

SECTION 480: MICROSURFACING

480.1 DESCRIPTION

This work shall consist of an application of microsurfacing material to an existing surface to produce a cured mixture with a homogeneous appearance, a firm surface adhesion, and a skid resistant texture. The microsurfacing material shall be a mixture of mineral aggregate, cationic polymer modified asphalt emulsion, mineral filler, water and other additives proportioned, mixed, and placed on an existing surface in accordance with these specifications and to the dimensions as shown on the plans or City Standard Drawings.

480.2 MATERIALS

480.2.1 Mineral Aggregate

The mineral aggregate shall be generated by crushing operations from a single source and shall be composed of clean, tough, and durable particles of crushed granite, or crushed stone meeting the following requirements:

1. Clean and free from organic matter, clay balls, or other deleterious material
2. Maximum weighted sodium sulfate soundness loss of 25 percent. Refer to AASHTO T 104.
3. Maximum loss by abrasion of 30 percent. Refer to AASHTO T 96.
4. Sand equivalent of 70 or greater. Refer to AASHTO T 176.

The mineral aggregate shall conform to the gradation requirements and tolerances of Table 480.2.1:1, "Mineral Aggregate Gradation" when tested in accordance with AASHTO T 11 and AASHTO T 27.

**Table 480.2.1:1
Mineral Aggregate Gradation**

Sieve Size	Percent Passing By Weight	Tolerance (TV = Target Value)
3/8"	100	0
No. 4	90-100	TV +/- 5 %
No. 8	65-90	TV +/- 5 %
No. 16	45-70	TV +/- 5 %
No. 30	30-50	TV +/- 5 %
No. 50	18-30	TV +/- 4 %
No. 100	10-21	TV +/- 3 %
No. 200	5-15	TV +/- 2 %

If the mineral aggregates are stored or stockpiled, they 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 mixing plant shall be uniform. The aggregate shall be passed over a scalping screen prior to transfer to the microsurfacing mixing machine to remove oversized material.

480.2.2 Emulsified Asphalt

The Contractor shall provide emulsified asphalt in accordance with AASHTO M 208. The settlement, solubility with trichloroethylene and cement mixing test requirements shall not apply.

The emulsified asphalt shall be a CSS-1P or a CQS-1HP cationic polymer modified emulsified asphalt unless otherwise specified in the contract documents or approved by the City Engineer or designee. The polymer material shall be milled or blended into the asphalt or emulsifier solution prior to the emulsification process. The emulsion shall be homogeneous and shall show no separation of polymer. The Contractor shall obtain certification from the asphalt emulsion manufacturer that the emulsion contains a minimum of 3.0 percent polymer solids based on the weight of asphalt (asphalt residual). The Contractor shall provide copies of this certification to the City Engineer or designee for each load, lot, or batch of asphalt emulsion used on the project.

The emulsified asphalt shall comply with the requirements of Table 480.2.2:1, "Emulsified Asphalt Material Properties."

**Table 480.2.2:1
Emulsified Asphalt Material Properties**

Description	Min	Max	Test Method
Test on Emulsion			AASHTO T 59
Residue by Distillation(*modified)	62%		
Viscosity, Saybolt Furol at 77°F (25°C)	20 sec.	100 sec.	
Storage stability test, one day	-	1%	
Particle charge test	Positive		
Tests on residue from distillation:			
Penetration, 77°F, 100 g, 5 seconds	55	90	AASHTO T 49
Softening Point, Ring & Ball	135°F	-	AASHTO T 53

*The standard distillation procedure shall be modified as follows: The temperature on the lower thermometer shall be brought slowly to 350°F +/- 10°F and maintained at this point for 20 minutes. Complete the total distillation in 60 minutes +/- 5 minutes from the first application of heat.

The emulsified asphalt material storage shall be ample to meet the requirements of the plant. All equipment used in the storage and handling of emulsified asphalt material shall be kept in a clean condition at all times and shall be operated in such manner that there will be no contamination with foreign matter. All equipment used in the storage and handling of emulsified asphalt material shall be made available for inspection by the City Engineer or designee upon request and corrective action shall be taken by the Contractor to clean equipment identified in non-compliance with this specification at the Contractor's expense.

480.2.3 Mineral Filler

Mineral filler shall be non-air-entrained Portland cement Type I, which is free of lumps or foreign matter conforming to the requirements of AASHTO M17. The amount of mineral filler needed shall be determined by the laboratory mix design and will be considered as part of the mineral gradation requirement. The laboratory mix design percentage of mineral filler may be increased or decreased up to 0.5% by the contractor as the microsurfacing is being placed if it is found to be necessary for better consistency or set times.

480.2.4 Water

Water shall be potable and free of harmful salts, reactive chemicals, and any other contaminants.

480.2.5 Other Additives

Additives may be used as required to accelerate or retard the break-set of the microsurfacing mix; to improve the resulting finished surface; or to increase adhesion. Additives used shall be those recommended for use by the emulsion manufacturer. The initial additive quantities shall be determined from the mix design for the microsurfacing mix or individual materials. Additives used shall be compatible with the other components of the mix. Use of additives not specified in the mix design shall require approval by the City Engineer or designee prior to use.

A polymer based modifier that consists of latex shall be milled into the emulsified asphalt. This additive shall allow the microsurfacing mixture to cure sufficiently so that normal traffic can be permitted in one hour after placement of the microsurfacing mixture, without damage to the new surface.

480.2.6 Mix Design

The mix design and resulting job mix formula is the responsibility of the Contractor. The Contractor shall provide a laboratory mix design developed by an AMRL or NMDOT certified testing laboratory. The laboratory mix design shall be certified by a licensed registered Professional Engineer in the State of New Mexico. A list of the NMDOT approved testing laboratories is available from the NMDOT State Materials Bureau. All costs associated with the development of the mix design shall be at the Contractor's expense.

The Contractor shall submit the mix design to the City Engineer or designee for approval, 14 calendar days prior to the commencement of microsurfacing placement. The issuance of a mix design developed by a certified testing laboratory and approved for use by the City Engineer or designee shall not relieve the Contractor of full responsibility for producing an acceptable mixture through the mixing plant or portable mixer.

Compatibility of the aggregate, emulsion, mineral filler, water, and other additives shall be verified by the mix design. The mix design shall be prepared with the same materials and aggregate gradation that the Contractor will use on the project. The mix design shall be prepared according to ASTM D 6372 and shall show each ingredient amount meets the following:

1. Residual asphalt: within 6.0 to 9.0 percent combined weight of dry aggregate and mineral filler.
2. Aggregate gradation (target) within the gradation design limits in accordance with Table 480.2.1:1, "Mineral Aggregate Gradation."
3. Mineral Filler: within 0.5 to 3.0 percent by weight of dry aggregate.
4. Polymer modifier: 3.0 percent minimum polymer solids based on the residual asphalt content certified by the emulsion supplier.
5. Water: As required to provide proper consistency.
6. Identify the optimum emulsion content as a percentage of the dry weight of aggregate to meet the requirements of the ISSA A143 specifications listed in Table 480.2.6:1,

“Microsurfacing Mixture Requirements.” The mix design shall identify and provide percent limits for all additives required to meet mixture design requirements.

**Table 480.2.6:1
Microsurfacing Mixture Requirements**

Description	Specification	Test Method
Wet Cohesion		
@ 30 Minutes Minimum (Set)	12 kg-cm Minimum	ISSA-TB-139
@ 60 Minutes Minimum (Traffic)	20 kg-cm Minimum Or Near Spin Min	
Excess Asphalt by LWT Sand Abrasion	50 g/ft ² Maximum	ISSA-TB-109
Wet Track Abrasion Loss		
One Hour Soak	50 g/ft ² Maximum	ISSA-TB-100
Six Day Soak	75 g/ft ² Maximum	
Lateral Displacement	5 % Max	ISSA-TB-147
Mix Time @ 77°F	Controllable to 120 Seconds Minimum	ISSA-TB-113
Wet Stripping	Pass (90% Minimum)	ISSA-TB-114

A Job Mix Formula (JMF) or target gradation shall be selected within the gradation band shown in Table 480.2.1:1, “Mineral Aggregate Gradation” and the JMF shall be based on this gradation. The percent passing each sieve shall not vary by more than the tolerance shown in Table 480.2.1:1, “Mineral Aggregate Gradation” and shall remain within the gradation band after the target gradation has been submitted.

480.2.6.1 Mix Design Submittal Requirements

The mix design submittal shall include but not be limited to items defined in Table 480.2.6.1:1, as directed by the City Engineer or designee. A submittal may be rejected if it does not include the information specified.

**Table 480.2.6:1
Mix Design Submittal Requirements**

A.	Date of submittal; Mix Design identification number
B.	Name of Testing Laboratory; Name of Contractor requesting design
C.	Signature of Registered Professional Engineer certifying design
D.	Project Name, Project Number, and Control Number (when applicable)
E.	Results of each of the required tests compared to specification values.
F.	Job Mix Formula clearly identifying the target proportions and percentage of mineral aggregate, mineral filler, water (range approximation), additives (min and max) and residual asphalt

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- solids content (min and max) based on the dry weight of the mineral aggregate.
 - G. Quantitative effects of moisture content on the unit weight of the mineral aggregate (bulking effect)
 - H. Source of aggregate, results of aggregate tests, mix compatibility tests, and mix design gradation.
 - I. Type of asphalt emulsion, base stock asphalt cement, manufacturer of the polymer, and manufacturer of the emulsified asphalt cement.
 - J. Manufacturer and type of mineral filler and additives
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These mix design requirements are subject to verification by testing of laboratory produced mixes or trial batch material prior to placement of project material.

480.3 CONSTRUCTION REQUIREMENTS

480.3.1 General

The Contractor shall produce, transport, and place the specified microsurfacing mixture in accordance with these specifications, contract documents, design details, and as approved by the City Engineer or designee. The finished microsurfacing shall have a uniform texture free from excessive scratch marks, tears or other surface irregularities. The cured microsurfacing mixture shall adhere fully to the underlying pavement. The microsurfacing mixture shall cure sufficiently so that normal traffic can be permitted in one hour after placement without damage to the new surface.

480.3.2 Equipment

All equipment used in handling, transporting, mixing, and placement of the microsurfacing material shall be maintained in good repair. Any equipment found to be defective and potentially affecting the quality of the microsurfacing mixture shall be removed from operation by the Contractor and repaired or replaced prior to placing back in service. All scales used in weighing aggregate, emulsion, or other microsurfacing material components shall conform to the requirements of Section 109.1, "Measurement and Quantity" of the NMDOT Standard Specifications for Road and Bridge Construction, current edition.

480.3.2.1 Microsurfacing Mixing Machine

The material shall be mixed by an automatically sequenced, self-propelled microsurfacing mixing machine that will be a continuous flow mixing unit, able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, control setting additive, and water to a revolving multi-blade double shafted mixer and discharge the mixed product on a continuous flow basis. The machine shall have sufficient storage capacity for aggregate, emulsified asphalt, mineral filler, control additive and water to maintain an adequate supply to the proportioning controls. The machine shall be capable of self-loading materials while continuing placement of microsurfacing. The machine shall be equipped to allow the operator to have full control of the forward and reverse speed during placement of the

microsurfacing material. The machine shall have a hydraulically adjustable spreader box with a positive screed adjustment for yield control and a positive adjustment for the joint matcher.

The machine shall have an Electronic Monitoring System (EMS). The EMS shall monitor and display application rates and totals used for aggregate, emulsion, mineral filler, water and additive. It shall also calculate and display ratios of emulsion to aggregate, mineral filler to aggregate, additive to aggregate, water to aggregate and application rate in pounds per square yard. The machine shall be capable of providing a hard copy report on demand containing date, weight of aggregate used, weight of emulsion used, weight of mineral filler used, gallons of additive used, gallons of water used, emulsion to aggregate ratio, mineral filler to aggregate ratio, additive to aggregate ratio, and water to aggregate ratio.

Individual volume or weight controls for proportioning each material to be added to the mix shall be calibrated and properly marked in the presence of the City Engineer or designee prior to use on the project or after repairs are made to the machine or as directed by the City Engineer or designee. The Contractor shall provide 5 calendar days advance notice to the City Engineer or designee of machine calibration. The mixing machine shall be equipped with a water pressure system and nozzle type spray bar to provide a water spray immediately ahead of and outside the spreader box. It also shall be equipped with an approved fines feeder that shall provide a uniform, positive, accurately metered, predetermined amount of the specified mineral filler.

480.3.2.2 Spreading Equipment

The microsurfacing mixture shall be spread uniformly by means of a mechanical type spreader box attached to the mixer, equipped with paddles, ribbon flights or other devices to continually agitate and distribute the materials throughout the box. The spreader box must be capable of obtaining the desired lines and grade as shown on the plans or as directed by the City Engineer or designee. The spreader box shall be capable of applying microsurfacing mixture in variable widths up to 15 ft. A front seal shall be provided to insure no loss of the mixture at the road contact surface. The rear seal shall act as a 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 to produce a free flow of material to the rear strike-off. Longitudinal joints shall be neat appearing and uniform.

480.3.3 Placement Operations

The area to be surfaced shall be thoroughly cleaned of all vegetation, loose aggregate, soil and other deleterious material immediately prior to applying microsurfacing. Allow un-sealed cracks to dry thoroughly before applying microsurfacing when using water to clean the surface. Manholes, valve boxes, and other service utility entrances shall be covered and cataloged prior to surfacing.

When required by local conditions, the roadway surface may be pre-wet at a rate sufficient to dampen the surface without causing any free flowing water ahead of the spreader box. The rate of application of the pre-wetting operation shall be adjusted during the day to suit temperatures, surface texture, humidity, and dryness of the pavement to achieve a uniform and consistent placement of microsurfacing material.

The Contractor shall place a microsurfacing mixture which conforms to the mix design and quality control tolerances for the project. The Contractor shall control the ingredient proportions with metering or measuring devices on the microsurfacing equipment and shall use readings from those metering or measuring devices to determine compliance with limits stated in the approved mix design.

The microsurfacing material shall be mixed and spread using a self-propelled microsurfacing mixing machine meeting the requirements of Section 480.3.2.1 of these specifications to fill cracks and minor surface irregularities and shall leave a uniform skid resistant application of aggregate and asphalt on the surface. The spreader box shall maintain its flexible seals in contact with the road to prevent loss of the mixture from the box. A secondary strike off shall be provided to improve the surface texture.

All excess material that overruns in gutters, on curbs, driveway approaches, inlet tops, into inlets, or on sidewalks shall be removed immediately or squeegeed back onto the applied surface. All excess material removed from any non-paved area and from the end of each days operation shall be removed immediately. Discolored curbs, inlets and sidewalks shall be immediately cleaned and flushed before the material sets. Any set material left on curbs, inlets and sidewalks shall be removed by the Contractor at their expense. If the material cannot be removed, the Contractor shall remove and replace those affected portions of curbs, inlets and sidewalks at no cost to the City.

The mixture shall be placed to the lines and grades shown on the plans or as directed by the City Engineer or designee.

Longitudinal and transverse joints shall not be constructed within the wheel path of traffic lanes. Longitudinal and transverse joints shall be constructed without any buildups to a neat and uniform appearance. Longitudinal joints shall be constructed within 6 inches of the lane lines. The overlap of microsurfacing at any joint shall not exceed 6 inches. Joints shall be repaired if buildup of material at the joints occurs or if uncovered areas at the joints exist. The microsurfacing edges shall follow the centerline, lane lines, shoulder lines, and curb lines of the roadway and shall be straight and uniform in appearance.

Microsurfacing placed at intersections shall be done in stages, or blotter materials shall be used, to allow crossing and turning movements. The blotting material shall be the same aggregate used in the microsurfacing and shall be removed by the Contractor when no longer needed.

Microsurfacing placed adjacent to concrete pavements or concrete curb and gutter shall be placed with a straight longitudinal edge and shall not overlap onto the concrete in these 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 lightly dampened prior to mix placement. Care shall be exercised in areas that require hand work so that the finished surface is uniform in texture, dense, and of overall appearance comparable to that produced by the spreader box. Areas of hand work shall be limited to locations inaccessible by the mixing machine and spreader box. The Contractor shall control its operations to minimize areas requiring hand work.

480.3.4 Application Rate

The Contractor shall place the Microsurfacing material at an application rate of 20 pounds per square yard and shall not vary by design Target Value +/- 3 pounds per square yard unless otherwise approved by the City Engineer or designee.

480.3.5 Temperature and Weather Limitations

Microsurfacing material shall not be placed if either the pavement or air temperature is below 50°F or when the ambient temperature is projected to drop below 37°F within 48 hours of placement.

Microsurfacing material shall not be placed during rain, when road surface moisture is present, or during other adverse weather conditions as directed by the City Engineer or designee.

Microsurfacing material shall not be placed if adverse weather conditions will prolong opening the road surface to traffic beyond two hours.

480.3.6 Filling Ruts

Microsurfacing material shall be used to fill ruts, utility cuts and/or dips in the existing surface as shown on the Plans or as directed by the City Engineer or designee. These placement applications may require multiple passes be made with the spreader box prior to placement of the final surface.

A rut filling spreader box either 5 foot or 6 foot in width specifically designed to fill ruts or dips shall be used when filling surface irregularities with an average depth greater than 1/2 inch.

Microsurfacing shall be applied in a full width scratch-coat pass when required to fill ruts, dips, or irregularities less than 1/2 inch in depth. Ruts or dips 1 inch or greater shall be filled using multiple passes of the spreader box.

A twenty-four (24) hour cure time shall be required after filling ruts or dips before placement of the final microsurfacing layer.

480.3.7 Surface Tolerances

The finished microsurfacing shall have a uniform texture free of scratches, tears, drag marks and other surface irregularities. The Contractor shall repair the surface at its own expense if any of the following conditions exist:

1. More than four surface irregularities greater than 1/2 inch wide and four (4) inches long in any 100 linear foot section.
2. More than four surface irregularities 1 inch to 3 inches long in any 25 square yard area.
3. No transverse ripples or longitudinal streaks in excess of 1/4 inch when measured by placing a 10 ft. straight edge over the surface.
4. Any tire tracking damage to the fresh microsurfacing.
5. Slick spots in any area of bleeding or surface flushing.

Microsurfacing material required to repair deficiencies due to unsatisfactory workmanship shall be entirely at the Contractor's expense. Areas of unsatisfactory workmanship will be designated by the City Engineer or designee.

480.3.8 Sampling and Testing**480.3.8.1 Contractor Quality Control**

The Contractor is responsible for the quality of materials and construction. The Contractor shall provide a quality control plan to control the quality of the product. The quality control plan shall be submitted to the City Engineer or designee for review and acceptance at least 14 calendar days prior to

starting placement operations. The quality control plan should itemize inspections, testing procedures, sampling and testing frequencies, and corrective action strategies that the Contractor will use to control the work. The quality control plan may be developed using the NMDOT Contractor Process Quality Control Plan Guidelines available from the NMDOT Construction Bureau, the City Engineer or designee. The Contractor shall provide written certification that testing equipment is calibrated and meets the applicable specification. The Contractor shall provide a qualified and experienced individual to administer the plan. The individual will have full authority to take actions necessary for the successful operation of the plan.

The Contractor shall control operations such that the mineral aggregate gradation of the finished product meets the gradation target values established in the mix design within the tolerance requirements of Table 480.2.1:1, "Mineral Aggregate Gradation."

The Contractor shall control operations such that the acceptance requirements of Section 480.3.8.2, "Quality Acceptance" are met.

480.3.8.2 Quality Acceptance

Material shall be sampled and tested for acceptance by an AMRL or NMDOT Certified Private Testing Laboratory. A list of the NMDOT approved testing laboratories is available from the NMDOT State Materials Bureau. The Contractor may be required to obtain a certified Private Testing Laboratory independent of its quality control sampling and testing process to perform acceptance testing on behalf of the City if required by the Contract. Acceptance will be based on results obtained from tests performed on representative samples of Micorsurfacing material taken from the mixing unit discharge.

Acceptance sampling and testing of the Microsurfacing material shall be performed in accordance with Table 480.3.8.2:1, "Microsurfacing Minimum Acceptance Guidelines." If the Material appears defective, or if the City Engineer or designee determines that a change in the process or product has occurred, additional testing may be performed at the Contractor's expense.

Table 480.3.8.2:1 Microsurfacing Minimum Acceptance Guidelines				
Sampling	Point of Acceptance	Testing Frequency per Lot (minimum of)	Lot Size (smallest of the following)	Test Method
Gradation	Mixing Unit discharge	1 per 30 Ton 1 per 3000 SY	30 Ton 3000 SY	AASHTO T 30
Asphalt Content	Mixing Unit discharge	1 per Street or Site	Per Street Per Site	AASHTO T 164

Mix samples for gradation and asphalt content shall be taken from the mixing unit discharge in a manner such that the complete discharge stream is included in the sample. Mix samples shall be dried to constant weight at 230 degrees F plus or minus 10 degrees F prior to determination of asphalt content and aggregate gradation.

Target Values (TV) shall be established by the Contractor based on the approved Mix Design and Job Mix Formula.

Aggregate - The aggregate portion of the paving mixture produced shall not vary from the design gradation by more than the tolerances shown in Table 480.2.1:1, "Mineral Aggregate Gradation" of these specifications. The material passing the No. 200 sieve is further restricted to conform to the limitations for the master grading.

Residual Asphalt Content - The residual asphalt content of the paving mixture shall not vary from the design amount by more than +/- 0.5% by weight and is also restricted to conform to the design limits.

Application Rate - The Contractor shall compute the application rate for each lot identified in Table 480.3.8.2:1, "Microsurfacing Minimum Acceptance Guidelines" and shall submit the application rate along with supporting data and computations (tons of dry aggregate consumed per lot, tons of emulsified asphalt consumed per lot, and square yardage covered per lot) to the City Engineer or designee before the start of the next day's production or as otherwise directed by the City Engineer or designee. The Contractor shall place the Microsurfacing material at an application rate of 20 pounds per square yard and shall not vary by plus or minus three (+/- 3) pounds per square yard unless otherwise approved by the City Engineer or designee.

Material not conforming to the acceptance requirements of this section shall be removed and replaced by the Contractor at the Contractor's expense.

480.4 Method of 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.

The weight of the composite microsurfacing mixture shall be based on daily printed weigh tickets from the Electronic Monitoring System on the microsurfacing mixing machine as required under Section 480.3.2.1 of this specification. The weight shall be computed in tons.

The weight of water and additives will not be included in the payment quantity and shall be considered incidental to the microsurfacing pay item.

480.5 Basis of Payment

Microsurfacing will be paid at the contract unit price per ton complete in place.

The price shall be full compensation for all labor, equipment, and materials used to produce the microsurfacing end product in conformance with plans and specifications.

Payment will be made under:

Pay Item	Pay Unit
<i>Microsurfacing</i>	Ton