Cracks must be clean and dry before treating. Before treating, blast cracks with oil-free compressed air at a pressure of at least 90 psi.

If the pavement temperature is below 40 °F or if there is evidence of moisture in the crack, use a hot air lance immediately before applying crack treatment. The hot air lance must not apply flame directly on the pavement.

Heat hot-applied crack treatment material in compliance with the manufacturer's instructions. Comply with the manufacturer's application instructions.

Insert crack treatment with a nozzle inserted into the crack. Fill the crack recessed less than 1/4-inch. If after 2 days the crack treatment is more than 1/4 inch below the specified level, or the sealant fails or the crack re-opens, retreat the crack.

Immediately remove crack treatment material spilled or deposited on the pavement surface.

**MEASUREMENT AND PAYMENT**

Crack treatment is measured by the lane-mile. A lane-mile consists of a paved lane and any adjacent shoulders. The Engineer determines the quantity paid from actual measurements along the edge of each paved lane parallel with the pavement centerline.

The contract price paid per lane-mile for crack treatment includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in treating cracks, complete in place, including crack treatment of shoulders, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

**10-1.18 THIN HIGH FRICTION SURFACE TREATMENT**

**GENERAL**

**Summary**

This work will place a thin high friction surface treatment (HFST) onto asphalt concrete pavement. The thin HFST is comprised of a single layer consisting of an epoxy-resin binder with a calcined bauxite aggregate topping. A second layer of thin HFST will be placed where shown on the plans. Do not apply thin HFST to asphalt pavement surfaces that are less than 30 days old.

**Submittals**

Submit a thin HFST Quality Control Plan (QCP) as per Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The plan review time will be 5 working days.

The thin HFST QCP must include:

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

Submit a material safety data sheet for each shipment of thin HFST components before use. Submit a Certificate of Compliance for the epoxy-resin binder and calcined bauxite aggregate topping in the thin HFST as per Section 6-1.07, “Certificate of Compliance,” of the Standard Specifications.

**Quality Control and Assurance**

Complete a trial of thin HFST on pavement before starting work. The trial location is provided in the Supplemental Project Information elsewhere in these special provisions.

The trial thin HFST must:

1. Be at least 12 feet wide by 80 feet long
2. Be constructed using the same equipment as the production work
3. Replicate field conditions, including ambient and surface temperatures, for the production work
4. Determine the initial set time for epoxy-resin binder in thin HFST
5. Determine that work can be completed within time permitted in Lane Requirement Charts as provided elsewhere in these special provisions
6. Have a coefficient of friction of at least 0.50 when tested in conformance with CTM 342 and have a coefficient of friction of at least 0.75 when tested in conformance with ASTM E1911.
7. Demonstrate suitability of the proposed means and methods
8. Demonstrate the removal of thin HFST, 12 feet wide by 4 feet long.
9. Be disposed as per Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications

The department will be responsible for performing CTM 342 and the contractor will be responsible for performing ASTM 1911 testing. If the result of CTM 342 testing is below the specified value of 0.50 or the results of ASTM 1911 testing is below 0.75, the Contractor will, at the Contractor's expense, remove and replace the trial thin HFST with corrective measures to meet or exceed the specified value of 0.50 for CTM 342.

**MATERIALS**

The thin HFST will consist of one of the following product suppliers or equal.

<table>
<thead>
<tr>
<th>PRODUCT NAME</th>
<th>SUPPLIER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tyregrip</td>
<td>Ennis Traffic Safety Solutions</td>
</tr>
<tr>
<td></td>
<td>918 Ottawa Dr.</td>
</tr>
<tr>
<td></td>
<td>Claremont, CA 91711</td>
</tr>
<tr>
<td></td>
<td>Phone: 1-800-331-8118</td>
</tr>
<tr>
<td>HFS High Friction Surface</td>
<td>CRAFCO</td>
</tr>
<tr>
<td></td>
<td>420 N. Roosevelt Ave.</td>
</tr>
<tr>
<td></td>
<td>Chandler, AZ 85226</td>
</tr>
<tr>
<td></td>
<td>Phone: 1-800-528-8242</td>
</tr>
<tr>
<td>FlexoGrid</td>
<td>Poly-Card, Inc.</td>
</tr>
<tr>
<td></td>
<td>33095 Bainbridge Rd.</td>
</tr>
<tr>
<td></td>
<td>Solon, Ohio 44139</td>
</tr>
<tr>
<td></td>
<td>Phone: 1-800-225-5649</td>
</tr>
</tbody>
</table>

**Epoxy-Resin Binder**

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

**Table 1**

<table>
<thead>
<tr>
<th>Epoxy Binder Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Property</strong></td>
</tr>
<tr>
<td>Tensile Strength, min. psi</td>
</tr>
<tr>
<td>Tensile Elongation, min. percent</td>
</tr>
<tr>
<td>Compressive Strength, min. psi</td>
</tr>
<tr>
<td>Gel Time, minutes</td>
</tr>
<tr>
<td>Water Absorption, max percent by wt</td>
</tr>
<tr>
<td>Shore D Hardness, min 77 °F</td>
</tr>
<tr>
<td>Adhesion to Concrete</td>
</tr>
<tr>
<td>Flexural Yield Strength, min. psi</td>
</tr>
<tr>
<td>Percent Solids</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 2

Aggregate Topping Requirements

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirement</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate Abrasion Value</td>
<td>10% max.</td>
<td>CTM 211</td>
</tr>
<tr>
<td>Aggregate Grading</td>
<td>No. 6 Sieve</td>
<td>95% min. Passing</td>
</tr>
<tr>
<td></td>
<td>No. 16 sieve</td>
<td>5% max. Passing</td>
</tr>
<tr>
<td>Aggregate Acid Insolubility</td>
<td>Greater than 90%</td>
<td>ASTM D3042</td>
</tr>
<tr>
<td>Aggregate Magnesium Soundness</td>
<td>30% max.</td>
<td>ASTM C88</td>
</tr>
</tbody>
</table>

PRE-CONSTRUCTION

Pre-construction Conference

Attendance at the pre-construction conference is mandatory for:
1. Thin HFST supplier
2. Construction Foreman
3. Construction Superintendent

CONSTRUCTION

Attendance during construction activities is mandatory for:
1. Thin HFST supplier
2. Construction Foreman
3. Construction Superintendent

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

The thin HFST will conform to the following requirements:

A. The minimum application coverage rate for epoxy-resin binder is 2.5 LBS/SQYD per layer.
B. The minimum application coverage rate of retained aggregate is 13 LBS/SQYD per layer.
C. Epoxy-resin components will be thoroughly mixed prior to application, then uniformly applied to the prepared surface by a mechanical method.
D. Surface preparation work, surface temperature, placement thin HFST shall be in conformance with the Supplier's specifications, these special provisions and as approved by the Engineer.
E. Thin HSFT will be allowed to cure for the minimum duration as recommended by the Supplier's specifications and during that time the application area will be closed to all vehicle and Contractor equipment traffic.
F. The surface texture of the thin HFST will be uniform and will have a coefficient of friction of not less than 0.50 as tested by CTM 342 or as approved by the Engineer. Any surface that fails to conform to the above friction requirements shall be removed and reapplied at the Contractor's expense.
G. Do not apply the epoxy 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 of the surface treatment as determined by the Engineer.
H. Automated continuous application shall be performed by an applicator equipment. The applicator shall heat, continuously mix, meter, monitor and apply the epoxy binder and high friction calcined bauxite aggregate in one continuous pass of two separate layers. The second layer shall be installed within 4 hours of the completely cured first layer. Hand application will be allowed on areas under 200 square feet.
I. Delays in application of mixed epoxy through octopus assembly and extruder bar exceeding 20 minutes will require replacement with new equipment.

Excess and loose aggregate shall be removed by power sweeping. Application on high speed highway ramps will require final power sweeping 24 to 48 hours after initial installation is complete.

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

Contract No. 01-0B63U4

55
Unless otherwise called out on the project plans, all existing pavement delineation and markers within the treatment location shall be removed prior to application of the thin HFST, then replaced after the thin HFST has cured and power sweeping is completed.

MEASUREMENT AND PAYMENT

Thin HFST will be measured by the square yard. The area to be paid for will be based on the dimensions shown on the plans. Areas receiving a second layer of thin HFST will be measured by the square yard, as based on the dimensions shown on the plans, and added to the first layer.

The contract price paid per square yard for thin HFST shall include full compensation for furnishing all labor, materials, tools, equipment, and incidental and for doing all the work involved in thin HFST, complete in place, including the trial thin HFST, submittals, surface preparation, and pre-construction conference, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.19 RUMBLE STRIP

GENERAL

Summary

This work includes constructing rumble strips in the top layer of hot mix asphalt surfacing by ground-in methods.

CONSTRUCTION

Select the method and equipment for constructing ground-in indentations.

Do not construct rumble strips on structures or approach slabs.

Construct rumble strips within 2 inches of the specified alignment. The grinding equipment must be equipped with a sighting device enabling the operator to maintain the rumble strip alignment.

Indentations must comply with the specified dimensions within 0.06 inch in depth and 10 percent in length and width.

The Engineer orders grinding or removal and replacement of noncompliant rumble strips to bring them within specified tolerances. Ground surface areas must be neat and uniform in appearance.

The grinding equipment must be equipped with a vacuum attachment to remove residue from the roadbed.

Dispose of removed material under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

On ground areas, apply fog seal coat under Section 37-1, "Seal Coats," of the Standard Specifications.

MEASUREMENT AND PAYMENT

The contract item for centerline rumble strip is measured by the station along the length of the centerline rumble strips without deductions for gaps between indentations.

The contract price paid per station for centerline rumble strip includes full compensation for furnishing all labor, materials, tools, equipment, and incidental and for doing all the work involved in constructing centerline rumble strip complete in place including furnishing and applying fog seal coat to the actual ground areas, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.20 FURNISH SIGN

Signs shall be fabricated and furnished in accordance with details shown on the plans, the Traffic Sign Specifications, and these special provisions.

Traffic Sign Specifications for California sign codes are available for review at:

http://www.dot.ca.gov/hq/traffops/signtech/signdel/specs.htm

Traffic Sign Specifications for signs referenced with Federal MUTCD sign codes can be found in Standard Highway Signs Book, administered by the Federal Highway Administration, which is available for review at:


Information on cross-referencing California sign codes with the Federal MUTCD sign codes is available at:

http://www.dot.ca.gov/hq/traffops/signtech/signdel/specs.htm