

computerized printouts from the Contractor's plant as verified by cement cutoffs with the consideration of any waste as determined by the Engineer.

- (5) The Contractor shall not make claim for any additional ride incentive or a reduction in the ride disincentive due to Mn/DOT selecting the finished profile of the concrete overlay.
- (6) All concrete cores shall be taken at 0.6 m [2 feet] from the outside pavement edge.

S-141.8 MEASUREMENT AND PAYMENT

Method of measurement for PASRC will be in accordance with Mn/DOT 2350.8, modified as follows. Bituminous mixture and bituminous material for mixture will be paid for separately.

(A) Measurement will be made by the weight of bituminous mixture for PASRC. Payment will be made under Item 2350.609 (Bituminous Mixture for Permeable Asphalt Stabilized Stress Relief Course) at the Contract bid price per metric ton [ton]. Payment for the accepted bituminous mixture shall be payment in full for all costs of constructing the PASRC surface, including the costs of the mixture production, aggregate incorporated, placement, and compaction. Cost for Asphalt Cement is specifically excluded.

(B) Measurement will be made by the weight of Asphalt Cement incorporated into the PASRC bituminous mixture. Payment will be made under Item 2350.609 (Asphalt Cement for Mixture) at the Contract bid price per metric ton [ton]. Payment for the asphalt cement, based on the acceptance of the PASRC bituminous mixture, will be payment in full for asphalt cement, any additives, and the incorporation of the cement into the mixture.

S-142 (2356) BITUMINOUS SEAL COAT

Always use SP2005-138.1 (BITUMINOUS TACK COAT) with this writeup.

REVISED 3/26/08

SP2005-136

Mn/DOT 2356 is deleted and replaced by the following:

S-142.1 DESCRIPTION

Construct a seal coat on a prepared surface. A seal coat is the application of bituminous material, followed immediately by an application of a single layer of aggregates. Fog seal the completed seal coat.

S-142.2 MATERIALS

A. Bituminous Material

- 1. Provide CRS-2P, bituminous material for seal coat, and CSS-1h for fog sealing. The CRS-2P, bituminous material for seal coat, and CSS-1h for fog sealing, shall meet the following requirements for the type and grade specified. Only Bituminous Material supplied from a certified source is approved for use. A list of certified sources is on file at the Chemical Laboratory.

- a. Emulsified Asphalt

The emulsified asphalt shall meet the requirements of **AASHTO M-316-99 CRS-2P** subject to the following modification.

- (1) The CRS-2P shall be distilled at 400°F for 20 minutes.
- (2) **Polymer-Modified Cationic Emulsified Asphalt, (CRS-2P) shall be produced by using polymer modified base asphalt only. The use of Latex modification shall not be allowed. Any emulsion not meeting this requirement shall not be used.**

- b. Provide a CSS-1h, bituminous material for fog seal, as specified in Mn/DOT 3151.E.

B. Seal Coat

Provide a Class A, B, or C aggregate, as specified in Mn/DOT 3137.2B. Use aggregates, uniform in quality and free from wood, bark, roots and other deleterious materials. All Class C aggregates shall be 80% crushed one face (mechanical or natural), of the plus 4.75 mm [#4] fraction (use Mn/DOT Laboratory Manual Method 1214). Gradation and quality requirements are specified in Table 1. All percentages are by weight. The aggregate size to be used will be shown in the Plans.

Table 1 (Values are the percent passing the sieve).

Sieve Size	FA-1	FA-2	FA- 2 1/2	FA-3	FA-3 1/2	QC range
12.5 mm [1/2 inch]	100	100	100	100	100	
9.5 mm [3/8 inch]	100	100	100	100	90-100	±5%
6.3 mm [1/4 inch]	100	100	0-80	0-70	0-70	±7%
4.75 mm [# 4]	0-100	0-100	0-50	0-25	0-25	±7%
2.36 mm [# 8]	---	0-40	0-12	0-5	0-5	±4%
1.18 mm [# 16]	0-30	0-10	0-5	---	---	±4%
300 µm [# 50]	0-15	0-5		---	---	±4%
150 µm [# 100]	0-5	---		---	---	±4%
75 µm [# 200]	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	
Material Tests						
% Shale, max. Mn/DOT 1209	5	5	5	3	2	
Flakiness Index, max. %, FHL T 508 ¹	N/A	25	25	25	25	
Los Angeles Rattler, max. % loss, AASHTO T 96 (Mn/DOT modified)				35	35	

¹ Aggregate retained on each sieve, which comprises at least 4 percent of the total sample shall be tested.

C. Water

Use potable water, compatible with the seal coat

S-142.3 SEAL COAT DESIGN

The quantity on the Plans for bituminous material for seal coat is for estimating and bidding purposes only.

The Contractor shall design the seal coat using Mn/DOT's seal coat design method, available through the Mn/DOT web site. Base the design on the traffic volume(s) and pavement condition(s). Determine the starting application rate for the bituminous material and seal coat aggregate. Provide the following design information to the Project Engineer, two weeks before construction is to begin:

- (1) Test results required in Table 1.
- (2) Seal coat aggregate design application rate.
- (3) Bituminous material design application rate.
- (4) Loose unit mass [**weight**] of the aggregate.
- (5) Bulk specific gravity of the aggregate.
- (6) 150 pound sample of each proposed aggregate source.

All Mn/DOT projects will have the design reviewed by Mn/DOT District Materials Office personnel. Failure of the Contractor to submit 150 pounds of material for each source to Mn/DOT for design review at least 14 days before start of construction may result in postponement of the start of the Project until a design has

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been completed as determined by the Engineer. The Contractor will be charged one working day for each weekday that the Project is delayed.

After the seal coat design has been established, the aggregate supplied to the Project shall conform to the QC tolerances in Table 1. The tolerance range does not extend the specification limits set in Table 1.

Note: The seal coat aggregate design rate is the minimum amount of material based on the design program. If additional material is needed, this material is incidental to the square meter [**square yard**] bid price.

Schedule of Price Reduction for Seal Coat Construction.

Failing gradations will result in a price reduction. The Contract bid price for seal coat will be reduced 1 percent, for each 1 percent passing outside of the requirements for any sieve, except the 75 μm [**# 200**] sieve. The 75 μm [**# 200**] sieve will have 1 percent price reduction for each 0.1 percent outside of the specification. All failing results will be added together. These deductions apply to the specification range in Table 1. If any gradations fall outside of the quality control range but within specifications, stop construction and a new design will be required.

Failing flakiness tests will result in a \$1,000 reduction for each failing test.

S-142.4 EQUIPMENT

A. Distributor

Use a distributor as specified in Mn/DOT 2321.3C1.

B. Aggregate Spreader

Use a self-propelled mechanical type aggregate spreader capable of distributing the aggregate uniformly to the required width and at the designed rate. Use a self-propelled type mounted on pneumatic-tired wheels.

C. Pneumatic-Tired Rollers

Provide a minimum of three (3) self-propelled pneumatic-tired rollers as specified in Mn/DOT 2321.3C2.

D. Brooms

Provide motorized brooms with a positive means of controlling vertical pressure and capable of cleaning the road surface prior to spraying bituminous material and removing loose aggregate after seal coating.

S-142.5 CONSTRUCTION REQUIREMENTS

A. Weather Limitations

Construct seal coat operations (including traffic restrictions on the freshly constructed seal coat) and fog sealing according to the following:

- (1) Not before May 15 or after August 10, for the part of Minnesota located in the North and North-Central Road Spring Restriction Zone. Not before May 15 or after August 31, for the part of Minnesota located south of the North and North-Central Spring Road Restriction Zone.
- (2) Work only during daylight hours.
- (3) Start when the pavement and air temperature are 15.5 °C [**60 °F**] and rising.
- (4) The road surface may be damp. There shall be no standing water.
- (5) No construction is allowed in foggy weather.

B. Road Surface Preparation

Clean all pavements to be seal coated. Sweep the pavement with a motorized broom to remove loose material. Clean depressions not reached by the power broom, using hand brooming.

Cover iron (manholes, gate valve covers, catch basins, sensors, etc.) to prevent adherence of the bituminous material. Suitable covering includes plywood disks, sand, Kraft paper, roofing felt or other approved methods. Remove the protective coverings before opening the road to traffic.

Apply a tack coat, if required, to the prepared road surface in accordance with Mn/DOT 2357. No direct payment will be made for the application of the tack coat.

C. Application of Bituminous Material

Begin the rate of application for the bituminous material as determined by the seal coat design. Construct a test strip 30 meters [**100 feet**] long to ensure the bituminous material application rate is adequate. After applying the bituminous material to this test strip, place the seal coat aggregate at the design application rate. Inspect the aggregate in the wheel paths for proper embedment. Make adjustments to the rate of application, if necessary. Construct one full lane width at a time. Make additional adjustments to the rate of application during the Project, if needed.

Apply the bituminous material above the minimum limits specified below:

Bituminous Material	Minimum Temperature	Ideal Temperature
CRS-2P	60° C [140° F]*	76.6-82.2° C [170-180° F]
CSS-1h	37.7° C [100° F]	

* Intended for uniform lay down of emulsion.

D. Application of Seal Coat

Prior to construction, calibrate the aggregate spreader in accordance with ASTM D5624, in the presence of the Engineer. The allowable deviation in the amount of aggregate spread on each of the rubber mats shall not exceed $\pm 0.5 \text{ kg/m}^2$ [**$\pm 1 \text{ pound per square yard}$**] in the transverse direction, or $\pm 0.5 \text{ kg/m}^2$ [**$\pm 1 \text{ pound per square yard}$**] in the longitudinal direction, from the design application rate.

Provide uniformly moistened aggregates, which are damp at the time of placement. Immediately (within one minute) after the bituminous material has been sprayed, apply the aggregates. The speed of the spreader shall be such that the aggregates are not rolling over, and starting and stopping of the spreader is minimized. The edges of the aggregate applications shall be sharply defined. Previously used (sweeping) aggregates will not be allowed.

E. Rolling Operations

Complete the initial rolling within 2 minutes after applying the aggregate. Proceed at a recommended speed less than or equal to 8 km per hour [**5 miles per hour**], to prevent turning over aggregate. Make a minimum of three complete passes over the aggregate. Roll the aggregate so the entire width of the treatment area is covered in one pass of all the rollers. The total compacting width of each pneumatic-tired roller shall exceed 1.5 m [**5 feet**].

F. Sweeping

Sweep off the surplus aggregate on the same day of the seal coat construction. Sweep with care to not dislodge aggregate that is setting. Re-sweep areas the day after the initial sweeping. The Contractor will dispose of the surplus seal coat aggregate in a manner satisfactory to the Engineer.

G. Protection of the Surface

No traffic is permitted on the seal coated road surface until after the specified rolling has been completed and the bituminous material has set and will not pick up on vehicle tires.

H. Protection of Motor Vehicles

The Contractor is responsible for claims of damage to vehicles until the roadways and shoulders have been swept free of loose aggregate and permanent pavement markings have been applied. If permanent

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pavement markings are to be applied by State forces, the Contractor's responsibility ends after completion of the fog seal and placement of temporary pavement markings.

I. Application of Bituminous Material for Fog Sealing

Fog seal completed seal coated areas, after sweeping and before placement of permanent pavement markings. Construct the fog seal as specified in Mn/DOT 2355, as modified as follows: Construct a 30 meter [100 foot] test strip. Review the application of diluted (1:1) bituminous material and adjust the application rate as needed. Apply between 0.3 to 0.8 liters per square meter diluted [0.07 to 0.18 gallons per square yard, diluted]. Apply the fog seal to minimize the amount of overspray. Do not allow traffic on the fog seal until it has cured.

J. Progress of Work

The seal coat will usually cure within 24 hours under dry conditions and temperatures above 15.5 °C [60 °F]. Allow the seal coat to cure a minimum of one day before fogging. The fog seal can be applied after the seal coat is cured. The fog seal will usually cure within 2 hours under dry conditions and temperatures above 15.5 °C [60 °F]. Interim pavement markings can be placed after the fog seal cures. The permanent pavement markings shall not be placed for three days after placing the fog seal.

S-142.6 METHOD OF MEASUREMENT

A. Bituminous Material

1. Measure the bituminous material for fog seal by volume, at 15 °C [60 °F], **undiluted**. This material must be diluted (1:1) before application at place of manufacture.
2. Measure the bituminous material for seal coat by volume, at 15 °C [60 °F].

B. Seal Coat

Measure the seal coat by area of pavement surfaced.

S-142.7 BASIS OF PAYMENT

(A) Payment for bituminous material for fog seal: as specified in Mn/DOT 2355.5.

(B) Payment for the accepted quantity of bituminous material for seal coat (including any required additives) at the Contract bid price of measure is compensation in full for all costs of furnishing and applying the material as specified.

(C) Payment for the accepted quantity of seal coat at the Contract bid unit price of measure is compensation in full for all costs of furnishing and applying the material as specified, including cleaning the existing pavement, stationing, purchasing of aggregate, delivery of aggregate, all labor, equipment, and materials necessary for the placement of the seal coat for full lane coverage, sweeping of any loose aggregate after construction and other requirements as specified.

(D) Payment will be made in accordance with the schedule set forth below at the Contract bid price for the specified unit of measure. Such payment, in each instance, is compensation in full for all costs incidental thereto.

<u>Item No.</u>	<u>Item</u>	<u>Unit</u>
2355.502	Bituminous Material for Fog Seal.....	Liter [Gallon]
2356.505	Bituminous Material for Seal Coat	Liter [Gallon]
2356.604	Bituminous Seal Coat.....	Square meter [Square yard]

S-143 (2356) SEAL COAT - MACRO-SURFACING

Use on very high volume roadways like freeways

SP2005-137

Mn/DOT 2356 is hereby deleted and replaced with the following: