

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION**

**SPECIAL PROVISION NO. 907-405-6**

**CODE: (SP)**

**SUBJECT: Micro-Surfacing**

Section 405, Micro-Surfacing, is hereby added to and made a part of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows:

**SECTION 907-405 -- MICRO-SURFACING**

**907-405.01--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 shall be 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 shall be properly proportioned, mixed and spread on the paved surface in accordance with this Specification and as directed by the Engineer.

**907-405.02--Materials.** The materials to be used and the specifications for them are as listed below:

**907-405.02.1--Aggregate.** Fine aggregate used in the micro-surfacing material shall meet the requirements of Subsection 703.02, and the Sand Equivalent Value shall not be less than 65 when tested in accordance with AASHTO Designation: T 176.

Course aggregate used in the micro-surfacing material shall meet the requirements of Subsection 703.03.

Aggregates shipped to the project shall be uniform and shall not require blending or pre-mixing at the storage area before use and shall meet the appropriate gradation as shown in Table No. 1.

**907-405.02.2--Mineral Filler.** The mineral filler shall be Portland Cement or Hydrated Lime meeting the following requirements:

- Portland Cement ..... Section 701
- Hydrated Lime ..... Subsection 714.03

**907-405.02.3--Cationic Asphalt Emulsion.** The emulsified asphalt shall be a cationic type CSS-1HP meeting the following requirements.

Test on Emulsions Vis. Saybolt Furol at 77°F, sec.	20 min - 100 max
Storage Stability Test, 1-Day, % (a)	1 max
Settlement, 5-Day, % (b)	5 max
Particle Charge Test	Positive
Sieve Test, %	0.10 max
Residue, %	62 min
Tests on Residue From Distillation Test: (c)	
Penetration, 77°F, 100 g., 5 sec.	40 min - 90 max
Ductility, 77°F, 5 cm per min., cm	40 min
Solubility in Trichloroethylene, % (d)	97 min
Softening Point, °F	135 min

- (a) The 24-hour (1-day) storage stability test may be used but does not predict that the 5-day settlement test will pass.
- (b) The test requirement for settlement may be waived when the emulsified asphalt is used in less than five days time, or the purchaser may require that the settlement test be run from the time the sample is received until it is used, if the elapsed time is less than five days.
- (c) The residue from the emulsified asphalt shall be obtained in accordance with AASHTO Designation: T59 except that the maximum test temperature shall not exceed 350°F and the duration shall not exceed 20 minutes.
- (d) Solubility test is to be performed on the base asphalt used for emulsion manufacture

**907-405.02.4--Latex Rubber Additive (LRA).** The LRA shall be a latex in a centrifuged latex form. The supplier of the emulsion shall provide certification that the LRA meets the following requirements:

<u>Test</u>	<u>Results</u>	<u>Test Method</u>
Rubber Solids content, Minimum % by weight	60	ASTM Designation: D 1417
Brookfield Viscosity, cps Maximum	5000	ASTM Designation: D 1417
Total Ash, Maximum %	3.5	ASTM Designation: D 297

The LRA shall be co-milled with the asphalt cement during the manufacture of the emulsified asphalt to produce a homogeneous mixture. The LRA shall be added in the necessary proportions to result in 3.0% neat latex by weight of residual asphalt cement in the emulsion. The LRA modified emulsified asphalt, upon standing undisturbed for a period of 24 hours, shall show no separation of emulsion and LRA, no color striations, but shall be a uniform color throughout.

**907-405.02.5--Tack Coat.** Normally, tack coat is not required unless the surface to be covered is concrete or is extremely dry and raveled. The emulsified asphalt should be the same grade and type as used for the micro-surfacing. The tack coat shall be placed using a standard distributor capable of evenly applying the emulsion. The tack coat shall be allowed to cure sufficiently before the application of micro-surfacing. If the tack coat is required, it will be noted on the plans or in the contract documents.

**907-405.02.6--Water.** The water for the micro-surfacing mixture shall be potable and free from any contaminants detrimental to the mixture.

**907-405.02.7--Other Additives.** The emulsion manufacturer shall provide other additives as required to control the set time of the mixture in the field.

**907-405.02.8--Composition of Mixture.** The Mix Design shall be supplied by the contractor. As a minimum, the design shall include the following: 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. The Contractor shall submit to the Central Laboratory representative samples of each ingredient to be used in the micro-surfacing mixture for design verification. The samples shall include information relative to sources, type of materials and project number. No micro-surfacing work shall begin nor shall any mixture be accepted until the Laboratory has approved the micro-surfacing design. Acceptance of the design by the Engineer is solely for the purpose of quality control and in no way releases the Contractor from the responsibility to perform acceptable work under this specification.

The micro-surfacing material shall be a uniform mixture of aggregate, LRA-modified emulsion, mineral filler, water and other additives as required to control the set time in the field. The emulsion and aggregate shall be compatible so that a complete, uniform coating of the aggregate shall be obtained in the mixing unit. The mixture shall have sufficient working life to allow for proper placement at the existing ambient temperature and humidity. The Engineer shall require the mixture to be redesigned if replacement of a constituent, or change in gradation, is needed to produce an acceptable mixture. The constituents shall be proportioned to produce a uniform mixture meeting the requirements of Table No. 1. Reference to ISSA TB means International Slurry Surfacing Association Technical Bulletin.

**TABLE NO. 1  
JOB MIX FORMULA AND DESIGN LIMITS**

**MICRO-SURFACING**

MIXTURE CONTROL TOLERANCES	GRADING REQUIREMENTS % PASSING	TYPE II	TYPE III
<u>+0</u>	3/8" Sieve	100	100
<u>+6</u>	No. 4 Sieve	90 – 100	70 - 95
<u>+5</u>	No. 8 Sieve	65 – 90	45 - 70
<u>+5</u>	No. 16 Sieve	45-70	30 - 50
<u>+4</u>	No. 30 Sieve	30-50	20 - 35
<u>+4</u>	No. 50 Sieve	18-30	12 - 25
<u>+3</u>	No. 100 Sieve	10-21	7 - 18
<u>+3</u>	No. 200 Sieve	5 – 15	5 - 12

**DESIGN REQUIREMENTS**

<u>+0.50</u>	Range for Residual Asphalt, %	6.0 - 9.0	6.0 - 9.0
	Range for Mineral Filler, %	0.5 - 3.0	0.5 - 3.0
	Wet Track Abrasion Loss (Maximum) ISSA TB 100 1 hour soak ISSA TB 100 6 day soak	50 g/ft <sup>2</sup> 75 g/ft <sup>2</sup>	50 g/ft <sup>2</sup> 75 g/ft <sup>2</sup>
	Vertical Displacement (Maximum) ISSA TB 147A or 147C	10%	10%
	Excess Asphalt by LWT (Maximum) ISSA TB 109 System Compatibility TB 144	50 g/ft <sup>2</sup> 11 grade points minimum	50 g/ft <sup>2</sup> 11 grade points minimum

Note 1: Percent residual asphalt and percent mineral filler shall be based on weight of dry aggregate.

Note 2: The gradation and percent residual asphalt as shown on the micro-surfacing design or as established by the Engineer shall be maintained within the listed Mixture Control Tolerances. Additionally, the aggregate shall remain within the master gradation band. Mineral filler shall not be used to satisfy the requirements as set forth in Table 1. Should these tolerances fail to be met, immediate adjustments will be made to bring the gradation and percent residual asphalt back within tolerances or the work will not be allowed to continue.

Note 3: The laboratory report shall also provide the following information which shall be within the test parameters given:

<u>Test</u>	<u>Result</u>	<u>Test Method</u>
Mixing Time Test, Seconds @ 77°F, minimum	120	ISSA TB 113
Set Time Test, 30 minutes, minimum	12 kg-cm	ISSA TB 139
Early Rolling Traffic Time, 60 minutes, minimum	20 kg-cm	ISSA TB 139
Water Resistance Test, 30 minutes	No Discoloration	ISSA TB 102
Wet Stripping Test, % Coating, minimum	90	ISSA TB 114
System Compatibility	Pass	ISSA TB 115

Note 4: Gradation type shall be as specified in the plans and proposal.

**907-405.02.9--Equipment.** The Engineer shall approve all equipment, tools, and machines used in the performance of this work. No work shall be attempted with equipment that is malfunctioning. The Engineer may order that the work be discontinued if sufficient equipment and tools are not in use to place the materials satisfactorily.

**907-405.02.9.1--Mixing Equipment.** The paving mixture shall be blended by a self-propelled, positive, non-slipping aggregate delivery system (belt over chain) micro-surfacing mixing machine which shall be a continuous flow mixing unit able to accurately deliver and proportion the aggregate, LRA-modified emulsion, mineral filler, field control additives and water to a revolving multi-blade, twin shafted mixer and discharge the mixed product on a continuous flow basis. The mixture shall be thoroughly blended so that no uncoated aggregate is visible upon discharge from the mixing unit. The machine shall be equipped with self loading devices which provide for the loading of all materials while continuing to lay micro-surfacing, thereby minimizing construction joints. The machine shall be equipped with opposite side driving stations to optimize longitudinal alignment. The machine shall be equipped to allow the operator to have full hydrostatic control of the forward and reverse speed during the application of the micro-surfacing material. Continuous-run equipment will be required to ensure continuity of mix and reduction of start-up joints.

In some cases and with the Engineer’s approval, truck mounted units may be used for short narrow roadways, crossovers and irregular areas. If truck mounted units are allowed, they shall be equipped with a positive, non-slipping aggregate delivery system (belt over chain) and have the capability of applying a minimum of 10 tons of aggregate without recharging the aggregate bin.

1. Water Pressure System. The mixing machine shall be equipped with a water pressure system and nozzle type spray bar to provide a water spray ahead of and outside the spreader box when required.
2. Calibration & Proportioning Devices. The machine shall be equipped with individual volume or mass controls or other gauging devices for measuring and proportioning each material added to the mix. Each material control device shall be calibrated, properly marked, and positively interlocked. The aggregate feed to the mixer shall be equipped with a revolution counter or similar device so that the amount of asphalt emulsion, aggregate and mineral filler used may be determined at any time. Each mixing unit shall be calibrated prior

to commencement of the work. The calibrations shall be performed and verified in the presence of the Engineer or the Engineer's representative. Once calibrated, the aggregate and emulsion flows shall not be changed without the approval of the Engineer. The water and additive may be adjusted in the field to control the mix properties to produce an acceptable mix. With the Engineers approval, previous calibration documentation covering the exact materials to be used may be acceptable provided they were made within the last three (3) months.

3. Emulsion Pump. The emulsion pump shall be a heated, positive displacement type pump.

Attached to the machine shall be a hydraulically adjustable (adjustable while applying mixture) type spreader box with a positive screed adjustment for yield control. The box shall be attached to the mixer, equipped with ribbon flights mounted on an adjustable shaft to continually agitate and distribute the material throughout the box. The box will be equipped with curb bumpers and replaceable runners with a minimum of 5-foot long end runners. The box shall be equipped with a sufficient walkway to provide access to either side of the spreader box without walking through the freshly applied material. The box must be capable of laying mix to a width of 14 feet. The equipment shall provide sufficient turbulence to prevent the mix from setting in the box or causing excessive build-up or lumps. To prevent the loss of mixture from the box, the contractor shall attach flexible seals, front and rear, in contact with the road. The full width application box shall be equipped with a secondary strike-off located approximately 2 to 3 feet behind the primary strike-off to minimize transverse corrugations. The secondary strike-off shall have elevation and width adjustments similar to the primary strike-off. It shall have a pivot point where it can be tilted for texturing or raised completely off of the surface. The use of burlap drags or other drags necessary to obtain the desired surface texture, shall require approval by the Engineer. Drags having excessive build-up shall be replaced. Drags shall be kept in a completely flexible condition at all times.

**907-405.02.9.2--Auxiliary Equipment.** Suitable surface cleaning equipment, barricading equipment, hand tools and other support equipment shall be provided by the Contractor as necessary to perform the work.

**907-405.02.10--Stockpiling and Storage.**

**907-405.02.10.1--Aggregate Storage.** The mineral aggregate shall be handled in such a manner as to prevent segregation, mixing of the various materials or sizes, and contamination with foreign materials. The grading of aggregates proposed for use and as supplied to the project shall be uniform. Suitable equipment of acceptable size shall be furnished by the Contractor to maintain the stockpiles and prevent segregation of aggregates. The aggregate shall be passed over a scalping screen immediately prior to transfer to the micro-surfacing mixing machine to remove oversized material. In addition the scalping screen unit, when payment for micro surfacing is to be by the ton of aggregate and gallon of asphalt emulsion, shall be equipped with certified scales capable of providing an automated ticket printout for each truck load of material delivered to the micro surfacing machine. Each ticket shall include the project number, ticket number, truck number, date and batch weight of material loaded.

**907-405.02.10.2--Storage of Bituminous Material.** The bituminous storage shall be adequate to meet the requirements of the production rate. All equipment used in the storage and handling of

bituminous material shall be kept in a clean condition at all times and shall be operated in such a manner that there will be no contamination with foreign matter.

**907-405.03--Construction Requirements.** It shall be the responsibility of the Contractor to produce, transport and place the specified materials in accordance with these specifications and as approved by the Engineer. The finished micro-surfacing shall have a uniform texture free from excessive scratch marks, tears or other surface irregularities. The cured mixture shall adhere fully to the underlying surface. Based upon a visual examination or test results the Engineer may reject any work due to poor workmanship, loss of texture, raveling or apparent instability.

**907-405.03.1--Seasonal and Weather Limitations.** No micro-surfacing shall be performed from December 1 and March 1.

The micro-surfacing mixture shall be spread only when both the pavement surface and the ambient temperature is at least 50°F and rising and the weather is not foggy or rainy and there is no forecast of temperatures below 32°F within 48 hours from the time of placement. The Contractor shall supply a surface temperature thermometer.

**907-405.03.2--Surface Preparation.** The area to be surfaced shall be thoroughly cleaned of vegetation, loose aggregate and soil. Manholes, valve boxes and other service entrances shall be protected from the surfacing material. Unless otherwise directed by the Engineer, pre-wetting of the surface will be required. Water shall be sprayed ahead of and outside of the spreader box at a acceptable rate to dampen the surface without any free flowing water ahead of the spreader box.

**907-405.03.3--Tack Coat.** The tack coat, when required, shall be diluted at the rate of one part emulsion and three parts water and shall be applied with an asphalt distributor. The application rate shall be 0.05 to 0.10 gallons of diluted emulsion per square yard. When required, tack coat will not be measured for separate payment; costs shall be included in other items bid.

**907-405.03.4--Application.** The paving mixture shall be spread on the prepared surface in such a way to leave a uniform finished surface. Care shall be taken 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. The Contractor shall use squeegees and lutes to spread the mixture in areas inaccessible to the spreader box and areas requiring hand spreading. A sufficient amount of material shall be carried at all times in all parts of the spreader box to ensure complete coverage.

Adjustments to the additive will be permitted if necessary to provide a slower setting time when hand spreading is needed. If hand spreading is necessary, the mixture shall be poured in a small windrow along one edge of the surface to be covered and then spread uniformly by a hand squeegee or lute. A smooth, neat seam shall be provided where two passes meet. Excess material shall immediately be removed from ends of each run.

**907-405.03.5--Traffic Control.** The emulsified asphalt shall be formulated in such a way to allow the paving mixture to cure at a rate which will permit straight rolling traffic on the pavement within one hour after application without damaging the pavement surface. The Contractor shall maintain traffic control as necessary to prevent damage to the mixture. Any such damage done by traffic to the mixture shall be repaired by the Contractor at the Contractor's expense.

**907-405.03.6--Rut Filling and Leveling Course.** When required, before the final surface course is placed, preliminary micro-surfacing materials shall be required to fill ruts, utility cuts, depressions in the existing surface, etc. Ruts greater than 1/2" in depth shall be filled independently with a rut filling spreader box either 5-foot or 6-foot in width. For irregular or shallow rutting 1/2" or less in depth, a leveling course may be used as directed by the Engineer. The spreader box used for the leveling course shall be the same as used for the surface course; however, a steel or high density strike-off shall be used in lieu of a flexible rubber. Using a rut fill spreader box, each individual rut fill shall be crowned to compensate for traffic compaction at a rate of 1/8" per 1" of rut depth. Rut filling shall be placed and opened to traffic a minimum of 24 hours prior to surfacing. All materials, mixture composition, equipment, and construction procedures and requirements shall be as specified above.

**907-405.03.7--Workmanship.** Excessive buildup, uncovered areas, or unsightly appearance shall not be permitted on longitudinal or transverse joints. Longitudinal joints shall be placed on lane lines and excessive overlap shall not be permitted. Care shall be taken to insure straight lines along the roadway centerline, lane lines, shoulders or edge lines. Lines at intersections shall be kept straight to provide a neat and uniform appearance.

1. **Finished Surface.** The finished micro-surfacing shall have a uniform texture free from excessive scratch marks, tears, or other surface irregularities. Excessive tear marks are considered as four marks that are  $\geq 1/2$ " in width and  $\geq 6$ " in length per 100 square yards, or any marks  $\geq 1$ " in width or  $\geq 4$ " in length. The edges of the micro-surfacing shall be neat in appearance and longitudinal alignment shall be parallel to the roadway centerline.
2. **Joints and Seams.** The longitudinal and transverse joints shall be neat in appearance and uniform. Transverse joints shall be constructed as butt-type joints. No excessive buildup, uncovered areas or unsightly appearance will be permitted on longitudinal or transverse joints. Longitudinal joints shall be placed on lane lines when possible. Gaps between applications shall not be permitted. Joints will be considered acceptable if no more than a 1/2" vertical space exists between the pavement surface and a 4-foot straight edge placed perpendicular on the longitudinal joint, and no more than 1/4" for a transverse joint.
3. **Irregular Areas.** Areas which cannot be reached with the mixing machine shall be surfaced using hand tools to provide complete and uniform coverage. The area to be hand worked shall be cleaned and lightly dampened prior to mix placement. Care shall be exercised in areas that require handwork 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 shall not be paid for but shall be entirely at the contractor's expense. When transitions are included as part of the work, then these areas are to be surfaced prior to application of the main line. This shall include intersections, turnouts, radii, ramps etc.

**907-405.03.8--Aggregate Application Rate.** The target spread rate for all full width micro-surfacing not intended as a leveling course shall be controlled to within plus or minus two pounds per square yard of spread rate and shall be based on the weight of dry aggregate. Unless otherwise approved by the Engineer, the full width spread rate shall be 18 pounds (for Type II) and 25 pounds (for Type III) per square yard. A five-percent (5%) reduction in unit price will be applied for each pound of aggregate per square yard outside the spread rate tolerances established above for each



day’s placement of material. In lieu of pay reduction, the Contractor may elect to overlay the deficient area at no additional costs to the Department. Continued operation and placement of materials outside the spread rate tolerances shall not be allowed. The Contractor shall make adjustments as necessary in the placement operation to maintain production within the tolerances given.

**907-405.04--Method of Measurement.** Emulsified Asphalt for micro-surfacing shall be measured by the gallon. The Contractor will be required to submit certified bill of ladings from the emulsion manufacturer indicating total gallons delivered. In addition, the Contractor will be responsible for submitting a way-back ticket representing un-used material at the conclusion of each project.

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Aggregate for micro-surfacing shall be measured by the ton of dry aggregate used. The aggregate shall be weighed on certified scales. The weight will be based on a 2000-pound ton and the aggregate will be corrected for moisture. The mineral filler will be counted by the 94-pound sack and will be included in the payment for aggregate.

**907-405.05--Basis of Payment.** Emulsified Asphalt for micro-surfacing, measured as prescribed above, will be paid for at the contract bid price per gallon, which shall be full compensation for furnishing all materials including LRA modified bituminous materials and mineral filler, and for all equipment, work and labor to complete the work.

Aggregate for micro-surfacing, measured as prescribed above, will be paid for at the contract bid price per ton, which shall be full compensation for furnishing all equipment, work and labor to complete the work.

These prices shall be full compensation for furnishing all materials, for preparation, mixing and applying these materials and for all labor, equipment, tools, test design, clean up and incidentals necessary to complete the work as specified herein.

Payment will be made under:

- 907-405-A: Emulsified Asphalt for Micro-Surfacing - per gallon
- 907-405-B: Aggregate for Micro-Surfacing (Type \_\_\_\_\_) - per ton
- 907-405-C: Square Yard -per square yard