be surfaced using hand tools to provide complete and uniform coverage. The area to be worked by hand shall be lightly dampened before mix placement. Handwork shall not result in any unsightly appearance. Handwork shall be completed at the time of the machine applying process.

Areas deficient in quality of workmanship shall be patched by overlay with the full width paving box. Individual hole patching is not permitted. Patching must be completed in such a manner as to leave the roadway with a uniform appearance, texture, and skid resistant surface, free of segregation and flushing. Micro-Surfacing material required to repair deficiencies due to unsatisfactory workmanship will not be paid for but shall be entirely at the Contractor's expense.

**METHOD OF MEASUREMENT**

**409.09** Micro-surfacing seal coat will be measured by the ton. The total tonnage of the micro-surfacing will be calculated by adding the accepted quantity of aggregate and emulsion only.

**BASIS OF PAYMENT**

**409.10** The accepted quantities will be paid for at the contract unit price for the pay items listed below.

**Pay Item Pay Unit**

Micro-Surfacing Seal Coat Ton

All materials, emulsion, mineral filler, additives, water, haul, labor, tools, equipment, placement and all other work necessary to complete each of the pay items will not be measured and paid for separately but shall be included in the work.

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**INSTRUCTIONS TO DESIGNERS** (delete instructions from final draft):

1. A scratch course will normally be required to address minor irregularities before placement of the final wearing surface.

2. When used for rut filling before overlay:

The micro-surfacing shall not be overlaid until after at least 24 hours of exposure to traffic and placement of the overlay shall be approved by the Engineer.   
The Contractor shall use a rut box capable of putting necessary crown into rut filling pass.

3. If used on concrete or on badly aged and oxidized asphalt pavements, a tack coat at the rate of 0.1 gallon/yd2 will be required Materials for tack coat shall be a 50% dilution of SS or CSS emulsion and shall be paid for per Section 407.

4. If crack sealing is required before overlay on concrete before Micro-surfacing, the crack sealant shall be placed such that it is recessed below the pavement surface 1.6 mm to 3.2 mm (1/16" to 1/8"). Avoid leaving a thick layer of crack sealant.