WARM-MIX ASPHALT

**From Castleton-West Rutland/Castleton AC STP 2705(1)/2908(1)/2909(1)

xx. DESCRIPTION. This work shall consist of constructing one or more courses of bituminous mixture on a prepared foundation in accordance with these specifications and the specific requirements of the type of surface being placed, and in reasonably close conformity with the lines, grades, thicknesses, and typical cross sections shown on the Plans or established by the Engineer.

The work under this Section shall be performed in accordance with these provisions, the Plans, and Section 490 of the Standard Specifications.

xx. GENERAL. Warm Mix Asphalt (WMA) is an asphaltic mixture made using a wide range of technologies that allow for production and placement at lower temperatures than typical for Hot Mix Asphalt (HMA). The temperature of the WMA at the time of production shall be below T_{max}-50 degrees, where T_{max} is the maximum allowable production temperature of HMA. WMA technologies may be used as a compaction aid to extend the paving season in colder climates when produced at a range of temperatures up to those typical for HMA production. A WMA technology may include an additive, specialty equipment, or both. The words “bituminous concrete”, in the Standard Specifications and other documents referenced by this specification, shall apply to “Warm Mix Asphalt” and “WMA”.

xx. MATERIALS.

(a) Warm Mix Asphalt (WMA) Technologies. The WMA technology shall be one of the products or processes identified in the table below. WMA technologies not included in the table below shall be submitted to the Materials and Research Engineer for approval.

Organic additives (waxes) may be blended with the asphalt binder at the asphalt terminal or may be introduced into the binder at the HMA production facility. Asphalt binder that has been blended with an organic additive (wax) at the asphalt terminal shall meet the requirements of Subsection 702.02. A Type D Certification in accordance with Subsection 700.02 shall be supplied for terminal blended WMA asphalt binders.

If organic wax additives are introduced at the HMA facility, the producer shall submit a plan that describes, in detail, the manner in which the additive will be added and controlled to assure that the manufacturer’s recommended target dosage rate is maintained and that the additive is thoroughly mixed with the asphalt binder. The plan must be approved by the Materials and Research Engineer prior to beginning production.

ALLOWABLE WMA PRODUCTS AND PROCESSES

WMA TECHNOLOGY	TECHNOLOGY PROVIDER
ORGANIC ADDITIVES (WAXES)	
SONNEWARMix™	Sonneborn, Inc. 575 Corporate Drive, Suite 415

	Mahwah, NJ 07430
Sasobit®	Sasol Wax North America Corporation 21325B Cabot Blvd Hayward, California 94545
FOAMING PROCESSES	
FOAMING ADDITIVES	
Ashpa-Min	Ashpa-Min GmbH Lise-Meitner-Str. 35 D-63457 Hanau Germany
Advera®WMA	PQ Corporation P.O. Box 840 Valley Forge, PA 19482-0840
WATER INJECTION SYSTEMS	
Double Barrel Green System Green Pac for continuous and batch plants	ASTEC Industries, Inc. P.O. Box 72787 4101 Jerome Ave. Chattanooga, TN 37407
MAXAM AQUABlack warm mix asphalt system	MAXAM Equipment, Inc. 1575 Universal Ave. Kansas City, MO 64120
Terex® foamed warm mix asphalt system	Terex Roadbuilding 9528 W. I-40 Service Road Oklahoma City, OK 73128

xx. COMPOSITION OF MIXTURE.

(a) Warm Mix Asphalt (WMA) Mix Design. A Warm Mix Asphalt (WMA) mixture design shall modify an existing approved Superpave Bituminous Concrete Pavement design, currently in production status, using a WMA technology. Test specimens may be made from plant produced or laboratory prepared WMA. If adding the WMA technology in the lab does not simulate the production process, test specimens shall be made from plant produced WMA. The WMA design submittal shall identify the WMA technology, target rate and acceptable variation (min/max rate), as well as temperatures to be applied to the mix for all stages of production. The WMA design shall include an evaluation of the moisture sensitivity (AASHTO T 283 “Standard Test Method for Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage”) of the WMA mixture. The producer shall comply with the manufacturer’s recommendations for utilizing WMA technologies. Notify the Materials and Research Engineer the manner in which WMA technology will be incorporated prior to fabricating the test specimens. The mix design shall include sufficient trials to confirm the appropriate ranges for plant and field operations. If necessary to simulate

the production process and determine optimum compaction temperature, test specimens may be made from plant produced WMA.

(b) Control of Mixtures. The Quality Control (QC) Plan shall additionally address the following elements:

(1) If organic additives are added to the asphalt binder at the HMA plant, describe process for assuring complete mixing of the additive and asphalt binder.

(2) WMA technology and Quality Control guidelines.

(3) Describe field feedback requirements and production responses to maintain high quality.

xx. WEATHER AND SEASONAL LIMITATIONS. The minimum delivery, placement, and compaction temperatures shall be reviewed to accommodate the reduced temperature of WMA. Minimum ambient paving temperature requirements may be lowered for WMA, if approved by the Engineer, but must remain above 2°C (35°F).

xx. BITUMINOUS MIXING PLANT AND TESTING.

(a) Requirements for All Plants. The asphalt mixing plant may be modified as required by the supplier to introduce WMA technology. The modifications shall be integrally managed by the operator's process control. These modifications shall be approved by the Materials and Research Engineer.

xx. METHOD OF MEASUREMENT. The quantity of Special Provision (Warm-Mix Asphalt) to be measured for payment will be the number of metric tons (tons) for a lot mixture (each type) complete in place in the accepted work as determined from the weigh tickets.

The quantities of all applicable Pay Adjustments calculated for the project will be determined as specified below.

When applicable, and when the air voids pay factor, PF(av), for a lot of Special Provision (Warm-Mix Asphalt) of the type specified is less than or more than 0.000, the measured quantity of Special Provision (Warm-Mix Asphalt) of the type specified placed that day will be multiplied by such pay factor to determine an Air Voids Pay Adjustment, (PA(av)), to the accepted tonnage placed (Q) for that lot based on the Contract bid price (B), as follows:

$$PA(av) = PF(av) \times Q \times B$$

When boxed samples are taken to determine mix properties, PF(av) shall be assumed as equal to 1.000 for a "single day" lot. Additionally, when the RQL of 50% is not attained for a lot, all other applicable pay factors for that lot shall not be greater than 1.000.

When applicable, and when the density pay factor, PF(d), for a lot of Special Provision (Warm-Mix Asphalt) of the type specified is less than or more than 0.000, the measured quantity of Special Provision (Warm-Mix Asphalt) of the type specified placed that day will be multiplied by such pay factor to determine a Mat Density Pay Adjustment, (PA(d)),

to the accepted tonnage placed (Q) for that based on the Contract bid price (B), as follows:

$$PA(d) = PF(d) \times Q \times B$$

When applicable, and when the surface tolerance pay factor, PF(r), for a lot of Special Provision (Warm-Mix Asphalt) of the type specified is less than or more than 0.000, the measured quantity of Special Provision (Warm-Mix Asphalt) of the type specified placed that day will be multiplied by such pay factor to determine a Surface Tolerance Pay Adjustment, (PA(r)), to the tonnage placed (Q) for that lot per based on the Contract bid price (B), as follows:

$$PA(r) = PF(r) \times Q \times B$$

When applicable, and when the longitudinal joint pay factor, PF(j), for a lot of Special Provision (Warm-Mix Asphalt) of the type specified is less than or more than 0.000, the measured quantity of Special Provision (Warm-Mix Asphalt) of the type specified placed that day will be multiplied by such pay factor to determine a Longitudinal Joint Pay Adjustment, (PA(j)), to the tonnage placed (Q) for that lot based on the Contract bid price (B), as follows:

$$PA(j) = PF(j) \times Q \times B$$

When the material for any lot is removed from the project under any provisions of the Contract, no payment will be made for that material nor for any applicable Pay Adjustments under this Section.

xx. BASIS OF PAYMENT. The measured quantity of Special Provision (Warm-Mix Asphalt) of the type specified will be paid for the Contract unit price per metric ton (ton). Payment shall be full compensation for furnishing, mixing, hauling, and placing the material specified and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

Payment for Pay Adjustments shall be debited against the Contract prices (Lump Units) bid for the Pay Adjustment items.

The cost of repairing bridge deck core areas will not be paid for separately, but will be considered incidental to Special Provision (Warm-Mix Asphalt) of the type specified.

The costs of furnishing testing facilities and supplies at the plant will be considered included in the Contract unit price of Special Provision (Warm-Mix Asphalt) of the type specified.

The costs of obtaining, furnishing, transporting, and providing the straightedges required by Subsection 490.16, as appropriate, will be paid for under the appropriate Section 631 pay item included in the Contract.

The costs associated with obtaining samples for acceptance testing will be incidental to the cost of Special Provision (Warm-Mix Asphalt) of the type specified.

When not specified as items in the Contract, the costs of cleaning and filling joints and cracks, sweeping and cleaning existing paved surfaces, the emulsified asphalt applied to tack these surfaces, and tacking of manholes, curbing, gutters, and other contact surfaces will not be paid for directly, but will be incidental to Special Provision (Warm-Mix Asphalt) of the type specified.

Special Provision (Warm-Mix Asphalt) mixture approved by the Engineer for use in correcting deficiencies in the base course constructed as part of the Contract will not be paid for as Special Provision (Warm-Mix Asphalt), but will be incidental to the Contract item for the specified type of base course.

Special Provision (Warm-Mix Asphalt) mixture used to correct deficiencies in an existing pavement or to adjust the grade of a bituminous concrete surface completed under the Contract will be paid for at the Contract unit price for Special Provision (Warm-Mix Asphalt) of the type specified.

Payment will be made under:

Pay Item	Pay Unit
900.680 Special Provision (Warm-Mix Asphalt, Foaming Process)	Metric Ton (Ton)
900.680 Special Provision (Warm-Mix Asphalt, Organic Wax Additive)	Metric Ton (Ton)