# CHIP SEAL SPECIFICATION

## 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 and a Fog Seal to an existing roadway surface.

## MATERIALS

**Latex Modified Emulsion:** Latex Modified Cationic Rapid Set emulsion (CRS-2R) shall be an emulsified blend of asphalt, water, emulsifiers, and latex polymer. The emulsion shall contain a minimum of three percent (3.0%) styrene-butadiene latex rubber (SBR) solids 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. The emulsion shall be pumpable and suitable for application through a distributor truck. The emulsified asphalt shall conform to the following requirements:

| Tests on CRS-2R Emulsion | Minimum | Maximum | Test Method |
|---|---|---|---|
| Viscosity, Saybolt Furol, 50 C, sec, (a) | 50 | 450 | ASTM D 244 |
| Storage Stability Test, 24-h, % (a) | | 1.0 | ASTM D 6930 |
| Demulsibility, 35 ml, 0.8% Dioctyl Sodium Sulfosuccinate, % | 40 | | ASTM D 6936 |
| Particle Charge Test | Positive | | ASTM D 244 |
| Sieve Test, % (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 |
| **Tests on Residue (b)** | | | |
| Penetration, 25 $^{o}$C, 100g , 5s, dmm | 70 | 150 | ASTM D 5 |
| Ductility, 4 $^{o}$C, 5 cm/min, cm | 40 | | ASTM D 113 |
| Solubility in Trichloroethylene, % (c) | 97.5 | | ASTM D 2042 |
| Toughness, in-lb | 90 | | ASTM D 5801 |
| Tenacity, in-lb | 60 | | ASTM D 5801 |

The specification for CRS-2R 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 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.

**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.

| Tests on CRS-2P Emulsion | Minimum | Maximum | Test Method |
|---|---|---|---|
| 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 |
| **Tests on Residue (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.

**Cover Coat Material:** The chip or cover coat 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% fractured faces. The aggregate shall have maximum loss of 20% when tested with the LA Abrasion procedure as defined by AASHTO T96.

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 | ½" Chip | 3/8" Chip | 1/4" Chip |
|---|---|---|---|
| 1/2" | 95-100 | 100 | 100 |
| 3/8" | 0-60 | 95-100 | 100 |
| 1/4" | 0-10 | 0-35 | 95-100 |
| No. 8 | 0-3 | 0-3 | 0-3 |
| No. 200 | 0-1.5 | 0-1.5 | 0-1.5 |

## 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 twenty 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 fifty 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. 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.

**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 | 1/2" Chip Seal | 3/8" Chip Seal | ¼" Chip Seal |
|---|---|---|---|
| CRS-2P Chip Seal | .38-.46 Gal/SY | .34-.40 Gal/SY | .28-.34 Gal/SY |
| Fog Seal | .12 Gal/SY Minimum | .11 Gal/SY Minimum | .08 Gal/SY Minimum |
| Cover Coat Aggregate | 25 lbs/SY Minimum | 23 lbs/SY Minimum | 20 lbs/SY Minimum |

The specific emulsion and cover aggregate application rate 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, Valve Boxes and Existing Thermo Markings:** Manholes, valve boxes and thermo markings shall be covered with an approved material during the operation and shall be removed immediately after the street has been Chip Sealed and Fog Sealed. The Contractor is responsible for locating all exposed manholes, valve boxes and thermo markings prior to Chip Sealing.

**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. No Chip Seal shall be applied 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.

## 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 Materials:** 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 the 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 placement at all times during construction. The width of the emulsion application shall be no greater than the width of the aggregate spreader except where additional passes are required then the emulsion shall be four inches beyond the aggregate spread at a 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**: 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:** 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 10 miles per hour.

**Sweeping and Fog Seal**: Within 24 hours of curing, excess aggregate shall be swept from the roadway and adjacent areas. Excess aggregate that is clean may be stockpiled and re-used in subsequent locations at the discretion of the Project Manager. 48 hours after the initial sweeping an application of Fog Seal shall be applied to all areas chip sealed. The polymer modified Fog Seal or approved equal emulsion shall be diluted 40 percent with water. The application rate shall vary between 0.08 and 0.12 gallons per square yard as deemed necessary by the Contractor and Project Manager.

**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 Chip 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 Chip Seal.

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