# High Friction Surface Treatment NJSP-15-13B

**1.0 Description.** This work shall consist of furnishing and placing a High Friction Surface Treatment (HFST) on asphalt or concrete pavement.

**1.1** The HFST shall be comprised of surface preparation and a minimum of a single layer using a Binder Resin System which holds a surface applied aggregate firmly in place. The Binder Resin System shall include Polymeric or Methl Methacrylate (MMA) Resins.

**2.0 Material.**

**2.1.1 Resin Binder System.** Resin Binder Systems shall be recommended by the manufacturer as suitable for use on the intended pavement surface and for the potential range of atmospheric exposure.

**2.1.2** The contractor shall furnish and install a Resin Binder System that meets the criteria in (AASHTO PP 79-14 Table 1):

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| **Table 1 - Resin Binder System** | | | |
| **Property** | **Test Method** | **Requirements** | |
| **Polymeric Resin** | **MMA** |
| Ultimate Tensile Strength | AASHTO M-235 | 2500-5000 psi | 1500-5000 psi |
| Elongation at break point | AASHTO M-235 | 30-70% | 30-70% |
| Compressive Strength | ASTM C 579 | 1000 psi min. at  3 hours  5000 psi min. at  7 days | 1000 psi min. at  3 hours  2000 psi min. at  7 days |
| Water Absorption | AASHTO M-235 | 1% max. | 1% max. |
| Durometer Hardness  (Shore D) | ASTM D-2240 | 60-80 | 40-75 |
| Viscosity | ASTM D-2556 | Class C:  7-30 poises | Class C:  12-20 poises |
| Gel Time | AASHTO M-235 | Class C:  10 minutes min. | Class C:  10 minutes min. |
| Cure Rate (Dry through time) | ASTM D-1640 | 3 hrs. max. | 3 hrs. max. |
| Adhesive Strength at  24 hours | ASTM D 4541 | 250 psi min. or  100% substrate failure | 250 psi min. or 100% substrate failure |

**2.1.3** Independent laboratory reports per formulation shall be provided, documenting that the resin binder meets the requirements of this specification. A sample of the resin binder or components lot/batch shall be supplied upon request.

**2.1.4** At the request of the engineer, the manufacturer of the Resin Binder System shall certify that the Resin Binder System meets the requirements of this specification. Such certification shall consist of either a copy of the manufacturer’s test report or a statement by the manufacturer, accompanied by a copy of the current test results, that the Resin Binder System has been sampled and tested. Such certification shall indicate the date of testing and shall be signed by the manufacturer.

**2.2.1** **Aggregate.** The contractor shall furnish and install a high friction aggregate that is clean, dry and free from deleterious material. The high friction aggregate shall be Calcined Bauxite for this project.

**2.2.2** The calcined bauxite aggregate shall meet the criteria in Table 2:

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| **Table 2 - Calcined Bauxite Aggregate** | | |
| **Property** | **Test Method** | **Requirement** |
| Resistance to Degradation | AASTHO T-96 | 20% max. |
| Aggregate Grading | AASHTO T-27 | No. 4 Percent Passing 100% min. No. 6 Percent Passing 95% min. No. 16 Percent Passing 5% max. |
| Moisture Content | AASHTO T-255 | 0.2% max. |
| Aluminum Oxide | ASTM C-25 | 87% min. |

**2.2.3** All aggregates shall be furnished in appropriate packaging that is clearly labeled and protects the aggregate from any contaminates on the jobsite and from exposure to rain or other moisture.

**2.2.4** At the request of the engineer, the manufacturer of the aggregate shall certify that the aggregate meets the requirements of this specification. Such certification shall consist of either a copy of the manufacturer’s report or a statement by the manufacturer, accompanied by a copy of the current test results, that the aggregate has been sampled and tested. Such certification shall indicate the date of testing and shall be signed by the manufacturer.

**2.2.5** Test methods should be in accordance with AASHTO PP 79-14.

**3.0 Construction Requirements.** A manufacturer’s representative of the Resin Binder System shall be present at the jobsite during all construction operations relating to the preparation and placement of the HFST. All construction operations relating to the HFST shall meet the recommendations of the manufacturer’s representative. Final approval of all HFST placement operations will be given by the engineer.

**3.1 Weather Limitations.** Resin Binder system shall not be placed on any wet surface or when the ambient temperature or the temperature of the pavement is above or below the manufacturer’s recommendations or when the anticipated weather conditions would prevent the proper application of the surface treatment as directed by the manufacturer’s representative. Temperatures shall be obtained in accordance with MoDOT Test Method TM 20.

**3.2 Surface Preparations.** The surface shall be thoroughly cleaned immediately prior to installation of the HFST. The surface shall be clean, dry and free of all dust, oil, debris and any other material that might interfere with the bond between the resin binder material and the existing surface as recommended by the manufacturer’s representative.

**3.2.1** The contractor shall pre-treat joints and cracks greater than ¼ inch in width and depth with the mixed Resin Binder System. Once the resin binder in the pre-treated areas has gelled, the installation of the HFST may proceed.

**3.2.2 Asphalt Pavement.** 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. HFST shall not be applied to newly placed asphalt pavement surfaces that are less than 30 days old.

**3.2.3 Concrete Pavement.** 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. The prepared surface shall comply 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.

**3.2.4** All existing edge line pavement markings that are adjacent to the HFST location shall be covered and protected as approved by the engineer prior to performing surface preparation. HFST shall not be placed over existing pavement markings or rumble strips. Lane line pavement markings that conflict with the HFST installation shall be removed by methods approved by the manufacturer’s representative. Any existing edge line pavement markings that are damaged during the HFST application process shall be replaced at the contractor’s expense.

**3.3** HFST shall be allowed to cure for the minimum duration as recommended by the binder component supplier’s specifications and during that time the application area shall be closed to all vehicles and contractor’s equipment traffic. After placement and cure of the HFST, the contractor shall test the finished surface in accordance with ASTM D7234 to detect unbonded areas.

**3.4** Excess and loose aggregate shall be removed from the traveled way and shoulders in such a way that the HFST is not damaged or disturbed. Excess aggregate that can be reused shall be reclaimed by a vacuum sweeper. The recovered aggregate shall be clean, uncontaminated and dry, if it is to be re-used in the HFST application. All reclaimed aggregate must be in conformance with the requirements in Section 2.0. Material.

**3.5** Utilities, drainage structures, curbs and any other structures within or adjacent to the treatment location shall be protected against the application of the HFST materials.

**3.6 Surface Friction Test.** The surface friction of the completed HFST shall meet a minimum requirement of 65 FN40R from the ASTM E274 test. MoDOT will perform this test, at the expense of the Commission, within 7 calendar days after completion of the HFST. In order to allow for adequate scheduling time for the surface friction test, the contractor shall provide an anticipated completion date of the HFST for each segment of roadway being treated in this contract. The contractor shall provide this date(s) to the engineer a minimum of two weeks prior to any anticipated completion date of the HFST.

**3.6.1** Any surface that fails to conform to the above friction requirement must be removed and replaced at the contractor’s expense within 24 hours after being notified by the engineer.

**3.7 Surface Quality Verification.** The engineer will check the HFST surface for areas of debonding or excessive loss of aggregate fourteen days after completion of the HFST. Any deficiencies found shall be corrected at the contractor’s expense.

**4.0 Application Methods.** HFST shall be applied in accordance with the manufacturer’s recommendations. The HFST can be applied by either mechanical or manual techniques.

**4.1** The Resin Binder System shall be blended and mixed in the ratio per the manufacturer’s specification (+/- 2% by volume) and shall be continuously applied once blended.

**4.1.1** The Resin Binder System shall be applied at a uniform thickness of 50-65 mils (25-32 square feet per gallon). Coverage rate is based upon expected variances in the surface profile of the pavement.

**4.1.2** The operation shall 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 aggregate.

**4.1.3** The high friction aggregate shall be immediately applied at a rate of 12-15 pounds per square yard (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 high friction aggregate.

**4.1.4** Wet spots shall be covered with the high friction aggregate prior to the gelling of the Resin Binder System.

**4.1.5** Walking, standing on, or any form of contact or contamination with the wet uncured Resin Binder System without spiked shoes as approved by the engineer, prior to application of the aggregate, will result in that section of Resin Binder System being removed and replaced at the contractor’s expense.

**4.1.6** Applications on high speed highways such as interstate, interstate ramps, and bridge decks will require additional sweeping three days after the initial installation is completed to remove excess and loose aggregate from the traveled way and shoulders.

**5.0** **Method of Measurement.** Final measurement of the completed HFST will not be made except for authorized changes during construction, or where appreciable errors are found in the contract quantity. When required, measurement of HFST, complete in place, will be made to the nearest square yard. The revisions or correction will be computed and added to or deducted from the contract quantity.

**6.0**  **Basis of Payment.** The accepted quantity of HFST, in place, will be paid for at the contract unit price bid for Item Number 413-99.05, “High Friction Surface Treatment-Bauxite”, per square yard. The contract price per square yard of HFST shall include full compensation for all labor, materials, tools, equipment, testing and incidental items necessary to complete the described work.