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**Standard Practice for**

**Ultrathin Bonded Wearing  
Course Design**

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AASHTO Designation: PP xxx-yy<sup>1</sup>

Technical Subcommittee: 5b, Bridge and  
Pavement Preservation

Release: Group 1 (April)

Working Draft

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**AASHTO**

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## Ultrathin Bonded Wearing Course Design

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### 1. SCOPE

- 1.1. This standard practice for ultrathin bonded wearing course includes a mix design evaluation for the asphalt surface mixture, usually  $\frac{1}{2}$  to 1 in. (12.5 to 25.4 mm) thick to determine the proportions of polymer-modified emulsified asphalt that is used as the tack coat, PG binder, mineral aggregate, mineral filler, and additives to produce an ultrathin bonded wearing course job-mix formula.

### 2. REFERENCED STANDARDS

2.1. *AASHTO Standards:*

- M 295, Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
- M 303, Lime for Asphalt Mixtures
- M 316, Polymer-Modified Emulsified Asphalt
- M 320, Performance Graded Asphalt Binder
- M 332, Specification for Performance-Graded Asphalt Binder Using Multiple Stress Creep Recovery (MSCR) Test
- MP XX, Materials for Ultrathin Bonded Wearing Course
- R 30, Mixture Conditioning of Hot Mix Asphalt (HMA)
- T 59, Emulsified Asphalts
- T 209, Theoretical Maximum Specific Gravity ( $G_{mm}$ ) and Density of Hot Mix Asphalt (HMA)
- T 269, Percent Air Voids in Compacted Dense and Open Asphalt Mixtures
- T 283, Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage
- T 305, Determination of Draindown Characteristics in Uncompacted Asphalt Mixtures
- T 312, Preparing and Determining the Density of Asphalt Mixture Specimens by Means of the Superpave Gyrotory Compactor

2.2. *Indiana Department of Transportation Test Method:*

- ITM-589, Aggregate Binder Film Thickness

### 3. SIGNIFICANCE AND USE

- 3.1. The procedure described in this standard practice is used to produce an ultrathin bonded wearing course. The materials used in the design of ultrathin bonded wearing course can be found in MP XX.

### 4. EVALUATION OF MATERIALS

- 4.1. Evaluate the aggregate in accordance with the requirements of MP XX.
- 4.2. Evaluate the polymer-modified, emulsified asphalt in accordance with the requirements in M 316 and MP XX.
- 4.3. Evaluate the mineral filler in accordance with M 295 for fly ash and M 303 for lime. Baghouse fines collected during the mixing process may be reintroduced into the mixture.
- 4.4. Evaluate the performance \_ graded binder in accordance with M 320 and M 332.

### 5. DESIGN PROCESS

- 5.1. *Job \_ Mix Formula:*
- 5.1.1. The job \_ mix formula, JMF, shall be determined for the asphalt surface mixture prepared in a mix design laboratory that has been approved by the owner agency.
- 5.1.2. The JMF shall state the maximum particle size in the mixture, the mixture gradation, the total aggregate bulk specific gravity, the maximum and bulk specific gravity of the ultrathin bonded wearing course mixture, and the application rate for any anti-stripping additives.
- 5.2. *Mix Design:*
- 5.2.1. The binder content and the percentage of aggregate passing each sieve shall be in accordance with the requirements in Table 1.

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**Deleted:** The contractor shall submit a JMF for each mixture engineer one week prior to use.

**Deleted:** No mixture will be accepted until the JMF is approved.

**Table 1—Binder Content and Aggregate Gradation Guidelines for the Asphalt Surface Mixture<sup>a</sup>**

Sieve Size	Mixture Designation—Control Point (Percent Passing)		
	1/2 in. (12.5 mm)	3/8 in. (9.5 mm)	#4 (4.75 mm)
3/4 in. (19.0 mm)	100.0	—	—
1/2 in. (12.5 mm)	85.0–100.0	100.0	—
3/8 in. (9.5 mm)	55.0–80.0	85.0–100.0	100.0
No. 4 (4.75 mm)	22.0–38.0	22.0–38.0	40.0–55.0
No. 8 (2.36 mm)	19.0–32.0	19.0–32.0	20.0–32.0
No. 16 (1.18 mm)	15.0–24.0	15.0–24.0	15.0–24.0
No. 30 (600 µm)	11.0–18.0	11.0–18.0	11.0–18.0
No. 50 (300 µm)	8.0–14.0	8.0–14.0	8.0–14.0
No. 100 (150 µm)	5.0–10.0	5.0–10.0	5.0–10.0
No. 200 (75 µm)	4.0–5.5	4.0–5.5	4.0–5.5
Binder Content, %	4.6–6.1	4.8–6.1	5.0–6.3
Recommended Placement Rate (lb/yd <sup>2</sup> )	90	75	65±10

<sup>a</sup> Placement rates are based on 100 lb/yd<sup>2</sup>/in. using a mixture with a specific gravity of 2.5. Mixtures with different specific gravity will require an adjusted equivalent placement rate.

**Note 1**—The information provided in Table 1 for binder content and gradation are guidelines. Many agencies have used ultrathin bonded wearing course over time and have developed their specifications or special provisions to meet their specific conditions.

5.2.2. *Other requirements for the ultrathin bonded wearing course include the following:*

5.2.2.1. The effective binder film thickness shall be a minimum of 10 µ (± 1 µ). The binder content of the mix shall be determined by calculating the binder film thickness in accordance with ITM 589.

5.2.2.2. The maximum specific gravity of the ultrathin bonded wearing course mixture shall be mass determined in water in accordance with T 209.

5.2.2.3. Draindown from the loose mixture shall not exceed 0.10 percent when tested in accordance with T 305.

5.2.2.4. The tensile strength ratio, TSR, shall meet or exceed 80 percent when tested in accordance with T 283. Specimens for T 283 shall be 6 in. (150 mm) in diameter by 3 3/4 ± 1/4 in. (95.25 mm ± 6.35 mm) in height and compacted in accordance with T 312, except the specimens shall be compacted to 100 gyrations and resultant air voids reported for information purposes only. The compaction temperatures shall be 300 ± 10°F (149 ± 12°C) or as recommended by the binder supplier.

**Note 2**—Follow T 283 with the following exceptions:

- Condition the mixture for 2 h in accordance with R 30, Section 7.1.
- Compact the Superpave Gyratory Compactor, SGC, specimens to 100 gyrations.
- Extrude the samples as soon as possible without damage to the sample.
- Use T 269 to determine the void content.
- Record the void content of the specimens.
- If less than 55 percent saturation is achieved, the procedure does not need to be repeated unless the difference in tensile strength between duplicate specimens is greater than 25 lb/in.<sup>2</sup> (0.17 Mpa).

5.3. *Asphalt Emulsion:*

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**Deleted:** The asphalt emulsion shall be applied, at a temperature recommended by the emulsion supplier, uniformly across the entire width of pavement to be overlaid. Equipment shall not operate on the applied asphalt emulsion before the asphalt mix is placed.¶

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- 5.3.1. The recommended plan application rates of the asphalt emulsion are as shown in Table 2. ~~The actual application rates will be determined per the owner agency's specifications.~~

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**Table 2**—Recommended General Asphalt Emulsion Application Rate and Adjustment Factors for Surface Conditions<sup>a</sup>

	Mixture Designation		
	1/2 in. (12.5 mm)	3/8 in. (9.5 mm)	#4 (4.75 mm)
General Application Rate, gal/yd <sup>2</sup> (L/m <sup>2</sup> )	0.20 (0.91)	0.18 (0.81)	0.14 (0.63)
Recommended Adjustments to Application Rate, gal/yd <sup>2</sup> (L/m <sup>2</sup> ), by Existing Surface Condition			
PCCP, Smooth or Polished	-0.03 (-0.14)	-0.03 (-0.14)	-0.03 (-0.14)
PCCP, Broomed or Textured	0	0	0
Flushed Asphalt Concrete Surface	-0.02 (-0.09)	-0.03 (-0.14)	-0.03 (-0.14)
Dense, Unaged Asphalt Concrete	0	0	0
Open Textured, Dry, Aged or Oxidized	+0.02 (+0.09)	+0.01 (+0.05)	+0.01 (+0.05)
Milled Asphalt Concrete Surface	+0.02 (+0.09)	+0.01 (+0.05)	+0.01 (+0.05)

<sup>a</sup> A tolerance of ±0.02 gal/yd<sup>2</sup> (0.09 L/m<sup>2</sup>) shall be applied to the final target application rate.

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## 6. REPORT

- 6.1. Report all test results from Sections 4 and 5.
- 6.2. Report the recommended mix formulation including proportions of all mixture components and appropriate tolerances.

## 7. KEYWORDS

- 7.1. Aggregate; emulsified asphalt; performance \_ graded binder; ultrathin bonded wearing course.

<sup>1</sup> This provisional standard was first published in [YYYY].