SECTION 02787
MICRO-SURFACING

PART 1 GENERAL

1.1 RELATED WORK

A. Section 02785 – Seal Coats
B. Section 02786 – Slurry Seal
C. Section 02740 – Asphalt Concrete Paving
D. Section 02760 – Traffic Striping, Pavement Markers and Pavement Markings

1.2 REFERENCES

Current Caltrans Standard Specifications

A. Section 37 – Bituminous Seals
B. Section 94 – Asphaltic Emulsions

1.3 SUBMITTALS

The Contractor shall furnish materials certificates, including mill test reports for the asphalt, emulsions, and crack sealers signed by the material producer and the Contractor, showing compliance with the respective specifications.

PART 2 PRODUCTS

2.1 GENERAL

Micro-surfacing is a mixture of polymer modified asphalt emulsion, aggregate, mineral filler, and other additives mixed and spread on a paved surface.

2.2 MATERIALS / MIX DESIGN / TESTING

A. Emulsified Asphalt. The emulsified asphalt shall be a quick-traffic, polymer-modified asphalt emulsion conforming to the requirements specified in AASHTO M208 or ASTM D2397 for CSS-1h. The polymer shall be milled or blended into the asphalt or emulsifier solution prior to the emulsification process. The micro-surfacing emulsion shall conform to the following requirements:
### POLYMER MODIFIED MICROSURFACING EMULSION

<table>
<thead>
<tr>
<th>Specification Designation</th>
<th>Test Method</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viscosity SSF @ 77 F (25 C)</td>
<td>AASHTO T 59</td>
<td>15-90 Seconds</td>
</tr>
<tr>
<td>Sieve, max.</td>
<td>AASHTO T 59</td>
<td>0.30 Percent</td>
</tr>
<tr>
<td>Settlement, 5 days, max.</td>
<td>ASTM D244</td>
<td>5 Percent</td>
</tr>
<tr>
<td>Storage Stability, 1 day, max.</td>
<td>AASHTO T 59</td>
<td>1 Percent</td>
</tr>
<tr>
<td>Residue by Evaporation, min.</td>
<td>California Test 331</td>
<td>62 Percent</td>
</tr>
</tbody>
</table>

### SPECIFICATION DESIGNATION FOR RESIDUE

<table>
<thead>
<tr>
<th>Specification Designation</th>
<th>Test Method</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penetration@ 77 F (25C), 100g, 5s ,0.1mm</td>
<td>AASHTO T 51</td>
<td>40-90</td>
</tr>
<tr>
<td>Softening Point F (C) Min.</td>
<td>AASHTO T53</td>
<td>135 (57)</td>
</tr>
</tbody>
</table>

B. **Water and Additives.** Water shall be of such quality that the asphalt will not separate from the emulsion before the micro-surfacing is placed on the pavement. If necessary for workability, a set-control agent that will not adversely affect the micro-surfacing product may be used.

C. **Mineral Filler.** Mineral filler shall be Portland cement or hydrated lime that is free of lumps. Portland cement shall be either Type I, Type II, Type III or combination thereof. The type of mineral filler shall be determined by the Contractor based on laboratory mix designs. The mineral filler will be considered part of the aggregate gradation requirement.

D. **Aggregate.** The mineral aggregate used shall be of the type and grade specified for the particular use of the micro-surfacing. The material shall be free from vegetable matter and other deleterious substances. Aggregate shall be 100% crushed, with no round particles, and shall be volcanic in origin and black in color. To assure the material is totally crushed, 100% of the parent aggregate will be larger than the largest stone in the gradation to be used. All aggregate shall be free of caked lumps and oversize particles.

The aggregate, prior to the addition of emulsion shall conform to the requirements of this section. If aggregates are blended each component aggregate shall meet the sand equivalency and abrasion resistance and shall be 100% crushed as tested in accordance with California Test 205. The definition of a crushed particle in California Test 205 Section D, is amended to read: “Any particle having 2 or more fresh mechanically fractured faces shall be considered a crushed particle.”
The percentage composition by mass of the aggregate (including mineral filler) shall conform to the following grading requirements when tested in conformance with California Test 202:

### PERCENTAGE PASSING

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Type II</th>
<th>Type III</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 3/8”</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>94 – 100</td>
<td>70 – 90</td>
</tr>
<tr>
<td>No. 8</td>
<td>65 – 90</td>
<td>45 – 70</td>
</tr>
<tr>
<td>No. 16</td>
<td>40 – 70</td>
<td>28 – 50</td>
</tr>
<tr>
<td>No. 30</td>
<td>25 – 50</td>
<td>19 – 34</td>
</tr>
<tr>
<td>No. 200</td>
<td>5 – 15</td>
<td>5 – 15</td>
</tr>
</tbody>
</table>

The aggregate (excluding mineral filler) shall conform to the following additional quality requirements:

<table>
<thead>
<tr>
<th>Test</th>
<th>California Test</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand Equivalent (Min.)</td>
<td>217</td>
<td>70</td>
</tr>
<tr>
<td>Durability Index (Min.)</td>
<td>229</td>
<td>75</td>
</tr>
<tr>
<td>Percentage of Crushed Particles (Min.)(^1)</td>
<td>205</td>
<td>100%</td>
</tr>
<tr>
<td>Los Angeles Rattler Loss at 500 Rev. (Max.)(^2)</td>
<td>211</td>
<td>35%</td>
</tr>
</tbody>
</table>

Notes:
1. CT205, Section D, is amended to read: "Any particle having 2 or more freshly, mechanically fractured faces shall be considered a crushed particle."
2. Los Angeles Rattler shall be performed on the parent aggregate before crushing

### E. Mix Design

At least 7 working days before micro-surfacing placement commences, the Contractor shall submit to the Project Manager for approval a laboratory report of tests and proposed mix design covering the specific materials to be used on the project.

The percentage of each individual material proposed in the mix design shall be shown in the laboratory report. Individual materials shall be within the following limits:
Residual Asphalt | 5.5% to 9.5% by dry mass of aggregate  
Mineral Filler | 0% to 3% by dry mass of aggregate  
Additive | As needed  
Water | As needed

Adjustments may be required during construction based on field conditions.

The proposed micro-surfacing mixture shall conform to the specified requirements when tested in conformance with the following tests:

<table>
<thead>
<tr>
<th>Test</th>
<th>ISSA Test Method</th>
<th>Requirements</th>
</tr>
</thead>
</table>
| Wet Cohesion                                                        | TB* 139          | 12 kg-cm  
@ 30 Minute (Set) (Min.) @ 60 Minute (Traffic) (Min.) 20 kg-cm |
| Excess Asphalt (Max.)                                               | TB* 109          | 538 g/m²               |
| Wet Stripping (Min.)                                                | TB* 114          | 90%                    |
| Wet Track Abrasion 6-day Soak Loss (Max.)                           | TB* 100          | 807 g/m²               |
| Displacement Lateral (Max.)                                         | TB* 147A         | 5%                     |
| Specific Gravity After 1000 Cycles of 125 lbs. (56.8 kg)(Max.)      |                  | 2.10                   |
| Classification Compatibility (min.)                                 | TB* 144          | 11 Grade Points        |
| Mix Time @ 77°F (25°C) (Min.)                                      | TB* 113          | Controllable to        |
|                                                                 |                  | 120 Seconds            |
| TB* = Technical Bulletin                                           |                  |                        |

The report shall show the results of the tests on individual materials and shall compare their values to those required by these special provisions. The report shall clearly show the proportions of aggregate, filler (minimum and maximum), water (minimum and maximum), set control additive, and emulsified asphalt solids content (minimum and maximum) based on the dry mass of aggregate.

The component materials used in the mix design shall be representative of the micro-surfacing materials proposed by the Contractor for use on the project.
Once the mix design is approved by the Project Manager, no substitution of other material will be permitted unless the materials proposed for substitution are first tested and a laboratory report is submitted for the substituted design in conformance with the provisions of these special provisions. Substituted materials shall not be used until the mix design for those materials has been approved by the Project Manager.

The completed mixture, after addition of water and set control agent, if used, shall be such that the micro-surfacing mixture has proper workability. At the expiration of the road closure hours, in conformance with the provisions in "Maintaining Traffic" of these special provisions, the micro-surfacing mixture shall be sufficiently cured to support unrestricted traffic.

F. **Proportioning.** Aggregate, mineral filler, emulsified asphalt, water, and additives, including the set-control agent, if used, shall be proportioned by volume utilizing the mix design approved by the Project Manager. If more than one kind of aggregate is used, the correct amount of each kind of aggregate to produce the required grading shall be proportioned separately, prior to adding the other materials of the mixture, in a manner that will result in a uniform and homogeneous blend.

A temperature-indicating device shall be installed in the emulsion storage tank at the pump suction level. The device shall indicate the temperature of the emulsified asphalt and shall be accurate to within 10°F (5°C).

**PART 3 EXECUTION**

3.1 MIXING AND SPREADING EQUIPMENT

The mixture shall be agitated and spread uniformly in the surfacing box by means of twin-shafted paddles or spiral augers fixed in the spreader box. A front seal shall be provided to insure no loss of the mixture at the road contact point. The rear seal shall act as a final strike-off and shall be adjustable. The spreader box and rear strike-off shall be so designed and operated that a uniform consistency is achieved to produce a free flow of material to the rear strike-off. The spreader box shall have suitable means provided to side shift the box to compensate for variations in the pavement geometry.

A. A secondary strike-off shall be provided to improve surface texture. The secondary strike-off shall have the same adjustments as the spreader box.

B. When required on the plans, before the final surface course is placed, preliminary micro-surfacing material may be required to fill ruts, utility trenches, depressions in the existing surface, etc. Ruts of one-half inch or greater in depth shall be filled independently with a rut-filling spreader box. For irregular or shallow rutting of less than one-half inch in depth, a full-width scratch coat pass may be used. Ruts that are in
excess of one and one-half inches in depth may require multiple placements to restore the cross-section.

3.2 SURFACE PREPARATION

A. All existing pavement to receive micro-surfacing shall be prepared as follows:

1. Cracks less than ½ inch in width shall be cleared of dirt, dust, and other deleterious materials and repaired with asphalt crack sealer applied in accordance with the manufacturer's recommendations.

2. Cracks or holes larger than ½ inch in width shall be cleared of dirt and other deleterious materials and filled with hot asphalt concrete mix.

3. Areas specified for dig-out shall be excavated to sub-base or to the depth specified. The sub-base shall be scarified to a depth of 6 inches and compacted to 95 percent density.

4. The top 2 inches of the asphalt patch shall be ½-inch maximum size, medium grade asphalt concrete.

5. The maximum thickness of any lift of asphalt concrete in digouts shall be 3 inches.

B. All existing pavement markers, paint and thermoplastic shall be removed and disposed of by the contractor. Said removal shall not occur sooner than 2 days prior to the day that micro-surfacing is performed.

C. Surface to receive micro-surfacing shall be prepared in accordance with the requirements specified for preparing surfaces to receive asphaltic emulsion as specified in Section 37-1.04, “Preparation for Seal Coat”, of the Caltrans Standard Specifications.

D. Immediately prior to applying the micro-surfacing, the pavement surface shall be cleared of all loose material, vegetation and other extraneous material. Power sweepers shall be required to sweep from face of curb to face of curb. This shall involve a minimum of three passes with a power broom street sweeper (Mobile or equivalent). Pavement missed by or inaccessible to broom sweepers shall be swept clean by other approved methods. Contractor shall provide whatever flushing, compressed air, or other cleaning methods necessary to remove all dirt and loose material from the pavement.

E. A tack coat may be required if the surface to be micro-surfaced is extremely dry and raveled or is concrete. If required, the tack coat should consist of one part emulsified asphalt to three parts water and should be applied with a standard distributor. The emulsified asphalt should be SS or CSS grade. The distributor shall be capable of applying the dilution evenly at a rate of 0.05 to 0.10 gallons per yard. The tack coat shall be allowed to cure sufficiently before application of the micro-surfacing.
3.3 PRESERVATION OF PROPERTY:

A. Immediately proceeding the micro-surfacing application, the Contractor shall cover all grates, manholes, valves, monuments, etc. on the pavement that would be covered by the micro-surfacing mixture. Raised pavement markers and thermoplastic pavement markings shall also be removed.

B. Drainage inlets shall be uncovered and cleaned to the satisfaction of the Project Manager as soon as the applied micro-surfacing mixture sets. The other surface utilities shall be uncovered and cleaned the following day. If they are not uncovered within this time frame, no additional surfacing shall be placed until they are uncovered.

C. Gutters, curbs, sidewalks, driveways, shoulders and other structures adjacent to the pavement to be micro-surfaced shall be cleaned of excess material to the satisfaction of the Project Manager.

D. Asphalt pavement, concrete curb, gutter, sidewalk, and other concrete surface structures along existing streets damaged by the Contractor's operations, including but not limited to walkways, lawns and other landscaping, fences, gates, driveways, walls and mail boxes shall be replaced in kind by the Contractor.

E. Full compensation for protecting and repairing property as specified herein shall be considered as included in the price paid for other items of work, and no additional compensation will be allowed therefore.

3.4 APPLICATION AND WORKMANSHIP

The micro-surfacing shall be uniformly spread at the rate specified without spotting, rehandling or shifting of the mixture. The mixture shall be uniform and homogeneous after placing on the surface and shall not show separation of the emulsion and aggregate after setting. The completed surface shall be of uniform texture and free from ruts, humps, depressions, or irregularities.

A. The micro-surfacing mixture shall not be applied when the ambient temperature is below 50° F or during unsuitable weather. Micro-surfacing shall not be placed if rain is imminent or if there is the possibility that there will be freezing temperatures within 24 hours.

B. When required by local conditions, the surface shall be fogged with water directly preceding the spreader. The mixture shall be of the desired consistency when deposited on the surface. A sufficient amount of material shall be carried in all parts of the spreader at all times so that complete coverage is obtained. No lumping, balling or unmixed aggregate shall be permitted. No segregation of the emulsion and aggregate fines from the coarse aggregate will be permitted.
C. The mixture shall be placed at a rate to produce 10 to 20 pounds of aggregate per square yard for Type II and 20-32 pounds per square yard for Type III on asphalt concrete pavement. The placement rate on concrete pavement shall be 30-32 pounds per square yard.

E. Adequate means shall be provided to protect the micro-surfacing from damage by traffic until such time that the mixture has cured sufficiently so that the micro-surfacing will not adhere to or be picked up by the tires of vehicles.

F. Care shall be taken to ensure straight lines along curbs, gutters and shoulders. No runoff on these areas will be permitted. Excess material and spills shall be cleaned immediately.

G. The micro-surfacing mixture shall be applied in such a manner that the joint between the new and existing surface is neat and uniform in appearance. Roofing paper or a comparable substitute shall be used at all ends of micro-surfacing limits to provide for a clean, neat, and straight definition of the end of the slurry.

H. Longitudinal joints shall correspond with the edges of the travel lanes whenever possible.

I. No excessive buildup or unsightly appearance shall be permitted on longitudinal or transverse joints.

K. At any time the quality of the mix or workmanship is not to the satisfaction of the Project Manager, the job shall be discontinued until a correction is made which is satisfactory to the Project Manager.

L. A sand blotter may be required to be spread at selected intersections and where required by the Project Manager, to accommodate pedestrian or vehicular traffic until the mixture sets. Sand blotter shall be placed by lightly broadcasting aggregate so the wet micro-surfacing mixture is not displaced. Sand blotters at intersections shall be swept within 24 hours of placement or sooner if directed by the Project Manager.

M. Traffic control devices (barricades, cones, or signs) moved in the process of applying the micro-surfacing mixture shall be returned to their proper position by the Contractor as soon as possible.

N. Wheel tracks, footprints, and other undesired markings in the micro-surfacing shall be repaired to the satisfaction of the Project Manager.

END OF SECTION