Replace Section 405 with:

SECTION 405

HIGH FRICTION SURFACE TREATMENT

405-1.01 DESCRIPTION. Construct high friction surface treatment (HFST) onto an asphalt concrete or Portland concrete pavement. The HFST consists of a polymer resin binder with a calcined bauxite aggregate topping. Provide a manufacturer's experienced technical supervisor during installation.

405-2.01 MATERIALS.

Polymer Resin Binder

Provide a two-part exothermic polymer resin binder which holds the aggregate topping firmly in place, and which meets the requirements of Table 1.

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirement</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultimate Tensile Strength</td>
<td>2650 psi min.</td>
<td>ASTM D638</td>
</tr>
<tr>
<td>Elongation at break point</td>
<td>30% min.</td>
<td>ASTM D638</td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>1600 psi min.</td>
<td>ASTM D695</td>
</tr>
<tr>
<td>Water Absorption</td>
<td>1.0% max.</td>
<td>ASTM D570</td>
</tr>
<tr>
<td>Shore D Hardness, min. 77°F</td>
<td>65-75</td>
<td>ASTM D2240</td>
</tr>
<tr>
<td>Viscosity</td>
<td>1000-2000 cps</td>
<td>ASTM D2393</td>
</tr>
<tr>
<td>Gel Time, minutes</td>
<td>15-45 min.</td>
<td>ASTM C881</td>
</tr>
<tr>
<td>Cure Rate</td>
<td>3 hrs. max. @ 40°F</td>
<td>ASTM D1640, 50-55 wet mil thickness</td>
</tr>
<tr>
<td>Mixing Ratio</td>
<td>As recommended by Technical Supervisor</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Aggregate Topping

Furnish a blend of calcined bauxite aggregate. The aggregate topping is to be clean, dry, and free from deleterious matter. The aggregate topping must meet the requirements of Table 2.

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate Grading</td>
<td>WAQTC FOP for AASHTO T 27/ T 11</td>
<td>No. 6 Percentage Passing 95% min. No.16 Percentage Passing 5% max.</td>
</tr>
<tr>
<td>Aggregate Quality</td>
<td></td>
<td>Manufacturer's Certification</td>
</tr>
</tbody>
</table>
405-2.02 SUBMITTALS AND QUALITY CONTROL PLAN. Submit a HFST Quality Control Plan (QCP). The plan review time will be 5 working days.

The HFST QCP must include:

1. Schedule for the trial HFST work and the production HFST work
2. Description of equipment for placing HFST
3. Description of equipment for measuring, mixing, placing, and finishing HFST
4. Method for protecting areas not to receive HFST
5. Cure time estimates for HFST
6. Storage and handling of HFST components
7. Disposal of excess HFST and containers
8. Contingency plan for possible failure during the HFST application
9. Name of the certified independent testing laboratory.

Submit a material safety data sheet (MSDS) for each shipment of HFST components before use.

Submit a certificate of compliance for the polymer resin binder and the calcined bauxite aggregate topping.

Have the polymer resin binder and calcined bauxite aggregate topping tested at a certified independent testing laboratory and then furnish the verifications to the Engineer that the materials meet all requirements listed in these specifications.

Allow 2 working days for the Engineer to review each MSDS submittal, certificate of compliance, the mix design and certified independent testing laboratory test results.

Do not begin a trial HFST until authorized by the Engineer in writing.

405-2.03 MANUFACTURER’S HFST TECHNICAL SUPERVISOR. Provide onsite the manufacturer’s technical representative to supervise the HFST installation process and the related process control of the product. The technical supervisor shall have supervised the installation of HFST on a minimum of 5 previous successful projects and his resume shall be submitted to the Engineer for approval prior to the pre-construction conference.

Provide a submittal that includes the following information:

1. Resume of the Technical Supervisor;
2. A list of successful projects; provide owners contact, address, and telephone number; location of projects.

405-2.04 PRE-CONSTRUCTION CONFERENCE
The Engineer shall schedule a pre-construction conference after submittals and the contractor’s quality control plan is approved. Discuss the HFST requirements, submittals, test strip, and construction work plan and operations. Discuss potential failures of the HFST and the remedy.

Attendance at the pre-construction conference is mandatory for:

1. HFST Technical Supervisor;
2. HFST Foreman; and
3. Project Superintendent
CONSTRUCTION REQUIREMENTS

405-3.01 WEATHER LIMITATIONS. Do not apply the polymer resin binder on a wet surface or when the ambient temperature is below 55°F or when the anticipated weather conditions would prevent the proper application and cure of the surface treatment as determined by the Engineer. Do not apply after September 1 unless recommended by the HFST technical supervisor and approved by the Engineer in writing.

405-3.02 TEST STRIP. Complete a HFST trial on asphalt concrete pavement before starting HFST production work at a location approved by the Engineer.

The HFST trial shall:

1. Be at least 12 feet wide by 20 feet long.
2. Be constructed using the same equipment as the production work.
3. Replicate field conditions, including ambient and surface temperatures, anticipated for the production work.
4. Demonstrate surface preparation requirements.
5. Remove pavement markers and delineation within the area to receive HFST, for the lane and length involved, prior to placing polymer resin binder.
6. Calibrate equipment before it is used on the test strip. Document the settings on the applicator equipment, initial quantities of resin and aggregate topping, and unused quantities of resin and aggregate topping remaining in the applicator equipment after applying the HFST.
7. Determine the initial set time for polymer resin binder in HFST.
8. Have temporary or permanent pavement markers and delineation in place when lanes are open to public traffic.
9. Determine that work can be completed within time permitted.
10. Have a coefficient of friction of at least 0.75 when tested in conformance with ASTM E1911 Dynamic Friction Tester. If the coefficient of friction testing is below 0.75, correct or remove and replace the trial HFST to meet or exceed the specified value of 0.75. The Engineer will measure the friction.
11. Demonstrate HFST removal methods by removing the trial HFST.
12. Dispose of removed material.

Do not begin production HFST until authorized by the Engineer in writing after successful completion of the trial HFST. A test strip that meets specification shall be measured and paid at the contract unit price.

405-3.03 CONSTRUCTION. The HFST technical supervisor shall be on-site during the entire time the surface treatment is being installed.

Surfaces must be clean, dry, and free of all dust, oil, debris and any other material that might interfere with the bond between the polymer resin binder material and existing surfaces. Adequate cleaning of all surfaces will be determined by the Engineer.

Remove pavement markers and delineation within the area to receive HFST, prior to placing polymer resin binder.

Perform street sweeping before placing pavement markers and delineation.

Temporary or permanent pavement markers and delineation must be in place before lanes are open to public traffic.

The Engineer will inspect the construction equipment and cleaned asphalt surface before test strip construction, and prior to project production/application of the seal coat materials.
Application of the HFST shall conform to the following:

1. Do not apply HFST to asphalt pavement surfaces that are less than 90 days old (can apply the following year), unless sandblasted prior to application.
2. Surface preparation work, surface temperature, placement of the HFST must be in conformance with the binder supplier's specifications, these special provisions and as approved by the Engineer.
3. The minimum spread rate for polymer resin binder is 0.28-0.32 gal/sq yd.
4. The minimum spread rate of retained aggregate is 13-20 lb/sq yd.
5. HSFT must be allowed to cure for the minimum duration as recommended by the manufacturer's specifications and during that time the application area must be closed to all vehicle and Contractor equipment traffic.
6. The surface texture of the HFST must be uniform and have a coefficient of friction not less than 0.75 as tested by ASTM E1911 Dynamic Friction Tester. Provide a correction plan for HFST that fails to meet the coefficient of friction of 0.75. The correction plan may include correction of existing HFST or remove & replace. The Engineer will measure the friction.
7. The smoothness of the finished surface after application of the HFST will be tested with a straightedge and accepted by the Engineer. The surface shall not vary more than 0.02 foot from the lower edge of a 12-ft straightedge placed in any direction. Any surface that fails to conform to the above tolerance must be removed and replaced at the contractor's expense.
8. Provide daily records of the quantity of each component of resin used and of the aggregate topping.

Contractor shall take a 1-quart sample of polymer resin binder from the trial HFST and once per day during production work and have it tested in accordance with ASTM D838 by a certified independent testing laboratory. Provide the test results to the Engineer within 72 hours after taking the sample.

405.3.04 MIXING AND APPLICATION METHODS. Utilize one of the following methods to apply the resin binder and aggregate wearing course, in accordance with manufacturer's recommendations.

Application method 1 shall be utilized on areas greater than 250 feet in length.

Method 1. Automated Continuous Application
Automated continuous application shall be performed by an applicator vehicle with a minimum aggregate capacity of 30,000 lbs and a minimum of 1200 gallons of the resin binder. The applicator shall continuously mix, meter, monitor and apply the resin binder and high friction aggregate in one continuous pass.

The applicator vehicle shall be equipped with a 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, the volume of aggregate applied throughout the application width. The automated continuous application vehicle will have continuous pumping and portioning devices that blend the polymer binder within a controlled system. The polymer binder shall be blended and mixed in the ratio per the manufacturer's specification (+/- 2% by volume); the polymer binder shall be continuously applied once blended. The application vehicle should be capable of applying the minimum polymer binder spread rate.

The high friction aggregate shall be applied by the same automated continuous application vehicle that applies the resin binder to the pavement section. The automatic aggregate spreader shall be capable of applying up to a continuous 12 foot width application. The high friction aggregate shall be applied within 3 seconds (+/- 1 sec) of the base polymer binder application onto the pavement section, from a minimum height of 12 inches from above the pavement section surface, at the minimum spread rate.

No exposed wet spots of the polymer binder shall be 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. Any form of contact (walking, standing, or scraping of surface) or contamination with the wet uncured resin will result in that section of resin being removed and replaced at the contractor's expense.
Method 2. Mechanical and Hand Mixing and Aggregate Broadcast (less than 250 feet in length). Mix polymer resin binder with equipment capable mixing, metering, monitoring and distributing while maintaining the designed, proper stoichiometric ratio. Uniformly spread the resin binder onto the surface using a serrated edge squeegee. Mechanically apply the high friction surface aggregate. Exposed areas of wet resin must be covered by aggregate, hand spread, immediately prior to the gelling of the resin binder.

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. The excess aggregate can be reused; the aggregate shall be reclaimed by a mechanical sweeper, the recovered aggregate must be clean, uncontaminated and dry.

Excess and loose aggregate must be removed 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.

Utilities, drainage structures, curbs, inlaid markings, and any other structures within or adjacent to the treatment location must be protected against the application of the HFST materials.

Before opening HFST areas to public traffic, the Engineer may test for the coefficient of friction.

### 405.01 METHOD OF MEASUREMENT. Section 109.

### 405.01 BASIS OF PAYMENT. Payment includes all materials and equipment required to perform the specified work including the HFST technical supervisor and product acceptance testing.

Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item No.</th>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>405(3)</td>
<td>High Friction Surface Treatment</td>
<td>Square Yard</td>
</tr>
</tbody>
</table>

57700
SECTION 406

RUMBLE STRIPS

406-1.01 DESCRIPTION. Form a series of indentations (rumble strips) into the roadway pavement. Place rumble strips in each shoulder to the width, depth and length as indicated in the Contract documents and/or directed by the Engineer.

406-1.02 RUMBLE STRIP. A single uniform circular concave (cross section) indentation/depression milled into the pavement surface having a length measured perpendicular to the direction of travel, a width measured in the direction of travel and a depth measured from the surface of the pavement to the bottom of the indentation.

406-2.01 MATERIALS. None.

406-2.02 MILLING EQUIPMENT. Use equipment designed specifically for milling rumble strips into asphalt pavement. Equip milling machine with a rotary type cutting head with a maximum outside diameter of 24-inches and a minimum length of 16-inches capable of producing a depression both 12-inches and 16-inches in length by 7 1/2-inches in width to a depth shown in the Plans. Arrange the cutting tips to provide a smooth cut (approximately 1/16-inch between peaks and valleys).

Furnish the milling equipment with a guidance system, including a guide, clearly visible to the operator, to provide for consistent alignment of each rumble strip cut at the offsets from traveled way indicated on the Plans and to provide uniformity and consistency throughout the project. The equipment shall incorporate water into the cutting head to minimize dust caused by the milling operation.

Equipment Manufacture: provide training for the operators and a representative onsite during installation of the rumble strip test section(s) (Subsection 408-3.03). Representative: remain onsite until test specimen(s) satisfy the Plans and Specifications as determined by the Engineer.

CONSTRUCTION REQUIREMENTS

406-3.01 PAVEMENT SURFACE PREPARATION. Inspect roadway to receive rumble strips for acceptable pavement condition and stake locations to receive rumble strips prior to installation. Prepare the roadway for the milling operation by providing a smooth clean surface. Sweep all loose material from the roadway surface in line with the planned rumble strips and to each side of the strips for the width of the milling machine plus an additional 12” minimum per side or edge of pavement whichever is smaller, and as directed by the Engineer.

Sweep and broom as noted and with the equipment indicated in Subsection 643-3.04, No. 6, Sweeping and Power Brooming.

406-3.02 TOLERANCES FOR RUMBLE STRIPS.

1. Length: ± 1/2-inch.
2. Width: ± 1/2-inch.
3. Depth: ± 1/16-inch.
4. Spacing: ± 1/2-inch.
5. Alignment: ± 1-inch from the striping layout in the Plans; existing striping and re-established striping.

If it is determined that the rumble strips are not being placed to specification, make immediate adjustments to correct the problem.
Rumble strips are unacceptable if:

1. The strips are not straight.
2. The length or width does not meet tolerance.
3. The depth of the depression does not meet tolerance.
4. The depression/indentation concave surface is not smooth, does not meet tolerance.
5. The edge of the indentation/depression is not straight, smooth, and free of spalling.
6. Pavement surface is damaged as a result of improper rumble strip installation.

Unacceptable rumble strip installation, dimensional, alignment, surface irregularities, and surface damage shall be ground, resurfaced and the rumble strip reinstalled to the satisfaction of the Engineer and at the Contractor's expense. Perform repairs using equipment similar to the equipment initially used to mill the rumble strip. Do not perform repairs in a "patch work" manner. If more than one repair is required; in a group of rumble strips repair the entire group. Where a repair is required in a continuous run, repair the unacceptable rumble strip(s) and repair or replace the rumble strip to each side of the unacceptable rumble strip as required to provide continuity between rumble strips as originally intended. The Engineer will confirm the extent of the repair(s) required.

If during production the work becomes unacceptable the Engineer may require resumption of testing, Subsection 406-3.03. Testing in addition to the initial test for each rumble strip type will be at the Contractor's expense.

406-3.03 RUMBLE STRIP TEST SECTION. Install an initial 1/4 mile test section for each of the following rumble strip type(s):

1. **Shoulder.**

   Demonstrate for each type of rumble strip that the equipment and method will provide the desired milled-in rumble strip, including the surface inside each depression, without damaging the surrounding asphalt pavement. If any of the initial test sections do not meet tolerances, provide new equipment, new method, or make necessary adjustments and retest. These additional test sections will be required before production runs will be allowed to begin.

   Testing in addition to the initial test sections will be at the Contractor's expense.

Additionally, demonstrate the means and methods, including the equipment, for containing dust and waste material.

406-3.04 TRAFFIC STRIPING RE-ESTABLISHMENT. Traffic striping is required to provide guidance for the rumble strip installation operation. Contractor, where shoulder and/or centerline striping is missing to the extent that rumble strip location cannot be determined by the Engineer, re-establish the striping location prior to the milling operation. Re-establish missing striping location by measuring laterally across the roadway from adjacent visible striping. Maintain the same lane widths that exist at each end of the missing striping. Provide sufficient location marking or "rabbit tracks" to ensure an accurate milling operation. Shoulder re-striping is not required. Re-establishing roadway striping location will not be measured or paid for separately but will be subsidiary to the respective rumble strip pay items.

406-3.05 RUMBLE STRIP INSTALLATION. Install the following types of rumble strip at the locations shown in the Plans:

1. **Shoulder.** Do not disturb existing shoulder striping.

In compacted pavement with a temperature below 80° F, mill each type of rumble strip to the dimensions shown in the Plans. Locate the inside edge of the rumble strip as shown in the Plans. The Engineer will randomly check the edge alignment of the milled pattern.
406-3.06 CLEAN UP OF MILLINGS. Handle, transport, and store, or dispose of material according to the Alaska Department of Environmental Conservation (DEC) regulations. Remove off the project, on a daily basis, waste material (millings) resulting from the operation.

Disposal: Dispose waste material outside the project limits, unless directed otherwise, in writing, by the Engineer. Obtain written consent from the property owner. Milled material not being spread on the roadway side slopes requires a Solid Waste Disposal Permit from the DEC. Obtain a permit for disposal of milled material or dispose the material in a site previously approved.

Remove millings immediately following rumble strip installation. Maintain the removal operation within 50 feet of the milling machine. Dry power brooming and power brooming without direct immediate means of collection/pickup is not permitted.

During milling operations keep the travel lanes free of milling debris. Do not berm the millings at the shoulder edge, do not allow milling debris to impede roadway drainage or enter waterways. Use a sweeper, sweeper/vacuum, (Subsection 843-3.04 No. 6, Street Sweeping, and Power Brooming), continuously removing waste material, including dust from the operation. Keep millings damp to help control airborne dust. Millings shall not enter adjacent lanes open to traffic.

Remove the waste material from the roadway surface and any adjacent pathway beyond the shoulder. Shoulder millings may be placed off of the road or pathway beyond the shoulder on the side slopes, except in areas where guardrail is present. Uniformly spread shoulder millings on the roadway side slopes; alternatively, it may become property of the Contractor and disposed of off the project as indicated above.

Milled roadway segments shall be returned to debris-free state prior to re-opening for traffic.

406-4.01 METHOD OF MEASUREMENT. Section 109 and as follows:

Measure pay units by station, foot, or mile parallel to the centerline of the highway.

Station: A single lineal measurement for every measured station for each shoulder rumble strip and centerline rumble strip installed.

Linear Foot: A single lineal measurement for every measured foot of rumble strip installed.

Mile: A single lineal measurement for every measured mile for each shoulder rumble strip installed.

Shoulder rumble strip measurement includes gaps (provided for bicycles or other as shown in the Plans) between groups of rumble strips.

406-5.01 BASIS OF PAYMENT. Section 109.

Except where specified as individual Pay Items:
All work, including test strips and materials is subsidiary to 406 Pay Items.

Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item No.</th>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>406(1)</td>
<td>Rumble Strips</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>406(2)</td>
<td>Rumble Strips</td>
<td>Station</td>
</tr>
<tr>
<td>406(3)</td>
<td>Rumble Strips</td>
<td>Linear Foot</td>
</tr>
<tr>
<td>406(4)</td>
<td>Rumble Strips – Shoulders</td>
<td>Mile</td>
</tr>
<tr>
<td>406(5)</td>
<td>Rumble Strips – Centerline</td>
<td>Mile</td>
</tr>
<tr>
<td>406(6)</td>
<td>Sweeping and Disposal of Millings – Shoulders</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>406(7)</td>
<td>Sweeping and Disposal of Millings – Centerline</td>
<td>Lump Sum</td>
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</table>

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PARKS HIGHWAY MP 123.5 - 146 REHABILITATION
PROJECT NO.: 0A42(009)/57700 80  ALASKA 2004