

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:

Pay Item	Pay Unit
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.

Item	Section
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)

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1 Use either PG 70-28 or PG 76-22 binder in the mix design. Conform to Section 620. Ensure
2 that the asphalt binder is compatible with the PMEM and the existing pavement.

3 **661-3 COMPOSITION OF MIX**

4 Do not use crystalline limestone, crystalline-dolomitic limestone or marble for aggregates and
5 do not use RAP. Use a mixture of coarse and fine aggregate, asphalt binder, mineral filler and
6 other additives when required. Size, uniformly grade and combine in such proportions such
7 that the resulting mixture meets the gradation and physical requirements of Tables 661-1 and
8 661-2. Use the mix design and optimum asphalt content for *Ultra-thin Bonded Wearing*
9 *Course Mix Design Guidelines* on file with the Materials and Tests Unit and available upon
10 request. RAS may be used in accordance with Subarticle 610-3(A).

11 Submit in writing a mix design and proposed JMF targets for each required mix type and
12 combination of aggregates to the Engineer for review and approval at least 20 days before
13 start of asphalt mix production. Submit the mix design and proposed JMF targets on forms
14 and in a format approved by the Department and in accordance with applicable requirements
15 of Article 610-3.

16 Establish the JMF target values within the mix design criteria specified in Table 661-2 for the
17 particular type mixture.

18 Have on hand at the asphalt plant, the approved mix design and JMF issued by the
19 Department, before beginning the work.

20 The JMF for each mixture shall remain in effect until modified in writing by the Engineer,
21 provided the results of QMS tests performed on material currently being produced conform
22 with specification requirements. If a change in sources of aggregate materials needs to be
23 made, a new mix design and JMF will be required before the new mixture is produced. When
24 unsatisfactory results or other conditions make it necessary, the Engineer may establish a new
25 JMF.

26 Determine and certify compatibility of all asphalt emulsion, asphalt binder and aggregate
27 components.

Sieves (mm)	% Passing by Weight
12.5	100
9.50	85 - 100
4.75	28 - 44
2.36	17 - 34
1.18	13 - 23
0.600	8 - 18
0.300	6 - 13
0.150	4 - 10
0.075	3.0 - 7.0

**TABLE 661-2
UBWC MIX DESIGN CRITERIA**

Property	Requirement
Asphalt Content, %	4.6 - 5.8
Draindown Test, AASHTO T 305	0.1% max
Moisture Sensitivity, AASHTO T 283 ^A	85% min
Application Rate, lb/sy	70 lb/sy
Approximate Application Depth, in.	5/8"
Asphalt PG Grade, AASHTO M 320	PG 70-28 or PG 76-22

- 1 A. Specimens for T 283 testing are to be compacted using the Superpave gyratory
2 compactor. The mixtures shall be compacted using 100 gyrations to achieve
3 specimens approximately 95 mm in height. Use mixture and compaction
4 temperatures recommended by the binder supplier.

5 **661-4 CONSTRUCTION METHODS**

6 **(A) Equipment**

7 Use asphalt mixing plants in accordance with Article 610-5. Furnish paving machine
8 with the following capabilities:

- 9 (1) Self-priming paving machine capable of spraying the Polymer-Modified Emulsion
10 Membrane, applying the hot asphalt concrete overlay and screeding the surface of
11 the mat to the required profile and cross section in one pass at any rate between
12 30 and 92 ft/minute.
- 13 (2) Receiving hopper, feed conveyor, storage tank for Polymer-Modified Emulsion
14 Membrane material, PMEM emulsion single variable-width spray bar and a variable
15 width, heated, vibratory-tamping bar screed.
- 16 (3) Screed with the ability to be crowned at the center both positively and negatively and
17 have vertically and horizontally adjustable extensions to accommodate the desired
18 pavement profile and widths.
- 19 (4) Sprayer system capable of accurately and continuously monitoring the rate of spray
20 and providing a uniform application across the entire width to be overlaid.
- 21 (5) Use pavers equipped with an electronic screed control that will automatically control
22 the longitudinal profile and cross slope of the pavement. Control the longitudinal
23 profile through the use of either a mobile grade reference(s), including mechanical,
24 sonic and laser grade sensing and averaging devices, an erected string line(s) when
25 specified, joint matching shoe(s), slope control devices or the approved methods or
26 combination of methods. Unless otherwise specified, use a mobile grade reference
27 system capable of averaging the existing grade or pavement profile over
28 at least a 30 ft distance or by non-contacting laser or sonar type ski with
29 at least 4 referencing stations mounted on the paver at a minimum length of 24 ft.
30 Establish the position of the reference system such that the average profile grade is
31 established at the approximate midpoint of the system. The transverse cross slope
32 shall be controlled as directed by the Engineer.

33 Use an erected fixed stringline for both and longitudinal profile and cross slope control
34 when required by the contract. When an erected fixed string line is required, furnish and
35 erect the necessary guide line for the equipment. Support the stringline with grade stakes
36 placed at maximum intervals of 25 ft for the finished pavement grade.

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1 Use the 30 ft minimum length mobile grade reference system or the non-contacting laser
2 or sonar type ski with at least 4 referencing stations mounted on the paver at a minimum
3 length of 24 ft to control the longitudinal profile when placing the initial lanes and all
4 adjacent lanes of all layers, including resurfacing and asphalt in-lays, unless other
5 specified or approved. A joint matching device (short 6" shoes) may be used only when
6 approved.

7 Use the automatic slope control system unless otherwise approved. The Engineer may
8 waive the use of automatic slope controls in areas where the existing surface (subgrade,
9 base, asphalt layer, etc.) exhibits the desired cross slope of the final surface. The
10 Engineer may also waive the use of automatic slope controls in areas where the use of
11 such equipment is impractical due to irregular shape or cross section (such as
12 resurfacing). When the use of the automatic slope controls is waived, the Engineer may
13 require the use of mobile grade references on either or both sides of the paver. Manual
14 screed operation will be permitted in the construction of irregularly shaped and minor
15 areas, subject to approval. Waiver of the use of automatic screed controls does not
16 relieve the Contractor of achieving plan profile grades and cross slopes.

17 In the case of malfunction of the automatic screed control equipment, the paver may be
18 manually operated for the remainder of the workday provided this method of operation
19 produces acceptable results. Do not resume work thereafter until the automatic system is
20 functional.

21 The Engineer will waive the requirement for use of pavers for spreading and finishing
22 where irregularities or obstacles make their use impractical. Spread, rake and lute the
23 mixture by hand methods or other approved methods in these areas.

24 Operate the paver as continuously as possible. Pave intersections, auxiliary lanes and
25 other irregular areas after the main line roadway has been paved, unless otherwise
26 approved.

27 Compact the wearing course with a steel double drum asphalt roller(s) with a minimum
28 weight of 10 tons. Maintain rollers in reliable operating condition and equip with
29 functioning water system and scrapers to prevent adhesion of the fresh mix onto the roller
30 drums. Supply adequate roller units and compact promptly following the placement of
31 the material.

32 Request approval of equipment before the start of any work. Maintain all equipment and
33 tools in satisfactory working condition at all times.

34 **(B) Surface Preparation**

35 Perform the following items before the commencement of paving operations.

36 (1) Protect and cover manhole covers, drains, grates catch basins and other such utility
37 structures with plastic or building felt before paving and reference for location and
38 adjustment after paving.

39 (2) Remove thermoplastic traffic markings symbols, characters or other markings
40 greater than 1/4" in thickness on the existing pavement.

41 (3) Clean and completely fill pavement cracks and joints greater than 1/4" wide. Do not
42 overband the existing cracks and joints. Apply sealant per manufacturer's
43 recommendation.

44 (4) Fill surface irregularities greater than 1" deep with a material approved by the
45 Engineer.

46 (5) Thoroughly clean the entire pavement surface, giving specific attention to
47 accumulated mud and debris. Pressurized water and/or vacuum systems may be
48 required to ensure a clean surface.

(C) Application of Ultra-thin Bonded Wearing Course

Produce, transport to the site and place the UBWC in accordance with Section 610, except as otherwise provided below.

Use only one asphalt binder PG grade for the entire project, unless the Engineer gives written approval.

Do not place ultra-thin bonded wearing course between October 31 and April 1, when the pavement surface temperature is less than 50°F or on a wet pavement. In addition, when PG 76-22 binder is used in the JMF, place the wearing course only when the road pavement surface temperature is 60°F or higher and the air temperature in the shade away from artificial heat is 60°F or higher.

Apply the ultra-thin bonded wearing course mixture at the rate per square yard as shown in Table 661-2 for the mix type shown in the plans.

Spray the polymer-modified emulsion membrane at a temperature of 140°F to 180°F. Provide a uniform application across the entire width. Determine the rate of application (typically 0.15 to 0.25 gal/sy) by the mix design and current pavement condition for the specified project. Ensure the rate of application is approved by the Engineer before beginning work.

Do not allow wheels or other parts of the paving machine to touch the polymer-modified emulsion membrane before the hot mix asphalt concrete wearing course is applied.

Place the hot asphalt concrete wearing course over the full width of the polymer-modified emulsion membrane. Apply the hot mix asphalt concrete at a temperature of 300°F to 330°F and within a maximum of 3 seconds immediately after the application of the membrane.

Before opening to traffic, allow the pavement to sufficiently cool after the rolling operation to resist damage to the pavement.

(D) Compaction

Compact the wearing course with at least 2 passes of a steel double drum asphalt roller before the material temperature has fallen below 185°F. Do not allow the rollers to remain stationary on the freshly placed asphalt concrete. Compact immediately following the placement of ultra-thin bonded wearing course. A release agent (added to the water system) may be required to prevent adhesion of the fresh mix to the roller drum and wheels. Compact in the static mode.

661-5 QUALITY MANAGEMENT SYSTEM FOR ASPHALT PAVEMENTS

Produce the ultra-thin hot mix asphalt in accordance with Section 609.

661-6 MEASUREMENT AND PAYMENT

Ultra-thin Bonded Wearing Course will be measured and paid by the actual number of tons of mixture incorporated into the completed and accepted work. The hot mix asphalt pavement will be measured by being weighed in trucks on certified platform scales or other certified weighing devices.

Application of Ultra-thin Hot Mix Asphalt will be measured and paid at the contract unit price per square yard. In measuring this quantity, the length will be the actual length constructed, measured along the surface. The width will be the width required by the contract or directed by the Engineer.

Polymer Modified Asphalt Binder for Plant Mix will be paid in accordance with Article 620-4. Asphalt binder price adjustments when applicable will be based on Grade PG 64-22, regardless of the grade used.

Section 663

1 Where PG 76-22 is being used in the production of ultra-thin, the grade of asphalt binder to be
2 paid will be PG 70-28, unless otherwise approved.

3 The above prices and payments will be full compensation for all work covered by this section
4 including, but not limited to, furnishing all materials, producing, weighing, transporting,
5 placing and compacting the polymer modified asphalt emulsion; maintaining the ultra-thin
6 bonded wearing course until final acceptance of the project; performing QC as specified in the
7 contract; and making any repairs or corrections to the surface of the pavement or adjacent
8 landscape that may become necessary.

9 Payment will be made under:

Pay Item	Pay Unit
Ultra-thin Bonded Wearing Course, UBWC	Ton
Application of Ultrathin Hot Mix Asphalt	Square Yard

SECTION 663

HOT IN-PLACE RECYCLED ASPHALT CONCRETE

663-1 DESCRIPTION

13 This work shall consist of hot in-place recycling of the existing asphalt concrete surface by
14 heating and softening the existing asphalt pavement with indirect heat, loosening the heated
15 pavement by hot milling to the depth specified in the plans, adding a plant produced hot mix
16 asphalt admixture, if required, applying a rejuvenating agent, thoroughly remixing the
17 material in a pugmill, leveling, relaying and compaction of the hot in-place recycled asphalt
18 mixture. Use a continuous, single train, single pass, multi-step process to accomplish this
19 work.

20 Provide and conduct the QC and required testing for acceptance of the hot in-place recycled
21 mixture in accordance with the contract.

663-2 MATERIALS

(A) Hot Mix Asphalt Admixture

24 Determine the type and amount of plant produced hot mix asphalt (HMA) admixture to
25 be added to the recycled mixture, subject to the approval of the Engineer. The HMA
26 admixture shall be a plant mixture of asphalt binder and aggregate(s) meeting Division 10
27 as shown below. The aggregate in the admixture may be a single standard size aggregate
28 or a combination of aggregate sizes as needed. Provide enough binder content for the
29 admixture such that the aggregate particles are fully coated. Provide a gradation and
30 binder content for the admixture such that when blended with the other mix components,
31 the hot in-place recycled mix properties shall meet the mix design criteria for the
32 applicable mix type specified in the plans, unless otherwise approved by the Engineer.

33 Refer to Division 10.

Item	Section
Anti-strip Additives	1012-1(G)
Asphalt Binder	1020-2
Coarse Aggregate	1012-1(B)
Fine Aggregate	1012-1(C)