INDEX FOR
SPECIFICATIONS FOR MICRO SURFACING TREATMENT

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827. 1 SCOPE

These Specifications govern all operations necessary for and pertaining to the construction of a Micro Surfacing treatment.

1.1 Pre-Construction Meeting

The Contractor and his Superintendent shall attend a pre-construction meeting with the Construction Engineer and Departmental staff, at a mutually agreed upon date, to discuss the project. The meeting shall be initiated by the Contractor and be held a minimum of 15 business days in advance of commencing his field operations. Topics to be discussed will include the type and quantity of equipment including transport units to be used, sequence of work and detailed work schedule, traffic control and the traffic management plan, schedule for calibration of equipment, aggregate acceptance and other pertinent topics.

827. 3 MATERIALS

3.1 Aggregates

The Contractor shall forward to the Department all of the locations including legal description for the intended aggregate source. All correspondence between the intended emulsified asphalt supplier and the Contractor regarding the intended aggregate source(s) shall be forwarded to the Department.

The Department reserves the right to inspect, sample and perform tests on any of the intended aggregate sources.

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

The mineral aggregate shall be free of any deleterious (unsound / nondurable) substances, with the exception of:

(1) The Department will allow a maximum of 1.0% shale on the +0.425 or the +4.75 sieves;

(2) The Department will allow a maximum of 1.5% ironstone on the +0.425 or the +4.75;

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

The production of all aggregates will be considered as an incidental operation to the bid item for Micro Surfacing (Oil Supplied by Contractor).

3.2 Gradation

Type III Specification Band

Sieve size	Percent passing	Stockpile Tolerance
3/8 (9.5 mm)	100	
#4 (4.75 mm)	70-90	+/- 5%

#8 (2.36 mm)	45-70	+/- 5%
#16 (1.18 mm)	26-50	+/- 5%
#30 (600 um)	18-34	+/- 5%
#50 (330 um)	12-25	+/- 4%
#100 (150 um)	7-18	+/- 3%
#200 (75 um)	5-15	+/- 2%

The aggregate will be accepted at the job location or stockpile 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 test specification in 827.7.7.3 before blending and must be blended in a manner to produce a consistent gradation.

Aggregate blending may require a new mix design.

At the discretion of the Owner, screening shall be required at the stockpile if there are any problems created by oversized materials in the mix.

3.3 Water

The water for Micro Surfacing Mix shall be free of harmful salts and contaminants.

3.4 Additives

Additives may be used to accelerate or retard the break / set of the Micro Surfacing.

3.5 Mix Design

The Contractor shall submit a mix design along with the test results of the aggregate and emulsion prior to acceptance of aggregate at the staging area.

A mix design shall be provided to the Department from a certified laboratory to demonstrate aggregate, polymer-modified emulsion, mineral filler and other additive compatibility.

The mineral filler shall be industry recognised non-air entrained Portland cement designed for Micro Surfacing and slurry seal, The Department reserves the right to independently verify the mix design through third party testing.

Mix design shall meet the specifications in the chart below:

Test	Specification
Mix Time @ 77°F (25°C)	Controllable to 120 seconds minimum
Wet Cohesion @ 30 minutes minimum (Set) @ 60 minutes minimum (Traffic)	 12kg – cm Minimum 20kg – cm or Near Spin Minimum
Wet Stripping	Pass (90% Minimum)

Wet – Track Abrasion Loss One – hour Soak Six – day Soak	 50g/ft^2 (538 g/m^2) Maximum 75 g/ft^2 (807 g/m^2) Maximum
Lateral Displacement Specific Gravity after 1,000 Cycles of 125lb. (56.71kg)	5% Maximum 2.10 Maximum
Excess Asphalt by LWT Sand Adhesion	50 g/ft^2 (538 g/m^2) Maximum
Classification Compatibility	11 Grade Points Minimum (AAA, BAA)

The component materials shall be designed within the following limits:

Component Materials	Limits
Residual Asphalt	5.5 – 10.5% by dry weight of aggregate
Mineral Filler	0.3 – 3.0% by dry weight of aggregate
Polymer Content	Minimum of 3.0% solids based on bitumen weight content
Additives	As needed
Water	As required to produce proper mix consistency

3.6 Emulsified Asphalt Materials Supplied by Contractor

The Emulsified Asphalt supplied by the Contractor shall be in accordance with the specifications identified in Section 7.7.2 Polymer Modified Emulsion and of a type identified on the Approved Products List.

The Contractor shall obtain a representative and uncontaminated sample from every load of emulsified asphalt that is delivered to each project site and provide the Department with a sample from each load delivered. The sample obtained by the Contractor shall be placed in the containers supplied by the Department. The sampling procedure may be supervised by Department personnel or designates.

The Contractor shall provide certified weigh scale tickets for all tank trucks of polymer modified asphalt emulsion.

Prior to payment, the Contractor must provide copies of all certified weigh scale tickets representing the quantity of polymer modified asphalt emulsion delivered.

827. 5 EQUIPMENT

5.1 Inspection of Equipment

Equipment shall be on site and available for inspection, testing and approval before operations commence.

5.2 Paver

The machine shall be specifically designed and manufactured to apply Micro Surfacing. The material shall be mixed by an automatic-sequenced, self-propelled Micro Surfacing mixing machine. 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.

To minimize transverse joints, the specified machine must be capable of loading materials while continuing to apply Micro Surfacing. The continuous-run machine shall be equipped to provide the operator with full control of 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.Equipment required for this work shall be in satisfactory working condition and so maintained for the duration of the work.

The paver shall come equipped with a spray bar with fogging capabilities that is capable of spraying the existing surface ahead of the spreader box.

The Contractor shall come equipped with a rut filling box that has an inside measurement of 1.5m and 1.8m to fill ruts as well as an adjustable spreader box capable of surfacing widths of 3.0m to 4.3m lane width for top lift Micro Surfacing. The top lift spreader box shall be hydraulically expandable and collapsible and shall be capable of changing width during construction operations. The top lift spreader box shall be equipped with a secondary strike-off device to improve the surface texture.

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. The front seal shall be provided to insure no loss of the mixture at the road contact point. The spreader box shall come with a front and rear seal. The spreader box and rear strike-off shall be designed and operated 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.

Secondary Strike Off

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.

Burlap or Jute will not be allowed.

The Department reserves the right to reject any equipment which does not conform to Specification 827.5.

5.3 Water Truck

The Contractor shall supply a water truck with a capacity of 16,000L.

The Contractor shall provide a spray bar equipped water truck and operator dedicated to watering granular shoulders to minimize dusty conditions. Application of water to granular shoulders shall be at the direction of the Department and shall be considered incidental to the Contract.

5.4 Sweeper

All surfaces shall require power sweeping immediately before application of Micro Surfacing.

This work is considered incidental to the contract.

5.5 Calibration

Equipment calibration is required before the commencement of work and will not be allowed on weekends or observed holidays. The Contractor shall supply necessary personnel and equipment to the Department to assist in the calibration.

Any component replacement affecting material proportioning requires that the machine be recalibrated. No equipment will be allowed to work on the project until the calibration has been completed and accepted.

Micro Surfacing aggregate must be accepted before calibration. If required, representative samples of the Micro Surfacing may be taken directly from the Micro Surfacing machine. Data obtained from the proportioning devices on the Micro Surfacing machine may be used to determine individual material quantities and application rate.

827. 7 CONSTRUCTION METHODS

7.1 Micro Surfacing Treatment

Immediately prior to applying the Micro Surfacing, the surface shall be cleared of all lose material, silt spots, vegetation and other deleterious material. Any standard cleaning method will be acceptable. 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. The Engineer or designate shall approve the surface preparation prior to surfacing.

When conditions warrant, the surface shall be fogged with water ahead of the spreader box. The rate of application of the fog spray may be adjusted as the temperature, surface texture, humidity and dryness of the pavement change.

The Micro Surfacing shall be thoroughly mixed 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 lumps or unmixed aggregate shall be permitted. No dry aggregate either spilled from the lay-down machine or existing on the road, will be permitted.

No streaks, such as those caused by oversized aggregate or broken mix, shall be left in the finished surface. If excessive streaking develops, the job will be stopped until the Contractor proves to the Department that the situation has been corrected.

Excessive streaking is defined as more than four drag marks greater than 12.7mm wide and 101 mm long, or 25.4mm wide and 76.2mm long, in any $25m^2$ area. No transverse joints / ripples or longitudinal streaks of 6.4mm in depth will be permitted, when measured by placing a 3m straight edge over the surface.

No excess buildup, uncovered areas, or unsightly appearance shall be permitted on longitudinal or transverse joints. The contractor shall provide suitable width spreading equipment to produce a minimum number of longitudinal joints throughout the project. When possible, longitudinal joints shall be placed on lane lines. Partial width passes will only be used when necessary and shall not be the last pass of any paved area. A maximum of 76.2mm shall be allowed for overlap of longitudinal joints. Also, the joint shall have no more than a 6.4mm difference in elevation when measured by placing a 3m straight edge over the joint and measuring the elevation difference.

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 will not be permitted.

Lines at intersections, curbs, and shoulders will be kept straight to provide a good appearance. If necessary, a suitable material will be used to mask off the end of streets to provide Edge lines. Longitudinal edge lines shall not vary by more than ± 51mm horizontal variance in any 29m of length.

All rut-filling and level-up material should cure under traffic for at least twenty-four (24) hours before additional material is placed.

Rut Filling Application

Rut filling will consist of 2 rut pulls of 1.5m and or 1.8m wide on each lane. Rut filling shall be performed to correct roadway cross fall and improve surface drainage. The rut filling shall have a crown to allow for compaction under traffic as shown in Figure 1.

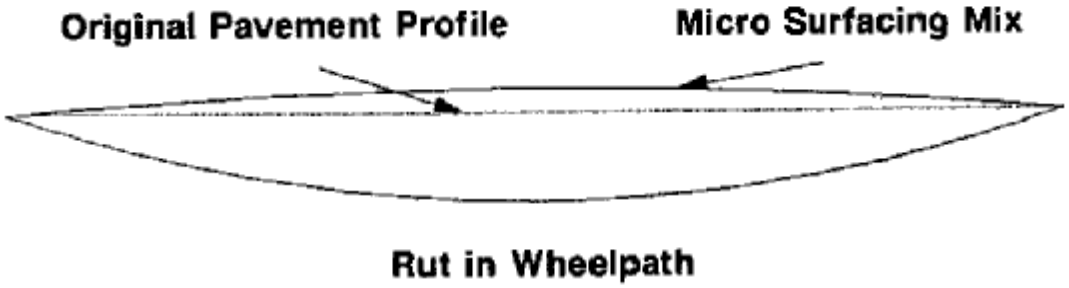

FIGURE 1

The rut filling material shall be consistent in texture and appearance and shall be homogeneous during and following mixing, spreading and final cured product.

Additional rut filling may be required outside of the wheel ruts to maintain roadway drainage. These areas will be identified onsite by the Engineer or designate.

Full Lane Application

Full lane Micro Surfacing will consist of 1 full cover of 3.0m to 4.3m wide on each lane of roadway. Additional full lane applications may be required to include but not limited to intersections, turning lanes, paved shoulders and parking lanes etc. Additional full lane applications will be identified onsite by the Engineer or designate.

7.1.1 Clean Up

All utility access areas, gutters and intersections, shall have the Micro Surfacing removed as specified by the Department. The contractor shall remove any debris associated with the performance of the work on a daily basis.

7.1.2 Weather Limitations

Micro Surfacing shall not be applied if either the pavement or air temperature is below 10°C and falling, but may be applied when both pavement and air temperatures are above 7°C and rising. No Micro Surfacing shall be applied when there is the possibility of freezing temperatures at the

project location within 24 hours after application. The Micro Surfacing shall not be applied when weather conditions prolong opening to traffic beyond a reasonable time.

7.2 Traffic Control

The Contractor is required to have a Level IV Traffic Control. All modifications will be identified in the Special Provisions.

All work associated with "Traffic Control" will not be paid for directly but will be considered as incidental operation to the Contract.

7.3 Hours of Work

The Contractor shall cease all construction and Traffic Control operations and have the roadway open to traffic 30 minutes before official sunset.

The Contractor shall give a minimum of forty-eight (48) hours' notice prior to changing the hours of work from that agreed upon at the Pre-Construction Meeting.

Unless otherwise permitted by the Department the Contractor shall cease all construction operations during the following periods:

- On all Statutory or Civic Holidays.
- On weekends on which Friday is a Statutory or Civic Holiday from 3:00pm Thursday to sunrise Monday.
- On weekends on which the Monday is a Statutory or Civic Holiday from 3:00pm Friday to sunrise Tuesday.
- Between 30 minutes before official sunset and sunrise.

Blackout dates for construction shall be listed in the Special Provisions.

7.4 Surface Quality

All surfaces shall be free from excessive scratch marks, tears, rippling and other surface irregularities. The surface shall not contain transverse ripples or excessive streaks. Excessive streaking shall be defined as more than one drag mark greater than 13mm wide and 100mm long or 25mm wide and 75mm long, in any 25m² area. The surface shall not exhibit tear marks greater than 13mm wide and 100mm long or 25mm wide and 75mm long, in any 25m² area. The surface shall have a uniform and even texture free of tire marks and transition joints shall be smooth.

The surface shall not contain excessive flushing. Excessive flushing shall be defined as any area larger than 1m² during rut fill or top lift application. These areas shall be identified and marked by Department staff during construction and repaired immediately. The Contractor shall overlay the excessively flushed section(s), at no expense to the Department.

7.5 Protective Covers

Manhole, Valve, Bridge Expansion Joints and Catch Basin Protective Covers

The Contractor shall be responsible for locating, supplying, installing and removal of protective covering for all utility covers and bridge expansion joints within the work area. Where utility covers are absent, the Contractor shall take the necessary steps to prevent the Micro Surfacing or its components from entering the utility structure. During the installation and removal of the protective coverings the Contractor shall take the necessary steps to prevent foreign material from entering the utility structure or expansion joint.

Where foreign material has entered the utility structure or expansion joint due to the Contractor's

activities, the Contractor shall arrange for the cleaning of utility structures or bridge expansion joints. There will be no extra payment for the cost of subsurface utility cleaning(s) as a result of the Contractor's activity.

Installation of Protective Covers

All utility covers and expansion joints shall have a protective cover installed over them to prevent any Micro Surfacing material from entering into them. Tar paper is deemed the acceptable method of covering.

Protective coverings shall be installed in such a way as to prevent them from being caught on the spreader box and/or imbedded between the existing road surface and the Micro Surfacing material.

The Department must approve the method employed to protect the utility covers. If the Department site supervisor deems the installation of the coverings to be unacceptable, the Contractor shall cease operations at no cost to the Department until the coverings have been installed to the approval of the Department.

All utilities shall be marked on the curb with proper offsets by the Contractor so they may be relocated after the Micro Surfacing operation.

Removal of Protective Covers

Removal of the utility covers and expansion joint covers shall include the removal of the protective covering material and the removal of any Micro Surfacing material that may be present on and around the lip of where the utility lid is seated. The utility lid, when replaced, should not rock due to material under the utility lid and/or material on the utility frame where the utility lid is seated. The protective cover may be required to be removed and replaced during heavy rains to prevent localized flooding by the contractor at no additional cost to the Department.

Covering material must be removed within 24 hours of completion of the work at each job site or before the roadway is reopened to traffic.

The Contractor shall be responsible for locating the utilities for the purpose of removing the protective coverings.

The supply, installation, removal and disposal of the protective covering for all utilities lids and bridge expansion joints shall be considered incidental to the contract.

7.6 Repair of Defects

All handwork required behind the spreader boxes shall be performed with hand squeegees. The use of burlap or jute attached to the hand squeegees or the back of a shovel shall not be permitted for restoring surface imperfections.

If the Micro Surfacing does not comply with the quality requirements, the Contractor shall overlay the deficient section(s), at no cost to the Department. The Micro Surfacing overlay shall be performed with the same equipment as used in the original construction. The width of the Micro Surfacing overlay shall be no less than the width used for the original construction and shall extend to a length determined by the Engineer or designate.

All defects and deficiencies during production on each section shall be corrected prior to final acceptance of the work in that section.

7.7 Specifications and Required Test Procedures

The abrasion test using the Los Angeles Machine shall follow ASTM C-131.

The Department reserves the right to perform additional testing on any of the materials used in the Micro Surfacing mix.

7.7.1 Polymer Modified Emulsion

All tests for Polymer Modified Emulsion (CQS-1hp) shall be in accordance with AASHTO or ASTM methods with the following change:

- Distillation of Emulsified Asphalt shall be conducted at 205°C for 15 minutes.
- Percentage of Individual Material in Mix
- Micro Surfacing

The emulsified asphalt, and emulsified asphalt residue, shall meet the requirements of AASHTO M 208 or ASTM D 2397 for CQS-1hp, with the following exceptions:

TEST	TEST METHOD		SPECIFICATION
	AASHTO	ASTM	
Settlement and Storage Stability of Emulsified Asphalts, 24-h	T 59	D 6930	1% Maximum
Distillation of Emulsified Asphalt[1]	T59	D6997	62% Minimum
Tests on Emulsified Asphalt Residue			
Softening Point of Bitumen (Ring-and-Ball Apparatus)	T 53	D 36	135°F (57°C) Minimum
Penetration of Bituminous Materials at 77°F (25°C)	T 49	D 5	40-90[2]

[1] The temperature for this test should be held at 350°F (177°C) for 20 minutes.
[2] The climatic conditions should be considered when establishing this range.

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

Each load of emulsified asphalt shall be accompanied with a Certificate of Analysis/Compliance to indicate that the emulsion meets specification.

Component Materials shall be designed in accordance with (Mix Design) 827.3.

7.7.2 Aggregate Acceptance

1. The material shall be tested for acceptance from each staging area.

2. The Contractor shall construct a minimum of 50% of the staging area location stockpile 7 business days prior to any road work being done on that section to allow for acceptance testing of the aggregate.

3. The Department will acquire 5 samples per staging area. The average of the Department's 5 test results shall meet the Type III Specification Band and stockpile tolerance of the mix design as well as all quality tests. If the average of the samples is out of specification or mix design stockpile tolerance, the Contractor may remove the material or blend additional aggregate with the stockpile material to achieve compliance. Materials used in blending must meet the required aggregate quality tests specifications indicated below. The department will perform additional sampling and testing of the material at the staging area of the remaining 50% of the stockpiled material to ensure the material continues to meet specification and tolerance.

4. The Contractor shall notify the Engineer when sufficient aggregate is in stockpile at the staging area and arrange for acceptance sampling. The Contractor is responsible for the collection of the samples and the Department will be present.

5. The approved methods of sampling are:

   Stockpile Sampling with a Loader

   The loader shall dig into the stockpile setting aside a sampling pile approximately 10 to 15 tonnes in size. When forming the pile the loader bucket should be as low as possible and the operator should roll the material from the bucket rather than dumping the material. Each additional bucket shall be dumped in the same manner and placed uniformly over the preceding one. The loader bucket shall then mix the pile by beginning at the oblong end. Keeping the loader bucket as low as possible, the operator shall push the material until the front of the bucket passes the midpoint of the original pile. The loader bucket is then slowly raised and rolled forward. This procedure is then repeated for the opposite end.

   Two (2) samples shall then be taken from the pile by removing material from the center of the volume which is approximately one-third of the height of the pile. The shovel shall be inserted full-depth horizontally into the material and raised vertically. Each sample shall consist of a minimum of six (6) full shovels taken at equal increments around the pile.

   The loader may repeat this procedure several times until the required number of samples are obtained. The piles shall be composed of material taken from various levels and locations in the main pile so that there is a good representation of the material.

   Stockpile Sampling by Hand

   Where a loader is not available, samples shall be taken from the stockpile as shown in Figure 1. A board shall be shoved vertically into the pile just above the sampling point to avoid further segregation.

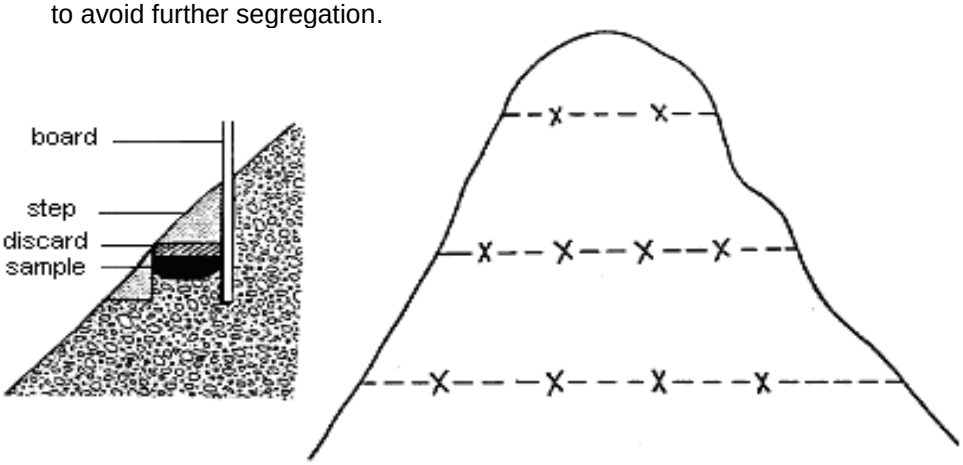

FIGURE 1

The aggregate should meet these minimum requirements:

Test	Test Method		Specification
	AASHTO	ASTM	
Sand Equivalent Value of Soils and Fine Aggregate	T 176	D 2419	60 Minimum

Soundness of Aggregates by use of Sodium Sulfate of Magnesium Sulfate	T 104	C 88	15% Maximum w/NA_2SO_4 25% Maximum w/$MgSO_4$
Resistance to degradation of small – size coarse aggregate by abrasion and impact in the Los Angeles Machine[1]	T 96	C 131	30% Maximum

[1]The abrasion test is run on the parent aggregate.

7.8 Warranty, Performance and Final Acceptance

1. Definitions

The following terms and surface deficiencies will be used to evaluate the warranty performance:

- Segment - An area 200m in length with a width identified by the paving pass, or as the defined length and width of the specific Micro Surfacing area.
- Flushing - Excess asphalt binder that occurs on the Micro Surfacing that creates a shiny reflective condition that becomes tacky to the touch at higher temperatures.
- Delaminating - A physical separation of the Micro Surfacing from the pre-existing surface.
- Weathering & Raveling - wearing away of the Micro Surfacing, caused by the dislodging of aggregate particles (raveling) and loss of asphalt binder (weathering).

2. Repair of Defects and Warranty Criteria

Surface deficiencies of the Micro Surfacing that will be measured during the warranty period shall not exceed the following threshold values. The threshold values for each parameter will be determined separately. If either threshold value is exceeded during the warranty period, the Micro Surfacing will be considered in non-compliance with the warranty performance provision and will require corrective action by the Contractor;

- Flushing - no more than $1m^2$.
- Delaminating - no more than 2% per segment.
- Weathering & Raveling - no more than 2% per segment.

The Department will contact the Contractor when corrective action is required. The Contractor shall make the needed repairs to the satisfaction of the Department.

3. Performance Bond

Notwithstanding Provision No. 100.3.7, the Performance Bond shall remain in full force and virtue for at least two (2) years after the date on which the final payment was made.

7.8.1 Warranty and Repairs

The Contractor shall promptly correct defects or deficiencies in the work which appear within one year from the date on which the work is completed. The Engineer shall give the Contractor written notice of defects and deficiencies.

If the Contractor fails to do repairs within one (1) year or to the satisfaction of the Engineer, the Department may arrange to have the repairs done, the cost of which shall be paid by the Contractor to the Department.

7.9 Deficiencies

Deficiencies identified in a section of work will be rectified before the Contractor is allowed to move to the next section of work.

7.10 Final Acceptance

Prior to final acceptance of the work in each section the Contractor shall provide 24 hour notice and arrange an on-site meeting with the Engineer.

827. 9 METHOD OF MEASUREMENT

Micro Surfacing (Oil Supplied by Contractor) will be measured in tonnes of emulsified asphalt used. Adjustments in the length, width and thickness of the Micro Surfacing layer may be required, as directed by the Engineer or designate.

Once the Contractor reaches the estimated tender quantity of emulsified asphalt for a single section, the Department may elect to discontinue Micro Surfacing operations for that particular section.

The Department will not consider claims for discontinuing operations after approximate design quantities are met.

827. 11 BASIS OF PAYMENT

The unit price per tonne for "Micro Surfacing (Oil Supplied by Contractor)", which will be payment in full for performing all operations associated with performing Micro Surfacing both necessary and incidental thereto.