

INDEX TO CLAUSES

PART 1 - GENERAL

- 1.1 Work Included
- 1.2 Related Sections
- 1.3 Reference Standards
- 1.4 Codes, Bylaws, Ordinances and Regulations
- 1.5 Quality Control and Testing
- 1.6 Quality Assurance

PART 2 - PRODUCTS

- 2.1 General
- 2.2 Polymer Modified Emulsified Asphalt (Binder)
- 2.3 Aggregates
- 2.4 Mineral Filler
- 2.5 Water
- 2.6 Polymer Modifier
- 2.7 Additives
- 2.8 Mix Design
- 2.9 Equipment

PART 3 - EXECUTION

- 3.1 General
- 3.2 Trial Area
- 3.3 Placement/Weather Limitations
- 3.4 Notification and Traffic Control
- 3.5 Surface Preparation
- 3.6 Application
- 3.7 Temporary Pavement Markings
- 3.8 Clean Up
- 3.9 Protection of Work
- 3.10 Testing
- 3.11 Liability

PART 1 - GENERAL

1.1 Work Included

- .1 This section specifies the requirements for polymer modified micro-surfacing. The reference to micro-surfacing shall be understood to include both surface and scratch course application unless otherwise specified.
- .2 Micro-surfacing shall consist of thoroughly cleaning the existing surface, applying a homogeneous proportioned mixture of cationic polymer modified emulsified asphalt, mineral aggregate, mineral filler, water and other additives to the existing pavement surface.
- .3 Those materials which are not specified and/or indicated but are necessary for the complete installation of the work shall be deemed the responsibility of the Contractor and shall be included at no extra cost to the Contract.

1.2 Related Sections

- .1 S-1 Specification for Hot Mix Asphaltic Concrete.
- .2 S-4 Pavement Markings

1.3 Reference Standards

- .1 Uniform Traffic Control Devices for Canada, (3<sup>rd</sup> Edition), latest revision.
- .2 ASTM D2397, Standard Specification for Cationic Emulsified Asphalt
- .3 ASTM D6997, Standard Test Method for Distillation of Emulsified Asphalt
- .4 ASTM D6930, Standard Test Method for Settlement and Storage Stability of Emulsified Asphalts
- .5 ASTM D36, Standard Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)
- .6 ASTM D2170, Standard Test Method for Kinematic Viscosity of Asphalts
- .7 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- .8 ASTM D2419, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
- .9 CSA A23.2-23A, Concrete materials and methods of concrete construction / Test methods and standard practices for concrete
- .10 ISSA TB-139, Classify Emulsified Asphalt/Aggregate Mixture Systems by Modified Cohesion Tester Measurement of Set and Cure Characteristics
- .11 ASTM D242, Standard Specification for Mineral Filler For Bituminous Paving Mixtures
- .12 ISSA TB-114, Wet Stripping Test for Cured Slurry Seal Mix
- .13 ISSA TB-100, Wet Track Abrasion of Slurry Surfaces

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|---|-----|--|
|   | .14 | ISSA TB-147, Measurement of Stability and Resistance to Compaction, Vertical and Lateral Displacement of Multi-layered Fine Aggregate Cold Mixes - Method A  |
|   | .15 | ISSA TB-109, Measurement of Excess Asphalt in Bituminous Mixtures by Use of a Loaded Wheel Tester and Sand Cushion   |
|   | .16 | ISSA TB-113, Trial Mix Procedure for Slurry Seal Design  |
|   | .17 | ISSA TB-144, Classification of Aggregate Filler - Bitumen Compatibility by Schulze-Breuer and Ruck Procedures  |
| 1.4 Codes, Bylaws, Ordinances and <u>Regulations</u>    | .1  | All work covered by this section shall be performed according to applicable Halifax Regional Municipality Codes, bylaws, Ordinances, and Regulations.  |
|   | .2  | Nova Scotia Department of Transportation and Infrastructure Renewal "Temporary Work Place Traffic Control Manual" (latest revision).   |
|   | .3  | HRM Traffic Control Manual Supplement.   |
| 1.5 <u>Quality Control / Testing</u>                    | .1  | Quality Control testing is the responsibility of the Contractor throughout every stage of the work from and including the production of the aggregates and polymer modified asphalt emulsion to the design and placement of the final product  |
|   | .2  | The Contractor shall provide the Engineer with a copy of all quality control test results within 24 hours of testing.  |
| 1.6 <u>Quality Assurance</u>                            | .1  | During the progress of the work, quality assurance testing may be conducted by the Engineer or his representative to ensure compliance with the specifications.  |
|   | .2  | Results of the Quality Assurance testing shall be available to the Contractor.   |
|   | .3  | Quality Assurance testing performed by the Engineer or his representative shall not be considered to be quality control testing. Sampling and testing necessary to perform quality assurance monitoring shall be at no cost to the Contractor. |
| <br><b><u>PART 2 - PRODUCTS</u></b>                     |     |  |
| 2.1 <u>General</u>                                      | .1  | No recycle or other waste materials shall be permitted.  |
| 2.2 <u>Polymer Modified Emulsified Asphalt (Binder)</u> | .1  | The binder shall be a polymer modified cationic type CQS-1hP emulsion.   |
|   | .2  | The polymer modified emulsified asphalt shall be homogeneous after mixing and show no signs of separation within 14 days of  |

delivery. The addition of polymers or other additives after the manufacture of the emulsified asphalt shall not be permitted.

- .3 The emulsified asphalt shall conform to the requirements of ASTM D2397 for CQS-1hP emulsion, with the amendments listed in Table 1 below.

<b>Test Method</b>	<b>Property</b>	<b>Requirements</b>
ASTM D6997	Residue by Distillation	62% minimum
ASTM D6930	Settlement and Storage Stability of Emulsified Asphalt, 24 hr.	1% maximum
<b>Tests on Residue</b>		
ASTM D36	Softening Point	57°C minimum
ASTM D2170	Kinematic Viscosity @ 135°C	650 mm <sup>2</sup> /s minimum

2.3 Aggregates

- .1 The aggregates shall consist of 100 percent crushed bedrock material, meeting the physical properties provided in Table 2 below.

<b>Test Method</b>	<b>Property</b>	<b>Requirements</b>
ASTM C131*	Los Angeles Abrasion	30% maximum
ASTM D2419	Sand Equivalency	65 minimum
CSA A23.2-23A	Fine Aggregate Micro-Deval	20% maximum

\* LA Abrasion completed on parent aggregate

- .2 The aggregate gradation shall conform to the requirements for Type II and Type III M provided below in Table 3.
- .3 The aggregate stockpile shall be within the specified tolerances. The Engineer reserves the right to sample aggregate stockpiles to ensure the gradation conforms to the specifications.
- .4 Type III M modified shall be used on all streets except for low volume residential streets.

**Table 3 – Aggregate Gradation**

Sieve	Type II	Type III M
6.7 mm	---	95-100
4.75 mm	90-100	80-95
2.36 mm	65-90	50-75
1.18 mm	45-70	33-55
600 µm	30-50	25-40
300 µm	18-30	15-30
150 µm	10-21	7-20
75 µm	5-15	5-15

- 2.4 Mineral Filler .1 The requirement for use of mineral filler, to a maximum of 3 percent and meeting the requirements of ASTM D242, shall be determined by the mix design.
- 2.5 Water .1 The water shall be potable and shall be free of harmful salts and contaminants.
- 2.6 Polymer Modifier .1 The polymer solids shall be milled or blended into the emulsifier solution prior to the emulsification process.
- .2 The polymer modifier shall consist of a minimum of 3% polymer solids by mass of asphalt residue.
- 2.7 Additives .1 Additives may be added to the emulsion mix during construction to provide control of the quick-set properties and increase of adhesion. They shall be included in the mix design and compatible with the other components of the micro-surfacing.
- 2.8 Mix Design .1 The Contractor shall designate the mix proportions and prepare the job mix formula.
- .2 The aggregate and the polymer modified emulsified asphalt shall be assessed to confirm compatibility. The Contractor shall supply the results of the physical tests for the aggregate.
- .3 All component materials used in the mix design shall be representative of the material proposed by the Contractor for use on the contract.
- .4 The Contractor shall submit to the Engineer the final mix design and the results of the tests listed in Table 4. The material shall not be placed until the Engineer has received the mix design. The mix proportions shall be within the following limits:

<b>Table 4 - Micro-Surfacing Mix Properties</b>		
	Residual Asphalt	5.5% - 9.5% by dry mass
	Mineral Filler	As required
<b>Test</b>	<b>Property</b>	<b>Requirements</b>
ISSA TB-139	Wet Cohesion	
	@ 30 minutes min. (set)	12 kg-cm minimum
	@ 60 minutes min. (traffic)	20 kg-cm minimum
ISSA TB-114	Wet Stripping	Pass (90% min.)
ISSA TB-100	Wet Track Abrasion Loss	
	One Hour Soak	538 g/m <sup>2</sup> maximum
	Six Day Soak	807 g/m <sup>2</sup> maximum
ISSA TB-147	Lateral Displacement	5% maximum
	Specific Gravity after 1,000 Cycles of 56.7 kg.	2.1 maximum
ISSA TB-109	Excess Asphalt by LWT Sand Adhesion	538 g/m <sup>2</sup> maximum
ISSA TB-113	Mix Time @ 25°C	Controllable to 120 sec min.
ISSA TB-144	Classification Compatibility	11 Grade Points Minimum (AAA, BAA)

.5 The micro-surfacing shall be designed so that traffic can be allowed on the surface within one hour.

2.9 Equipment

.1 Rotary Power Brooms shall be capable of cleaning gravel, sand, dirt and other debris from bituminous surfaces.

.2 Mixing Equipment shall be specifically designed and manufactured to place micro-surfacing. The material shall be mixed by an automatic sequenced, self-propelled micro surfacing 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 shaft mixer and 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.

- .3 Proportioning Devices shall have 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 usually revolution counters or similar devices and are used in material calibration and determining the material output at any time.
- .4 Calibration of Proportioning Devices. Prior to beginning placement of micro-surfacing on this contract, the Proportioning Devices shall be calibrated to the satisfaction of the Engineer. The Engineer shall be notified 24 hours prior to calibration occurring. A copy of the results of the calibration must be given to the Engineer prior to any micro-surfacing operation.
- .5 Re-Calibration of Proportioning Devices. Over the duration of the work, the Proportioning Devices shall be re-calibrated, to the satisfaction of the Engineer, should the following occur:
  - .1 After every 2000 tonne of aggregate placed throughout the duration of the contract.
  - .2 A change in the source of aggregate from that used in the previous calibration.
  - .3 Mechanical failure to the application system and/or Proportioning Devices in which repair is required.
- .6 Spreading Equipment shall be used to apply the mixture. The mixture shall be spread uniformly by means of a conventional augured surfacing spreader box attached to the mixing machine and equipped with paddles 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 pavement contact point. The rear seal shall act as 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 manoeuvre the box to compensate for variations in the pavement geometry. The rut filling spreader box shall be specifically designed for rut filling applications. Rear strike-off bar shall be one piece of rigid steel or metal (scratch course only).

### PART 3 - EXECUTION

- 3.1 General
- .1 Location and dimensions as indicated on drawings or as directed by Engineer.

- 3.2 Trial Area .1 The Contractor shall place a trial area 100 m in length for the commencement of the micro-surfacing operation, one lane width, to demonstrate the ability to produce micro-surfacing in conformance with this specification. The trial area shall be accepted after inspection by the Engineer after 1 hour. The Contractor shall remove and replace any damaged or unsatisfactory micro-surfacing at no cost to the Municipality. The location of the trial area shall be approved by the Engineer.
- 3.3 Placement/  
Weather Limitations .1 Micro-surfacing work shall only be completed between June 1st and September 1st. In addition, the micro-surfacing shall not be applied if either the pavement or air temperature is below 50°F (10°C) and falling but may be applied when both pavement and air temperature are above 45°F (7°C) and rising. No micro-surfacing shall be applied when there is danger that the finished product will freeze before 24 hours. The mixture shall not be applied when weather conditions prolong opening to traffic beyond a reasonable time.
- 3.4 Notification and  
Traffic Control .1 The Contractor shall notify homeowners and businesses affected by the construction at least one day in advance of the surfacing. Should work not occur on the specified day, a new notification shall be distributed. The notification shall be in the form of a written posting, stating the time and date that the surfacing will take place. If necessary, signage alerting traffic to the intended project shall be posted.
- .2 The Contractor is responsible for providing traffic control required to protect the work zone and to ensure the safe passage of traffic in conformance with the Nova Scotia Department of Transportation and Infrastructure Renewal “Temporary Work Place Traffic Control Manual” (latest revision), the HRM Traffic Control Manual Supplement and as directed by the Engineer.
- 3.5 Surface  
Preparation .1 Immediately prior to applying the micro-surfacing, the area to be surfaced shall be thoroughly cleaned of all vegetation, loose material, sand, dirt and other debris. Dried mud or other foreign matter, which cannot be removed with the rotary power broom, shall be removed by hand blade or other approved method. Water, if required, shall be applied to pre-wet the surface immediately ahead of the spreader at a rate to dampen the surface without allowing any freestanding or free flowing water. If water is used, cracks shall be allowed to dry thoroughly before applying micro-surfacing. Manholes, valve boxes, drop inlets and other service entrances shall be protected from the micro-surfacing by a suitable method. Tack coat shall be applied at a rate of 0.30 l/m<sup>2</sup>.
- 3.6 Application .1 The mixture shall be spread to fill minor cracks and shallow potholes and leave a uniform surface. The application shall consist of a minimum of a scratch coat and a final coat with combined minimum rate of application of 18 kg/m<sup>2</sup>.

- .2 A sufficient amount of surface sealer shall be carried in all parts of the spreader box at all times so that complete coverage is obtained. Spraying of additional water into the spreader box shall not be permitted.
- Overloading of the spreader box shall be avoided. No lumping, balling, or unmixed aggregate shall be permitted in the finished surface. No dry aggregate, either spilled from the lay-down machine or existing on the road, shall be permitted. Any oversized aggregate or foreign materials shall be screened from the aggregate prior to delivery to the mixing machine.
- .3 Handwork. In restricted areas where hand spreading is necessary, slight adjustments to the mix formula may be used to retard the setting time. The mixture shall be poured into a small windrow along one edge of the surface to be covered. The mixture shall be spread uniformly with squeegees or other suitable hand tools. As much as possible, handwork shall exhibit the same finish as that applied by the spreader box. All handwork shall be completed prior to final surfacing.
- .4 Appearance as follows:
- .1 The finished micro-surfacing shall have a uniform texture free from excessive scratch marks, tears or other surface irregularities. Tear marks in any 12 m<sup>2</sup> per lane are considered excessive if there are: 1) four or more marks 12 mm wide or wider and 100 mm or more long; or 2) any marks 25 mm wide or wider and 25 mm or more long.
  - .2 There shall be no longitudinal ripples (raking) or wash-boarding (chatter), 7.5 mm deep, as measured with a 3 metre straight edge or other irregularities that will affect the ride quality.
  - .3 The edges of the micro-surfacing for surface application shall be uniform with neat appearance along the roadway centerline, lane lines, shoulder, pavement edge, and curb lines.
- .5 Joints as follows:
- .1 The longitudinal and transverse joints shall be neat and uniform in appearance. No excessive buildup, uncovered areas, non-homogeneous mixture or unsightly appearance shall be permitted on longitudinal or transverse joints.
  - .2 The longitudinal joints in the scratch course shall be constructed as a butt joint. The longitudinal joints in the surface course shall be placed on lane lines with less than 100 mm overlap on adjacent passes.
  - .3 Transverse joints shall be constructed with no more than 6 mm difference in elevation across the joint as measured with a 3 m straight edge.
  - .4 Rolling. The micro-surfacing shall be rolled unless otherwise directed by the Engineer.

- .6 Mixture as follows:
- .1 The micro-surfacing 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 shall not be permitted.
- .7 Defects as follows:  
Defects in finished surface shall include but are not necessarily limited to the following:
- Total ruts > 6 mm deep, as measured with a 3-metre straight edge, exceeding 2% base on 10 random samples per lane-km.
  - Total areas exhibiting raking and chatter exceeding 2% in any 100 m<sup>2</sup> area.
  - Bleeding and flushing exceeding 2% in any 100 m<sup>2</sup> area.
  - Bleeding and/or flushing at joints

Any 400 metre lane segment with repairs or defects exceeding 5% of the area shall require re-application of micro-surfacing over the entire segment.

All work for reconstruction of unacceptable areas shall be at the Contractor's expense.

Any part of completed micro-surfacing rejected for surface defects shall be repaired within 20 days from the time the Contractor receives notification of rejection, but in no case later than August 31<sup>st</sup> of the current year.

If the 20day period extends past August 31<sup>st</sup> of the current year, the Contractor shall complete the repairs between June 1<sup>st</sup> and June 16<sup>th</sup> of the following year. All defects shall be repaired using micro-surfacing (this includes any repairs within the two-year warranty).

The Contractor shall guarantee the Work against failure and defects, and shall hold the Owner blameless in all claims arising from the Work, any of which results from factors including, but not limited to poor workmanship, poor or incompatible materials, improper design of application rates, inadequate traffic control, and/or failing to practice proven micro-surfacing procedures.

Generally, areas of delamination and flushing or bleeding surfaces shall be construed as failure; however, the Engineer shall be the sole judge as to the areas that must be re-treated.

- 3.7 Temporary Pavement Markings .1 Once the micro-surfacing application is capable of supporting traffic, temporary pavement markings shall be installed immediately.
- 3.8 Clean Up .1 All areas, such as shoulders and gutters, shall have the micro-surfacing mix removed as specified by the Engineer. The Contractor shall, on a daily basis, remove any debris associated with the performance of the work.
- .2 After completion of the micro-surfacing, all areas such as gutters and adjacent asphalt surfaces, shall be thoroughly cleaned of all loose material, sand, dirt and other debris.
- .3 All hardware to be removed from site daily.
- 3.9 Protection of Work .1 The Contractor shall be responsible for ensuring that the mixture is not damaged by traffic.
- .2 Traffic, including construction traffic, shall be kept off the freshly placed mixture for whatever time is required to prevent damage to the surface and until premarking of traffic lines with paint is complete.
- 3.10 Testing .1 Straight Edges. A 3 m straight edge may be used to check for cross fall at the discretion of the Engineer.
- .2 Stringline. A stringline or other device may be required to ensure the longitudinal edges are straight and meet the existing pavement edge or as directed by the Engineer.
- 3.11 Liability .1 During the period of construction and the two year maintenance period the Contractor shall be responsible for processing any and all claims for property damage and/or bodily injury caused by failure of the Micro-Surfacing including but not limited to motor vehicle or pedestrians. The contractor shall be responsible for the payment of all property damage and bodily injury claims and agrees to save and holds harmless Halifax Regional Municipality from all such claims.

\*\*\*\* End S-5 \*\*\*\*