

ITEM 10410.102102 M - MICRO-SURFACING, TYPE II
ITEM 10410.103102 M - MICRO-SURFACING, TYPE III
ITEM 10407.10 M - EMULSION TACK COAT

DESCRIPTION.

Apply a properly proportioned mixture of polymer modified asphalt emulsion, mineral aggregate, mineral filler, water, and other additives to a paved surface. All necessary surface cleaning, joint sealing, crack filling, pavement markings removal, tack coats, and utility grade adjustments will be paid for under their appropriate items.

MATERIAL REQUIREMENTS.

A. Asphalt Emulsion. § 702 - Bituminous Materials, CQS-1p, Item 702-4801. Use this emulsion for both the tack coat and micro-surfacing mixture.

B. Aggregates. § 703-02, Coarse Aggregate, except as modified herein.

1. Use 100% crushed aggregate, from an approved source.
2. Use aggregate with a minimum sand equivalent quality of 65%, as determined according to AASHTO T 176, "Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test," or that is classified as non-plastic according to AASHTO T 89, "Determining the Liquid Limit of Soils," and AASHTO T 90, "Determining the Plastic Limit and Plasticity Index of Soils."
3. Use aggregate that consists of one of the following when sampled and tested in accordance with Materials Method 28, "Friction Aggregate Control and Test Procedures."
 - a. Limestone having an acid insoluble residue content \pm 20.0%, excluding particles of chert and similar siliceous rocks, unless otherwise approved by the Director, Materials Bureau. Blends of siliceous and non-siliceous limestones will not be permitted.
 - b. Dolomite having an acid insoluble residue content \pm 17.0%, excluding particles of chert and similar siliceous rocks, unless otherwise approved by the Director, Materials Bureau. Blends of siliceous and non-siliceous dolomite will not be permitted.
 - c. Sandstone, granite, chert, traprock, ore tailings or other similar non-carbonate materials.
 - d. Use gravel or blend two or more of: gravel, limestone, dolomite, sandstone, granite, chert, traprock, ore tailings, or other similar materials to produce a final blend having at least 40.0% (by weight with adjustments to equivalent volumes for materials of different specific gravities) non-carbonate particles in each size fraction coarser than the 600 μ m sieve. Non-carbonate particles are those having a minimum acid insoluble residue content of 80.0%.

C. Water. § 712-01, Water.

D. Mineral Filler. § 703-08, Mineral Filler.

E. Equipment. Use micro-surfacing equipment appearing on the Department's Approved List. Equipment must be designed and manufactured specifically for mixing and placing micro-surfacing. The equipment must be capable of accurately proportioning the constituent materials, thoroughly mixing those materials, and placing the micro-surfacing in conformance with this specification. Submit requests to add equipment to the Approved List to the Director, Materials Bureau, at least 30 days before the start of work.

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Calibrate each mixing unit according to Materials Method 8.4M, "Calibrating Micro-Surfacing Mix Units." Calibrations are valid for 90 days.

The emulsion, aggregate and mineral filler counters must be accessible to the Engineer and inspectors.

MIXTURE DESIGN.

Employ a Department approved laboratory to develop a mixture design meeting the requirements in Table 1 - Proportional Requirements, Table 2 - Physical Requirements, and Table 3 - Gradation Requirements. All materials used to develop the mixture design must be representative of the material to be used on the project. Submit the mixture design, to the Director, Materials Bureau, for approval at least 14 days before the start of work. Mixture design approvals are valid until December 31, of the year in which they are approved.

TABLE 1 - PROPORTIONAL REQUIREMENTS	
Constituent	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.
Water	As required to produce proper mixture consistency.
Field Control Additive	As required to control of the emulsion's set properties or increase adhesion, but must be part of the mixture design and compatible with all other components.

TABLE 2 - PHYSICAL REQUIREMENTS		
Property	Test Method	Requirement
Wet Cohesion	ISSA TB 139; 30 minutes	12 kg-cm, minimum
	ISSA TB 139; 60 minutes	20 kg-cm, minimum
Wet Track Abrasion Loss	ISSA TB 100; 1 hour soak	538 g/m ² , maximum
	ISSA TB 100; 6 day soak	807 g/m ² , maximum
Mix Time	ISSA TB 113	Controllable to 120 sec., min.
Classification Compatibility	ISSA TB 144	11 grade points, minimum
Wet Stripping	ISSA TB 114	Pass (90.0% minimum)
Excess Asphalt by LWT Sand Adhesion	ISSA TB 109	538 g/m ² maximum
Lateral Displacement	ISSA TB 147A	5.0% maximum
Specific Gravity after 1000 cycles of 125 lbs.	ISSA TB 147A	2.10 maximum

TABLE 3 - GRADATION REQUIREMENTS	
Mixture Type	Aggregate Gradation
Type II	2MS ⁽¹⁾
Type III	3MS ⁽¹⁾

⁽¹⁾ § 703-02 Material Requirements, Table 703-5 Sizes of Crushed Gravel, Stone, and Slag for Slurry.

CONSTRUCTION DETAILS.

Submit a copy of the approved mix design and equipment calibration information to the Engineer prior to the start of work. Adjust the material delivery settings on the micro-surfacing equipment to produce the approved mix design. Verify the calibration and material delivery settings during construction according to Materials Method 8.4M, "Calibrating Micro-Surfacing Mix Units" as requested by the Regional Materials Engineer.

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A. Stockpile. Build an aggregate stockpile 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 micro-surfacing equipment.

1. Testing. Take three samples, according to Materials Method 5, “Plant Inspector’s Manual for Bituminous Concrete Mix Production” and test for gradation, according to AASHTO T 11, “Materials Finer than 75µm 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.

When blending multiple aggregates, sample and test the stockpile in accordance with Materials Method 28, “Friction Aggregate Control and Test Procedures.”

Submit the test results to the Engineer and Regional Materials Engineer for approval before using material from the stockpile.

The Engineer will take at least one sample for friction aggregate analysis according to Materials Method 28.

2. Tolerance. The maximum stockpile tolerances are given in Table 4 - Maximum Stockpile Tolerances. The design value plus the stockpile tolerance cannot exceed the gradation limits (Table 3 - Gradation Requirements).

TABLE 4 - MAXIMUM STOCKPILE TOLERANCES								
Screen Sizes (mm)	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075
Stockpile Tolerance	-	±5.0%	±5.0%	±5.0%	±5.0%	±4.0%	±3.0%	±2.0%

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.

All micro-surfacing placed with material from a stockpile rejected for gradation will be rejected pending submission and approval of a mix design representing the stockpile gradation and admixture placed.

If the non-carbonate or acid insoluble residue contents of the material in the stockpile are not within the specified limits, the stockpile will be rejected. All micro-surfacing placed with material from a stockpile rejected for non-carbonate or acid insoluble residue content will be rejected pending evaluation of the pavement in accordance with Materials Method 28.

B. Weather and Seasonal Limitations. The requirements of Section 402-3.01 Weather and Seasonal Limitations apply, except as modified herein. Do not place micro-surfacing in the rain, or if the air temperature is expected to fall below freezing within 24 hours after application. Application will be permitted to begin when pavement temperature is > 7°C and expected to rise, above 10°C. Stop micro-surfacing if the temperature drops below 10°C.

C. Mixture Consistency. Produce a mixture which is homogeneous, with no lumps, balls, unmixed aggregate, segregation, and excess water or emulsion.

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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.

D. Surface Preparation.

1. Thoroughly clean the entire surface before applying the asphalt emulsion and micro-surfacing. The surface should be free of dirt, oil, and other foreign materials. Remove all debris and standing water.
2. Cover all manhole covers, water boxes, catch basins, and other such utility structures within the area being paved with plastic, building felt, or other material approved by the Engineer. Remove the covers each day.
3. Apply the asphalt emulsion on to the membrane in accordance to §407-3, Construction Details, at a rate of 0.16 to 0.20 L/m² before applying micro-surfacing mixture. Alternate application rates require the Engineer's approval.

E. Application.

1. **Application Rate.** Use at least 2 applications to achieve the application rate as detailed in the contract documents. Application rate limits are given in Table 5 - Application Limits. When filling ruts, fill each wheel rut as detailed in the contract documents.

TABLE 5 - APPLICATION LIMITS			
Gradation	Maximum Single Pass Application Rate (kg/m²)	Total Application Tolerance (kg/m²)	Typical Total Application Rate Range (kg/m²)
Type II	11	± 2.0	14 - 22
Type III	16	± 3.0	20 - 32

2. **Coverage.** Apply the micro-surfacing to the pavement evenly across the entire width of the spreader box to produce a smooth riding surface with no streaks, excess buildup, thin or uncovered areas. Do not use hand tools to expand the width of application wider than the spreader box, except as described under *Hand Finishing* below. Hand held squeegees may not be used to expand the width of application during mainline paving.
3. **Joints.** Minimize the number of joints. Construct joints such that no gap is present between adjacent applications. When possible, place longitudinal joints at the edges of traffic lanes. Measure the difference in grade across joints by laying a 3 m straight edge centered on the joint perpendicular to the direction of the joint. Joint overlap and grade difference requirements are given in Table 6 - Joint Requirements.

TABLE 6 - JOINT REQUIREMENTS		
Requirement	Minimum	Maximum
Difference in Grade	-	6.0 mm
Longitudinal Joint Overlap	50 mm	150 mm
Transverse Joint Overlap	50 mm	300 mm

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4. **Variable-Width Passes.** Apply no more than one variable-width pass. Variable-width passes will not be permitted as the last pass unless ordered 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 is applied by the spreader box.
6. **Excess Material.** Remove all excess material in areas such as driveways, gutters, intersections, etc. as specified by the Engineer, each day.

F. Curing. Allow each coat to cure sufficiently to resist damage from the micro-surfacing equipment, before applying the next coat. Protect the micro-surfacing from traffic until the mixture has cured sufficiently to resist damage. The time required will vary based on the mix design and environmental conditions. Repair damage from micro-surfacing equipment or traffic to the Engineer's satisfaction.

METHOD OF MEASUREMENT.

Micro-Surfacing. The Engineer will measure the total metric tons of aggregate, mineral filler, and asphalt emulsion used according to Materials Method 8.4M, "Calibrating Micro-Surfacing Mix Units."

Emulsion Tack Coat. The Engineer will measure the number of liters of asphalt emulsion used for the emulsion tack coat, measured at 16°C.

BASIS OF PAYMENT.

Micro-Surfacing. Include the cost of all labor, materials, and equipment necessary to perform the work in the unit price bid per metric ton.

Emulsion Tack Coat. Include the cost of all labor, materials, and equipment necessary to perform the work in the unit price bid per liter.

Payment will be made under:

Item No.	Item	Pay Unit
10410.102102 M	Micro-Surfacing, Type II	Metric Ton
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