

Subsection 4.22 Microsurfacing

- I. Scope:** The Contractor will furnish and place a microsurfacing system consisting of a mixture of cationic polymer-modified asphalt emulsion, mineral aggregate, mineral filler, water, and other additives.

- II. Materials:** Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications. Notify the ODR of all materials sources and before changing and material source for formulation. The Contractor will verify that the specification requirements are met when the source or formulation change, and may require a new laboratory mixture design, trial batch, or both. The ODR may sample and test project materials at any time during the project to verify specification compliance.
 - A. Cationic Polymer-Modified Asphalt Emulsion:** Provide CSS-1P in accordance with Subsection 4.23.II.E, "Emulsified Asphalt."

 - B. Aggregates:** The contractor will provide a crushed aggregate from a single source meeting the requirements of Table 1 and Table 2. Determine aggregate gradations for mixture design and production testing based on the washed sieve analysis given in Tex-200-F, Part II. Aggregate from sources listed in TxDOT's *Bituminous Rated Source Quality Catalog* (BRSQC) are preapproved for use. Do not combine approved material with unapproved material. Include the amount of mineral filler added to the mix in determining the total minus No. 200 aggregate fraction.

 - C. For sources not listed in TxDOT's BRSQC:**
 - a)** Build an individual stockpile for each material
 - b)** Provide test results on the stockpile for specification compliance; and
 - c)** Once approved, do not add material to the stockpile unless otherwise approved.

Table 1
Aggregate Gradation Requirements
Tex-200-F, Part II (Washed)

Sieve Size	Cumulative % Passing
3/8 in.	100.0
#4	86.0-94.0
#8	45.0-65.0
#16	25.0-46.0
#30	15.0-35.0
#50	10.0-25.0
#100	7.0-18.0
#200	5.0-15.0

Table 2
Aggregate Quality Requirements

Property	Test Method	Requirements
Surface Aggregate Classification	Tex-499A	A. ¹
Magnesium sulfate soundness, %, max. ¹	Tex-411-A	25
Crushed face count, ² %Min	Tex-460-A Part II	95
Sand equivalent value, %, min.	Tex-203-F	70
Acid insoluble, (%), Max	Tex-612-J	55

¹Use design gradation for the soundness test.

²Only applies to crushed gravel

D. Mineral Filler: Provide mineral filler that is free of lumps and foreign matter consisting of non-air-entrained cement meeting the requirements of DMS-4600, "Hydraulic Cement," or hydrated lime meeting the requirements of DMS-6350, "Lime and Lime Slurry."

E. Water: Water usage shall conform to Subsection 3.04 "Requirements for Water Usage."

F. Other Additives: Use approved additives as recommended by the emulsion manufacturer in the emulsion mix or in any of the component materials when necessary to adjust mix time in the field.

G. Tack Coat: Furnish CSS-1H or SS-1H for tack coat binder in accordance with Section 4.23 "Asphalts, Oils, and Emulsions." Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use.

III. Equipment: Maintain equipment in good repair and operating condition.

A. Mixing Machine. Calibrate and properly mark each control device that proportions the individual materials. Equip the aggregate feed with a revolution counter or similar device capable of determining the quantity of aggregate used at all times. Provide a positive-displacement-type emulsion pump with a revolution counter or similar device capable of determining the quantity of emulsion used at

all times. Provide and approved mineral filler feeding system capable of uniformly and accurately metering the required material. Furnish a self propelled microsurfacing mixing machine with:

1. Self-loading devices to promote continuous laying operations;
2. Enough storage capacity for mixture materials;
3. Individual volume or weight controls that will proportion each material to be added to the mix;
4. Continuous flowing mixing with a revolving multi-blade mixer capable of discharging the mixture on a continuous flow basis;
5. Opposite side driving stations;
6. Full hydrostatic control of the forward and reverse speed during operation;
7. A water pressure system and nozzle-type spray bar immediately ahead of the spreader box and capable of spraying the roadway for the width of the spreader box;
8. A mechanical-type spreader box equipped with paddles or other devices capable of agitating and spreading the materials throughout the box;
9. A spreader box with devices capable of providing lateral movement or side shift abilities; and
10. A spreader box with a front seat, adjustable rear strike-off, and an adjustable secondary rear strike-off.

B. Scales: Scales used for weighing aggregates and emulsion must meet all requirements of Subsection 4.26 "Weighing and Measuring Equipment." The weighing equipment for aggregates may be either a suspended hopper or a belt scale.

C. Asphalt Storage and Handling Equipment: Furnish a thermometer in each tank to indicate the asphalt temperature when continuously storage tanks are used. Keep equipment clean of and free of leaks. Keep asphalt materials free from contamination.

IV. Construction: Produce, transport, and place microsurfacing as specified in this Subsection. Provide emulsion and aggregate that are compatible so that the mixing process will completely and uniformly coat the aggregate. Ensure that the finished surface has a uniform texture and the microsurface mat is fully adhered to the underlying pavement. The ODR may perform production tests at any time during the project. Schedule and participate in a pre-paving meeting with the ODR on or before the first day of paving.

A. Mixture Design: Provide a mixture design meeting the proportions shown in Table 3 and the requirements shown in Table 4. The contractor will ensure the mixture design meets the minimum requirements for wet track abrasion wear value listed in Table 4. The ODR may accept an existing mixture design used on a previous project, but the mixture design may be subjected to annual verification using laboratory-produced mixes before starting the paving season.

Table 3
JMF Proportions

Material	Proportion
Residual asphalt	6.0 to 9.0% by wt. of dry aggregate
Mineral filler (hydraulic cement or hydrated lime)	0.5 to 3.0% by wt. of dry aggregate
Field control additive	As required to provide control of break and cure
Water	As required to provide proper consistency

Table 4
JMF Requirements

Property	Test Method	Requirements
Wet track abrasion, g/sq. ft., max. wear value	Tex-240-F, Part IV	75
Gradation (aggregate and mineral filler)	Tex-200-F, Part II (Washed)	Table 1
Mix time, controlled to 120 sec.	Tex-240-F, Part I	Pass
Lateral displacement Specific gravity after 1,000 cycles of 125 lb	ISSA TB-147	5% Max 2.10 Max
Excessive asphalt by LWT Sand Adhesion	ISSA TB-109	50 g/ft ²

B. Reporting, Testing, and Responsibilities: Submit a report to record and calculate all test data pertaining to production testing. The contractor will immediately report to the ODR any test results that fail to meet the specification requirements. Note that mix placed after test results are available from the Contractor may be considered unauthorized work if the results require suspension of operations. Unauthorized work will be accepted or rejected at the discretion of the ODR.

C. Temporary Material Storage.

1. Aggregate Storage: Stockpile materials to prevent segregation or contamination. Remix stockpiles with suitable equipment when necessary to eliminate segregation. Use a scalping screen to remove oversize material while transferring aggregates to the mixing machine.

2. Mineral Filler Storage: Store the mineral filler in a manner that will keep it dry and free from contamination.

3. Asphalt Material Storage: Keep asphalt materials free from contamination.

D. Weather Limitations: The Contractor may pave any time the roadway has no standing water on the roadway surface, the roadway surface temperature is at least 60°F and the ambient temperature is at least 50°F and rising. Place mixtures only when the ODR determines the roadway surface weather and moisture conditions are suitable. The ODR may restrict the Contractor from paving if the ambient temperature is below 60°F and falling. Cease placement 24 hr. before the weather forecast (National Weather Service) predict temperatures below 32°F unless otherwise approved.

E. Surface Preparation: Prepare the surface by removing raised pavement markers and objectionable material such as moisture, dirt, sand, leaves, and other loose impediments from the surface before placing mixture. Provide a water spray immediately ahead of the spreader box when required for existing surface conditions when tack coat is not required. Apply water at a rate that will dampen the entire surface without any free-flowing water ahead of the spreader box.

F. Tack Coat: Apply tack coat uniformly at the rate of between 0.04 and 0.10 gal. of residual asphalt per square yard of surface area. Apply tack coat in a uniform manner to avoid streaks and other irregular patterns.

G. Material Transfer: Minimize construction joints by providing continuous loading of material while placing microsurfacing. Ensure that oversized material has been removed prior to transferring the aggregates to the mixing machine.

H. Placing: Make necessary adjustments so that the mixture will have sufficient working life to allow for proper placement at the predicted ambient temperature and humidity. Spread the mixture uniformly to the lines and grades shown on the plans or as directed by means of a mechanical type spreader box. Shift the spreader box when necessary to maintain proper alignment. Clean the spreader box regularly to prevent build up from occurring and to minimize clumps. Set and maintain the spreader box skids to prevent chatter in the finished mat. Prevent loss of material from the spreader box by maintaining contact between the front seal and the road surface. Adjust the rear seal to provide the desired spread. Adjust the secondary strike-off to provide the desired surface texture. Clean strike-off regularly to prevent build up for occurring.

I. Curing: Protect the finished mat from traffic until the mix cures and will not be damaged by traffic. Adjust mixture properties according to humidity conditions and ambient air temperatures to allow uniformly moving traffic on completed travel lanes within 1 hour after placement with no damage to the surface. Protect other locations subject to sharp turning or stopping and starting traffic for longer periods when necessary.

J. Production Testing: Control the production process within the operational tolerances listed in Table 5. Suspend production when the Contractor's test results exceed the operational tolerances. The ODR will allow production to resume when test results or other information indicate the next mixture produced will be within the operational tolerances listed in Table 5. The asphalt content may be reduced below the tolerance shown in Table 5, when lean mixes are necessary for scratch and rut passes but not less than the design minimum shown for the wet track abrasion test when approved.

Table 5
Production Test

Property	Test Method	Requirements
Asphalt content, % by wt.	Tex-236-F ¹ or asphalt meter readings	Design target $\pm 0.5\%$ and within limits of Table 1
Gradation, % retained	Tex-200-F, Part II (washed) ¹	#8 sieve and larger: $\pm 5\%$ from design gradation. #16 sieve and smaller: $\pm 3\%$ from design gradation. ²

¹Dried to constant wt. at 230°F $\pm 10^\circ$ F.

²Material passing #200 sieve including the mineral filler must conform to the limitations of the master gradation shown in Table 1.

K. Workmanship: Immediately take corrective action if microsurfacing material is exhibiting evidence of poor workmanship, delayed opening to traffic, or surface irregularities, including excessive scratch marks, drag marks, tears, streaks, raveling, delamination, and segregation. The ODR may allow placement to continue for no more than one day of production while taking appropriate action. Suspend paving if the problem still exists after one day until the problem is corrected to the satisfaction of the ODR.

1. Finished Surface: Provide a finished surface that has a uniform texture free from excessive scratch marks, tears, or other surface irregularities. Marks, tears, or irregularities are considered excessive if:

- a) More than 1 is at least 1/4 inch wide and at least 10 feet long in any 100 foot of machine pull,
- b) more than 3 are at least 1/2 inch wide and more than 6 inches long in any 100 foot of machine pull, or
- c) Any are 1 inch wide or wider and more than 4 inches in length.

2. Construction Joints: Place mixture so that longitudinal joints coincide with on lane lines. Provide longitudinal and transverse joints that are uniform and neat in appearance. Provide construction joints that have limited buildup and that have no gaps between applications. Joints with buildup will be considered acceptable if:

- a) No more than 1/2 inch vertical space exists between the pavement surface and a 4-foot straightedge placed perpendicular to the longitudinal joint and
- b) No more than 1/4 inch vertical space exists between the pavement surface and a 4-foot straightedge placed perpendicular to the transverse joint.

3. Edges: Provide an edge along the roadway centerline, lane lines, shoulder, edge of pavement, or curb line that is uniform and neat in appearance. The edge is considered acceptable when:

- a) It varies no more than ± 3 inches from a 100-foot straight line on a tangent section and
- b) It varies no more than ± 3 inches from a 100-foot arc on a curved section.

L. Miscellaneous Areas: Use a single-batch-type lay-down machine or other approved method to place materials on ramps or other short sections. Apply tack coat or lightly dampen the surface before placing the mix when tack coat is not required. Provide 100% coverage that is uniform in appearance and comparable to that produced by the spreader box.

M. Ruts: Fill ruts, utility cuts, and depressions in the existing surface in a separate pass from the final surface. Cure each lift 24 hours before placement of the next lift when using multiple placements. Fill ruts as follows:

- 1. Fill irregular or shallow ruts less than 1/2 inch deep with a full-width scratch coat pass. Use a rigid primary strike-off plate.
- 2. Fill ruts 1/2 inch deep or deeper independently using a rut-filling spreader box that is at least 5 foot wide. Crown the spreader box to compensate for traffic compaction.
- 3. Fill ruts deeper than 1-1/2 inches in multiple placements.

V. Measurement: Microsurfacing will be measured by the ton of the composite microsurfacing mixture. The composite microsurfacing mixture is defined as the asphalt emulsion, aggregate, and mineral filler.

A. Aggregate: The quantity of aggregate used in the accepted portion of work will be measured by net ticket weight of each individual load of aggregate based on dry weight of aggregate. Weigh the aggregate at the project stockpile site. Use either a suspended hopper scale or a belt scale meeting the requirements of Subsection 4.21, "Weighing and Measuring Equipment." The calculated weight of mineral filler based on the accepted portion of work will be used for measurement and included in the total aggregate weight.

B. Polymer-Modified Asphalt Emulsion: The quantity of polymer-modified asphalt emulsion in the accepted portion of work will be measured by the ton of material based on the accepted load tickets issued from the manufacturer. At the completion of the project, any unused emulsion will be weighed back and deducted from the accepted asphalt emulsion quantity delivered.

VI. Payment: The work performed and materials furnished in accordance with this Subsection and measured as provided under "Measurement" will be paid for at the unit price bid per ton for "Microsurfacing." This price is full compensation for preparing the existing surface (including removing existing raised pavement markers); furnishing, hauling, preparing, and placing materials; and equipment, labor, tools, and incidentals.

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