

## Conventional Slurry Seal

### Sample Construction Specification Guideline

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### 1. Scope

The scope of this sample construction specification guideline is limited and intended to provide general information regarding the design, component material specification, application, inspection, measurement, and payment of a Conventional Slurry Seal.

### 2. Description

Conventional Slurry Seal is a laboratory-designed mixture of asphalt emulsion, aggregate, mineral filler, water, and other additives accurately proportioned, mixed, and uniformly spread over a properly prepared surface.

Conventional Slurry Seal can be used for both preventive and routine maintenance.

It is recommended on pavement with a sound base structure to prevent or correct distresses such as raveling, oxidation, loss of friction, and top-down cracking less than 0.25 inches (0.64 cm) in width. Bottom-up cracks, working cracks, and cracks larger than 0.25 inches (0.64 cm) should be sealed with a high-quality sealant prior to application.

### 3. Materials

#### 3.1 Asphalt Emulsion

The asphalt emulsion shall be designated CQS-1H and shall meet the requirements shown in Table 1. Asphalt emulsion delivered to the project shall be accompanied by a laboratory Certificate of Analysis and any other certifications as deemed necessary or advisable.

Table 1			
Property	Test Procedure	Specification	
	AASHTO	Min	Max
<b>Tests on Emulsion</b>			
Viscosity, Saybolt-Furol, 77°F, seconds	M208	20	100
Sieve Test, %	M208	-	0.1
Residue by Distillation, %	M208	62	-
<b>Tests on Residue From Distillation</b>			
Penetration, 77°F, 100 g, 5 seconds, 0.1mm	T49	40	90
Ductility, 77°F, 5 cm/min, cm	T51	40	-

### 3.2 Aggregate

#### 3.2.1 Gradation

The gradation type to be used shall be set forth in the plans.

The gradation of the aggregate stockpile shall not vary by more than the stockpile tolerance from the mix design gradation (indicated in Table 2) and shall remain within the specification gradation band. The percentage of aggregate passing any two successive sieves shall not change from one end of the specified range to the other end.

The aggregate will be accepted at the job location or stockpile based on five gradation tests. The average of the five tests shall be within the stockpile tolerance from the mix design gradation for the stockpile to be accepted.

Sieve Size	Type I Percent Passing	Type II Percent Passing	Type III Percent Passing	Stockpile Tolerance from the Mix Design Gradation
3/8" (9.5 mm)	100	100	100	
No. 4 (4.75 mm)	100	90-100	70-90	+/- 5%
No. 8 (2.36 mm)	90-100	65-90	45-70	+/- 5%
No. 16 (1.18 mm)	65-90	45-70	28-50	+/- 5%
No. 30 (600 um)	40-65	30-50	19-34	+/- 5%
No. 50 (330 um)	25-42	18-30	12-25	+/- 4%
No. 100 (150 um)	15-30	10-21	7-18	+/- 3%
No. 200 (75 um)	10-20	5-15	5-15	+/- 2%

### 3.2.2 Aggregate Source Requirements

The aggregate shall be from a single source consisting of 100% crushed stone. To assure the material is 100% crushed, the parent aggregate shall be larger than the largest stone in gradation to be used.

### 3.2.3 Aggregate Quality Tests

The aggregate shall also meet the properties shown in Table 3. Proven performance may justify the use of aggregates that do not pass all of the requirements. The polishing value of aggregates should be carefully evaluated, especially in higher traffic situations, and local agency experience, guidelines, and specifications should be considered. The polishing value requirement may be waived for ADT volumes less than 1,500.

Test	AASHTO Method	Specification
Sand Equivalent	T176	55 Minimum
Soundness	T104	15% Maximum using Sodium Sulfate 25% Maximum using Magnesium Sulfate
LA Abrasion	T96	30% Maximum
Polish Value	T278, T279	31 Minimum

### **3.3 Mineral Filler**

Mineral filler may be a Type I or I/II Portland cement, hydrated lime, limestone dust, fly ash, or other approved filler, as listed in ASTM D242 for mineral filler.

### **3.4 Water**

The water shall be from a potable source, free of harmful salts, chemicals, and contaminants. If the quality of the water is in question, it should be submitted to the laboratory with the other raw materials for the mix design.

### **3.5 Additives**

An additive may be used to control the breaking and setting characteristics of the Conventional Slurry Seal. The additive should be supplied by the asphalt emulsion manufacturer or approved by the laboratory as part of the mix design.

### **3.6 Tack Coat**

Normally, a tack coat is not required unless the surface to be covered is concrete, is extremely dry and raveled, or does not receive typical traffic as in an airport pavement. When required, the emulsified asphalt shall be designated as CQS-1H and meet the requirements set forth in Table 1. The asphalt emulsion shall be diluted at the rate of one part emulsion to three parts water and shall be applied with an asphalt distributor capable of evenly applying the emulsion. The application rate shall be 0.05 to 0.10 gallons of diluted emulsion per square yard. The tack coat shall be allowed to cure sufficiently before the application of Conventional Slurry Seal. If the tack coat is required, it will be noted on the plans or in the contract documents.

## **4. Mix Design**

The contractor shall submit a mix design to the agency a minimum of 10 days prior to the start of the project. As a minimum, the design shall include the following: aggregate properties, aggregate gradation, the results of Table 4 design requirements, design asphalt residue, and mineral filler percentages based on dry weight of the aggregate. The contractor shall submit to the agency representative samples of each ingredient to be used in the Conventional Slurry Seal mixture for design verification. The samples shall include information relative to sources, type of materials, and project number. No work shall begin until the agency has approved the mix design.

	Mixture Control Tolerance	Types		
		I	II	III
Range for Residual Asphalt, % <sup>1</sup>	+/- 0.5%	10%-16%	7.5%-13.5%	6.5%-12%
Range for Mineral Filler, % <sup>1</sup>	+/- 0.5%		0-3.0	
Test	Method – ISSA TB <sup>2</sup>	Value		
Wet Track Abrasion Loss, maximum 1-hour soak	TB 100	75 g/ft <sup>2</sup>		
Excess Asphalt by Loaded Wheel Test, maximum	TB 109	50 g/ft <sup>2</sup>		
Mixing Time, seconds, 77°F, minimum	TB 113	180		
Set Time, 30 minutes, minimum	TB 139	12 kg-cm		
Early Rolling Traffic Time, 60 minutes, minimum	TB 139	20 kg-cm		
Wet Stripping Test, % Coating, minimum	TB 114	90		

1. Percent residual asphalt and percent mineral filler shall be based on weight of dry aggregate.
2. Reference to ISSA TB means International Slurry Surfacing Association Technical Bulletin.

## 5. Composition of Mixture

The Conventional Slurry Seal material shall be a uniform mixture of aggregate, asphalt emulsion, mineral filler, water, and other additives as required to control set time in the field. The emulsion and aggregate shall be compatible so that a complete, uniform coating of the aggregate shall be obtained in the mixing unit. The mixture shall have sufficient working life to allow for proper placement at the existing ambient temperature and humidity. The agency shall require the mixture to be redesigned if replacement of a constituent source or a change of gradation outside of the tolerance is allowed. The constituents shall be proportioned to produce a uniform mixture meeting the requirements of Table 5.

Aggregate Type	Location	Suggested Application Rate
Type I	Parking Areas Urban and Residential Streets Airport Runways	8-12 lb/yd <sup>2</sup> (4.3-6.5 kg/m <sup>2</sup> )
Type II	Urban and Residential Streets Airport Runways	12-20 lb/yd <sup>2</sup> (6.5-10.8 kg/m <sup>2</sup> )
Type III	Primary and Interstate Routes	18-30 lb/yd <sup>2</sup> (9.8-16.3 kg/m <sup>2</sup> )

## 6. Equipment

### 6.1 Mixing Equipment

The paving mixture shall be blended by a self-propelled, positive, non-slipping aggregate delivery system (belt over chain) slurry surfacing mixing machine, which shall be a continuous flow mixing unit able to accurately deliver and proportion the aggregate, polymer modified emulsion, mineral filler, field control additives, and water to a revolving multi-blade, twin-shafted mixer, and discharge the mixed product on a continuous flow basis. The mixture shall be thoroughly blended so that no uncoated aggregate is visible upon discharge from the mixing unit. In general, either truck mounted or continuous-run pavers can be used. If a continuous-run machine is used, it shall be equipped with self-loading devices, which provide for the loading of all materials while continuing to lay material and shall be equipped with opposite side driving stations to optimize longitudinal alignment. A continuous-run machine shall be equipped to allow the operator to have full hydrostatic control of the forward and reverse speed during the application of the slurry seal material. If truck mounted units are allowed, they shall be equipped with a positive, non-slipping aggregate delivery system (belt over chain) and have the capability of applying a minimum of 10 tons of aggregate without recharging the aggregate bin.

### 6.2 Water Pressure System

The mixing machine shall be equipped with a water pressure system and nozzle-type spray bar to provide a water spray ahead of and outside the spreader box.

### 6.3 Calibration and Proportioning Devices

The machine shall be equipped with individual volume or mass controls or other gauging devices for measuring and proportioning each material added to the mix. Each material control device shall be calibrated, properly marked, and positively interlocked. The aggregate feed to the mixer shall be equipped with a revolution counter or similar device so that the amount of asphalt emulsion, aggregate, and mineral filler use may be determined at any time. Each mixing unit shall be calibrated prior to commencement of the work. The calibrations shall be performed and verified in the presence of the agency or the agency's representative. Once calibrated, the aggregate and emulsion flows shall not be changed without the approval of the agency. Mineral filler may be adjusted within the design tolerance, and the water and additive may be adjusted as necessary to control the mix properties to produce an acceptable mix. With agency approval, previous calibration documentation covering the exact materials to be used may be acceptable, provided they were made within the last three months.

### 6.4 Emulsion Pump

The emulsion pump shall be a heated, positive displacement-type pump.

## **6.5 Spreading Equipment**

Attached to the machine shall be a hydraulically adjustable-type spreader box with a positive screed adjustment for yield control. The box shall be attached to the mixer equipped with ribbon flights mounted on an adjustable shaft to continually agitate and distribute the material throughout the box. The box will be equipped with curb bumpers and replaceable runners with a minimum of five-foot-long end runners. The box shall be equipped with a sufficient walkway to provide access to either side of the spreader box without walking through the freshly applied material. The box must be capable of laying mix to a width of 14 feet. The equipment shall provide sufficient turbulence to prevent the mix from setting in the box or causing excessive build-up or lumps.

To prevent the loss of mixture from the box, the contractor shall attach flexible seals, front and rear, in contact with the road. The full width application box shall be equipped with a secondary strike-off located approximately two feet to three feet behind the primary strike-off to minimize transverse corrugations. The secondary strike-off shall have elevation and width adjustments similar to the primary strike-off. It shall have a pivot point where it can be tilted for texturing or raised completely off of the surface.

The use of burlap drags or other drags necessary to obtain the desired surface texture shall require approval by the agency. Drags having excessive build-up shall be replaced. Drags shall be kept in a completely flexible condition at all times.

## **6.6 Compaction Equipment**

Rolling of Conventional Slurry Seal mixtures is generally not required. Exceptions are airports and possibly parking lots and other pavements where traffic is light or irregular. In the event rolling is required by the agency, best practice is to use a maximum 10-ton pneumatic roller with a minimum of three passes over the mat the morning following application.

## **6.7 Auxiliary Equipment**

Suitable surface cleaning equipment, barricading equipment, hand tools, and other support equipment shall be provided by the contractor as necessary to perform the work.

## **7. Test Strip**

Prior to the beginning of the project, the contractor may be required to perform a test strip in a suitable area such as a parking lot or staging area to assure the materials, contractor personnel, and equipment are suitable to produce a satisfactory Conventional Slurry Seal mixture. The location for the test strip shall be approved by the owner. The test strip may be conducted as part of the calibration procedure and may be considered as a part of the project. The test strip shall be performed in similar conditions as those expected during the project.

## **8. Weather**

The Conventional Slurry Seal mixture shall be applied only when both the pavement surface and the ambient temperature is at least 50°F and rising, the weather is not foggy or rainy, and there is no forecast of temperatures below 32°F within 48 hours from the time of placement.

## **9. Traffic Control**

Prior to start of the project, a traffic control plan shall be developed to address all aspects of traffic control, including without limitation, coordination with local officials and traffic control equipment and methods. The traffic control plan is intended to promote controlled traffic flow through the project in order to protect the safety of the contractor and owner personnel, the public, and the product. The traffic control plan shall remain in place until the product has sufficiently cured to withstand traffic without damage. Any damage to the newly applied Conventional Slurry Seal due to the premature release of traffic shall be repaired to the satisfaction of the owner at the contractor's expense.

## **10. Surface Preparation**

### **10.1 General**

Prior to applying Conventional Slurry Seal, the pavement surface shall be cleared of all loose material, silt spots, vegetation, and other objectionable material. If water is used, cracks shall be allowed to dry thoroughly before applying the Conventional Slurry Seal. Manholes, valve boxes, drop inlets, and other service entrances shall be protected by a suitable method. Thermoplastic and other striping should be removed or protected. The agency shall approve the surface preparation prior to application of the Conventional Slurry Seal.

### **10.2 Cracks**

Cracks wider than 0.25 inches should be treated with an approved crack sealer 30 days prior to application of the Conventional Slurry Seal.

### **10.3 Patching**

Prior to application, all failed pavement sections should be removed and patched using accepted best practices and quality materials. The perimeter of excavated areas should be milled or saw cut to form a neat vertical face. Unstable areas of subgrade should be back-filled with well-graded and compacted aggregate, and filled flush with the pavement surface with an appropriate asphalt aggregate mixture.

## **11. Application**

The paving mixture shall be spread on the prepared surface in such a way to leave a uniform finished surface. The contractor shall use squeegees and lutes to spread the mixture in areas inaccessible to the spreader box and areas requiring hand spreading. A sufficient amount of material shall be carried at all times in all parts of the spreader box to ensure complete coverage.



Adjustments to the additive will be permitted if necessary to control the breaking and setting properties. If hand spreading is necessary, the mixture shall be poured in a small windrow along one edge of the surface to be covered and then spread uniformly by a hand squeegee or lute. A smooth, neat seam shall be provided where two passes meet. Excess material shall immediately be removed from ends of each run.

It shall be the responsibility of the contractor to produce, transport, and place the specified materials in accordance with these specifications and as approved by the agency. The finished Conventional Slurry Seal shall have a uniform texture free from excessive scratch marks, tears, or other surface irregularities. The cured mixture shall adhere fully to the underlying surface. Based upon a visual examination or test results, the engineer may reject any work due to poor workmanship, loss of texture, excessive raveling, or apparent instability.

## **12. Material Storage and Handling**

### **12.1 Asphalt Emulsion**

The storage shall be adequate to meet the requirements of the production rate. All equipment used in the storage and handling of bituminous material shall be kept in a clean condition at all times and shall be operated in such a manner that there will be no contamination with foreign matter. The contractor shall comply with all material handling, storage, and safety requirements outlined in any applicable SDS or other product label.

### **12.2 Aggregate**

The mineral aggregate shall be handled in such a manner as to prevent segregation, mixing of the various materials or sizes, and contamination with foreign materials. The grading of aggregates proposed for use and as supplied to the project shall be uniform. Suitable equipment of acceptable size shall be furnished by the contractor to maintain the stockpiles and prevent segregation of aggregates. The aggregate shall be passed over a scalping screen immediately prior to transfer to the mixing machine to remove oversized material. In addition, the scalping screen unit, when payment for aggregate is by the ton, shall be equipped with certified scales capable of providing an automated ticket printout for each truckload of material delivered to the mixing machine. Each ticket shall include the project number, ticket number, truck number, date, and batch weight of material loaded.

Aggregate intended for use on the project shall be maintained in such manner as to protect it from contamination by debris and excess moisture. Large or oversized particles shall be removed from the aggregate by screening or other acceptable method prior to use on the project.

## 13. Workmanship

### 13.1 General

Excessive buildup, uncovered areas, or unsightly appearance shall not be permitted on longitudinal or transverse joints. Longitudinal joints shall be placed on lane lines and excessive overlap shall not be permitted. Care shall be taken to ensure straight lines along the roadway centerline, lane lines, and shoulder or edge lines. Lines at intersections shall be kept straight to provide a neat and uniform appearance.

### 13.2 Finished Surface

The finished surface shall have a uniform texture free from excessive scratch marks, tears, or other surface irregularities. Excessive tear marks are considered four marks that are 0.5 inches wide or wider and six inches or more in length per 100 square yards or any marks one inch wide or wider, or four inches in length. The edges of the Conventional Slurry Seal shall be neat in appearance and longitudinal alignment shall be parallel to the roadway centerline.

### 13.3 Joints and Seams

The longitudinal and transverse joints shall be neat in appearance and uniform. Transverse joints shall be constructed as butt-type joints. No excessive buildup, uncovered areas, or unsightly appearance will be permitted on longitudinal or transverse joints. Longitudinal joints shall be placed on lane lines when possible. Gaps between applications shall not be permitted. Joints will be considered acceptable if no more than a 0.5-inch vertical space exists between the pavement surface, a four-foot straight edge placed perpendicular on the longitudinal joint, and no more than 0.25 inches placed across a transverse joint.

### 13.4 Irregular Areas

Areas that cannot be reached with the mixing machine shall be surfaced using hand tools to provide complete and uniform coverage. The area to be hand worked shall be cleaned and lightly dampened prior to mix placement. Care shall be exercised in areas that require handwork so that the finished surface is uniform in texture, dense, and of overall neat appearance comparable to that produced by the spreader box. Material required to repair deficiencies due to unsatisfactory workmanship shall not be paid for but shall be entirely at the contractor's expense. When transitions are included as part of the work, then these areas are to be surfaced prior to application of the main line. This shall include intersections, turnouts, radii, ramps, etc.

## 14. Measurement

Conventional Slurry Seal shall be measured and paid for by the square yard. The price shall be full compensation for furnishing all materials, for preparation, mixing, and applying these materials, and for all labor, equipment, tools, test design, clean-up, and incidentals necessary to complete the work as specified herein and in the plans.

In lieu of measurement by the square yard, Conventional Slurry Seal may be measured by the ton of aggregate and gallon or ton of emulsified asphalt. The aggregate shall be weighed on certified scales. The weight will be based on a 2,000-pound ton and the aggregate will be corrected for moisture. The mineral filler (if using Portland cement) will be counted by the sack of 94 pounds and will be included in the payment for aggregate.

Emulsified Asphalt shall be measured by the gallon or ton. The contractor will be required to submit certified bill of lading from the emulsion manufacturer, indicating total gallons or tons delivered. In addition, the contractor will be responsible for submitting a way-back ticket representing unused material at the conclusion of each project.

Tack Coat will be measured by the gallon or ton of undiluted emulsion used and included in the payment for emulsion.

## 15. Payment

Payment shall be in consideration of all materials, tools, labor, and other items as necessary to complete the project as required by the plans. The Conventional Slurry Seal shall be paid for by one of the following options:

- By the square yards covered
- By the gallons or tons of emulsion and ton of aggregate used