MICRO SURFACING

410 Micro Surfacing

410.1 Description

This section covers the materials, equipment, construction and application procedures for placing Micro Surfacing material for filling ruts and for surfacing existing paved surfaces. The Micro Surfacing is a mixture of a latex-modified asphalt emulsion, 100 percent crushed mineral aggregate, mineral filler, water and other additives for control of set time in the field. All ingredients are to be properly proportioned, mixed and spread on the paved surface in accordance with this Specification and as directed by the Asphalt Materials Engineer (AME).

410.2 Materials

410.2.1 Aggregate

Use aggregates meeting the applicable requirements of Subsection 401.03 except as modified in this subsection. Ensure that aggregates shipped to the project are uniform and do not require blending or pre-mixing at the storage area before use and meet the appropriate gradation as shown in Table 1 and have a Sand Equivalent value that is not less than 65 when tested in accordance with AASHTO T 176.

410.2.2 Mineral Filler

Use either Portland Cement or Hydrated Lime meeting the following requirements:

1. Portland Cement Subsection 701.02
2. Hydrated Lime Section 401

410.2.3 Cationic Asphalt Emulsion

Utilize a cationic type latex modified emulsified asphalt meeting requirements of a CSS-1 HLRA, CSS-1P or a CSS-1h in accordance to AASHTO M 208. Waive the cement-mixing test.

410.2.4 Latex Rubber Additive (LRA)

The LRA will be a natural latex or an unvulcanized styrene-butadine rubber in an emulsified latex form. Provide material certification from the manufacturer to the AME that the LRA meets the following requirements:

Rubber Solids content, Minimum %, ASTM D 1417 60 (By Weight)
Brookfield Viscosity, cps Maximum, ASTM D 1417 5000
Total Ash, Maximum %, ASTM D 297 3.5

Co-mill the LRA along with special emulsifiers and the asphalt binder during the manufacture of the emulsified asphalt to produce a homogeneous mixture. Add the LRA in the necessary proportions to result in 3.0% neat latex by weight of residual asphalt cement in the emulsion. Ensure that the LRA modified emulsified asphalt, upon standing undisturbed for a period of 24 hours, shows no separation of emulsion and LRA, no color striations, but is a uniform color throughout.

Obtain a minimum softening point of 135°F when tested in accordance with AASHTO T 53 except ensure that the maximum test temperature during the distillation process does not exceed 350°F and the duration of the holding period does not exceed 20 minutes on the residue from the LRA modified emulsified asphalt. Formulate the emulsified asphalt in such a way to allow the paving mixture to cure at a rate as to permit traffic on the pavement within one hour after application without damaging the pavement surface.
410.2.5 Asphalt Tack Coat

Use a CSS or SS emulsion meeting the requirements listed in AASHTO M 208. Tack coat may be waived by the AME if it is determined not to be needed.

410.2.6 Water

Use potable water free from any contaminants detrimental to the mixture for the Micro Surfacing mixture.

410.2.7 Other Additives

Provide other additives as recommended by International Slurry Surfacing Association (ISSA) requirements to control the set time of the mixture in the field.

410.3 Composition Of Mixture

Conduct the mix design in a laboratory by a technician with Micro Surfacing experience. Supply a certified mix design to the AME that includes the following information: aggregate test properties, aggregate target gradation, results of Table 1 design requirements, design asphalt residue and mineral filler percentages based on dry weight of the aggregate. Include information relative to sources, type of materials and project number. Do not begin Micro Surfacing work until the AME has reviewed the submitted design. Acceptance of the design by the AME is solely for the purpose of quality control and in no way releases the Contractor from his responsibility to perform acceptable work under this specification.

Provide uniform mixture of aggregate, LRA-modified emulsion, mineral filler, water and other additives as required to control set time in the field. Ensure compatible emulsion and aggregate so that a complete, uniform coating of the aggregate is obtained in the mixing unit and sufficient working life to allow for proper placement at the existing ambient temperature and humidity. The Resident Engineer (RE) may require the mixture to be redesigned if replacement of a constituent, or change in gradation, is needed to produce an acceptable mixture. Proportion the constituents to produce a uniform mixture meeting the requirements of Table 1.

Table 1
Job Mix Formula and Design Limits

<table>
<thead>
<tr>
<th>MIXTURE CONTROL TOLERANCES</th>
<th>GRADING REQUIREMENTS (AASHTO T 27)</th>
<th>RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>± 0.0</td>
<td>% Passing 3/8&quot; Sieve</td>
<td>100</td>
</tr>
<tr>
<td>± 6.0</td>
<td>% Passing No. 4 Sieve</td>
<td>90 – 100</td>
</tr>
<tr>
<td>± 5.0</td>
<td>% Passing No. 8 Sieve</td>
<td>65 – 90</td>
</tr>
<tr>
<td>± 5.0</td>
<td>% Passing No. 30 Sieve</td>
<td>30 – 55</td>
</tr>
<tr>
<td>± 4.0</td>
<td>% Passing No. 100 Sieve</td>
<td>10 – 25</td>
</tr>
<tr>
<td>± 3.0</td>
<td>% Passing No. 200 Sieve</td>
<td>5 – 15</td>
</tr>
</tbody>
</table>
### DESIGN REQUIREMENTS

<table>
<thead>
<tr>
<th></th>
<th>Range for Residual Asphalt, %</th>
<th>5.00 – 10.50</th>
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<tbody>
<tr>
<td>Range for Mineral Filler, %</td>
<td>0.5-3.0</td>
<td></td>
</tr>
<tr>
<td>Flow, AASHTO T-245 (Modified)</td>
<td>6-16</td>
<td></td>
</tr>
<tr>
<td>Min. Stability (kg), 50 Blow Marshall, AASHTO T-245 (Modified)</td>
<td>1800</td>
<td></td>
</tr>
<tr>
<td>Wet Track Abrasion Loss (Maximum)</td>
<td>ISSA TB 100 1 hour soak, 1 lb./yd.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ISSA TB 100 6 day soak, 1.5 lb./yd.2</td>
<td></td>
</tr>
<tr>
<td>Vertical Displacement (Maximum)</td>
<td>ISSA TB 147A or 147C 10%</td>
<td></td>
</tr>
<tr>
<td>Excess Asphalt by LWT (Maximum)</td>
<td>ISSA TB 109 1 lb./yd.2</td>
<td></td>
</tr>
</tbody>
</table>

**Note 1:** Base the percent residual asphalt and percent mineral filler on weight of dry aggregate.

**Note 2:** Procedures set forth in AASHTO T-245 for determination of Flow and Marshall Stability will be modified to permit air drying of the mixture at 70° - 77°F for three days before reheating and fabricating Marshall specimens.

**Note 3:** Ensure that the laboratory report also provides the following information which is within the test parameters given:

- Mixing Time Test, Seconds @ 25°C (77°F), (TB-102) 60 minimum*
- Set Time Test, 30 minutes (TB-139) 12 lb-in minimum
- Early Rolling Traffic Time, 60 minutes (TB-139) 20 lb-in minimum
- Water Resistance Test, 30 minutes (TB-102) No Discoloration
- Wet Stripping Test, % Coating (TB-114) 90 minimum
- System Compatibility (TB 115) Pass

*For double shafted, multi-bladed mixers and fully agitated spreaders. Conventional mixing and spreading equipment requires 90 to 120 seconds.

### 410.4 Equipment

Do not attempt to use equipment that is malfunctioning or not in excellent working condition. The RCE can order that the work be discontinued if sufficient equipment and tools are not in use to place the materials satisfactorily.

#### 410.4.1 Mixing Equipment

Blend the paving mixture by a self-propelled Micro Surfacing mixing machine by means of a continuous flow mixing unit capable of accurately delivering and proportioning the aggregate, LRA-modified emulsion, mineral filler, field control additives and water to a revolving multi-blade, twin shaft mixer and discharge the mixed product on a continuous flow basis. Thoroughly blend the mixture so that no uncoated aggregate is visible upon discharge from the mixing unit. Equip the machine with self loading devices which provide for the loading of all materials while continuing to lay Micro Surfacing, thereby minimizing construction joints. Ensure that the machine is equipped with opposite side driving stations to optimize longitudinal alignment and allow the operator to have full hydrostatic control of the forward and reverse speed during the application of the Micro Surfacing material.

Truck mounted equipment may be utilized on projects where quantity of Micro Surfacing the total project is less than 500 tons.

#### 410.4.2 Water Pressure System

Equip the mixing machine with a water pressure system and nozzle type spray bar to provide a water spray ahead of and outside of the spreader box when required.
410.4.3 Proportioning Devices

Equip the machine with individual volume or mass controls or other gauging devices for measuring and proportioning each material added to the mix. Calibrate each material control device to ensure all are properly marked and positively interlocked. Equip the aggregate feed to the mixer with a revolution counter or similar device so that the amount of emulsion used may be determined at any time. Calibrate each mixing unit prior to commencement of the work. Once calibrated, the aggregate and emulsion flows will not be changed without the approval of the RCE. Adjust the water and additive in the field to control the mix properties to produce an acceptable mix.

410.4.4 Emulsion Pump

Provide an emulsion pump that is heated and is equipped with a positive displacement type pump.

410.4.5 Spreading Equipment

Spread the Micro Surfacing mixture uniformly by means of a mechanical type spreader box attached to the mixer, equipped with paddles or other devices to agitate and spread the materials throughout the box. Design the paddles to maintain sufficient turbulence in the mixture to prevent the material from setting-up in the box or causing side buildup and lumps. Provide a front seal to ensure no loss of the mixture at the road contact surface. Equip the rut filling equipment with an adjustable steel strike-off plate to ensure a level surface. Provide a rear seal to act as an adjustable strike-off plate as well. Maintain the spreader to prevent the loss of the paving mixture in surfacing super-elevated curves. Operate the spreader box and rear strike-off so that a uniform consistency is achieved to produce a free flow of material to the rear strike-off without causing skips, lumps or tears in the finished surface. The spreader box must be capable of lateral movement or have side shift abilities to ensure proper alignment with the roadway.

410.4.6 Auxiliary Equipment

Provide a pressure distributor, power broom, and power blower along with sufficient hand tools and power equipment for cleaning the roadway surface prior to the application of the bituminous tack coat.

410.5 Stockpiling and Storage

410.5.1 Aggregate Storage

If the mineral aggregates are stored or stockpiled, handle in such a manner as to prevent segregating, mixing of the various materials or sizes, and contaminating with foreign materials. Ensure that the grading of aggregates proposed for use and as supplied to the project is uniform. Utilize suitable equipment of acceptable size to maintain the stockpiles and prevent segregation of aggregates. Pass the aggregate over a scalping screen immediately prior to transfer to the Micro Surfacing mixing machine to remove oversized material. In addition, equip the scalping screen unit with certified scales to record weights of aggregates prior to being shipped to the project. The Resident Engineer will obtain aggregate samples for moisture testing in accordance to ST 22 as necessary for accurate payment.

410.5.2 Storage of Asphalt Material

Provide adequate means of storage to meet the requirements of the production rate for the asphalt material. Maintain all equipment used in the storage and handling of asphalt material in a clean condition at all times and operate in such a manner that there will be no contamination with foreign matter.

410.6 Construction

410.6.1 General

Produce, transport and place the specified materials in accordance with these specifications and as approved by the Resident Engineer. Ensure that the finished Micro Surfacing has a uniform texture free from excessive scratch marks, tears or other surface irregularities.
Ensure that the cured mixture adheres fully to the underlying surface. Based upon a visual examination or test results the Resident Engineer may reject any work due to poor workmanship, loss of texture, raveling or apparent instability.

410.6.2 Weather Limitations

Apply Micro-Surfacing mixture only when the minimum ambient temperature for 48 hours immediately prior to the placement has been at least 50°F. Additionally, both the current pavement surface and the ambient temperature will be at least 50°F and rising with no forecast of temperatures below 32°F within 48 hours from the time of placement. Whenever the relative humidity exceeds 80 percent or the weather is overcast, apply Micro Surfacing at the discretion of the Resident Engineer only. Supply a surface temperature thermometer and a sling psychrometer for the purpose of taking temperature and humidity measurements as directed by the Resident Engineer.

410.6.3 Surface Preparation

Thoroughly clean the area to be surfaced of any vegetation, loose aggregate and soil as well as all cracks prior to overlay. Whenever conditions require pre-wetting the surface, spray water ahead of and outside of the spreader box at a rate to dampen the surface without any free flowing water ahead of the spreader box.

410.6.4 Tack Coat

Use an asphalt emulsion meeting requirements of 410.2.5 and dilute at the rate of one part emulsion and three parts water and apply with an asphalt distributor. Ensure an application rate of 0.05 to 0.10 gallons of diluted emulsion per square yard. Apply the tack coat in accordance with Section 401, Application of Prime and Tack Coat. A tack coat is not required between the leveling course and the surface course provided the surface course is placed within 30 days of the leveling course or if the Engineer determines that excessive tracking of material is evident.

410.6.5 Application

Spread the paving mixture on the prepared surface in such a way as to leave a uniformly finished surface. Take care when filling ruts to restore the designed profile of the pavement cross section. Excess crowning or overfilling of the rut area will not be permitted. Use squeegees and lutes to spread the mixture in areas inaccessible to the spreader box and areas requiring hand spreading. Carry a sufficient amount of material at all times in all parts of the spreader box to ensure complete coverage.

Adjust additives, if necessary, to provide a slower setting time when hand spreading is needed. Pour a small windrow along one edge of the surface to be covered and then spread uniformly by a hand squeegee or lute. Ensure a smooth, neat seam where two passes meet. Remove excess material immediately from the ends of each run.

410.6.6 Traffic Control

Prohibit traffic on the Micro Surfacing mixture until it has cured sufficiently to prevent pick up and/or marring of the surface. Maintain traffic control as necessary to prevent damage to the mixture. Repairs to any such damage done by traffic to the mixture will be at the Contractor’s expense.

410.6.7 Rut Filling and Leveling (Scratch) Course

When required on the plans, before the final surface course is placed, use preliminary Micro Surfacing materials to fill ruts, utility cuts, depressions in the existing surface, etc. Conduct rut filling greater than one half inch in depth and any additional leveling/scratch courses as directed by the Engineer. Construct each full-width leveling/scratch course by utilizing a full width spreader box with a steel strike-off. Open the rut filling or leveling (scratch) course to traffic at least 24 hours prior to the beginning of any surfacing. Ensure all materials, mixture composition, equipment, and construction procedures meet specifications listed above.
410.6.8 Workmanship

Excessive buildup, uncovere areas, or unsightly appearance will not be permitted on longitudinal or transverse joints. Place longitudinal joints on lane lines and ensure excessive overlap does not occur. Take care to ensure straight lines along the roadway centerline, lane lines, shoulder or edge lines. Keep lines at intersections straight to provide a neat and uniform appearance.

410.6.8.1 Finished Surface

Ensure the finished Micro Surfacing has a uniform texture free from excessive scratch/tear marks or other surface irregularities. Excessive scratch/tear marks are considered four marks that are 1/2” wide or wider and 6” or more in length per 100 square yards or any marks 1” wide or wider or 4” in length.

410.6.8.2 Joints and Seams

Ensure the longitudinal and transverse joints are neat in appearance and uniform. Construct transverse joints as butt-type joints. Excessive buildup, uncovered areas or unsightly appearance is not permitted on longitudinal or transverse joints. Gaps between applications are prohibited. Joints are considered acceptable if no more than a 1/2” vertical space exists between the pavement surface and a 4’ straight edge placed perpendicular on the longitudinal joint nor no more than 1/4” for a transverse joint.

410.6.8.3 Hand Work

Surface areas that cannot be reached with the mixing machine using hand tools to provide complete and uniform coverage. These areas will be cleaned and lightly dampened prior to mix placement. Use care so that the finished surface is uniform in texture, dense and of overall neat appearance comparable to that produced by the spreader box. Micro Surfacing material required to repair deficiencies due to unsatisfactory workmanship will be entirely at the contractor’s expense.

410.7 Acceptance

410.7.1 Mixture

Maintain the gradation and percent residual asphalt as shown on the Micro Surfacing design or as established by the Resident Engineer within the listed Mixture Control Tolerances.

A mixture adjustment period is provided during the first two days of operation. Adjust equipment settings to provide a mixture within the Mixture Control Tolerances if the deviation of sample test results from the first day are outside the Mixture Control Tolerances. Obtain two samples from the second day of production (after equipment changes, if any, have been made) and average the test results. If the average deviation of test results from the second day are within Mixture Control Tolerances, full payment for the first two days of operation will be given. If the average deviation of test results from the second day are not within Mixture Control Tolerances, each of the first two days will be assessed a reduction in Unit Price of two percent for each 0.1 percent the residual asphalt content is outside the Mixture Control Tolerances.

For each subsequent day of operation apply a two percent reduction in Unit Price for each 0.1 percent the residual asphalt content is outside the Mixture Control Tolerance given in Table No. 1. If more than one sample per day is taken, calculate the average deviation of the samples to determine conformance to the Mixture Control Tolerance. Do not continue operation and placement of materials outside the Mixture Control tolerances. Make adjustments as necessary in the mixing operation to maintain production within the tolerances given or suspend work.

410.7.2 Aggregate Application Rate

Control the target spread rate for all Micro Surfacing to within plus or minus 2 pounds per square yard of the spread rate specified in the contract and base on the weight of dry aggregate. Apply a five percent reduction in Unit Price for each pound of aggregate per square yard less than the spread rate tolerances established above for each day’s placement of material.
In lieu of pay reduction, overlay the deficient area at the Contractor’s expense. Do not continue operation and placement of materials outside the spread rate tolerances. Make adjustments as necessary in the placement operation to maintain production within the tolerances given.

410.8 Measurement

410.8.1 Micro-Surfacing

Measure and accept Micro Surfacing, Type II Surface Course, by the square yard placed.

410.8.2 Rut Filling and Leveling (Scratch Course)

Measure and accept rut filling and leveling (scratch) course by the ton of dry aggregate used.

410.9 Payment

Micro Surfacing will be paid for at the Contract Unit Price which will be for full compensation for furnishing all materials, including LRA modified bituminous materials and for all equipment, work and labor.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Description</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>4100200</td>
<td>Micro Surfacing, Type II</td>
<td>Square Yard</td>
</tr>
<tr>
<td>4100205</td>
<td>Micro Surfacing, Type II Leveling</td>
<td>Ton</td>
</tr>
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