REVISION OF SECTION 409

###### Ultrathin Bonded Wearing Course

Section 409 of the Standard Specifications is hereby deleted for this project and replaced with the following:

DESCRIPTION

## DESCRIPTIO

409.01 This work consists of applying a warm Polymer Modified Emulsion Membrane followed immediately with an ultrathin overlay of hot mix asphalt (HMA).

**MATERIALS**

409.02 Mix Design. The Contractor shall formulate and submit a job mix formula that satisfies the design general limits listed in Table 409-1.

Table 409-1

Mixture Requirements

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Composition by weight percentages** | | | | | | | | |
|  | **Type A** | | **Type B** | | | **Type C** | |  |
| Sieve Size | % Passing | | % Passing | | | % Passing | | Tolerance,  % |
| ¾ inch |  | |  | | 100 | | |  |
| ½ inch |  | | 100 | | 85 – 100 | | |  |
| 3/8 inch | 100 | | 85 - 100 | | 60 – 80 | | | ± 5 |
| #4 | 40 - 55 | | 28 - 38 | | 28 –38 | | | ± 4 |
| #8 | 22 - 32 | | 22 - 32 | | 22- 32 | | | ± 4 |
| #16 | 15 - 25 | | 15 - 23 | | 15 – 23 | | | ± 3 |
| #30 | 10 - 18 | | 10 - 18 | | 10 – 18 | | | ± 3 |
| #50 | 8 - 13 | | 8 - 13 | | 8 – 13 | | | ± 3 |
| #100 | 6 - 10 | | 6 - 10 | | 6 – 10 | | | ± 2 |
| #200 | 4 - 7 | | 4 - 7 | | 4 – 7 | | | ± 2.0 |
| Asphalt Content, % | | 5.0 - 5.8 | 4.8 - 5.6 | | | 4.6 - 5.6 | | ± 0.5 |
| Draindown Test, AASHTO T305 | | 0.10% max | | | | | | |
| Moisture Sensitivity, CP- L 5109 | | 80% min | | | | | | |
| Min. Application, lb/yd2 | | 40 | | 65 | | | 65 | |
| Min. Application, thickness | | 1/2 inch | | 5/8 inch | | | 5/8 inch | |
| PG Asphalt Grade as specified | | | | | | | | |
| Note: A target of 100% passing the 5/8-inch sieve is recommended. Mixtures containing 5/8-inch aggregate size will require greater placement depth and weight.  Specimens for Lottman testing shall be compacted to 100 gyrations according to CP-L 5115, then tested according to CP-L 5109, regardless of void content. Mixture and compaction temperatures shall be as recommended by the binder supplier. | | | | | | | | |

REVISION OF SECTION 409

### Ultrathin Bonded Wearing Course

**409.03 Coarse Aggregates.** The coarse aggregates selected should be those typically used for high performance surfaces. Coarse aggregates shall meet the requirements listed in Table 409-2.

Aggregates for Ultrathin Bonded Wearing Courses shall consist of clean, hard, durable fragments of crushed stone, crushed gravel, or crushed slag. The aggregate shall conform to the properties listed in Table 409-2.

**Table 409-2**

**Coarse Aggregate Properties**

|  |  |  |  |
| --- | --- | --- | --- |
| Tests | | **Method** | **Limit** |
| Los Angeles abrasion value, % loss | | AASHTO T 96-94 | 35 max |
| Soundness, % loss | Magnesium Sulfate or Sodium Sulfate | AASHTO T 104-94 | 18 max 12 max |
| Flat & Elongated Ratio | | ASTM D 4791 | 25% max (3:1) |
| % Crushed, two or more mechanically fractured faces | | CP-45 | 95 min |
| Micro-Deval, % loss | | CP-L 4211 | 18 max |

**409.04 Fine Aggregates.** The fine aggregates will be part of the asphalt mastic. The fine aggregates shall meet the requirements of Table 409-3.

**Table 409-3**

**Fine Aggregate Properties**

|  |  |  |
| --- | --- | --- |
| Tests | **Method** | **Limit** |
| Sand Equivalent | AASHTO T 176-86 | 45 min |
| Methylene Blue (on materials passing 200) | AASHTO TP 57-99 | 10 max |
| Uncompacted Void Content | AASHTO T 304-96 | 45 min |

**409.05 Mineral Filler.** Mineral filler may be used as an option to aid in meeting the gradation requirements. When required, hydrated Lime, certain classes of fly ash, baghouse fines and Type 1 portland cement are acceptable as mineral filler. Other materials are to be determined by mixture analysis.

**409.06 Polymer Modified Emulsion Membrane.** The Polymer Modified Emulsion Membrane is a styrene-butadiene block co-polymer (S.B.) modified asphalt emulsion. Its role is to form a water impermeable seal at the existing pavement surface and to bond the new hot mix to the existing surface. Polymer modification of the base asphalt shall be completed prior to emulsification. The emulsion shall be smooth and homogeneous and conform to the requirements of Table 409-4.

REVISION OF SECTION 409

### Ultrathin Bonded Wearing Course

#### Table 409-4

**POLYMER MODIFIED EMULSION TESTS**

|  |  |  |  |
| --- | --- | --- | --- |
| **Tests on Emulsion** | **Method** | **Min.** | **Max.** |
| Viscosity @ 77°F, SSF | ASTM D88 | 20 | **100** |
| 1Sieve Test, % | ASTM D244 |  | 0.05 |
| 224-Hour Storage Stability, % | ASTM D244 |  | 1 |
| 3Residue from Distillation @ 400°F, % | ASTM D244 | 63 |  |
| Oil portion from distillation, ml of oil per 100 g emulsion | ASTM D244 |  | 2 |
| **Test On Residue From Distillation** | | | |
| Elastic Recovery, 77 ° F, 20 cm elongation, % | AASHTO  T 301 | 58 |  |
| Penetration @ 77 °F, 100 g, 5 sec | ASTM D5 | 60 | 150 |
| 1The sieve test is waived if successful application of the material has been achieved in the field.  2 After standing undisturbed for 24 hours, the surface shall show no white, milky colored substance, but shall be a smooth homogeneous color throughout.  3 ASTM D244 with modifications to include a 400°F ± 10°F maximum temperature to be held for a period of 15 minutes. | | | |

**409.07 Asphalt Binder for Hot Mix Asphalt (HMA).** The PG graded binder shall conform to the requirements of Table 702-2 for the grade specified. The PG graded binder shall use the same polymer system as the polymer modified emulsion membrane and shall be compatible with the emulsion system.

The asphalt binder for this project shall be \_\_\_\_\_\_\_\_\_\_\_\_\_. @

Acceptance testing will be the same as for Items 411 and 403, except densities, which will not be tested.

## CONSTRUCTION REQUIREMENTS

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**409.08 Equipment.** The contractor shall use a self-priming paver, designed and built for the purpose of applying the Ultrathin Bonded Wearing Course. All other equipment and tools are subject to approval by the Engineer. All equipment and tools shall be maintained in satisfactory working condition at all times.

REVISION OF SECTION 409

### Ultrathin Bonded Wearing Course

The self-priming paving machine shall be capable of spraying the Polymer Modified Emulsion Membrane, applying the HMA overlay and leveling the surface of the mat in one pass at the rate of 30 to 100 feet per minute. The paving machine shall incorporate a receiving hopper, feed conveyor, insulated storage tank for Polymer Modified Emulsion Membrane, Polymer Modified Emulsion Membrane spray bar and a variable width, heated, vibratory-tamping bar screed. The screed shall have the ability to be crown the pavement at the center both positively and negatively and have vertically adjustable extensions to accommodate the desired pavement profile.

**409.09 Application.** The Ultrathin Bonded Wearing Course shall not be placed on a wet pavement. The pavement surface temperature shall not be less than 60°F at the time of placement. A damp pavement surface is acceptable for placement if it is free of standing water and favorable weather conditions are expected to follow for the next two hours.

The Polymer Modified Emulsion Membrane shall be spray applied immediately prior to the application of HMA overlay so as to produce a homogeneous wearing surface that can be opened to traffic immediately upon sufficient cooling. The finished wearing course shall have a minimum thickness of 1/2 inch for Type A and 5/8 inch for Type B and Type C.

The Polymer Modified Emulsion Membrane shall be sprayed at a temperature of 140 to 180 °F. The sprayer shall accurately and continuously monitor the rate of spray and provide a uniform application across the entire width to be overlaid. The rate of application (typically 0.10 to 0.25 gallons per square yard) shallbe determined by the mix design and current pavement condition.

No wheel or other part of the paving machine shall come in contact with the Polymer Modified Emulsion Membrane before the HMA is applied. The paver shall be capable of applying the HMA within 5 seconds of applying the Polymer Modified Emulsion Membrane

The HMA shall be applied at a temperature of 300 to 330 °F and shall be spread over the Polymer Modified Emulsion Membrane immediately after the application of the Polymer Modified Emulsion Membrane. The HMA shall be rolled over the full width of the Polymer Modified Emulsion Membrane with a heated, combination vibratory-tamping bar screed.

The new pavement shall not be opened to traffic until the rolling operation is complete and the material has cooled sufficiently to resist damage.

**409.10 Surface Preparation.** The following items shall be performed prior to the commencement of paving operations:

1. Manhole covers, drains, grates catch basins and other such utility structures shall be protected and covered with plastic or building felt prior to paving and also shall be clearly referenced for location and adjustment after paving.
2. Thermoplastic traffic markings shall be removed. Symbols, characters, or other markings greater than 1/4 inch thick over the existing pavement shall be removed.
3. Crack sealant shall be applied in accordance with Section 408. The sealant will be applied in accordance with manufacturer’s recommendation and approved by the Engineer.
4. Surface irregularities greater than 1 inch deep shall be filled with a material approved by the Engineer.
5. The entire pavement surface to be overlaid shall be thoroughly cleaned of deleterious material, giving specific attention to accumulated mud and debris. Pressurized water, vacuum systems, or both may be required to ensure a clean surface.

REVISION OF SECTION 409

### Ultrathin Bonded Wearing Course

**409.11 Rolling.**  Rolling of the wearing course shall consist of a minimum of two passes with a steel double drum asphalt roller of minimum weight of 11 tons, operated in the static mode, before the material temperature has fallen below 185 °F. At no time shall the roller or rollers be allowed to remain stationary on the freshly placed HMA. Rollers shall be well maintained, in reliable operating condition and be equipped with functioning water system and scrapers to prevent adhesion of the fresh mix onto the roller drums. Adequate roller units shall be supplied so the rolling will be accomplished promptly following the placement of the material. A release agent (added to the water system) may be required to prevent adhesion of the mix to the roller drum and wheels.

##### METHOD OF MEASUREMENT

**409.12** The Ultrathin Bonded Wearing Course will be measured by the square yards of pavement surface completed and accepted.

##### BASIS OF PAYMENT

409.13 The accepted quantity of Ultrathin Bonded Wearing Course will be paid for at the contract unit price bid per square yard.

Payment will be made under:

**Pay Item** **Pay Unit**

Ultrathin Bonded Wearing Course Square Yard

Payment will be full compensation for all labor, materials, and equipment necessary to complete the work

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**INSTRUCTIONS TO DESIGNERS** (delete instructions from final draft):

@ As determined by the Region, select one of the following: PG 70-28, PG 64-28, or

PG 58-34