

REVISION OF SECTION 409  
CAPE SEAL

Section 409 of the Standard Specifications is hereby deleted and replaced with the following:

**DESCRIPTION**

This work consists of furnishing and placing a thin surface treatment constructed by applying a slurry seal to a newly constructed chip seal. It is designed to be an integrated system where the primary purpose of the slurry is to fill voids in the chip seal. This is a two-step process.

**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 cape 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**

**Asphalt Emulsion for Chip Seal.** Emulsified asphalt shall be CRS-2P polymerized or latex modified, and shall be rapid set or medium set conforming to the requirements of subsection 702.02 (b). Chip seal application rate shall be 0.26 to 0.36 gal/SY.

Rejuvenating agent shall conform to the requirements of subsection 702.02(f).

**Bituminous Material for Slurry Seal.** 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.

**Chip Seal Aggregate.** Aggregate for the chip seal shall meet the requirements of subsection 703.05 for the Type I cover aggregate as specified. The material will be accepted at the spreader. Chip seal aggregate application rate shall be 19 to 21 lbs/SY.

**Slurry Seal Aggregate.** Slurry seal 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	Stockpile Tolerance
9.5 mm (3/8 in.)	100%	± 5%
4.75 mm (#4)	90 – 100	± 5%
2.36 mm (#8)	65 – 90	± 5%
1.18 mm (#16)	45 – 70	± 5%
600 µm (#30)	30 – 50	± 5%
300 µm (#50)	18 – 30	± 4%
150 µm (#100)	10 – 21	± 3%
75 µm (#200)	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:

- (1) Percentage of Wear, Los Angeles Abrasion Test (AASHTO T96), Shall not be more than 25
- (2) Soundness, AASHTO T104 using sodium sulfate, shall have a 10 percent maximum.
- (3) Sand Equivalent, AASHTO T176, shall be 45 minimum.

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

**Slurry Seal 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.

**Slurry Seal 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.

**Slurry Seal 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.

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

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.
<p>◆ The mixing test and set-time test should be performed at 77°F and 100°F.</p> <p>■ The Wet-tack Abrasion test is performed to determine the minimum asphalt content of the slurry system.</p>		

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.

The percentages of each individual material required shall be shown in the mix design. 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:

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

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**Master Range for Rate of Aggregate Application**

**AGGREGATE TYPE**

When placed over pavement - Type II

When placed over chip seal - Type II

**MASTER RANGE LIMITS**

18 ± 1 lb/sq. yd.

20 ± 1 lb/sq. yd.

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

**Slurry Seal Tolerances.** Tolerances for individual materials as well as the slurry seal mixture are as follows:

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 ± 0.2 inches (ISSA TB-106) from the job mix formula after field adjustments.

The rate of slurry application shall not vary more than ± 2 lb/sq. yd. from the designated target value.

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**CONSTRUCTION REQUIREMENTS**

**Chip Seal Weather Limitations.** Unless approved by the Engineer, asphalt emulsion shall not be applied on a damp surface, when either the air or pavement surface temperature is below 70 °F, or when weather conditions would prevent the proper construction of the chip seal.

**Slurry Seal Weather Limitations.** 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.

**Chip Seal Equipment.** The following equipment or its equivalent shall be used:

- (1) Asphalt distributor and equipment shall be capable of uniformly distributing asphalt emulsion at even temperature and uniform pressure on variable widths of surface up to 15 feet at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard. The allowable variation from any specified rate shall not exceed plus or minus 0.02 gallon per square yard. The distributor's spreading capabilities shall be computer controlled or it shall be calibrated to conform to the distributor manufacturer's procedure prior to applying the emulsified asphalt. Distributor equipment shall include a tachometer, pressure gauges, accurate volume measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. Distributors shall be equipped with a power unit for the pump, and full circulation spray bars adjustable laterally and vertically. Distributors shall be equipped with an automatic heater capable of maintaining the asphalt emulsion at the manufacturer's recommended application temperature or at 140 °F, whichever is higher.
- (2) A rotary power broom with hopper and shielding to limit errant rocks and/or vacuum sweepers with a negative air pressure at the intake of at least 46 inches of negative water pressure.
- (3) A minimum of two pneumatic tire rollers, which weigh at least 10 tons each.
- (4) One self-propelled aggregate spreader of approved design supported by at least four wheels equipped with pneumatic tires on two axles. The aggregate spreader shall be capable of applying the larger cover coat material to the surface ahead of the smaller cover coat material and shall have positive controls so the required quantity of material is deposited uniformly over the full width of the asphalt emulsion. Other types of aggregate spreaders may be used provided they accomplish equivalent results and are approved.

**Slurry Seal Equipment.** Equipment for the application of the slurry seal shall conform to the following:

- (1) **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.

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- (2) **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.
- (3) **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 ensure no loss of the mixture 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 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.

**Preparation of the Surface.** The entire surface that is to receive a seal and slurry coat shall be cleaned of loose sand, dust, 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.

**Advance Notification.** Contractor shall notify all homeowners adjacent to slurry seal areas at least 48 hours prior to application. Notification shall 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.

**Application of Chip Seal.** Asphalt material shall be applied by a pressure distributor in a uniform, continuous spread and within the temperature range specified. The distributor's spreading capability shall be computer controlled or calibrated to conform to the distributor manufacturer's procedure prior to applying the emulsified asphalt. If streaking occurs, the distributor operation shall be stopped immediately until the cause is determined and corrected. Streaking is alternating, narrow, longitudinal areas of excessive and then insufficient quantities of asphalt material. The quantity of asphalt material per square yard may vary from the rate shown in the Contract, as directed. A strip of building paper, at least 3 feet in width and with a length equal to that of the spray bar of the distributor plus 1 foot shall be used at the beginning of each spread. If the distributor does not have a positive cut-off, the paper shall be used at the end of each spread. The paper shall be removed and disposed of in a satisfactory manner. The distributor shall be moving forward at proper application speed at the time the spray bar is opened. Skipped areas and deficiencies shall be corrected. Junctions of spreads shall be carefully made to assure a smooth riding surface.

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**Application of Slurry Seal.** The slurry seal shall be applied within two weeks of completion of the chip seal application, but not before a minimum of 72 hours of cure-time for the chip seal. 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 or hardened slurry, 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.

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 shall be used only when approved by the Engineer. The half or odd-width passes shall not be the last pass of any paved area.

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.

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.

**METHOD OF MEASUREMENT**

Cape seal will be paid for as a single component including both the chip and slurry seal.

Cape seal will be measured by the actual number of square yards that are placed and accepted.

**BASIS OF PAYMENT**

Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
Cape Seal (Type I Cover Coat, Type II Slurry Aggregate)	Square Yard

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