Designer Note: This special should be included in contracts using high friction surface treatment.

HIGH FRICTION SURFACE TREATMENT (BDE)

Effective: November 1, 2025

Add the following Section to the Standard Specifications:

"**SECTION 409. HIGH FRICTION SURFACE TREATMENT**

409.01 Description. This work shall consist of constructing a high friction surface treatment (HFST) on an existing hot-mix asphalt (HMA) or Portland cement concrete (PCC) pavement surface.

409.02 Materials. Materials shall be according to the following.

Item	Article/Section
(a) Epoxy Resin Binder	1034
(b) Coarse Aggregate	1004.08

409.03 Equipment. Equipment shall be according to the following.

Item	Article/Section
(a) HFST Application Machine	1101.21
(b) Air Compressor	1101.19
(c) Regenerative Air Vacuum Sweeper	1101.22

CONSTRUCTION REQUIREMENTS

409.04 General. The HFST shall be placed by a qualified applicator according to the Department's qualified product list.

409.05 Weather Limitations. The epoxy resin binder shall be applied to a dry surface when no rain has occurred for 24 hours prior to application and the ambient air temperature is a minimum of 55 F (13 C), unless the epoxy resin manufacturer can provide test data to support installations at lower temperatures, to a maximum of 105 F (40 C) or when the anticipated weather conditions or pavement surface temperature would prevent the proper application of the surface treatment according to the manufacturer's recommendations.

The HFST shall only be applied if the surface moisture content is 4.5 percent or less when measured on a 20 ft. (6 m) spacing throughout the application area using a calibrated electronic moisture meter.

409.06 Quality Control (QC) Plan. The Contractor shall submit a QC Plan to the Engineer for approval at least 30 days before placement. The QC Plan requirements shall be discussed at the pre-construction, pre-pave, and progress meetings, and contain, at a minimum, the following:

(a) Key personnel and contact information, including the QC Manager.

(b) Equipment which will be used.

(c) Epoxy resin production plant.

(d) Aggregate production plant.

(e) Moisture control methods for aggregate.

(f) Provide the electronic moisture meter manufacturer's calibration documents and method of conducting periodic accuracy checks. Provide a procedure for measuring moisture on the pavement before HFST installation. Provide a procedure for corrective action if the moisture meter results fall outside of the acceptable range.

(g) List of manufacturer recommendations for storage of material, weather restrictions, epoxy resin blending procedures, curing time to begin sweeping operations and opening to traffic.

(h) Plan for monitoring and recording ambient conditions (air temperature, surface temperature, and relative humidity).

(i) Cleaning and maintenance schedule for truck-mounted application machines, including metering and monitoring devices.

(j) Traffic plan for ingress and egress for all material handling operations.

The QC Manager and a field technician shall be on the job site at all times during the placement of the HFST.

The field technician shall be responsible for the required field quality control sampling and testing. All sampling shall be performed in the presence of and in locations as directed by the Engineer. Maintain and make available upon request complete records of sampling, testing, actions taken to correct problems, and quality control inspection results.

409.07 Test Strip. A 200 sq. yd. (168 sq. m) test strip shall be required for contracts with a quantity of 1,000 sq. yd. (836 sq. m) or more of HFST to demonstrate the truck-mounted application machine has been properly calibrated. The Engineer will evaluate the application rate and cure time.

409.08 Surface Preparation. The surface shall be free of dust, dirt, oil, grease, paint, and all foreign matter. Pressure washing some areas may be necessary. Mild detergents may be used in pressure washing procedures when allowed by the manufacturer. Completely dry the area to be overlaid using compressed air or hot compressed air.

Pavement patching shall be performed in accordance with Section 442.

Joints and cracks 3/8 in. (10 mm) or wider shall be cleaned of vegetation, loose and unsound material and filled with a sealant recommended by the epoxy resin manufacturer that will bond to the specified epoxy resin binder. The cleaned cracks shall be filled such that the sealant is flush with the pavement surface.

Cover and protect all utilities, preformed joint seal, raised pavement markers, and existing pavement markings in areas where markings will be left in place.

409.09 HFST Application. HFST shall be applied not less than 30 days after placement of new HMA or new PCC surface or patches. The surface shall be clean, dry, and free of dust, oil, debris, and any foreign matter that might interfere with the bond between the epoxy resin binder material and existing surfaces. Shot blast all PCC surfaces. The blasted surface shall conform to the International Concrete Repair Institute, ICRI, Guideline No. 310.2 for surface roughness concrete surface profile of CSP 5. After shot blasting, remove dust, debris, and deleterious material by vacuuming, sweeping, and air washing, with a minimum of 180 cu. ft./min. (5 cu. m/min.) of clean and dry compressed air. Maintain the air lance perpendicular to the surface and the tip of the air lance within 12 in. (300 mm) of the surface. Install HFST within the same working day as the completed air wash.

(a) Projects Greater Than or Equal to 300 sq. yd. (250 sq. m). The epoxy resin binder and aggregate shall be applied by a HFST application machine in a single pass on projects with a total HFST quantity of at least 300 sq. yd. (250 sq. m). The binder shall be mixed per the manufacturer's recommendations and applied at a uniform rate with a uniform thickness of 55-65 mils (1.4-1.7 mm). The aggregate shall be applied at a uniform rate to ensure complete coverage of the "wet" epoxy resin binder.

The binder shall not be allowed to separate in the mixing lines, cure, dry, chill, set up, or otherwise impair retention bonding to the aggregate. The Contractor shall ensure that no seams are visible in the middle of the traffic lanes of the finished work.

(b) Projects Less Than 300 sq. yd. (250 sq. m). HFST application machine according to Article 409.09(a) or manual application shall be used on projects with a total HFST quantity less than 300 sq. yd. (250 sq. m).

For manual application, the binder shall be mixed to the manufacturers recommended proportion within 4 percent by weight using a low-speed high torque drill fitted with a helical stirrer and applied manually at a uniform rate with a uniform thickness of 55-65 mils (1.4-1.7 mm) using a serrated edged squeegee.

The aggregate shall be applied immediately and uniformly across the treated area without displacing the wet epoxy resin film, whether by mechanical or manual means to ensure complete coverage. Additional aggregate shall be applied to any remaining "wet" areas to ensure complete coverage of the epoxy resin binder.

The Contractor shall not compact or force embedment of the aggregate after placement.

409.10 Curing and Clean Up. Allow the treatment to cure following epoxy resin manufacturer recommendations. Perform three separate clean-up processes by removing the excess aggregate with a regenerative air vacuum sweeper on the treated area and adjacent areas. Perform initial clean-up before opening to traffic. Excess aggregate may be reused on

the following day's installation provided the aggregate is clean, uncontaminated, and dry. Perform secondary clean-up three to five (3-5) days after construction. Perform final clean-up three to five (3-5) weeks after construction. No loose aggregate shall remain after final clean-up.

409.11 Sampling and Testing. During the first day of placing HFST, 0.125 gal. (0.5 L) samples of each component of the epoxy resin binder and two 40 lb. (18 kg) sample bags of aggregate shall be submitted to the Department. The Contractor shall supply and label the samples under observation of the Engineer.

The finished HFST will be tested by the Department within 60 days after construction and shall meet the following requirements.

Field Acceptance Testing Requirements			
Property	Requirements	Frequency	Test Method
FN40R OPTIONAL	72 min.	Every 0.1 mile in each lane.	ASTM E 274 (Ribbed tire)
Mean Profile Depth (mm) OPTIONAL	1.0 min.	1 per each location, or 1 per every 1,500 lane-feet, whichever is shorter.	ASTM E 2157

409.12 Method of Measurement. High friction surface treatment will be measured for payment in Square Yards (sq. m).

Pavement patching will be measured for payment according to Article 442.10.

Pavement marking removal will be measured for payment according to Article 783.05.

Crack/joint filling will be measured for payment in Feet (Meters), measured along the crack.

409.13 Basis of Payment. High friction surface treatment will be paid for at the contract unit price per Square Yard (Square Meter) for HIGH FRICTION SURFACE TREATMENT.

Pavement patching will be paid according to Article 442.11.

Pavement marking removal will be paid according to Article 783.06.

Crack/joint filling will be paid for at the contract unit price per Foot (Meter) for "HIGH FRICTION SURFACE TREATMENT CRACK FILLING."

Add the following Article to the Standard Specifications:

"**1004.08 Coarse Aggregate for High Friction Surface Treatment.** The aggregate shall be calcined bauxite that is clean, dry, free from foreign matter, non-friable, non-polishing, durable and conforms to the requirements of AASHTO M 354, Table 4. Calcined bauxite shall be delivered to the construction site in clearly labeled packaging that protects the aggregate from any contaminants on the job site and exposure to rain or other moisture. All packages shall be labeled with the supplier, the manufacturer or source name, and the location of processing. The aggregate shall be on the Department's qualified product list "High Friction Surface Treatment".

Safety data sheets, technical data sheets, and other information about the safe practices for the storage, handling, and disposal of the materials, and their health hazards shall be obtained

from the manufacturer and posted in storage areas. A copy of such information shall be provided to the Engineer."

Add the following Section to the Standard Specifications:

"**SECTION 1034 EPOXY RESIN BINDER**

1034.01 Epoxy Resin Binder. The binder shall consist of a two-part exothermic epoxy resin which conforms to the requirements of AASHTO M 354, Table 1. The epoxy resin shall be packaged in sealed containers, labeled with the type of material and the ratio of components to be mixed by volume. Each packaged component shall display the type (resin or hardener), brand name, name of the manufacturer, lot number, temperature range for storage, expiration date, and quantity. Each container shall be labeled with the appropriate caution warnings regarding contact with the component. The epoxy resin binder shall be on the Department's qualified product list "High Friction Surface Treatment".

Safety data sheets, technical data sheets, and other information about the safe practices for the storage, handling, and disposal of the materials, and their health hazards shall be obtained from the manufacturer and posted in storage areas. A copy of such information shall be provided to the Engineer."

Add the following Article to the Standard Specifications:

"**1101.21 HFST Application Machine.** The HFST application machine shall be a self-propelled, fully or semi-automated truck-mounted applicator machine capable of continuously mixing and applying resin and aggregate at a uniform thickness and rate in varying widths of up to 12 ft. (3.6 m). Equipment shall be calibrated according to the manufacturer's recommendations. The quantity of all components shall be metered, controlled, and verifiable.

The aggregate shall be applied by a drop spreader capable of mechanically, continuously, and uniformly spreading bauxite aggregate. The aggregate spreader shall meet the requirements of the epoxy resin binder manufacturer."

Add the following Article to the Standard Specifications:

"**1101.22 Regenerative Air Vacuum Sweeper.** The regenerative air vacuum sweeper shall be self-propelled with power brooms capable of cleaning the existing pavement and removing loose aggregate without dislodging the bonded aggregate. The regenerative air vacuum sweeper shall blast re-circulated, filtered air through a vacuum head having a minimum width of 6 ft. (1.8 m) at a minimum rate of 20,000 cu. ft./min (560 cu. m/min.). The regenerative air vacuum sweeper shall be capable of recycling loose aggregate into clean, uncontaminated, and dry aggregate. The regenerative air vacuum sweeper shall be capable of being used without water for dust suppression to ensure a dry surface will be maintained."