Section 507. MICRO-SURFACING

507.01 Description. Prepare the surface and apply a properly proportioned micro-surfacing mixture.

507.02 Materials. Furnish a micro-surfacing mixture consisting of a properly designed and proportioned blend of polymerized asphalt emulsion, fine aggregate, Portland cement, water and other additives. Use materials meeting the following:

- Portland Cement, Type I ........................................ 901
- Fine Aggregates, 2FA, 3FA ................................. 902
- Asphalt Emulsion, CSS-1hM ............................ 904
- Asphalt Emulsion, CSS-1mM ............................ 904
- Water ....................................................... 911

A. Aggregates for Micro-Surfacing. A minimum AWI of 260 will apply to surface course aggregates only.

B. Asphalt Emulsion for Micro-Surfacing. Either CSS-1hM or CSS-1mM must be used.

Use CSS-1mM emulsion on all single course micro-surfacing projects with commercial traffic counts at or below those listed here, except when rut filling is required. When micro-surface rutting is specified use either CSS-1mM or CSS-1hM emulsion.

<table>
<thead>
<tr>
<th>Pavement Section</th>
<th>Two-way Commercial ADT</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 lanes</td>
<td>2000</td>
</tr>
<tr>
<td>4 lanes</td>
<td>3500</td>
</tr>
<tr>
<td>6 or more lanes</td>
<td>5000</td>
</tr>
</tbody>
</table>

Use CSS-1hM emulsion on all other single course micro-surfacing projects and on all multi-course micro-surfacing projects.

C. Mixture Requirements.

1. Asphalt Emulsion. Select the emulsion type, based on the two-way commercial ADT stated in the contract documents and the criteria in subsection 507.02.B.

2. Mix Design. Submit to the Engineer, at least five working days before the start of production, a complete mix design prepared and certified by an MDOT-approved laboratory. Provide a job mix formula (JMF) to the Engineer at the pre-paving meeting showing individual
proportions of each material, that when combined, will meet the following mix design criteria. A new mix design is required for any change in aggregate or asphalt emulsion source.

Table 507-1 Microsurfacing Mix Design Criteria

<table>
<thead>
<tr>
<th>Test Method</th>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISSA TB-114</td>
<td>Wet Stripping</td>
<td>90% min</td>
</tr>
<tr>
<td>ISSA TB-100</td>
<td>Wet Track Abrasion Loss</td>
<td>50 g/ft² max</td>
</tr>
<tr>
<td>ISSA TB-100</td>
<td>One Hour Soak</td>
<td>75 g/ft² max</td>
</tr>
<tr>
<td>ISSA TB-100</td>
<td>Six Day Soak</td>
<td></td>
</tr>
<tr>
<td>ISSA TB-144</td>
<td>Saturated Abrasion Compatibility</td>
<td>3 g loss, max</td>
</tr>
<tr>
<td>ISSA TB-113</td>
<td>Mix Time at 77 °F</td>
<td>Controllable to 120 sec, min</td>
</tr>
<tr>
<td>ISSA TB-113</td>
<td>Mix Time at 100 °F</td>
<td>Controllable to 35 sec, min</td>
</tr>
</tbody>
</table>

The JMF must be within the following limits.

Asphalt Binder Content (Residual) | 7.0% - 8.5%, dry weight, 2FA aggregate
Mineral Filler                  | 0.25% - 3.0%, dry weight, of aggregate

3. **Mix Design Format.** Provide the following information in the final mix design:

a. Sources of each material

b. Aggregate
   - Name and pit number
   - Gradation
   - Sand equivalence
   - Angularity index (A.I.)

c. Field Simulation Tests
   - Wet stripping test
   - Wet track abrasion loss
   - Saturated abrasion compatibility
   - Trial mix time at 77 °F and 100 °F

d. Interpretation of results and the determination of a JMF
   - Mineral filler (minimum & maximum), percent
   - Water, including aggregate moisture (minimum & maximum), percent
   - Mix set additive (if required), percent
507.02

- Modified emulsion, percent
- Residual content of modified emulsion
- Residual, percent

e. ADT for the pavement sections on which the mix will be used

f. Mix designer’s signature and date

D. **Quality Control.** Produce a mixture that will meet the JMF and the quality control tolerances shown in Table 507-2. Notify the Engineer immediately if the quality control test results exceed any of the tolerances shown in Table 507-2, and stop mixture production. Identify the cause of the excess deviation and determine the corrective action necessary to bring the mixture into compliance. Secure the Engineer’s approval before resuming work.

**Table 507-2 Micro-Surfacing Quality Control Tolerances**

<table>
<thead>
<tr>
<th>Aggregate Gradation Tolerances (±)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sieve Size</td>
</tr>
<tr>
<td>Tolerance</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>General Quality Control Tolerances (±)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
</tr>
<tr>
<td>Asphalt Cement Content Single Test</td>
</tr>
<tr>
<td>Asphalt Cement Content Daily Average</td>
</tr>
<tr>
<td>Application Rate (as determined by 1000 ft yield checks)</td>
</tr>
<tr>
<td>Sand Equivalent Test (ASTM D2419)</td>
</tr>
</tbody>
</table>

Verify and document quality control with the following minimum measures.

1. **Fine Aggregate.** Sample from the project stockpile and test for gradation at one test per 500 tons of aggregate or one test per day of mixture production, whichever is greater.

2. **Sand Equivalent Test (ASTM D 2419).** Perform a minimum of one test for each aggregate gradation used in producing micro-surface mixture for the project.

3. **Asphalt Content.** At least three times per day, on a random basis, calculate the percent asphalt content of the mixture using the equipment counter readings.
4. **Application Rate.** At least three times per day, on a random basis, calculate the yield of the course being placed using the equipment counter readings.

5. **Documentation.** Complete a daily report that includes the following information. Complete a separate daily report for each truck-mounted machine.

   a. Control section, job number, route, Engineer
   b. Date, air temperature
   c. Control settings, calibration values
   d. Unit weight of emulsion (lbs/gal), percent residue in emulsion
   e. Beginning and ending intervals
   f. Counter readings (beginning, ending, and total)
   g. Length, width, total area (syds), weight of aggregate, gallons of emulsion
   h. Percent of each material including asphalt cement
   i. Application rate, (lbs/syd), combined application rate, (lbs/syd)
   j. JMF (percent Portland cement, percent emulsion, gradations, percent asphalt cement)
   k. Contractor’s authorized signature
   l. Calibration forms
   m. QC aggregate gradations
   n. Aggregate certification or *Shipments of Tested Stock Report*, (Form 1922)
   o. Asphalt emulsion bill of lading
   p. QC sand equivalent test results

507.03 **Construction.**

A. **Equipment.** Provide safe, environmentally acceptable equipment that can produce a specification product.
1. **Mixing Machine.** Provide one or more self propelled, front feed, continuous loading mixing machines equipped and operated as follows.

   a. A positive connection conveyer belt aggregate delivery system and an interconnected positive displacement, water-jacketed gear pump to accurately proportion aggregate and asphalt emulsion.

   b. Continuous flow, twin shaft, multi-blade type pugmill a minimum of 50 inches long.

   c. Blade sizes and side clearances that meet the equipment manufacturer’s recommendations.

   d. Mineral filler feed located to ensure that the proper quantity of mineral filler drops on the aggregate before discharging into the pugmill.

   e. Asphalt emulsion introduced within the first one-third of the mixer length to ensure proper mixing of all materials before they exit from the pugmill.

   f. Rate indicators for proportioning each material that are readily accessible and positioned so the quantity of each material used can be determined anytime. Calibrate and test each material rate indicator to ensure proper operation before production.

   g. Equipped with a water pressure system and nozzle type spray bar to provide water spray ahead of and outside the spreader box when required. Apply water to dampen the surface without resulting in free flowing water ahead of the spreader box.

   h. Opposite side driving stations on the front to optimize longitudinal alignment during placement. Remote forward speed control at the back mixing platform so that the back operator can control forward speed and level of mixture in the spreader box.

Use a sufficient number of transports to assure a continuous operation during mix production and application. Use transport units with belt type aggregate delivery systems, emulsion and water storage tanks of adequate size to proportionally mix aggregate delivered by each transport.

Truck-mounted batch type machines are allowed on projects or sections of projects smaller than 15,000 square yards. Provide a minimum of
two units at all times. Schedule these truck-mounted machines so that mixture production is never delayed more than 15 minutes. Stop production anytime there is noncompliance with this requirement.

Calibrate the mixing machines before use. Maintain documentation of calibration of each material metering device at various settings. Supply all materials and equipment, including scales and containers, necessary for calibration. Recalibrate after all changes in aggregate or asphalt emulsion sources.

2. **Spreader Box.** Spread the mixture uniformly using a mechanical type spreader box, attached to the mixer and equipped with paddles mounted on adjustable shafts to continually agitate and distribute the mixture to prevent stagnation, excessive build-up, or lumps. Equip spreader boxes with front and rear flexible seals to maintain direct contact with the road. Use a secondary strike off attached to the spreader box to provide a finished smooth surface texture on the final pass or surface pass. Use a drag that produces a uniform finish. Replace the drag whenever excessive mixture builds up on it.

3. **Rut Box.** Use a steel V configuration screed rut box specifically designed and commercially manufactured to fill ruts to perform all micro-surface, rutting applications. Ensure a mixture spread width of 5 to 6 feet and use a secondary strike off to control crown on the rut box. The rut box must be equipped with a third strike off that may be used to control texture.

4. **Miscellaneous Equipment.** Provide hand squeegees, shovels and other equipment as necessary to perform the work. Provide cleaning equipment such as power brooms, air compressors, water flushing equipment, and hand brooms for surface preparation.

5. **Lights on Equipment.** Equip power brooms, distributors and truck mount spreaders with at least one approved, flashing, rotating or oscillating amber light that is visible in all directions. Equip continuous spreader units with one such light on each side.

B. **Pre-paving Meeting.** Hold an on-site pre-paving meeting with the Engineer before beginning work to discuss the following.

1. Detailed work schedule
2. Traffic control plan
3. Calibration of equipment
4. Mix design previously submitted to the Engineer
5. Equipment inspection, including transport units
6. Test strip(s) to check the material and demonstrate placement procedures. When multiple machines are used, use each machine to lay a test strip. All test strips will be compared to detect and correct variances in surface texture and appearance.
7. Permit to Place (Form 1125)
8. Review of job mix formula
9. Availability of materials

C. Surface Preparation. Remove all plastic pavement markings using an abrasion method. Remove markings just before the surfacing operation.

Thoroughly clean the existing surface of all loose materials, vegetation, dirt, dust, mud and other objectionable materials at the time of placing the mixture. Remove animal remains and thoroughly wash the surface before placing the mixture.

Protect drainage structures, monument boxes, water shut-offs, etc., during application of bond coat and mixture.

Apply bond coat on concrete surfaces, or as directed by the Engineer. Mix bond coat with one part emulsion to two parts water. Use the same emulsion as used in the production mixture. Apply the bond coat uniformly, at a rate of 0.035-0.070 gallons per square yard and without excessive run off. Allow the bond coat to cure before placement of mixture.

Establish 1,000-foot intervals for the entire project, before placing the mixture. Clearly identify and maintain these intervals until project completion.

D. Application. Apply micro-surface mixtures to the areas identified on the plans so that minor cracks and ruts in the roadbed are filled, resulting in a uniform surface with straight longitudinal joints, transverse joints and edges.

1. Rutfilling. Use a micro-surface mix with 3FA fine aggregate for rutfilling and apply with an approved rut box for each designated wheel track. Maintain a clean overlap and straight edges between wheel tracks. Limit each pass of rutfilling to a maximum depth of 1 inch.
For each 1 inch of applied mix, provide an additional ⅛ inch crown for traffic consolidation. Apply a second course of micro-surface mix with 2FA fine aggregate to the full lane width over the rutfilling course. Apply the second course at a rate of 20 pounds per square yard (±2 lbs/syd).

2. **Standard Micro-Surfacing.** Apply two separate courses of mixture, for a total application rate of 30 pounds per square yard. Apply the first course at 14 pounds per square yard with 2FA or 3FA fine aggregate mixture. Apply the second course at 16 pounds per square yard with 2FA fine aggregate mixture. Apply the second course to the entire paving pass including the shoulder as shown on the plans. Application rates are measured by weight of dry aggregate. Tolerances are ±2 pounds per square yard on each of the two courses and on the cumulative application.

3. **Single Course Micro-Surfacing.** Apply a single course over the full lane width at 20 pounds per square yard (±2 lbs/syd) by weight of dry aggregate. Use either 2FA or 3FA fine aggregate mixture. Do not leave excess buildup or uncovered areas.

E. **Surface Quality.** Provide a finished surface free from excessive scratch marks, tears, rippling, and other surface irregularities. Do not leave ripples greater than ⅛ inch measured by a 10-foot straight edge according to MTM 722. Do not leave tear marks greater than ½ inch wide and 4 inches long, or other marks greater than 1 inch wide and 1 inch long. If the finished surface exceeds the described tolerance, stop work immediately and determine appropriate correct action. Review corrective action with the Engineer before resuming production.

Place longitudinal construction joints and lane edges to coincide with the proposed painted lane lines. Construct longitudinal joints with less than 3 inches overlap on adjacent passes and no more than ⅜ inch overlap thickness as measured with a 10-foot straight edge. Place successive passes to prevent ponding of water on the up-slope side of the overlap. Construct neat and uniform transverse joints with less than a ⅛ inch difference in elevation across the joint as measured with a 10-foot straight edge. Provide neat and uniform lane edges with no more than 2 inches of horizontal variance in 100 feet. If defective joints or edges are placed, stop work and take corrective action and reviewed by the Engineer.
F. **Traffic Control.** Do not allow traffic on the mixture until it has cured sufficiently to prevent pickup by vehicle tires. The new surface must be able to carry normal traffic without damage within one hour of application. Protect the new surface from damage at intersections and driveways. Repair all damage to the mixture caused by traffic. All costs associated with this repair work will be borne by the Contractor.

G. **Weather and Seasonal Limitations.**

1. Place the mixture when the air and pavement temperatures are at least 45°F.

2. Do not place mixture in rain or inclement weather or when temperatures are forecast to be below 32°F within 24 hours of completion of the work.

3. Place mixture during these time periods.
   
   - June 15-September 15 for the Upper Peninsula.
   - May 1-October 1 for the Lower Peninsula

H. **Delayed Acceptance.** A minimum of 30 days after completion of the micro-surface rutting, standard or single course, the Engineer will inspect the project with the Contractor for surface flushing raveling or delamination. If these deficiencies are found, corrective work is required.

   Complete all corrective work within seven working days of the review, or by an agreed upon date. All costs associated with completing this corrective work, to the satisfaction of the Engineer, will be borne by the Contractor.

507.04 Measurement and Payment.

<table>
<thead>
<tr>
<th>Contract Item (Pay Item)</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro-Surface, Rutfilling</td>
<td>Ton</td>
</tr>
<tr>
<td>Micro-Surface, Std</td>
<td>Square Yard</td>
</tr>
<tr>
<td>Micro-Surface, Single Cse</td>
<td>Square Yard</td>
</tr>
</tbody>
</table>

Micro-surface includes removal of existing plastic pavement markings, cleaning existing pavement, temporary pavement markings, stationing, application of a bond coat if required. Corrective action, including the cost of providing traffic control to complete corrective action, will not be paid for separately but is included in the contract unit price for micro-surfacing items of work.
A. **Micro-Surface, Rutfilling** will be measured based on the dry weight of fine aggregate in the mixture placed. This work includes placement of mix over each wheel rut creating full lane coverage and applying a single course of mixture for full width coverage as shown on the plans.

B. **Payment for Micro-Surface, Std** includes placement of two courses of mixture for full width coverage as shown the plans.

C. Payment for **Micro-Surface, Single Cse** includes placement of one course of mixture for full width coverage as shown the plans.