

**Section 661**

**SECTION 661  
ULTRA-THIN BONDED WEARING COURSE**

**661-1 DESCRIPTION**

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

The Contractor may elect to use an alternate method for the placement of the UBWC. As an alternate to spraying PMEM prior to placement of the asphalt mix with a spray paver, the Contractor may use a non-tracking hot-applied polymer asphalt tack coat material prior to placement of the asphalt mix. If the alternate method is selected, submit documentation and proposed plan to the Engineer prior to beginning any work.

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

**661-2 MATERIALS**

Refer to Division 10.

<b>Item</b>	<b>Section</b>
Anti-strip Additives	1020-8
Coarse Aggregate	1012-1(B)
Fine Aggregate	1012-1(C)
Mineral Filler	1012-1(D)
Polymer Modified Asphalt Binder	1020-2
Polymer-Modified Emulsion Membrane (PMEM)	1020-4

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

Use an approved non-tracking hot applied polymer asphalt tack coat found on NCDOT's APL for *Non-Tracking Asphalt Tack Coat*.

**661-3 COMPOSITION OF MIX**

Do not use crystalline limestone, crystalline-dolomitic limestone or marble for aggregates and do not use reclaimed asphalt pavement (RAP). Use a mixture of coarse and fine aggregate, asphalt binder, mineral filler and other additives when required. Size, uniformly grade and combine in such proportions such that the resulting mixture meets the gradation and physical requirements of Tables 661-1 and 661-2.

At least 20 days before start of asphalt mix production, submit the mix design and proposed JMF targets for each required mix type and combination of aggregates to the Engineer for review and approval. Establish the JMF target values within the mix design criteria specified in Table 661-2 for the particular type mixture.

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

<b>Sieves (mm)</b>	<b>% Passing by Weight</b>
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

<b>Property</b>	<b>Requirement</b>
Asphalt Content, %	5.0 (minimum)
Draindown Test, AASHTO T 305	0.1% max
Moisture Sensitivity, AASHTO T 283 <sup>A</sup>	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 AASHTO T 283 testing are to be compacted using the 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 PMEM, applying the hot  
10          asphalt concrete overlay and screeding the surface of the mat to the required profile  
11          and cross section in one pass at any rate between 30 and 92 feet per minute.
- 12          (2) Receiving hopper, feed conveyor, storage tank for PMEM material, PMEM emulsion  
13          single variable-width spray bar and a variable width, heated, vibratory-tamping bar  
14          screed.
- 15          (3) Screed with the ability to be crowned at the center both positively and negatively and  
16          have vertically and horizontally adjustable extensions to accommodate the desired  
17          pavement profile and widths.
- 18          (4) Sprayer system capable of accurately and continuously monitoring the rate of spray  
19          and providing a uniform application across the entire width to be overlaid.
- 20          (5) Use pavers equipped with an electronic screed control that will automatically control  
21          the longitudinal profile and cross slope of the pavement. Control the longitudinal  
22          profile through the use of either a mobile grade reference(s), including mechanical,  
23          sonic and laser grade sensing and averaging devices, an erected string line(s) when  
24          specified, joint matching shoe(s), slope control devices or the approved methods or  
25          combination of methods. Unless otherwise specified, use a mobile grade reference  
26          system capable of averaging the existing grade or pavement profile over  
27          at least a 30 feet distance or by non-contacting laser or sonar type ski with  
28          at least four referencing stations mounted on the paver at a minimum length of 24

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1 feet. Establish the position of the reference system such that the average profile  
2 grade is established at the approximate midpoint of the system. The transverse cross  
3 slope shall be controlled as directed by the Engineer.

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

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

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

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

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

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

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

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

### 41 **(B) Surface Preparation**

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

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

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

- 1 (3) Clean and completely fill pavement cracks and joints greater than 1/4 inch wide. Do  
2 not overband the existing cracks and joints. Apply sealant per manufacturer's  
3 recommendation.
- 4 (4) Fill surface irregularities greater than 1 inch deep with a material approved by the  
5 Engineer.
- 6 (5) Thoroughly clean the entire pavement surface, giving specific attention to  
7 accumulated mud and debris. Pressurized water and/or vacuum systems may be  
8 required to ensure a clean surface.

9 **(C) Application of Ultra-thin Bonded Wearing Course**

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

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

14 Do not place UBWC between October 31 and April 1 and when the air and surface  
15 temperature is less than 60°F.

16 Apply the UBWC mixture at the rate per square yard as shown in Table 661-2 for the mix  
17 type shown in the plans.

18 Spray the PMEM at a temperature of 140°F to 180°F. Provide a uniform application  
19 across the entire width. Use a target application rate of 0.20 gal/sy and adjust according  
20 to the mix design, existing pavement type and condition for the specified project, and the  
21 manufacturer's recommendations. Ensure the rate of application is approved by the  
22 Engineer before beginning work.

23 Do not allow wheels or other parts of the paving machine to touch the PMEM before the  
24 hot mix asphalt concrete wearing course is applied.

25 Place the hot asphalt concrete wearing course over the full width of the PMEM. Apply  
26 the hot mix asphalt concrete at a temperature of 300°F to 330°F and within a maximum  
27 of 3 seconds immediately after the application of the membrane.

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

30 For the alternate method, use distributor equipment to uniformly place the non-tracking  
31 hot applied polymer asphalt tack coat in accordance with Section 605 and shall be applied  
32 at a temperature in accordance with the manufacturer's recommendations and at a target  
33 residual application rate of  $0.12 \pm 0.02$  gal/sy. For placing the asphalt mix, use of a spray  
34 paver is not required.

35 **(D) Compaction**

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

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1 **661-5 QUALITY MANAGEMENT SYSTEM FOR ASPHALT PAVEMENTS**

2 Produce the ultra-thin hot mix asphalt in accordance with Section 609 with the following  
3 exceptions.

4 Sample and test the completed mixture from each mix design per plant per year at the  
5 following minimum frequency during mix production:

<u>Accumulative Production Increment</u>	<u>Number of Samples per Increment</u>
500 tons	1

6 Record the following data on the standardized control charts and in accordance with the  
7 requirements of Section 7.4 of the *Asphalt QMS Manual*:

8 (a) Aggregate Gradation Test Results:

- 9 1. 2.36 mm
- 10 2. 0.075 mm Sieves

11 (b) Binder Content, %, P<sub>b</sub>

12 **661-6 MEASUREMENT AND PAYMENT**

13 *Ultra-thin Bonded Wearing Course* will be measured and paid by the actual number of tons of  
14 mixture incorporated into the completed and accepted work. The hot mix asphalt pavement  
15 will be measured by being weighed in trucks on certified platform scales or other certified  
16 weighing devices. Application of Ultra-thin Hot Mix Asphalt shall be included in the per ton  
17 pay item for *Ultra-thin Bonded Wearing Course*.

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

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

23 For the alternate method, *Ultra-thin Bonded Wearing Course* will be measured and paid by  
24 the actual number of tons of mixture incorporated into the completed and accepted work. The  
25 hot mix asphalt pavement will be measured by being weighed in trucks on certified platform  
26 scales or other certified weighing devices. Non-tracking hot applied polymer asphalt tack  
27 coat shall be included in the per ton pay item for *Ultra-thin Bonded Wearing Course*. No  
28 other pay item shall be associated with this alternate method.

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

35 Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
Ultra-thin Bonded Wearing Course	Ton