**ASPHALT MIXTURE IL-4.75 (Illinois Tollway)**

**Effective: December 11, 2017**

**Revised: January 18, 2018**

**Description.** This work shall consist of constructing either a Hot-Mix Asphalt (HMA) or warm mix asphalt (WMA) surface course or leveling binder with an IL-4.75 mixture except as modified by the Illinois Tollway special provision for Asphalt Binder and Surface Course Mixtures. When WMA pay items are required by design, an HMA mix may be utilized for special or low tonnage application in lieu of WMA mixtures upon approval by the Engineer at no additional cost to the Illinois Tollway. When HMA pay items are required by design, a WMA mix may be utilized for special or low tonnage application in lieu of an HMA mixture upon approval by the Engineer at no additional cost to the Illinois Tollway. Work shall be according to Sections 406, 1030 and 1032 of the Standard Specifications except as modified herein.

**Materials.** Add the following to Article 406.02 of the Standard Specifications:

“(d) Warm Mix Additives / Processes. When a warm mix technology is specified or permitted, the warm mix technology used shall be a recognized additive / process with successful project(s) constructed nationally or internationally that allow for a reduction in the temperature at which the HMA is produced and placed. Warm mix additives/processes that may be considered for Illinois Tollway approval and Contractor use include the following:

(1) Organic Additives (requiring minor plant modifications)

(2) Chemical Additives (requiring minor plant modifications)

(3) Water Injection Foaming Processes (requiring major plant modifications)

The Contractor shall ensure that a Technical Representative from the approved warm mix asphalt additive or process manufacturer is present during the first day of production and placement with warm mix technology.”

For IL-4.75 mixture containing more than 20 percent binder replacement, a chemical additive shall be used as the WMA technology.

Revise the first paragraph of Article 1003.03(b) of the Standard Specifications to read:

“(b) The fine aggregate quality shall be Class B. The total minus No. 200 (75 μm) material in the mixture shall be free from organic impurities.”

Revise the first paragraph of Article 1003.03(c) of the Standard Specifications to read:

“(c) Gradation. The fine aggregate gradation for IL-4.75 shall be FA 1, FA 2, FA-20, or FA-22.”

Revise Article 1030.02(c) of the Standard Specifications to read:

“(c) Reclaimed Asphalt Pavement (RAP) Material. Only processed RAP over a 3/8 in. (9.5 mm) or smaller screen will be permitted in the 4.75 mm mix.

Revise Article 1030.02(d) of the Standard Specifications to read:

“(d) Mineral Filler. Mineral filler shall conform to the requirements of Article 1011.01 of the Standard Specifications.”

Asphalt Binder (AB).

At the contractor’s option, the contractor shall use a SBS/SBR polymer, a terminal blend ground tire rubber (GTR), or a dry process GTR to modify the asphalt mixture. The asphalt binder requirements for the mixture will vary depending upon the amount and type of recycled asphalt binder contained in the mix design. This table summarizes these requirements:

|  |  |  |
| --- | --- | --- |
| **Reclaimed Material** | **Binder Replacement, %** | **Asphalt Binder Options** |
| Category 1 or 2 FRAP and RAS | Less than 20 | SBS/SBR PG 76-22  GTR PG 76-22  PG 64-22 10% Dry GTR |
| 21 to 30 | SBS/SBR PG 70-28  GTR PG 70-28  PG 58-28 10% Dry GTR |
| Category 1 FRAP and RAS | 31- 50 | SBS/SBR PG 64-34  GTR PG 64-34  PG 52-34¹ 10% Dry GTR |

1/ PG 46-34 will be allowed in lieu of PG 52-34

The asphalt binder modification technology shall be on the Illinois Tollway’s Approved List of Stone Matrix Asphalt Modification Technologies.

his table summarizes these options:

(1) SBS/SBR PG 76-22, PG 70-22, PG 70-28 Binder, or PG 64-34 Binder. The SBS/SBR PG 76-22, PG 70-22, PG 70-28 or PG 64-34 binder shall meet the requirements of Article 1032.05(b) of the Standard Specifications. In addition, the elastic recovery of the Asphalt Binder used shall be a minimum of 80.

(2) Terminal Blend GTR Binder. The base asphalt binder that is blended with the GTR shall be a performance-grade (PG) binder that is at least two high temperature grades lower than the required high temperature grade, as based on the recycled binder type and amount included in the mix design. The required base PG binder shall meet the requirements of Article 1032.05 of the Standard Specifications. The GTR shall be produced from processing automobile and/or truck tires by the ambient grinding method. Heavy equipment tires, uncured or de-vulcanized rubber will not be permitted. The GTR shall not exceed 1/16 in. in length and shall contain no free metal particles. Detection of free metal particles shall be determined by thoroughly passing a magnet through a 2 oz. sample. Metal embedded in rubber particles will be permitted.

The GTR shall be stored in a dry location protected from the rain. When the GTR is combined with the asphalt cement, the moisture content of the GTR shall not cause foaming of the blend.

When tested in accordance with Illinois-modified AASHTO T-27, a 2 oz. sample of the GTR shall conform to the following gradation requirements:

Sieve Size Percent Passing

No. 8 (2.36 mm) 100

No. 16 (1.18 mm) 98 ± 2

No. 30 (600 μm) 95 ± 5

No. 50 (300 μm) 50 ± 10

No. 100 (150 μm) 10 ± 5

No. 200 (75 μm) 2 ± 2

A mineral powder (such as talc) meeting AASHTO M17, Mineral Filler for Bituminous Paving Mixtures, requirements may be added, up to a maximum of 4% by weight of GTR particles, to reduce sticking and caking of the GTR particles.

GTR shall have a specific gravity of 1.15 ± 0.05 when tested in accordance with ASTM D-1817, Standard Test Method for Rubber Chemicals-Density.

Extender Oils or Polymeric Additions. With approval of the Engineer, compatible extender oils and/or polymers may be added to the GTR or if the material is compounded into a homogenous blend before the modification additive is added to the asphalt. The additional costs for the extender oils and/or polymer additions shall be borne by the Contractor. The Contractor shall provide material product information along with usage rates for approval.

The GTR blended asphalt shall comply with the specified PG Grade in accordance Table 1 of Article 1032.05 (b) of the Standard Specifications with exception to the Tests on Residue from Rolling Thin Film Oven Test (AASHTO T 240), and separation of polymer test. Dynamic Shear Rheometer tests shall use a 2.00mm gap for 25mm plates. In addition, the elastic recovery shall be a minimum of 75.

(3) Dry Process GTR. The base asphalt binder that is used in a dry process GTR mix shall be a performance-grade (PG) binder as based on the recycled binder type and amount included in the mix design. The required base PG binder shall meet the requirements of Article 1032.05 of the Standard Specifications.

The dry process GTR shall be produced from processing automobile and/or truck tires by ambient or cryogenic grinding methods. Heavy equipment tires, uncured or de-vulcanized rubber will not be permitted. The GTR shall not exceed 1/20 in. in diameter and shall contain no free metal particles. Detection of free metal particles shall be determined by thoroughly passing a magnet through a 2 oz. sample. Metal embedded in rubber particles will be permitted.

The dry process GTR shall be packaged and shipped in closed-top, water resistant bulk bags. The dry process GTR bags shall be stored in a dry location protected from the rain before use in the field. When the GTR is combined with the asphalt cement and aggregate, the moisture content of the GTR shall not cause foaming of the blend.

When tested in accordance with Illinois-modified AASHTO T-27, a 2 oz. sample of the dry process GTR shall conform to the following gradation requirements:

Sieve Size Percent Passing

No. 20 100

No. 30 (600 μm) 99 ± 1

No. 40 (300 μm) 60 ± 10

No. 100 (150 μm) 10 ± 5

A mineral powder (such as talc) meeting AASHTO M17, Mineral Filler for Bituminous Paving Mixtures, requirements may be added, up to a maximum of 4% by weight of GTR particles in order to reduce sticking and caking of the GTR particles.

The dry process GTR shall have a specific gravity of 1.15 ± 0.05 when tested in accordance with ASTM D-1817, Standard Test Method for Rubber Chemicals-Density.

No extender oils or polymeric additions (elastomers, plastomers) shall be included in the dry process GTR.

**Plant Requirements.**

(a) Asphalt Cement.

(1) SBS/SBR Polymerized PG 76-22, PG 70-22, PG 70-28 or PG 64-34 Binder. The polymer modified asphalt cement shall be shipped, maintained and stored at the mix plant according to the manufacturer’s requirements. Polymer asphalt cement shall be placed in an empty tank and not blended with other asphalt cements.

(2) Terminal Blend GTR Binder. Terminal blend GTR binder shall be blended with the asphalt cement, forming a consistent, homogeneous blend, prior to being added to aggregates. The Terminal Blend GTR binder shall be blended and reacted with the asphalt cement at the asphalt refinery or terminal.

The GTR shall be blended with the asphalt cement and reacted for a minimum of 45 minutes at a temperature of 325°F to 375°F.

Terminal Processing and Storage

(i) At the asphalt production facility for Terminal Processing, a separate agitated storage tank shall be required, with continuous mixing and recirculation of the asphalt-rubber blend to react the GTR with the asphalt cement. This tank shall be heated and capable of maintaining the temperature of the homogeneous blend of asphalt cement and GTR at 325°F to 375°F for a minimum of 45 minutes.

(ii) Once the Terminal Processing of GTR and asphalt cement produces a homogeneous blend at the production facility, test samples shall be obtained by the Illinois Tollway for testing.

(iii) Terminal Blended GTR modified asphalt may be stored at the asphalt production facility for up to 30 days at 300°F to 350°F with continuous mixing.

(iv) If Terminal Blended GTR modified asphalt cement is used, a dedicated storage tank for “terminal blended GTR” shall be required at the hot mix plant. The GTR binder shall be placed in an empty tank and not blended with other asphalt cements. This tank shall be equipped with a mechanical agitator, capable of providing continuous mixing and/or recirculation of the asphalt-rubber blend. This tank shall be heated and capable of maintaining the temperature of the homogeneous blend of asphalt cement and GTR at 300°F to 350°F for a maximum of 3 days.

(v) During IL-4.75 Level Binder production, monthly random split samples of the GTR asphalt shall be taken under Illinois Tollway supervision by the supplier from the port of the asphalt plant. The supplier shall submit the samples to both to the Illinois Tollway and to an independent ARML certified lab for testing to certify specification compliance.

The type of plant used for the manufacture of IL-4.75 Level Binder mixtures may be either a batch or drier drum plant meeting the requirements of Article 1102.01 of the Standard Specification, with the following exceptions:

(a) Mineral Filler System. The mineral filler system shall accurately proportion the large amounts of mineral filler required for the mixture. Alteration or adjustment of the current system may be required. Positive dust control must be used.

(b) Dry process GTR. Dry process GTR shall be controlled with a feeder system using a proportioning device that is accurate to within ± 3 percent of the amount required. The system shall automatically adjust the feed rate to maintain the material within this tolerance at all times, and shall have a convenient and accurate means of calibration. The system shall provide in-process monitoring, consisting of either a digital display of output or a printout of feed rate, in pounds per minute, to verify feed rate. The supply system shall report the feed in 1 lb increments using load cells that will enable the user to monitor the depletion of the GTR. Monitoring the system volumetrically will not be allowed. The feeder shall interlock with the aggregate weigh system and asphalt binder pump to maintain the correct proportions at all production rates.

Flow indicators or sensing devices for the system shall be interlocked with the plant controls to interrupt the mixture production if the GTR introduction output rate is not within the ±3 percent tolerance given above. This interlock will immediately notify the operator if the targeted rate exceeds introduction tolerances. All plant production will cease if the introduction rate is not brought back within tolerance after 30 seconds. When the interlock system interrupts production and the plant has to be restarted, upon restarting operations; the modifier system shall run until a uniform feed can be observed on the output display. All mix produced prior to obtaining a uniform feed shall be rejected.

With a drum mixing plant, introduce the dry process GTR prior to the injection of asphalt cement. The point of introduction in the drum mixer will be approved by the Engineer prior to production. Ensure the GTR will not become entrained in the exhaust system of the drier or plant and will not be exposed to the drier flame at any point after induction.

During operations, the asphalt plant shall record feed records daily from the feeder unit for the purposes of verifying dry process GTR inputs into the process.

1. Warm Mix Additives/Processes. When a mix is produced using an approved warm mix asphalt technology, the asphalt mixing plant shall be modified as required by the additive or process manufacturer to introduce the technology and produce a WMA IL-4.75 Level Binder mixture meeting the volumetric properties specified herein. Plant modifications may include additional plant instrumentation, the installation of asphalt binder foaming systems and/or WMA additive delivery systems, tuning the plant burner and adjusting the flights in order to operate at lower production temperatures and/or reduced tonnage.

All metering devices will meet the current IDOT requirement for liquid or mineral additives. Document the integration of plant controls and interlocks when using WMA additive metering devices.

1. General

(1) Plant modification. The use of GTR modified asphalt may require additional plant modifications. The Engineer will have final approval of the plant.

(2) Plant Calibration. The asphalt plant shall be calibrated and approved by The Illinois Department of Transportation Bureau of Materials and Physical Research or the Illinois Tollway before production of the WMA.

Revise the second sentence of Note 3 of Article 1030.02 of the Standard Specifications to read:

“For mixtures with an Ndesign ≥ 90 and for mixture IL-4.75, at least 50 percent of the required fine aggregate fraction shall consist of either stone sand, slag sand, or steel slag meeting the FA/FM 20 gradation. When the 4.75 mix is used as leveling binder, steel slag sand will not be permitted.”

Add the following to Article 1030.02 of the Standard Specifications:

(j) Recycled Asphalt Shingles (RAS). RAS may be used in an HMA IL-4.75 leveling binder mix. The percent to be added to the mix shall not exceed 5.0% of total mix.

**Mixture design.** Add the following to the list of Illinois Modified AASHTO references in Article 1030.04 of the Standard Specifications:

AASHTO T 305 Standard Method of Test for Determination of Draindown Characteristics in Uncompacted Asphalt Mixtures.

Add the following to Article 1030.04(a) of the Standard Specifications:

“(3) IL-4.75 Mixture. The Job Mix Formula (JMF) shall fall within the following limits

|  |  |
| --- | --- |
| Sieve | Percent Passing |
| 1/2 in. (12.5 mm) | 100 |
| 3/8 in. (9.5 mm) | 100 |
| No. 4 (4.75 mm) | 90 - 100 |
| No. 8 (2.36 mm) | 70 - 90 |
| No. 16 (1.18 mm) | 50 - 65 |
| No. 30 (600 μm) | 35 - 55 |
| No. 50 (300 μm) | 15 - 30 |
| No. 100 (150 μm) | 10 -18 |
| No. 200 (75 μm) | 7 - 9 |
|  |  |
| AB Content | 7% to 9% |

Add the following to Article 1030.04(b) of the Standard Specifications:

“(4) IL 4.75 Mixture.

|  |  |
| --- | --- |
| Volumetric Parameter | Requirement |
| Design Air Voids | 3.5 % at Ndesign 50 |
| Voids in the Mineral Aggregate (VMA) | 18.5% minimum |
| Voids Filled with Asphalt (VFA) | 72 - 85% |
| Dust/AC Ratio | 1.0 |
| Density (% of Target Density) | 95-102 |
| Maximum Drain-down | 0.3% |

Hamburg Wheel (IL Mod AASHTO T324) – 15,000 passes with less than 9 mm rut depth

Also, WMA IL-4.75 mix designs proposed shall also conduct a Disk-Shaped Compact Tension Test (DC(T)) test per ASTM D7313. The result of the DC(T) test shall greater than 450 J/m2 when tested at -12°C. The DC(T) test shall be performed by an AMRL approved laboratory.

**Mixture Production.** Plant modifications may be required to accommodate the addition of higher percentages of mineral filler as required by the JMF.

During production, mineral filler shall not be stored in the same silo as collected dust. This may require any previously collected bag house dust in a storage silo prior to production of the IL-4.75 mixture to be wasted. Only metered bag house dust may be returned back directly to the mix. Any additional minus No. 200 (75 μm) material needed to produce the IL-4.75 shall be mineral filler.

As an option, collected bag-house dust may be used in lieu of manufactured mineral filler, provided; 1) there is enough is available for the production of the IL-4.75 mix for the entire project and 2) a mix design was prepared with collected bag-house dust.

The mixture shall be produced within the temperature range recommended by the asphalt cement producer; but not less than 310°F.

The amount of moisture remaining in the finished mixture shall be less than 0.3 percent based on the weight of the test sample after drying.

Mixtures contain steel slag sand or aggregate having absorptions ≥ 2.5 percent shall have a silo storage plus haul time of not less than 1.5 hours.

**Control Charts/Limits.** Add the following to Control Limits table in Article 1030.04(d)(4) of the Standard Specifications:

| Parameter | Individual Test | Moving Average |
| --- | --- | --- |
| % Passing |  |  |
| No. 16 (1.18 mm) | ± 4% | ± 3% |
| No. 200 (75 μm) | ± 1.5% | ± 1.0% |
| Asphalt Binder Content | ± 0.3% | ± 0.2% |
| Air Voids | ± 1.2% (of design) | ± 1.0% (of design) |

Add the following to the Density Control Limits table in Article 1030.05(d)(4) of the Standard Specifications:

|  |  |  |
| --- | --- | --- |
| “DENSITY CONTROL LIMITS | | |
| Mixture Composition | Parameter | Individual Test |
| IL-4.75 2/ | Ndesign = 50 | 95-102% 2/ |

2/ The density of the IL-4.75 mixture shall be according to the following:

The Contractor shall perform a growth curve at the beginning of each day. QA shall be present for growth curve measurements. If an adjustment is made to the specific mix design, the Engineer reserves the right to request an additional growth curve and supporting tests at no additional cost to the Illinois Tollway.

Compaction of the growth curve shall commence immediately after the course is placed and at a temperature of not less than 300ºF. The growth curve, consisting of a plot of lb/cu ft vs. number of passes with the project breakdown roller, shall be developed. This curve shall be established by use of a nuclear gauge. Tests shall be taken after each pass until the highest lb/cu ft is obtained. This value shall be the target density provided the air voids are within acceptable limits. If air voids are not within the specified limits, corrective action shall be taken, and a new target density shall be established. A new growth curve is required if the breakdown roller used on the growth curve is replaced with a new roller during production.

The target density shall apply only to the specific gauge used. If additional gauges are to be used to determine density specification compliance, the Contractor shall establish a unique minimum allowable target density from the growth curve location for each gauge. The Illinois Tollway will establish a target density for its Quality Assurance nuclear gauge from the growth curve location.

All lifts shall be compacted to an average density of not less than 95 percent nor greater than 102 percent of the target density obtained on the growth curve. The average density shall be based on tests representing one day's production.

Quality Control density tests shall be performed at randomly selected locations within ¼ mile intervals. In no case shall more than one half day's production be completed without density testing being performed.

If the Contractor is not controlling the compaction process and is making no effort to take corrective action, the operation shall stop as directed by the Engineer.”

**CONSTRUCTION REQUIREMENTS**

**Placing.** Revise the table in Article 406.05(c) of the Standard Specifications to read:

|  |  |
| --- | --- |
| Leveling Binder | |
| Nominal, Compacted, Leveling Binder Thickness, in. (mm) | Mixture Composition |
| ≤ 1 1/4 (32) | IL-4.75, IL-9.5 or IL-9.5L |
| 1 1/4 to 2 (32 to 50) | IL-9.5, IL-12.5, or IL-9.5L |

Add the following to the end of the first paragraph of Article 406.05(c) of the Standard Specifications:

“Density requirements for IL-4.75 mixture shall apply when the nominal, compacted thickness is 3/4 in. (19 mm) or greater.”

Revise the first and second paragraphs of Article 406.06(b) of the Standard Specifications to read:

“General. The mixture shall be placed on a clean, dry base and when weather conditions are suitable. To avoid blistering, the surface shall be dry for at least 24 hours prior to mixture placement. Work shall not begin when local conditions indicate rain is imminent. The mixture shall be placed when the temperature in the shade is at least 50ºF and the forecast is for rising temperatures. The HMA mixture temperature shall be 310 to 350ºF and shall be measured in the truck just prior to placement. The WMA mixture temperature shall be within the temperature range for placement recommended by WMA technology manufacturer, and shall be measured immediately behind the paver.”

**Compaction.** Add the following after the first paragraph of Article 406.07(a) of the Standard Specifications:

“The compaction operation shall start immediately after the mixture has been placed. The Contractor shall provide a minimum of two steel-wheeled tandem rollers, two 3-wheeled rollers (3W) or combination for breakdown (TB) and one finish steel-wheeled roller (TF) meeting the requirements of Article 1101.01(e) of the Standard Specifications, except the minimum compression for all of the rollers shall be 280 lb/in. of roller width. Pneumatic-tired and vibratory rollers will not be permitted.”

A Disk-Shaped Compact Tension Test DC(T) test per ASTM D7313 shall be performed on mixture taken from the 1st day of production of the IL-4.75 Level Binder following an accepted Test Strip. The result of the DC(T) test shall greater than 450 J/m2 when tested at -12°C. The DCT test shall be performed by an AMRL approved laboratory.

**Method of Measurement.** This work will be measured in tons.

**Basis of Payment.** This work will be paid for at the contract unit price per ton for POLYMERIZED LEVELING BINDER (MACHINE METHOD), IL-4.75, N50 or POLYMERIZED WARM MIX LEVELING BINDER (MACHINE METHOD), IL-4.75, N50. If permissive use of an HMA mixture in place of a specified WMA mixture is granted by the Engineer, a new pay item will be established for the HMA with the same unit price. If permissive use of a WMA mixture in place of a specified HMA mixture is granted by the Engineer, a new pay item will be established for the WMA with the same unit price.

|  |  |  |
| --- | --- | --- |
| Pay Item Number | Designation | Unit of Measure |
| JI406060 | POLYMERIZED LEVELING BINDER (MACHINE METHOD), IL-4.75, N50 | TON |
| JI406064 | POLYMERIZED WARM MIX LEVELING BINDER (MACHINE METHOD), IL-4.75, N50 | TON |