# Department of Transportation

## Office of Project Development

**700 E Broadway Avenue**
**Pierre, South Dakota 57501-2586 605/773-3268**
**FAX: 605/773-6608**


June 27, 2014

**ADDENDUM NO. 1**

**RE: Item #9, July 16, 2014 Letting – PH 2292(96)5 PCN 04U2 Minnehaha County – High Frction Surface Treatment**

**TO WHOM IT MAY CONCERN:**

The following addenda to the plans shall be inserted and made a part of your proposal for the referenced project.

**SPECIAL PROVISIONS:**

Pen and Ink Revision – On the fourth paragraph of the NOTICE TO CONTRACTORS delete "Work Type 8."

Please remove the Special Provisions checklist and replace with attached Special Provisions checklist revised 06/27/14.

Please remove the "Special Provision for Specialty Work Classification", dated 6/20/14 and the "Special Provision for High Friction Surface Treatment", dated 6/19/14 and replace with the attached "Special Provision for Specialty Work Classification", dated 6/26/14 and the Special Provision for High Surface Treatment, dated 6/26/14.

**BID ITEM FILE:** No Revisions

**PLANS:** No Revisions

Sincerely,

Sam Weisgram
Engineering Supervisor

CC: Craig Smith, Mitchell Region Engineer
Travis Dressen, Sioux Falls Area Engineer

**REV.** 06/27/14

SPECIAL PROVISIONS

**PROJECT NUMBER(S): PH 2292(96)5 PCN: 04U2**

**TYPE OF WORK: HIGH FRICTION SURFACE TREATMENT**

**COUNTY: MINNEHAHA**

The following clauses have been prepared subsequent to the Standard Specifications for Roads and Bridges and refer only to the above described improvement, for which the following Proposal is made. In case of any discrepancy or conflict between said specifications and these Special Provisions, the latter are to govern.

The Contractor's attention is directed to the need for securing from the Department of Environment & Natural Resources, Foss Building, Pierre, South Dakota, permission to remove water from public sources (lakes, rivers, streams, etc.). The Contractor should make his request as early as possible after receiving his contract, and insofar as possible at least 30 days prior to the date that the water is to be used.

Greg Johnson is the official in charge of the Sioux Falls Career Center for Minnehaha County.

**THE FOLLOWING ITEMS ARE INCLUDED IN THIS PROPOSAL FORM:**

**Special Provision for Specialty Work Classification, dated 06/26/14**

**Special Provision for Contract Time & lane Rental, dated 6/19/14.**

**Special Provision for High Friction Surface Treatment, dated 06/26/14**

**Special Provision for Epoxy Pavement Markings, dated 6/16/14.**

Special Provision for Contractor Administered Preconstruction Meeting, dated 4/18/13.
Special Provision for Electronic Bidding Requirements, dated 12/18/13.
Special Provision for Fuel Cost Adjustment, dated 7/13/06.
Special Provision for Differing Site Conditions, dated 12/19/13.
Special Provision for Suspension of Work, dated 2/13/04.
Standard Title VI Assurance, dated 7/14/08.
Special Provision For Disadvantaged Business Enterprise, dated 12/19/12.
Special Provision For EEO Affirmative Action Requirements on Federal and Federal-aid Construction Contracts, dated 9/1/97.
Special Provision For Required Contract Provisions Federal-aid Construction Contracts, Form FHWA 1273 (Rev. May/1/12), dated 4/30/13.
Required Contract Provisions Federal-aid Construction Contracts, Form FHWA 1273 (Rev. 5/1/12).
Special Provision Regarding Minimum Wage on Federal-Aid Projects, dated 4/30/13.
Wage and Hour Division US Department of Labor Washington DC.

- US Dept. of Labor Decision Number SD100010, dated 8/30/13.

Supplemental Specification for Errata, dated 3/3/10.

Supplemental Specification to Standard Specifications for Roads and Bridges, dated 3/3/10.

Special Provision for Price Schedule for Miscellaneous Items, dated 9/26/13.

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# STATE OF SOUTH DAKOTA
# DEPARTMENT OF TRANSPORTATION

## SPECIAL PROVISION
## FOR
## SPECIALTY WORK CLASSIFICATION

## PROJECT PH 2292(96)5, PCN 04U2
## MINNEHAHA COUNTY

## JUNE 26, 2014

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In accordance with the Special Provision for Electronic Bidding Requirements, prequalification on state highway construction contracts is required unless the amount being bid is less than $200,000.

For this project, a prospective bidder must submit a Contractor's prequalification statement on a form approved by the Department (Contractor Prequalification Statement Form), in accordance with the Special Provision for Electronic Bidding Requirements, to request prequalification for specialty work. The application must include the prospective bidder's qualification requirements contained in the Special Provision for High Friction Surface Treatment as described below.

> The Contractor shall provide documentation of experience for the Contractor's superintendent placing the HFST. The Contractor's superintendent shall have a minimum of 2 years and 10,000 yd2 HFST experience on projects with other state highway agencies.

For this project, High Friction Surface Treatment is considered specialty work but is not considered a "specialty item" as specified in Section 8.1 of the specifications and all requirements of Section 8.1 will apply.

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# STATE OF SOUTH DAKOTA
# DEPARTMENT OF TRANSPORTATION

# SPECIAL PROVISION
# FOR
# HIGH FRICTION SURFACE TREATMENT

## PROJECT PH 2292(96)5, PCN 04U2
## MINNEHAHA COUNTY

## JUNE 26, 2014

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## I. DESCRIPTION

This work consists of construction of a High Friction Surface Treatment (HFST) using calcined bauxite aggregate bound with a polymeric resin binder.

## II. MATERIALS

**A. Polymeric Resin Binder:** The polymeric resin binder shall be either a polymer resin binder or an epoxy resin binder. The polymeric resin binder shall consist of a two-part resin binder/compound which holds the calcined bauxite aggregate firmly in position and conforms to the requirements of Table 1. The polymeric resin binder shall be certified to meet the requirements of Table 1. The certification shall contain test results from an accredited laboratory for the properties listed in Table 1.meeting the following requirements.

**Table 1**

| Polymeric Resin Binder Requirements | | |
|---|---|---|
| Property | Requirements | Test Method |
| Viscosity (Class C), poises | 7-30 | ASTM D2556 |
| Gel Time (Class C), minutes | 10 Minimum | AASHTO M 235 |
| Ultimate Tensile Strength, psi | 2,500 Minimum | AASHTO M 235 |
| Elongation at Break Point | 30-70% | AASHTO M 235 |
| Durometer Hardness (Shore D) | 60-80 | ASTM D2240 |
| Compressive Strength, psi | 1,600 Minimum | AASHTO M 235 |
| Cure Rate (Dry through time), hours | 3 Maximum | ASTM D1640<br>5 mil thickness @ 75 Deg F |
| Water Absorption | 1% Maximum | AASHTO M 235 |

| | | |
|---|---|---|
| Adhesion Strength, psi @ 24 hrs. | 250 Minimum or 100% Substrate Failure | ASTM C1583 |
| Mixing Ratio | Per Manufacturer | Provide manufacturer's recommendations a minimum of 15 days prior to construction. |
| Permeability to Chloride Ion @ 28 | Less than 100 | AASHTO T 277 |

**B. Calcined Bauxite Aggregate:** The material shall be clean, dry, free from foreign matter, and conform to the requirements in Table 3. The Contractor shall deliver the calcined bauxite aggregate to the construction site in clearly labeled containers. The calcined bauxite aggregate shall be certified to meet the requirements of Table 2. The certification shall contain the test results from an accredited laboratory for the properties listed in Table 3.

**Table 2**

| **Calcined Bauxite Aggregate Requirements** | | |
|---|---|---|
| Property | Requirements | Test Method |
| Mohs Hardness | 7.0 Minimum | Mohs |
| Polish Stone Value | 65 Minimum | ASTM E660 |
| Gradation | 100.0% Passing No. 4<br>95.0% - 100.0% Passing No. 6<br>0.0% - 5.0% Passing No. 16 | AASHTO T 27 |
| Moisture Content | 0.2% Maximum | AASHTO T 255 |
| Aluminum Oxide | 87% Minimum | ASTM C25 |
| Apparent Specific Gravity | 3.1 Minimum | AASHTO T 84 |
| Sodium Sulfate Soundness | 12% Maximum | AASHTO T 104 |
| LA Abrasion Test | 30% Maximum.<br>Test sample gradation differs from gradation requirements. | AASHTO T 96 (C grading) |

## III. CONSTRUCTION REQUIREMENTS

### A. General:

1. **Qualifications:** The Contractor shall provide documentation of experience for the Contractor's superintendent placing the HFST. The Contractor's superintendent shall have a minimum of 2 years and 10,000 $yd^2$ HFST experience on projects with other state highway agencies.

2. **Quality Control (QC) Plan:** The Contractor shall submit a QC plan to the Engineer for approval at least 15 days prior to the placement of the HFST. The QC plan shall show proposed methods to control the equipment,

materials, mixing, and placement operations to ensure conformance with these specifications. The Contractor shall discuss the QC plan at the preconstruction meeting and as requested by the Engineer.

At a minimum, the QC plan shall contain the following:

**a.** Key Personnel and Contact Information.

**1)** The QC plan shall designate a plan administrator, who shall have full authority to institute any action necessary for the successful operation of the plan. The plan administrator shall be available on the jobsite within one hour after being notified of a concern.

**2)** 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 QC plan and contract documents. The Contractor shall 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, without Engineer approval, shall be cause for immediate suspension of operations.

**b.** Polymeric resin binder production plants, locations of plant, personnel qualifications, inspection and record keeping methods, equipment calibration records, accreditation certificates, and minimum frequencies of sampling and testing per Table 1.

**c.** Calcined Bauxite 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.** Calcined Bauxite aggregate storage and moisture control methods.

**e.** Cleaning and maintenance procedures and schedule for mixing and application equipment. The cleaning and maintenance procedures and schedule shall contain the equipment manufacturer's recommendations for maximum allowable time the polymeric resin binder may remain in the application equipment before cleaning of the mixer and application system is required.

**f.** Corrective actions that will be taken for unsatisfactory construction practices.

3. **Weather Limitations:** The Contractor shall not apply the polymeric resin binder material on wet surfaces (including condensation moisture from construction vehicles in front binder application), when the ambient temperature is less than 55ºF or above 105ºF, 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.

4. **Seasonal Limitations:** HFST shall only be applied within the seasonal limitation of May 1 to October 15 (inclusive).

5. **Manufacturer's Representative:** A manufacturer's representative must be present on the jobsite for a minimum of the first two full production days of HFST application.

   The manufacturer's representative shall provide the Engineer and the Contractor with a copy of the written recommendations, technical data sheet, and product safety data sheet. In addition, the Contractor shall make a product safety data sheet available to anyone who will be exposed to the polymeric resin binder materials.

6. **Application Equipment:** The Contractor shall use an approved application machine capable of continuously and thoroughly mixing the polymeric resin binder components to the ratio recommended by the polymeric resin binder manufacturer. The application machine must continuously mix, meter, monitor, and apply the polymeric resin binder. The Contractor shall mechanically spray or squeegee the polymeric resin binder over the application surface area. The Contractor shall use spiked shoes for all walking, standing, or any other form of foot contact with the polymeric resin binder prior to the application of the calcined bauxite aggregate. Construction and public vehicle traffic will not be allowed on the HFST until the HFST has completely cured. The Contractor shall replace contaminated sections of polymeric resin binder at no additional cost to the Department.

   The application machine must have continuous pumping and proportioning devices which blend the polymeric resin binder within a controlled system. The polymeric resin binder must be blended and mixed to the ratio under the manufacturer's recommendations (+/- 2 percent by volume). The polymeric resin binder must be continuously applied once blended.

   Broadcasting of the calcined bauxite aggregate material shall be by equipment capable of variable width dispensing of the calcined bauxite aggregate material on the roadway in a uniform manner as approved by the manufacturer of the polymeric resin binder. Calcined bauxite

aggregate must be broadcast in a manner which will not disturb the leveling of the polymeric resin binder.

Exposed uncured mixed polymeric resin binder must not be visible after the calcined bauxite aggregate is applied. If exposed uncured mixed polymeric resin binder is visible after applying the calcined bauxite aggregate, the Contractor shall apply calcined bauxite aggregate to the exposed areas using an approved application method.

The Contractor shall not allow the mixed polymeric resin binder to separate, cure, dry, be exposed, or harden which may impair retention and bonding of the calcined bauxite aggregate.

7. **Test Section:** The Contractor shall construct a test section (minimum of 200 SY) at a self-determined location 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, the Contractor shall open the test section to traffic after curing has completed, and no uncovered polymeric resin binder remains exposed. The Contractor shall correct deficient areas before opening to traffic as directed by the Engineer at no additional cost. At the completion of the test section, the Contractor shall demonstrate the application equipment cleaning procedures.

**B. Bridge Deck Preparation and HFST Application:**

1. **Bridge Deck Preparation:** Surfaces must be clean, dry, and free of all dust, oil, debris and any other material that might interfere with the bond between the polymeric resin binder material and existing surfaces. Adequate cleaning of all surfaces will be determined by the Engineer. The Contractor shall remove pavement markers and delineation within the area to receive HFST prior to placing polymeric resin binder.

   The Contractor shall prepare the bridge deck receiving a HFST in accordance with the following.

   a. **Bridge Deck Grinding:** The bridge deck surface shall be ground prior to placement of a HFST.

      The grinding shall remove the existing surface conditions as defined by the bridge plan notes including, but not limited to; rubberized asphalt chip seal, epoxy chip seal, pavement markings, and tining and shall be to the satisfaction of the Engineer.

      The grinding shall be performed in the longitudinal direction. The grinding shall result in a parallel corduroy texture consisting of grooves between 0.090 and 0.130 inches (2 and 3 mm) wide. The distance

between the grooves shall be between 0.060 and 0.125 inches (1.5 and 3 mm). The peaks of the ridges shall not be greater than 1/16 inch (1.5 mm) higher than the bottom of the grooves. The grinding shall be uniform and shall follow the existing profile of the bridge deck. The grinding process shall not introduce dips and bumps that did not previously exist on the bridge deck surface or in any way decrease the existing riding quality of the bridge deck.

Grinding of the bridge deck shall be accomplished utilizing diamond blades mounted on a self-propelled machine designed for grinding and texturing pavement. The equipment shall be operated in such a manner that it will not damage the underlying deck surface. Grinding equipment that causes ravels, aggregate fractures, or spalls shall not be permitted. Residue or excess water generated by the grinding operations shall be removed with vacuum equipment from the deck surface before the residue has time to set up. Vacuumed residue or excess water shall not be expelled on the approach roadway or shoulder surfaces.

b. **Abrasive Blasting of Bridge Deck:** After grinding and removal and replacement of loose and delaminated concrete, the entire bridge deck surface shall be thoroughly shot blasted to approximately an International Concrete Repair Institute (ICRI) concrete surface profile CSP-5 (medium shot blast) to remove all foreign materials which may interfere with the bonding or curing of the HFST. The shot blasting shall remove all surface laitance and shall expose the coarse aggregate to the satisfaction of the Engineer. Small areas where shot blasting is unable to be performed (curb lines, etc.) shall be cleaned by abrasive blast cleaning to the satisfaction of the Engineer.

Upon completion of the shot blasting and abrasive blasting, the entire bridge deck shall be blown clean with dry compressed air to remove all dust and debris.

Cleaning by shot blasting, abrasive blasting, and compressed air shall be done no more than 24 hours prior to the placement of the HFST. In the event the HFST is not placed within 24 hours of shot blasting and abrasive blast cleaning or in the event of rain or other inclement weather contaminating the surface, the surface shall be re-cleaned by abrasive blast cleaning and dry compressed air.

Only equipment required for the application of the HFST will be allowed on any portion of the bridge deck which has been cleaned and prepared for application of the HFST. If equipment is used on the cleaned and prepared bridge deck, the area shall be protected from contamination with plastic.

2. **Bridge Deck HFST Application:** The Contractor shall apply the HFST on the bridge deck in accordance with the following.

   a. **Polymeric Resin Binder Application Requirements:**

      **1)** The openings of any bridge deck drains shall be temporarily sealed during polymeric resin binder placement as approved by the Engineer.

      **2)** When phased construction of the two coat HFST is required, the Contractor shall maintain a straight line between the phases of polymeric resin binder placement for both layers by masking the line between phases with duct tape, or other material approved by the Engineer. The masking shall be completely removed before the polymeric resin binder achieves initial set and shall be removed in a manner that will not damage the adjacent polymeric resin binder. Overlapping the new HFST onto existing HFST shall not be done.

      **3)** A prime coat, if required by manufacturer, shall be applied according to manufacturer's recommendations and will be applied in addition to the two coats of HFST.

      **4)** The Contractor shall mix the polymeric resin binder components proportionally in accordance with the manufacturer's recommended ratio. The Contractor shall apply the two part modified polymeric resin binder onto the bridge deck section to be treated within the temperature range specified at the manufacturer's recommended application rate. The application rate shall be a minimum of 1 gallon per 40 square feet (1 liter per 1 square meter). The Contractor shall not allow the polymeric resin binder to separate in the mixing lines, cure, dry, chill, set up, or otherwise impair retention bonding of the HFST calcined bauxite aggregate. The Contractor shall ensure no seams are visible in the middle of the traffic lanes of the finished work after application of the HFST calcined bauxite aggregate.

      Hand application may be used for areas less than 300 $yd^2$. For hand applications, the Contractor shall mix the polymeric resin binder components to the correct proportion within 4% by weight using a low speed high torque drill fitted with a helical stirrer.

   b. **Calcined Bauxite Aggregate Application Requirements:**

      **1)** After the polymeric resin binder is distributed on the application area of the bridge deck surface, a broadcast of calcined bauxite aggregate shall be made to refusal such that:

**2)** A uniform layer of calcined bauxite aggregate is attained. *(A non-uniform broadcast will result in an inconsistent HFST thickness and a poor riding bridge deck)*.

**3)** There are no visible shiny wet spots after application.

**4)** The Contractor shall apply the calcined bauxite aggregate at a uniform minimum rate of 13 lbs/yd$^2$. The Contractor shall completely cover the "wet" polymeric resin binder with calcined bauxite aggregate to achieve a uniform surface with no exposed polymeric resin binder remaining visible on the surface before the polymeric resin binder begins to gel. The Contractor must vertically drop the calcined bauxite aggregate material in a manner which will not disturb the level of the polymeric resin binder liquid.

Hand application may be used for areas less than 300 yd$^2$. For hand applications, the Contractor shall sprinkle or vertically drop the calcined bauxite aggregate resulting in a minimum coverage rate of 13lbs/yd$^2$ without splashing or disrupting the leveling of the "wet" polymeric resin binder during placement, whether by mechanical or manual means.

**c. Curing and Clean Up:** The Contractor shall allow the HFST to cure in accordance with the polymeric resin binder manufacturer's recommendations (3 hours maximum at an ambient air temperature of at least 75ºF). The Contractor shall clean up the HFST by removing the excess calcined bauxite aggregate on the treated area and adjacent areas with raveled calcined bauxite aggregate. The Contractor shall perform the clean-up prior to applying the second coat of HFST. The Contractor may reuse excess HFST calcined bauxite aggregate. In order to reuse the reclaimed excess HFST calcined bauxite aggregate, the Contractor must reclaim the excess HFST calcined bauxite aggregate with a mechanical sweeper. The recovered calcined bauxite aggregate must be clean, uncontaminated, and dry.

**d. Second Coat HFST Application:** A second coat of HFST shall be distributed at the manufacturer's recommended application rate. The application rate shall be a minimum of 1 gallon per 20 square feet (2 liters per 1 square meter). The Contractor shall apply the calcined bauxite aggregate as per section III.B.2.b of this special provision. In the event of rain before second coat is applied, the surface shall be dried for 24 hours prior to application. If second coat is not applied within 24 hours or traffic is allowed on the first coat, the bridge deck must be abrasive blasted prior to application. The Contractor shall perform street sweeping before placing pavement markings.

Temporary or permanent pavement markings must be in place prior to opening lanes to traffic.

**C. Bridge Approach Slab Preparation and HFST Application:**

1. **Bridge Approach Slabs Preparation:** Surfaces must be clean, dry, and free of all dust, oil, debris and any other material that might interfere with the bond between the polymeric resin binder material and existing surfaces. Adequate cleaning of all surfaces will be determined by the Engineer. The Contractor shall remove pavement markers and delineation within the area to receive HFST prior to placing polymeric resin binder.

   The Contractor shall prepare the bridge approach slab receiving a HFST in accordance with the following.

   The entire concrete surface shall be thoroughly shot blasted to approximately an International Concrete Repair Institute (ICRI) concrete surface profile CSP-5 (medium shot blast) to remove all foreign materials which may interfere with the bonding or curing of the HFST. The shot blasting shall remove all surface laitance and shall expose the coarse aggregate to the satisfaction of the Engineer. Small areas where shot blasting is unable to be performed (curb lines, etc.) shall be cleaned by abrasive blast cleaning to the satisfaction of the Engineer.

   Upon completion of the shot blasting and abrasive blasting, the entire surface shall be blown clean with dry compressed air to remove all dust and debris.

   Cleaning by shot blasting, abrasive blasting, and compressed air shall be done no more than 24 hours prior to the placement of the HFST. In the event the HFST is not placed within 24 hours of shot blasting and abrasive blast cleaning or in the event of rain or other inclement weather contaminating the surface, the surface shall be re-cleaned by abrasive blast cleaning and dry compressed air.

   Only equipment required for the application of the HFST will be allowed on any portion of the surface which has been cleaned and prepared for application of the HFST. If equipment is used on the cleaned and prepared surface, the area shall be protected from contamination with plastic.

   Surfaces may need to be washed with a mild detergent, rinsed, and dried using a hot compressed air lance.

2. **Bridge Approach Slab HFST Application:** The Contractor shall apply the HFST on the bridge approach slab in accordance with the following.

a. **Polymeric Resin Binder Application Requirements:** The Contractor shall mix the polymeric resin binder components proportionally in accordance with the manufacturer's recommended ratio. The Contractor shall apply the two part modified polymeric resin binder onto the surface to be treated within the temperature range specified. The number of layers (minimum of one) and the application rates of the polymeric resin binder in the various layers shall be as recommended by the manufacturer in order to achieve an average thickness of 60 mils (cured) on the surface. The Contractor shall not allow the polymeric resin binder to separate in the mixing lines, cure, dry, chill, set up, or otherwise impair retention bonding of the HFST calcined bauxite aggregate. The Contractor shall ensure no seams are visible in the middle of the traffic lanes of the finished work after application of the HFST calcined bauxite aggregate.

   Hand application may be used for areas less than 300 $yd^2$. For hand applications, the Contractor shall mix the polymeric resin binder components to the correct proportion within 4% by weight using a low speed high torque drill fitted with a helical stirrer.

b. **Calcined Bauxite Aggregate Application Requirements:** The Contractor shall apply the calcined bauxite aggregate immediately after placing the polymeric resin binder at a uniform minimum rate of 13 $lbs/yd^2$. The Contractor shall completely cover the "wet" polymeric resin binder with calcined bauxite aggregate to achieve a uniform surface with no exposed polymeric resin binder remaining visible on the surface before the polymeric resin binder begins to gel. The Contractor must vertically drop the calcined bauxite aggregate material in a manner which will not disturb the level of the polymeric resin binder liquid.

   Hand application may be used for areas less than 300 $yd^2$. For hand applications, the Contractor shall sprinkle or vertically drop the calcined bauxite aggregate resulting in a minimum coverage rate of 13$lbs/yd^2$ without splashing or disrupting the leveling of the "wet" polymeric resin binder during placement, whether by mechanical or manual means.

c. **Curing and Clean Up:** The Contractor shall allow the HFST to cure in accordance with the polymeric resin binder manufacturer's recommendations (3 hours maximum at an ambient air temperature of at least 75ºF). The Contractor shall clean up the HFST by removing the excess calcined bauxite aggregate on the treated area and adjacent areas with raveled calcined bauxite aggregate. The Contractor shall perform the clean-up prior to opening the section to traffic. The Contractor may reuse excess HFST calcined bauxite aggregate. In

order to reuse the reclaimed excess HFST calcined bauxite aggregate, the Contractor must reclaim the excess HFST calcined bauxite aggregate with a mechanical sweeper. The recovered calcined bauxite aggregate must be clean, uncontaminated, and dry. The Contractor shall perform street sweeping before placing pavement markings. Temporary or permanent pavement markings must be in place prior to opening lanes to traffic.

**D. Portland Cement Concrete Pavement Preparation and HFST Application:**

1. **Portland Cement Concrete Pavement Preparation:** Surfaces must be clean, dry, and free of all dust, oil, debris and any other material that might interfere with the bond between the polymeric resin binder material and existing surfaces. Adequate cleaning of all surfaces will be determined by the Engineer. The Contractor shall remove pavement markers and delineation within the area to receive HFST prior to placing polymeric resin binder.

   The Contractor shall prepare the Portland cement concrete pavement receiving a HFST in accordance with the following.

   The entire surface shall be thoroughly shot blasted to approximately an International Concrete Repair Institute (ICRI) concrete surface profile CSP-5 (medium shot blast) to remove all foreign materials which may interfere with the bonding or curing of the HFST. The shot blasting shall remove all surface laitance and shall expose the coarse aggregate to the satisfaction of the Engineer. Small areas where shot blasting is unable to be performed (curb lines, etc.) shall be cleaned by abrasive blast cleaning to the satisfaction of the Engineer.

   Upon completion of the shot blasting and abrasive blasting, the entire surface shall be blown clean with dry compressed air to remove all dust and debris.

   Cleaning by shot blasting, abrasive blasting, and compressed air shall be done no more than 24 hours prior to the placement of the HFST. In the event the HFST is not placed within 24 hours of shot blasting and abrasive blast cleaning or in the event of rain or other inclement weather contaminating the surface, the surface shall be re-cleaned by abrasive blast cleaning and dry compressed air.

   Only equipment required for the application of the HFST will be allowed on any portion of the surface which has been cleaned and prepared for application of the HFST. If equipment is used on the cleaned and prepared surface, the area shall be protected from contamination with plastic.

Surfaces may need to be washed with a mild detergent, rinsed, and dried using a hot compressed air lance.

2. **Portland Cement Concrete Pavement HFST Application:** The Contractor shall apply the HFST on Portland cement concrete pavements in accordance with the following.

   a. **Polymeric Resin Binder Application Requirements:** The Contractor shall mix the polymeric resin binder components proportionally in accordance with the manufacturer's recommended ratio. The Contractor shall apply the two part modified polymeric resin binder onto the surface to be treated within the temperature range specified. The number of layers (minimum of one) and the application rates of the polymeric resin binder in the various layers shall be as recommended by the manufacturer in order to achieve an average thickness of 60 mils (cured) on the surface. The Contractor shall not allow the polymeric resin binder to separate in the mixing lines, cure, dry, chill, set up, or otherwise impair retention bonding of the HFST calcined bauxite aggregate. The Contractor shall ensure no seams are visible in the middle of the traffic lanes of the finished work after application of the HFST calcined bauxite aggregate.

      Hand application may be used for areas less than 300 $yd^2$. For hand applications, the Contractor shall mix the polymeric resin binder components to the correct proportion within 4% by weight using a low speed high torque drill fitted with a helical stirrer.

   b. **Calcined Bauxite Aggregate Application Requirements:** The Contractor shall apply the calcined bauxite aggregate immediately after placing the polymeric resin binder at a uniform minimum rate of 13 $lbs/yd^2$. The Contractor shall completely cover the "wet" polymeric resin binder with calcined bauxite aggregate to achieve a uniform surface with no exposed polymeric resin binder remaining visible on the surface before the polymeric resin binder begins to gel. The Contractor must vertically drop the calcined bauxite aggregate material in a manner which will not disturb the level of the polymeric resin binder liquid.

      Hand application may be used for areas less than 300 $yd^2$. For hand applications, the Contractor shall sprinkle or vertically drop the calcined bauxite aggregate resulting in a minimum coverage rate of 13$lbs/yd^2$ without splashing or disrupting the leveling of the "wet" polymeric resin binder during placement, whether by mechanical or manual means.

c. **Curing and Clean Up:** The Contractor shall allow the HFST to cure in accordance with the polymeric resin binder manufacturer's recommendations (3 hours maximum at an ambient air temperature of at least 75ºF). The Contractor shall clean up the HFST by removing the excess calcined bauxite aggregate on the treated area and adjacent areas with raveled calcined bauxite aggregate. The Contractor shall perform the clean-up prior to opening the section to traffic. The Contractor may reuse excess HFST calcined bauxite aggregate. In order to reuse the reclaimed excess HFST calcined bauxite aggregate, the Contractor must reclaim the excess HFST calcined bauxite aggregate with a mechanical sweeper. The recovered calcined bauxite aggregate must be clean, uncontaminated, and dry. The Contractor shall perform street sweeping before placing pavement markings. Temporary or permanent pavement markings must be in place prior to opening lanes to traffic.

E. **Field Acceptance Testing:** The Contractor shall ensure the coverage rate of the retained calcined bauxite aggregate is a minimum of 13 lbs/yd$^2$. The Contractor shall remove and reapply HFST where any patches of exposed polymeric resin binder exist, at no additional cost. The Contractor shall perform testing in accordance with Table 3.

**Table 3**

| **Field Acceptance Testing Requirements** | | | |
|---|---|---|---|
| **Property** | **Requirements** | **Frequency** | **Test Method** |
| FN40R (Corrected field FN by adding the correction in Table 4) | 72 Minimum | Every 0.1 mile in each lane. Location determined by SDDOT | ASTM E274 using a ribbed tire |
| Field Dynamic Friction Value | 0.90 Minimum | 1 per each location or 1 per every 1,500 lane feet, whichever is shorter. Location determined by SDDOT | ASTM E1911 |
| Mean Profile Depth (mm) | 1.0 Minimum | 1 per each location or 1 per every 1,500 lane feet, whichever is shorter. Location determined by SDDOT | ASTM E2157 |

**Table 4**

| **HFST Speed Correction Factors for ASTM E274 Testing** | | | | | |
|---|---|---|---|---|---|
| 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 |

## IV. METHOD OF MEASUREMENT

A. **Bridge Deck Grinding:** Measurement will not be made for bridge deck grinding. The plan quantity will be the basis of payment

B. **Abrasive Blasting of Bridge Deck:** Measurement will not be made for abrasive blasting of bridge deck. The plan quantity will be the basis of payment.

C. **Two Coat High Friction Surface Treatment:** Measurement will not be made for two coat high friction surface treatment. The plan quantity will be the basis of payment unless additional applications areas are ordered by the Engineer. No deductions will be made for the areas occupied by manholes, inlets, drainage structures, pavement markings, or by any public utility appurtenances within the area.

D. **Abrasive Blasting of PCC Pavement:** Measurement will not be made for abrasive blasting of PCC Pavement. The plan quantity will be the basis of payment.

## V. BASIS OF PAYMENT

A. **Bridge Deck Grinding:** Bridge deck grinding, when specified in the plans, will be paid for at the contract unit price per square yard. Payment will be full compensation for all labor, equipment, materials, and all incidental work required to grind the bridge deck surface to the required profile and to remove and dispose of the grinding residue and water.

B. **Abrasive Blasting of Bridge Deck:** Abrasive blasting of bridge deck will be paid for at the contract unit price per square yard. Payment will be full compensation for all labor, equipment, materials, and all incidental work required to shot blast and abrasive blast clean the bridge deck surface of all foreign materials and to remove and dispose of all residue.

C. **Two Coat High Friction Surface Treatment:** Two Coat high friction surface treatment will be paid for at the contract unit price per square yard. Payment will be full compensation for all labor, equipment, materials, and all incidental work required to furnish and install the two coat high friction surface treatment

including all testing and to remove and dispose of existing pavement markings and excess calcined bauxite aggregate.

D. **Abrasive Blasting of PCC Pavement:** Abrasive blasting of PCC pavement will be paid for at the contract unit price per square yard. Payment will be full compensation for all labor, equipment, materials, and all incidental work required to shot blast and abrasive blast clean the PCC pavement surface of all foreign materials and to remove and dispose of all residue.

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