

04030 Emulsified Asphalts

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04030-1 General**1.1 Description**

The work covered by this specification shall consist of supplying all plant, labour, equipment and materials and in performing all operations in connection with **Emulsified Asphalts** in accordance with this specification.

1.2 Related Sections

Section 04025 Asphalt Prime, Tack and Flush Coat

1.3 Micro Surfacing Mix Design Submittal

Prior to construction, the Contractor shall submit a signed mix design for each aggregate type and source. This design will be performed by a testing firm which has experience in designing micro surfacing mixes. After the mix design has been approved, no material substitution will be permitted unless approved by the Engineer.

Compatibility of the aggregate, polymer-modified emulsified asphalt, water, mineral filler, and other additives shall be evaluated in the mix design. The mix design shall be completed using materials consistent with those supplied by the contractor for the project. The mix design submittal shall include the following:

- **Emulsified Asphalt data;**
 - **Emulsion supplier**
 - **Type of emulsion**
 - **24-hour settlement results**
 - **Distillation results**
 - **Softening point**
 - **Penetration @25°C**
- **Aggregate data;**
 - **Source(s) of aggregate**
 - **Los Angeles Abrasion test results**
 - **Sand Equivalency results**
- **Micro Surfacing Mix data;**
 - **Emulsion content**
 - **Residual Asphalt**

- **Mineral Filler type and content**
- **Polymer content**
- **Additives**
- **Water content**
- **Aggregate gradation**
- **Mix time @25°C**
- **Wet Cohesion @30 min**
- **Wet Cohesion @60 min**

04030-2 Materials**2.1 Emulsified Asphalts**

Emulsifiers used to stabilize asphalt emulsions shall not be harmful to the performance of the asphalt in service.

2.1.1 Slurry Seal

The emulsified asphalt shall conform to the requirements of the current specifications of the Asphalt Institute. SS-1 grade emulsified asphalt shall be used with the Penetration of Residue at 38°C shall be 40-90 and a viscosity range of 20-50.

SS-1 and SS-2 grade emulsified asphalt may be used if approved by the Engineer.

The Contractor shall supply the emulsified asphalt.

2.1.2 Micro Surfacing

The emulsified asphalt shall be milled or blended into the asphalt or emulsifier solution prior to the emulsification process. A minimum of three percent (3%) polymer solids based on asphalt weight is required.

The emulsified asphalt and emulsified asphalt residue shall meet the requirements of AASHTO M 208 or ASTM D 2397 for CQS-1HP, with the exceptions shown in Table 1. The temperature for this test should be held at 177°C for 20 minutes.

The climatic conditions should be considered when establishing this range. The solubility test, if required, should be evaluated on the base asphalt.

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Table 1: Emulsified asphalt test exception

Test	Test Method		Requirement
	AASHTO	ASTM	
Settlement of storage stability of emulsified asphalts, 24h	T 59	D 6930	1% maximum
Distillation of emulsified asphalt	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 minimum
Penetration of bituminous materials at 25°C	T 49	D 5	40-902

2.2 Aggregate

2.2.1 **Slurry Seal**

Aggregate shall consist of natural, hard, durable, angular sand. The aggregate shall be clean, free from deleterious material, lumps of dried fines or adherent coatings.

The mineral aggregate shall meet the following gradation requirements:

Table 2: Slurry Seal Mineral Aggregate Gradation

Sieve Designation	Percent Passing by Weight
2.0 mm	100
900 µm	40 - 65
400 µm	25 - 45
160 µm	11 - 22
75 µm	7 - 15

2.2.2 **Micro Surfacing**

The mineral aggregate used shall be the type specified for the particular application requirements of the microsurfacing. The aggregate shall be a crushed stone such as granite, slag, limestone, chat, or other high-quality aggregate, or

combination thereof. To assure the material is 100 percent crushed, the parent aggregate will be larger than the largest stone in the gradation used.

To account for aggregate bulking, it is the responsibility of the contractor to check stockpile moisture content and to set the machine accordingly.

The aggregate shall meet the specified polishing values and minimum requirements shown in Table 3.

Table 3: Micro Surfacing Aggregate Physical Properties

Test	Test Method		Requirement
	AASHTO	ASTM	
Sand equivalence	T 176	D 2419	65% minimum
Aggregate Soundness by use of sodium sulfate and magnesium sulfate	T 104	C 88	15% maximum w/ Na ₂ SO ₄ 25% maximum w/ MgSO ₄
Los Angeles Abrasion ¹	T 96	C 131	30% maximum

Notes:

1. The LA Abrasion test shall be run on the parent aggregate.

The aggregate gradations for Type 2 and Type 3 Micro Surfacing shall meet the following requirements in Table 4.

Table 4: Micro Surfacing Gradation Requirements

Sieve Designation	Percent by Weight Passing	
	Type II	Type III
9.0mm	100.0	100.0
5.0mm	90.0 – 100.0	75.0 – 90.0
2.0mm	59.0 – 84.0	35.0 – 70.0
900µm	38.0 – 60.0	26.0 - 40.0
400µm	21.0 – 35.0	15.0 - 30.0
160µm	10.0 – 22.0	7.0 - 18.0
71µm	5.0 – 14.0	5.0 - 15.0

The aggregate will be accepted based on five gradation tests sampled according to AASHTO T 2 (ASTM D 75). If the average of the five tests is within the stockpile tolerance from the mix design gradation, the material will be accepted. If the

average of those test results is out of specification or tolerance, the contractor will be given the choice to either remove the material or blend additional aggregate with the stockpile material to bring it into compliance. Materials used in blending must meet the required aggregate quality test specifications before blending and must be blended in a manner to produce a consistent gradation. Aggregate blending shall require the submittal of a new mix design.

2.3 Filler

2.3.1 Slurry Seal

When required to produce a proper "slurry consistency", the addition of a correct filler shall be added as required. Commercial fillers consisting of Portland Cement, Hydrated Lime, limestone dust or crusher run dust shall be used. Natural occurring materials, namely, silt or clay, will only be permitted to be used as a filler when approved by the Engineer.

2.3.2 Micro Surfacing

Mineral filler may be used to improve mixture consistency and to adjust mixture breaking and curing properties. Portland cement, hydrated lime, limestone dust, fly ash, or other approved filler meeting the requirements of ASTM D 242 shall be used if required by the mix design. Typical use levels are normally 0.0 - 3.0 percent and may be considered part of the aggregate gradation.

2.4 Micro surfacing Mix

The micro surfacing mix shall be designed to pass the following test requirements in Table 5:

Table 5: Micro Surfacing Mix Requirements

Test	ISSA Table No.	Requirement
Mix Time @ 25°C	TB 113	Controllable to 120 seconds minimum
Wet Cohesion @ 30 minutes minimum (set) @ 60 minutes minimum (traffic)	TB 139	12 kg-cm minimum 20 kg-cm or near spin minimum
Wet stripping	TB 114	Pass (90% minimum)
Wet-track abrasion loss over one-hour soak Six-day soak	TB 100	538g/m² maximum 807g/m² maximum
Lateral displacement Specific gravity after 1000 cycles of 56.71kg	TB 147	5% maximum
Excess asphalt by LWT sand adhesion	TB 109	538g/m² maximum
Classification compatibility	TB 144	11 grade points minimum (AAA, BBB)

The micro surfacing mix shall be designed to the limits listed in Table 6:

Table 6: Micro Surfacing Mix Limits

Component Materials	Limits
Residual asphalt	5.5 – 10.5% by dry weight of aggregate
Type of mineral filler	0 – 3% by dry weight of aggregate
Polymer content	Minimum of 3.0% solids based on bitumen weight content

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2.4.1 Water

The water shall be free of harmful salts and contaminants. If the quality of the water is in question a sample shall be submitted to the City.

The Contractor is responsible for providing all water required at the construction site. An application form for a portable water meter is available from the City's Water and Waste Stream Division.

The Contractor shall not operate any hydrant, valve or curb stop without the Engineer's permission.

2.4.2 Additives

Additives may be used to accelerate or retard the break/set of the micro surfacing. Appropriate additives, and their applicable use range, should be approved by the City as part of the mix design.

2.4.3 Fibres

Fibres shall be added to the micro surfacing mix before the pug mill by mechanical distributor in order to ensure an even distribution throughout the mix.

Fibres shall be 12.5mm (0.5 inches) in length.

04030-3 Equipment

All equipment, tools, and machinery used in the performance of this work shall be maintained in satisfactory working condition.

3.1 Slurry Seal**3.1.1 Mixer Equipment**

The slurry seal coat mixing machine shall be a continuous flow mixing unit and be able to accurately deliver and proportion aggregate, asphalt emulsion, and water to a revolving spiralled multiblade mixer and discharge the thoroughly mixed product on a continuous basis in a minimum amount of time.

The mixing machine shall be equipped with an approved fines feeder with an accurate metering device or method to introduce a predetermined amount of mineral filler into the mixer at the same time and location where the aggregate is fed. A calibrated control for aggregate and asphalt shall be provided capable for accurately proportioning materials.

The mixing machine shall be equipped with a water pressure system and a fog type spray bar adequate for complete fogging of the surface preceding spreading equipment with a maximum application of 0.30 litres per square metre.

The machine while in operation shall have a minimum speed of 18 metres per minute and shall not be allowed to exceed 55 metres per minute. Sufficient machine storage capacity shall be provided to properly mix and apply a minimum of 5 tonnes of slurry.

3.1.2 Spreading Equipment

The mechanical type squeegee distributor shall be equipped with flexible material in contact with the surface to prevent the loss of slurry from the distributor. It shall be maintained so as to prevent loss of slurry on varying grades and crown by adjustments to assure uniform spread and depth.

There shall be a steering device and a flexible strike-off. A piece of burlap or a piece of heavy canvas shall be attached behind the spreader to provide a smooth surface. The squeegee shall be attached behind the mixer.

3.1.3 Auxiliary Equipment:

Hand squeegees, shovels and hand equipment shall be provided as necessary to perform the work.

3.2 Micro Surfacing

All equipment, tools, and machines used in the application of microsurfacing shall be maintained in satisfactory working condition at all times.

All water and emulsion storage containers used in delivery or application of microsurfacing shall be free of contaminants and shall not leak. Spray bar nozzles shall be regularly inspected to ensure that a continuous even spray is being maintained. All lighting and reflectors must remain clean and operational at all times.

Equipment must be maintained to ensure that contaminants such as, but not limited to, motor oil, antifreeze, or hydraulic fluids are not leaking onto the road. At the discretion of the Engineer, the Contractor will cease operations and rectify the concerns regarding the condition of the equipment or tools.

All counting devices shall be in proper working condition prior to work commencing at each location. The Contractor will not receive payment for work completed with non-working counting devices.

For the safety of the crew, all equipment used in the application of microsurfacing or transportation of its components will have sufficient lighting, reflectors and warning lights to be clearly seen at night.

If the Engineer deems there is insufficient lighting or reflectors, the Contractor will take necessary steps to satisfy the requirements of the Engineer.

3.2.1 Mixing Equipment

The machine shall be specifically designed and manufactured to apply microsurfacing. The material shall be mixed by an automatic-sequenced, self-propelled, front feed, continuous loading, microsurfacing mixing machine. A mobile truck mounted microsurfacing unit is also acceptable.

It shall be a continuous-flow mixing unit that accurately delivers and proportions the mix components through a revolving multi-blade, double-shafted mixer. Sufficient storage capacity for all mix components is required to maintain an adequate supply to the proportioning controls.

When utilizing continuous machinery to minimize transverse joints, the specified machine must be capable of loading materials while continuing to apply microsurfacing. The continuous-run machine shall be equipped to provide the operator with full control of the forward and reverse speeds during application. It shall 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 of original-equipment-manufacturer design.

3.2.2 Proportioning Devices

Individual volume or weight controls for proportioning mix components shall be provided and properly labeled. These proportioning devices are used in material calibration to determine the material output at any time.

3.2.3 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 insure 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 designed and operated such that a uniform consistency is achieved and a free flow of material is provided 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 secondary strike-off shall be provided to improve surface texture. The secondary strike-off shall be adjustable to match the width of the spreader box and allow for varying pressures to control the surface texture.

3.2.4 Auxiliary Equipment

Suitable surface preparation equipment, traffic control equipment, hand tools, and other support and safety equipment necessary to perform the work shall be provided by the contractor unless otherwise stated.

04030-4 Execution

Immediately prior to applying slurry seal coat or micro surfacing, the surface shall be cleaned of all loose material, silt spots and other objectionable material.

4.1 Slurry Seal coating

The Slurry Seal Coat shall consist of a mixture of emulsified asphalt, mineral aggregate and water, properly mixed and spread on the surface as specified and as directed by the Engineer.

On old pavement, a tack coat consisting of a dilution of 1 part emulsified asphalt to 3 parts water shall be applied with a conventional pressure distributor

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4.1.1 Mix Preparation

The quantities of aggregate, emulsified asphalt and water shall be measured or weighed into each batch. When preparing slurry seal mixes, the water and emulsified asphalt shall be added first, and then the aggregate. The amount of water used shall be a minimum to provide a fluid homogeneous mixture.

The Contractor shall make trial batches, at his expense, to determine the final blend of mineral aggregate, mineral filler and asphaltic binder until approved by the Engineer. Approximately 9.5 to 11.5 litres of emulsified asphalt shall be used per 45 kilograms of dry aggregate weight

4.1.2 Application

The surface shall be fogged with water from pressure nozzles directly preceding the drag distributor. No puddles of free water shall remain after fogging. The slurry mix shall be of the desired consistency when deposited on surface and no additional elements added. Total time of mixing shall not exceed 4 minutes. A maximum amount of slurry shall be carried in the distributor and the maximum allowable speed shall be 55 m per minute.

The average thickness of slurry seal coat applied shall be 3 mm or approximately 1 tonne per 1,500 square metres of surface.

Slurry seal shall be protected from all traffic until the slurry has set. The minimum time period, in excellent drying weather, shall be 4 hours or the time required for the slurry colour to change from uniform brown to uniform black.

Slurry application shall be suspended when rain is imminent within 12 hours.

4.2 Micro Surfacing

Microsurfacing shall consist of a mixture of polymer-modified emulsified asphalt, mineral aggregate, water, and additives, proportioned, mixed and uniformly spread over a properly prepared surface. The microsurfacing shall be applied as a homogeneous mat, adhere firmly to the prepared surface, and have a skid-resistant texture throughout its service life.

4.2.1 Calibration

Each mixing unit to be used in the performance of the work shall be calibrated in the presence of the Engineer prior to the start of the project. Previous calibration documentation covering the exact materials to be used may be acceptable, provided that no more than 60 days have passed. The documentation shall include an individual calibration for each material at various settings that can be related to the machine metering devices. Any component replacement affecting material proportioning or measuring requires that the machine be recalibrated. No machine will be allowed to work on the project until the calibration has been completed and accepted by the Engineer.

The Contractor shall repair defective metering devices and components and provide the Engineer notice as to when the equipment will be recalibrated. The Engineer may request the Contractor to verify the calibration of the equipment. There will be no additional payments for calibrating, re-calibration or for verifying the calibration of the equipment.

4.2.2 Tack Coat

Tack Coats shall be applied in accordance to Section 04025.

4.2.3 Protecting Existing Utilities

All utilities shall be protected from the microsurfacing and tack oil by a suitable method. The Engineer must approve the method employed to protect the utility covers. If the Engineer deems the protective coverings material or installation to be unacceptable, the Contractor will cease operations until the installation meets the approval of the Engineer.

Protective coverings must be removed within 24 hours of completion of the work or before the roadway is reopened to traffic. Removal of utility covers includes removal of protective covering material and removal of any microsurfacing material or other material that may be present on the utility.

4.2.4 Application

The microsurfacing is to be applied with a drag (burlap or a similar material) to ensure a uniform textured finish. The Contractor is to apply the microsurfacing in

such a manner to ensure a continuous seal, tight along curb or gutter where present.

The microsurfacing shall be of the appropriate consistency upon leaving the mixer. A sufficient amount of material shall be carried in all parts of the spreader at all times so that complete coverage is obtained. Overloading of the spreader box shall be avoided. No dry aggregate either spilled from the lay-down machine or existing on the road will be permitted.

Mixes resulting in lumping, unmixed aggregate, roughness or excessive streaking in the mat surface will be rejected and operations ceased until the Contractor proves to the Engineer that the situation has been corrected. Excessive streaking is defined as more than four drag marks greater than 10mm wide and 100mm long, or 25mm wide and 75mm long, in any 25 square meter area. No transverse ripples or longitudinal streaks of 5mm in depth will be permitted, when measured by placing a 3m straight edge over the surface. Mixes that are unable to hold straight lines or that cause an asphalt-rich surface with segregation will be rejected.

It is the responsibility of the Contractor to protect the microsurfacing until it has cured sufficiently to prevent pickup or damage. The Contractor will not be responsible for damage caused by circumstances that are out of their control, such as emergency vehicles requiring access through the work area.

4.2.4.1 Rate of Application

Acceptable Micro Surfacing application rate shall be in accordance with Table 7. Application rates are based upon the weight of aggregate in the mixture.

Table 7: Micro Surfacing Application Rates

Aggregate Type	Application Rate
Type II	14 – 17kg/m ²
Type III	16 – 19kg/m ²

4.2.4.2 Joints

No excess buildup, uncovered areas, or unsightly appearance shall be permitted on longitudinal or transverse joints. The contractor shall provide suitable width

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spreading equipment to produce a minimum number of longitudinal joints throughout the project. Longitudinal joints shall be placed 200mm from lane lines or as approved by the Engineer. Partial width passes will only be used when necessary and shall not be the last pass of any paved area. The joint shall have no more than a 5mm difference in elevation when measured by placing a 3m straight edge over the joint and measuring the elevation difference.

4.2.4.3 Mixture

The microsurfacing shall possess sufficient stability so that premature breaking of the material in the spreader box does not occur. The mixture shall be homogeneous during and following mixing and spreading. It shall be free of excess liquids which create segregation of the aggregate. Spraying of additional water into the spreader box will not be permitted.

4.2.4.4 Handwork

Areas which cannot be accessed by the mixing machine shall be surfaced using hand squeegees to provide complete and uniform coverage. Handwork shall exhibit the same finish as that applied by the spreader box. All handwork shall be completed prior to final surfacing.

4.2.4.5 Lines

Lines at intersections, curbs, and shoulders will be kept straight to provide a good appearance. A suitable material will be used to mask off the end of streets to provide straight lines. Longitudinal edge lines shall not vary by more than +/- 50mm in any 30m length.

04030-5 Testing

The supplier shall, prior to initial delivery, undertake standard control tests and provide test results to prove compliance with the requirements for the desired type and grade of emulsified asphalt.

04030-6 Payment**6.1 Slurry Seal Coating**

Payment for Slurry Seal Coating will be at the contract unit price per square metre. The unit price will be for full compensation for supplying emulsified asphalt slurry seal aggregate and filler, preparing and applying the slurry seal, applying tack coat when required and cleaning the surface to be treated.

6.2 Microsurfacing

Payment for emulsion and aggregate for microsurfacing will be at the contract unit price per tonne. Aggregate and emulsion quantities shall be calculated utilizing the calibration and application rate as measured in the field. The unit price will be full compensation for furnishing all materials, all preparation, mixing and application of materials, and for all labour, equipment, tools, testing, cleaning, and incidentals necessary for completing the work as specified herein.

End of Specification 04030