

## CAPE SEAL SPECIFICATIONS

### DESCRIPTION

The Contractor shall furnish all labor, equipment, material, supplies, environmental protection, no parks, raised markers, signage, traffic control, secondary sweeping, and other incidentals necessary to provide an application of polymerized emulsified asphalt, cover coat aggregate, followed by a polymerized Slurry Seal to an existing roadway surface. This two-step process is called Cape Seal.

### MATERIALS

**Polymer Pre-Modified Base Emulsion:** Polymer Modified Cationic Rapid Set emulsion (CRS-2P) shall be an emulsified blend of polymer modified asphalt, water, and emulsifiers. The emulsion shall contain a minimum of three percent (3.0%) styrene-butadiene (SB) or styrene-butadiene-styrene (SBS) polymer by weight of asphalt cement. The asphalt cement shall be polymer modified prior to emulsification using a block SB or SBS co-polymer. The emulsion standing undisturbed for a minimum of 24 hours shall show no white, milky separation but shall be smooth and homogeneous throughout. The emulsion shall be pumpable and suitable for application through a distributor.

<b>Tests on CRS-2P Emulsion</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Test Method</b>
Viscosity, Saybolt Furol, 50°C, sec, (a)	50	450	ASTM D 244
Storage Stability, 24-hr, % (a)		1.0	ASTM D 6930
Demulsibility, 35 ml, 0.8% Dioctyl Sodium Sulfosuccinate, %	40		ASTM D 6936
Particle Charge	Positive		ASTM D 244
Sieve, % (a)		0.1	ASTM D 6933
Distillation: (b)			AASHTO T 59
Oil Distillate by Volume of Emulsion, %		3.0	AASHTO T 59
Residue, %	65		AASHTO T 59
<b>Tests on Residue (b)</b>			
Penetration, 25 °C, 100g, 5s, dmm	70	150	ASTM D 5
Solubility in Trichloroethylene, % (c)	97.5		ASTM D 2042
Toughness, in-lb	70		ASTM D 5801
Tenacity, in-lb	45		ASTM D 5801

The specification for CRS-2P is in accordance with the material properties and test methods as specified by ASTM, AASHTO, and CDOT.

- (a) This test requirement on representative samples is waived if successful application of the material has been achieved in the field.
- (b) Residue by evaporation is intended to provide rapid determination of the percent residue and to provide material for tests on residue. If the percent residue or any test on the residue fails to meet specifications, the tests will be repeated using the distillation test specified by AASHTO T 59. For polymer modified emulsions, the distillation and evaporation tests will be modified to include 400F maximum temperature to be held for

15 minutes.

- (c) If the solubility of the residue is less than 97.5%, the base asphalt binder for the emulsion shall be tested. The solubility of the base asphalt binder shall be greater than 99 percent.

**Emulsified Asphalt Material** – The liquid emulsion shall be water-based emulsified asphalt comprised of straight-run vacuum tower bottoms, synthetic SBR latex polymer, and emulsification agents. The SBR polymer shall be co-milled during the emulsification process such that a bicontinuous polymer-asphalt network is formed upon curing of the finished emulsion. The emulsion shall be pumpable and suitable for use in a Slurry Seal machine.

The emulsified asphalt shall conform to the requirements of the ASTM specification for quick set CQS with revisions as indicated in the table below. In addition, the emulsion shall contain 3% minimum SBR latex solids based on weight of asphalt cement. The slurry seal mixture shall contain an emulsion content of 10 – 20% by weight of dry aggregate which shall be determined in the laboratory by an approved mix design process. The residual asphalt content shall be 5 – 15% based on weight of dry aggregate.

<b>Tests on CQS Emulsion</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Test Method</b>
Viscosity, Saybolt Furol, 25°C, sec, (a)	15	100	ASTM D 244
Storage stability, 24 hr, % max <sup>1</sup>	1	1	T 59
Particle Charge Test	Positive		ASTM D 244
Sieve Test, % (a)		0.1	ASTM D 6933
Distillation: (b)			AASHTO T 59
Residue, %	62		AASHTO T 59
<b>Polymer:</b>			
Polymer Solids Based on Weight of Asphalt, %	3		Supplier Cert.
Polymer Type:	SBR Latex		Supplier Cert.
<b>Tests on Residue (b)</b>			AASHTO T 59
Penetration, 25°C, 100g, 5s	40		ASTM D 5
Ductility, 25°C, 5 cm/min, cm	50		ASTM D 113
Solubility in Trichloroethylene, %	97.5		ASTM D 2042
Elastic Recover, 77 F, 10cm, 1h, %	40		ASTM D 5976

The specification for Slurry Emulsion is in accordance with the material properties and test methods as specified by ISSA, ASTM, AASHTO, and CDOT.

- (a) This test requirement on representative samples is waived if successful application of the material has been achieved in the field.
- (b) Residue by evaporation is intended to provide rapid determination of the percent residue and to provide material for tests on residue. If the percent residue or any test on the residue fails to meet specifications, the tests will be repeated using the distillation test specified by AASHTO T59. For polymer modified emulsions, the distillation and evaporation tests will be modified to include 400F maximum temperature to be held for 15 minutes.

- (c) If the solubility of the residue is less than 97.5%, the base asphalt binder for the emulsion shall be tested. The solubility of the base asphalt binder shall be greater than 99 percent.

**Cover Coat Material:** The chip or cover coat and slurry aggregate shall be washed, hard, durable, clean rock and free from coatings or deleterious material. All of the aggregate shall be crushed gray granite with 100 percent fractured faces. The aggregate shall have maximum loss of 20 percent when tested with the LA Abrasion procedure as defined by AASHTO T96 using grade C or D.

The maximum amount of flat and elongated aggregate with a ratio of 3:1 shall not exceed 12% as determined by ASTM D4791. Only one source of aggregate shall be used and shall conform to the following gradations.

**Gradation Table - Cover Coat Aggregate (percent passing)**

Sieve Size	3/8" Chip	1/4" Chip
1/2"	100	100
3/8"	95-100	100
1/4"	0-35	95-100
No. 8	0-3	0-3
No. 200	0-1.5	0-1.5

**Gradation Table – Slurry Aggregate (percent passing)**

Sieve Size	Type II % Passing	Type III % Passing	Stockpile Tolerance
3/8	100	100	+ or- 5%
No. 4	90-100	70-90	+ or- 5%
No. 8	65-90	45-70	+ or- 5%
No. 16	45-70	28-50	+ or- 5%
No. 30	30-50	19-34	+ or- 5%
No. 50	18-36	12-25	+ or- 4%
No. 100	10-24	7-18	+ or- 3%
No. 200	5-15	5-15	+ or- 2%

## CONSTRUCTION REQUIREMENTS

**Equipment:** The size and condition of all equipment shall be approved prior to construction. Should equipment be unsatisfactory for whatever cause, the Contractor shall remove and replace the equipment without delay or cost. The equipment shall conform to the following minimum requirements.

**Bituminous Distributor:** A minimum of two like distributors shall be used on this project. The distributors shall be self-powered and capable of providing a uniform application rate of emulsion varying from .05-1.00 gallons per square yard over a variable width up to 20 feet in a single pass. The uniformity of the distributors shall not vary by more the two-hundredths gallons per square yard. The distributors shall be equipped with a variable power unit for the pump and full circulation spray bars, which are adjustable laterally and vertically. The nozzle angle and bar height shall be set to provide one hundred percent of double coverage in a single pass. Where multiple passes will be required to complete the full width, the four inches adjacent to the second pass may be left with 50 percent coverage so that the next pass will

complete the full application rate specified. Distributors shall be self-powered and include a computerized application controls, a tachometer, pressure gauges, accurate volume devices, calibrated tank, and a thermometer for measuring temperatures of the emulsion in the tank.

**Aggregate Spreader:** The aggregate spreader shall be self-propelled and supported by at least four tires on two axles capable of providing a uniform application rate of aggregate from five to fifty pounds per square yard over a variable width up to 20 feet in a single pass. The uniformity of this machine shall not vary by more than one pound per square yard. The aggregate spreader shall be equipped with the means of applying the cover coat material to the surface with computerized application controls so that the required amount of material will be deposited uniformly over the full width of the bituminous material. A computer rate controlled aggregate spreader shall be required.

**Rollers:** A minimum of two self-propelled pneumatic tired rollers shall be used on the project unless otherwise requested by the Project Manager. The rubber tired rollers shall have a gross load adjustable to apply 200 – 250 pounds per inch of rolling width. Tire pressure shall be specified for the pneumatic tire rollers and shall not vary more than plus or minus 5.0 psi. The smooth drum roller shall be a single drum roller with a loaded rate of five tons. Depending on the speed of the Chip Seal operation and the width of coverage, additional rollers may be required. At no time shall the rollers travel more than 10 miles per hour.

**Mixing Slurry Machine:** The Slurry course shall be mixed in a self-propelled mixing machine equipped with a continuous flow pug mill capable of accurately delivering and automatically proportioning the aggregate, emulsified asphalt, water and admixtures to a double shafted, multi-blade pugmill mixer capable of minimum speeds of 200 revolutions per minute.

A minimum of two mixing machines, of 12 cubic yards or larger shall be utilized on the project. The Slurry course retention time in the pugmill shall be less than three seconds. The mixing machine shall have sufficient storage capacity of aggregate, emulsified asphalt, and water to maintain an adequate supply to the proportioning controls.

The mixing machine shall be equipped with hydraulic controls for proportioning the material by volume to the mix. Each material control device shall be calibrated, properly marked, preset. The mixing machine shall be equipped with water pressure system and nozzle type spray bars to provide water spray immediately ahead of the spreader box.

The mixing machine shall be equipped with an approved fines feeder that provides a uniform, positive, accurately metered, pre-determined amount of a mineral filler at the same time and location that the aggregate is fed.

The Slurry mixture shall be uniformly spread by means of a controlled spreader box capable of spreading a traffic lane width and shall have strips of flexible rubber belting or similar material on each side of the box. The rear flexible strike-off blade shall make close contact with the pavement and shall be capable of being adjusted to the various crown shapes so as to apply a uniform layer of material. Slurry mixture, to be spread in areas inaccessible to the controlled spreader box, may be spread by other approved methods.

Each mixing unit to be used in performance of the Slurry work shall be calibrated prior to

construction at a minimum of once per year. Calibration documentation covering the exact materials to be used may be acceptable, provided they were made during the calendar year. The documentation shall include an individual calibration of each material at various setting, which can be related to the machine's metering devices. No machine will be allowed to work on the project until the calibration has been completed and accepted.

**Sweepers:** A minimum of two vacuum designed sweepers having only negative air pressure at the road surface capable of removing excess aggregate and debris material shall be used on this project. The body hoppers of the vacuum sweepers shall be a minimum capacity of ten cubic yards, and the negative air pressure at the intake shall be rated at 46 inches of negative water pressure. Sweepers shall meet applicable U.S. Environmental Protection Agency Standards. No mechanical pick-up brooms will be allowed on the project. Any areas adjacent to the project where a vacuum broom cannot access, shall be removed by the use of a blow pack. No mechanical pick-up brooms will be allowed on the project.

### MATERIAL APPLICATION RATES

Material	3/8" Cape Seal	1/4" Cape Seal
CRS-2P Chip Seal	.34-.38 Gal/SY	.30-.36 Gal/SY
Cover Coat Aggregate	23 lbs/SY Minimum	20 lbs/SY Minimum
Slurry Aggregate - Dry	18 lbs/SY Minimum	16 lbs/SY Minimum

The specific size of aggregate used shall be determined using factors such as surface temperature, traffic volume, existing road condition, and time of year. The Contractor may alter the application rate at any time during the course of the construction upon approval by the Project Manager.

**Manholes, Valves and Inlets:** Manholes, valve boxes, and inlets shall be covered and or protected with an approved material during the operation and shall be removed immediately after the street has been Cape Sealed. The Contractor is responsible for locating all exposed manholes, valve boxes and prior to construction.

**Weather Limitations:** The Chip Seal shall not be applied when the pavement is moist, or when the weather is or may be detrimental. Detrimental weather is defined as rain showers, cool temperatures, moist pavements, threat of rain showers, or other environmental factors which could affect the performance of the Chip Seal construction. If either the pavement or air temperature is below 55°F (10°C) and falling, but may be applied when both pavement and air temperatures are above 50°F (7°C) and rising.

The Slurry Seal shall not be applied if either the pavement or air temperature is below 50°F (10°C) and falling, but may be applied when both pavement and air temperatures are above 45°F (7°C) and rising. No Slurry Seal shall be applied when air temperatures will be below freezing within 24 hours. The mixture shall not be applied when weather conditions prolong opening to traffic beyond a reasonable time.

**Water:** All water used in making the Slurry shall be potable. The effect of moisture content on the specific weight of the aggregate, and the moisture content of the aggregate being used,

shall be taken into account in calibrating the machine to deliver asphalt in the correct proportion.

**Mix Design:** Before work begins the Contractor shall submit a mix design for the Slurry Seal, covering the specified materials to be used on this project. This design shall be prepared by the emulsion supplier with a laboratory qualified in Slurry Seal mix design and testing. Once the materials are selected, no substitution will be permitted unless first tested and approved by the laboratory preparing the mix design.

## EXECUTION OF THE WORK

**Surface Preparation:** The Contractor shall be responsible for all measures required providing a thoroughly clean and dry pavement surface including vegetation removal, and sweeping prior to the Chip Seal application. The Contractor shall observe the condition of the pavement prior to bidding to determine the work necessary to provide a clean, dry pavement for construction and shall include the work necessary in the bid.

**Application of Bituminous Material (Chip Seal):** The application of the emulsion shall be performed by means of a pressure distributor in a manner to achieve a uniform and continuous spread over the asphalt surface. The temperature of the emulsion shall be a minimum of 160 F. The quantity of emulsion per square yard shall be as specified herein and agreed upon with the project manager. The distributor shall be moving forward at proper application speed at the time the spray bar is opened. If at any time a nozzle becomes clogged or not spraying a proper pattern, the operation shall be immediately halted until repairs are made. Repairs shall be made immediately after deficiencies are noted and prior to the aggregate spreader at all times during construction. The width of the spread shall be no greater than the width of the aggregate spreader except where additional passes are required the emulsion shall be four inches beyond the aggregate spread at fifty percent application rate. At no time shall the emulsion be allowed to break, chill, setup, harden, or otherwise impair the aggregate retention before the aggregate has been properly applied and rolled

**Application of Cover Coat Aggregate (Chip Seal):** The aggregate shall be applied immediately following the emulsion application by the approved aggregate spreader. The quantity of cover coat aggregate per square yard shall be specified herein and agreed upon with the Project Manager. The Contractor, prior to start of work, shall calibrate the aggregate spreader to achieve the design application rate of the cover coat aggregate. Spreading shall be accomplished in such a manner that the tires of the trucks and aggregate spreader never contact the newly applied bituminous material. The width of the aggregate spreader shall be equal to the width of the emulsion spread, except where additional passes are required. Areas, which are deficient in aggregate, shall be covered immediately with additional material.

**Rolling (Chip Seal):** Initial rolling shall begin immediately after the application of cover coat aggregate. Rollers shall work in tandem and complete a minimum of three passes with a sufficient overlap. Should the rolling operation be delayed, the aggregate and emulsion spreading shall be halted until the operation regains proper sequencing and timing. The maximum speed of the rolling operations shall be ten miles per hour.

**Sweeping (Chip Seal):** Within the first 24 hours after the Chip Seal is applied, the initial sweep will begin and all loose aggregate will be removed from the street.

**Application of Material (Slurry):** Within 48 hours of the Chip Seal application the Slurry course will be applied. The surface shall be fogged with water directly preceding the spreader. The Slurry mixtures shall be of the desired consistency, based on the submitted mix design, as it leaves the mixer with additional approved additive if required. A sufficient amount of Slurry shall be carried in all parts of the spreader at all times so that complete coverage is obtained.

No lumping, balling, or unmixed aggregates shall be permitted. No segregation of the emulsion and aggregate fines from the coarse aggregate will be permitted. No excessive breaking of the emulsion will be allowed in the spreader box. Rippling of the finished pavement is undesirable and shall be minimized.

No excessive build-up or unsightly appearance shall be permitted on longitudinal or transverse joints. The use of burlap drags or other type drags shall be used so that joints will be straight and have a neat appearance. Squeegees shall be used to spread Slurry in areas not accessible to the Slurry mixer. Care shall be exercised as they leave a good appearance. Care shall be taken to insure straight lines along curbs, shoulders and joints. Lines at intersections will be kept straight to provide a good appearance.

Slurry treated areas shall be allowed to cure until such time as traffic will not damage the finished product. Contractor will be responsible for monitoring roadways treated to insure sufficient cure time is allowed before allowing traffic over the treated areas.

**Traffic Control:** A traffic control plan approved by Project Manager will be required before any work commences. Temporary raised pavement markers will be installed as needed, at a minimum of 40' spacing. The cost of signage, markers, and traffic control necessary to complete this project shall be included in the unit price of the Cape Seal.

**Public Notification:** The Contractor shall distribute an approved information flyer to all residents adjacent to the project no more than two weeks prior to the anticipated start of construction. A local telephone number will be located on the flyer and manned 24/7 until the contract is completed. No parks are to be provided by the contractor 24 – 48 hours prior to the commencement of the work. The cost of public notification shall be included in the unit price of the Cape Seal.

**Method of Measurement & Payment:** The Cape Seal shall be measured and paid for by the square yard sealed and accepted by the owner. Payment shall be full compensation for the Cape Seal work completed in accordance with the above specifications.

**PAY ITEM**

**PAY UNIT**

Cape Seal

S.Y.

