

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

DEC 1 1 2006

DEPARTMENT ORDER) SUBJECT: Use of Polymer Modified Bitumen (Petron PMB) as) NO. Additive to Porous Asphalt Mix Series of 2006 (12- 13- 8)

In line with the continuing efforts to upgrade the construction technology thru the adoption of successful research studies, this Department has approved the use of Polymer Modified Bitumen (Petron PMB) as Additive to Porous Asphalt Mix to improve the quality of asphalt, subject to the specifications hereto attached A Certificate of Conditional Approval had been issued by this Department, accrediting the use of Petron (PMB) in DPWH Projects, from May 2006 until May 2011.

This order takes effect immediately.

HERMOGEN Æ.JR. Acting Secretar





REPUBLIC OF THE PHILIPPINES DEPARTMENT OF PUBLICWORKS AND HIGHWAYS OFFICE OF THE SECRETARY

CERTIFICATE OF CONDITIONAL APPROVAL

Product Accreditation

This is to certify that

PETRON PMB

which is exclusively distributed in the Philippines by:

<u>Petron Corporation</u> <u>Petron Megaplaza</u> <u>358 Sen. Gil Puyat Avenue</u> <u>Makati City 1200</u>

is duly accredited for use in DPWH projects as polymer modified bitumen to Porous Asphalt Pavement, subject to its specifications (hereto attached) pursuant to the provisions of DPWH Department Order No. 189, series of 2002.

This accreditation shall remain in force until expiry date printed below, subject to compliance with the requirements of the aforementioned Department Order.

Conditional Approval No.	•	008
Date Issued	:	May 2006
Expiry Date	•.	May 2011

HERMOGENE Acting Secretar



DEPARTMENT ORDER NO. 60 Series of 2006 Annex Page 1 of 7

DPWH STANDARD SPECIFICATION FOR

POROUS ASPHALT PAVEMENT WITH POLYMER MODIFIED BITUMEN (PETRON PMB)

1. Description

This item shall consist of constructing a porous asphalt mix, an open graded hot mix asphalt surface course laid on existing concrete or asphalt pavement as wearing course in accordance with this Specification and in conformity with lines, grades, thickness and typical cross-section shown on the Plans.

2. Materials Requirements

2.1 Composition and Quality of Porous Asphalt Mixture

The porous asphalt mixture is an open graded bituminous asphalt mix composed of large proportion of coarse aggregate, small proportion of fine aggregate, mineral filler and Petron PMB. The porous asphalt mixture shall allow the passage of water through it. It shall have air voids within the range of 18% - 25% when tested using ASTM D 3203.

At least three weeks prior to the construction, the Contractor shall submit in writing a job mix formula for each mixture supported by laboratory test data along with samples and sources of the components and viscosity-temperature relationships information to the Engineer for testing and approval.

Each job-mix formula submitted shall propose definite single values for:

- 1. The percentage of aggregate passing each specified sieve size.
- 2. The percentage of Petron PMB to be added.
- 3. The temperature of the mixture delivered on the road.
- 4. The kind and percentage of additive to be used.
- 5. The kind and percentage of mineral filler to be used.

After the job-mix is established, all mixture furnished for the project shall conform thereto within the following ranges of tolerances:

Passing No.4 and larger sieves	±	5 percent
Passing No.8 to No.100 sieves (inclusive)	±	4 percent
Passing No.200 sieve	±	2 percent
Bituminous Material	±	0.4 percent
Temperature of Mixture	±	10°C percent

Should a change in source of material be proposed or should a job-mix formula prove unsatisfactory, a new job-mix formula shall be submitted by the Contractor in writing and be approved by the Engineer prior to production.

DEPARTMENT ORDER NO. <u>40</u> Series of 2006 Annex Page 2 of 7

Approval of a new job-mix formula may require laboratory testing and verification.

The porous asphalt mixture shall have a minimum compressive strength of 1.4 Mpa (200 psi).

The mixture shall also have an index of retained strength of not less than 70 when tested by AASHTO T 165. For Aggregate having maximum sizes over 25 mm (1 inch), AASHTO T 165 will be modified to use 150 mm x 150 mm (6 x 6 inches) cylindrical specimens. The 150 mm (6 inches cylinders will be compacted by the procedures outlined in AASHTO T 167 modified to employ 10 repetitions of a molding load of 9.6 Mpa (1,400 psi), with no appreciable holding time after each application of the full load.

2.2 Petron PMB Properties

Polymer Modified bitumen to be used in porous asphalt mixes shall be Petron PMB conforming to PG 76 – 22 when tested using AASHTO M 320.

In addition, Petron PMB shall meet the following requirements.

	Test Method	Range
Penetration @ 25°C	ASTM D 5	40 - 70
Softening Point, °C	ASTM D 2398	60 minimum
Flash Point, COC, °C	ASTM D 92	232 minimum
Solubility in Trichloroethylene, %	ASTM D 2042	99.50 minimum
Ductility, cm	ASTM D 113	150 minimum

2.3 Aggregates

2.3.1 Coarse Aggregate

Coarse aggregate shall consist of crushed stone or crushed gravel or a combination of two. The maximum size of coarse aggregate used shall not exceed 19 mm and shall conform to the applicable requirements of Item 703, Aggregates.

2.3.2 Fine Aggregate

Fine aggregate shall conform to the applicable requirements of Item 703, Aggregates.

2.4 Mineral Filler

The mineral filler to be used shall be Portland cement and it shall conform to the requirements of Item 703 A, Mineral Filler.

2.5 Mixing Temperature

Aggregates shall be heated to 20°C above the recommended mixing temperature. Petron PMB should not be heated above 200°C. The ideal mixing

DEPARTMENT ORDER NO. <u>60</u> Series of 2006 Annex Page 3 of 7

temperature should be established prior to blending and may be determined by using a Bitumen Test Data Chart, plotting viscosity with respect to temperature. Mixing temperature must not exceed 180°C or that recommended by the Polymer Modified Bitumen supplier.

2.6 Proportioning of Porous Asphalt Mixture.

The Proportion of Petron PMB (Polymer Modified Bitumen) shall be 4.0 to 5.5 percent by total dry aggregate weight. The exact percentage to be used shall be fixed by the Engineer in accordance with the job-mix formula and other quality control requirements.

Samples shall be taken from the hot bins in the asphalt plant. Sieve analysis shall be carried out on the samples and the proportioning of the mixture will be based on the results obtained.

2.7 Storage

The storage silo shall be emptied prior to the production of asphalt concrete. The storage time should be kept minimum.

2.8 Recommended mix Design of Porous Asphalt.

The percent void content of porous asphalt mixture shall be designed by adjusting the ratio of fine and coarse aggregates. The following gradation is recommended to yield a higher percentage of voids, high stability and requirements necessary in the design of the mix.

	Sieve Sizes (mm)	Passing %
3⁄4	(19)	100
1/2	(12.5)	90 – 100
3/8	(9.5)	85 – 95
No.4	(4.75)	37 – 45
No.8	(2.36)	9 - 17
No.16	(1.19)	3 – 11
No.200	(0.075)	1 – 4

Asphalt Content, % by weight of aggregate	4.0 - 5.5
Air Voids, mass %	18 – 25
Stability, Ibs	1,500 minimum

DEPARTMENT ORDER NO. <u>40</u> Series of 2006 Annex Page 4 of 7

2.9 Mix Design

Test specimens shall be made using methods described in ASTM D 1559 or equivalent. The specimens shall be compacted with 50 blows on each side of the specimen sample.

Using the selected design gradation, prepare three (3) samples with binder contents at 0.50% increments.

Porous asphalt mix shall have a mass percent air voids with the range of 18% to 25%.

Test stability, flow, specific gravity and durability.

2.10 Evaluation Procedure on the Design of Bitumen Content.

To determine the optimum asphalt content, the Cantabro test using the Los Angeles abrasion machine (ASTM C 131) on the samples must be conducted. The specimen samples shall be stored for at least 2 days at a temperature of not more than 25°C and tested within 7 days from manufacture of the sample. In this method, subject the specimen samples to 300 rotations in Los Angeles abrasion machine without the steel spheres at a rate of 30 to 33 revolutions per minute and a temperature of 25°C ± 1°C. The abrasion, expressed as a loss in mass, is charted with respect to the binder content. The wear loss decreases when the binder content increases with the curve slope downward and becomes flat when a certain percentage of bitumen is reached, which corresponds to the minimum binder content needed to ensure adequate adhesion. The abrasion loss from the Cantabro test should not exceed 20% on the unaged specimens. The inflection point is the minimum asphalt content which the sample mixture can retain its shape under the condition after compaction. The optimum asphalt content is determined as the average of the two asphalt contents. Abrasion tests on aged (7 days @ 60°C) samples must also be conducted with abrasion loss not exceeding 30% on the aged specimens.

3. Construction Requirements

The construction requirements shall be in accordance whenever applicable with Item 307 Bituminous Plant – Mix Surface Course (General) subsection 307.3 Construction Requirements.

3.1 Weather Limitations

Asphalt paving mix shall not be placed on any wet surface or when weather conditions will otherwise prevent its proper handling or finishing. It shall only be placed when the mix can be compacted to the specified density. No work shall commence when rain is imminent and all works should be suspended when it is raining and asphalt concrete delivered to the site shall be returned to the Contractor without compensation.

DEPARTMENT ORDER NO. <u>60</u> Series of 2006 Annex Page 5 of 7

3.2 Construction Equipment

The Contractor shall provide a minimum of two (2) paving gangs for each Contract where necessary.

The Contractor shall have a minimum of two pavers, each with a capacity of not less than 40 tonnes per hour and are steel – wheeled rollers.

For the smooth operation of the works, the Contractor shall have an asphalt plant with a manufacturer quoted capacity of not less than 120 tonnes/hour for the purpose of this Contract. The Asphalt Concrete plant shall be equipped with a separate bitumen tank with capacity of not less than 20 tons for the purpose of storing the approved polymer modified bitumen.

Rolling should be carried out using a tandem, non-vibrating steel roller weighing not less than 6 tons.

3.3 Placement

Before commencing the paving work, it shall be the responsibility of the Contractor to check that all tools, equipment and machines necessary for the job are on the site and in proper working conditions. A competent paver operator shall be operating the paving machine throughout the duration of the works. All rollers to be used must be checked to ascertain that they contain water which are not muddy or in any way contaminated with chemicals.

A representative from the Contractor well versed in asphalt laying work must be on site and be present throughout the duration of the works to organize and supervise the works and to handle all contingencies which may arise.

The underlying surface shall be clean before placing the mix. The approved tack coat of bitumen emulsion shall also be spray-applied at a rate of at least 0.54 liter per sq.m. to completely cover the surface where the Porous Asphalt Pavement is to be laid.

During the placement, the mix temperature shall not deviate from the mixing temperature by more than 10°C. The temperature shall be measured at a point 100mm within the load on the truck.

The asphalt paver hopper shall not left more than half empty unless new mix is immediately available to fill it up. In the event of break for rest or when the machine has remained idle for more than 15 minutes, the mix shall be fully discharged and joints constructed if no new mix is added.

As far as possible, the paving work shall cover the entire pavement width within one day.

DEPARTMENT ORDER NO. <u>40</u> Series of 2006 Annex Page 6 of 7

3.4 Laying Temperature

The temperature of Plant mixtures in the spreader hopper shall be around 140°C at the time of spreading depending on the ambient temperature.

3.5 Compaction Temperature

Compacting temperatures should be determined by establishing the temperature range at which the Polymer Modified Bitumen obtains an SF viscosity of 160 ± 15 sec or depending on the recommendation of the Polymer Modified Bitumen supplier. Initial compaction should stop before it reaches minimum. The surface shall be rolled when the mixture is in proper condition and when rolling does not cause undue displacement, cracking or shoving.

Firstly use a 3 - 4 metric ton static steel-wheeled rollers to compact the porous asphalt for 4 passes. Then followed by another 2 passes by using 6 - 8 metric ton steel wheeled rollers to finish the compaction.

The compacted porous asphalt concrete shall be opened to traffic movement at ambient temperature.

3.6 Acceptance Procedures.

Acceptance Procedures for Petron PMB shall conform to the applicable requirements of Item 702; subsection 702.4 Acceptance Procedures for Bituminous Material.

4.0 Method of Measurement

The area to be paid for under this item shall be the number of square meters (m²) of porous asphalt pavement with Petron PMB placed, compacted and accepted.

5.0 Basis of Payment

The accepted quantity, measured as prescribed in Section 4, shall be paid for at the contract unit price for Porous Asphalt Pavement with Polymer Modified Bitumen (Petron PMB) which price and payment shall be full compensation for furnishing all materials, handling, mixing, hauling, placing, rolling, compacting, labor, equipment, tools and incidentals necessary to complete this item.

DEPARTMENT ORDER NO. <u>4</u>⁰ Series of 2006 Annex Page 7 of 7

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
1	Porous Asphalt Pavement with Polymer Modified Bitumen (Petron PMB)	Square Meter

REFERENCES :

- 1. CONSTRUCTION OF PILOT ROAD RESEARCH PROJECT USING POROUS ASPHALT PAVEMENT WITH POLYMER MODIFIED BITUMEN (PMB – PETRON) BY DPWH – BRS – RDD (MAY 2004)
- 2. DPWH STANDARD SPECIFICATION FOR HIGHWAYS, BRIDGES AND AIRPORTS, VOLUME II (2004)

AJDELAVEGAHB