

Attachment 10

**Detailed Specifications -
Warm Mix Asphalt (WMA)**

(2020 VPP NYSDOT Specific Projects)
(Federal & State Funds)

IFB# 23194

ITEM 404.XXYZQ108 – WARM MIX ASPHALT

DESCRIPTION. This work shall consist of developing, producing, and paving a Warm Mix Asphalt (WMA) mixture. WMA is standard HMA produced using a WMA technology typically resulting in a production mixture temperature of 275°F or lower.

WMA pavement course shall be constructed in accordance with this specification and in reasonably close conformity with the required lines, grades, thicknesses, and typical sections shown on the plans or established by the Engineer. The Contractor is responsible for compacting pavement to a specified density requirement.

The words “hot mix asphalt” and “HMA” in the standard specifications and other documents referenced by this specification shall apply to WMA.

MATERIALS

Requirements of §401-2 and §402-2 shall apply except as noted herein.

1. **WMA Technology.** Use a WMA technology appearing on the State’s Approved List for Warm Mix Asphalt Technologies.
2. **WMA Design.** Design a mixture using a WMA Technology in accordance with MM 5.16, *Superpave Hot Mix Asphalt Mixture Design and Mixture Verification Procedure*. At a minimum, a one-point verification of the mixture’s volumetric properties is acceptable for the following situations:
 - When the WMA mix design is based on an existing Production Status HMA mix design.
 - When the WMA mix design utilizes a different WMA technology than an existing Production Status WMA mix design.

Comply with the manufacturer’s recommendations for incorporating the WMA technology. Notify the Regional Material Engineer (RME) how the WMA technology will be incorporated prior to fabricating the test specimens. Test specimens may be made from plant produced or laboratory prepared WMA. Test specimens must be made from plant produced WMA if adding the WMA technology in the lab does not simulate the production process. The RME may require a State representative be present during the fabrication and testing. Submit the WMA design to the RME for review and verification at least 14 calendar days before production, including:

- Name of WMA technology being used and the target dosage rate.
- If using an additive other than water,
 - Submit a MSDS for the additive.
 - Submit either enough of the additive for the laboratory mix design verification, or the additive pre-blended in the PG Binder at the correct dosage. If the additive is not pre-blended into the PG Binder, include directions for properly incorporating the additive into the laboratory made mixture.

Prior to the submission of any mix design, contact the RME to determine if there is an increased concern regarding the mixture’s moisture susceptibility based on the WMA

technology and/or the type of aggregate being used, or the performance of similar mixes. The RME may require AASHTO T 283 moisture susceptibility test results, meeting a minimum Tensile Strength Ratio (TSR) of 80%, as part of the mix design submission.

Submit Production Quality Control Plan revisions incorporating the WMA technology if not previously submitted.

CONSTRUCTION DETAILS

Requirements of §401-3 and §402-3 shall apply except as noted herein.

Mix Temperature. Select a desired WMA mixture temperature within the mixing and compaction range as recommended by the WMA technology provider. If the asphalt mixture is being placed over a *Sheet-Applied Waterproofing Membrane*, maintain a minimum delivery temperature in accordance with the Material Detail Sheets prepared by the membrane manufacturer.

For 80 Series compaction method, complete all breakdown roller passes before the mat temperature falls below 230°F, unless approved by the Director, Materials Bureau.

METHOD OF MEASUREMENT

Requirements of §401-4 and §402-4 shall apply.

BASIS OF PAYMENT

The unit price bid for WMA mixtures shall meet the requirements specified in §402-5 Basis of Payment

Item No.	Item	Pay Unit
404.01090108	Type 1 F9, Asphalt-Treated Permeable Base Course	Ton
404.01190108	Type 2 F9, Asphalt-Treated Permeable Base Course	Ton
404.01790108	True & Leveling F9, WMA, 70 Series Compaction	Ton
404.01890108	True & Leveling F9, WMA, 80 Series Compaction	Ton
404.05890108	Shim Course F9, Warm Mix Asphalt	Ton
404.09510108	9.5 F1 WMA, 50 Series Compaction	Ton
404.09520108	9.5 F2 WMA, 50 Series Compaction	Ton
404.09610108	9.5 F1 WMA, 60 Series Compaction	Ton
404.09620108	9.5 F2 WMA, 60 Series Compaction	Ton
404.09630108	9.5 F3 WMA, 60 Series Compaction	Ton
404.09710108	9.5 F1 WMA, 70 Series Compaction	Ton
404.09720108	9.5 F2 WMA, 70 Series Compaction	Ton
404.09730108	9.5 F3 WMA, 70 Series Compaction	Ton
404.09810108	9.5 F1 WMA, 80 Series Compaction	Ton
404.09820108	9.5 F2 WMA, 80 Series Compaction	Ton
404.09830108	9.5 F3 WMA, 80 Series Compaction	Ton
404.09890108	9.5 F9 WMA, Shoulder Course, 80 Series Compaction	Ton
404.12510108	12.5 F1 WMA, 50 Series Compaction	Ton
404.12520108	12.5 F2 WMA, 50 Series Compaction	Ton
404.12610108	12.5 F1 WMA, 60 Series Compaction	Ton
404.12620108	12.5 F2 WMA, 60 Series Compaction	Ton
404.12630108	12.5 F3 WMA, 60 Series Compaction	Ton
404.12710108	12.5 F1 WMA, 70 Series Compaction	Ton
404.12720108	12.5 F2 WMA, 70 Series Compaction	Ton
404.12730108	12.5 F3 WMA, 70 Series Compaction	Ton

Item No.	Item	Pay Unit
404.12810108	12.5 F1 WMA, 80 Series Compaction	Ton
404.12820108	12.5 F2 WMA, 80 Series Compaction	Ton
404.12830108	12.5 F3 WMA, 80 Series Compaction	Ton
404.12890108	12.5 F9 WMA, Shoulder Course, 80 Series Compaction	Ton
404.19590108	19 F9 WMA, 50 Series Compaction	Ton
404.19690108	19 F9 WMA, 60 Series Compaction	Ton
404.19790108	19 F9 WMA, 70 Series Compaction	Ton
404.19890108	19 F9 WMA, 80 Series Compaction	Ton
404.25590108	25 F9 WMA, 50 Series Compaction	Ton
404.25690108	25 F9 WMA, 60 Series Compaction	Ton
404.25790108	25 F9 WMA, 70 Series Compaction	Ton
404.25890108	25 F9 WMA, 80 Series Compaction	Ton
404.37690108	37.5 F9 WMA, 60 Series Compaction	Ton
404.37790108	37.5 F9 WMA, 70 Series Compaction	Ton
404.37890108	37.5 F9 WMA, 80 Series Compaction	Ton
404.41890108	9.5 F9 Temporary Top Course WMA, 80 Series Compaction	Ton
404.42890108	12.5 F9 Temporary Top Course WMA, 80 Series Compaction	Ton
404.43890108	19 F9 Temporary Binder Course WMA, 80 Series Compaction	Ton
404.44890108	25 F9 Temporary Binder Course WMA, 80 Series Compaction	Ton
404.00001108	Plant Production Quality Adjustment to WMA Items	Quality Unit
404.00002108	Pavement Density Quality Adjustment to WMA Items	Quality Unit
404.00005108	Test Section Adjustment to WMA Items	Quality Unit

ITEM 404.06810309 - 6.3 F1 TOP COURSE WMA, 80 SERIES COMPACTION

ITEM 404.06820309 - 6.3 F2 TOP COURSE WMA, 80 SERIES COMPACTION

ITEM 404.06830309 - 6.3 F3 TOP COURSE WMA, 80 SERIES COMPACTION

DESCRIPTION

This work shall consist of mixture design and placement of 6.3 Polymer Modified Warm Mix Asphalt (WMA) in accordance with Section 401, Section 402, the contract documents and as directed by the Engineer. WMA is standard HMA produced using a WMA technology typically resulting in a production mixture temperature of 275°F or lower.

The words “hot mix asphalt” and “HMA” in the standard specifications and other documents referenced by this specification shall apply to WMA.

MATERIALS

Requirements of §401-2 and §402-2 shall apply except as noted herein.

WMA Technology. Use a WMA technology appearing on the State’s Approved List for Warm Mix Asphalt Technologies.

WMA Design. Design a mixture using a WMA Technology in accordance with MM 5.16, Superpave Hot Mix Asphalt Mixture Design and Mixture Verification Procedure. At a minimum, a one point verification of the mixture’s volumetric properties is acceptable for the following situations:

- When the WMA mix design is based on an existing Production Status HMA mix design.
- When the WMA mix design utilizes a different WMA technology than an existing Production Status WMA mix design.

Comply with the manufacturer’s recommendations for incorporating the WMA technology. Notify the Regional Material Engineer (RME) how the WMA technology will be incorporated prior to fabricating the test specimens. Test specimens may be made from plant produced or laboratory prepared WMA. Test specimens must be made from plant produced WMA if adding the WMA technology in the lab does not simulate the production process. The RME may require a State representative be present during the fabrication and testing. Submit the WMA design to the RME for review and verification at least 14 calendar days before production, including:

- Name of WMA technology being used and the target dosage rate.
- If using an additive other than water,
 - Submit a MSDS for the additive.
 - Submit either enough of the additive for the laboratory mix design verification, or the additive pre-blended in the PG Binder at the correct dosage. If the additive is not pre-blended into the PG Binder, include directions for properly incorporating the additive into the laboratory made mixture.
- Prior to the submission of any mix design, contact the RME to determine if there is an increased concern regarding the mixture’s moisture susceptibility based on the WMA technology and/or the type of aggregate being used, or the performance of similar mixes. The RME may require AASHTO T 283 moisture susceptibility test results, meeting a minimum Tensile Strength Ratio (TSR) of 80%, as part of the mix design submission.

Production Quality Control Plan revisions incorporating the WMA technology if not previously submitted.

The 6.3 Polymer Modified WMA shall be designed and produced in accordance with the procedures outlined in this specification and MM 5.16. The mixture shall be designed to meet the following requirements:

- <30 million ESALs,
- 96% of the mixture's maximum theoretical density
- Minimum PG Binder content of 6.0% by the total weight of the mixture.

The design shall be submitted to the Regional Materials Engineer (RME) which satisfies the design criteria outlined as modified below.

Table 1 - Design Aggregate Control Points

Standard Sieves	Percent Passing Criteria	
	Maximum	Minimum
3/8 in.		100
1/4 in.	100	90
No. 4	90	---
No. 8	70	37
No. 200	10	2

Table 2 - 6.3 Polymer Modified WMA Volumetric Design Criteria

% G _{mm} @ N _{initial}	% Voids Filled with Binder		% Voids in the Mineral Aggregate, Minimum
	Minimum	Maximum	
< 90.5	70	78	16

Table 3 - 6.3 Polymer Modified WMA Design Number of Gyration

Compactive Effort	N _{initial}	N _{design}	N _{maximum}
Number of Gyration	7	75	115

Table 4 - JMF Gradation Target Tolerances

Sieve Size	3/8 in.	1/4 in.	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
Tolerance (% Passing)	± 4	± 4	± 3	± 3	± 3	± 2	± 2	± 2	± 2

Aggregate. The aggregate shall meet the requirements of Section 703, MM 5.16, and the following:

A. Aggregate Type F1 Conditions

1. Sandstone, granite, chert, traprock, ore tailings, slag, or other similar non-carbonated Materials.
2. Use gravel or blend two or more of: gravel, limestone, dolomite, sandstone, granite, chert, traprock, ore tailings, or other similar materials to produce a final blend of which the non-carbonate plus No. 8 particles must comprise at least 30.0% of the total aggregate. In addition, at least 90.0% of the plus No. 4 particles must be non-carbonate.

B. Aggregate Type F2 Conditions

1. Limestone, dolomite, or a blend of the two having an acid insoluble residue content of not less than 20.0%.
2. Sandstone, granite, chert, traprock, ore tailings, slag, or other similar non-carbonated materials.
3. Use gravel or blend two or more of: gravel, limestone, dolomite, sandstone, granite, chert, traprock, ore tailings, or other similar materials to produce a final blend of which the non-carbonate plus No. 8 particles must comprise at least 10.0% of the total aggregate. In addition, at least 20.0% of the plus No. 4 particles must be non-carbonate.

C. Aggregate Type F3 Conditions

1. Limestone or a blend of limestone and dolomite having an acid insoluble residue content of not less than 20.0%.
2. Dolomite.
3. Sandstone, granite, chert, traprock, ore tailings, slag, or other similar non-carbonate materials.
4. Use gravel or blend two or more of: gravel, limestone, dolomite, sandstone, granite, chert, traprock, ore tailings, or other similar materials to produce a final blend of which the non-carbonate plus No. 8 particles must comprise at least 10.0% of the total aggregate. In addition, at least 20.0% of the plus No. 4 particles must be non-carbonated.

PG Binder. The Performance Graded Binder (PG Binder) grades are listed in Table 5, *PG Binder Selection*. Appropriate binder grade shall be selected based on the project location. The PG binder shall be modified with either elastomeric polymer or terminal blend crumb rubber for the production of WMA mixture. The modified PG Binder shall meet the requirements of AASHTO M 332, Standard Specification for Performance Graded Asphalt Binder using Multiple Stress Creep Recovery (MSCR). In addition, the binder grade must also meet the **elastomeric** properties as indicated by one of the following:

For $J_{nr3.2} \geq 0.1$, $Z = \%R_{3.2} - 29.371 * J_{nr3.2}^{-0.2633}$

And Z must be greater than 0

For $J_{nr3.2} < 0.1$, $\%R_{3.2}$ must be greater than 55%

Table 5 - PG Binder Selection

Location	Location by Counties	PG Binder Grades (Material Designation)
Upstate ¹	All Other Counties Not Listed Under Downstate	64V-22 (702-64V22)
Downstate	Orange, Putnam, Rockland, Westchester, Nassau, Suffolk Counties and City of New York	64E-22 (702-64E22)

NOTES:

1. For high volume roadways in Upstate Counties, PG 64E-22 may be specified with the concurrence of the Regional Materials Engineer. "High Volume" is defined as 2 or 3 lane highways with design year two-way AADT over 8,000, or for more than three lanes, with two-way AADT over 13,000.

When terminal blend CRM PG binder is used, the following shall apply:

- Crumb rubber particles shall be finer than #30 sieve size.
- The CRM PG binder shall be storage-stable and homogeneous.
- The Dynamic Shear Rheometer (DSR) shall be set at 2-mm gap.
- The CRM PG binder shall be 99% free of particles retained on the 600µm sieve as tested in accordance with Section 5.4 of M332.

In addition, the PG Binder shall meet the following requirements:

Upstate. Use of polyphosphoric acid (PPA) to modify PG binder properties is prohibited. This prohibition also applies to the use of PPA as a cross-linking agent for polymer modification.

Downstate. Polyphosphoric (PPA) is the only type of acid allowed when PG binders are modified using acid. The use of PPA modified PG binder is prohibited for mixtures containing limestone, limestone as an aggregate blend component, limestone as a constituent in crushed gravel aggregate, or recycled asphalt pavement (RAP) that includes any limestone. This prohibition also applies to the use of PPA as a cross-linking agent for polymer modification.

Other modified PG Binder grades may be used with a prior approval by the Director of the Materials Bureau.

Tack Coat. The tack coat used for this mixture shall meet the requirements of 702.3002T or 702.4002T Asphalt Emulsion Straight Tack Coat.

Reclaimed Asphalt Pavement (RAP). The maximum RAP blend portion is 20% by weight of the total mixture.

CONSTRUCTION DETAILS

The provisions of §401-3 and §402-3, *Construction Details*, will apply except as modified herein.

Mix Temperature. Select a desired WMA mixture temperature within the mixing and compaction range as recommended by the WMA technology provider.

For 80 Series compaction method, complete all breakdown roller passes before the mat temperature falls below 230°F, unless approved by the Director, Materials Bureau.

Tack Coat. The Straight Tack shall be applied and paid for in accordance with Section 407 of the Standard Specifications.

The Provisions of 402-3.07 Compaction, D. 80 Series Compaction Method, apply except as modified.

Table 6 - Number of Passes¹

Option 1 Three Roller Train (Static)		Option 2 Vibratory Rollers	
Steel-Wheel Roller Passes	Pneumatic Roller Passes	Vibratory Roller Passes	Static Roller Passes
4	2	4	2

Note 1 - These are recommended number of roller passes. Engineer-in-Charge may change the number of passes as needed.

METHOD OF MEASUREMENT

The provisions of §401-4 and §402-4, Method of Measurement, shall apply.

BASIS OF PAYMENT

The provisions of §402-5 Basis of Payment shall apply. Payment will be made under:

<u>ITEM NO.</u>	<u>ITEM</u>	<u>PAY UNIT</u>
404.06810309	6.3 F1 Top Course WMA, 80 Series Compaction	Ton
404.06820309	6.3 F2 Top Course WMA, 80 Series Compaction	Ton
404.06830309	6.3 F3 Top Course WMA, 80 Series Compaction	Ton