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March 19, 2015

Contract No. T201401004.01
Federal Aid Project No. ESTP-2014(38)
High Friction Surface Treatment, Statewide, Open End
Statewide

Ladies and Gentlemen:

Enclosed is Addendum No. 1 for the referenced contract consisting of the following:

1. Four (4) pages, Special Provisions, 760510 - High Friction Surface Treatment, pages 42 through 45, revised, to be substituted for the same pages in the Proposal.

Please note the revisions listed above and submit your bid based upon this information.

Sincerely,

signature on file

James H. Hoagland
Contract Services Administrator

:jhh
Enclosures

760510 - HIGH FRICTION SURFACE TREATMENT

Description:

Furnish and apply a high friction surface treatment, comprised of a polymeric resin binder and bauxite aggregate, in accordance with these specifications, as indicated on the Plans and as directed by the Engineer.

Materials:

The high friction surface system consists of a two-part base polymeric resin binder and high friction aggregate. In accordance with Section 106 of the Standard Specification, submit certification of conformance to the requirements in Table 1 and Table 2 at least 30 days prior to construction. Laboratory testing must be performed by an accredited laboratory.

Polymeric Resin Binder: The binder resin system shall be a two-part thermosetting modified exothermic polymeric resin compound which holds the aggregate firmly in position and conforms to the requirements of Table 1.

TABLE 1 BINDER RESIN SYSTEM REQUIREMENTS		
Property	Requirement	Test Method
Ultimate Tensile Strength neat @ 7 days	2,000 psi minimum	D638
Compressive Strength	1,000 psi minimum @ 3 hours 5,000 psi minimum @ 7 days	C579
Gel Time	10 minutes minimum	C881
Water Absorption neat @ 24 hours	1.0% maximum	D570
Durometer Hardness (Shore D)	70.0 minimum	D2240
Dry-to-touch Time	3 hours maximum	D1640 5 mil thickness @ 75° F
Elongation at Break Point	30 – 70%	D638
Mixing Ratio	Per Manufacturer	Provide manufacturer's recommendations a minimum of 30 days prior to construction
Permeability to Chloride Ion @ 28 days, C	Less than 100	T277
Adhesion Strength @ 24 hours	200 psi minimum	D4541

Bauxite Aggregate: The material shall be clean, dry and free from foreign matter and conform to the requirements in Table 2. Deliver the bauxite to the construction site in clearly labeled super sacks weighing at least 2,200 lbs. 55 lb. bags of material may be substituted when hand applications are necessary.

TABLE 2 AGGREGATE REQUIREMENTS		
Property	Specification Limits	Test Method
Gradation	95.0% - 100.0% passing No. 6 0.0% - 5.0% passing No. 16	T27
Apparent Specific Gravity	3.1 Minimum	C25
Sodium Sulfate Soundness	12% Maximum	T104
LA Abrasion Test	30% Maximum. Test sample gradation differs from gradation requirements.	T96 (C grading)

Equipment:

Truck Mounted Application Machine: Perform mechanical application using an automated continuous application device. The binder resin system manufacturer shall approve the use of the automated continuous application device with their material. The applicator shall mechanically mix, meter, monitor and apply the binder resin system and high-friction aggregate in one continuous pass. The application vehicle shall feature volumetric metering pumps that continuously mix, meter, and monitor and apply the resin binder. If recommended by the manufacturer, metering pumps shall be heated. The application vehicle shall have continuous pumping and portioning devices that blend the binder resin system within a controlled system.

Quality Control (QC) Plan:

Submit a QC Plan for approval at least 30 days prior to placement of the high friction surface treatment. The QC Plan shall show proposed methods to control the equipment, materials, mixing and paving operations to ensure conformance with these Specifications. Discuss the QC Plan requirements at the pre-construction, pre-pave and progress meetings. The QC Plan shall contain at a minimum:

- a) Key Personnel and contact information
- b) Resin Production Plants, location of plants, personnel qualifications, inspection and record keeping methods, equipment calibration records, accreditation certificates and minimum frequencies of sampling and testing per Table 1.
- c) Aggregate Production Plant locations, personnel qualifications, inspection and record keeping methods, equipment calibration records, accreditation certificates and minimum frequencies of sampling and testing per Table 2.
- d) Moisture control methods of aggregate
- e) Cleaning and maintenance schedule for truck mounted application machine.
- f) Corrective actions that will be taken for unsatisfactory construction practices and deviations from specifications.
- g) A manufacturer's representative must be sent to the construction site to train construction personnel prior to placing the high friction surface treatment and must remain available during application as necessary. The manufacturer's representative is only required to be on-site during the first day of construction until the operation is working correctly. The Engineer reserves the right to require the manufacturer's representative to be on-site more than once to assist with contractor compliance/additional training.

The QC Plan shall designate a Plan Administrator, who shall have the full authority to institute any action necessary for the successful operation of the Plan. The Plan Administrator may supervise the QC Plan on more than one project, if that person can be in contact with the job site within one hour after being notified of a concern.

A field technician shall be present at the job site unless otherwise approved in the QC Plan. The technician shall be responsible for the required field quality control sampling and testing in conformance with the approved quality control plan and contract documents. Maintain and make available upon request complete records of sampling, testing, actions taken to correct problems and quality control inspection results. Any deviation from the approved QC Plan shall be cause for immediate suspension of operations.

Construction Methods:

Weather Restrictions: Do not apply the binder resin material on wet surfaces (including condensation moisture from construction vehicles in front binder application), when the ambient temperature is less than 40°F or above 105°F, or when the anticipated weather conditions or pavement surface temperature would prevent the proper application of the surface treatment in accordance with the manufacturer's recommendations.

Surface Preparation: Clean and fill all inadequately sealed joints and cracks 1/4 to 1-3/4 in. with a sealant approved by the binder resin material manufacturer, which will bond to the specified epoxy binder. Where high friction surface treatment will be applied on new asphalt surface in the same project, construct the high friction surface treatment a minimum of 30 days after placement of underlying and adjacent pavement. Completely remove all curing compounds on new Portland Cement Concrete surfaces prior to installation. Adequately cover and protect all utilities prior to placement of high friction surface treatment.

Clean existing surface by use of mechanical sweepers, high pressure air or other methods approved by the manufacturer prior to installation. Receiving surfaces must be clean, dry and free of all dust, oil, debris and any other material that might interfere with the bond between the epoxy binder material and existing surfaces. Asphalt surfaces may need to be washed with a mild detergent, rinsed and dried unless waived by the Engineer. Concrete surfaces may need to be shot, sand or water blasted.

Test Section: Construct a test section (minimum of 200 SY) at a location approved by the Department in the preconstruction meeting to demonstrate equipment has been properly calibrated a minimum of 24 hours prior to beginning the project. If the project site is used for the test section, open the test section to traffic after curing has completed and no uncovered epoxy remains exposed. Correct deficient areas before opening to traffic as directed at no additional cost.

Mechanical Application of HFST: Blend and mix the binder resin system in the ratio per the manufacturer's specifications (± 2 percent by volume) and continuously apply once blended. The application vehicle shall be capable of applying a uniform application thickness of 50-65 mils (25 – 32 ft²/gal) and in varying widths of up to 12 feet. Coverage rate is based upon expected variances in the surface profile of the pavement. The operation should proceed in such a manner that will not allow the mixed material to separate, cure, dry, be exposed or otherwise harden in such a way as to impair retention and bonding of the aggregate. Do not spray binder material on existing pavement markings or utility appurtenances.

Apply the aggregate within 5 minutes (± 1 minute) of the base resin binder application onto the pavement section. Mechanically apply the aggregate at a rate of 12 -15 lbs/yd² (achieving saturation) in such a manner that there is no disruption to the leveled binder. It is the responsibility of the Contractor to ensure full embedment of the calcined bauxite aggregate. Wet spots must be covered with aggregate prior to the gelling of the binder resin system. Reclaim excess aggregate that can be reused by using a vacuum sweeper. The recovered aggregate must be clean, uncontaminated and dry. Ensure that no seams are visible in the middle of the traffic lanes of the finished work after application of the aggregate.

Applications on high speed highways such as interstate ramps and bridge decks will require additional sweeping 3 days after the initial installation is completed.

Walking, standing, or any form of contact or contamination with the wet uncured binder resin system prior to application of the aggregate without the use of spiked shoes to minimize the disturbance to the binder layer will result in that section of binder resin system being removed and replaced at the Contractor's expense. Contractor equipment and traffic is not permitted on the HFST during curing period.

Hand Application of HFST: Hand application may be used when less than 300 square yards will be used in a project. Mix the binder components to the correct proportions within 4% by weight using a low speed high torque drill fitted with a helical stirrer. Uniformly spread the binder resin system onto the surface using a serrated edge squeegee at a uniform application thickness of 50 – 65 mils (25 – 32 ft²/gal). Coverage rate is based upon expected variances in the surface profile of the pavement.

Immediately broadcast aggregate at a rate of 12–15 lbs/yd² (achieving saturation) in such a manner as to not disrupt the leveled binder. It is the full responsibility of the Contractor to ensure full embedment of the calcined bauxite aggregate. Wet spots must be covered with aggregate prior to the gelling of the binder resin system. Reclaim excess aggregate that can be reused by using a vacuum sweeper. The recovered aggregate must be clean, uncontaminated and dry. Ensure that no seams are visible in the middle of the traffic lanes of the finished work after application of the aggregate.

Applications on high speed highways such as interstate ramps and bridge decks will require additional sweeping 3 days after the initial installation is completed.

Walking, standing, or any form of contact or contamination with the wet uncured binder resin system prior to application of the aggregate without the use of spiked shoes to minimize the disturbance to the binder layer will result in that section of binder resin system being removed and replaced at the Contractor's expense. Contractor equipment and traffic is not permitted on the HFST during curing period.

Sampling and Testing: During construction, sample and test binder and aggregate per Tables 1 and 2 at a minimum frequency of 1 split set per 2,000 square yards, providing one set to the Engineer. Sample and label the material under the direct observation of the Engineer.

Curing and Clean Up: Allow the treatment to cure for the minimum duration as recommended by the binder resin material manufacturer. Remove excess aggregate on the treated area and adjacent areas with raveled aggregate by hand or by suction sweeping. Perform initial clean up before opening to traffic. Excess aggregate can be reused on the following day's installation provided the reclaimed aggregate is clean, uncontaminated and dry. Perform secondary clean up 3 to 5 days after construction. Perform final clean up 3 to 5 weeks after construction.

Field Acceptance Testing: Ensure that the coverage rate of the retained aggregate is 11-15 lbs per square yard. Remove and re-apply high friction surface treatment where any patches of exposed epoxy exist, at no additional cost. The high friction surface treated area will be tested by the Department within 60 days after construction in accordance with the requirements in Table 3. Remove and replace deficient locations as directed.

Property	Requirements	Frequency	Test Method
Field Dynamic Friction Value (20 km/hr) (By DelDOT)	0.90 Minimum	1 per each location or 1 per every 1,500 lane-feet, whichever is shorter. By DelDOT	ASTM E 1911
Mean Profile Depth (mm)	1.0 Minimum	1 per each location or 1 per every 1,500 lane-feet, whichever is shorter. By DelDOT	ASTM E 2157
FN40R (Corrected field FN by adding the correction in Table 4) OPTIONAL TEST	72 Minimum	Every 0.1 mile in each lane. By DelDOT	ASTM E 274 (Ribbed tire)

Test Speed (mph)	FN Correction	Test Speed (mph)	FN Correction	Test Speed (mph)	FN Correction
20	-9.3	30	-4.8	40	0.0
21	-8.9	31	-4.4	41	0.5
22	-8.4	32	-3.9	42	1.0
23	-8.0	33	-3.4	43	1.5
24	-7.6	34	-2.9	44	2.0
25	-7.1	35	-2.5	45	2.5
26	-6.7	36	-2.0	46	3.1
27	-6.2	37	-1.5	47	3.6
28	-5.8	38	-1.0	48	4.1
29	-5.3	39	0.5	49	4.6

Method of Measurement:

The Engineer will measure the quantity of acceptably placed high friction surface treatment. The quantity of high friction surface treatment will be measured in square yards of surface area, completed and accepted. No deduction will be made for the areas occupied by junction wells, manholes, inlets, drainage structures, pavement markings or by any public utility appurtenances within the area. Material placed outside of the designated treatment area will not be included in computing the quantity.

Basis of Payment:

The quantity of high friction surface treatment, installed and accepted, will be paid for at the Contract unit price per square yard. Price and payment will constitute full compensation for surface preparation, including removal of curing compounds on PCC pavement, filling cracks in hot-mix or concrete pavement surfaces as determined by the Engineer, furnishing and placing the epoxy binder and aggregate, test strip, sweeping, sampling and QC testing, cleanup and for all material, labor, equipment, tools and incidentals required to complete the work.