

**Section 660**

1 Heat and apply the sealant material according to the manufacturer’s recommendations. Use  
2 a portable melting kettle for heating the material that is equipped with indirect heating  
3 (air-jacketed flow) and is capable of constantly agitating the joint sealer to maintain a uniform  
4 temperature. Equip the kettle with either mechanically operated paddles and/or a continuous  
5 circulating pump to maintain agitation. Use heating equipment capable of controlling the  
6 sealant material temperature within the manufacturer’s recommended temperature range and  
7 that is thermostatically-control calibrated between 200°F to 600°F. Locate a thermometer on  
8 the kettle so the Engineer can safely check the temperature of the sealant material.  
9 Overheating of the sealant material will not be permitted.

10 Apply sealant in the prepared cracks and joints within the manufacturer’s recommended  
11 temperature range, using a pressure screed shoe to completely fill the crack or joint, leaving  
12 a sealed 2" overband. Excessive overbanding or waste of sealant materials will not be  
13 tolerated. Immediately squeegee the crack seal material to minimize the height of the  
14 overband. All sealed cracks and joints shall have a minimum of 1/8" depth of sealant  
15 installed.

16 Do not apply the hot applied joint sealer when the surface temperature of the pavement is  
17 below 32°F. Follow manufacturer’s recommendations.

18 After the crack or joint has been sealed, promptly remove any surplus sealer on the pavement.  
19 Do not permit traffic over the sealed cracks and joints without approval by the Engineer.  
20 When approved by the Engineer, place sand or other approved material over the crack or joint  
21 to prevent tracking.

22 **657-4 MEASUREMENT AND PAYMENT**

23 Sealing existing pavement cracks and joints will be measured and paid as the actual number  
24 of pounds of material that has satisfactorily been used to seal pavement cracks and joints in  
25 the designated highway. Any material spilled, used in excessive overbanding, wasted,  
26 misapplied or unsatisfactorily used in any way will be deducted in determining quantities for  
27 payment. The Engineer will determine the quantity, if any, to be deducted. The Engineer's  
28 decision on the quantity to be deducted will be final and binding.

29 Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
Sealing Existing Pavement Cracks and Joints	Pound

30 **SECTION 660**  
31 **ASPHALT SURFACE TREATMENT**

32 **660-1 DESCRIPTION**

33 Perform the work covered by this section including, but not limited to, furnishing, hauling,  
34 spreading and rolling the asphalt material and aggregate consisting of one or more  
35 applications of liquid asphalt material and one or more applications of aggregate cover coat  
36 material on a prepared surface; furnishing and spreading blotting sand; and maintaining and  
37 repairing the asphalt surface treatment.

38 **660-2 MATERIALS**

39 Refer to Division 10.

40 Use one of the following grades of asphalt:

<b>Item</b>	<b>Section</b>
Aggregates for Asphalt Surface Treatment	1012-2
Blotting Sand	1012-3
Emulsified Asphalt, Grade CRS-2	1020-3
Emulsified Asphalt, Grade CRS-2L	1020-3

Item	Section
Emulsified Asphalt, Grade CRS-2P	1020-3
Emulsified Asphalt, Grade CSS-1H	1020-3
Fine Aggregate	1014
Mineral Filler	1012-1(D)
Water	1024-4

1 Before any asphalt surface treatment is placed, obtain from the asphalt supplier and furnish to  
 2 the Engineer a certification of compatibility of the asphalt with the aggregate proposed for  
 3 use.

#### 4 **660-3 WEATHER AND SEASONAL LIMITATIONS**

5 Do not place any asphalt surface treatment between October 15 and March 16, except for  
 6 asphalt surface treatment that is to be overlaid immediately with asphalt plant mix.

7 Apply asphalt material only when the surface to be treated is dry and when the atmospheric  
 8 temperature is above 50°F in the shade away from artificial heat.

9 When placing asphalt surface treatment that is to be immediately overlaid with asphalt plant  
 10 mix, the seasonal and temperature limitations of Article 610-4 shall apply.

11 Do not apply asphalt material when the weather is foggy or rainy.

#### 12 **660-4 SURFACE PREPARATION**

13 Clean the surface to be treated of all dust, dirt, clay, grass, sod and any other deleterious  
 14 matter before application of the asphalt surface treatment.

#### 15 **660-5 ACCEPTANCE OF ASPHALT MATERIALS**

16 The acceptance of asphalt materials will be in accordance with Section 1020-1.

#### 17 **660-6 APPLICATION EQUIPMENT**

18 Use asphalt application equipment that meets Article 600-5.

19 Apply aggregate by the use of a self-propelled, pneumatic-tire aggregate spreader capable of  
 20 maintaining a specified rate with a uniform application for the width of asphalt material being  
 21 covered. Tailgate spreaders will not be permitted. Areas that are inaccessible to the  
 22 aggregate spreader may be covered by hand spreading or other acceptable methods.

#### 23 **660-7 APPLICATION OF ASPHALT MATERIALS**

24 The grades, rates of application and the temperature that the asphalt material is to be applied  
 25 shall be within the limits shown in Table 660-1.

26 Base the required rates of application on the volume of material at the application  
 27 temperature.

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**TABLE 660-1  
MATERIAL APPLICATION RATES AND TEMPERATURES**

Type of Coat	Grade of Asphalt	Asphalt Rate Gal/SY Total	Application Temp. °F	Aggregate Size	Aggregate Rate Lb/SY Total
Mat	CRS-2 or CRS-2P	0.35 - 0.45	150 - 175	No. 6M <sup>A,C</sup>	30 - 35
	CRS-2 or CRS-2P	0.30 - 0.35	150 - 175	No. 67	35 - 45
	CRS-2 or CRS-2P	0.45 - 0.50	150 - 175	No. 5 <sup>B,C</sup>	45 - 50
	CRS-2 or CRS-2P	0.30 - 0.40	150 - 175	No. 78M <sup>A,C</sup>	15 - 20
Straight Seal	CRS-2 or CRS-2P	0.35 - 0.40	150 - 175	No. 78M	16 - 22
	CRS-2 or CRS-2P	0.35 - 0.40	150 - 175	Lightweight	9 - 12
Split Seal	CRS-2 or CRS-2P	0.5 - 0.60	150 - 175	No. 78M	30 - 35
	CRS-2 or CRS-2P	0.45 - 0.60	150 - 175	Lightweight	18 - 20
Triple Seal	CRS-2 or CRS-2P	0.60 - 0.75	150 - 175	No. 78M	45 - 51
	CRS-2 or CRS-2P	0.60 - 0.75	150 - 175	Lightweight	27 - 29
Sand Seal	CRS-2 or CRS-2P	0.22 - 0.30	150 - 175	Blotting Sand	12 - 15

1       **A.** Use No. 6M or No. 78M aggregate for retreatment before an overlay on existing  
2 pavement.

3       **B.** Use No. 5 aggregate for initial treatment on new construction.

4       **C.** Article 660-9 includes more details regarding variations of the types of coats.

5       **660-8 APPLICATION OF AGGREGATES**

6       The size of the aggregate shall be as shown in Table 660-1 for the mat coat or the type of seal  
7 coat to be constructed. The rate of application for mat and seal aggregates shall be within the  
8 limits shown in Table 660-1. When directed, weigh a sufficient number of truck loads of  
9 aggregate before spreading to verify that the rate of application is within the required limits  
10 and use ASTM D5624 to determine rate of application.

11       **660-9 CONSTRUCTION METHODS**

12       **(A) Asphalt Mat Coat**

13       The surface on which the mat coat is to be applied shall be approved by the Engineer  
14 before the mat coat liquid asphalt is applied.

15       Place a string line guide for application equipment unless otherwise permitted. Place the  
16 mat coat in full-lane widths, unless otherwise permitted.

17       Immediately follow the application of mat liquid asphalt with the spreading of the  
18 aggregate. No more than 5 minutes can elapse from the time the liquid asphalt is applied  
19 and the rolling is completed when using CRS-2. No more than 4 minutes can elapse from  
20 the time the liquid asphalt is applied and the rolling is completed when using CRS-2P or  
21 CRS-2L.

22       Test mat coat aggregate, have approved and drained of free moisture before use. Spread  
23 the aggregate uniformly at the required rate and correct all non-uniform areas before  
24 rolling.

25       Roll immediately after the aggregate is uniformly spread. Rolling consists of at  
26 least 3 complete coverages with two 5 to 8 ton steel-wheel rollers. Continue rolling until  
27 the aggregate is thoroughly keyed into the mat liquid asphalt. Do not allow crushing of  
28 the aggregate or picking up of the material by the rollers. A combination steel-wheel and  
29 pneumatic-tire roller will not be permitted. Use 2 individual steel-wheel rollers. The  
30 3 coverages shall be completed within 5 minutes of the spraying of the mat liquid asphalt.

31       At the beginning of each mat liquid asphalt application, spread a paper over the end of  
32 the previously completed mat coat and begin the asphalt application on the paper. After  
33 application, remove and dispose of the paper.

1 After the aggregate is thoroughly seated, broom all excess aggregate off of the surface of  
2 the mat coat as directed. Traffic may be permitted on the mat coat immediately after the  
3 rolling and brooming is complete.

4 Correct defects or damage to the mat coat before the application of seal coat or plant mix  
5 overlay. The seal coat or plant mix may be applied the same day the mat coat is placed  
6 provided the mat coat has been satisfactorily applied and rolled.

#### 7 **(B) Asphalt Seal Coat**

8 Use the type of seal coat as required by the contract. Test seal coat aggregates, obtain  
9 approval and drain of free moisture before use.

10 Adjust the aggregate rates to provide a sufficient quantity of cover material to be spread  
11 over the surface of the seal coat preventing traffic damage, where it is necessary to permit  
12 traffic on sections of a completed seal coat.

13 Perform rolling of each layer immediately after the aggregate has been uniformly spread.  
14 Rolling will consist of at least 3 complete coverages with 2 pneumatic-tire rollers  
15 followed by at least one complete coverage with a 5 to 8 ton steel-wheel roller. These  
16 coverages shall be completed within 5 minutes of the asphalt emulsion being placed  
17 when using CRS-2. When CRS-2P or 2L is used all roller coverages shall be completed  
18 within 4 minutes of the asphalt emulsion being placed. Do not allow crushing of the  
19 aggregate or picking up of the material by the rollers. The use of a combination steel-  
20 wheel and pneumatic-tire roller will be permitted instead of the 5 to 8 ton steel-wheel  
21 roller.

22 The requirements of Subarticle 660-9(A) will apply to the width of seal coat construction,  
23 application of liquid asphalt and aggregate and the construction of joints. When directed,  
24 broom excess aggregate material from the surface of the seal coat and apply blotting sand  
25 in accordance with Section 818.

26 The construction of the various types of seal coats will be in accordance with the  
27 following additional requirements:

##### 28 (1) Straight Seal

29 Apply liquid asphalt material to the existing surface followed immediately by  
30 an application of granite or lightweight aggregate using Table 660-1 and  
31 requirements in the contract. Uniformly spread the full required amount of aggregate  
32 in one application and correct all non-uniform areas before rolling.

33 Immediately after the aggregate has been uniformly spread, perform rolling as  
34 previously described.

##### 35 (2) Split Seal

36 Apply liquid asphalt material to the existing surface followed immediately by an  
37 application of granite or lightweight aggregate using Table 660-1 and requirements  
38 in the contract ensuring each is uniformly placed over the existing surface and rolled  
39 as previously described.

40 Immediately after the first application of seal aggregate has been made uniform and  
41 rolled, apply the second application of the required amount of liquid asphalt material  
42 and seal coat aggregate or blotting material as defined in Article 1012-3 and roll as  
43 previously described.

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1 (3) Triple Seal

2 Follow the procedure outlined in Subarticle 660-9(B)(2) with the exception that only  
 3 granite or lightweight aggregate can be used on the second application. Apply liquid  
 4 asphalt material and granite aggregate, lightweight aggregate or blotting material as  
 5 defined in Article 1012-3 as a third layer and roll as previously described.

6 Instead of the No. 78M or lightweight stone, blotting material as defined in  
 7 Article 1012-3 may be used for the top aggregate layer with an application rate of  
 8 approximately 6 to 12 lb/sy.

9 (4) Slurry Seal

10 (a) Mix Requirements

11 Submit to the Engineer a mix design and results of the wear loss by the wet track  
 12 abrasion test (WTAT) as prepared by an approved testing laboratory. The  
 13 WTAT will be performed in accordance with ASTM D3910. The wear loss by  
 14 the Wet Track Abrasion Test shall not be greater than 100 g/sf. Apply the wear  
 15 loss to the asphalt content limits designated on the JMF.

16 Place a test strip for approval by the Engineer before beginning the work. Once  
 17 the consistency of the mix has been approved by the Engineer, maintain the total  
 18 water content within 3% of the approved blend during the course of operation.

19 Submit a mix design for each type slurry. The gradation of the mix produced  
 20 shall conform to the job mix range. The asphalt content (residual asphalt) shall  
 21 not vary by more than 1.5% from the approved mix design.

<b>TABLE 660-2 SLURRY SEAL GRADATION CRITERIA</b>									
<b>Type</b>	<b>Percentage of Total by Weight Passing</b>								<b>Remarks</b>
	3/8"	#4	#8	#16	#30	#50	#100	#200	
B	100	90-100	65-90	45-70	30-50	18-33	10-21	5-15	Design Asphalt Content, % #: 8.5-13
C	100	90-100	70-90	32-54	23-38	16-29	9-20	5-15	Design Asphalt Content, % #: 8.5-11.5

22 (b) Sampling Requirements

23 Samples for gradation will be taken from aggregate stockpiles designated by the  
 24 Contractor for use. Take samples for asphalt content and total water content  
 25 from the completed mixture. Samples of aggregate, filler and emulsion for wet  
 26 track abrasion check test will be taken at the job site. The frequency of  
 27 sampling and testing will be established by the Engineer based upon the  
 28 Department's acceptance program and local conditions encountered.

29 (c) Equipment

30 Combine the mixing and spreading equipment in a single mobile operating unit.  
 31 Attach a burlap drag 19" wide to the back of the unit for the purpose of  
 32 smoothing the slurry seal. Equip the mobile unit with an approved feeder that  
 33 will accurately meter or otherwise introduce a predetermined amount of material  
 34 into the mixer simultaneously with the aggregate. Use the feeder whenever  
 35 mineral filler is added to the mix. Equip the mobile unit with a water pressure  
 36 system and fog type spray bar capable of completely fogging the surface to that  
 37 slurry seal is to be applied. Use a mobile unit capable of an operative speed of  
 38 at least 60 ft/min and that has sufficient storage capacity to mix and apply  
 39 a minimum of 5 tons of slurry.

- 1 (i) Mixer
- 2 Use a continuous flow type mixer capable of delivering water and
- 3 a predetermined proportion of aggregate and asphalt emulsion to
- 4 a revolving multiblade mixer tank. Use a mixer that discharges the
- 5 thoroughly mixed product on a continuous basis and in that the blades of the
- 6 mixing unit are capable of thoroughly blending all ingredients.
- 7 (ii) Spreader
- 8 Use a spreader equipped with a flexible type squeegee positioned in contact
- 9 with the pavement surface and designed to apply a uniform spread with
- 10 a minimum loss of slurry.
- 11 (iii) Auxiliary Equipment
- 12 Provide hand squeegees, shovels and other hand equipment as necessary to
- 13 perform work in areas that are inaccessible to the unit.
- 14 (d) Construction Methods
- 15 (i) Preparation of Surface
- 16 Thoroughly clean the surface upon which slurry seal is to be applied of all
- 17 loose material, vegetation, silt spots and other objectionable materials
- 18 immediately preceding application by either brooming or the use of
- 19 compressed air.
- 20 (ii) Application
- 21 Wet aggregate immediately before mixing with the emulsion. The Engineer
- 22 may direct that the surface of the pavement be fogged with water
- 23 (approximately 0.05 gal/sy) immediately preceding the pass of the spreader.
- 24 Provide a slurry mixture of a consistency such that it rolls in the spreader
- 25 box in a continuous mass. Slurry that segregates in the spreader box, so that
- 26 flowing of liquids (water and emulsion) is evident, is not acceptable and
- 27 shall not be applied. The liquid portion of slurry mixture shall not flow
- 28 from either the spreader box or the applied slurry. Evidence of such flow is
- 29 sufficient cause for rejection of the applied material. Place the slurry on the
- 30 road in full lane widths up to and including 12 ft. Use a mechanical device
- 31 such as an auger to distribute the slurry mix in the spreader box.
- 32 Correct excess buildup of slurry on longitudinal and transverse joints.
- 33 Do not open treated areas to traffic until such time as the slurry seal has
- 34 cured to the extent that it will no longer be damaged by traffic. The applied
- 35 slurry mixture shall be uniform in texture and not flush under traffic.
- 36 Correct any areas not satisfactory to the Engineer. Nothing contained
- 37 herein is intended to relieve the Contractor from sharing in the
- 38 responsibility and performance of the treatments, if a failure occurs before
- 39 acceptance of the contract. Article 105-17 is amended accordingly.
- 40 Do not apply slurry seal surface course on surfaces containing ponding
- 41 water and the minimum surface temperature shall be 50°F.
- 42 The Engineer may require the surface area to that the slurry has been
- 43 applied by hand to be rolled using a pneumatic-tire type roller. Operate the
- 44 roller at an approximate tire pressure of 50 psi and subject the paved area to
- 45 a minimum of 2 coverages.
- 46 If oversize aggregate is encountered in the stockpile, immediately cease
- 47 operation and remove the oversize aggregate by screening.

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### 1 (iii) Thickness of Application

2 The average minimum thickness of application shall be at least 3/16" for  
3 Type B and at least 5/16" for Type C, unless otherwise specified.

4 In the event of a test failure on compatibility or WTAT (loss greater than  
5 100 g/sf) for a sample of material being applied to the road, take corrective  
6 action before start-up of another day's run. If the sample taken following  
7 adjustment fails the compatibility or WTAT, cease application on the road.  
8 Maintain responsibility for furnishing additional compatibility or WTAT  
9 results and field application site(s). Resume application when the  
10 acceptability of seal is clearly demonstrated.

11 The disposition of rejected material will be subject to the approval of the  
12 Engineer.

### 13 (5) Sand Seal

14 Place the fully required amount of asphalt material in one application and  
15 immediately cover with the seal coat aggregate. Uniformly spread the fully required  
16 amount of aggregate in one application and correct all non-uniform areas before  
17 rolling.

18 Immediately after the aggregate has been uniformly spread, perform rolling.

19 When directed, broom excess aggregate material from the surface of the seal coat.

20 When the sand seal is to be constructed for temporary sealing purposes only and will  
21 not be used by traffic, other grades of asphalt material meeting Articles 1020-5  
22 and 1020-6 may be used instead of the grade of asphalt required by Table 660-1  
23 when approved.

### 24 (C) Asphalt Mat and Seal

25 Construct the mat coat in accordance with Subarticle 660-9(A) using the size aggregate  
26 required by the contract.

27 Construct the seal coat in accordance with Subarticle 660-9(B) using the type seal  
28 required by the contract.

### 29 (D) Cape Seal

30 Construct the cape seal by applying a seal coat followed by applying a slurry seal as  
31 defined in Subarticle 660-9(B).

## 32 660-10 MAINTENANCE AND PROTECTION

33 Maintain and protect the asphalt surface treatment until it is accepted by the Department.  
34 Make all necessary repairs in such a manner as to preserve the uniformity of the surface.

## 35 660-11 MEASUREMENT AND PAYMENT

36 *Asphalt Surface Treatment, Mat Coat, No. \_\_\_ Stone; Asphalt Surface Treatment, \_\_\_ Seal*  
37 *and Asphalt Surface Treatment, Mat and Seal* will be measured and paid at the contract unit  
38 price per square yard. *Asphalt Surface Treatment, \_\_\_ Seal* includes *Straight Seal, Split*  
39 *Seal, Triple Seal, Slurry Seal, Sand Seal* and *Cape Seal*. Payment at the above prices will be  
40 made for replacing any satisfactorily completed asphalt surface treatment when such  
41 replacement has been made necessary by defects in subgrade or base constructed by others.

42 When the Engineer directs that the rate of application of asphalt material be decreased below  
43 the minimum rate shown in Table 660-1, no reduction in compensation will be made.

1 When the Engineer directs that the rate of application of asphalt material be increased above  
 2 the maximum rate shown in Table 660-1, compensation to the Contractor will be made in the  
 3 amount of 5 cents plus the verified cash cost to the Contractor at the point of delivery for each  
 4 gallon of asphalt material, measured at application temperature, necessitated by the increase.

5 *Blotting Sand* will be paid in accordance with Article 818-4.

6 *Asphalt Surface Treatment, Slurry Seal* materials placed in stockpiles or on the road not  
 7 meeting the required tolerances may be accepted at a reduced price if it is not considered  
 8 detrimental to the life of the treatment by the Engineer in accordance with Article 105-3. The  
 9 following price adjustment schedule will be used for *Asphalt Surface Treatment, Slurry Seal*  
 10 when appropriate:

11 (A) One percent reduction in the bid price per square yard for each 1/10% the asphalt content  
 12 is out of tolerance.

13 (B) One-quarter percent price adjustment in the bid price per square yard for each 1% that the  
 14 aggregate gradation is out of the job mix range.

15 (C) One-half percent reduction in the bid price per square yard for each gram per square foot  
 16 of wet-track abrasion test (WTAT) loss between 101 g and 200 g. Material having a loss  
 17 greater than 200 g will not be accepted for payment.

18 (D) One percent reduction in the bid price per square yard for each 1% water in excess of the  
 19 approved water content plus 3%.

20 Price adjustments under Subarticles 660-11(A) through 660-11(D) above shall apply  
 21 concurrently; however, price adjustment will not apply in the event the material is rejected.

22 Furnishing and applying prime will be paid as provided in Article 600-9 for *Prime Coat*.

23 Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
Asphalt Surface Treatment, Mat Coat, No. ___ Stone	Square Yard
Asphalt Surface Treatment, ___ Seal	Square Yard
Asphalt Surface Treatment, Mat and Seal	Square Yard

## 24 SECTION 661

### 25 ULTRA-THIN BONDED WEARING COURSE

#### 26 661-1 DESCRIPTION

27 Produce and place an Ultra-thin Bonded Wearing Course (UBWC), including an application  
 28 of a warm Polymer-Modified Emulsion Membrane (PMEM) followed immediately with  
 29 an UBWC hot mix asphalt overlay. Spray polymer-modified emulsion membrane  
 30 immediately before applying hot mix asphalt.

31 Provide and conduct the QC and required testing for acceptance of the UBWC in accordance  
 32 with the contract.

#### 33 661-2 MATERIALS

34 Refer to Division 10.

<b>Item</b>	<b>Section</b>
Anti-strip Additives	1012-1(G)
Coarse Aggregate	1012-1(B)
Fine Aggregate	1012-1(C)
Mineral Filler	1012-1(D)
Polymer Modified Asphalt Binder	1020-2
Reclaimed Asphalt Shingles (RAS)	1012-1(E)