

REVISION OF SECTION 409  
SLURRY SEAL

Section 409 of the Standard Specifications is hereby revised for this project to include the following:

**DESCRIPTION**

This work consists of furnishing and placing a mixture of an approved emulsified asphalt, mineral aggregate, water, and specified additives, proportioned, mixed and uniformly spread in conformance to the Contract and to the dimensions as shown on the plans. The completed slurry seal shall leave a homogeneous mat and adhere firmly to the underlying pavement.

**SPECIFICATION INTENT**

This specification is modeled after CDOT standard specifications and is intended to establish a starting point for bidding, design, and construction; however, the City recognizes the specialized and sometimes proprietary nature of slurry seal applications. In recognition of this fact, the City is open to deviations from this specification with demonstration by the supplier that such deviations would produce a better product for the intended application and local conditions. The consideration of deviations from this specification may be had either pre- or post-bid based on discussions with potential suppliers. Ultimately, any deviations from the specification would need to be approved by the City of Montrose in writing prior to implementation.

**MATERIALS**

**Bituminous Material.** Bituminous material shall be CQS-1hL and shall conform to the requirements in subsection 702.02, Table 702-4. The emulsion shall be capable of being pumped and shall be suitable for use in slurry seal mixing, spreading and application using slurry seal equipment and a distributor truck.

The modified emulsion shall contain a minimum of 3 percent polymer, SBR latex, or natural latex by weight of asphalt cement. The SBR polymer dispersion shall be co-milled during the emulsification process such that a bicontinuous polymer-asphalt network is formed upon curing of the finished emulsion.

**Slurry Aggregate.** Slurry aggregate shall be washed, hard, durable, clean rock, free from coatings or deleterious material. The aggregate shall be manufactured crushed stone such as granite, slag, limestone, or other high-quality material. To ensure that the material is totally crushed, 100 percent of the parent aggregate shall be larger than the largest stone in the gradation to be used. The target mix design aggregate gradation, including mineral filler, shall be Type II and conform to the following:

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Gradation for Slurry Aggregate:

Sieve Size	Type II Percent Passing	Type III Percent Passing	Stockpile Tolerance
9.5 mm (3/8")	100	100	± 5%
4.75 mm (#4)	90 – 100	70 - 90	± 5%
2.36 mm (#8)	65 – 90	45 - 70	± 5%
1.18 mm (#16)	45 – 70	28 - 50	± 5%
600 µm (#30)	30 – 50	19 - 34	± 5%
300 µm (#50)	18 – 30	12 - 25	± 4%
150 µm (#100)	10 – 21	7 - 18	± 3%
75 µm (#200)	5 – 15	5 – 15	± 2%

The target gradation for the project shall establish a single percentage of aggregate passing each required sieve size. This shall be the project aggregate gradation specification and the percent passing each sieve on subsequent tests shall not vary by more than the stockpile tolerance and shall still remain within the gradation band.

Aggregate shall be screened at the stockpile, just prior to loading to eliminate oversize. If oversize or clay balls are detected in the aggregate, the slurry operation shall stop until corrective actions are taken, as approved by the Engineer.

Slurry aggregate shall meet the following quality requirements:

- (a) Percentage of Wear, Los Angeles Abrasion Test (AASHTO T96), Shall not be more than 25
- (b) Soundness, AASHTO T104 using sodium sulfate, shall have a 15 percent maximum.
- (c) Sand Equivalent, AASHTO T176, shall be 45 minimum.

**Mineral Filler.** Mineral filler shall conform to the requirements of subsection 703.06.

**Water.** All water used in making the slurry shall be potable. The moisture content of the aggregate being used, and the effect this moisture content has on the specific weight of the aggregate, shall be taken into account in calibrating the machine to deliver asphalt in the correct proportion.

**Additives.** Additives may be used to accelerate or retard the break-set of the slurry seal or to improve the resulting finished surface. The use of additives in the slurry mix shall be made initially in quantities predetermined by the mix design. Field adjustments, if required, shall be as approved by the Engineer.

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**Mix Design.** Before work begins, the Contractor shall submit to the Engineer for approval a signed, certified mix design covering the specific materials to be used on the project. This mix design shall be prepared and signed by a laboratory that has experience in designing Emulsified Asphalt Slurry Seal Surfacing. The Contractor shall certify the materials and the laboratory shall certify the design. Compatibility of the aggregate, emulsion, mineral filler, and other additives shall be verified by the mix design. The mix design shall be made with the same aggregate gradation that the Contractor proposes to use on the project.

Tests and required values to be used in preparing mix design shall be as follows:

ISSA Test	Description	Specification
TB 106	Slurry Seal Consistency	
TB 139	Wet Cohesion (30 minutes) minimum (Set) Wet Cohesion (60 minutes) minimum (Traffic)	12 kg-cm minimum 20 kg-cm minimum
TB 109	Max. Excess Asphalt by LWT Sand Adhesion	50 g/ft <sup>2</sup>
TB 114	Wet Stripping	90% Min. Pass
TB 100■	Wet-tack Abrasion Loss, One-hour Soak	75 g/ft <sup>2</sup>
TB 113◆	Mix Time	Controllable to 180 seconds Min.
◆ The mixing test and set-time test should be performed at the highest temperatures expected during construction.		
■ The Wet-tack Abrasion test is performed is to determine the minimum asphalt content of the slurry system.		

The mixing test is used to predict how long the material can be mixed in the machine before it begins to break.

The laboratory shall also report the quantitative effects of moisture content on the unit weight of the aggregate (bulking effect). The report shall clearly show the proportions of aggregate, mineral filler (minimum and maximum), water (minimum and maximum), additive(s) (usage), and asphalt emulsion based on the dry weight of the aggregate.

All the component materials used in the mix design shall be representative of the materials proposed by the contractor to be used on the project.

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The percentages of each individual material required shall be shown in the laboratory report. Adjustments may be required during construction, based on field conditions. All proposed adjustments must be approved by the Engineer prior to implementing.

Work shall not begin until written approval of the mix design and all slurry materials has been received from the Engineer

The component materials shall be within the following limits:

<b>Component Materials</b>	<b>Limits</b>
Residual Asphalt	7.5 – 13.5 % ♦
Mineral Filler	0.0 – 3.0 % ♦
Additives	As needed
Water ●	As needed to achieve proper mix consistency●
♦ Based on dry weight of Aggregate ● Total mix liquids should not exceed the loose aggregate voids. ISSA T106 shall be used to check optimum liquids.	

**Master Range for Rate of Aggregate Application**

**AGGREGATE TYPE**

Type II

**MASTER RANGE LIMITS**

18 ± 1lb/sq. yd.

Application rates are based on the weight of dry aggregate in the mixture

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**Tolerances.** Tolerances for individual materials as well as the slurry seal mixture are as follow:

After the designed residual asphalt content is determined, a plus or minus one percentage point variation will be permitted.

The percentage of aggregate passing each sieve shall be within stockpile tolerance range as described above

The percentage of aggregate passing shall not go from the high end to the low end of the specified range of any two successive sieves.

The slurry consistency shall not vary more than  $\pm 0.2$  inches (ISSA TB-106) from the job mix formula after field adjustments.

The rate of slurry application shall not vary more than  $\pm 2$  pounds per square yard from the designated target value. The  $\pm 2$  pound limit shall be within the Master Range limits.

**Equipment.** All equipment, tools, and machines used in performance of this work shall be maintained in satisfactory working condition at all times to ensure a high-quality product.

- (a) **Mixing Equipment:** The machine shall be specifically designed and manufactured to lay slurry seal. The material shall be mixed by a self-propelled, slurry seal mixing machine of truck-mounted or continuous -run design. The machine shall have sufficient storage capacity for, and be able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, control setting additive, and water to a revolving mixer and to discharge the mixed product on a continuous-flow basis.
- (b) **Proportioning Devices:** Individual volume or weight control devices for proportioning each material to be added to the mix shall be provided and properly marked. These devices shall provide information so that material output can be determined at any time. The contractor shall provide the Engineer this information and access to the devices at the Engineers request.

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- (c) Spreading Equipment: The mixture shall be spread uniformly by means of a conventional surfacing spreader box attached to the mixer and equipped to agitate and spread the material evenly throughout the box. A front seal shall be provided to insure no loss of the mixture at the at the road contact point. The rear seal shall act as final strike-off and shall be adjustable. The spreader box and rear strike-off shall be so designed and operated that a uniform consistency is achieved to produce a free flow of material to the rear strike-off. The spreader box shall have suitable means provided to side shift the box to compensate for variations in the pavement geometry. A burlap drag or other approved screed shall be attached to the rear of the spreader box to provide a uniform, highly textured mat. A drag stiffened by hardened slurry is ineffective and shall be replaced immediately.

**Calibration.** Each mixing unit to be used in performance of the work shall be calibrated in the presence of the Engineer prior to construction. The Engineer may, at his option, use previous calibration documentation from the current calendar year and covering the exact materials to be used on this project. No machine will be allowed to work on the project until the calibration has been completed and/or accepted.

**CONSTRUCTION REQUIREMENTS**

The entire surface that is to receive a slurry seal shall be cleaned of loose sand, rock, mud, and all other debris that could prevent proper adhesion of the coating. The cleaning shall be accomplished by power broom, vacuum sweeper, scraping, blading, or other approved measures. Coating operations shall not be started until the surface is approved.

The slurry seal shall not be applied if either the pavement or air temperature is below 50°F and falling, but may be applied when both pavement and air temperatures are above 45°F and rising. No slurry seal shall be applied when there is the possibility of freezing temperatures at the project location within 24 hours after application.

The slurry seal shall be of the desired consistency upon leaving the mixer. A sufficient amount of material shall be carried in all parts of the spreader at all times so that a complete coverage is obtained. Overloading of the spreader shall be avoided.

No lumping, balling, or unmixed aggregate shall be permitted.

No streaks, such as those caused by oversized aggregate, shall be left in the finished surface. If, in the opinion of the Engineer, excess oversize develops, the job will be stopped until the contractor has corrected his aggregate pre-screening operation to eliminate the oversize.

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**Joints.** No excess buildup, uncovered areas, or unsightly appearance shall be permitted on longitudinal or transverse joints. Longitudinal joints shall be placed on lane lines. Half passes and odd-width passes will be used only when approved by the Engineer. The half or odd-width passes shall not be the last pass of any paved area.

**Mix Stability.** The slurry seal shall possess sufficient stability so that premature breaking of the material in the spreader box does not occur. The mixture shall be homogeneous and free of excess water and emulsion, with no segregation of the emulsion and aggregate fines from the coarser aggregate during and following mixing and spreading.

**Advance Notification.** Contractor shall notify all homeowners adjacent to slurry seal areas at least 48 hours prior to application. Notification may be performed through door hangers containing a summary of the work to be performed, the anticipated time when vehicular access will be unavailable, a request for no on-street parking, and contact information for a contractor representative should the resident have any questions. Contractor shall also place no parking signage on streets at least 48 hours in advance of slurry seal operations. Should vehicles remain parked on the street despite the notification efforts, the City will work with the Montrose Police Department to have these vehicles towed at the City's expense.

**Cure and Protection.** Contractor shall be responsible for ensuring that vehicular traffic is kept off of the applied slurry seal until the slurry has sufficiently cured to a point that vehicular traffic will not damage the material. Any damaged areas shall be repaired by the contractor at no additional cost to the City. One exception to this would be for emergency access in which case the repair would be eligible for additional payment.

**Protection of Existing Improvements.** Existing concrete, manholes, valve boxes, and inlets shall be covered and/or otherwise protected during slurry seal operations and protective coverings removed following application of the slurry seal.

**Quality Control Testing.** Quality control testing shall be performed according to the following test procedures and minimum frequencies unless approved otherwise.

- Gradation (CDOT CP31): 1 per 15,000 SY
- LA Abrasion (AASHTO T-96): One per source
- Fractured Faces (CDOT CP45): 1 per 100,000 SY
- Coating Test (CDOT CPL2213): 1 per source

Sample Project Special Provision: 409ss  
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**METHOD OF MEASUREMENT**

Slurry seal will be measured by the actual number of square yards complete in place.

**BASIS OF PAYMENT**

Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
Slurry Seal (CQS-1hL with Type II Aggregate)	Square Yard

Payment shall include mix design, neighborhood notification, surface prep, placement, and cleanup.