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REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
OFFICE OF THE SECRETARY
MANILA

097.130 PWH
10-07-2015

DEPARTMENT ORDER) SUBJECT : DPWH Standard Generic
) Specification on the Use of Polymer
) Modified Bitumen (PMB) In Item
No. 152) 310, Bituminous Concrete Surface
Series of 2015) Course, Hot-Laid and Item 734,
10.07.15) Stone Mastic Asphalt (SMA)

In line with the mandate of the Department of providing effective standards for application in the implementation of various infrastructure projects and in view of the need of setting standard specifications on the use of Polymer Modified Bitumen (PMB) in dense and Stone Mastic Asphalt (SMA) grading applications, the attached **DPWH Standard Generic Specifications on the Use of Polymer Modified Bitumen (PMB) In Item 310, Bituminous Concrete Surface Course, Hot-Laid and Item 734, Stone Mastic Asphalt (SMA)**, is hereby prescribed for the guidance and compliance of all concerned.

This Order shall take effect immediately.


ROGELIO L. SINGSON
Secretary

Department of Public Works and Highways
Office of the Secretary



WIN5U01161

5.5.2 FET/JFS

**DPWH Standard Generic Specifications on the Use of
Polymer Modified Bitumen (PMB) In Item 310, Bituminous Concrete
Surface Course, Hot-Laid and Item 734, Stone Mastic Asphalt (SMA)**

1.0 Description

This Item shall consist of constructing a Bituminous Concrete Surface Course and/or Stone Mastic Asphalt (SMA) pavement composed of aggregates, mineral filler, hydrated lime and Polymer Modified Bitumen (PMB) material mixed in a central plant, constructed and laid hot on a newly prepared base or existing concrete or asphalt pavement.

PMB is a highly specialized blend of bitumen with high quality polymer (elastomeric) and is manufactured under carefully controlled conditions in a plant. PMB is an exceptionally versatile product with enhanced properties that makes it suitable for wearing course application under special conditions like heavy rainfall and traffic.

Bituminous Concrete Surface Course, Hot-Laid and SMA, utilizing PMB as binder, shall be prepared in accordance with this Specification and in conformity with the lines, grades, thickness and typical cross-sections shown in the Plans within the tolerances specified or established by the Engineer.

2.0 Materials Requirements

2.1 Composition and Quality

For Item 310, Bituminous Concrete Surface Course, Hot-Laid and Item 734, Stone Mastic Asphalt, it shall conform to the requirements of Item 307.2.1 - Composition and Quality of Bituminous Mixture and Item 734.2.1 - Composition and Quality, respectively, except that PMB shall be used as binder and not the Penetration Grade asphalt.

2.2 Polymer Modified Bitumen (PMB)

PMB to be used in Item 310 and Item 734 shall be tested in accordance with AASHTO M 320 and shall meet the requirements of Performance Grade or PG 76-10.

The requirements for PMB under PG 76-10 shall be the following:

Properties	Unit	Test Method	Limits
Softening Point	°C	ASTM D 36	≥ 75
Penetration @ 25°C	0.1 mm	ASTM D 5	< 60
Dynamic Viscosity @ 135°C	Pa·s	ASTM D 4402	≤ 3
Dynamic Viscosity @ 170°C	Pa·s	ASTM D 4402	≤ 0.8
Flash Point COC	°C	ASTM D 92	≥ 230
Elastic Recovery @ 25°C	%	ASTM D 6086	≥ 75
Storage Stability @ 180°C, 72 hrs		ASTM D 7173*	
Difference in Softening Point	°C	ASTM D 7173*	≤ 5

- * Only the test methods mentioned in ASTM D 7173 shall be followed. The requirements mentioned in its properties shall govern.

Properties	Unit	Test Method	Limits
SHRP Performance Grading			
Dynamic Shear before RTFOT, $G^*/\sin\delta$ @ 10 rad/s, 76°C	kPa	AASHTO T 315	≥ 1.00
Rolling Thin Film Oven Test (RTFOT)		ASTM D 2872	
Dynamic Shear after RTFOT, $G^*/\sin\delta$ @ 10 rad/s, 76°C	kPa	AASHTO T 315	≥ 2.20
PAV ageing on RTFOT residue		AASHTO R 28	
Dynamic Shear after PAV, $G^*/\sin\delta$ @ 10 rad/s, 76°C	kPa	AASHTO T 315	≤ 5000
Creep Stiffness, S and m-value @60 s, 0°C	Mpa	AASHTO T 313	$S \leq 300$
			$m > 0.300$

In addition, Polymer Modified Bitumen shall meet the requirements in Item 735.3.2.

2.3 Coarse Aggregates

Coarse aggregates retained on the 4.75 mm (No. 4) sieve for SMA shall be crushed stone/rock, crushed slag and unless otherwise stipulated, shall conform to the quality requirements of AASHTO M 79. For dense graded, the coarse aggregates retained on the 2.36 mm (No. 8) sieve shall be used and the requirements are the same with the requirements for Item 734. Both shall conform to the applicable requirements of Section 703.5.1, Coarse Aggregates of Item 703.

2.4 Fine Aggregates

Same as Item 734.2.4.

2.5 Stabilizing Additives

Cellulose fibers, either pure or bitumen coated should be used as additives to SMA to inhibit the loss of bituminous binder by drainage from the aggregate. Cellulose fibers, in pellets and loose form, shall conform to the requirements of Item 734.2.5 - Stabilizing Additives.

2.6 Mineral Filler

Same as Item 734.2.6.

2.7 Proportioning of Mixture

The proportion of PMB, on the basis of total weight of mix, shall be from 5.0 to 8.0 mass percent for Item 310 while 4.0 to 5.5 mass percent for Grading A with 1" (25 mm) maximum size aggregates and 4.5 to 6.5 mass percent for Grading B of Item 734 with ½" (12.5 mm) maximum size aggregates both with the addition of cellulose fibers. The exact percentage to be used shall be fixed by the Engineer in accordance with the Job-Mix formula and other quality control requirements.

To get the desired Job-Mix formula, Marshall Stability and Immersion-Compression Tests on Asphalt Mix shall be conducted. The results shall pass the requirements indicated in the Table of Recommended Gradation Target Value Ranges of Item 734.

For Item 310, the results shall pass the requirements in Table 703.2 Gradation Ranges – Hot Plant Mix Bituminous Pavements of Item 703 – Aggregates

Proportioning Cellulose fibers shall conform to the requirements of Item 734.2.7.

3.0 Construction Requirements

The construction requirements shall be in conformance, whenever applicable, with section 307.3 of Item 307.

Sealing works on defects like cracks shall be performed by the Contractor. Transverse and longitudinal joints of existing PCCP shall also be sealed before paving.

Prior to application of Item 302 – Bituminous Tack Coat, all loose stones, debris and other scattered materials on the surface of existing concrete pavement shall be cleaned/ removed with the use of air compressor. After cleaning the pavement surface, tack coat materials (emulsified asphalt) shall be sprayed/ applied with the use of hose with nozzle attached to the asphalt distribution tank.

3.1 Weather Limitations

Bituminous stone mastic plant mix shall not be placed on any wet surface or when weather conditions would prevent the proper handling or finishing of the bituminous mixtures.

3.2 Mixing Procedure with Cellulose Fiber Additives

- a. Heat the aggregate between 160°C - 180°C.
- b. Add the cellulose fibers, in pellets form, on the dry mix aggregates and allow approximately 5-15 seconds mixing time. It shall be added through a separate inlet directly into the weigh hopper above the pug-mill or through an opening in the pug-mill.
- c. Add/spray bitumen/asphalt cement on the dry mix for 5-15 seconds.
- d. The standard wet mixing time shall be observed to ensure adequate blending with asphalt cement.

3.3 Laying

The mixture shall be placed at a temperature of not less than 135°C and a maximum of 180°C measured in the truck before dumping into the spreader.

The mixture shall be spread and struck off to the grade and elevation established. Bituminous pavers shall be used to distribute the mixture either over the entire width or over such partial width as may be practicable.

3.4 Compaction

Rolling shall be continued until roller marks are eliminated and a minimum of at least 97% of the theoretical density has been obtained. After the required density has been achieved, rolling operations should stop to avoid migration of polymer modified bitumen and filler to the compacted pavement.

Vibratory compaction (8-10 tonnes tandem roller) shall only be used after the static rollers have been applied and when the temperature of the mixture is high. Vibratory rolling shall be limited to a maximum of 3 passes at a mixture temperature of not less than 100°C.

The newly paved section shall be closed to vehicular traffic until such time that the temperature cools down to atmospheric temperature of 60-70°C. After attaining the required atmospheric temperature, the paved section shall be opened for vehicular traffic.

4.0 Method of Measurement

The bituminous mixture, either Bituminous Concrete Surface Course or SMA, both with PMB as binder, shall be measured by square meter (m²). The quantity to be paid for shall be the number of square meters of the mixture placed and compacted in the accepted pavement. No deduction will be made for the weight of bituminous material in the mixture.

Batch weights shall not be permitted as a method of measurement.

5.0 Basis of Payment

The accepted quantity shall be paid at the contract unit price for Bituminous Concrete Surface Course, Hot-Laid and Stone Mastic Asphalt which price shall be full compensation for furnishing of materials, handling, mixing, hauling, placing, rolling, compacting, labor, equipment, tools and incidentals necessary to complete this item of work.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
-	Stone Mastic Asphalt without Cellulose Fibers and PMB/PG 76-10	Square Meter
-	Stone Mastic Asphalt with Cellulose Fibers and PMB/PG 76-10	Square Meter
-	Bituminous Concrete Surface Course, Hot-Laid with PMB/PG 76-10	Square Meter

References:

- 1) DPWH Final Report of Pilot Road Research Project Using Polymer Modified Bitumen (Petron PMB) in Dense and Stone Mastic Asphalt Grading Application – January 2015
- 2) DPWH Final Report of Pilot Road Research Project Using Shell Cariphalte PG 76-10 in Dense and Stone Mastic Asphalt Grading Application
- 3) DPWH Standard Specifications for Highways, Bridges, and Airports (2012 Edition)
 - a. Item 302 - Bituminous Tack Coat
 - b. Item 310 - Bituminous Concrete Surface Course
 - c. Item 734 - Stone Mastic Asphalt
 - d. Item 735 - Porous Asphalt Pavement
- 4) ASTM
- 5) AASHTO