

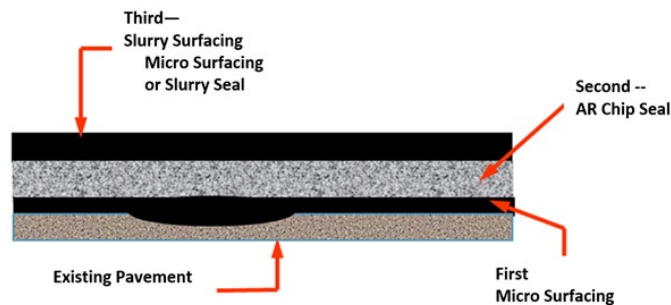
*Disclaimer*

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## CHAPTER 10 MULTI-LAYERED SYSTEMS

### 10.1 OVERVIEW

In recent years, multi-layer treatments including a layer of a Type III micro surfacing followed by a hot applied cape seal and either as slurry seal or micro surfacing have been used on poor pavements with considerable success. Figure 10-1 shows this concept where the Type III micro surfacing can be used to fill cracks or ruts.



**Figure 10-1 Triple Layer Cape Seal with Rut Filling**

By combining multiple layers (2 and 3-layer systems), it results in a cost-effective alternative compared to HMA overlays, or a mill and fill strategy. A multi-layer system may include a Type III micro surfacing course, an asphalt rubber chip seal and a slurry or micro surfacing wearing course.

Some multi-layered systems are often referred to as a Cape seal, which preserves pavements until a re-construction project can be designed and funded. Cape seals also extend the life of a pavement by the prevention of moisture intrusion into HMA as well as the base and subgrade. A multi-layer system is designed to use over pavements that has too much surface distress to be preserved with only one treatment type. When properly designed and constructed, a Cape seal is a cost-effective tool that provides improved life cycle cost benefits.

Although an untreated asphalt pavement may still be adequate after several years of use, pavement deterioration has already begun, and the application of a Cape seal needs to be applied before significant deterioration has occurred.

### 10.1.1 Types of Seals

Chip sealing is the application of a bituminous binder immediately followed by the application of an aggregate. The aggregate is then rolled to embed it into the binder. This practice has been discussed in detail in Chapter 7 of this manual. Multiple layers may be placed, and various binder and aggregate types can be used to address specific distress modes or traffic situations.

A chip seal can be either the first layer or an intermediate layer of several types of multi-layers systems depending on the distress type and level in the existing pavement. Two broad types of chip seals, including polymer-modifier emulsion and hot-applied binders are currently used. For slurry surfacing over the chip seal, either a slurry seal or micro surfacing could be used depending on the climate, traffic, and other factors.

Two or more layers of surface treatments are:

- Double chip seal
  - Polymer-Modified Emulsion (PME)
  - Hot applied Asphalt Rubber
- Micro surfacing followed by a slurry seal usually with polymer modification
- Rut filling using micro surfacing followed by a chip seal, either PM emulsion or hot-applied asphalt rubber
- Rut filling with micro surfacing followed by a chip seal and an additional slurry surfacing layer
- Chip seal followed by a slurry surfacing layer

### 10.1.2 Binder Types

Types of binders or emulsions:

- Chip seals (MTAG Chapter 7)
  - Polymer-Modified Emulsions (PME)
  - Rapid-Setting Polymer-Modified Asphaltic Emulsion (PMCRS-2 or PMCRS-2h)
  - Polymer Modified Asphalt (PMA) (Hot applied)
  - Asphalt Rubber (AR) and Terminal Blends (Hot applied)
- Slurry systems
  - Slurry Seals (MTAG Chapter 8)
    - Quick-Setting Polymer-Modified Cationic Asphaltic Emulsions (Table 8-1, and 8-2)
  - Micro Surfacing (MTAG Chapter 9)
    - Micro Surfacing Emulsion (MSE) (only emulsion specified for micro surfacing)

## 10.2 PROJECT SELECTION

The general selection of preventive maintenance treatments as a function of distress type and severity, traffic and other factors was covered in Chapter 3. The selection of the pavement for multi-layered project is based on the structural soundness of a pavement and the types of distress that are present. A multi-layered system would be suitable for correcting or improving the following distresses in pavements:

- Rutting
- Low level fatigue cracking
- Raveling and weathering
- Skid resistance
- Small cracks and voids
- Aesthetics
- Oxidation of asphalt concrete
- Surface water infiltration
- Degradation due to the elements

Usually, emulsion chip seals are applied in daytime conditions, however both micro surfacing and a hot applied chip seal can be placed in nighttime conditions when temperatures are cooler. Figure 10-2 shows examples of good candidates for multi-layer surface treatments.

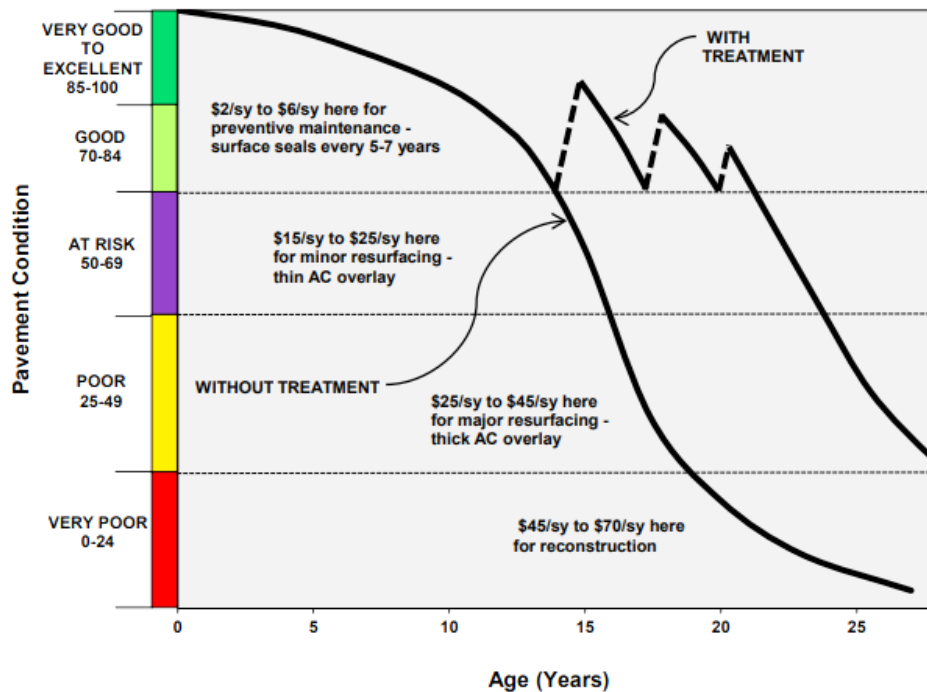


**Figure 10-2 Good Candidates for a Multi-Layer Surface Treatment (Cape Seal)**

The best practices would be to place a pavement preservation treatment prior to the pavement reaching a Pavement Condition Index (PCI) of less than 80. However, with some of the hot applied cape seals, treatments have been applied to pavements with a PCI value below 50 and multi-layer treatments have been applied to pavements with a PCI as low as 30. The City of Lompoc and County of Riverside have both used multi-layer treatments on low PCI roads with good success.

Figure 10-3 shows the PCI values from 0-100 and their corresponding pavement condition rating with and without a pavement preservation treatment.

A multi-layer system would not be a good choice if the site has wide cracks, severe rutting, or structural issues without making repairs prior to placing a surface treatment. With a PCI less than 10, Figure 10-4 shows an example of an unsuitable candidate for any preservation treatment.



**Figure 10-3 Pavement Deterioration Curve with and without Treatment (Courtesy of County of Riverside Transportation Department, Pavement Management Report 2015)**



**Figure 10-4 PCI < 10 (Very Poor Condition) (Courtesy of County of Riverside Transportation Department, Pavement Management Report 2015)**

## 10.3 DESIGN AND SPECIFICATIONS

### 10.3.1 Material Specifications

Caltrans Standard Specification, 2025, does not have a separate specification for multi-layered systems. To use this strategy, a special provision would need to be developed referring to different sections of Caltrans Standard Specifications.

Section 37 of the Standard Specifications is dedicated to seal coats. It has various sub-sections for the different types of seal coats including the following:

- 37-2 Chip Seals (emulsion, or rubberized asphalt)
- 37-3 Slurry Seals and Micro-Surfacing (usually polymerized emulsion)
- 37-4 Fog Seals and Flush Coats (emulsion)
- 37-5 Parking Area Seals (emulsion)

Section 92, Asphalt Binders, of the Standard Specifications includes the specifications for furnishing asphalt binders, while Section 94, Asphalt Emulsions, includes the specifications for furnishing asphaltic emulsions. Information on the samples must include the supplier and the type/grade of asphaltic emulsion or asphalt binder. If it is a rubberized binder, the sample needs to include the type of modifier used which includes the polymer or crumb rubber or both.

Chapter 7, Chip Seals; Chapter 8, Slurry Surfacing; and Chapter 9 Micro Surfacing include detailed description and best practices for these treatments. Each of these chapters need to be reviewed for the requirements of each treatment type. Seal coats do not increase the structural capacity of a highway section and their purpose is pavement preservation and should only be applied over a pavement that is structurally sound.

### 10.3.2 Design Process for Cape Seals

For more information on the design process for Cape seals, which are a combination of layers of chip seal and slurry surfacing refer to the specific MTAG Chapters.

- **Example of Micro surfacing + AR Chip Seal + Slurry Seal:** This combination for a multilayer cape seal can perform very well over a relatively long time period of 8-years. Figure 10-5 shows a highly distressed pavement both before treatment and 8-years after treatment within the City of Lompoc, California. The treatment is holding up very well with residential traffic (Hicks et. al., 2019).



**Figure 10-5 City of Lompoc Pre-project (Lt.), Same Location after 8-Years (Rt)**

- **Example of AR Chip Seal + Slurry Seal:** Instead of a 3-Step approach, only a cape seal was placed over approximately 40 percent of the project area, where the streets had fewer voids and depressions than the ones pictured in Figure 10-6. However, some PCIs were as low as 30. Those cape seal-only streets had no microsurfacing beneath the chip seal. Figure 10-6 (Rt.) shows an example of a cape seal using a two-layer approach of AR chip seal followed by a slurry seal after 8-years of performance.



**Figure 10-6 City of Lompoc, Pre-project (Lt.), Same Location After 8+ years (Rt.)**

### 10.3.3 Preconstruction Meeting

A preconstruction meeting shall be held within 5 days of the start of the seal coat work. The meeting should include the following:

- Unique project conditions (schools, hospitals and the like)
- Project documentation and agency expectations
- Communications
- Materials measurement
- Progress payments
- Traffic Control
- Safety

### 10.3.4 Surface Preparation

Surface preparation is covered in MTAG Chapter 9, Section 9.5.4 for micro surfacing. The key issues are:

- Clean and sound surface, make repairs if necessary
- Remove raised markers, and thermoplastic (Minimum removal 85 percent)
- Cover drainage inlets with heavy paper or roofing felt
- Cover manholes or other utility facilities with heavy paper or roofing felt
- Place temporary marker over protected utility facilities
- Starts and stops in operations should be done with roofing felt
- Use roofing felt around areas of handwork, and on turnouts
- Follow Storm Water Pollution Prevention Plan

The above surface preparation also needs to be followed for chip seals, and slurry seals.

### 10.3.5 Equipment

Equipment requirements for micro surfacing machines and chip seal equipment are covered in Caltrans Standard Specifications 2025, Section 37. Calibration requirements are discussed in the Material Plant Quality Program (MPQP).

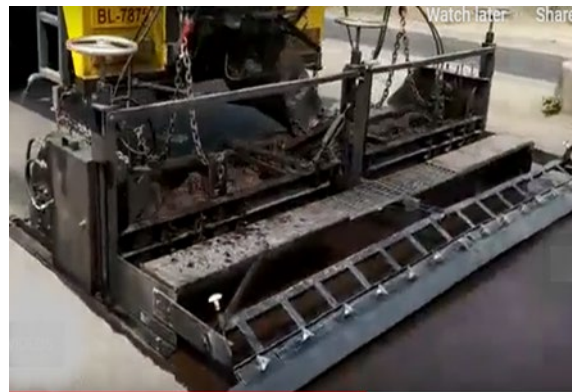
#### **Slurry Surfacing Equipment:**

- Calibrated Slurry Paver, on-board mixer which blends the aggregate, water, and additives (Figure 10-7 and Figure 10-8)
- Rollers
- Self-contained sweeper trucks or brooms
- Haul Trucks

Figure 10-7 shows a typical slurry surfacing machine. The same truck mounted slurry surfacing machine may be used for both micro surfacing and slurry surfacing.

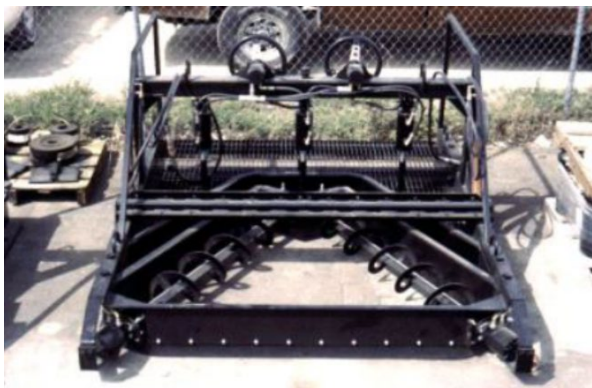


**Figure 10-7 Micro Surfacing Machine**



**Figure 10-8 Micro Surfacing Screed (Schafer)**

The equipment is very similar between slurry seals and microsurfacing. For microsurfacing the screen must have augers to evenly spread the material over the pavement surface as shown in Figure 10-8. Figure 10-9 shows a rut filling machine used for placing a surface course and a mounted outrigger used for shoulder work. Figure 10-10 shows a micro surfacing being rolled with a pneumatic roller.



**Figure 10-9 Micro Surfacing Rut Filling Machine (Lt.), Mounted Outrigger (Rt.)**



**Figure 10-10 Rolling a Micro Surfacing (Courtesy of Scott Metcalf, NPPC2021-S2)**

**Chip Seal Equipment:**

- Calibrated Distributor truck
- Calibrated Aggregate Spreader
- Pneumatic-Tire Rollers
- Self-contained sweeper trucks or brooms
- Haul trucks with dump beds:
  - Device to lock onto the rear aggregate spreader hitch
  - Dump bed that will not push down on the spreader when fully loaded
  - Dump bed must not spill aggregate on the roadway when material is being transferred to the spreader hopper

Asphalt distributor truck and the aggregate spreader should be calibrated. The calibration should be current, and it should be noted who performed the calibration and when it was done. There should be a sticker on the equipment verifying the calibration in accordance with the MPQP manual which is available at the following website:

<http://www.dot.ca.gov/manuals.htm>

Figure 10-11 shows a distribution truck applying binder for a chip seal. This chip seal may be the first layer in a multi-layer surface treatment. This binder may be either an emulsion or a hot-applied asphalt rubber binder for a chip seal. Some hot-applied binders may be polymer modified asphalt binders. Figure 10-12 shows the chips being applied to the fresh binder.



**Figure 10-11 Distribution Truck for Chip Seal Binder**



**Figure 10-12 Chips Applied by Bear Cat Spreader**

Figure 10-13 shows two rollers compacting the newly applied chips. Figure 10-14 shows a standard sweeper that is used to sweep the excess chips to the shoulder of the road. These chips may be left to augment shoulder backer.



**Figure 10-13 Multiple Rollers Compacting Freshly Applied Chips**



**Figure 10-14 Sweeper**

Figure 10-15 shows a self-contained sweeper truck on the right. Contractors often resell these recovered chips to nearby residents for their driveways. Figure 10-16 shows the Bear Cat chip spreader. This equipment is commonly used for various types of chips. For an emulsion chip seal, the chips are dampened and applied at ambient temperatures, and for hot-applied chip seals the chips are asphalt-coated and are applied at temperatures close to the hot-applied binder temperature. When a hot-applied chip seal is being placed, the

chip spreader follows the distribution truck very closely so that the chips adhere to the hot binder. The rollers follow the spread very closely so that the chips get the proper embedment.



**Figure 10-15 Self-Contained Sweeper Truck on Right**



**Figure 10-16 Bear Cat Chip Spreader**

Figure 10-17 shows a rear-dump haul truck emptying chips into the Bear Cat spreader.



**Figure 10-17 Rear-Dump Haul Truck Emptying Chips into Spreader**

### 10.3.6 Construction Process

The materials must be approved prior to being used on the project. For multi-layer systems the materials for each treatment must be submitted by the contractor and approved by the Resident Engineer.

For the chip seal portion of the construction process, the materials should include a binder sample and an aggregate sample. 37-2.01A(3) Submittals of the Caltrans Standard Specifications lists the sample requirements for chip seals. Samples are to be submitted at least 15 days before the beginning of work.

**Binder sample:** Submittals are specified in Section 37-2.01A(3) of the Caltrans 2025 Standard Specification. These samples should be sent to the District's Materials Laboratory to be forwarded to Translab. If the supplier has had these samples pre-approved, they may simply be kept as reference samples should there be a problem. Emulsions have a limited time that they can be stored for testing to be valid.

**Aggregate Sample:** Samples should be submitted to the District's Materials Laboratory, and the following chip seal aggregate test results are to be submitted to the resident engineer prior to beginning construction and should include the following:

- Gradation
- Los Angeles Rattler
- Percent of Crushed Particles
- Flat And Elongated Particles
- Film Stripping
- Cleanness Value
- Durability

Chip seal aggregate is typically cubical and close to one sized and damp for emulsion, or pre-coated when hot applied. Refer to Chapter 7 of this MTAG edition for more details on chip seals.

The QC sampling and testing plan should include the lot size and the sampling frequency, sample identification, storage and retention procedures and the sampling test procedures for both the binder and the chips.

### 10.3.7 Workmanship or Quality Issues

Workmanship and quality issues include the following as shown in MTAG section 9.5.7:

- Longitudinal Joints Best at Lane Lines (No Overlaps in Wheel Paths)
- Transverse Joints (Must Be Butted to Avoid Bumps and Started on Roofing Felt)
- Correct Amount of Water in Emulsions for Proper Texture
- Minimize Handwork at Edges of Treatment, Use Spreader Box
- Regulate Water and Cement in The Mixture

The above listed workmanship and quality issues are similar to those described in MTAG Chapters 7, 8, and 9.

To ensure the quality of the surface treatment, have the contractor place a test strip prior to beginning the contract work on the project. With a multi-layer system, the test strip should include the complete multi-layer system as shown in the plans, not just the single treatment. If the system includes polymer-modified emulsions, a reasonable cure time can be determined from the test strip prior to placing the multi-layer treatment on mainline. A test strip requirement needs to be included in the contract special provisions since multi-layer treatment specifications are not included in the Caltrans Standard Specifications, 2025. Test strip specifications should follow the requirements for each treatment type that is included in the Standard Specifications and can also be referred to in MTAG Chapters 8 and 9.

### 10.3.8 Safety

Safety issues are commonly encountered during construction. Proper traffic control is primary for the safety of the workers as well as the travelling public. Section 9.5.1 in MTAG Chapter 9 includes resources for setting up traffic control. Temporary traffic control systems are also included in the Caltrans Standard Plans, T-9 through T-22, and in MTAG Chapter 8, Field Considerations. Section 37-2.01C, "Construction", also describes traffic control for chip seal projects.

Per MTAG Chapter 9, section 9.5.1, "All employees are advised to wear and use the safety gear required for a slurry seal operation. This includes, but is not limited to, items such as hard hats, approved Caltrans shirts, safety vests, earplugs, gloves, and safety glasses. See Chapter 2 of the Caltrans Construction Manual, dated June 2023, for construction requirements and personnel duties."

### 10.3.9 Measurement and Payment

Measurements and payments are specified in the Caltrans Standard Specifications, 2025. Variations from the Standard Specifications must be made in the project’s special provisions, or by contract change order.

Payments are generally based on weights in tons of aggregate, and binder. Project progress payments are usually made monthly to the contractor. Prior to submitting the payment requests, the project’s resident engineer and the contractor meet and agree on the items to be paid. Projects that have a few working days may only have only one payment.

## 10.4 FIELD TESTING

### 10.4.1 Chip Seals

#### Chip Seal Aggregates

- Single-Sized (if possible)
- Clean
- Free of Clay
- Cubical (limited flat and elongated particles)
- Crushed Faces
- Compatible with the Selected Binder Type
- Aggregates Must be Dry for Use with Hot Binders, or Damp for Emulsion Applications

Field acceptance testing includes the following tests specified in section 37-2.01A(4)(c), Department Acceptance, of the Standard Specifications dated 2025. Table 10-1 below shows the acceptance testing criteria.

**Table 10-1 Criteria for Chip Seal Aggregate**

Quality Characteristic	Test Method	Requirement
Los Angeles Rattler Loss (Max, %) At 100 Revolutions At 500 Revolutions	California Test 211	10 40
Percent of Crushed Particles: Coarse Aggregate (Min, %) One-fractured Face Two-fractured Faces Fine Aggregate (Min, %) (Passing No. 4 Sieve and Retained on No. 8 Sieve) One Fractured Face	AASHTO T 335	95 90 70
Flat and Elongated Particles (Max by Weight at 3:1, %)	ASTM D4791	10
Film Stripping (Max, %)	California Test 302	25
Durability (Min)	California Test 229	52
Gradation (% Passing by Weight)	California Test 202	Aggregate Gradation Table Shown Under Materials for the Chip Seal Type Specified
Cleaness Value (Min)	California Test 227	80

The most common field tests include gradation, California Test 202, and cleanness value, California Test 227. For most projects, the aggregate is produced ahead of the project and stockpiled. Testing may be done during aggregate production.

Aggregate spread rates vary depending on the gradation. Table 10-2 below shows the ranges for spread rates. For 1/2-inch aggregate, the application rate may be as high as 35 lbs./ yd<sup>2</sup>.

**Table 10-2 Aggregate Spread Rates**

<b>Aggregate Gradation</b>	<b>Spread Rate Range (lbs./yd<sup>2</sup>)</b>
3/8"	20-30
5/16"	16-25
1/4"	12-20

### **Chip Seal Binder**

Binder for chip seal emulsion is usually PMCRS-2 or PMCRS-2h and is included in Section 94 of the Caltrans Standard Specifications, 2025. Polymer modified binders have better chip retention. The recommended application rate is from 0.25 to 0.40 gal/yd<sup>2</sup>. If it is a rubberized binder, the base binder grade is chosen for the climate zone as shown in the Caltrans Highway Design Manual and the application rate is heavier with a rate from 0.55 to 0.65 gal/ yd<sup>2</sup>. Caltrans Standard Specifications, 2025, state the following:

“For asphaltic emulsion or asphalt binder, acceptance is based on the Department’s sampling and testing for compliance with the requirements for the quality characteristics specified.”

If a rejuvenating emulsion is used on a Cape seal, it should be the first layer on the existing pavement and applied as a scrub seal.

The most commonly used hot applied binders for chip seals are:

- Performance Graded (PG) Asphalt
- Asphalt Rubber Binder
- Terminal Blend

The application rate for hot applied binder ranges from 0.35 to 0.50 gal/yd<sup>2</sup> depending on the size of the chips.

#### *10.4.2 Slurry Surfacing*

**Slurry Surfacing Aggregates** - Aggregates for slurry surfacing are well graded and of good quality. The best performance is obtained when the aggregate has the following characteristics:

- Well-graded
- Clean
- Free of Clay
- Crushed Faces
- Compatible with the Selected Binder Type
- Aggregates Must be Damp

Slurry surfacing emulsion includes the following:

- Conventional QS emulsions
- Polymer modified QS emulsions
- Rubberized emulsions
- Rubberized Polymer Modified Emulsions (RPME)
- Micro Surfacing emulsion (MSE)

Micro surfacing has only one binder that is specified in the Caltrans Standard Specifications, 2025, and that is the MSE.

## **10.5 TROUBLESHOOTING AND FIELD CONSIDERATIONS**

### *10.5.1 Chip Seals*

See MTAG Chapter 7, Chip Seals, for the complete Troubleshooting and Field Considerations guide.

### *10.5.2 Slurry Surfacing*

See MTAG Chapters 8, Slurry Seals, and Chapter 9, Micro Surfacing for the complete Troubleshooting and Field Considerations guides.

### *10.5.3 Field Considerations (General)*

The following table (Table 10-3) lists the guides to the important aspects of performing a multi-layer project. The table lists items that should be considered for a successful job outcome. The answers to these questions should be determined, as required, before, during, and after construction. The contractor's staff will vary by job type and size. Some topics may need attention from Caltrans construction staff. Both the Resident Engineer and the contractor's superintendent should be acquainted with potential problems and their responsibilities.

The intention of the table is not to form a report but to bring attention to important aspects and components of the Cape seal or multi-layer project process. Some information is product specific and is contained in the relevant Caltrans Standard Specifications, special standard provisions, or special provisions.

**Table 10-3 Field Considerations**

<b>Preliminary Responsibilities</b>	
<b>Project Design Review</b>	<ul style="list-style-type: none"> <li>• Is the project a good candidate for slurry surfacing?</li> <li>• What is the depth and extent of any rutting?</li> <li>• How much and what type of cracking exists?</li> <li>• Is crack sealing needed?</li> <li>• How much bleeding or flushing exists?</li> <li>• Is the pavement raveling?</li> <li>• What is the traffic level?</li> <li>• Is the base sound and well drained?</li> <li>• Review project for bid/plan quantities.</li> </ul>
<b>Document Review</b>	<ul style="list-style-type: none"> <li>• Engineer's Estimate</li> <li>• Specifications</li> <li>• Mix Design Information</li> <li>• Special Provisions</li> <li>• Construction Manual</li> <li>• Traffic Control Plan (TCP)</li> <li>• Material safety data sheet</li> </ul>
<b>Materials Checks</b>	<ul style="list-style-type: none"> <li>• Has a full mix design and compatibility test been completed?</li> <li>• Is the binder from an approved source (if required)?</li> <li>• Has the binder been sampled and submitted for testing?</li> <li>• Does the aggregate meet all specifications?</li> <li>• Is the aggregate clean and free of deleterious materials?</li> <li>• Is the aggregate dry?</li> <li>• Is the emulsion temperature within application temperature specifications?</li> <li>• Have rut-filling and leveling course application rates been calculated or estimated separately and included in the Engineer's Estimate?</li> </ul>

**Table 10-3 Field Considerations (Continued)**

<b>Pre-seal Inspection Responsibilities</b>	
<b>Surface Preparation</b>	<ul style="list-style-type: none"> <li>• Is the surface clean and dry?</li> <li>• Have all necessary pavement distresses been repaired?</li> <li>• Has the existing surface been inspected for drainage problems?</li> <li>• Have the drainage inlets been protected from potential storm damage?</li> <li>• Have the utility covers, i.e., manhole covers, valve covers, and electrical underground boxes been covered with Kraft paper for protection from slurry?</li> </ul>
<b>Equipment and Other Inspection Considerations</b>	
<b>Sweeper</b>	<ul style="list-style-type: none"> <li>• Are the bristles the proper length?</li> <li>• Can the broom be adjusted vertically to avoid excess pressure?</li> </ul>
<b>Slurry Seal Equipment</b>	<ul style="list-style-type: none"> <li>• Who carried out calibration and what documentation has been provided?</li> <li>• Is the machine fully functional?</li> <li>• Has the machine been calibrated for this project's aggregate, and emulsion, and certified. Is there a current sticker from Independent Assurance?</li> <li>• Is the spreader screed clean and not worn?</li> <li>• Is the texture screed clean and set at the right angle?</li> <li>• Are all paddles in the pug mill intact?</li> <li>• Is the spreader box clean?</li> </ul>
<b>Rollers (If Used)</b>	<ul style="list-style-type: none"> <li>• Do the roller tire pressures comply with the manufacturer's recommendations?</li> <li>• Is the pressure in all tires the same?</li> <li>• What type of roller will be used on the project (pneumatic-tired roller required)?</li> <li>• Do all tires have a smooth surface?</li> <li>• Does the roller meet Caltrans equipment specifications?</li> </ul>
<b>Stockpile</b>	<ul style="list-style-type: none"> <li>• Is the stockpile site well drained and clean?</li> <li>• Are the stockpiles protected from potential storm damage?</li> <li>• Does the Contractor have the necessary equipment required at the stockpile site (loaders, tankers, and so on)?</li> </ul>

**Table 10-3 Field Considerations (Continued)**

<b>Equipment and Other Inspection Considerations</b>	
<b>Equipment for Continuous Run Operations</b>	<ul style="list-style-type: none"> <li>• Is all equipment free of leaks?</li> <li>• Are emulsion nurse units clean and functional?</li> <li>• Are there enough units to allow continuous running with minimal stops including cleaning box screed?</li> </ul>
<b>Site Considerations</b>	
<b>Weather Requirements</b>	<ul style="list-style-type: none"> <li>• Have air and surface temperatures been checked at the coolest location on the project?</li> <li>• Do air and surface temperatures meet Caltrans requirements?</li> <li>• Are adverse weather conditions expected? High temperatures, humidity, and wind will affect how long the emulsion takes to break.</li> <li>• The application of the slurry surfacing does not begin if rain is forecast.</li> <li>• Are freezing temperatures expected within 24 hours of the completion of any application runs?</li> </ul>
<b>Traffic Control</b>	<ul style="list-style-type: none"> <li>• Do the signs and devices used match the traffic control plan?</li> <li>• Does the work zone comply with Caltrans requirements?</li> <li>• Flaggers hold the traffic for specified periods of time, or less.</li> <li>• Unsafe conditions are reported to Resident Engineer or the contractor's superintendent, including any accidents.</li> <li>• The pilot car leads traffic slowly, 25 mph (40 kph) or less?</li> <li>• Signs are to be removed or covered when they no longer apply.</li> </ul>
<b>Application Considerations</b>	
<b>Determining Application Rates</b>	<ul style="list-style-type: none"> <li>• Have agency guidelines and requirements been followed?</li> <li>• Has a full mix design been performed and approved by the Resident Engineer?</li> <li>• Is more material applied to dried-out and porous surfaces?</li> <li>• Is more material applied on roads with low traffic volumes?</li> <li>• Is less material applied to smooth, non-porous, and asphalt-rich surfaces?</li> <li>• Has aggregate moisture content been adjusted in the application rate?</li> </ul>

**Table 10-3 Field Considerations (Continued)**

<b>Project Inspection Responsibilities</b>	
<b>Slurry Surfacing Application</b>	<ul style="list-style-type: none"> <li>• Has a test strip been done and is it satisfactory?</li> <li>• Have field tests been carried out and are the results within specification?</li> <li>• Are there enough trucks on hand to keep a steady supply of material for the slurry machine?</li> <li>• Does the application start and stop with neat, straight edges? Will an edge box be used?</li> <li>• Does the application start and stop on building paper or roofing felt?</li> <li>• Are drag marks minimized due to oversize aggregate or a dirty screed?</li> <li>• Are screeds cleaned regularly and at the end of each day?</li> <li>• Does the machine take a straight, even line with minimal numbers of passes to cover the pavement?</li> <li>• Is the mix even and consistent?</li> <li>• Are fines migrating to the surface?</li> <li>• Is the application stopped as soon as any problems are detected?</li> <li>• Does the application appear uniform?</li> <li>• Does the surface have an even and uniform texture?</li> <li>• Is the application rate and mix checked based on the amounts of aggregate and emulsion used?</li> <li>• Is the slurry surfacing adequately cured between spreading, foot traffic, and opening to vehicular traffic?</li> </ul>
<b>Rolling</b>	<ul style="list-style-type: none"> <li>• Does rolling wait until the mat is stable? Roller is 3-6 tons (Caltrans, 2025) maximum.</li> <li>• Is the entire surface rolled only once?</li> <li>• Do the rollers travel slowly, 5 mph maximum?</li> </ul>
<b>Truck Operation</b>	<ul style="list-style-type: none"> <li>• Are trucks staggered across the fresh seal coat to avoid driving over the same area?</li> <li>• Do trucks travel slowly on the fresh seal?</li> <li>• Are stops and turns made gradually to avoid turn marks in the new slurry surface?</li> <li>• Do truck operators avoid driving over the new slurry?</li> <li>• Do truck operators stagger their wheel paths when backing into the paving unit?</li> </ul>

**Table 10-3 Field Considerations (Continued)**

<b>Project Inspection Responsibilities</b>	
<b>Longitudinal Joints</b>	<ul style="list-style-type: none"> <li>• Is the longitudinal joint overlap a maximum of 3 in.?</li> <li>• Do the spreader box runners avoid running on freshly applied surface?</li> <li>• Are the longitudinal joints made at the center of the road, center of a lane, or edge of a lane, and not in the wheel paths? (Lane line preferable.)</li> </ul>
<b>Transverse Joints</b>	<ul style="list-style-type: none"> <li>• Do all applications begin and end on building paper or roofing felt?</li> <li>• Mixture is not too wet at start up.</li> <li>• Is the building paper or roofing felt disposed of properly after use?</li> </ul>
<b>Sweeping</b>	<ul style="list-style-type: none"> <li>• Does sweeping begin after the slurry surfacing is able to carry traffic?</li> <li>• Does sweeping dislodge the slurry surfacing</li> <li>• Is the surface raveling? Follow-up sweeping should be done if traveling is high or if traffic is high volume</li> </ul>
<b>Opening The Slurry Surfacing to Traffic</b>	<ul style="list-style-type: none"> <li>• Does the traffic travel slowly — 25 mph or less—over the fresh slurry surfacing? (Open to traffic within 4 hours after placement without pilot cars.)</li> <li>• Are reduced speed limit signs used when pilot cars are not used?</li> <li>• After sweeping, have pavement markings been placed before opening to traffic?</li> <li>• Have all construction-related signs been removed when opening to normal traffic and all pavement markings have been completed?</li> </ul>
<b>Clean Up</b>	<ul style="list-style-type: none"> <li>• Have all loose aggregates from sweeping been removed from traveled way prior to opening to traffic?</li> <li>• Have all binder spills been cleaned up?</li> </ul>

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*Note: Caltrans manuals referenced above may have later editions than those cited. Refer to the latest editions of these references for the most current information.*