

**MICRO SURFACING.****(REV 11-2-17)****SECTION 335  
MICRO SURFACING****335-1 Description.**

Construct a micro surfacing pavement with the type of mixture specified in the Contract Documents. Micro surfacing is a mixture of polymer-modified emulsified asphalt, mineral aggregate, mineral filler, water, and other additives, properly proportioned, mixed and spread on a paved surface.

The mix shall be capable of being spread in variable thickness cross-sections (wedges, ruts, scratch courses and surfaces) which, after curing and initial traffic consolidation, resists compaction throughout the entire design tolerance range of asphalt binder content and variable thickness to be encountered. The end product shall maintain a skid-resistant surface in variable thick sections throughout the service life of the micro surfacing.

The mix shall be a quick-traffic system that will be able to accept straight rolling traffic one hour after application.

**335-2 Materials.****335-2.1 Emulsified Asphalt:**

**335-2.1.1 General Requirements:** Provide a quick-traffic, polymer-modified emulsified asphalt conforming to the requirements specified in AASHTO M 208 for CSS-1h, as listed in Table 335-1. The cement mixing test shall be waived for this product.

The polymer material shall be co-milled into the asphalt or added to the emulsifier solution prior to the emulsification process. The amount of polymer modifier shall not be less than 3.0% polymer solids based on the asphalt content (by weight) and will be certified by the emulsified asphalt supplier.

**335-2.1.2 Quality Tests:** The emulsified asphalt, and emulsified asphalt residue, shall meet the requirements of AASHTO M 208 for CSS-1h, and the requirements of Table 335-1.

Table 335-1 Quality Tests for Emulsified Asphalt		
AASHTO Test No.	Emulsified Asphalt Property	Specification Requirements
AASHTO T 59	Residue after Distillation (1)	62% Minimum
AASHTO T 59	Cement Mixing	Not Required
Quality Tests for Emulsified Asphalt Residue		
AASHTO T 53	Softening Point	135°F Minimum
1. Maintain the test temperature at 350°F (177°C) for 20 minutes.		

**335-2.1.3 Sampling, Certification, and Verification:** For the first load of emulsified asphalt produced for the project, the supplier shall submit a sample to the Engineer for testing before use. Do not proceed with construction until the Engineer has completed testing and has approved the material for use.

At any time during application, the Engineer may sample and test all subsequent loads of emulsified asphalt delivered to the project to verify and determine compliance with specification requirements. Where these tests identify material outside specification requirements, the Engineer may require the supplier to cease shipment of that pre-tested product. Further shipment of that pre-tested product will remain suspended until the cause of the problem is evaluated and corrected by the supplier to the satisfaction of the Engineer.

### **335-2.2 Aggregate:**

**335-2.2.1 General:** Use an aggregate consisting of 100% crushed granite. To assure the material is 100% crushed, the parent aggregate will be larger than the largest stone in the gradation used. Use aggregate source(s) from the list of "granitic" aggregates available on the Florida Department of Transportation's website and also meeting the requirements of this specification. The URL for obtaining the list of "granitic" aggregates is: <https://mac.fdot.gov/>.

**335-2.2.2 Aggregate Quality Tests:** In addition to the requirements of FDOT Standard Specification Sections 901 and 902, meet the minimum aggregate requirements of Table 335-2.

Table 335-2 Quality Tests for Aggregate		
AASHTO Test No.	Aggregate Property	Specification Requirements
AASHTO T 176	Sand Equivalent	65 Minimum
AASHTO T 104	Soundness	15% Maximum using Na <sub>2</sub> SO <sub>4</sub> or 25% Maximum using MgSO <sub>4</sub>
AASHTO T 96	Abrasion Resistance (1)	30% Maximum
1. The abrasion test will be performed on the parent aggregate.		

**335-2.2.3 Gradation Requirements:** When tested in accordance with FM 1-T 027 and FM 1-T 011, the target (mix design) aggregate gradation, including the mineral filler, shall be within the gradation range for a Type II mixture shown in Table 335-3, Column II.

Table 335-3 Mix Design Gradation Requirements		
Sieve Size	Type II Mix Design Range Percent Passing	Stockpile Tolerance from Mix Design Percent Passing
3/8 inch	100	N/A
No. 4	90 – 100	± 5%
No. 8	65 – 90	± 5%
No. 16	45 – 70	± 5%
No. 30	30 – 50	± 5%
No. 50	18 – 30	± 4%
No. 100	10 – 21	± 3%
No. 200	5 – 15	± 2%

The aggregate will be accepted from the stockpile located at the project. The stockpile will be accepted based on five quality control gradation tests conducted in accordance with FM 1-T 002. If the average of the five gradation tests is within the stockpile

tolerances shown in Table 335-3, Column III, for all the sieve sizes, then the stockpile is accepted. If the average of the five gradation tests is not within the stockpile tolerances shown in Table 335-3, Column III, for any sieve size, remove the stockpiled material and replace it with new aggregate or blend other aggregate sources with the stockpiled material. Aggregates used in blending must meet the quality tests shown in Table 335-2 before blending and must be blended in a manner to produce a consistent gradation and sand equivalent value. If new aggregate is obtained or blending of aggregates is performed resulting in an aggregate that is not represented by the mix design, submit a new mix design to the Engineer for approval prior to production of the mix.

The Engineer may obtain stockpile samples at any time. If the average of five gradation tests conducted in accordance with FM 1-T 002 is not within the gradation tolerances shown in Table 335-3, Column III, for any sieve size, cease production until the problem is corrected to the satisfaction of the Engineer.

Screen all stockpiled aggregates at the stockpile area prior to delivery to the paving machine to remove oversize material and non-desirable particles.

**335-2.3 Mineral Filler:** If mineral filler is utilized in the mix design, use non-air-entrained Portland cement or hydrated lime that is free from lumps. The Engineer will accept the mineral filler by visual inspection. The type and amount of mineral filler shall be determined by a laboratory mix design and will be considered as part of the aggregate gradation. An increase or decrease of less than one percent mineral filler may be permitted during production if it is found to result in better consistency or set times. Any changes to the percentage of mineral filler must meet the requirements of Table 335-5.

**335-2.4 Water:** Utilize water that is potable and free of harmful soluble salts, reactive chemicals, or any other contaminants.

**335-2.5 Additives:** Additives may be added to the mixture or any of the component materials to provide control of quick-trafficking properties. The additives to be used should be indicated on the mix design and be compatible with the other components of the mix.

**335-2.6 Crack Filler:** Utilize a crack filler meeting the material requirements of Developmental Specification Section 305.

### **335-3 Mix Design.**

Before work begins, the Contractor shall submit a mix design to the Engineer. The mix design must have been developed using the specific materials to be used on the project. The mix design shall be developed by a laboratory that is endorsed by the International Slurry Surfacing Association (ISSA) and has experience in designing micro surfacing mixtures.

Submit the proposed mix design with supporting test data indicating compliance with all mix design criteria to the Engineer. Allow the Engineer a maximum of two weeks to either conditionally verify or reject the mix design.

Meet the requirements provided in Table 335-4. After the mix design has been approved, no substitutions to the mix design will be permitted, unless approved by the Engineer. The Engineer will consider inadequate field performance of a mix as sufficient evidence that the properties of the mix related to the mix design have changed, and the Engineer will no longer allow the use of the mix design. The project will be stopped until it is demonstrated that those properties, or issues, have been sufficiently addressed.



Table 335-4 Mix Design Testing Requirements		
ISSA(1) Test No.	Property	Specification Requirements
ISSA TB-139(2)	Wet Cohesion: @ 30 Minutes, Minimum (Set) @ 60 Minutes, Minimum (Traffic)	12 kg-cm Minimum 20 kg-cm Minimum or Near Spin
ISSA TB-109	Excess Asphalt by Loaded Wheel Tester (LWT) Sand Adhesion	50 g/ft <sup>2</sup> Maximum
ISSA TB-114	Wet Stripping	90% Minimum
ISSA TB-100	Wet-track Abrasion Loss: One-hour Soak Six-day Soak	50 g/ft <sup>2</sup> Maximum 75 g/ft <sup>2</sup> Maximum
ISSA TB-147	Lateral Displacement after 1,000 Cycles of 125 lb. Specific Gravity	5% Maximum 2.10 Maximum
ISSA TB-113(2)	Mix Time @ 77°F (25°C)	Controllable to 120 Seconds Minimum
1. ISSA = International Slurry Surfacing Association 2. The Cohesion test and Mixing Time test should be checked and reported for the highest temperatures expected during construction.		

The mix design must clearly show the proportions of aggregate, emulsified asphalt, mineral filler, water, and additive usage based on the dry weight of the aggregate. Meet the mix design component material requirements provided in Table 335-5.

Table 335-5 Mix Design Component Material Requirements	
Component Materials	Specification Requirements
Residual Asphalt	5.5 to 10.5% (by dry weight of aggregate)
Mineral Filler	0.5 to 3.0% (by dry weight of aggregate)
Polymer-based Modifier	Minimum of 3.0% (solids based on asphalt weight content)
Additives	As needed
Water	As required to produce proper mix consistency

The materials (aggregates, emulsion, mineral filler, and additives) must be from the same source, grade, and type used to develop the approved mix design. Any substitutions or alternate supplies must be preapproved by the Engineer. Changes in the aggregate source or emulsion source requires re-validating the mix design and the performance properties. Blending, comingling and otherwise combining materials from two or more sources, grades, or types not noted in the approved Mix Design is strictly prohibited. Aggregate stockpiles and emulsion material should be located at or near the job site in sufficient quantity for the job or designated parts of the job.

### 335-4 Equipment.

**335-4.1 General:** Maintain all equipment, tools, and machines used in the performance of this work in satisfactory working condition at all times to ensure a high-quality product.

**335-4.2 Mixing Equipment:** Use a machine specifically designed and manufactured to place micro surfacing. Truck mounted and self-loading continuous machines are acceptable. Mix the material with an automatic-sequenced, self-propelled, micro surfacing mixing machine. It shall be a continuous-flow mixing unit able to accurately deliver and proportion the mix components through a revolving multi-blade, double-shafted mixer and to discharge the mixed product on a continuous-flow basis. The machine shall have sufficient storage capacity for all mix components to maintain an adequate supply to the proportioning controls.

Self-loading continuous machines shall be capable of loading materials while continuing to lay micro surfacing, thereby minimizing construction joints. Self-loading continuous machines shall be equipped to allow the operator to have full control of the forward and reverse speeds during applications of the micro surfacing material and 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 original equipment-manufacturer design.

**335-4.3 Proportioning Device:** Provide and properly mark individual volume or weight controls for proportioning each material to be added to the mix (i.e., aggregate, mineral filler, emulsified asphalt, additives, and water).

**335-4.4 Spreading Equipment:** Agitate and spread the mixture uniformly in the spreader box by means of twin-shafted paddles or spiral augers fixed in the spreader box. Provide a front seal to ensure 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 so 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 to hydraulically adjust the box width automatically while traveling behind the mixing unit, and be able to side shift the box to compensate for variations in the pavement geometry.

**335-4.4.1 Secondary Strike-off:** Provide a secondary strike-off to improve surface texture. The secondary strike-off shall have the same adjustments as the spreader box.

**335-4.4.2 Rut-filling Equipment:** When required by the Contract Documents, micro surfacing material may be used to fill ruts, utility cuts, depressions in the existing surface, etc. When rutting or deformation is less than 1/2 inch, a full width scratch course may be applied with the spreader box using a metal or stiff rubber strike-off. Ruts of 1/2 inch or greater in depth shall be filled independently with a rut-filling box, either five or six feet in width. Ruts that are more than 1-1/2 inch in depth may require multiple applications with the rut-filling box to restore the cross-section.

When a rut box is used, emulsified asphalt content may be reduced by 0.5% of the mix design target. Any reduction of emulsified asphalt content must be within the tolerance of the job mix formulation listed in the mix design. Material placed with the rut-filling box shall have a 1/4 inch crown to allow for traffic consolidation. Before placing subsequent lifts, allow all rut-filling material to cure under traffic for at least 24 hours.

**335-4.5 Auxiliary Equipment:** Provide suitable surface preparation equipment, traffic control equipment, hand tools, and any other support and safety equipment necessary to perform the work.

### **335-5 Calibration.**

Calibrate each mixing unit to be used in the performance of the work in the presence of the Engineer prior to the start of construction. Document the individual calibration of each material at various settings, which can be related to the machine metering devices. Do not utilize



any mixing unit on the project until the calibration has been completed and approved by the Engineer. Any component replacement affecting material proportioning requires that the machine be recalibrated. No machine will be allowed to work on the project until the calibration has been completed and accepted.

### **335-6 Weather Limitations.**

Do not apply micro surfacing if either the pavement or air temperature is below 50°F. Do not apply micro surfacing when there is the possibility that the finished product will freeze within 24 hours. Do not apply micro surfacing in the rain or when there is standing water on the pavement. The mixture shall not be applied when weather conditions prevent opening to traffic within a reasonable amount of time, as determined by the Engineer.

### **335-7 Surface Preparation.**

**335-7.1 General:** Utilize water blasting to roughen the surface of any thermoplastic striping materials to the satisfaction of the Engineer. Remove any retro-reflective pavement markers in the areas to be micro surfaced. Provide temporary striping as necessary to comply with Contract Document requirements. Immediately prior to applying the micro surfacing, clear the surface of all loose material, silt spots, vegetation, and other material that will negatively affect the quality of the micro surfacing, utilizing any standard cleaning method. If water is used for cleaning, allow any unsealed cracks to dry thoroughly before applying micro surfacing. Protect manholes, valve boxes, drop inlets and other service entrances from the micro surfacing mixture by a suitable method. The Engineer will approve the surface preparation prior to micro surfacing. No loose aggregate, either spilled from the lay-down machine or existing on the road, will be permitted.

**335-7.2 Cracks:** Pre-treat any cracks in the surface of the pavement with a crack filler meeting the material requirements of Developmental Specification Section 305 prior to the application of the micro surfacing. Fill any cracks with a width greater than 1/4 inch. Do not overfill the cracks. Crack filling material must cure for a minimum of 30 days prior to application of the micro surfacing.

**335-7.3 Rumble Strips:** Where shoulders are not to be micro surfaced, prevent material from being applied to or entering any rumble strip depressions. If necessary, remove any material that enters the depressions. When rumble strips are to be micro surfaced, place a scratch course to fill the depressions prior to placing the final surface course.

**335-7.4 Tack Coat:** Place a tack coat on all pavement prior to constructing a micro surfacing course. A tack coat is not required between the leveling (scratch) course and the surface course provided the surface course is placed within 30 days of the leveling (scratch) course. If required, the tack coat should be type SS, type CSS, or the micro surfacing emulsified asphalt. It may consist of one-part emulsified asphalt to three parts water and should be applied with a standard distributor. The distributor shall be capable of applying the tack evenly at an emulsion rate of 0.05-0.15 gallons per square yard.

### **335-8 Application.**

**335-8.1 General:** Pre-wet the surface by fogging ahead of the spreader box with water. Adjust the rate of application of the fog spray to suit temperatures, surface texture, humidity, and dryness of the pavement.

The micro surfacing shall be of the desired consistency upon leaving the mixer. Carry a sufficient amount of material in all parts of the spreader box at all times so that complete

coverage is obtained. Avoid overloading of the spreader box. Do not allow lumping, balling, or unmixed aggregate in the micro surfacing mixture.

Do not leave streaks, such as those caused by oversized aggregate, in the finished surface. If excess streaking develops, stop production until the situation has been corrected. Excessive streaking is defined as more than four drag marks greater than 1/2 inch wide and 4 inches long, or 1 inch wide and 3 inches long, in any 30 square yard area. Do not permit transverse ripples or longitudinal streaks of 1/4 inch in depth or greater, when measured by placing a 10-foot straight edge over the surface.

**335-8.2 Application Rate:** The average application rate shall be in accordance with Table 335-6, unless otherwise specified in the Contract Documents. Full width application rates must be maintained within plus or minus 2 pounds per square yard of the specified rate. Application rates are based upon the weight of dry aggregate in the mixture. The maximum thickness of any single layer of micro surfacing at the edge of the pavement shall be 1/4 inch.

Table 335-6 Application Rates	
Layer	Application Rate (lbs/yd <sup>2</sup> )
Bottom	14-18
Top	16-20
Total	30-34

**335-8.3 Joints:** Prevent excessive buildup, uncovered areas, or unsightly appearance on longitudinal and transverse joints. Provide suitable-width spreading equipment to produce a minimum number of longitudinal joints throughout the project. Place longitudinal joints on lane lines, where possible. Use half passes and odd-width passes only when absolutely necessary. Do not apply a half pass as the last pass of any area. Do not overlap longitudinal lane line joints by more than three inches. Do not construct joints having more than a 1/4 inch difference in elevation when measured by placing a 10-foot straight edge over the joint and measuring the elevation drop-off. Construct longitudinal joints so that water is not held at the joint. Construct transverse joints at the beginning and end project limits so that the elevation difference between the micro surfacing and the adjacent pavement does not exceed 1/4 inch.

**335-8.4 Mix Stability:** Produce a micro surfacing mixture that possesses 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. The mixture shall be free of excess water or emulsified asphalt and free of segregation of the emulsified asphalt and aggregate fines from the coarser aggregate. Do not spray water directly into the spreader box while applying micro surfacing material under any circumstances.

**335-8.5 Handwork:** Utilize hand squeegees to provide complete and uniform coverage of micro surfaced areas that cannot be reached with the mixing machine. Lightly dampen the area to be hand worked prior to mix placement, if necessary. Care shall be exercised to leave no unsightly appearance from handwork. When performing handwork, provide the same type of finish as that applied by the spreader box.

**335-8.6 Lines:** Construct straight lines along curbs and shoulders. Do not permit runoff on these areas. Keep lines at intersections straight to provide a good appearance. If necessary, utilize a suitable material to mask off the end of streets to provide straight lines. Edge lines shall not vary by more than 2 inches horizontally.



**335-8.7 Cleanup:** Remove micro surfacing mixture from all areas such as manholes, gutters, drainage structures, rumble strips, and as otherwise specified by the Engineer. On a daily basis, remove any debris resulting from the performance of the work.

**335-8.8 Post Sweeping:** Broom the surface of any loose material within 48 hours after the completion of the micro surfacing. If directed by the Engineer, perform this operation again approximately seven to ten days after completion of the micro surfacing. Additionally, clean the surface, as necessary, prior to application of the final pavement markings.

### **335-9 Quality Control.**

**335-9.1 Material Monitoring:** Provide a computerized material monitoring system with integrated material control devices that are readily accessible and positioned so the amount of each material used can be determined at any time. Ensure the computer system is functional at the beginning of work and during each calibration. Provide a back-up electronic materials counter that is capable of recording running count totals for each material being monitored. Equip the mixer with a radar ground measuring device. The computer system shall have the capability to record, display and print the following information:

1. Individual sensor counts for emulsion, aggregate, cement, water, and additive.
2. Aggregate, emulsion, and cement output in pounds per minute.
3. Ground travel distance.
4. Spread rate in pounds per square yard.
5. Percentages of emulsion, cement, water, and additive.
6. Cumulative totals of aggregate, emulsion, cement, water, and

Additive.

7. Scale factor for all materials.

**335-9.2 Sampling and Testing:** Obtain one sample of micro surfacing mixture for each day of production. Obtain the sample by taping a piece of tar paper approximately 3 feet wide by 3 feet long at the end of the production run in the path of the micro surfacing machine. Allow the material to set up on the tar paper prior to removing from the roadway. Other means of obtaining the sample may be used if approved by the Engineer. Utilizing a laboratory approved by the Department, test each sample in accordance with FM 5-563 and FM 1-T030 to determine the residual asphalt content and the gradation of the sample. Evaporate any residual water from the sample prior to testing. Determine the deviation of the test results for each sample from the mix design target values. Compare the deviation from the mix design to the mixture control tolerances shown in Table 335-7. Remove and replace micro surfacing material not meeting the Acceptance Limits for Residual Asphalt Content of Mixture, unless approved to remain in place by the Engineer or unless the Engineer agrees to evaluate the material in place. For material not meeting the gradation Acceptance Limits, adjust the micro surfacing process to correct the problem. If two consecutive days production have gradation test results not meeting the Acceptance Limits in Table 335-7, cease production and determine the cause of the problem. Do not resume production until receiving approval from the Engineer.

Table 335-7 Aggregate and Emulsified Asphalt - Acceptance Limits	
Aggregate	Tolerance from Mix Design Target Values
Percent Passing No. 4 Sieve	± 6 percent
Percent Passing No. 8 Sieve	± 7 percent



Table 335-7 Aggregate and Emulsified Asphalt - Acceptance Limits	
Percent Passing No. 50 Sieve	± 6 percent
Percent Passing No. 200 Sieve	± 3.0 percent
Emulsified Asphalt	
Residual Asphalt Content of Mixture	± 0.6 percent

### 335-10 Quality Acceptance.

**335-10.1 Sampling and Testing:** The Engineer will be provided with one sample of micro surfacing mixture on the first day of production and every second day of production after the first day. The Contractor will obtain the samples by taping a piece of tar paper approximately 3 feet wide by 3 feet long at the end of the production run in the path of the micro surfacing machine. Allow the material to set up on the tar paper prior to removing from the roadway. Other means of obtaining the sample may be used if allowed by the Engineer.

Test each sample in accordance with FM 5-563 and FM 1-T 030 to determine the residual asphalt content and the gradation of the sample. Evaporate any residual water from the sample prior to testing. Determine the deviation of the test results for each sample from the mix design target values. Compare the deviation from the mix design to the mixture control tolerances shown in Table 335-7. Remove and replace micro surfacing material not meeting the Acceptance Limits for Residual Asphalt Content of Mixture, unless approved to remain in place by the Engineer or unless the Engineer agrees to the Contractor evaluating the material in place.

For material not meeting the Acceptance Limits for Aggregate gradation, adjust the micro surfacing process to correct the problem. If two consecutive gradation test results (does not have to be the same sieve size) do not meet the Acceptance Limits in Table 335-7, cease production and determine the cause of the problem. Do not resume production until receiving approval from the Engineer.

**335-10.2 Application Rate:** Control the application rate for micro surfacing on a lot basis to within the "Total" range specified in Table 335-6. A lot will be considered as 0.10 lane miles. No additional compensation will be paid for micro surfacing application rates placed in excess of the "Total" specified range. The unit price for each deficient lot will be reduced by ten percent for each pound per square yard rate less than the "Total" specified range. For application rates outside the "Total" specified range, stop production of the mixture and make adjustments to correct the problem to the satisfaction of the Engineer prior to resuming production. Accept a pay reduction for deficient lot production or overlay the deficient area at full plan width and depth at no additional cost.

### 335-11 Method of Measurement.

The quantity to be paid for under this Section will be the number of square yards of micro surfacing completed and accepted

### 335-12 Basis of Payment.

Price and payment shall be full compensation for performing all micro surfacing work, including the cost of crack sealing.

Payment will be made under:

Item No. 335-1      Micro surfacing, per square yard