

Special Specification 3014

High Friction Surface Treatment



1. DESCRIPTION

Furnish and apply a high friction surfacing system in accordance with this Specification and the details shown on the plans.

Ensure the manufacturer's representative is present at the construction site to train Department and Contactor personnel before placing the surface treatment and remains available during the application as necessary.

2. MATERIALS

2.1. **General.** Furnish a high friction surface treatment (HFST) containing polymer binder capable of retaining a bauxite aggregate topping under vehicular traffic conditions.

2.2. **Polymer Binder Resin System.** Provide a binder resin system recommended by the manufacturer as suitable for use on the intended pavement surface and for the potential range of atmospheric exposure.

Table 1
Polymer Binder Resin System Requirements

Property	Test Method	Requirement
Viscosity	ASTM D-2556	7 – 30 poises
Gel Time	ASTM C-881	10 minutes min
Ultimate Tensile Strength	ASTM D-638	2,500 – 5,000 psi
Elongation at Break Point	ASTM D-638	30% – 70%
Durometer Hardness (shore D)	ASTM D-2240	60 – 80
Compressive Strength	ASTM C-579	1,000 psi min at 3 hours 5,000 psi min at 7 days
Cure Rate (dry through time)	ASTM D-1640	3 hours max
Water Absorption	ASTM D-570	1% max
Adhesive Strength	ASTM C-1583	250 psi min or 100% substrate failure

2.3. **Aggregate Topping.** Furnish an aggregate topping that is calcined bauxite consisting of a 1-3 mm gradation. Ensure the aggregate is delivered to the construction site in clearly labeled 55 lb. bags or 2,200 lb. super sacks. Provide aggregate that is clean, dry, and free from foreign matter. Provide aggregate that meets the requirements of Table 2.

Table 2
Aggregate Requirements

Property	Test Method	Requirement
Aggregate Grading		No. 6 Percentage Passing 95% min No. 16 Percentage Passing 5% max
Aggregate Abrasion Value	LA Abrasion ASTM	10% max
Loss at 100 rev	C-131	
Aggregate Acid Insolubility	Tex-512-J	Greater than 90%
Aggregate Magnesium	Tex-411-A	30% max
Soundness	(Stockpile gradation)	
Aluminum Oxide Content	ASTM C-25	87% min

- 2.4. **Certification.** Provide an independent laboratory report showing that the polymeric binder meets the requirements of this section. Submit certification from the manufacturer that the aggregate topping meets the above requirements. Submit documentation of the in-place friction characteristics (minimum 65 FN40R in accordance with ASTM E274) of aggregate bonded to a vehicular bearing surface using the polymer binder. Supply a sample of the resin binder or components lot/batch upon request.

3. CONSTRUCTION

- 3.1. **General.** Do not apply the modified polymer binder on a wet surface, when the surface temperature is below 55°F or the ambient temperature is above 105°F unless the manufacturer provides test data demonstrating a cure rate (dry through time) of 3 hours maximum when cured at representative temperatures. Do not apply the polymer binder when the anticipated weather conditions would prevent the proper application of the surface treatment as determined by the manufacturer's representative. Do not place the HFST with visible moisture on the prepared surface. Test for moisture in the pavement by taping an 18"x18" plastic sheet to the pavement per ASTM D4263. Perform the plastic sheet test only when surface temperatures and ambient conditions are within the established parameters for application of the overlay system. In the event of rain, the pavement must be allowed to air dry for a minimum of 24 hours prior to performing the plastic sheet test. A 2-hour minimum test duration is allowed in lieu of the 16 hours specified in ASTM D4263.

- 3.2. **Preparation.** For applications on new pavements, install the high friction polymer binder and aggregate topping a minimum of 30 days after placing the underlying and adjacent asphalt pavement to reduce the likelihood of "tracking."

Protect utilities, drainage structures, curbs, and any other structure within or adjacent to the treatment location against the application of the surface treatment materials. Cover and protect existing pavement markings that are adjacent to the application surfaces as directed. Remove existing or temporary pavement markings that conflict with the surface application in accordance with Item 677, "Eliminating Existing Pavement Markings and Markers," except for Measurement and Payment.

Clean asphalt pavement surfaces using mechanical sweepers and high pressure air wash with sufficient oil traps. Mechanically sweep all surfaces to remove dirt, loose aggregate, debris, and deleterious material. Vacuum sweep or air wash using a minimum of 180 cfm of clean and dry compressed air, all surfaces to remove all dust, debris, and deleterious material. Maintain air lance perpendicular to the surface and the tip of the air lance within 12 inches of the surface.

Clean concrete pavement surfaces by shot blasting and vacuum sweeping. Shot blast all surfaces to remove all curing compounds, loosely bonded mortar, surface carbonation, and deleterious material. Ensure that the prepared surface complies with the International Concrete Repair Institute (ICRI) standard for surface roughness CSP 5. After shot blasting, vacuum sweep or air wash, with a minimum of 180 cfm of clean and dry compressed air, all surfaces to remove all dust, debris, and deleterious material. Maintain air lance perpendicular to the surface and the tip of the air lance within 12 inches of the surface.

Treat joints and cracks greater than 1/4 in. in width and depth with the mixed polymer specified in this specification. Once the polymer in the pre-treated areas has gelled, the high friction polymer binder and aggregate topping installation may proceed.

- 3.3. **Control Strip.** Complete a trial of HFST before starting HFST production work. The control strip shall:

- Be paid for as part of the project if successful,
- Be a minimum of 8 feet wide by 20 feet long and done within the limits of the project, and
- Be constructed using the same equipment as the production work.

Replicate field conditions, including ambient and surface temperatures, anticipated for the production work. Demonstrate surface preparation requirements. Remove pavement markers within the area to receive HFST, for the lane and length involved, prior to placing polymer binder resin system. Document the settings on the applicator equipment, initial quantities of polymer binder resin and aggregate topping, and unused quantities of resin and aggregate topping remaining in the applicator equipment after applying the HFST. Determine the "Dry through time" for the polymer binder resin system. Have temporary or permanent

pavement markers and delineation in place when lanes are open to traffic. Determine that work can be completed within time permitted.

- 3.4 **Mixing and Application Methods.** Utilize one of the following methods to apply the polymer binder and aggregate wearing course, as shown in the plans. Utilize the automated continuous application (method 1) on areas greater than 250 feet in length. If mechanical application equipment is used, take 2 ounce samples for each 100 gallons of resin placed to verify mix ratios and curing times. Place samples at the roadway shoulder and ensure that the gel time is within proper range in accordance with the manufacturer's recommendation.

- 3.4.1 **Automated Continuous Application.** Ensure that the applicator continuously mixes, meters, monitors and applies the resin binder and high friction aggregate in one continuous application pass with a single self-containing application unit.

Ensure that the applicator vehicle is equipped with an inbuilt data management unit which is capable of producing real time data flow showing the volume of resin, the resin mil thickness on average throughout the application width and the volume of aggregate applied throughout the application width. The automated continuous application vehicle must have continuous pumping and portioning devices that blend the polymer binder within a controlled system. Ensure the polymer binder is blended and mixed in the ratio per the manufacturer's specification (+/- 2% by volume); the polymer binder must be continuously applied once blended. The application vehicle should be capable of applying the minimum polymer binder spread rate.

The high friction aggregate must be applied by the same automated continuous application vehicle that applies the resin binder to the pavement section. The automatic aggregate spreader must be capable of applying up to a continuous 12 foot width application. The high friction aggregate must be applied within 3 seconds (+/- 1 sec) of the base polymer binder application onto the pavement section, from a maximum height of 12 inches from above the pavement section surface, at the minimum spread rate. Recovered bauxite aggregate may only be reused once. The recovered bauxite must be blended with new bauxite at a rate of 2:1 (two parts of new bauxite to one part of recovered bauxite). Provide a written record of the recovered bauxite aggregate and mark the containers containing the recovered bauxite aggregate as follows, "Recovered Bauxite" with the project number.

Ensure no exposed wet spots of the polymer binder are visible once the aggregate is installed. The operations 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 high friction surfacing aggregate, walking, standing or any form of contact or contamination with the wet uncured resin will result in that section of resin being removed and replaced at the contractor's expense.

- 3.4.2 **Hand Mixing and Application.** For areas deemed to be low volume and areas less than 250 feet in length, hand-mix the resin binder in accordance to the manufacturer's recommendations. Uniformly spread the resin binder onto the surface using a serrated edge squeegee. Immediately broadcast the high friction surfacing aggregates until refusal. Reuse the excess aggregate by reclaiming with a mechanical sweeper. Ensure the recovered aggregate is clean, uncontaminated and dry. Recovered bauxite aggregate may only be reused once. The recovered bauxite must be blended with new bauxite at a rate of 2:1 (two parts of new bauxite to one part of recovered bauxite). Provide a written record of the recovered bauxite aggregate and mark the containers containing the recovered bauxite aggregate as follows, "Recovered Bauxite" with the project number.

Remove the excess and loose aggregate from the traveled way and shoulders by street sweeping. Application of HFST on highway ramps requires a second street sweeping 24-48 hours after application on the ramp.

Protect utilities, drainage structures, curbs, and any other structures within or adjacent to the treatment location against the application of the HFST materials.

When magnesium phosphate concrete is placed prior to the HFST bridge deck overlay, the magnesium phosphate concrete must be placed at least 72 hours prior to placing the polymer resin binder.

When modified high alumina based concrete is placed prior to the HFST bridge deck overlay, the polymer resin binder must not be placed on the concrete until at least 30 minutes after final set of the modified high alumina based concrete.

Adequately isolate expansion joints and deck drains prior to applying HSFT.

Before opening HFST areas to traffic, test for the coefficient of friction per ASTM E1911. Provide results to the Engineer on the same working day that the tests are performed.

4.**MEASUREMENT**

High Friction Surface Course will be measured by the square yard of completed and accepted work. No deduction will be made for the areas occupied by manholes, inlets, drainage structures, pavement markings, or by any public utility appurtenances within the area.

This is a plans quantity item. The quantity to be paid is the quantity shown in the proposal, unless modified by Article 9.2, "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

PAYMENT

The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid for "High Friction Surface Course." This price is full compensation for surface preparation, furnishing, preparing, hauling and placing materials including epoxy binder, removing existing pavement markings and excess aggregate as needed, and for labor, tools, equipment, and incidentals.