

411-R-432 WARRANTED MICRO-SURFACING

(Revised 05-28-09)

The Standard Specifications are revised as follows:

SECTION 411, BEGIN LINE 1, INSERT AS FOLLOWS:

SECTION 411 – WARRANTED MICRO-SURFACING

411.01 Description

This work shall consist of furnishing materials and the construction of warranted micro-surfacing in accordance with 105.03. Multiple course micro-surfacing shall consist of a surface course over a rut fill or leveling course. Single course micro-surfacing shall consist of a surface course.

The Contractor shall be responsible for the warranted micro-surfacing for a period of three years after the date all warranted micro-surfacing is completed and open to unrestricted traffic.

MATERIALS

411.02 Materials

Materials shall be in accordance with the following:

<i>Asphalt Emulsion</i>	<i>As Defined*</i>
<i>Coarse Aggregates – Class B or Higher **</i>	<i>904</i>
<i>Fine Aggregates***</i>	<i>904</i>
<i>Portland Cement, Type I</i>	<i>901.01(b)</i>
<i>Water</i>	<i>913.01</i>

** Polymer Modified Asphalt Emulsion shall be a quick-set, CSS-1h emulsion in accordance with AASHTO M 208 except the cement-mixing test is waived. The polymer material shall be milled or blended into the asphalt or blended into the emulsifier solution prior to the emulsification process. The minimum polymer solids content will be 3.0% based on the residual of the emulsion. Mix set additives shall be added as required to provide control of the quick-set properties. Additional requirements shall be in accordance with the following.*

<i>Characteristics</i>	<i>Test Method</i>	<i>Requirement</i>
<i>Residue (Note 1)</i>	<i>AASHTO T 59</i>	<i>62+</i>
<i>Softening Point, °F (°C)</i>	<i>AASHTO T 53</i>	<i>140+ (60+)</i>
<i>Viscosity @140°F (60°C)</i>	<i>AASHTO T 202</i>	<i>8000+</i>
<i>Elastic Recovery @ 77°F (25°C)</i>	<i>AASHTO T 301</i>	<i>60</i>
<i>NOTE 1. The temperature for this test shall be held below 180°F (82°C). The sample is oven evaporated on a glass plate at 77°F (25°C) for 24 h (forced draft oven). Material is then scraped from the plate with a razor blade tool.</i>		

*** The coarse aggregate angularity shall be a minimum of 95% in accordance with ASTM D 5821. The coarse aggregate for rut fill shall be limestone, dolomite, crushed gravel, sandstone, ACBF, or SF. The surface application aggregate type shall be based on the ESAL category in the Surface Aggregate Table below.*

**** The fine aggregate for micro-surface shall be limestone, dolomite, crushed gravel, sandstone, ACBF, or SF. The fine aggregate angularity shall be a minimum of 45 in accordance with AASHTO T 304 Method A. The clay content of the blended aggregate material from the fine and coarse aggregates shall meet a minimum sand equivalency of 65 in accordance with AASHTO T 176. The surface leveling application aggregate type shall be based on the ESAL category as follows:*

<i>Surface Aggregate Table</i>			
<i>Coarse or Fine Aggregate Type</i>	<i>Traffic ESALs</i>		
	<i>< 3,000,000</i>	<i>< 10,000,000</i>	<i>≥ 10,000,000</i>
<i>Air-Cooled Blast Furnace Slag</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>Steel Furnace Slag</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>Sandstone</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>Crushed Dolomite</i>	<i>Yes</i>	<i>Yes</i>	<i>Note 1</i>
<i>Polish Resistant Aggregates</i>	<i>Yes</i>	<i>Yes</i>	<i>Note 1</i>
<i>Crushed Stone</i>	<i>No</i>	<i>No</i>	<i>No</i>
<i>Gravel</i>	<i>No</i>	<i>No</i>	<i>No</i>
<i>NOTE 1. Polish resistant aggregate or crushed dolomite may be used when blended with ACBF or sandstone but cannot exceed 50% of the coarse aggregate by weight (mass), or cannot exceed 40% of the coarse aggregate by weight (mass) when blended with SF.</i>			

411.03 Design Mix Formula

The Contractor shall submit a Design Mix Formula, DMF, for the specific materials to be used on the project to the District Testing Engineer one week prior to use. The DMF shall state the following (all percentages are based on the dry weight of the aggregate):

- (a) source of each individual material
- (b) The aggregation gradation shall be in accordance with the following:

<i>Sieve Size</i>	<i>Surface/Leveling</i>	<i>Rut Fill*</i>
<i>3/8 in. (9.5 mm)</i>	<i>100</i>	<i>100</i>
<i>No. 4 (4.75 mm)</i>	<i>85-100</i>	<i>70-90</i>
<i>No. 8 (2.36 mm)</i>	<i>50-80</i>	<i>45-70</i>
<i>No. 16 (1.18 mm)</i>	<i>40-65</i>	<i>28-50</i>
<i>No. 30 (600 μm)</i>	<i>25-45</i>	<i>19-34</i>
<i>No. 50 (300 μm)</i>	<i>13-25</i>	<i>12-25</i>
<i>No. 100 (150 μm)</i>	<i>7-18</i>	<i>7-18</i>
<i>No. 200 (75 μm)</i>	<i>5-15</i>	<i>5-15</i>
<i>* If rut fill course is used as a surface application, the aggregates shall be in accordance with the Surface Aggregate Table above.</i>		

- (c) percentage of aggregate
- (d) percentage of mineral filler (minimum and maximum)
- (e) percentage of water (minimum and maximum)
- (f) percentage of mix set additives (if required)
- (g) percentage of polymer modified CSS-1h emulsified asphalt
- (h) state the quantitative effects of moisture content on the unit weight of the aggregate
- (i) results for the tests in the following:

<i>Characteristic</i>	<i>Test Method ISSA*</i>	<i>Requirement</i>
<i>Wet Cohesion</i> 30 Minutes, Min. (Set Time) 60 Minutes, Min. (Traffic)	<i>TB-139**</i>	12 kg-cm 20 kg-cm
<i>Wet Stripping, Min.</i>	<i>TB-114</i>	90%
<i>Wet Track Abrasion Loss</i> 60 Minutes Soak, Max.	<i>TB-100</i>	536 g/m ²
<i>Saturated Abrasion</i> <i>Compatibility, Max</i>	<i>TB-144</i>	3g loss
<i>Mix Time @ 77°F (25°C)</i>	<i>TB-113**</i>	<i>Controllable to 120 s</i>
<i>Mix Time @ 104°F (40°C)</i>	<i>TB-113**</i>	<i>Controllable to 35 s</i>
* <i>International Slurry Surfacing Association</i>		
** <i>The TB-139 (set time) and TB-113 (mix time) tests shall be checked at the highest temperature expected during construction. For the TB-113 test at 104°F (40°C), all ingredients and containers shall be preheated.</i>		

411.04 Pre-Paving Coordination

A pre-paving meeting between the Contractor and Engineer will be held on-site prior to beginning work. The agenda for this meeting will include as a minimum:

- (a) Contractor's detailed work schedule*
- (b) traffic control plan*
- (c) calibration of equipment*
- (d) Design Mix Formula/Job Mix Formula*
- (e) inspection and evaluation of the condition and adequacy of equipment, including units for transport of materials*
- (f) Quality Control Plan in accordance with ITM 803*

CONSTRUCTION REQUIREMENTS

411.05 Preparation of Surfaces

The Contractor shall be responsible for all surface preparation that may affect the performance of warranted micro-surfacing, including, but not limited to compatibility of crack sealing materials when the contract includes crack sealing prior to micro-surfacing. All castings and detector housings shall be protected during application of material.

411.06 Opening to Traffic

The micro-surface shall be capable of being opened to traffic within 1 hour after application. If the micro-surface is not stable under traffic loading within 1 hour of placement, the Contractor shall immediately cease operations. Prior to resuming operations, the Contractor shall notify the Engineer of the cause and the corrective action to be taken.

411.07 Finished Pavement Properties

Pavement smoothness shall be in accordance with 401.18 except profilograph requirements will not apply. Smoothness requirements shall not apply to shoulder micro-surface placed separately.

The longitudinal construction joints and lane edges shall coincide with the proposed painted lane lines. Longitudinal joints shall be constructed with less than a 3 in. (75 mm) overlap on adjacent passes and no more than 1/4 in. (6 mm) overlap thickness measured with a 10 ft (3 m) straight edge in accordance with 409.03(f). If applicable, overlapping passes shall be on the uphill side to prevent ponding of water. Construct neat and uniform transverse joints with no more than a 1/8 in. (3 mm) difference in elevation across the joint as measured with a 10 ft (3 m) straight edge. The lane edge shall be neat and uniform with no more than 2 in. (50 mm) of horizontal variance in any 100 ft (30 m).

411.08 Warranty

Upon completion of all warranted micro-surfacing and opening to unrestricted traffic, the warranty bond shall be in effect for a total of three years. The warranty bond shall be properly executed by a surety company satisfactory to the Department and be payable to the State of Indiana and submitted with the Contractor's bid.

The warranty bond shall be an amount equal to 100% of the contract total for the warranted micro-surfacing excluding patching or other work included in the contract. The bond is intended to insure completion of required warranty work, including payments for all labor, equipment, materials and closure periods used to remediate any warranted distresses.

Upon the final acceptance of the project, the contractual obligations of the Contractor are satisfied as long as the micro-surfacing continues to meet or exceed the warranted values as defined herein.

All warranty work shall be accomplished in accordance with 411.10. At the end of the warranty period, the Contractor will be released from further warranty work or responsibility, provided all previous warranty work has been satisfactorily completed and approved by the Department.

411.09 Conflict Resolution Team

The scope of work for the conflict resolution team includes all issues concerning the warranted pavement relative to the quality control plan, material selection, warranted pavement evaluations, distress indicators, remedial action, and remediation plans.

The team will consist of two Contractor representatives, two Department representatives, and a fifth person mutually agreed upon by both the Department and the Contractor. All costs for the fifth person will be equally shared between the Department and the Contractor.

The team members will be identified in writing when needed and will be knowledgeable in the terms and conditions of this warranty and the methods used in the measurement and calculation of pavement distress. The team will render a final recommendation to the Chief Engineer by a majority vote. Each member has an equal vote.

411.10 Warranty Work

During the warranty period, remedial work shall be performed at no cost to the Department and shall be based on the results of pavement distress surveys. Remedial work to be performed and materials to be used shall be a decision of the Contractor with approval of the Department. Prior to proceeding with any warranty work or monitoring, all necessary permits shall be obtained from the Department.

During the warranty period, the Contractor may monitor the warranted micro-surfacing using non-destructive procedures. All proposed remedial actions shall be coordinated with the Department.

Coring, milling or other destructive procedures may not be performed by the Contractor, without prior consent of the Department. The Contractor will not be responsible for damages to the pavement as a result of coring, milling or other destructive procedures conducted by the Department.

The Contractor will have the first option to perform the remedial work. If, in the opinion of the Engineer, the problem requires immediate attention for safety of the traveling public and the Contractor cannot perform the remedial work within 24 hours of notification the Department has the option to have emergency remedial work performed by other forces. The Contractor shall be responsible to pay for all costs incurred by the Department for emergency remedial work. Remedial work performed by other forces will not alter the requirements, responsibilities, or obligations of the warranty.

411.11 Pavement Distress Indicators, Thresholds, and Remedial Action

The Department will use the following pavement distress indicators throughout the warranty period:

- (a) Rutting – transverse displacement of the micro-surfacing*
- (b) Delamination – physical separation of the micro-surfacing that exposes the underlying surface within a wheelpath*
- (c) Raveling – wearing away of the micro-surfacing*
- (d) Skid Resistance – friction number as measured by ASTM E 274 and E 524*

The pavement threshold values for the pavement distress indicators will be evaluated for the entire length of the contract for each lane. The threshold values for the pavement distress indicators are listed below:

	<i>Single Location</i>	<i>Multiple Location/mile</i>
<i>Delamination</i>	<i>0.5 yd²</i>	<i>1.0 yd²</i>
<i>Raveling</i>	<i>0.5 yd²</i>	<i>1.0 yd²</i>

Rut Depthaverage 1/4 in. (6 mm)
Friction Numberaverage 35, no value less than 30*

** Individual friction tests will be done in each lane every 1/2 mi for the length of the contract.*

The Department may evaluate the warranted micro-surfacing during the warranty period. A final condition survey will be made by the Department and the Contractor will be notified in writing of all sections exceeding the warranty threshold at least 90 days in advance of the expiration of the warranty period.

If any of the threshold levels are met or exceeded, the Contractor shall recommend remedial action to the Department. After the remedial action is approved, the Contractor shall perform the remedial work.

Remedial action shall be taken within 30 calendar days of the date the Contractor is notified that a threshold level has been met or exceeded by the final condition survey. If threshold levels are met or exceeded within the warranty period, the Contractor shall submit for approval his recommended remedial action and work schedule.

If, anytime during the warranty period, 30% or more of the project requires, or has received remedial action, the entire project shall receive a remedial action as determined by the Contractor and the Department. If an impasse develops, the team will make a final recommendation.

If remedial action work or elective/preventive action work performed by the Contractor necessitates a corrective action to the pavement markings, adjacent lanes or roadway shoulders, such corrective action to the pavement markings, adjacent lanes, and shoulders shall be the responsibility of the Contractor.

Warranty requirements for all remediation work will be limited to the life of the original contract warranty.

If any of the threshold levels are met or exceeded and the Contractor does not agree to the pavement distress survey or the Department does not agree with the proposed remedial action, the team will provide a recommendation within 30 calendar days.

The Contractor will not be held responsible for distresses that are caused by factors beyond the control of the Contractor. The Contractor shall be responsible for materials and workmanship problems.

411.12 Elective/Preventive Action

Elective or preventive action may be performed by the Contractor with concurrence from the Department.

411.13 Department Maintenance

The Department will perform routine maintenance operations during the warranty period such as plowing, applying de-icing chemicals, repairs to safety appurtenances, pavement markings, mowing and sign maintenance. The Department, during the warranty period, will perform no routine pavement surface maintenance activities.

411.14 Method of Measurement

Micro-Surfacing, Warranted, of the type specified will be measured by the square yard (square meter) of the surface course. The width of the surface course will be the width placed. The length of the surface course will be measured along the centerline of each roadway or ramp.

Only the micro-surface surface course will be measured for payment.

411.15 Basis of Payment

The accepted quantities for this work will be paid for at the contract unit price per square yard (square meter) of micro-surface, warranted, of the type specified, complete in place.

Payment will be made under:

Pay Item	Pay Unit Symbol
<i>Micro-Surfacing, Warranted, Single Course</i>	<i>SYS (m2)</i>
<i>Micro-Surfacing, Warranted, Multiple Course.....</i>	<i>SYS (m2)</i>

The cost of furnishing materials, equipment, labor, maintenance of traffic, underlying micro-surface courses, and tack coat, if required, and all incidentals shall be included in the cost of micro-surfacing, warranted, of the type specified.

411.16 Final Warranty Acceptance

The Engineer will review the project in the field for any obvious general defects not addressed in the indicators and recommend a Final Warranty Acceptance. The Construction Management Division will issue the Contractor a Final Warranty Acceptance letter.