STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

ROY COOPER
GOVERNOR

JAMES H. TROGDON, III
SECRETARY

April 19, 2018

- SUBJECT: **ADDENDUM 1 FOR DE00234 - Safety Improvements at 3 locations in Wake County**
  WBS Element: 47649.3.1, 2018CPT.05.24.20921.1, 44851.3.6 & 50138.3.154

MEMORANDUM TO PROSPECTIVE BIDDERS

To Whom It May Concern:

The subject proposal is being revised by an addendum, referred to here as Addendum 1.

The following revisions have been made to the proposal:

Revision #1: Revised High Friction Surface Treatment Provision.

The prequalification requirements have been revised in the High Friction Surface Treatment Provision. Please void the existing High Friction Surface Treatment Provision and replace with the new attached High Friction Surface Treatment Provision.

Please note that an .ebs amendment file has been provided and must be used with electronic bidding. This information will also be posted electronically.

If you have additional questions prior to bid opening, feel free to call me at (919) 220-4600.

Sincerely,

Robbie N. Weisz, PE
Division 5 Contract Engineer

RNW

cc: B. Tharrington
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HIGH FRICTION SURFACE TREATMENT:
(SPECIAL)

Description

This work shall consist of the application of High Friction Surface Treatments (HFST) for use on asphalt and concrete pavements in accordance with these specifications. The HFST is comprised of a single layer of a binder resin system and a special surface applied aggregate.

Prequalification Requirements

Due to the specialized nature of HFST work, prime contractors or subcontractors must be prequalified to do work covered by Work Code **670 (Mechanical Application) or 671 (Hand Application)** in accordance with Article 102-2 of the *2012 Standard Specifications***.** The bidder shall be prequalified for the applicable work code prior to the bid opening or shall submit a letter of intent written documentation that a subcontractor prequalified to perform said work will be used to perform the work, in order to be awarded the contract. The documentation shall be received no later than 2:00 pm of the fifth calendar day following opening of bids.

Materials

Use HFST components listed on the Approved Products List at https://apps.dot.state.nc.us/vendor/approvedproducts/ or approved equal.

(A) Polymeric Binder Resin

(1) Specification of Binder Resin System

Use a multi-component, cold-applied, modified polymeric resin treatment covered with calcined bauxite. Ensure that the binder consists of a polymeric resin compound that holds the calcined bauxite aggregate firmly in position and meets the following requirements:

Binder Resin System		
Property	**Requirement**	**Test Method**
Viscosity	7 – 30 Poise	ASTM D2556
Durometer Hardness	60-80	ASTM D2240
Cure Time (Dry through time)	3 hours max.	ASTM D1640
Adhesive Strength	250 psi min. (100% substrate failure)	ASTM C1583
Ultimate Tensile Strength	2,500 psi min.	ASTM D638
Compressive Strength	1,000 psi @ 3 hours min. 5,000 psi @ 7 days min.	ASTM D695
Elongation at break point	30% min.	ASTM D638
Gel Time	10 minutes min.	ASTM C881
Water Absorption	1 % max.	ASTM D570
Mixing Ratio	Per Manufacturer's Recommendations	-

(2) Polymer Resin Packaging

Polymer binder resin shall be packaged in suitable well sealed containers with labels stating the type of material and the ratio of components to be mixed by volume. Any special instructions regarding mixing shall be included. Label the components with brand name, name of manufacturer, lot or batch number, temperature range for storage, expiration date and the quantity contained therein. Caution warnings regarding the handling, and contact with skin and eyes shall be included on the labels. The volumes of the pails or containers shall be labeled in US gallons to assist in proper mixing dosage and application rates. Ensure that samples are obtained and tested.

(3) Polymeric Resin Material Certification

Provide Type 3 and Type 4 material certifications for the polymeric resin in accordance with Article 106-3 of the *Standard Specifications*. Any QC samples taken by the contractor or the manufacturer during construction shall be readily available to the Department once test results are obtained. Provide a copy of the Safety Data Sheet (SDS) for the components of the polymeric resin to the Engineer.

(B) Aggregate

(1) Specification for HFST Aggregate

Ensure that the aggregate is a calcined bauxite material that is clean, dry and free from deleterious matter and meets the following requirements:

Aggregate Properties		
Property	**Requirement**	**Test Methods**
Polish Stone Value	50.0 min.	AASHTO T279
Resistance to Degradation	20.0% max.	AASHTO T96
Aggregate Grading	100.0 % Passing No. 4 95.0-100.0% Passing No. 6 0.0 – 5.0% Passing No. 16	AASHTO T27
Moisture Content	0.2% max.	AASHTO T255
Aluminum Oxide	87% min.	ASTM C25

(2) Aggregate Packaging

The calcined bauxite aggregates shall be supplied to the construction site in clearly labeled super-sacks or bins weighing a minimum of 1,000 lbs. Small bags of calcined bauxite aggregate material may be substituted when hand applications are necessary. Ensure that samples are obtained and tested.

(3) Aggregate Material Certification

Provide Type 3 and Type 4 material certifications for the bauxite aggregate in accordance with Article 106-3 of the *Standard Specifications*. Any QC samples taken by the contractor or the manufacturer shall be readily available to the Department once test results are obtained. Provide a copy of the SDS to the Engineer.

(C) Sampling and Testing

Provide a minimum quantity of one quart samples of the multi-component polymeric binder components each in separate half gallon containers (individually). Provide aggregate at a minimum sample frequency of one sample per 2,000 square yards or one sample per day if installation is less than 2,000 square yards. Ensure that all material sampling and labeling is performed under the direct observation of the Engineer. Collect at least 10 pounds of aggregate sampled in cloth bags and submit to NCDOT Materials and Tests Unit representative. Take a one quart sample of polymer resin binder once per day from production work and test in accordance with ASTM D638 by certified independent testing lab. Provide test results to the Engineer within 72 hours after taking the sample.

Construction Requirements

Schedule a pre-application meeting prior to the construction or the first day of production of the HFST with representatives from the Contractor, Subcontractor, Manufacturer, Project Engineer, Area Roadway Construction Engineer, Pavement Management Unit, Materials and Tests Unit, Regional Traffic Engineer, and State Pavement Construction Engineer.

(A) Qualification of Installer

The installer shall submit a Quality Control (QC) Plan that is project specific detailing the installers key personnel (including contact information), equipment to be used, materials, proposed methods prior to installation including preparation of the pavement surface (including crack sealing, cleaning, sweeping, drying), material blending procedures, procedures for installation, and proposed methods of curing, clean up, and traffic marking operations. Ensure the QC Plan is submitted to the Engineer a minimum of 7 days prior to placement of HFST. Ensure that all placement personnel are trained and are familiar with the products being placed and work diligently in order to obtain long lasting bond of the HFST to the existing pavement surface and high friction aggregate retention within the finished product.

(B) Test Section

Construct a test section of at least 200 square yards a minimum of 3 hours prior to beginning the project in accordance with the installation requirements herein. The test section shall be considered part of the HFST quantity of the project. In the event that the test section is not completely cured within 3 hours, additional time may be deemed necessary by the Engineer before application can begin.

If the test section does not meet any requirements in the specification, the operation shall cease until the deficiencies are corrected to the satisfaction of the Engineer. If the Contractor is unable to correct deficiencies with an acceptable method, the test section, if it is within the project limits, will be considered unacceptable and may be subject to removal and replacement at the Contractor's expense and other remedies in accordance with Article 108-5 or 105-3 of the *Standard Specifications.*

(C) Installation

(1) General

Ensure that a polymeric resin manufacturer's representative is on site to provide technical assistance during the startup operations and as necessary during the surface preparation, material placement and during any necessary remedial work. Do not apply high friction surface treatment on open graded friction course.

(2) Preparation

If required by the manufacturer, place a prime coat prior to the installation of the HFST. Clean and fill all inadequately sealed joints and cracks greater than 1/4" with a crack sealant or material approved by the polymeric resin manufacturer. Magnesium phosphate based materials will not be allowed.

Clean asphalt surfaces by water blasting or use of mechanical vacuum sweepers or brooms, high pressure air or other methods outlined in the installers QC plan. Receiving surfaces shall be clean, free of all dust, oil, debris and any other material that might interfere with the bond between the polymeric binder material and existing surfaces using vacuum sweep, broom, water blasting or air wash, with a minimum of 180 cfm of clean and dry compressed air. Surfaces may need to be washed with a mild detergent, and then rinsed and dried using a hot compressed air lance. Ensure that the pavement surface is clean and completely dry prior to the installation of the HFST to the satisfaction of the manufacturer's representative and Engineer. Cover and protect utilities if applicable.

Clean concrete pavement surfaces by water blasting or shot blasting and vacuum sweeping. Shot blast all concrete surfaces to remove all curing compounds, loosely bonded mortar, surface carbonation, and deleterious material. The prepared surface shall comply with the International Concrete Repair Institute (ICRI) standard for surface roughness CSP 5. After shot blasting, air wash with a minimum of 180 cfm of clean and dry compressed air, all surfaces to remove all dust, debris, and deleterious material.

Ensure for applications on new asphalt pavements, that the installation of the polymeric binder and high friction aggregate topping is a minimum of 30 days after placement of underlying and adjacent pavement. On new concrete surfaces, all curing compounds shall be completely removed prior to installation. Any full or partial depth repairs on concrete surfaces shall cure a minimum of 3 days before the HFST can be placed.

Cover or tape the joints in concrete pavement.

Cover or tape raised pavement markers and pavement markings that are to be retained prior to applying binder resin.

(3) Binder Application

Apply the polymeric binder resin material on a dry surface, when the air temperature is above 55ºF and below 95ºF or in accordance to the manufacturer recommendations. Do not apply the polymeric binder resin material if the anticipated weather or pavement surface conditions would

prevent the proper application of the surface treatment as determined by the polymeric resin manufacturer.

Proportion the multi-component polymeric binder to the correct ratio and mechanically mix the polymeric binder to the correct ratio (+/- 2% by weight). Ensure that any blushing (waxy surface coating on the resin) caused by a reaction of the moisture with the hardening agent does not occur during the application process. Remove any areas that show signs of blushing that typically cause adhesion issues to occur. Ensure when placing in multiple lifts that the aggregate used is the same calcined bauxite material as the final riding surface and the aggregate material is properly embedded into the polymer. The mixed components are applied onto a prepared pavement surface with a uniform thickness of 55-65 mils onto the pavement. Coverage rate is based upon expected variances in the surface profile of the existing pavement. Contractor will measure and monitor placement using a contractor supplied depth gauge at a minimum rate of one measurement per 100 square yards placed to ensure proper application thickness. Operations should proceed in a manner that will not allow the mixed polymeric resin to separate, cure, dry, be exposed or otherwise harden in such a way as to impair retention and bonding of the aggregate. Walking, standing or any form of contact or contamination with the wet uncured polymeric resin prior to the application of the aggregate without the use of proper footwear to not disturb the binder layer will result in that section of the HFST being removed and replaced at the Contractor's expense.

(a) Hand Application of the multi-component polymeric base binder

Define "hand applications" as any operation using a squeegee to apply resin and blowers to apply aggregate.

Hand application may be used when installing low volume areas of less than 800 square yards total or small irregular areas. Mix polymeric components using a low speed high torque drill fitted with a helical agitator.

Hand applied base binder will be uniformly spread onto the substrate surface by means of a serrated edged squeegee capable of spreading at a rate of 55-65 mils. Mix only the quantity that can be used within its gel time.

(b) Mechanical Application of the multi-component polymeric binder

Define "mechanical applications" as any operation 800 square yards or greater using sprayers, truck mounted applicators, or automated trucks capable of process control and reporting capabilities.

Apply the multi-component polymeric binder by a truck or trailer application machine onto the pavement section in varying widths of up to full width of the lane at a uniform application thickness. Ensure the polymeric resin manufacturer has approved the installers application equipment for spreading their material as stated in the installer's QC Plan. Automation of the installer's equipment will provide continuous pumping and proportioning devices that blend the polymeric resin within a controlled system. Heated pumps may be necessary if required by the polymer manufacturer to ensure proper installation. The system shall mechanically mix, meter, monitor and apply the HFST polymer and aggregate in a uniform manner. Apply the polymer so no seams are visible in the middle of the traffic lanes of the finished work after application of the surface aggregate. Operations will proceed in such a manner that will not allow the polymeric base binder material to separate in the mixing lines, cure, dry, or otherwise impair retention bonding of the high friction surfacing aggregate. The application machine shall be equipped with flushing systems such that blockages of lines will not occur, and installation operations are not delayed, stopped or otherwise compromised. Ensure the mixed components are mechanically applied onto a prepared pavement surface with a uniform thickness of 55-65 mils. Provide documentation to the Engineer ensure proper mil thickness. Existing porous surfaces may cause the application rate to be adjusted in order to achieve overall desired mil thickness of finished product. Ensure that mechanical applications are capable of applying binder uniformly in one pass to obtain the desired mil thickness with varying placement widths and will automatically adjust based on application vehicle speed. Ensure that operations proceed in a manner that does not allow the polymer to separate or set up in a way that would impair the retention of the aggregate.

(4) Aggregate Application

Ensure that immediately after placing the polymeric binder; the aggregate is applied at a retained aggregate spread rate of 12-15 pounds per square yard. Rate may be adjusted based on test section results. The placement of this material does not require any compaction. Aggregate shall completely cover the "wet" polymeric binder to achieve a uniform surface. During the placement of the aggregate, by either hand application or mechanical means, the aggregate will be dropped in a manner to not excessively disturb the wet polymer film. It is the responsibility of the installer to ensure full embedment of the calcined bauxite aggregate, immediately cover any wet spots of excess polymer with aggregate prior to the gelling of the polymeric resin. Remove the excess aggregate from job site including shoulders by vacuum sweeping or by mechanical rotary broom before opening to traffic. Excess aggregate shall not be reused.

Application on high speed ramps or horizontal curves will require final vacuum sweeping 36 hours after initial installation has been completed. Additional vacuum sweeping or brooming may be necessary as deemed by the Engineer. Do not allow any of installation equipment, construction vehicles, or traffic onto the HFST during the curing period.

(D) Acceptance Testing

High Friction Surface Treatment (HFST) installer's representative will remain onsite through the Engineer's inspection of the job site and for the first hour when job site is re-opened to traffic. The installation will provide the following friction values:

Acceptance Testing		
Property	**Friction Value**	**Test Method**
Skid Resistance (FN40R) (after 90 days of completion of project)	70 min.	ASTM E274 or AASHTO T 242
Texture (sand patch)	1.0 mm min.	ASTM E965

Skid resistance testing will be performed by the contractor in application areas where speed limits equal or exceed 40 mph with safe traffic and geometric conditions as determined by the Engineer. If the friction values fail to meet guidelines in the table above, the entire HFST shall be removed and replaced by the Contractor, at no additional expense to the Department. If the surfaced area is unable to be tested due to speed, traffic or geometric conditions as determined above, then the Engineer will inspect the roadway and will either accept the work or direct repairs needed, up to and including removal and replacement, before the work will be accepted. Any ordered repairs or removal and replacement of material will be at no additional expense to the Department.

A repair procedure shall be submitted to the Engineer within 30 days of receiving notice that repairs are needed to a particular section. The repair procedure shall be acceptable to the Engineer and shall be completed within 60 days of receiving notice of repairs.

(E) HFST Warranty

The High Friction Surface Treatment (HFST) shall be warranted by the project payment and performance bonds for a period of 12 months.

(1) Warranty Period

The Department will conduct an inspection of the work and provide written acceptance in accordance with Article 105-17 of the *2012 Standard Specifications*. Written acceptance of the work will constitute the start date for the HFST warranty period.

(2) Situations Affecting the Warranty

During the warranty period, the Contractor will not be held responsible for distresses that are caused by factors not related to materials and workmanship. These include, but are not limited to, chemical and fuel spills, vehicle fires, base failures, and snow plows. Other factors considered to be beyond the control of the Contractor, which may contribute to pavement distress, will be considered by the Engineer on a case by case basis upon receipt of a written request from the Contractor. Maintaining traffic on the pavement surface prior to the Engineer's acceptance will not be a condition for voiding the warranty.

(3) Emergency Repairs

If, in the opinion of the Department, a pavement condition covered by the warranty requires immediate attention for the safety of the traveling public, the Contractor will be notified immediately. If the Contractor cannot perform the work in a timely manner, the Department may directly perform or have the corrective work performed by another entity at the Contractor's expense. Any emergency work performed will not alter the requirements, responsibilities, or obligations of the warranty.

(4) Warranty Performance Criteria

Surface Defects	**Severity**	**Extent (Per Lot)**
Surface Patterns	Pop outs over the entire pavement surface. Delamination of the Resin Overlay.	Greater than 10% of a lot affected; distress spotted evenly over the lot or over localized areas within the lot.
Loss of Cover Aggregate	Large patches or cover aggregate loss from the pavement surface.	Greater than 10% of a lot affected; distress spotted evenly over the lot or over localized areas within the lot.
Loss of Friction	Skid resistance less than 60 as measured by ASTM E274 or AASHTO T 242.	Greater than 10% of a lot affected; distress spotted evenly over the lot or over localized areas within the lot.

Lot - A 100-foot section of pavement or portion thereof, a lane width wide, on which HFST is constructed on a single map.

The beginning point of the first lot will be the beginning point of each day's operation.

The Department will review the HFST and advise the Contractor of any required corrective work in writing prior to expiration of the warranty period.

The Department will approve all materials and methods used in warranty work.

The Department will determine if warranty work performed by the Contractor meets the contract and provide written acceptance of the warranty work when complete.

Measurement and Payment

Payment for the accepted quantity for *High Friction Surface Treatment* will be measured and paid in square yards at the contract unit bid price for the pay item. The quantity for the pay item *High Friction Surface Treatment* is the surface area of the road with surface treatment and is measured by the square yard, complete in-place, and accepted. Material placed outside of the designated treatment area is disregarded in computing the quantity. Payment for this item is full compensation for constructing the *High Friction Surface Treatment* as specified or directed and includes furnishing, hauling, surface preparation, applying, spreading, sweeping and vacuuming the surface treatment, repairs, testing, and incidentals necessary to fulfill the requirements of this pay item in accordance with the Plans, the Specifications and other terms of the Contract. Payment for the accepted quantity for *High Friction Surface Treatment* will not be made until the HFST material certifications and results of field samples (polymeric resin and aggregate and all testing results) have been obtained by the Engineer.

Payment will be made under:

Pay Item	**Pay Unit**
High Friction Surface Treatment	Square Yard