Section 2307. Bituminous Seal Coat

2307.01 DESCRIPTION.

One or more applications of binder bitumen with one or more successive applications of cover aggregate.

2307.02 MATERIALS.

Use materials meeting the following requirements:

A. Aggregates.

1. Use cover aggregate meeting requirements of Section 4125 for the size designated. Unless designated otherwise, use sand for shoulders and winter seals, and use the 1/2 inch (12.5 mm) size crushed aggregate for other work. On Primary projects, when 1/2 inch (12.5 mm) size cover aggregate is specified, use crushed stone or crushed gravel.

2. For each contract, each load of each size of aggregate is to be similar in type and gradation. Source changes require the Engineer's approval.

3. For Primary projects, furnish the aggregate size designated in the contract. Do not use the 1/2 inch (12.5 mm) size when the 3/8 inch (9.5 mm) size is designated.

B. Bituminous Material.

Meet the requirements of Section 4140 or 4138.

1. **Emulsified Asphalt.**
   Unless specified otherwise in the contract documents, use binder bitumen meeting the requirements for CRS-2P as specified in Section 4140.

2. **Cutback Asphalt.**
   Furnish cutback asphalt with an approved anti-stripping additive as described in Article 4138.01.

3. **Asphalt Emulsion for Dust Control.**
   Use grade CSS-1, CSS-1H, or SS-1H as specified in Section 4140. Dilute with water prior to application. Use an initial dilution rate of seven parts water to one part emulsion.

2307.03 CONSTRUCTION.

A. Equipment.

Use equipment meeting requirements of Section 2001 and the following:

1. **Aggregate Spreaders.**
   - **a.** Apply Article 2001.13, B, except that, when provided in the contract documents, an aggregate spreader meeting requirements of Article 2001.13, A, may be used.
   - **b.** Equip aggregate spreaders described in Article 2001.13, B, with a scalper or segregator screen (provided by the manufacturer) mounted below the feeder roll. Use scalper screen opening sizes recommended by the spreader manufacturer. When adjusted to the proper angle, the coarse fraction of the aggregate is placed first. Afterwards, the fine fraction is dropped through the screen on top of the larger particles. Adjust the screen angle as necessary on the project. Use of this screen is required.

2. **Equipment for Distributing Bitumen.**
   - **a.** Apply Article 2001.12.
   - **b.** When emulsion binder bitumen is used, use a distributor spray bar equipped with nozzles (furnished by the distributor manufacturer) which are specifically designed to apply emulsion. Before the work is started, provide the Engineer with a written statement indicating the size or part number of the nozzles recommended, and certifying that these nozzles are installed on the distributor.

3. **Brooms.**
   - **a.** Apply Article 2001.14.

b. When using a power broom to remove loose aggregate from a newly seal coated surface, ensure that it is capable of exerting uniform down pressure (for the full width of the broom and without vibration or bounce) sufficient to remove loose aggregate without dislodging particles which are stuck in the binder bitumen.

4. Heating Equipment.
Apply Article 2001.11.

5. Rollers.
a. Use self propelled, pneumatic tired rollers meeting the requirements of Article 2001.05, C, to embed the cover aggregate.
b. One pneumatic tired roller will be required for work involving sand cover aggregate.
c. A minimum of two pneumatic tired rollers will be required for work involving other cover aggregate.

6. Weighing Equipment.
Apply Article 2001.07.

B. Bituminous Seal Coat Construction.
The rates of application for binder bitumen and cover aggregate shown in the contract documents or specified herein are approximate. These rates may be varied as found desirable on the basis of laboratory or field tests.

1. Surface Preparation.
a. Immediately before bitumen is applied, clean the entire surface to be treated, as well as the adjacent gutters, of all foreign material, including dust.
b. Blade, clean, and perform incidental work required to produce a clean surface. If the power broom fails to remove dust from depressions and pockets, use hand brooms.
c. In rural areas, blade or sweep material removed from the road surface off the road surface. In cities and towns, remove the material according to Article 1104.08. This material becomes the property of the Contractor.
d. Priming, if required, will be specified in the contract documents.

2. Heating Bituminous Materials.
a. Heat bituminous materials to a temperature which will permit uniform spreading. Temperatures between the limits in Table 2307.03-1 should produce the desired viscosity:

Table 2307.03-1: Bituminous Material Temperatures

Designation	Temperature ºF* (ºC)
CRS-1 and 2 and CRS-2P	150-185 (65-85)
MC-800	175-255 (80-125)
MC-3000	215-290 (100-145)
MC-70	145-165 (60-75)
* Some temperatures listed may be above the flash point of the material. Use extreme caution when handling to reduce fire hazard.	

b. Material which has been damaged by overheating will be rejected.

3. Spreading Bituminous Material.
a. General.
1) Before spreading bituminous material, ensure the distributor:
- Complies with recommendations of the manufacturer as to nozzle size, nozzle angle with the axis of the spray bar, and spray bar or nozzle height above the road surface.
- Has been tested to assure uniform bitumen distribution on the road surface at the specified rate.

2) Minimize longitudinal overlap of adjacent bitumen applications. Spread between 95% and 105% of the bituminous material the Engineer prescribes. Correct the rate of application for temperature to deliver the desired volume at 60°F (16°C).

3) Use a suitable covering to protect the items below from being soiled by bitumen. Leave the protective covering in place until the bitumen has set and no splashing occurs under traffic.
   - Curbs and handrails of bridges.
   - Guardrails.
   - Headwalls of culverts.
   - Pavements.
   - Curbs and gutters.
   - Utility accesses.
   - Intakes.
   - Water and gas valves.
   - Railroad flangeways.
   - Other installations requiring protection.
4) Place suitable covering, as required, to prevent cover aggregate from entering intakes or other similar structures during placement and while brooming excess cover aggregate.
5) Preserve the integrity of areas with rumble strip panels. This may include (at the Contractor's option and subject to the Engineer's approval):
   - Placing a suitable covering over rumble strip panels which prevents filling with bituminous seal coat, or
   - Using hand labor to restore uncovered rumble strip panels.

b. Binder.

1) Sweep the surface clean of loose aggregate and foreign material which may prevent adhesion of the binder to the surface on which it is applied. This applies to fillets at intersecting roads and drives only when specified.
2) Apply binder bitumen to the surface (including fillets at intersecting roads and drives when specified) at the rates and in the manner the Engineer specifies or designates.
3) When traffic must be maintained through the work while construction is in progress and the width is 24 feet (7.2 m) or less, place the bituminous seal coat in two passes. For the first course, spread the bitumen for the first lane approximately 12 inches (0.3 m) wider than one-half of the width of the pavement to be surfaced. For other courses, spread the bitumen for each lane approximately one-half the width of the pavement to be surfaced.
4) Progress in the direction from which aggregate is to be hauled to the spreader. Complete one side for one day's run before the seal coat is applied on the adjacent lane. Auxiliary lanes may be done on the same day. One side may be completed for the full length of a short project before the seal coat is applied to the other side. It is the intention that the maximum length of road with new seal coat on only one side would be limited to approximately 6 miles (10 km). This length may be increased with the Engineer's approval.
5) Limit the length of any spread to that which can be covered with aggregate and rolling completed within 30 minutes. Limit the distance between the bitumen distributor and the aggregate spreader to 150 feet (45 m). Maintain initial roller coverage as close to the aggregate spreader as possible, not to exceed 200 feet (60 m).
6) In any case where emulsion is used, cover the binder bitumen with aggregate and initially roll within 2 minutes after the bitumen has been spread. When the 2 minute requirement for emulsion or the 30 minute requirement for all work is not met, the work may be considered not in reasonably close conformity according to Article 1105.04.
7) Apply bitumen for winter seals with limitations the Engineer deems appropriate. Apply other binder bitumen only when the road surface is free of moisture and has a temperature no less than 60°F (15°C). When the environment places a portion of the pavement in shade, use a shaded area to determine road surface temperature.

c. Joints.

1) Secure binder bitumen distribution at the specified rate of application using paper placed at the start of each distributor run. Use commercial grade building paper that is approved by the Engineer and is no less than 36 inches (0.9 m) wide.
2) When the end of the run joins newly placed seal coat, place paper at that joint also. Cut the joint straight along the off edge of the paper. Remove the seal coat material on the paper adjacent to the off edge from the roadbed surface. Ensure a smooth ride is obtained.

4. **Spreading Cover Aggregate.**
   a. **General.**
      1) Use specified mechanical spreaders to spread cover aggregate on the freshly applied bitumen. Avoid spillage or piling of aggregate. Correct spillage or piling using manual methods before rollers cover the area. Do not use the ballast in rollers for spreading aggregate. Vehicles other than those required to deliver aggregate to the spreader will not be permitted to pass over the treated area of the roadbed until after the aggregate has been spread and rolled.
      2) Fillet surfacing at intersecting roads and drives may be placed subsequent to that on the roadbed itself, but shall promptly follow binder bitumen spreading.
   b. **Moisture.**
      At the time of spreading, ensure the surfaces of the cover aggregate are damp, but with no free water. This will be determined by visual inspection.

5. **Rolling.**
   a. After the aggregate has been spread, promptly roll to secure early aggregate embedment in the bitumen. Complete rolling no later than 30 minutes after the bitumen is spread.
   b. Do not apply succeeding applications of binder bitumen until the most recent one applied as been covered with aggregate and all rolling operations completed.
   c. Satisfactory embedment usually will be secured by one roller coverage of sand cover and five roller coverages of other cover aggregate. One roller coverage is interpreted as the number of passes of the roller required to ensure that the entire area has been touched at least once by the entire roller.
   d. Operate rollers at a speed of no more than 5 mph (8 km/h).

6. **One Course Seal Coats.**
   In addition to requirements of Articles 2307.03, B, 4 and 5, apply the following:
   a. **Spreading Binder Bitumen.**
      Apply bitumen to the prepared base or surface at the rate the Engineer designates, usually within the ranges of Table 2307.03-2:

Table 2307.03-2: Bitumen Spreading Rates

Aggregate Size	Spreading Rate Gal. per Sq. Yds. (L/m^2)	Basic Rate[(a)] Gal. per Sq. Yds. (L/m^2)
Sand	0.15 - 0.20 (0.7 - 0.9)	0.15 (0.8)
3/8 inch (9.5 mm)	0.25 - 0.35 (1.1 - 1.6)	0.30 (1.4)
1/2 inch (12.5 mm)	0.35 - 0.45 (1.6 - 2.0)	0.40 (1.8)
(a) The basic rate will be used for design purposes.		

   b. **Spreading Cover Aggregates.**
      1) Uniformly spread cover aggregate of the size specified, over the treated area promptly after the spread of bitumen has been completed on any section.
      2) Unless otherwise specified, use a rate of 10 pounds per square yard (5 kg/m^2) for shoulders, 15 pounds per square yard (8 kg/m^2) for winter seals, and 30 pounds per square yard (16 kg/m^2) for other applications.
      3) When bituminous seal coat is placed on two lanes, spread the aggregate for the first lane to a width of 50% of the roadway to be treated.

7. **Two Course Seal Coats.**
   In addition to requirements of Articles 2307.03, B, 4 and 5, apply the following:
   a. **First Course Construction.**
      1) **Spreading Binder Bitumen.**
         Apply bitumen to the prepared base of surface at the rate of 0.35 gallon per square yard (1.6 L/m^2).
      2) **Spreading Cover Aggregate.**
         a) Uniformly spread cover aggregate of the size specified over the treated area at the rate of 30 pounds per square yard (16 kg/m^2) promptly after spreading bitumen on any section.
         b) When bituminous seal coat is placed in each lane separately, spread the aggregate for the first lane to a width of 12 inches (0.3 m) greater than 50% of the width of the lane to be surfaced.

c) When the full width is surfaced integrally, spread the aggregate to a width such that the junction of the two aggregate spreads is offset 12 inches (0.3 m) from the center of the full width surface.

b. Second Course Construction.

1) Preparation of Roadbed.

a) After completing the first course, prepare roadbed for the second course by either:

- A vacuum machine, or
- By lightly brooming the full surfaced width with the power broom to remove loose material.

b) After cleaning, roll the entire surface once with the steel roller.

c) Complete the preparation of the roadbed in sections just prior to application of bitumen for the second course.

2) Spreading Binder Bitumen.

Spread bitumen on the prepared surface at the rate of 0.30 gallon per square yard (1.4 L/m^2).

3) Spreading Cover Aggregate.

a) Spread cover aggregate of the size specified over the treated area at the rate of 25 pounds per square yard (14 kg/m^2) promptly after spreading bitumen on any section of roadbed.

b) For two lane roadways, place the two aggregate spreads so the seam between the two spreads is near the centerline.

8. Maintenance During Construction Period.

a. If bleeding occurs during construction, the Engineer may order additional aggregate placed at the contract unit price for cover aggregate. Additional compensation will not be allowed for incidental rolling.

b. On Primary projects and where specified on other projects, gently sweep the surface free of loose cover aggregate using a rotary broom. Perform this sweeping early the next morning while the bituminous binder is hard and stuck particles will not be disturbed. Other means of removing the loose particles, such as vacuum machines or air blast, may be used with the Engineer's approval.

c. In areas with curb and gutter sections or storm sewer intakes, in addition to sweeping the surface, collect loose particles and haul them off the project. The Engineer may also designate that loose particles be hauled off the project in additional areas within municipal corporate limits, such as entrances or shallow drainage ditch locations.

d. The Engineer may require additional sweeping to remove loose cover aggregate from the surface throughout the project duration.

e. When the contract includes an item for asphalt emulsion for dust control, apply the dust control following the removal of loose particles and before other work continues, according to Article 2307.03, B, 9.

9. Dust Control Treatment.

a. On Primary Road projects where limestone or crushed gravel cover aggregate is used, apply diluted asphalt emulsion to the completed bituminous seal coat surface to control dust. Uniformly spread diluted asphalt emulsion at the initial rate of 0.12 gallon per square yard (0.5 L/m^2).

b. On non-Primary Road projects, apply dust control as specified in the contract documents.

c. Apply dust control following the removal of particles and before other work continues. Apply dust control within 24 hours after bituminous seal coat placement unless directed otherwise by the Engineer.

d. Broom off loose material and apply dust control on the calendar day following placement of bituminous seal coat.

10. Traffic Control.

a. When the road is not closed for construction, maintain normal traffic on the project. No detour will be provided. Do not delay traffic unnecessarily. Refer to the contract documents for traffic maintenance during work on shoulders of multilane pavements.

b. Traffic control setups which cause unnecessary stopping or turning movements generally will not be allowed.

c. Unless otherwise stated in the contract documents, furnish the signs and mounting devices, including posts.

d. Furnish and install the signs as follows:

1) **"NO PAVEMENT MARKINGS NEXT __ MILES" signs.**
Place at each end of the area where pavement markings have been obliterated, on each side of towns, and on each side of all intersections with Primary and Secondary Roads.

2) **"LOOSE STONE - REDUCE SPEED" signs.**
Place, along with a 35 mph advisory speed plate, approximately 500 feet (150 m) in advance of the "No Pavement Markings" signs.

3) **"DO NOT PASS" signs.**
Place on the right-hand side of the road at the beginning of each no-passing zone.

4) **"PASS WITH CARE" signs.**
Place on the right hand side of the road at the end of each no-passing zone.

e. Mount signs on posts.

f. The Contracting Authority will place new pavement markings and remove the signs when the project is complete.

g. Provisions for handling other traffic are as follows:

1) Direct traffic through restricted portions of the project using pilot cars described in Article 2528.03, D. Furnish pilot cars and pilot car signs.

2) Station one flagger immediately ahead of the application of the bitumen, one immediately behind the bitumen, and one immediately behind the section being rolled. Display suitable warning, speed limit, and fresh oil signs. Move the signs forward with the flagger as the work progresses.

3) After the bituminous seal coat has been spread, smoothed, rolled, and cured for a minimum of 2 hours, the road may be open to traffic.

4) In some areas it is more practical to place the bituminous seal coat in short sections and to allow traffic to use the completed bituminous seal coat immediately after the surface treatment has been completed. In these areas, control traffic on the newly placed bituminous seal coat to a speed of no more than 25 mph (40 km/h) for a minimum of 2 hours. The Engineer will specifically authorize such areas. The Engineer may extend the minimum 2 hour period due to low temperature and visually observed damage to the bituminous seal coat under traffic or when turning movements may damage the bituminous seal coat. (The intent of traffic modifications is to not allow traffic on completed bituminous seal coat sections until satisfactorily cured. This requires a minimum of 2 hours, depending on climatic conditions.)

11. Limitations.

a. The Engineer may prohibit construction if the weather is unfavorable for the embedment of cover aggregate in the binder bitumen as specified in Article 2307.03, B, 3.

b. Limit the area on which binder is spread to that which can be covered with aggregate, and the rolling completed, within daylight hours of the same working day. When traffic is being carried through the work, keep the entire roadbed free of construction equipment, according to Article 1107.08.

c. Except for winter seals, do not apply seal coats after September 1 on Primary projects or after September 15 on other projects. When the entire project cannot be completed by the specified cutoff date, do not complete placement on one side only for the full length of the project. Instead, complete both sides to the same location by the specified cutoff date.

d. When this contract includes pavement marking, complete traffic line construction within 72 hours after the seal coat has been completed to the full width at that location, weather permitting.

e. When dust control treatment is required, allow it to cure prior to allowing traffic on the roadway.

12. Surfacing Intersecting Roads, Driveways, and Turnouts.

a. Use seal coat applied at the same rate provided for the roadway to cover the area of any fillets of base courses constructed at driveways to farmsteads and commercial establishments, unless otherwise specified in the contract documents.

b. Surface remaining areas within the right-of-way on earth or gravel surfaced approach roads and driveways and turnouts for mail boxes according to Section 2315. These areas will be measured and paid for according to Section 2315.

C. Finishing and Opening to Traffic.
Restore to an acceptable condition any portion of the roadway disturbed by operations related to bituminous seal coating. After the bituminous seal coat has been spread, smoothed, rolled, and cured as specified in Article 2307.03, B, the road may be opened to traffic.

2307.04 METHOD OF MEASUREMENT.
Unless otherwise provided, winter seal will not be measured for payment. Measurement for the quantities of the various classes of other work involved in bituminous seal coat, satisfactorily constructed, will be as follows:

A. Aggregate.
Tons (megagrams), except as provided in this specification, from the net weight (mass) of individual loads weighed on scales furnished by the Contractor, according to Article 2001.07. Includes fillets at intersecting roads, drives, and turnouts. At locations where the quantity of aggregate required for a single section of road is less than 300 tons (300 Mg), volume measurement will be permitted.

B. Binder Bitumen.
Gallons (liters) computed from field measurements of distributors or from tank cars or transport trucks as provided in Article 4100.03. Includes bitumen for fillets at intersecting roads, drives, and turnouts. When quantities computed from field measurements check within 1.0% of the billed gallons (liters), payment will be based on billed gallons (liters). When quantities computed from field measurements differ from billed gallons (liters) by more than 1.0%, payment will be based on the quantity from field measurements. From these quantities, any amount used by the Contractor as fuel, left in cars, or otherwise not delivered to the road surface will be deducted. The Engineer will advise the Contractor promptly, in writing, of the quantities deducted.

C. Driveway Surfacing Material.
Computed as and provided in Section 2315, for granular surfacing placed at intersecting roads, drives, and turnouts. Excavation required for placing this surfacing is considered incidental to the work and will not be measured for payment.

D. Asphalt Emulsion for Dust Control.
Undiluted asphalt emulsion measured as provided in Article 2307.04, B.

E. Traffic Control.
Article 2528.04 applies.

2307.05 BASIS OF PAYMENT.
For the various items of work involved in bituminous seal coat, measured as provided above, payment will be the contract unit price as described below. Payment for additional rolling the Engineer requires will be according to Article 1109.03, B.

A. Aggregate.

1. Per ton for the number of tons (megagrams) of roadway cover aggregate placed in accepted portions of the work.

2. Payment for roadway cover aggregate is full compensation for furnishing, delivering, and spreading the aggregate, for all brooming, rolling, final cleanup, and incidental work necessary to complete the project and not paid for as other items.

B. Binder Bitumen.
Per gallon (liter) for the quantity of binder bitumen spread on accepted portions of the road and the quantity used in making trial runs for adjustment of distributors.

C. Driveway Surfacing Material.
As provided in Section 2315 for the quantity of granular surfacing placed at intersecting roads, drives, and turnouts.

D. Asphalt Emulsion for Dust Control.

1. Per gallon (liter) for the number of gallons (liters) placed.

2. Payment is full compensation for sweeping, furnishing, mixing with water and applying the asphalt emulsion, and curing of the dust control material.

E. Traffic Control.
Article 2528.05 applies.