



Illinois Department of Transportation

Memorandum

To: All Regional Engineers
From: Maureen M. Addis
Subject: Special Provision for Preventive Maintenance –
Micro-Surfacing
Date: April 15, 2016

A handwritten signature in black ink that reads "Maureen M. Addis".

This special provision was developed by the Bureau of Materials and Physical Research to:

- clarify crushed aggregate requirement,
- add polyester fibers to Jobsite-Mixed Sealant, and
- revise tack coat application rate to reflect residual asphalt.

This special provision should be inserted into preventive maintenance – micro-surfacing contracts and should be used in lieu of Check Sheet #30 Preventive Maintenance – Micro-Surfacing.

The districts should include the BDE Check Sheet marked with the applicable special provisions for the July 29, 2016 and subsequent lettings. The Project Development and Implementation Section will include a copy in the contract.

This special provision will be available on the transfer directory April 15, 2016.

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PREVENTIVE MAINTENANCE – MICRO-SURFACING (BDE)

Effective: January 1, 2009

Revised: July 1, 2016

Description. This work shall consist of micro-surfacing hot-mix asphalt (HMA) surfaces.

Materials. Materials shall be according to the following.

- (a) Micro-Surfacing. Materials shall be according to the following Articles/Sections of the Standard Specifications.

Item	Article/Section
(1) Mineral Filler (Note 1)	1001
(2) Water	1002
(3) Coarse Aggregate (Note 2)	1004.03
(4) Bituminous Material (Tack Coat)	1032.06
(5) Latex-Modified Emulsified Asphalt (Note 3)	
(6) Additives (Note 4)	

Note 1. The mineral filler shall be Type 1 portland cement.

Note 2. The coarse aggregate material shall be selected from the table in Article 1004.03(a) of the Standard Specifications based upon the friction aggregate mixture specified. The quality of the aggregate shall be Class B and the gradation shall be as shown in the table below.

Sieve Size	Type II % Passing	Type III % Passing ^{1/}
3/8 in. (9.5 mm)	100	100
#4 (4.75 mm)	95 ± 5	80 ± 10
#8 (2.36 mm)	77 ± 13	57 ± 13
#16 (1.18 mm)	57 ± 13	39 ± 11
#30 (600 µm)	35 ± 10	26 ± 8
#50 (330 µm)	19 ± 6	18 ± 7
#100 (150 µm)	15 ± 6	12 ± 6
#200 (75 µm)	10 ± 5	10 ± 5

- 1/ Rut filling mixes shall be constructed using a Type III gradation. All surface mixes shall be constructed using a Type II gradation.

When coarse aggregate is used, it shall be crushed gravel, crushed stone, crushed slag, crushed sandstone, or crushed steel slag. The blending, alternate use, and /or substitutions of aggregates from different sources for use in this work will not be permitted without the approval of the Engineer. Any blending shall be by interlocked

mechanical feeders. The blending shall be uniform, compatible with the other components of the mix, and the equipment shall be approved by the Engineer.

If blending aggregates, the blend shall have a washed gradation performed every other day or a minimum of three tests per week. Testing shall be completed before the aggregate receives final acceptance for use in the mix.

Aggregates shall be screened at the stockpile prior to delivery to the paving machine to remove oversized material or contaminants.

Note 3. CSS-1h Latex Modified Emulsified Asphalt. The emulsified asphalt shall be a quick-traffic latex modified asphalt emulsion containing a minimum of 3.0 percent latex solids by weight of asphalt binder. The latex shall be milled or blended into the emulsifier solution prior to the emulsification process. The CSS-1h latex modified emulsified asphalt shall be according to the following.

Test (AASHTO T 59)	Result
Viscosity, Saybolt Furol, 77 °F (25 °C), SFS	20-100
Storage Stability Test, 24 hours, %	1 max.
Particle Charge Test	Positive
Sieve Test, No. 20 (850 µm), retained on sieve, %	0.10 max.
Distillation Test, Residue from distillation test to 347 ± 9 °F (175 ± 5 °C), %	62 min.

Tests on residue from distillation	Result
Penetration, 77 °F (25 °C), 100 grams, 5 seconds, (AASHTO T 49), dmm	40-90
Ductility, 77 °F (25 °C), 50 mm/min, (AASHTO T 51), mm	400 min.
Solubility in trichloroethylene, (AASHTO T 44), %	97.5 min.
Softening Point, (AASHTO T 53), °F (°C)	135 (57) min.
Absolute Viscosity, 140 °F (60 °C), (AASHTO T 202), Poises (Pa · sec)	8,000 (800) min.

Note 4. Additives may be added to the emulsion mix or any of the component materials to provide the control of the quick-traffic properties. They shall be included as part of the mix design and be compatible with the other components of the mix.

(b) Crack/Joint Sealant. The crack/joint sealant shall be a fiber-modified asphalt binder mixed at the jobsite or premixed.

(1) Jobsite-Mixed Sealant. The sealant shall consist of an asphalt binder and fibers, and be according to the following.

- a. Asphalt Binder. The asphalt binder shall be PG 58-28, PG 58-22, or PG 64-22 and meet the requirements of Article 1032.05 of the Standard Specifications.
- b. Fibers. Fibers shall be short cut polypropylene or polyester fibers meeting the properties listed below. The fiber will be accepted by certification. The Contractor shall supply a certification from the manufacturer stating that it meets the specified requirements.

Property	Value	
	Polypropylene	Polyester
Length, in. (mm)	0.3 - 0.5 (8 - 12)	0.25 ± 0.02 (6.3 ± 0.5)
Denier	13 - 16	3 - 6
Crimps	None	None
Tensile Strength, min., psi (kPa)	40,000 (275,000)	70,000 (482,000)
Specific Gravity (typical)	0.91	1.32 – 1.40
Moisture Regain @ 70 °F (21 °C) and 65% RH (typical), %	0.1	N/A
Elongation at Break, %		35 - 38
Melt Temperature, °F, °C		475 – 490 (246 – 254)
Percent Fibers by weight (mass)	8.0	5.0 ± 0.5

- c. Sealant Heating. The sealant shall be heated in the kettle at temperatures between 255 and 285 °F (124 and 141 °C).
- (2) Premixed Sealant. The sealant shall be packaged and consist of an asphalt binder, fibers, and other modifiers meeting the following requirements. The sealant and its components will be accepted by certification. The Contractor shall submit a certification from the manufacturer stating that it meets the specified requirements.
- a. Asphalt Binder. The asphalt binder shall be PG 64-22 and meet the requirements of Article 1032.05 of the Standard Specifications.
 - b. Fibers. Fibers shall be short cut polyester fibers meeting the properties listed in the table above for Jobsite-Mixed Sealant.

The sealant, in its final form, shall meet the following requirements when sampled and heated to the manufacturer's recommended maximum heating temperature according to ASTM D 5167.

Test	Value
Cone Penetration @ 77 °F (25 °C), ASTM D 5329	10-35 dmm

Softening Point, ASTM D 36	175 °F (79 °C) min.
Maximum Heating Temperature	400°F (204 °C)
Application Temperature	350°F (177 °C) min.

Equipment. Equipment shall be according to the following.

(a) Micro-Surfacing. Equipment shall be according to the following.

(1) Micro-Surfacing Mixing Machine. The machine shall be either a continuous (self-loading) machine or a non-continuous (self-contained) machine depending on the size of the project as described below. Both types of machines 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 mixing unit shall be 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.

Machines that are the continuous (self-loading) type shall be an automatic-sequenced, self-propelled, continuous-flow mixing unit able to discharge the mixed product on a continuous-flow basis. The machine shall be equipped to allow the operator to have full control of the forward and reverse speeds during applications of the material and be equipped with opposite-side driver stations to assist in alignment.

Non-continuous (self-contained) machines will be allowed on projects with a length of 2 lane-miles (3.2 lane-km) or less. For mainline paving, the Contractor shall have at least three self-contained machines in continuous operation to ensure appropriate production rates. Self-contained machines will also be allowed on shoulders, ramps, short applications such as bridge decks, or where the material can be placed in a single loading capacity of the machine.

Each mixing unit to be used in the performance of the work shall be calibrated in the presence of the Engineer prior to construction. Each new or different aggregate requires a new calibration. Previous calibration documentation covering the exact materials to be used may be acceptable, provided that no more than 30 days have lapsed. The documentation shall include an individual calibration of each material at various settings, which can be related to the machine metering devices. Prior to the calibration process, portable scales used to calibrate the mixing machine for emulsion and aggregate shall be checked with 25 lb and 50 lb weights, respectively. Results from the standard weight checks shall be furnished to the Engineer. No machine will be allowed to work on the project until the calibration has been completed and/or accepted.

(2) Micro-Surfacing Spreader. The mixture shall be agitated and spread uniformly in the surfacing box by means of twin shafted paddles or spiral augers fixed in the spreader box. A front seal shall be provided to insure 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 to produce a free flow of material to the rear strike-off. The spreader box shall have suitable means provided to side shift the box to compensate for variations in the pavement geometry.

A secondary strike-off shall be provided to improve surface texture on the surface course. The secondary strike-off shall have the same adjustments as the spreader box and shall not bounce, wobble, or chatter.

When required on the plans, before the final surface course is placed, preliminary micro-surfacing material may be required to fill ruts, utility cuts, depressions in the existing surface, etc. Ruts of 1/2 in. (13 mm) or greater in depth shall be filled independently with a rut-filling spreader box, either 5 or 6 ft (1.5 or 1.8 m) in width. For irregular or shallow rutting of less than 1/2 in. (13 mm) in depth, a full-width scratch-coat pass may be used as directed by the Engineer utilizing either a stiff primary rubber or else a metal primary strike off. Ruts that are in excess of 1 1/2 in. (38 mm) in depth may require multiple placements with the rut-filling spreader box to restore the cross-section. All rut-filling level-up material should cure under traffic for a minimum of 24 hours before additional material is placed on top of the level up.

- (3) Micro-Surfacing Proportioning Devices. Individual volume or weight controls for proportioning each material to be added to the mix (i.e. aggregate, mineral filler, emulsified asphalt, additive, and water) shall be provided and properly marked. These proportioning devices are used in material calibration and determining the material output at any time. Calibration records, conversion formulas, and daily run sheets including the beginning and final numbers shown on the proportioning devices shall be submitted to the Engineer for approval. During production any deviations from the original JMF shall be approved by the Engineer.

(b) Crack/Joint Sealing. Equipment shall be according to the following.

- (1) Air Compressor. The air compressor shall be capable of producing a minimum pressure of 90 psi (620 kPa) at the end of the discharge hose. The air stream shall discharge onto the pavement through an appropriate air lance. The tool lubricator shall be bypassed and a filter installed on the discharge valve to keep water and oil out of the line.
- (2) Oil Kettle. The crack sealant shall be heated in an oil jacketed double wall kettle equipped with an agitator (reversing rotary auger action) and separate thermometers for the oil bath and mixing chamber. The unit shall also be equipped with a reversible hydraulic 2 in. (50 mm) hot asphalt pump and a recirculating pump to circulate the oil bath.

CONSTRUCTION REQUIREMENTS

General. The paving mixture shall be capable of filling up to 1 1/2 in. (38 mm) wheel ruts in one pass, be capable of field regulation of the setting time, and be suitable for nighttime placement. The compatibility of all ingredients of the mix, including the mix set additive, shall be certified by the emulsified asphalt manufacturer.

Weather Limitations. Placement of the micro-surfacing shall be done between May 1 and October 15, and when the temperature is at least 50 °F (10 °C) and rising and the forecast for the next 24 hours is above 40 °F (5 °C).

Mix Design. A Contractor provided laboratory shall develop the mix design for the micro-surfacing mixture, shall verify the functioning of the set regulating additives, and shall present certified test results for the Engineer's approval. This laboratory shall be recognized by the International Slurry Surfacing Association (ISSA) as being capable of performing mix designs. The Engineer will verify the laboratory tests required in ISSA A143 have been conducted.

Proportions for the mix design shall be within the following limits.

Mineral Aggregate, dry weight (mass) lb/sq yd (kg/sq m)	15-50 (8-30)
Latex Emulsified Asphalt Residue, % by wt. of Aggregate	5.5-10.5
Latex Base Modifier	As required with % by weight (mass) of binder, min. of 3.0
Mix Set Additive	As required
Mineral Filler, % by weight (mass) of Aggregate	0.25 - 3 depending on weather conditions

The amount of mineral filler needed shall be determined by the laboratory mix design and will be considered as part of the aggregate gradation.

The amount and type of latex shall be determined by the laboratory performing the mix design. The minimum amount required shall be based on asphalt weight content and shall be certified by the emulsion supplier.

Compatibility of the aggregate, latex-modified emulsified asphalt, mineral filler, and other additives shall be verified by the mix design. The materials shall meet the following requirements for ISSA A143.

ISSA Test No.	Description	Specification
ISSA TB-139	Wet Cohesion @ 30 minutes min. (Set) @ 60 minutes min. (Traffic)	12 kg-cm min. 20 kg-cm min. or Near Spin
ISSA TB-109	Excess Asphalt by LWT Sand Adhesion	50 gm/sq ft (538 gm/sq m) max.
ISSA TB-114	Wet Stripping	Pass (90% min.)
ISSA TB-100	Wet-Track Abrasion Loss One-hour Soak Six-day Soak	50 gm/sq ft (538 gm/sq m) max. 75 gm/sq ft (807 gm/sq m) max.

ISSA TB-147	Lateral Displacement	5% max.
	Specific Gravity after 1,000 Cycles of 25 lb (11.34 kg)	2.10 max.
ISSA TB-144	Classification Compatibility	11 Grade Points min. (AAA, BAA)
ISSA TB-113	Mix Time @ 77 °F (25 °C)	Controllable to 120 seconds min.

The mixing test and set-time test shall be checked at the highest temperatures expected during construction.

The mix design shall report the quantitative effects of moisture content on the unit weight of the aggregate (bulking effect). The report shall clearly show the proportions of aggregate, mineral filler (minimum and maximum), water (minimum and maximum), additive usage, and latex-modified asphalt emulsion based on the dry weight of the aggregate.

For the aggregate blend in the mix design, test results for AASHTO T 176 shall be provided with the mix information to the Engineer. Aggregate test values below 65 shall require review and approval from the Engineer.

Before the work commences, the Contractor shall submit to the Engineer a complete mix design covering the specific materials to be used on the project. The percentages of each individual material required shall be shown in the laboratory report. The Engineer shall approve the mix design prior to its use. After approval, no substitutions will be permitted, unless approved by the Engineer, and the Contractor shall maintain continuous control of the latex-modified emulsified asphalt to dry aggregate proportioning to conform to the approved mix design within a tolerance of ± 2 gal/ton (± 8 L/metric ton).

Test Strip. For projects over 100,000 sq yd (83,600 sq m), at least one day prior to starting the project the Contractor shall designate a mutually agreeable location and apply a test strip of micro-surfacing using the aggregate indicated in the mix design. The Engineer will evaluate the micro-surfacing application rate and cure time.

Surface Preparation. Pavement markings shall be removed according to Article 783.03(a) of the Standard Specifications. Only very small particles of tightly adhering existing markings may remain in place.

When specified in the plans, pavement markers shall be removed according to Article 783.03(b) of the Standard Specifications.

Bumps greater than or equal to 1/2 in. (13 mm) shall be removed by grinding. The Contractor shall determine bump grinding locations in the presence of the Engineer by using a 16-ft (5-m) straightedge with the scratcher bolts set to 1/2 in. (13 mm). All locations marked by the scratcher bolts shall be ground using either a grinding machine consisting of multiple saws or a cold-milling machine with a double- or triple-wrap milling head.

Joints and cracks 3/16 in. (5 mm) or wider shall be cleaned of loose and unsound material and sealed. The sealant shall be applied only when the joints and cracks are clean and dry, and the

ambient temperature is 40-85 °F (4-29 °C). The sealant shall be applied using a pressurized wand delivery system with such devices as necessary to seal the cracks/joints and form a nominal 0.125 in. (3 mm) thick by 3 in. (75 mm) wide overseal band centered so that the center of the 3 in. (75 mm) wide band is within 1 in. (25 mm) of the crack. The sealant shall be allowed to cure before opening to traffic. When approved by the Engineer, the sealant may be dusted with fine sand, portland cement, or mineral filler to prevent tracking.

Micro-Surfacing. The micro-surfacing shall be applied as shown on the plans and the following.

- (a) Preparation. Prior to applying the micro-surfacing, the pavement surface shall be cleaned. On highly oxidized surfaces, a tack coat shall be applied at a rate of **0.025 lb/sq ft (0.122 kg/sq m)** according to Article 406.05(b) of the Standard Specifications. Manholes, valve boxes, drop inlets, and other service entrances shall be protected from the micro-surfacing by a suitable method. The surface preparation shall be approved by the Engineer prior to the application of the micro-surfacing. No dry aggregate either spilled from the lay-down machine or existing on the road will be permitted.

The Contractor shall apply the micro-surfacing according to the following methods.

- (1) Micro-Surfacing Rut Filling. This method shall consist of filling each of the two wheelpath ruts in a lane using the specially designed rutbox and the rutfill (Type III) mix. It shall be the Contractor's responsibility to determine and estimate the quantities of rutfill mix required for rut filling. This work is then followed by one pass of micro-surfacing as described below.
- (2) Micro-Surfacing, Single Pass. This method shall consist of applying the surface mix over the entire width of each lane in one pass at an application rate of 20 lb/sq yd (11 kg/sq m).

Determinations of application rates shall be from daily readings taken from the material control devices during the progress of the work.

The pavement surface shall be prewetted by water fogging ahead of the spreader box when road conditions require, as determined by the Engineer. The rate of fogging shall be adjusted during the day based on pavement temperature, surface texture, and dryness.

The paving mixture shall be spread to fill minor cracks and shallow potholes and leave a uniform surface. Care shall be taken when rut filling to restore the designed profile of the pavement cross section. Excess crowning (over-filling) of rut areas shall be avoided. A sufficient amount of material shall be carried at all times in all parts of the spreader box to ensure complete coverage. Overloading of the spreader shall be avoided. No lumps or uncoated aggregate will be permitted in the finished surface.

Adjustments to the mix design may be required during construction, based on field conditions. The percent of mineral filler in the mix design may be increased or decreased by less than 0.3 percent when the slurry seal is being placed if it is found to be necessary for better consistency or set times. The Engineer will give final approval for all adjustments.

- (b) **Mix Consistency.** The finished product shall be uniform in color and composition. No streaks, such as those caused by oversized aggregate, shall be left in the finished surface. If excess streaking develops, the job will be stopped until the Contractor proves to the Engineer that the situation has been corrected. Excessive streaking is defined as more than four drag marks greater than 1/2 in. (13 mm) wide and 4 in. (100 mm) long, or 1 in. (25 mm) wide and 3 in. (75 mm) long, in any 30 sq yd (25 sq m) area. No transverse ripples or longitudinal streaks of 0.25 in. (6 mm) in depth will be permitted, when measured by placing a 10 ft (3 m) straightedge over the surface.
- (c) **Mix Stability.** The micro-surfacing shall possess 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. It shall be free of excess water or emulsified asphalt and free of segregation of the emulsified asphalt and aggregate fines from the coarser aggregate. Under no circumstances shall water be sprayed directly into the lay-down box while placing micro-surfacing material.
- (d) **Joints and Edges.** The Contractor shall devise a joint plan according to ISSA A143 and submit to the Engineer for approval. When practical, the surface course joint shall be at least 10 in. (255 mm) away from the nearest edge of any subsequent permanent pavement markings.

Micro-surfacing edges shall be parallel with the existing pavement edges. If the existing pavement edge cannot be used to give a straight edge, a stringline or other guide will be required. Edge lines shall not vary by more than ± 2 in. (50 mm) horizontally in any 100 ft (30 m) of length.

A smooth, neat seam shall be provided where two passes meet. Excess material shall be immediately removed from the ends of each run. Any damage to, or irregularities in, the micro-surfacing shall be repaired, as directed by the Engineer. All repairs shall be made with a paver box, except areas designated as hand work areas.

- (e) **Hand Work.** Those areas inaccessible to the spreader box and approved by the Engineer shall be designated as hand work areas. Adjustments to the additive will be permitted 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. Hand work areas shall have an appearance consistent with that being placed with a spreader box.

Clean-Up. All areas, such as manholes, gutters, and intersections, shall have the micro-surfacing mix removed as specified by the Engineer. The Contractor shall, on a daily basis, remove any debris associated with the performance of the work.

Sampling and Testing. The Contractor shall check yield of the application after the first 1000 ft (300 m), and throughout each day's paving, with a minimum of three tests per day. Yield check results shall be furnished to the Engineer daily.

The Contractor shall submit a daily "run sheet" for each day's work as soon as all the data is available. The run sheet shall provide a breakdown of the actual meter numbers and quantities of all materials actually used each day, as well as the respective locations.

Opening to Traffic. The micro-surfacing shall be opened to traffic within one hour of its application.

Curing. The micro-surfacing shall cure for a minimum of 7 days before placement of the permanent pavement markings.

Method of Measurement. This work will be measured for payment as follows.

- (a) Contract Quantities. The requirements for the use of contract quantities shall conform to Article 202.07(a) of the Standard Specifications.
- (b) Measured Quantities. Crack/Joint sealing will be measured for payment in feet (meters), measured along the crack.

Pavement marking removal will be measured for payment according to Article 783.05 of the Standard Specifications.

The micro-surfacing will be measured according to the following for the method of application provided in the plans.

- (1) Micro-Surfacing Rut Filling. Micro-surfacing rut filling will be measured for payment in place in feet (meters) along the wheel path or filled rut.
- (2) Micro-surfacing, Single Pass. Micro-surfacing, single pass will be measured for payment in place and the area computed in square yards (square meters). The width for measurement will be the width of the top surface as shown on the plans or as directed by the Engineer.

PrimeTack coat, when required, will be measured for payment according to Article 406.13(b) of the Standard Specifications.

Basis of Payment. Crack/joint sealing will be paid for at the contract unit price per foot (meter) of FIBER-MODIFIED ASPHALT CRACK SEALING.

Bump removal will be paid for at the contract unit price per each for BUMP REMOVAL.

Pavement marking removal and pavement marker removal will be paid for according to Article 783.06 of the Standard Specifications.

Rut filling will be paid for at the contract unit price per foot (meter) for MICRO-SURFACING RUT FILLING.

Micro-surfacing, single pass will be paid for at the contract unit price per square yard (square meter) for MICRO-SURFACING, SINGLE PASS, of the gradation type and friction aggregate mixture specified.

Tack coat, when required, will be paid for according to Article 406.14 of the Standard Specifications.

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