

MICROSURFACE TREATMENT

**\*\*From Georgia-St. Albans IM SURF(21)**

xx. DESCRIPTION. This work shall consist of applying a properly proportioned mixture of polymer-modified asphalt emulsion, mineral aggregate, mineral filler, water, and other additives to a prepared pavement surface in accordance with the Contract Documents and as directed by the Engineer.

xx. MATERIALS. Materials shall meet the following requirements:

(a) Emulsified Asphalt. Emulsified asphalt shall meet the following requirements:

- (1) The emulsified asphalt shall be polymer modified. The polymer material shall be milled or blended into the asphalt or emulsifier solution prior to the emulsification process. In general, a three percent (3%) polymer solids, based on asphalt mass (weight), is considered minimum. Each load of emulsified asphalt shall be accompanied with a Certificate of Analysis/Compliance to indicate that the emulsion meets specification and that three percent (3%) minimum polymer solids content is contained within the emulsion.

The emulsified asphalt, and emulsified asphalt residue, shall meet the requirements of Subsections 702.01 and 702.04 for CQS-1h or CSS-1h, with the following exceptions:

TABLE 1 - EMULSION PROPERTIES

TEST	TEST METHOD		SPECIFICATION
	AASHTO	ASTM	
Settlement and Storage Stability of Emulsified Asphalts, 24 HOUR	T 59	D 6930	1% Maximum
Distillation of Emulsified Asphalt <sup>1</sup>	T 59	D 6997	62% Minimum
TESTS ON EMULSIFIED ASPHALT RESIDUE			
Softening Point of Bitumen (Ring-and-Ball Apparatus)	T 53	D 36	57°C (135°F) Minimum
Penetration of Bituminous Materials at 77°F (25°C)	T 49	D 5	40-90 <sup>2</sup>

- <sup>1</sup> Distillation is determined by AASHTO T 59, with modifications to include distillation temperature and time in accordance with the manufacturers' recommendations.
- <sup>2</sup> The climatic conditions should be considered when establishing this range.

The solubility test, if required should be evaluated on the base asphalt.

A Type D Certification shall be furnished in accordance with Subsection 700.02.

- (b) Aggregates. Aggregates shall meet the requirements of Subsection 704.10, except as modified herein.
- (1) Aggregate sources of crushed stone, gravel, or slag shall meet the minimum requirements specified in Table 2 - Aggregate Properties and appropriate gradation requirements specified in Table 3 - Gradation Requirements and Maximum Stockpile Tolerances. The use of natural sands is prohibited.

TABLE 2 - AGGREGATE PROPERTIES

TEST	TEST METHOD		SPECIFICATION
	AASHTO	ASTM	
Sand Equivalent Value of Soils and Fine Aggregate	T 176	D 2419	65 Minimum
Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	T 104	C 88	15% Maximum w/NA <sub>2</sub> SO <sub>4</sub> 25% Maximum w/MgSO <sub>4</sub>
Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine Machine <sup>1</sup>	T 96	C 131	30% Maximum

<sup>1</sup>The abrasion test is run on the parent aggregate.

TABLE 3 - GRADATION REQUIREMENTS AND MAXIMUM STOCKPILE TOLERANCES

SIEVE SIZE	TYPE II DESIGN LIMITS PERCENT PASSING	TYPE III DESIGN LIMITS PERCENT PASSING	STOCKPILE TOLERANCE
9.5 mm (3/8 inch)	100	100	

4.75 mm (No. 4)	90 - 100	70 - 90	± 5%
2.36 mm (No. 8)	65 - 90	45 - 70	± 5%
1.18 mm (No. 16)	45 - 70	28 - 50	± 5%
0.600 mm (No. 30)	30 - 50	19 - 34	± 5%
0.300 mm (No. 50)	18 - 30	12 - 25	± 4%
0.150 mm (No. 100)	10 - 21	7 - 18	± 3%
0.075 mm (No. 200)	5 - 15	5 - 15	± 2%

- (c) Water. Water shall meet the requirements of Section 745.
- (d) Mineral Filler. Mineral Filler shall be any brand of non-air entrained portland cement or hydrated lime as prescribed in the mix design and in accordance with Subsection 701.02.
- (e) Verification. For the purpose of verifying materials used on the project, the Engineer may require that all deliveries made of emulsion and stockpiled aggregates to be used as part of the micro surfacing is evidenced by fully completed delivery records that accurately reflect the quantity and material delivered.
- xx. MIX DESIGN. Employ a qualified laboratory as determined by the Agency's Qualified Laboratory Program to develop a mix design meeting the requirements specified in Table 4 - Proportional Requirements, Table 5 - Physical Requirements, and Table 3 - Gradation Requirements and Maximum Stockpile Tolerances. All materials used to develop the mix design shall be representative of the material to be used on the project. Submit the mix design to the Materials and Research Engineer for approval a minimum of 14 days prior to the start of work.

Once a mix design is approved, the job-mix formula (JMF) is valid until a change is made in aggregate source, mineral filler, the polymer-modified emulsion, or polymer-modified emulsion source. If a change is made in aggregate source, a new mix design shall be submitted and a minimum 14 day evaluation period shall be allowed prior to resuming production. If a change is made in the mineral filler type, a new mix design shall be submitted and a minimum 14 day evaluation period allowed prior to resuming production. If a change is made in the polymer-modified emulsion type, a new mix design shall be submitted and a minimum 14 day evaluation period allowed prior to resuming production. If there is a change in source for the polymer-modified emulsion, a Type D Certification in accordance with Subsection 700.02 specific to that source shall be submitted to the Engineer before resuming production.

TABLE 4 - PROPORTIONAL REQUIREMENTS

COMPONENT MATERIALS	PROPORTIONAL REQUIREMENT
Residual Asphalt	5.5% to 10.5% by dry mass of aggregate
Mineral Filler	0.0% to 3.0% by dry mass of aggregate
Polymer Content	Minimum of 3.0% solids based on bitumen weight content
Field Control Additive	As required to control the emulsion's set properties or increase adhesion, but must be part of the mixture design and compatible with all other components
Water	As required to produce proper mixture consistency

TABLE 5 - PHYSICAL REQUIREMENTS

PROPERTY	TEST METHOD (ISSA TB NO.)	REQUIREMENT
Mix Time at 25°C (77°F)	TB 113	Controllable to 120 Seconds, Minimum
Wet Cohesion at 30 Minutes Minimum (Set) at 60 minutes minimum (Traffic)	TB 139	12 kg-cm, Minimum 20 kg-cm, Minimum
Wet Stripping	TB 114	Pass(90.0% Minimum)
Wet Track Abrasion Loss One-hour Soak Six-day Soak	TB 100	538 g/m <sup>2</sup> (50 g/ft <sup>2</sup> ) Maximum 807 g/m <sup>2</sup> (75 g/ft <sup>2</sup> ) Maximum
Lateral Displacement	TB 147	5.0% maximum
Specific Gravity after 1000 cycles of 56.71 kg (125 lbs)	TB 147	2.10 maximum
Excess Asphalt by LWT Sand Adhesion	TB 109	538 g/m <sup>2</sup> (50 g/ft <sup>2</sup> ) Maximum
Classification Compatibility	TB 144	11 grade points Minimum (AAA, BAA)

- (a) Stockpile. Aggregate stockpile(s) shall be built at a location approved by the Engineer. When blending multiple aggregates, use automated proportioning and blending equipment to produce a uniformly graded stockpile. Screen the aggregate at the stockpile prior to delivering it to the microsurfacing equipment.
- (1) Testing. Three samples shall be taken of each stockpile built, in accordance with AASHTO T 2, and test for gradation in accordance with AASHTO T 11 "Materials Finer than 75µm (No. 200) Sieve in Mineral Aggregates by Washing" and AASHTO T 27 "Sieve

Analysis of Fine and Coarse Aggregates". Each sample must contain material from each face of the stockpile.

Submit the test results to the Engineer and the Materials and Research Engineer for approval. Approval must be granted before material from a stockpile can be used.

- (2) Tolerance. The maximum stockpile tolerances are given in Table 3 - Gradation Requirements and Maximum Stockpile Tolerances. The design values established in the JMF plus the corresponding stockpile tolerance shall not exceed the design limits.
- (3) Approval. Stockpile gradation approval is valid until new material is added to the stockpile. Approval will be based on the average of three gradation tests. If the percent passing exceeds the stockpile tolerance or is outside the gradation limits for any sieve, or ranges from the high end to the low end of the tolerance limits for any two consecutive sieves, the stockpile will be rejected until such time that either a new mix design representing the stockpile gradation and mixture is approved, or the stockpile is adequately re-blended to bring the stockpile within stockpile tolerances.
- (4) Wintering. Any stockpile built, approved for use, and then wintered shall be re-sampled and gradation approval reestablished before any material from the stockpile can be used. Material from a wintered stockpile that is rejected for gradation shall not be used until such time that either a new mix design representing the stockpile gradation and mixture is approved, or the stockpile is adequately re-blended to bring the stockpile within stockpile tolerances.

xx. EQUIPMENT. All equipment, tools, and machines used in the performance of this work shall be maintained in satisfactory working condition at all times to ensure a high-quality product. Submit list of equipment intended for use to the Engineer a minimum of 7 days prior to start of work.

- (a) Mixing Equipment. The machine shall be specifically designed and manufactured to lay. The material shall be mixed by an automatic-sequenced, self-propelled microsurfacing mixing machine, which shall be a continuous-flow mixing unit able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, control setting additive, and water to a revolving multi-blade, double-shafted mixer and to discharge the mixed product on a continuous-flow basis. The machine shall have sufficient storage capacity for aggregate, emulsified asphalt, mineral filler, control additive, and water to maintain an adequate supply to the proportioning controls. On major highways, the machine may be required to be a self-loading machine

capable of loading materials while continuing to lay microsurfacing, thereby minimizing construction joints. If used, the self-loading machine shall be equipped to allow the operator to have full control of the forward and reverse speeds during applications of the microsurfacing material and be equipped with opposite-side driver stations to assist in alignment. The self-loading device, opposite-side driver stations, and forward and reverse speed controls shall be original equipment manufacturer design.

- (b) Proportioning Devices. Individual volume or weight controls for proportioning each material to be added to the mix (i.e. aggregate, mineral filler, emulsified asphalt, additive, and water) shall be provided and properly marked. These proportioning devices are used in material calibration and determining the material output at any time.
- (c) Spreading Equipment. The mixture shall be agitated and spread uniformly in the surfacing box by means of twin-shafted paddles or spiral augers fixed in the spreader box. A front seal shall be provided to ensure no loss of the mixture at the road contact point. The rear seal shall act as a final strike-off and shall be adjustable. The spreader box and rear strike-off shall be so designed and operated that a uniform consistency is achieved to produce a free flow of material to the rear strike-off. The spreader box shall have suitable means provided to side shift the box to compensate for variations in the pavement geometry.
- (d) Secondary Strike-Off. A secondary strike-off shall be provided to improve surface texture. The secondary strike-off shall have the same adjustments as the spreader box.
- (e) Rut-Filling Box. When required on the Plans, before the final surface course is placed, preliminary microsurfacing material may be required to fill ruts, utility cuts, depressions in the existing surface, etc. Ruts of one-half (1/2) inch (12.7 mm) or greater in depth shall be filled independently with a rut-filling spreader box, either five (5) foot (1.5 m) or six (6) foot (1.8 m) in width. For irregular or shallow rutting of less than one-half (1/2) inch (12.7 mm) in depth, a full-width scratch-coat pass may be used as directed by the Engineer. Ruts that are in excess of one and one-half (1-1/2) inches (38.1 mm) in depth may require multiple placements with the rut-filling spreader box to restore the cross-section. All rut-filling level-up material should cure under traffic for at least a twenty-four (24) hour period before additional material is placed on top of the level up.
- (f) Auxiliary Equipment. Suitable surface preparation equipment, traffic control equipment, hand tools, and any other support and safety equipment shall be provided by the Contractor as necessary to perform the work, except where provided for under other items within the Contract.

(g) Calibration. Each mixing unit to be used in the performance of the work shall be calibrated in the presence of the Engineer or designee prior to construction and the corresponding calibration documentation provided to the Engineer. Previous calibration documentation covering the exact materials to be used may be acceptable, provided that no more than 60 days have lapsed. The documentation shall include an individual calibration of each material at various settings, which can be related to the machine metering devices. No machine will be allowed to work on the project until the calibration has been completed and accepted.

(h) Weather and Seasonal Limitations. The requirements of Subsection 406.04 shall apply, except as modified herein.

Do not place microsurfacing in the rain, or if the air temperature is expected to fall below 7°C (45°F) within 24 hours after application. Application will be permitted to begin when pavement temperature is greater than 7°C (45°F) and is expected to rise above 10°C (50°F). Stop microsurfacing if the surface or air temperature drops below 10°C (50°F).

(i) Mixture Consistency. Produce a homogeneous mixture without lumps, balls, unmixed aggregate, segregation, excess water, or excess emulsion.

Control the break time and mix consistency with mixture proportion adjustments. Keep the mixture from setting until after application. The maximum allowable adjustment of the mineral filler is 1.0%. Report all mixture adjustments to the Engineer before they are made.

(j) Surface Preparation.

- (1) Remove all debris and standing water.
- (2) Cover all manhole covers, water boxes, catch basins, and other such utility and drainage structures within the area being paved with plastic, building felt, or other material approved by the Engineer. Remove the covers each day.
- (3) If necessary, dampen the pavement surface with water or apply a tack coat of emulsion to the pavement surface before applying microsurfacing.

(k) Application.

- (1) Application Rate. Use at least 2 applications to achieve the application rate, or as detailed in the Contract Documents. Application rate limits are given in Table 6 - Application Limits. When filling ruts, fill each wheel rut as detailed in the Contract Documents.

- (2) Coverage. Apply the microsurfacing to the pavement evenly across the entire width of the spreader box to produce a smooth riding surface with no streaks, excess buildup, or thin or uncovered areas. Do not use hand tools to expand the width of application wider than the spreader box, except as described under subpart (5) below. Hand-held squeegees shall not be used to expand the width of application during mainline paving.
- (3) Joints. Minimize the number of joints. Construct joints in order that no gap is present between adjacent applications. Place longitudinal joints at the edges of traffic lanes. Other longitudinal joint arrangements require the Engineer's approval. Measure the difference in grade across joints by laying a 10 foot (3 m) straightedge centered on the joint perpendicular to the direction of the joint. Joint overlap and grade difference requirements are specified in Table 7 - Joint Requirements.
- (4) Variable-Width Passes. Apply no more than one variable-width pass. Variable-width passes will not be permitted as the last pass unless approved by the Engineer.
- (5) Hand Finishing. Use hand-held squeegees to finish areas which cannot be reached with the spreader box, and to produce straight lines along curbs, shoulders, and through intersections. Apply the same type of finish to the surface as that applied by the spreader box.
- (6) Excess Material. Remove all excess material in areas such as driveways, gutters, intersections, etc. each day.

TABLE 6 - APPLICATION LIMITS

GRADATION	MAXIMUM SINGLE PASS APPLICATION RATE (kg/m <sup>2</sup> )	TOTAL APPLICATION TOLERANCE (kg/m <sup>2</sup> )	TYPICAL TOTAL APPLICATION RATE RANGE (kg/m <sup>2</sup> )
Type II	11	± 2.0	14 - 22
Type III	16	± 3.0	20 - 32

TABLE 7 - JOINT REQUIREMENTS

REQUIREMENT	MINIMUM	MAXIMUM
Difference in Grade	-	6.0 mm
Longitudinal Joint	50 mm	150 mm

Overlap		
Transverse Joint Overlap	50 mm	300 mm

(1) Curing. Allow each coat to cure sufficiently to resist damage from the microsurfacing equipment, prior to applying the next coat. Protect the microsurfacing from traffic until the mixture has cured sufficiently to resist damage, such that deformations from wheel loading are not evident. The time required will vary based on the mix design and environmental conditions and will be at the discretion of the Engineer. Repair damage from microsurfacing equipment or traffic to the satisfaction of the Engineer.

xx. METHOD OF MEASUREMENT. The quantities of Special Provision (Microsurface Treatment, Type II) and Special Provision (Microsurface Treatment, Type III) to be measured for payment will be the number of metric tons (tons) of mixture complete in place in the accepted work as determined and metered by the calibrated proportioning devices.

xx. BASIS OF PAYMENT. The accepted quantities of Special Provision (Microsurface Treatment, Type II) and Special Provision (Microsurface Treatment, Type III) will be paid for at the Contract unit price per metric ton (ton). Payment shall be full compensation for furnishing, mixing, hauling, and placing the material specified, including performing surface preparation as specified herein, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
900.680 Special Provision (Microsurface Treatment, Type II)	Metric Ton (Ton)
900.680 Special Provision (Microsurface Treatment, Type III)	Metric Ton (Ton)