

SPECIAL PROVISION
SPECIFICATION 962 – WARM MIX ASPHALT (WMA) PAVEMENTS - MARSHALL

962-1 **WARM MIX ASPHALT PAVEMENT** - Warm Mix Asphalt (WMA) is the generic term used to describe the reduction in production, paving, and compaction temperatures achieved through the application of one of several WMA technologies.

Production and paving temperatures may need to be increased, within the limits stated herein, for higher reclaimed asphalt pavement (RAP) contents, increased haul distances, decreased ambient temperatures, or other WMA project specific conditions.

962-1.01 **Description**

- a. This work shall consist of constructing one or more courses of Marshall Warm Mix Asphalt (WMA) pavement on a prepared foundation in accordance with these specifications, using manufactured WMA additives indicated in PRHTA W 401-10, and in conformance with the lines, grades, thickness and typical cross sections and smoothness requirements shown on the plans or established by the Engineer. Courses will be identified as, leveling (**L**), base (**B**) and surface (**S**).
- b. The work shall also include the application of any required tack and prime coats as specified in Specifications 407 and 408 respectively.

962-2 **COMPACTIVE EFFORT LEVELS, CATEGORIES AND TYPES OF MIXES, AND THICKNESS REQUIREMENTS** – Shall be as per Article **401-2**.

962-3 **MATERIALS** - Provide materials as follows:

962-3.01 **Asphalt Binder** – Provide a virgin asphalt binder as specified in article **401-3.01**.

962-3.02 **Virgin Aggregate** – Provide virgin aggregate as specified in article **401-3.02**

962-3.03 **Reclaimed Asphalt Pavement (RAP)** – As an alternative for using virgin aggregates provide RAP as specified in article **401-3.03**, except that the maximum percentage of RAP allowed to be incorporated in each course shall be 20% by weight of total mix.

962-3.04 **Hydrated Lime** – At the option of the contractor, provide hydrated lime as specified in **401-3.04**.

962-3.05 **Chemical Anti-Strip Agent** – At the option of the contractor, provide a chemical anti-strip agent as specified in **401-3.05**. In cases in which the WMA additive

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may have an anti-stripping agent as an integral part of the product, a certification from the WMA supplier shall be provided to that effect.

The use of chemical anti-strip agents and/or hydrated lime is mandatory in WMA. The Contractor shall be responsible for verifying the affinity/compatibility of the proposed quantity and source of anti-strip agent and/or hydrated lime with all mix components, including the WMA additive. The quantity of anti-strip agent and/or hydrated lime shall be determined based upon moisture susceptibility test procedure (AASHTO T 283).

962-3.06 Warm Mix Asphalt Additives - WMA may be produced by one of the mineral or chemical additives stated in PRHTA W 401-10 that allow the reduction of mix production temperatures to within 185 degrees Fahrenheit to 280 degrees Fahrenheit.

Provide WMA additive blended with the asphalt binder at the liquid asphalt terminal prior to production of the asphalt mixture; or Blend the WMA additive with the asphalt mixture in the mixing plant. When blending in the asphalt mixing plant, introduce the WMA additive according to the recommendations of the additive producer in order to achieve a uniform blend.

962-3.07 Composition of Mixtures - Each job mix formula shall be capable of being produced, placed, and compacted as specified. Apply all mix design requirements for HMA to development of WMA mix design. Develop and submit a job mix formula for each mixture according to article **401-3.06**, except as follows:

The job mix formula for WMA mixtures shall be developed using conventional HMA design practices in order to determine the optimum asphalt content of the mix. Pre-approved job mix formulas may be used for such purposes; however, the proportions of mix design shall be verified and adjusted, if necessary to ensure 4% air voids at the optimum asphalt content. Once the optimum asphalt content of the mix is determined, the WMA additive shall be introduced at the proposed dosage and the production and compaction temperatures determined. The job mix formula, including the WMA additive, shall produce 4% air voids at the selected compacted temperature. Mix design samples shall be conditioned at the selected production temperature for two hours and then allow to cool down to the compaction temperature prior to testing.

After determining the optimum asphalt binder content and the production and compaction temperature as described above, perform AASHTO T-283 and determine compliance with the following moisture susceptibility requirements:

- a. AASHTO T 283 for Laboratory Mixed - Laboratory Compacted Specimens:

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- i. For AASHTO T 283 procedures include the freeze and thaw cycle (severity conditioning). In addition, all samples shall be compacted to 7 ± 1.0 percent air voids. The test specimens shall be 6-inch diameter samples compacted using a gyratory compactor (AASHTO T 312).
- ii. Tensile Strength – The minimum dry and unconditioned tensile strength shall be 80-psi for surface mixes and 70-psi for other mixes.
- iii. Retained Tensile Strength Ratio (TSR) – Minimum 75 percent of conditioned to control Tensile Strength.

If mix design, including WMA additives, does not meet the moisture susceptibility requirements stated above, the Contractor shall increase the dosage of the chemical anti-stripping agent.

Submit the following information:

1. All information required in article **401-3.06 c**.
2. WMA additive information.
3. WMA technology manufacturer's established recommendations for usage.
4. WMA technology manufacturer's established target rate for additives, the acceptable variation for production, and documentation showing the impact of production variations.
5. WMA technology material safety data sheets (MSDS).
6. Production Temperature.
7. Compaction Temperature
8. Provide binder grade at a range of WMA additive addition rates expected during production in order to determine if the WMA additive is adversely affecting the PG of the binder at those addition rates.

962-3.08 Sampling and Testing - Perform sampling and testing as specified in **401-3.07**. All acceptance and performance sampling and testing shall be conducted with WMA technology added to the mix. Acceptance samples shall be conditioned at the selected production temperature for one hour and then allow to cool down to the compaction temperature prior to testing. Performance testing samples shall be conditioned as per acceptance samples, however, if reheating is required bring material to compaction temperature prior to testing.

962-4 CONSTRUCTION REQUIREMENTS - Comply with manufacturer's recommendations for incorporating additives and WMA technologies into the mix. Comply with manufacturer's recommendations regarding the receiving, storage, and delivery of additives.

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Use equipment and WMA technologies capable of producing an asphalt mixture that meet specification requirements and are workable at the minimum placement and compaction temperature desired.

- 962-4.01 Production Start-Up Procedures** - Construct a Control Strip Section as per article **401-4.01a** and conduct a pre-paving meeting as per article **401-4.01b**. Ensure a technical representative from the producer of the WMA additive utilized in the WMA is present during placement of the control strip section and at the pre-paving meeting, and available upon the request of the Engineer.
- 962-4.02 Bituminous Mixing Plant** - Shall meet the requirements of article **401-4.02**. The contractor shall modify the bituminous mixing plant as required by the manufacturer to introduce the WMA technology. Plant modifications may include additional plan instrumentation, the installation of WMA additive delivery system, tuning the plant burner and adjusting the flights in order to operate at lower production temperature and/or reduced tonnage.
- Also, the additive feed system shall be automated and tied into the plant controls to automatically adjust the additive rate according to mix production rate.
- 962-4.03 Hauling Equipment** – Shall meet the requirements of article **401-4.03**.
- 962-4.04 Delivery Trucks** - Shall meet the requirements of article **401-4.04**.
- 962-4.05 Bituminous Pavers** – Shall meet the requirements of article **401-4.05**.
- 962-4.06 Rollers** – Shall meet the requirements of article **401-4.06**
- 962-4.07 Weather Limitations** – Meet the requirements of article **401-4.07**.
- 962-4.08 Preparation of Surface to be Paved** – Shall meet the requirements of article **401-4.08**.
- 962-4.09 Preparation of Bituminous Material** – Meet the requirements of article **401-4.09**.
- 962-4.10 Mixing** – Shall meet the requirements of article **401-4.10**. Production Temperature shall be as established during mix design and control strip section. Delivery temperature to the project site shall be consistent with the WMA additives and performance during control strip section.
- 962-4.11 Transporting, Spreading and Finishing** – Shall meet the requirements of article **401-4.11**.

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- 962-4.12 Compaction Requirements** - Shall meet the requirements of article **401-4.12**.
- 962-4.13 Joints, Trimming Edges and Cleanup** - Shall meet the requirements of article **401-4.13**.
- 962-4.14 Surface Requirements** – Shall meet the requirements of article **401-4.14**.
- 962-4.15 Protection of Pavement** - Shall meet the requirements of article **401-4.15**, except that the contractor will establish the necessary strategies and practices as to comply with this requirement.
- 962-5 BASIS OF ACCEPTANCE** – Shall be as per Section **401- 5**.
- 962-6 METHOD OF MEASUREMENT** - Shall be as per Section **401-6**.
- 962-7 BASIS OF PAYMENT** - Shall be as per Section **401-7**, **except that** prices and payment shall also include full compensation for the cost of the WMA additive, additional sampling and testing performed and any other plant adjustment or equipment necessary for proper use of the WMA technologies.

Payment will be made under items described below:

<u>Pay Item</u>	<u>Pay Unit</u>
Warm Mix Asphalt Pavement - Marshall - S (50 or 75)* (38 or 12)**	Ton
Warm Mix Asphalt Pavement – Marshall - B (50 or 75)* (12, 34 or 1)**	Ton
Warm Mix Asphalt Pavement – Marshall L (50 or 75)* (38, 12, 34 or 1)**	Ton
Control Strip Section	Ton

* Indicates the number of applicable hammer blows (AASHTO T 245)

** Indicate the applicable Nominal Maximum Aggregate Size (NMAS) of Mix as follows:

- 38 = Mix NMAS of 3/8-inch
- 12 = Mix NMAS of 1/2-inch
- 34 = Mix NMAS of 3/4-inch
- 1 = Mix NMAS of 1-inch

In those cases in which the Authority does not require a specific NMAS in the mix pay item, the Contractor will have the option of selecting the NMAS of the mix to be designed, produced and placed in the project. The selection by the Contractor of the above mix properties shall be based upon mix compliance with all specification requirements.