**ULTRA-THIN BONDED WEARING COURSE WITH ALTERNATE METHOD:**

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| (06-30-14) (Rev 01-29-16) | 661 | SP 6 R90 |

Revise the *2012* *Standard Specifications* as follows:

P**age 6-55, Section 661 ULTRA-THIN BONDED WEARING COURSE, line 24,** replace the section with the following:

**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 hot-mix asphalt (HMA) with a spray paver, the Contractor may use a non-tracking hot-applied asphalt tack coat material prior to placement of the HMA. If the alternate method is selected, submit documentation and proposed plan to 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.

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

Use an approved Hot Applied Tack non-tracking asphalt tack coat found on NCDOT’s Approved Product List for *Non-Tracking Asphalt Tack Coat* maintained by the Materials & Tests Unit at the following website:

<https://connect.ncdot.gov/resources/Materials/MaterialsResources/Approved%20Non-Tracking%20Tack%20Coat%20Products%20for%20NC.pdf>

**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. Use the mix design and optimum asphalt content for *Ultra-thin Bonded Wearing Course Mix Design Guidelines* on file with the Materials and Tests Unit and available upon request.

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

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

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

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

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

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| **TABLE 661-1UBWC GRADATION CRITERIA** |
| **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 |

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| **TABLE 661-2****UBWC MIX DESIGN CRITERIA** |
| **Property** | **Requirement** |
| Asphalt Content, % | 5.0 (minimum) |
| 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. Specimens for AASHTO T 283 testing are to be compacted using the Superpave gyratory compactor. The mixtures shall be compacted using 100 gyrations to achieve specimens approximately 95 mm in height. Use mixture and compaction temperatures recommended by the binder supplier.
	1. **CONSTRUCTION METHODS**

**(A) Equipment**

Use asphalt mixing plants in accordance with Article 610-5.

Furnish paving machine with the following capabilities:

(1) Self-priming paving machine capable of spraying the PMEM, applying the hot asphalt concrete overlay and screeding the surface of the mat to the required profile and cross section in one pass at any rate between 30 and 92 ft/minute.

(2) Receiving hopper, feed conveyor, storage tank for PMEM material, PMEM emulsion single variable-width spray bar and a variable width, heated, vibratory-tamping bar screed.

(3) Screed with the ability to be crowned at the center both positively and negatively and have vertically and horizontally adjustable extensions to accommodate the desired pavement profile and widths.

(4) Sprayer system capable of accurately and continuously monitoring the rate of spray and providing a uniform application across the entire width to be overlaid.

(5) Use pavers equipped with an electronic screed control that will automatically control the longitudinal profile and cross slope of the pavement. Control the longitudinal profile through the use of either a mobile grade reference(s), including mechanical, sonic and laser grade sensing and averaging devices, an erected string line(s) when specified, joint matching shoe(s), slope control devices or the approved methods or combination of methods. Unless otherwise specified, use a mobile grade reference system capable of averaging the existing grade or pavement profile over at least a 30 ft distance or by non-contacting laser or sonar type ski with at least 4 referencing stations mounted on the paver at a minimum length of 24 ft. Establish the position of the reference system such that the average profile grade is established at the approximate midpoint of the system. The transverse cross slope shall be controlled as directed by the Engineer.

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

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

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

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

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

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

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

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

**(B) Surface Preparation**

Perform the following items before the commencement of paving operations.

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

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

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

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

(5) Thoroughly clean the entire pavement surface, giving specific attention to accumulated mud and debris. Pressurized water and/or vacuum systems may be 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 UBWC between October 31 and April 1 and when the air and surface temperature is less than 60°F.

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

Spray the PMEM at a temperature of 140°F to 180°F. Provide a uniform application across the entire width. Use a target application rate of 0.20 gal/sy and adjust according to the mix design, existing pavement type and condition for the specified project, and the manufacturer’s recommendations. 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 PMEM before the hot mix asphalt concrete wearing course is applied.

Place the hot asphalt concrete wearing course over the full width of the PMEM. 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.

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

**(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 UBWC. 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.

* 1. **QUALITY MANAGEMENT SYSTEM FOR ASPHALT PAVEMENTS**

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

* 1. **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 shall be included in the per ton pay item for *Ultra-thin Bonded Wearing Course*.

*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.

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

For the alternate method, *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. Non-tracking hot-applied polymer (NTHAP) asphalt tack coat shall be included in the per ton pay item for *Ultra-thin Bonded Wearing Course*. No other pay item shall be associated with this alternate method.

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

Payment will be made under:

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| --- | --- | --- |
| **Pay Item** |  | **Pay Unit** |
| Ultra-thin Bonded Wearing Course | Ton |