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CHAPTER 8 SLURRY SEALS

8.1 OVERVIEW

This chapter provides an overview of the types of slurry seals presently used in California, including materials and specifications, mix design, project selection, and details regarding construction. A troubleshooting guide is also included to assist the Engineer if problems arise during the placement of these treatments, and a listing of suggested field considerations when placing a slurry surfacing.

8.1.1 General Description

Slurry seals are a mixture of asphalt emulsion, graded aggregates, mineral filler, water, and other additives. The mixture is made and placed on a continuous basis using a slurry surfacing machine. The slurry surfacing machine meters the mix components in a predetermined order into a pug mill. The typical mixing order is aggregate followed by cement, water, the additive, and the emulsion. Figure 8-1 illustrates the process of mixing and placing a slurry seal.

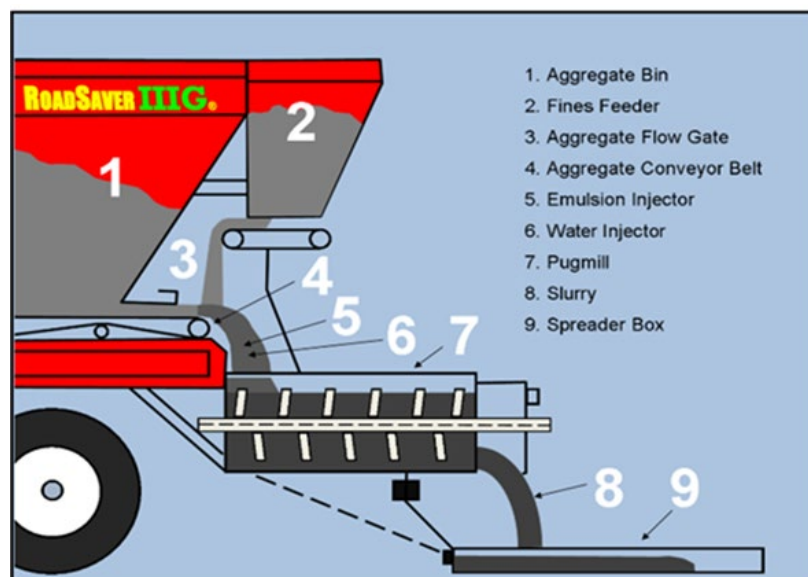


Figure 8-1 Schematic of a Slurry Seal Machine (RoadSaver)

The resulting slurry material is a free-flowing composite material that is spread via a spreader box over the existing road surface. The consistency of the slurry material allows it to spread evenly over the pavement, wetting it, and forming an adhesive bond to the pavement.

The slurry mixture contains asphalt emulsion that breaks on the pavement surface through heterogeneous or homogenous flocculation. The asphalt particles coalesce into films, creating a cohesive mixture. After placement, the slurry mixture cures, by loss of water, into a hard wearing, dense-graded asphalt/aggregate mixture that is bonded to the existing pavement.

A slurry surfacing does not add any structural capacity to an existing pavement; they are applied as a maintenance treatment to improve the functional characteristics of the pavement surface. The types of slurry surfacing and the pavement characteristics they improve are described in the following sections of this chapter. Slurry seals are considered a “green” cost effective preventative maintenance treatment.

8.1.2 Purpose of a Slurry Seal

A slurry seal is a thin surface treatment that is laid in a thickness equal to the largest stone in the grading of its component aggregate. It may include either a conventional or polymer modified emulsion, and the slurry seal may be slow or quick setting. The emulsion is usually cationic in nature but may be anionic. Slow set systems break mostly by evaporation; quick set systems have additives that react chemically with the aggregate surfaces. These quick set emulsions maintain a degree of chemical break. For both systems, breaking and curing times are strongly influenced by the environmental conditions at the time of application; at high temperatures the emulsion in quick set systems breaks and cures very quickly such that the surface treatment can be opened to traffic within a few hours; slow set systems typically require a longer time to break and cure. In cooler conditions, the times before opening to traffic are longer for both systems. For this reason, slurry seals should not be applied at night.

A slurry seal is used to:

- Seal sound and oxidized HMA pavements
- Restore surface texture by providing a skid-resistant wearing surface
- Improve waterproofing characteristics by filling minor cracks
- Correct raveling
- Provide a new smoother surface, and may be used where weight restrictions preclude the use of heavier overlays (e.g., bridge decks)
- Provide a new surface where height restrictions are a problem with thicker HMA overlays (e.g., overcrossings)
- Improve the appearance of oxidized pavements, and make pavement delineation stand out to the drivers
- Extend life expectancy of pavement to delay a major rehabilitation
- Improve appearance and seal minor cracks in concrete pavements, or to match adjacent HMA

A slurry seal should not be used to:

- Correct surface profile or cross-slope
- Fill potholes
- Alleviate moderate or major cracking (with or without polymer modification)
- Add structural capacity to a structurally deficient pavement
- Correct severe alligator cracking

The advantage of a slurry seal is that it is a cost-effective treatment that allows agencies to stretch their budget. It is presented by International Slurry Surfacing Association (ISSA) as a “green” technology that uses 40% less energy and produces 45% fewer greenhouse emissions since it uses cooler production temperatures. Slurry seals also use less asphalt and aggregate than some of the traditional pavement maintenance methods (ISSA, 2024). Slurry seals do not require modifications to meet ADA requirements, whereas micro surfacing may require modifications.

8.1.3 Parking Area Seals

Although not officially a slurry seal, Parking Area Seals (aka. seal coats) may be a better surface treatment for high stress areas such as parking lots and cul-de-sacs, where sharp turning and power steering movements can cause scuffing of conventional slurry seals. Parking Area Seal products are covered in Standard Specifications Section 37-4, which requires asphalt emulsion binders to be made with a harder grade of residual asphalt to be tougher in high stress areas. Many proprietary products are available.

8.2 MATERIALS

The main materials used in slurry surfacing are:

- Asphalt Emulsion
- Water
- Graded aggregate
- Mineral Filler (cement or aluminum sulphate)
- Additives

8.2.1 Asphalt Emulsion

Asphalt emulsions are defined in Chapter 2 of this advisory guide as asphalt dispersed in water stabilized by chemicals. In the case of slurry surfacing, the emulsion may be cationic or anionic; however, cationic emulsions are the most common. Caltrans Standard Specifications Section 94 (Caltrans, 2025) provides specifications for the allowable emulsion types. Emulsions used in slurry seals are either slow setting (SS or CSS) or quick setting (QS). Caltrans (2025) specifies the following slow and quick setting emulsion types:

- PMCQS-1h (Polymer Modified CQS)

- CSS-1 and CSS-1h (Cationic Slow Set)
- CQS-1 and CQS-1h (Cationic Quick Set)
- SS-1, and SS-1h (Anionic Slow Set)
- QS-1 and QS1h (Anionic Quick Set)

These emulsions are specially formulated for compatibility with the aggregate and to meet the appropriate mix design parameters. These emulsions are defined in Chapter 2 of this guide and in Section 94 of the Standard Specifications (Caltrans, 2025). Emulsion specifications are based on standard emulsion characteristics, such as stability, binder content, and viscosity. In some quick set slurry systems, polymer is added to the emulsion. The polymer enhances aggregate retention, especially in the early life of the treatment. The added polymer also reduces thermal susceptibility. Polymers also improve the softening point and flexibility, which enhance the treatment's crack resistance.

Conventional emulsions may be either slow setting or quick setting mixtures. Emulsions are usually cationic but may also be anionic. It is important to consider weather conditions when placing an emulsion slurry seal because it cures by evaporating of the water in the mixture.

Emulsions are usually modified with latex, which is an emulsion of rubber particles. The latex does not mix with the asphalt; rather, the latex and the asphalt particles intermingle to form a sort of 3-D structure. The latex used is either neoprene or styrene butadiene styrene (SBR) for slurry seal. When modified with latex, slurry seal emulsions are referred to PMCQS-1h (Quick-Setting Polymer-Modified Cationic Asphaltic Emulsion).

Latex may be used as the polymer, and it separates from the emulsion due to the differences in density. If separation occurs, the latex must be remixed into the emulsion by circulation in the tanker before the modified emulsion is transferred to the slurry machine for application per Caltrans Standard Specifications, 2025.

Emulsions are listed in Caltrans Standard Specifications (2025), Section 94-1.02B through Section 94-1.02K, show the specifications for the various asphalt emulsions. However, only the two emulsions shown below are approved in the Caltrans Standard Specifications, 2025, in section 37-3.02A(4)(b)(ii), and section 37-3.02A(4)(b)(iii) for slurry seal.

Quick-setting Asphaltic Emulsion (approved for Slurry Seals and shown in Section 37 and Section 94) Polymer Modified Cationic Quick Setting Asphaltic Emulsion (approved for Slurry Seals and shown in Section 37 and Section 94).

Key requirements include the binder content and residual asphalt properties. Viscosity and storage stability are important to ensure that the emulsion can be used effectively in the field. If it is stored for more than 24 hours after it has been diluted, it must be circulated in the storage tank or tanker for a minimum of 30 minutes before use, per section 37-4.02C, Construction.

Table 8-1, and Table 8-2 show the requirements for the approved asphaltic emulsions as shown in sections 94-1.02I, "Quick-Setting Asphaltic Emulsions" and 94-1.02J, "Quick-Setting Polymer-Modified Cationic Asphaltic Emulsions", of the Caltrans 2025 Standard Specifications.

Table 8-1 Caltrans Requirements for Quick-Setting Asphaltic Emulsion

Quality Characteristic	Test Method	Grade QS-1	Grade QS-1h	Grade CQS-1	Grade CQS-1h
Saybolt Furol viscosity, at 25°C (Saybolt Furol seconds)	AASHTO T 59	15-90	15-90	15-90	15-90
Storage stability test, 1 day (max, %)	AASHTO T 59	1	1	1	1
Particle charge ^a	AASHTO T 59	--	--	Positive	Positive
Sieve test (max, %)	AASHTO T 59	0.3	0.3	0.3	0.3
Residue from distillation or evaporation test (min, %) ^b	AASHTO T 59	57	57	57	57
Tests on residue:					
Penetration, 25°C (dmm)	AASHTO T 49	100-200	40-90	100-200	40-90
Ductility, 25°C (min, mm)	AASHTO T 51	400	400	400	400
Solubility in Trichloroethylene (min, %)	AASHTO T44	97.5	97.5	97.5	97.5

^aIf the result of the particle charge test is inconclusive; the asphaltic emulsion must be tested for pH under ASTM E70. Grade QS-1h asphaltic emulsion must have a minimum pH of 7.3. Grade CQS-1h asphaltic emulsion must have a maximum pH of 6.7.

^bDistillation is the defining test if there is a conflict with evaporation.

Table 8-2 Caltrans Requirements for Quick-Setting Polymer-Modified Cationic Asphaltic Emulsion

Quality Characteristic	Test Method	Requirement for Grade PMCQS-1h
Saybolt Furol viscosity, at 25°C (Saybolt Furol seconds)	AASHTO T 59 ^d	15–90
Storage stability test, 1 day (max, %)	AASHTO T 59 ^d	1
Sieve test (max, %)	AASHTO T 59 ^d	0.30
Particle charge ^a	AASHTO T 59 ^d	Positive
Residue from distillation or evaporation test (min, %) ^b	AASHTO T 59 ^d	60
Tests on residue:		
Penetration, 25°C (dmm)	AASHTO T 49	40–90
Ductility, 25°C (min, mm)	AASHTO T 51	400
Torsional recovery (min, %) ^c	CT 332	18
or		
Elastic recovery, 25°C (min, %) ^c	AASHTO T 301	60

^aIf the result of the particle charge test is inconclusive; the asphaltic emulsion must be tested for pH under ASTM E70.

^bDistillation is the defining test if there is a conflict with evaporation.

^cElastic recovery is the defining test if there is a conflict with torsional recovery.

^dDistillation temperature of 350°F.

8.2.2 Aggregates

The aggregate's key physical characteristics for suitable incorporation into a slurry surfacing mix are defined by:

- **Geology:** This determines the aggregate's compatibility with the emulsion along with its adhesive and cohesive properties.
- **Shape:** Caltrans (2023) requires that the aggregates must have 95% fractured faces. Rounded aggregates result in poor mix strength.
- **Texture:** Rough surfaces form bonds more easily with emulsions.
- **Age and Reactivity:** Freshly crushed aggregates have a higher surface charge than aged (weathered) aggregates. Surface charge plays a primary role in emulsions reaction rates.
- **Sand Equivalent:** Deleterious materials such as clay, dust, or silt can cause poor cohesion and adversely affect reaction rates. The sand equivalent (CT 217) is used.
- **Durability:** Los Angeles Rattler (CT 211) is used for hardness, and Durability (CT 229).

The aggregate gradation and quality requirements for the three different types of slurry seals are shown in the Caltrans Standard Specifications (2025), in Section 37-3.01B(2) Aggregate, and the requirements for aggregate quality are shown in Section 37-3.02B(4), Aggregate.

The primary difference among these gradations is the aggregate top size. Type I slurries are the finest and are used for lightly trafficked roads, tennis courts, or parking lots. Type II slurries are coarser and are suggested to be used for raveling and oxidation distresses on roadways with moderate to heavy traffic volumes. Type III slurries have the coarsest grading and are appropriate for filling minor surface irregularities, correcting raveling, and oxidation, and restoring surface friction. Type III slurries are typically used on arterial streets and highways.

The role of fines (i.e., aggregate particles No. 200 [75 μ m] and finer) in a slurry surfacing mix is to form a mortar with the residual asphalt to cement the larger size aggregates in place. The fines content is essential for creating a cohesive hardwearing mix. Generally, the fines content should be at the mid-point of the grading envelope. Figure 8-2 shows a cross-section of a slurry seal application, which may vary from 1/4-inch to 3/8-in in thickness based on the largest nominal aggregate size.

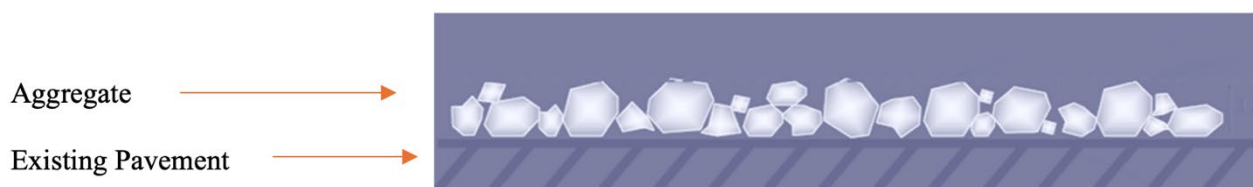


Figure 8-2 Slurry Seal Placement (WRAPP)

8.2.3 Mineral Filler and Additives

According to ISSA, the mineral filler can be Portland cement, hydrated lime, limestone dust, fly ash or other approved filler meeting the requirements of ASTM-D242 (2019), and is considered part of the dry aggregate. The Caltrans Standard Specifications, 2025, section 37-3.03B(4) state that a mineral filler must be a Type I or Type II Portland cement, and if a mineral filler is used in the mix design, it must be used during production. Type II-V can also be used for the slurry seal mix.

In most slurry surfacing, cement is used as a mixing aid allowing the mixing time to be extended and creating a creamy consistency that is easier to spread. Additionally, hydroxyl ions counteract the emulsifier ions, resulting in a mix that breaks faster with a shorter curing time. Cement is also a fine material and, as such, absorbs water from the emulsion, causing it to break faster after placement. Fine materials, as previously discussed, also promote cohesion of the mixture by forming a mortar with the residual asphalt.

Other additives other than cement, are not approved in the Caltrans Standard Specifications, 2025. If other additives are to be incorporated into the mix design, it would either be included in the special provisions, or as a contract change order after award of contract. They may act as retardants to the reaction with emulsions, either as a prophylactic, slowing the emulsifier's access to the aggregate surface, or by reacting with the emulsifier in the system. Additives include emulsifier solutions, aluminum sulfate, aluminum chloride, and borax. Generally, increasing the concentration of an additive slows the breaking and curing times. This is useful when temperatures increase during the day.

8.3 MIX DESIGN

The performance of a slurry surfacing depends on the quality of the materials and how they interact during and after cure. The mix design procedure looks at the various phases of this process, which include:

- **Mixing:** Will the components blend to form a slurry with the desired consistency?
- **Breaking and Curing:** Will the emulsion break in a controlled way, coating the aggregate? Will the emulsion build up cohesion to a level that will resist abrasion due to traffic?
- **Performance:** Will the slurry seal resist traffic-induced stresses i.e., raveling?

The steps in slurry design include:

- Prescreening of Materials
- Job Mix Design
- Final Testing

At each stage, mixing, breaking, and curing, performance issues must be addressed.

8.3.1 Prescreening

Prescreening involves testing the physical properties of the raw materials. The emulsion type is selected based on job requirements and is checked against the requirements laid out in the specifications (Standard Specifications, Section 37 and Section 94). The aggregate is checked against specifications in Section 37, and a simple mixing test is performed to assess compatibility with the emulsion. The job mix formula can be developed once it is determined that the materials are compatible and meet specifications.

8.3.2 Slurry Seal Mix Design

Mix designs for slurry seals are generally done by private laboratories or suppliers and follow the ISSA mix design procedure. The following sections discuss some of the design requirements for slurry seals.

Mixing Proportions and Consistency

The International Slurry Surfacing Association (ISSA) Test Method TB 102 (Technical Bulletin 102) is no longer listed by ISSA. This was a subjective test, and the result was highly dependent on the operator. TB 106 (2015) is the current test for Slurry Seal Consistency, and ISSA A105 provides specific target values for consistency results. This test may be used in conjunction with TB 113 (2014) for determining mix time for slurry seal. Figure 8-3 illustrates a good slurry mixture consistency.



Figure 8-3 Good Mixture Consistency

Wet Stripping of Cured Slurry Seal

ISSA recommends TB 114, “Test Method for Wet Stripping of Cured Slurry Surfacing Mixtures”, and this test is also a requirement for Caltrans mix designs. This test identifies the ability of the cured slurry mixture to remain coated.

Compatibility

TB 115, “Determination of Slurry System Compatibility” is a test requirement for Caltrans mix designs. The characteristics that are evaluated are:

- Smooth, stable homogeneous mass
- Two-minute minimum mixing and workability, after addition of the asphalt emulsion
- Remain stable and homogeneous after placement
- Cures with a firm bond with internal adhesion and cohesion to prevent raveling

Cohesion Build-up

Once the emulsion content is determined, three mixes are then made, one at the selected emulsion percentage from above, one at -2% of the selected emulsion content and one at +2% of the selected emulsion content. This allows a bracketing of the desired mix proportions. The ISSA test method detailed in TB 139 (ISSA, 2017) is used to determine the initial set and cure development as a function of torque over time in a slurry mixture. This test may be performed at the expected field temperatures to provide the most accurate estimate of the treatment’s characteristics.

Wet Track Abrasion

TB 100, “Laboratory Test Method for Wet Track Abrasion of Slurry Surfacing Systems”, measures the wearing qualities of slurry surfacing systems under wet abrasion conditions. This test is listed for both slurry seals and micro surfacing, and this test is a requirement for Caltrans mix designs. ISSA A105 and A143 provide the specific target values for this test.

Table 8-3 lists Caltrans slurry seal mix design requirements included in section 37-3.02B(5) of the Caltrans Standard Specifications, 2025. Other test methods that may be used include TB 144, and TB 147A. TB 147 A is “Test Method for Measurement of Stability and Resistance to Compaction, Vertical and Lateral Displacement of Multilayered Fine Aggregate Cold Mixes”. These test method procedures are available under the ISSA Technical Bulletins.

Table 8-3 Slurry Seal Mix Design Requirements (2025)

Property	Test Method ^a	Slurry Seal Requirements
Consistency (max, mm)	TB 106 (Rev. 2015)	30
Wet Stripping	TB 114 (Rev. 2017)	Pass
Compatibility	TB 115 (Rev. 2005)	Pass ^b
Cohesion Test, Within 1hour (min, kg-mm)	TB 139 (Rev. 2017)	200
Wet Track Abrasion (max, g/m ²)	TB 100 (Rev. 2024)	810

^aTest methods are by the International Slurry Surfacing Association (ISSA)

^bMixing test must pass at the maximum expected air temperature at the project site during placement

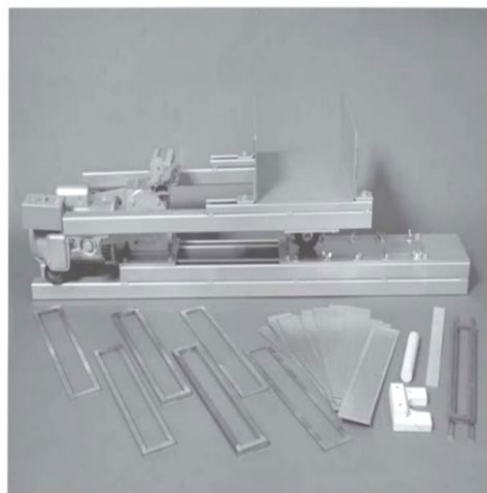
The results of the abrasion test are plotted along with the specification requirements. This allows selection of the minimum binder content of the mixture. The slurry seal type shows a wide range of allowable percentages of residual asphalt for each type of slurry seal, as shown in Table 8-4 in accordance with Caltrans 2025 Standard Specifications, section 37-3.02B(5), “Slurry Seal Mix Design”.

Table 8-4 Requirements of Asphaltic Residue for Different Slurry Seal Types (Caltrans 2025)

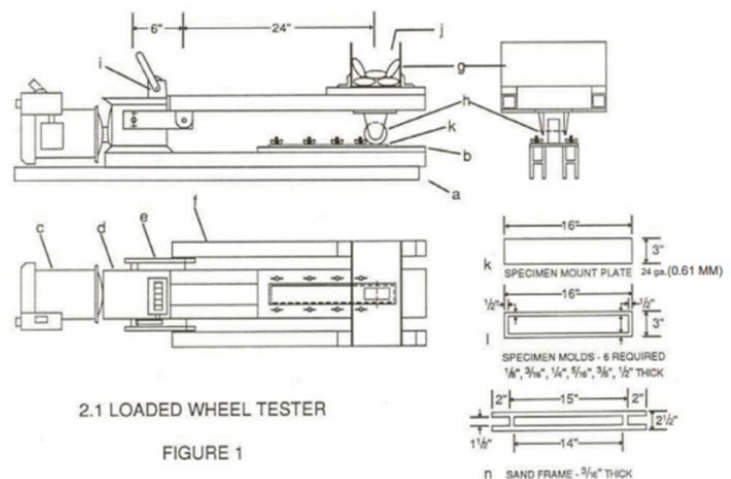
Slurry Seal Type	Residue Range
Type I	10-16
Type II	7.5-13.5
Type III	6.5-12.0

Upper Binder Limit

The upper binder limit is determined using the Loaded Wheel Test, as described in TB 109 (ISSA, 2022). In this test, the slurry seal specimen is compacted by means of a loaded rubber-tired reciprocating wheel as illustrated in Figure 8-4. After 1000 loading cycles, the specimen is removed from the machine, washed, and dried to constant weight. Then, the specimen is mounted again on the machine and hot sand is added on the surface. After another 100 cycles of compaction, the increase in weight of the specimen due to sand adhesion is noted. This provides a measure of the free asphalt on the surface of the sample. When more sand is retained on the specimen, the more prone the mix is to flushing or bleeding under traffic loading. Figure 8-5 illustrates the test apparatus along with a series of tested samples. See TB 109 for further details of the Loaded Wheel Tester and sand adhesion test.



a) Testing Apparatus



b) Schematic

Figure 8-4 Loaded Wheel Test Equipment (ISSA TB 109) for Excess Asphalt



Figure 8-5 Tested Samples (TB 109) Showing Retained Sand from Loaded Wheel Test

Optimum Binder

The optimum percentage emulsion or binder content is found by plotting the results obtained from the Wet Track Test (TB 100) and the Loaded Wheel Test (TB 109). Figure 8-6 illustrates a typical plot of test results. The optimum binder content is chosen close to the intersection of the two plotted lines. The optimum binder content should be selected by a designer based on their laboratory experience and field knowledge.

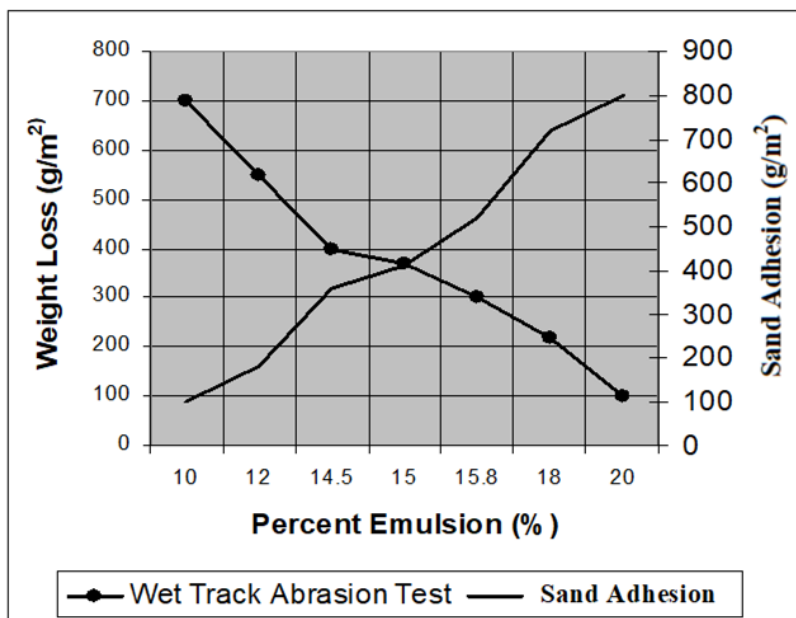


Figure 8-6 Determining Optimum Binder Content

8.3.3 Final Testing

Once the job mix components have been selected, the mix is tested to determine its properties and to ensure compliance with the specifications listed in Table 8-3. Additional testing may include TB 144 for compatibility between aggregate and emulsions, and TB 147A for stability and resistance to compaction. If the mix conforms to the specifications, the emulsion content and aggregate grading, it is then proposed as the job mix formula.

Field adjustments may be made to the job mix formula to accommodate climatic variables during application. As a result of the mix design process, adjustments are limited to the amount of additives (cement and retardant) and water content required to ensure a good homogeneous mix at the time of placement.

8.3.4 A Modern, Rational Mix Design for Slurry Surfacing Systems

Recognizing the need for more rational design methods for slurry seal and micro surfacing, the Federal Highway Administration (FHWA) enlisted the California Department of Transportation (Caltrans) to form a pooled fund study with the overall objective of developing a rational mix design method for slurry seal and micro surfacing. The improved mix design procedures, guidelines, and specifications will address the performance needs of the owners and users, the design and application need of the suppliers, and improve the reproducibility of the test methods used for the mix designs. The pooled fund study project involved 13 State Departments of Transportation, was started in 2003 and the last progress report was dated March 2005. Since 2005 several organizations associated with the slurry surfacing industry have developed training courses for mix designs. Virginia Education Center for Asphalt Technology (VECAT) has several online course modules taught by GERMANN Community College. The International Slurry Seal Association (ISSA) maintains the test methods and is responsible for making updates to these test methods. The Asphalt Emulsion Manufacturers Association (AEMA) also offers training and an Inspector's Manual, Additional information is available through the Asphalt Institute, California Asphalt Pavement Association, and Road Resources Pavement Preservation & Recycling Alliance (PPRA). The California Pavement Preservation Center (CP2 Center) also offers a yearly training seminar which includes slurry seal and micro surfacing.

8.3.5 Project Selection

Slurry surfacing may be used for a range of applications, but project selection is critical and often pretreatments such as pothole patching, crack sealing, and dig outs are required. Table 8-5 lists general job selection criteria for slurry surfacing treatments and typical application rates.

The main use of slurry surfacing materials is for pavement preservation as a part of a program of periodic surfacing before distresses appear. The main criteria for project selection are:

- Sound and well drained bases, surfaces, and shoulders

- Free of distresses, including potholes and cracking
- Pavement Condition Index (PCI)

Placing a pavement preservation treatment prior to the pavement reaching a PCI of between 70 to 80 is a current best practice shown by previous studies done with MTI. Figure 8-7 shows the pavement condition index classifications, and that best management practices are to place a slurry seal when the pavement is still in good condition. Table 8-5 is a slurry type selection table for traffic volumes and aggregate spread rates.

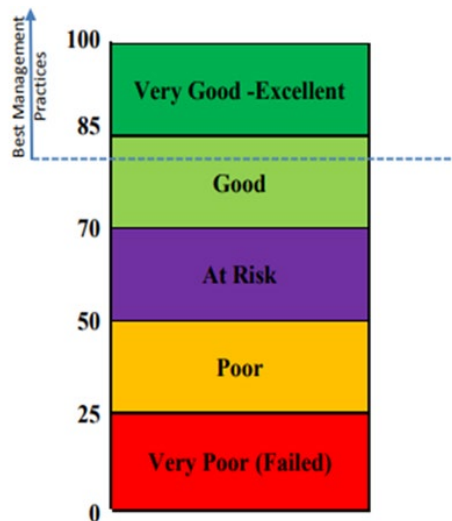


Figure 8-7 Pavement Condition Index Classifications

Table 8- 5 Project Selection Criteria

Slurry Seal Spread Rates	Aggregate Type I	Aggregate Type II	Aggregate Type III
Void Filling	•	•	
Wearing Course (AADT) < 100	•	•	
Wearing Course (AADT) 100 – 1,000		•	•
Wearing Course (AADT) 1,000 – 20,000			•
Minor Shape Correction (0.4-0.8 in [10-20mm]) ^{ab}			•
Application Rates in pounds of dry aggregate per square yard	8 - 12	10 - 18	20 - 25

^aIf shape correction is required, micro surfacing may be more appropriate.

^bMulti-layer systems, i.e., cape seals, or double chip seals may provide a longer life wearing surface for higher traffic volumes.

Distress modes that can be addressed using slurry seals include:

- Raveling: Aged surfaces or surfaces losing aggregate
- Oxidized pavement with hairline cracks
- Friction Loss: Skid resistance can be restored

Distress modes that cannot be addressed using slurry seals include:

- Rutting
- Cracking (including reflection cracking)
- Base Failures (of any kind)
- HMA Layers that exhibit plastic shear deformation

Slurry seals will not alleviate the cause of these distresses. As a result, the distresses will continue to form despite the application of a slurry surfacing.

Many agencies are currently using Pavement Management Systems (PMSs) that may trigger maintenance treatments related to the age and the type of pavement. Two of the common systems are StreetSaver, and Micro Paver. Some agencies have developed their own PMS.

8.3.6 Performance of Slurry Seals

According to a California study, slurry seals have been estimated to last around 3 to 5 years (Van Kirk, 2004). Longer service lives (up to 15 years) have been observed when the seals are placed as true preventive maintenance treatments on suitable roads.

Traffic is not a limiting factor. The main failure mechanism is wear. Over time, the slurry seals oxidizes and abrades under traffic. Premature failure occurs from placement on highly deflecting surfaces, cracked surfaces, pavements with base failures, and on dirty or poorly prepared surfaces which may result in delamination. If the existing surface is a chip seal, a higher application rate of a slurry seal will be required.

8.4 CONSTRUCTION

The main components of the construction process include:

- Traffic Control and Safety
- Equipment Requirements
- Stockpile/Project Staging Area Requirements
- Surface Preparation (including treating vegetation with herbicide to prevent regrowth following slurry seal)
- Equipment Calibration
- Test Strips
- Application Conditions, i.e. weather
- Quality Issues
- Post Construction Conditions
- Post-Treatments

Section 8.5.2, “Field Considerations”, at the end of this chapter, provides a series of tables to guide project personnel through the important aspects of placing a slurry surfacing.

8.4.1 Traffic Control and Safety

Traffic control must be in place before work forces and equipment arrive in the work zone. Traffic control is required both for the safety of the traveling public and the personnel performing the work. Traffic control includes construction signs, construction cones and/or barricades, flag personnel, and pilot cars to direct traffic, around the construction operation. For detailed traffic control requirements, refer to the Caltrans project specifications and the Caltrans Code of Safe Operating Practices (2022). It is recommended that the public is informed of the pavement maintenance activities that will take place in their neighborhood and that it is very important not to drive on the new surface for as long as the traffic signs are present. Very often drivers assume that the slurry seal is drivable despite the warning signs and cause damage to the fresh placed treatment. Doorknob cards or fliers are recommended to notify the residents and provide information on how to accommodate the construction activities.

Traffic control is also required to protect the integrity of the application. The curing time for the slurry seal material will vary depending on the pavement surface conditions and the weather conditions at the time of application as well as chemical additives that may control set time. Under ideal conditions, including increasing air and surface temperatures, it is suggested that traffic be kept off the slurry seal material until it is adequately cured. Caltrans Standard Plans, 2023, has several plans for traffic control for various highway configurations. See Temporary Traffic Control Systems, T-9 through T-22 of the Standard Plans, and Chapter 8, Field Considerations of the manual.

All construction personnel 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.

8.4.2 Equipment Requirements

Equipment requirements for slurry machines are covered in Caltrans Standard Specifications Section 37 (Caltrans, 2025). Calibration requirements are discussed in the Material Plant Quality Program (MPQP). Modern equipment, as shown in Figure 8-8, can be used to place slurry surfacing.

A slurry seal spreader box is a drag box, as shown in Figure 8-9. The drag box is pulled behind the paver by means of chains. This box may or may not have augers; for quick set systems, augers should be used. The slurry seal should be easy to work and spread, and not cause any hang-up in the box.

The design mix is proportioned by weight while the slurry seal or surfacing machines deliver materials by volume. Due to this different nature of the measurements, it is essential that calibration be done with the actual job materials by qualified testers. No machine should be allowed to work on a Caltrans job without proper calibration. If the equipment was calibrated on a previous project the calibration should be for no more than six months, and the calibration should be re-checked.

Caltrans Material Plant Quality Program (MPQP) has calibration procedures in the MPQP Manual (2022) for many different types of plants and slurry seal pavers. The staff performing the calibration must also be certified to perform the work. Often, the calibration is performed with the County Weights and Measures personnel present along with the District Weights and Measures Coordinator. With equipment computerization, the calibration procedures have changed, and several of the slurry surfacing equipment manufacturers have developed new calibration procedures for their new computerized equipment.



Figure 8-8 Slurry Surfacing Machine



Figure 8-9 Slurry Seal of Micro Surfacing Box with Augers

Figures 8-10 through 8-13 show various stages of HB-Hi-Mod Slurry Surfacing.



Figure 8-10 HB Hi-Mod Slurry Seal, CP2 Center, 2024 (Courtesy of Erik Updyke)



Figure 8-11 HB Hi-Mod Slurry Seal CP2 Center, 2024 (Courtesy of Erik Updyke)



Figure 8-12 Freshly Placed HB Hi-M



Figure 8-13 Example of Scuffing from Early Traffic on HB Hi-M

As industry progresses, the choices for different types of slurry seals have increased. Currently, fiber slurry seals have been placed with success. The fibers should delay reflective cracking and increase the lifespan of the slurry seal. Carbon black and carbon fiber has also been added to the slurry seal mixture. This increases the aesthetics of the slurry seal and improves the visibility of the pavement markings.

Fiber slurry is not currently included in the 2025 Caltrans Standard Specifications. If this strategy is chosen, the individual district would have to construct it as a pilot project. It is currently touted as a cost-effective preventative maintenance treatment, consisting of glass or carbon fibers, finely crushed aggregates, mixed with a polymer modified emulsion. This treatment should be effective in sealing minor cracks and delaying reflective cracking.

A new type of slurry seal is a Hi-Mod Slurry Seal recently used on residential streets in Huntington Beach. The city specification was for Rubberized Polymer Modified Slurry

(RPMS). It's a Polymer Modified Emulsion slurry seal that requires the addition of about 5 percent of dry weight of aggregate (DWA) of crumb rubber, whether added to the emulsion before delivery or during mixing in the distribution truck. The hi-mod slurry was substituted for RPMS on several streets as a demonstration project in Huntington Beach.

RAP has been substituted for virgin aggregate. This is a cost saving strategy for both the aggregate and the emulsion binder. The RAP already has asphalt binder on the aggregate, so less binder is needed for the slurry seal mixture. RAP also has a 100 percent crushed aggregate.

The new slurry seal technology is producing superior materials which are expected to extend the service life by 2 or more years.

8.4.3 Stockpile / Project Staging Area Requirements

The stockpile and project staging area must meet some basic requirements. These requirements include:

- A clean, well-drained pad for aggregate piles
- A front-end loader for loading equipment
- A salt-free water supply
- An emulsion tanker
- An additive tanker

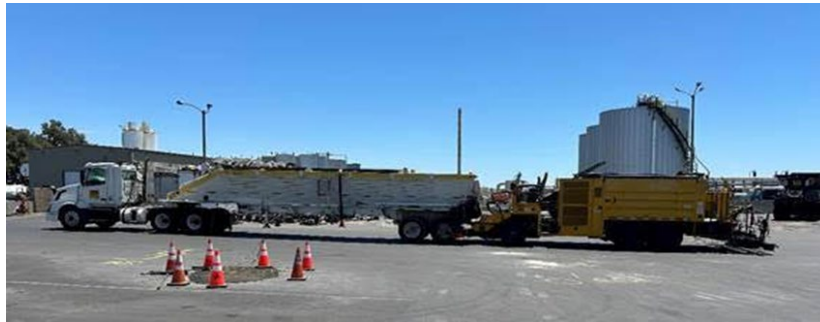
There are two basic types of slurry seal paving equipment as shown in Figures 8-14 and Figure 8-15. They are a truck mounted batch type mixer, and a continuous self-loading mixer. Figure 8-15 (b) shows a continuous slurry machine with a nursing trailer (93 feet long bumper to bumper). The continuous slurry machine has a length of 93 feet with the flow-boy trailer attachment making this equipment train almost the length of two Semis combined. Some jobs may not be constructible using a continuous machine and must use a truck mounted mixer.



Figure 8-14 Truck Mounted Mixer



(a)



(b)

Figure 8-15 Continuous Self-Loading Mixers (a) and (b)

The stockpile and staging area should be as close as possible to the job site. Figure 8-16 illustrates a typical stockpile and staging area.



Figure 8-16 A Typical Stockpile and Project Staging Area

Operations should be scheduled to run as smoothly as possible and provide good traffic flow through the work zone. Aggregates that are below optimum moisture content specified in the mix recipes should be remixed using the front-end loader to avoid segregation. In some cases, aggregates that are separating in the stockpile or during loading may need to be sprayed with water to avoid fines loss.

8.4.4 Surface Preparation

The main objective of surface preparation is to provide a clean and sound surface on which the slurry seal is applied. The first step of surface preparation is to restore the pavement's structural integrity and functional performance characteristics through crack sealing and patching (see Chapters 4 and 5 of this guide for more information on these procedures).

Immediately before the slurry surfacing is applied, the road must be swept clean of all debris including clay and hard-to-remove materials (such as organic matter). High power pressure washing may be required. If left on the road, these types of contaminants will cause delamination of the treatment in these areas. Thermoplastic road markings must also be removed prior to placing a slurry surface or at least abraded to produce a rough surface. Paint markings require no pretreatment. Rubber crack sealant on the roadway should be removed prior to applying a slurry surface.

Utility inlets should be covered with heavy paper or roofing felt adhered to the surface of the inlet. The paper is removed once the slurry surfacing has sufficiently cured. In addition to covering the inlets, all starts, stops, and handwork on turnouts should be done on roofing felt to ensure sharp, uniform joints and edges. Figure 8-17 illustrates the various surface preparation steps along with illustrations of delamination resulting from poor surface preparation.



Figure 8-17 Surface Preparation Methods

8.4.5 Equipment Calibration

Equipment requirements for slurry seal machines are covered in section 37 of the 2025 Caltrans Standard Specifications. Calibration requirements are discussed in the Material Plant Quality Program (MPQP). Equipment, as shown in Chapter 9, Figure 9-9, can be used to place either micro surfacing or slurry seal. The spreader box must include augers for micro surfacing due to it being a stiffer mix. The augers are not required to place slurry seal.

Caltrans Material Plant Quality Program (MPQP) has calibration procedures in the MPQP Manual (2022) for many different types of plants and slurry seal pavers. The staff performing the calibration must also be certified to perform the work. Often, the calibration is performed with the County Weights and Measures personnel present along with the District Weights and Measures Coordinator. With equipment computerization, the calibration procedures have changed, and several of the slurry surfacing equipment manufacturers have developed new calibration procedures for their new computerized equipment.

8.4.6 Test Strips

If a test strip is required, it should be included in the special provisions for slurry seals. The requirements should be similar to those in section 37-3.03C(4) Test Strips for micro surfacing. It is important to inspect the test strip after traffic has used it for 12 hours to determine if the placement procedure is acceptable. The test strip should be from 300 to 450 feet in length. The location of the test strip should be determined at the pre-construction meeting with the contractor.

8.4.7 Application Conditions

The application conditions required are addressed in detail in the Caltrans Standard Specifications Section 37 (Caltrans, 2025). The basic requirement for success is that the emulsion must be able to break and form continuous films, as it is the only way a slurry mixture can become cohesive. As a result, humidity, wind conditions, air and pavement surface temperatures are important and need to be considered. Modifications to additives should be made according to the changing environment during application. In any case, application of a slurry seal is generally not suitable for night work. This is due to the lower evaporation rate at night, which results in longer breaking and curing times.

For a conventional slurry seal project, air temperature should be a minimum of 50°F (10°C) and rising. Humidity should be 60% or less and a slight breeze is advantageous. Work should not be started if rain is imminent. Slurry seals will typically resist rain induced damage after as little as one hour but typically require at least three hours to cure to a fully waterproof state. Additionally, breaking time for a slurry is affected by ambient temperature. Work should not be started if freezing temperatures are anticipated within 24 hours of construction. Aggregate and emulsion temperature are also affecting the breaking time. An example is given in Figure 8-18.

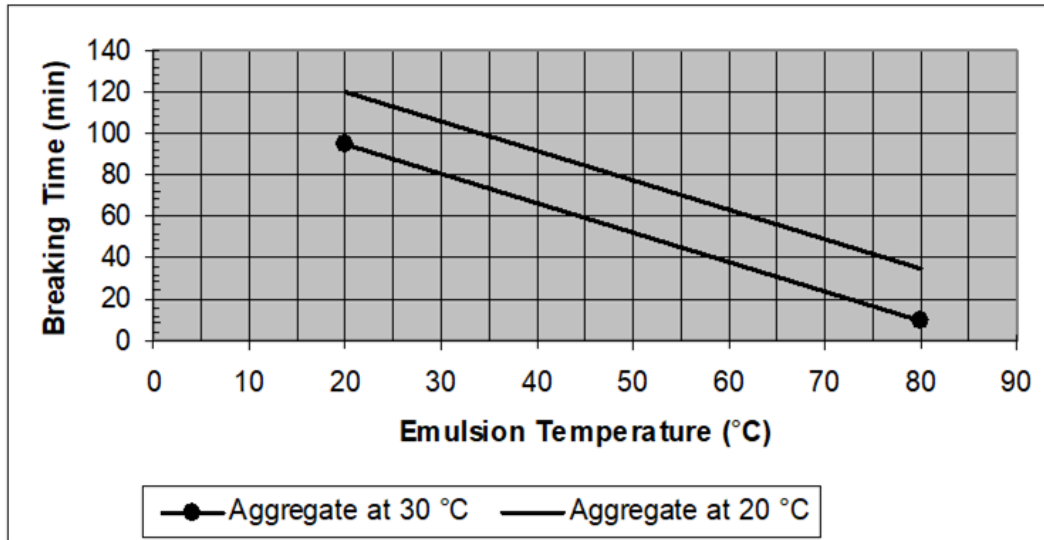


Figure 8-18 Effect of Temperature on Break Rate

8.4.8 Quality Issues

Quality control is critical during the construction process to achieve a uniform surface finish. The main areas of concern are discussed below.

Longitudinal Joints

Longitudinal joints may be overlapped or butt jointed. They should be straight or curve with the traffic lane. Overlaps should not be in the wheel paths and should not exceed 3 in (75 mm) in width. Figure 8-19 illustrates high-quality and poor-quality longitudinal joints.



a) High-Quality Longitudinal Joint b) Poor-Quality Longitudinal Joints

Figure 8-19 Longitudinal Joints

Transverse Joints

Transverse joints are inevitable when working with batch systems; every time a truck is emptied a transverse joint is required. Transitions at these joints must be smooth to avoid creating a bump in the surface. The joints must be butted to avoid these bumps, and handwork should be kept to a minimum. The main difficulty in obtaining a smooth joint occurs as the slurry machine starts up at the joint. Some contractors tend to over wet (add too much water) to the mix at start-ups. This leads to poor texture and scarring at the joints. Starting transverse joints on roofing felt can eliminate these problems. Figure 8-20 illustrates high-quality and low-quality transverse joints.



a) High-Quality Transverse Joint



b) Low-Quality Transverse Joint

Figure 8-20 Transverse Joints

Edges and Shoulders

Slurry sealed edges and shoulders can be rough and look poor. The edge of the spreader box should be outside the line of the pavement and edge boxes should be used when shoulders are covered. Figure 8-21 illustrates high-quality and poor-quality edge and handwork.



a) High-Quality Edges and Shoulder



b) Poor-Quality Edges and Shoulder

Figure 8-21 Edges and Shoulders

Uneven Mixes and Segregation

Poorly designed slurry mixtures or mixtures with low cement content or too high a water content may separate once mixing in the box has ceased. This leads to a black and flush looking surface with poor texture. Separated mixes may lead to a “false slurry” where the emulsion breaks onto the fine material. In such instances delamination may occur, resulting in premature failure. These types of mixes can be recognized as non-uniform mixes that appear to be setting very slowly. Figure 8-22 illustrates segregation and delamination resulting from a false slurry caused by poor mixes.

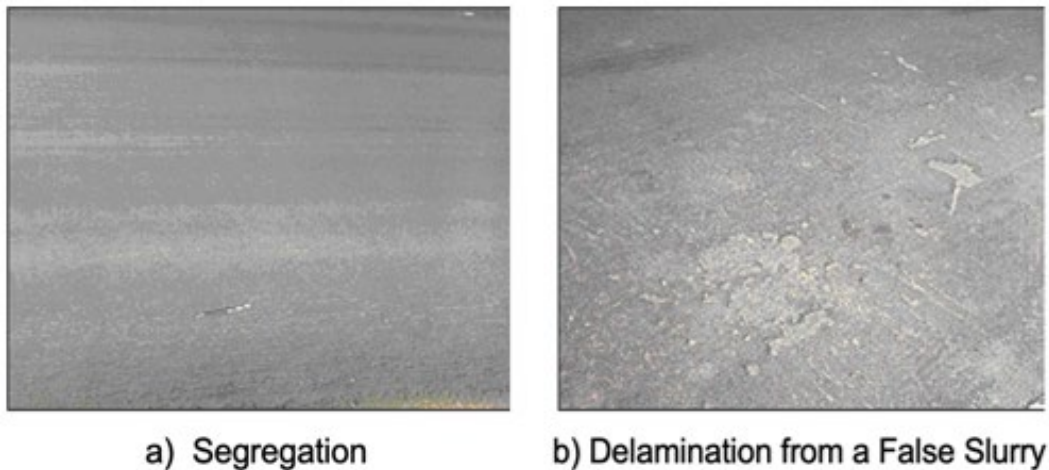


Figure 8-22 Poor Mixes

Smoothness Problems

Slurry mixtures follow the existing road surface profile and thus do not have the ability to significantly change the pavement’s smoothness. However, when using stiffer mixes, the spreader box may, if incorrectly set up, chatter or bump as the material is spread and produce a washboard effect. The chattering may be addressed by making the mixture slower to set, adjusting the screed on the box, or adding weight to the back of the spreader box. Figure 8-23 illustrates the washboard effect.

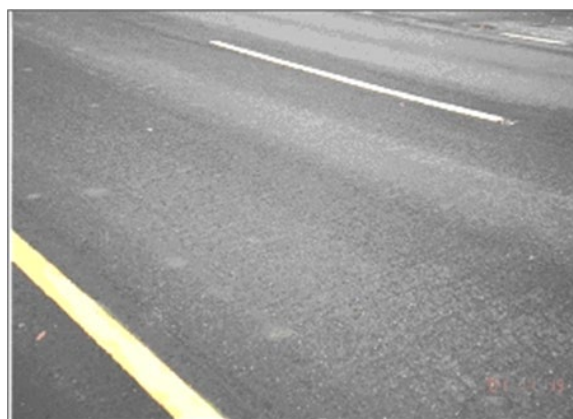


Figure 8-23 Wash Boarding Effect

Damage Caused by Premature Opening to Traffic

The slurry seal must build sufficient cohesion to resist abrasion due to traffic. Early stone shedding is normal but should not exceed 3%. If a mixture is reopened to traffic too early it will ravel off quickly, particularly in high stress areas. It is important that the mixture has formed adequate cohesion before it is opened to traffic. Choosing the right time to reopen a surface to traffic is based largely on experience. However, a general rule of thumb for a slurry seal is that it can be opened to traffic when it has turned black. Figure 8-24 illustrates raveling caused by premature opening to traffic.



Figure 8-24 Traffic Damage Caused by Early Trafficking

8.4.9 Post Construction Conditions

Emulsion systems do not lose all water in the first hours after placement; the total water loss process can take up to several weeks. During this period the surface will be water resistant; however, if the water freezes, it can cause rupture of the binder film and subsequent raveling. Thus, projects should not be started when freezing weather is expected to occur in a 2-week period.

Asphalt emulsion cannot re-emulsify; however, if not fully cured, these systems can be tender enough to re-disperse under the effects of traffic loading and excessive water, especially ponding water. In this process, broken aggregates or asphalt particles that have not fully coalesced into films are dispersed in water, which disintegrates the emulsion. Thus, while light rain 3 hours after placing a slurry seal may be acceptable, heavy rain coupled with heavy traffic will likely lead to surface damage, especially in high shear areas (e.g., turning movement). Figure 8-25 illustrates damage caused by a combination of heavy rain and high shear.



Figure 8-25 Damage Due to Post Application Heavy Rain with Shear

8.4.10 Post-Treatments

Rolling

Slurry seals will lose stone until the surface voids have been closed off, but it is acceptable for approximately 3% of surface stone to be lost. To limit the amount of aggregate loss, rolling with pneumatic rollers may be incorporated. For rut filling with micro surfacing applications, rolling is almost always recommended. The roller should be light (6-7 tons maximum) and non-ballasted. One to two passes at a slow speed are recommended. This allows the water to be pressed to the surface, promoting evaporation and curing. Larger stones will be punched into the new surface, reducing shedding or early raveling. Figure 8-26 illustrates a typical roller operation.

Since rolling improves the density of slurry seal, it can be of special benefit for slurry seals in high-stress areas such as parking lots, where scuffing from sharp turns and power steering movements is a problem.



Figure 8-26 Rolling a Slurry Surfacing

Sweeping

On heavily trafficked roads, where opening has led to excessive stone loss, sweeping is essential. A self-contained vacuum sweeper is the best type of sweeper to use. Sweeping

should be done just prior to opening to traffic and at periods determined by the level of stone loss. Figure 8-27 illustrates a self-contained vacuum sweeper.



Figure 8-27 Self-contained Vacuum Sweeper

Sanding

Sanding may be used to reduce the time that cross streets or intersections are closed. Sanding is the application of a fine layer of dry, washed sand that is broadcast over the slurry surface to prevent pickup. Sanding may also be used on wet spots. Sanding should not be done until the slurry can withstand walking traffic. Figure 8-28 illustrates the use of sanding at a cross street.



Figure 8-28 Sanding at a Cross Street

8.5 TROUBLESHOOTING AND FIELD CONSIDERATIONS

8.5.1 Troubleshooting Guide

This section provides information to assist the maintenance personnel in troubleshooting problems with slurry seals along with “dos and don’ts” that address common problems that may be encountered during the project. The troubleshooting guide presented in Table 8-6 associates common problems with their potential causes. For example, an unstable emulsion, too little water in the mix, incompatibility between the emulsion and the aggregate may cause a slurry surface to delaminate.

Table 8-6 Trouble Shooting Slurry Seal Project Problems

Cause	Brown	Whitish	Won't Set	Poor Coating	Delayed Opening to Traffic	Breaks In Box	Ravels	Flushes	Delamination	Segregation	Scuffing
Emulsion Unstable				<input type="checkbox"/>		<input type="checkbox"/>			<input type="checkbox"/>		
Emulsion Too Stable	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>				
Emulsion Too Hot						<input type="checkbox"/>					
Too Little Emulsion	<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>				
Too Much Emulsion								<input type="checkbox"/>			
Mix Too Many Fines				<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Mix Too Much Cement		<input type="checkbox"/>				<input type="checkbox"/>					
Mix Too Little Cement			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>
Mix Too Little Additive				<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>
Mix Too Much Additive		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>				
Mix Too Much Water	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Mix Too Little Water		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		
Mix Aggregate/Emulsion Not Compatible			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Too Hot	<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Too Cold			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		
Rain	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
High Humidity		<input type="checkbox"/>	<input type="checkbox"/>								
Surface after Treatment Fatty (Oily)			<input type="checkbox"/>					<input type="checkbox"/>			
Surface after Treatment Dusty or Dirty Aggregate							<input type="checkbox"/>		<input type="checkbox"/>		
Surface after Treatment Aggregate not Pre-wetted									<input type="checkbox"/>		
Surface after Treatment Wrong Treatment Selection					<input type="checkbox"/>						<input type="checkbox"/>

In addition to the troubleshooting guide, Table 8-7 lists some commonly encountered problems and their recommended solutions.

Table 8-7 Problem Solving

Problem	Solution
Uneven Surface – Wash Boarding	<ul style="list-style-type: none"> • Ensure the spreader box is correctly set up. • Ensure the viscosity of the mix is not too high. • Adjust so that the mix does not break too fast. • Wait until the ambient temperature is lower. • Use water sprays on the front of the spreader.
Poor Joints	<ul style="list-style-type: none"> • Reduce the amount of water at start up. • Use water spray if runners of spreader box are running on fresh material.
Excessive Ravel	<ul style="list-style-type: none"> • Add cement and reduce additive so that the mix breaks and cures faster. • Check aggregate to ensure the clay fines are not too high. • Control traffic longer and at low speeds. • Wait until fully cured before allowing traffic. • Wait until mix is properly set before brooming or opening to traffic.

8.5.2 Field Considerations

The following tables are guides to the important aspects of performing a slurry surfacing project. The tables list 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 slurry surfacing project process. Some information is product specific and is contained in the relevant standard specifications, special standard provisions, or special provisions.

Table 8-8 Field Considerations

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

Table 8-8 Field Considerations (Continued)

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

Table 8-8 Field Considerations (Continued)

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

Table 8-8 Field Considerations (Continued)

Project Inspection Responsibilities	
Slurry Surfacing Application	<ul style="list-style-type: none"> • Has a test strip been done and is it satisfactory? • Have field tests been carried out and are the results within specification? • Are enough trucks on hand to keep a steady supply of material for the slurry machine? • Does the application start and stop with neat, straight edges? Will an edge box be used? • Does the application start and stop on building paper or roofing felt? • Are drag marks minimized due to oversize aggregate or a dirty screed? • Are screeds cleaned regularly and at the end of each day? • Does the machine take a straight, even line with minimal numbers of passes to cover the pavement? • Is the mix even and consistent? • Are fines migrating to the surface? • Is the application stopped as soon as any problems are detected? • Does the application appear uniform? • Does the surface have an even and uniform texture? • Is the application rate and mix checked based on amounts of aggregate and emulsion used? • Is the slurry surfacing adequately cured between spreading, foot traffic, and opening to vehicular traffic?
Rolling	<ul style="list-style-type: none"> • Does rolling wait until the mat is stable? Roller is 3-6 tons (Caltrans, 2023) maximum. • Is the entire surface rolled only once? • Do the rollers travel slowly, 5 mph (8-9 kph) maximum?
Truck Operation	<ul style="list-style-type: none"> • Are trucks staggered across the fresh seal coat to avoid driving over the same area? • Do trucks travel slowly on the fresh seal? • Are stops and turns made gradually to avoid turn marks in the new slurry surface? • Do truck operators avoid driving over the new slurry? • Do truck operators stagger their wheel paths when backing into the paving unit?

Table 8-8 Field Considerations (Continued)

Project Inspection Responsibilities	
Longitudinal Joints	<ul style="list-style-type: none"> • Is the longitudinal joint overlap a maximum of 3 in (75 mm)? • Do the spreader box runners avoid running on fresh mat? • 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.)
Transverse Joints	<ul style="list-style-type: none"> • Do all applications begin and end on building paper or roofing felt? • Mixture is not too wet at start up. • Is the building paper or roofing felt disposed of properly after use?
Brooming	<ul style="list-style-type: none"> • Does brooming begin after the slurry surfacing is able to carry traffic? • Does brooming dislodge the slurry surfacing? • Is the surface raveling? Follow-up brooming should be done if raveling is high or if traffic is high volume.
Opening the Slurry Surfacing to Traffic	<ul style="list-style-type: none"> • Does the traffic travel slowly — 25 mph (40 km/h) or less—over the fresh slurry surfacing? (Open to traffic within 4 hours after placement without pilot cars.) • Are reduced speed limit signs used when pilot cars are not used? • After brooming, have pavement markings been placed before opening to traffic? • Have all construction-related signs been removed when opening to normal traffic and all pavement markings have been completed?
Clean Up	<ul style="list-style-type: none"> • Have all loose aggregates from brooming been removed from traveled way prior to opening to traffic? • Have all binder spills been cleaned up?

8.6 REFERENCES

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Valley Slurry Seal International, Matthew Ferguson, PMP, Vice President Construction, 3785 Channel Drive, West Sacramento, CA 9569, 2024.

Western Regional Association for Pavement Preservation (WRAPP), Julie Ackman, Executive Director.

8.7 WEBSITE SOURCES

FHWA Checklists: <https://www.fhwa.dot.gov/preservation/>

FHWA: https://www.dot.gov/civilrights/programs/ada/doj_fhwa_ta.cfm

FHWA Manual on Uniform Traffic Control Devices (MUTCD):
<https://mutcd.fhwa.dot.gov/?vm=r>

ISSA for guidelines to Crack Sealing A-175 Pavement Preservation & Recycling Alliance (PPRA): https://www.roadresource.org/treatment_resources/micro_surfacing

FP2: Formerly the Foundation for Pavement Preservation: <https://fp2.org>

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.