411-R-432 WARRANTED MICRO-SURFACING

(Revised 11-16-11)

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 placement 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 in accordance with 411.09.

MATERIALS

411.02 Materials

Materials shall be in accordance with the following:

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

* *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:*

Characteristics	*AASHTO Test Method*	*Requirement*
Residue by Distillation, % (Note 1)	*T 59*	*62+*
Softening Point, °F (°C)	*T 53*	*140+ (60+)*
Viscosity @140°F (60°C)	*T 202*	*8000+*
Elastic Recovery @ 77°F (25°C), %	*T 301*	*60*
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.		

** *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*

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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:

Surface Aggregate Table			
Coarse or Fine Aggregate Type	*Traffic ESALs*		
	< 3,000,000	*< 10,000,000*	*≥ 10,000,000*
Air-Cooled Blast Furnace Slag	*Yes*	*Yes*	*Yes*
Steel Furnace Slag	*Yes*	*Yes*	*Yes*
Sandstone	*Yes*	*Yes*	*Yes*
Crushed Dolomite	*Yes*	*Yes*	*Note 1*
Polish Resistant Aggregates	*Yes*	*Yes*	*Note 1*
Crushed Stone	*No*	*No*	*No*
Gravel	*No*	*No*	*No*
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.			

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, where the percentages shown 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:

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

(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:

Characteristic	*Test Method ISSA**	*Requirement*
Wet Cohesion	*TB-139***	

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30 minutes, min. (set time) *60 minutes, min. (traffic)*		*12 kg-cm* *20 kg-cm*
Wet Stripping, min.	*TB-114*	*90%*
Wet Track Abrasion Loss *60 minutes soak, max.*	*TB-100*	*536 g/m²*
Saturated Abrasion *Compatibility, max*	*TB-144*	*3g loss*
Mix Time @ 77°F (25°C)	*TB-113***	*controllable to 120 s*
Mix Time @ 104°F (40°C)	*TB-113***	*controllable to 35 s*

* *International Slurry Surfacing Association*
** *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.*

411.04 Equipment

The Contractor shall use self-contained, self-propelled, continuous loading units designed for micro-surfacing.

Truck-mounted batch type machines will be allowed on projects with quantities less than or equal to 50,000 sq yds. The Contractor shall provide a minimum of 2 truck-mounted units at all times.

411.05 Pre-Paving Coordination

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

(a) the 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

411.06 Preparation of Surfaces

The Contractor shall be responsible for all surface preparation necessary to meet the performance requirements for warranted micro-surfacing. All castings and detector housings shall be protected prior to the application of material in accordance with 404.07, except that raised pavement markers shall be removed.

411.07 Opening to Traffic

The micro-surface shall be capable of being opened to traffic within 1 h after application. If the micro-surface is not stable under traffic loading within 1 h 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.

411.08 Finished Pavement Properties

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All finished surface irregularities in excess of 1/8 in. measured with a 10 ft straightedge shall be corrected.

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. overlap on adjacent passes and no more than 1/4 in. overlap thickness measured with a 10 ft straightedge in accordance with 409.03(f). If applicable, overlapping passes shall be made to prevent ponding of water. Construct transverse joints with no more than a 1/8 in. difference in elevation across the joint as measured with a 10 ft straightedge. The lane edge shall have no more than 2 in. of horizontal variance in 100 ft.

411.09 Warranty

A warranty bond is to insure completion of required warranty work, including payments for all labor, materials, equipment, and incidentals necessary or convenient to the successful completion of the project and the carrying out of the duties and obligations imposed by the contract used to remediate any warranted distresses.

The Contractor shall provide a warranty bond equal to 100% of the contract total for the warranted micro-surfacing pay items. The warranty bond shall be in effect for 3 years from the date of substantial completion. The warranty bond shall be properly executed by a surety satisfactory to the Department and be payable to the State of Indiana and submitted with the Contractor's bid.

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 411.11. 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. 10 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 2 Contractor representatives, 2 Department representatives, and an additional person mutually agreed upon by both the Department and the Contractor. All costs for the additional person will be equally shared by 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.

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411.11 Warranty Work

Elective work is performed by the Contractor at its discretion to meet the performance requirements of warranted micro-surfacing prior to direction from the Department for the Contractor to perform remedial work.

Remedial work is performed as a result of pavement distress surveys performed by the Department.

During the warranty period, elective work and remedial work shall be performed at no cost to the Department. Elective work shall be at the Contractor's option. The scope of all elective work or remedial work to be performed as well as materials to be used shall be proposed by the Contractor and shall be subject to approval by the Department. Prior to proceeding with any warranty work or monitoring, all necessary permits shall be obtained from the Department.

Elective work during the warranty period will not be assessed a lane closure fee. For remedial work, costs for closure periods will be applied using the following closure period rates:

From _____ to_____: .....$_____/lane/hour
From _____ to _____: .....$_____/lane/hour

During the warranty period, the Contractor may monitor the warranted micro-surfacing using non-destructive procedures.

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

411.12 Pavement Distress Indicators, Thresholds, and Remedial Work

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
(c) Raveling – wearing away of the micro-surfacing
(d) Skid Resistance – friction number as measured by ASTM E 274 and E 524

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

Distress	*Single Location*	*Multiple Locations*
Delamination or Raveling	*1/2 sq yd*	*1 sq yd/mi*
Rut Depth	*1/4 in.*	*average 1/4 in./mi*
*Friction Number**	*no less than 30*	*average 35*

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

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 the Department determines that any threshold level has been met or exceeded and remedial work is required, the Contractor shall submit a work plan and schedule to the Engineer for approval. The Contractor shall perform the remedial work within 30 calendar days of notification of approval by the Engineer.

If, anytime during the warranty period, 30% or more of the project requires, or has received remedial work, remedial work as determined by the Department shall be performed on the entire project.

If remedial or elective work performed by the Contractor necessitates repair or replacement of pavement markings, adjacent lanes or roadway shoulders, the required work shall be the responsibility of the Contractor.

Warranty requirements for elective and remedial work will be limited to the life of the original contract warranty.

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411.13 Department Maintenance

The Department may perform routine maintenance operations during the warranty period including, but not limited to, 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

Warranted micro-surfacing, of the type specified, will be measured by the square yard of surface course.

Only the surface course will be measured for payment.

411.15 Basis of Payment

Warranted micro-surfacing, of the type specified, will be paid for at the contract unit price per square yard of micro-surface, warranted, of the type specified, complete in place.

Payment will be made under:

Pay Item	***Pay Unit Symbol***
Micro-Surfacing, Warranted, for Approaches, Multiple Course	*SYS*
Micro-Surfacing, Warranted, for Approaches, Single Course	*SYS*
Micro-Surfacing, Warranted, Multiple Course	*SYS*
Micro-Surfacing, Warranted, Single Course	*SYS*

The cost of all incidentals including, but not limited to, surface preparation, meeting smoothness requirements, and warranty bond shall be included in the cost of the pay items.

411.16 Final Warranty Acceptance

The Engineer will review the project in the field for any defects not addressed in the indicators and recommend a Final Warranty Acceptance. The Department will issue the Contractor a Final Warranty Acceptance letter upon completion of the warranty period and all remedial work.

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