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

MAR 10 2006

DEPARTMENT ORDER)
NO. 19)
Series of 2006) 03-13-06

SUBJECT: Use of Cellulose Fiber (Technocel 1004/Topcel) as Additive to Stone Mastic Asphalt (SMA)

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 Cellulose Fiber (Technocel 1004/Topcel) as Additive to Stone Mastic Asphalt (SMA), to absorb the excess binder and to improve the properties of the asphalt mix subject to its specifications hereto attached. A Certificate of Conditional Approval had been issued by this Department, accrediting the use of Cellulose Fiber (Technocel 1004/Topcel) in DPWH projects from May 2003 until May 2008.

This order takes effect immediately.

HERMOGENES E. EBDANE, JR.
Acting Secretary

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SPECIFICATION FOR
STONE MASTIC ASPHALT (SMA)

Description

The Stone Mastic Asphalt (SMA) is a gap graded hot mix asphalt surface course laid on the proposed base in accordance with this specification and in conformity with the lines, grades and typical cross-section shown in the plan within the tolerances specified or established by the Engineer.

Materials Requirements

Composition and Quality of Stone Mastic Asphalt Mixture

The Stone Mastic Asphalt shall be composed of high proportion of coarse aggregates, fine aggregates, mineral filler and a bituminous material mixed in a central plant. A pure cellulose fiber (Technocel 1004/Topcel) which is non-polymer and non-bitumen coated type may be added to the mix to absorb the excess binder and to improve the properties of the asphalt mix.

At least three weeks prior to 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 binder material 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 mixtures furnished for the project shall conform thereto within the following ranges of tolerances:

Aggregate Fraction	Permissible Variation from JMF (%)	
	Individual Results	Average of Three Consecutive Results
Coarser than 2.36 mm	± 5	± 3
2.36 mm – 0.075 mm	± 3	± 2
Binder Content	± 0.5	± 0.3

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

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

The mixture shall have a minimum dry compressive strength of 1.4 MPa (200 psi).

The mixture shall have an index of retained strength of not less than 70 when tested by AASHTO 165. For aggregates having a maximum sizes over 25 mm (1 inch), AASHTO 165 will be modified to use 150 mm x 150 mm (6x6 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 (1400 psi), with no appreciable holding time after each application of the full load.

Stone Mastic Asphalt Mixture

The kind of gap graded bituminous mixture to be used will be as called for in the Bill of Quantities while the type and grade will be specified in the special provisions. The grade may be changed one step by the Engineer at no change in unit price. The bituminous material shall be asphalt cement or modified bitumen and shall conform to the applicable requirements of Item 702, Bituminous Materials.

Coarse Aggregates

Coarse aggregates retained on the 4.75 mm (No. 4) sieve shall be crushed stone/rock, crushed slag and unless otherwise stipulated, shall conform to the quality requirements of AASHTO M 79-74. It shall conform to the applicable requirements of Section 703.5.1, Course Aggregates of Item 703.

Fine Aggregates

Fine aggregates passing the 4.75 mm (No. 4) sieve shall consist of natural sand, stone, stone screenings or slag screenings or a combination thereof and unless stipulated shall conform to the quality requirements of AASHTO M 29 (ASTM D 1073). It shall conform to the applicable requirements of Section 703.5.2, Fine Aggregates of Item 703.

Recommended Gradation Target Value Ranges

Maximum Aggregate Sieve Designation, mm		Grading 'A' 19.0 mm (3/4") Passing, %	Grading 'B' 9.50 mm (3/8") Passing, %
19.00	(3/4 inch)	90-100	100
12.5	(1/2 inch)	55-85	100
9.5	(3/8 inch)	-	90-100
4.75	(No. 4)	-	30-50
2.36	(No.8)	18-35	20-30
0.60	(No. 30)	-	-
0.30	(No. 50)	-	-
0.075	(No. 200)	3-13	8-13
0.02		3	-
Binder Asphalt Content % by Weight of Mix		4.5-6.5	5.5-7.0
Voids in Mix		4.0-8.0	3.0-5.0
Cellulose fibers (Technocel 1004/Topcel)		0.3-0.4	0.3-0.4
Layer Depth (mm)		50	50

Stabilizing Additives

Cellulose fibers (Technocel 1004/Topcel) may be used as additives to Stone Mastic Asphalt to inhibit the loss of bituminous binder by drainage from the aggregate. The Technocel 1004/Topcel is a pure cellulose fiber, in pellets form shall conform to the following data sheet:

a. Appearance	Grey cylindrical fiber pellets
b. Residue on Ignition (%)	15 (approx.)
c. Moisture Content (%)	6 (approx.)
d. Ph Value (%)	7 (approx.)
e. Bulk Density (g/l)	25 (approx.)
f. Bitumen/Polymer Content (%)	0
g. Cellulose Fiber (% by Weight)	0.3-0.4 (3-4 kgs./m.t.)
h. Sieve Analysis (Alpine Air Draught Sieve) < 800 um(%) < 200 um(%) < 32 um(%)	 85 (approx.) 50 (approx.) 15 (approx.)

Mineral Filler

Mineral filler shall be the fraction of fine aggregates that predominantly passes the 0.075 mm (No. 200) sieve. It may consists of finely divided mineral matter such a rock dust, slag dust, hydrated lime, hydraulic cement, fly ash or other suitable mineral matter. It shall be free from organic impurities and at the time of use, shall be sufficiently dry to flow freely and shall be essentially free from agglomerations. It shall conform to the applicable requirements of Item 703-A, Mineral Filler.

Proportioning of Mixture

The proportion of bituminous materials, on the basis of total dry aggregate, shall be from 5.0 to 8.0 mass percent. The exact percentage to be used shall be fixed by the Engineer in accordance with job mix formula and other quality control requirements.

Pure cellulose fibers, in pellets form, are usually added to the dry mix aggregates in the amount of 0.3 to 0.4 percent by weight (3 to 4 kgs. per metric tonnes) of bituminous mixture. Mineral filler shall be added to the mixture during the mixing operation in the amount of one-half to one (0.5 to 1.0) mass percent, dry aggregate basis. The lower percentage limit is applicable to aggregates which are predominantly calcareous.

Construction Requirements

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

Weather Limitations

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

Mixing Procedure with Cellulose Fiber Additives

a. Add the pure cellulose fibers, in pellets form, on the dry mix aggregates and allow approximately 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.

b. Add/spray bitumen/asphalt cement

c. The standard wet mixing time shall be observed to ensure adequate blending with asphalt cement.

Laying

The mixture shall be placed at a temperature of not less than 135^0C and a maximum of 180^0C 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 at may be practicable.

Compaction

Rolling shall be continued until roller marks are eliminated and a maximum of at least 97% of the theoretical density has been obtained. After the in-placed

density have been achieved, rolling operations should stop, after at least 8 passes, to avoid migration of asphalt cement and filler to the compacted pavement.

Vibratory compaction shall only be used after the static rollers have been applied and when the temperature of the mixture is sufficiently high. Vibratory rolling shall be limited to a maximum of 3 passes at a mixture temperature of not less than 100^0C.

The newly paved section shall be closed to vehicular traffic until such time that the temperature lowers to 60-70^0C.

Marshall Mix Design Criteria

Mix Criteria	Medium Traffic Surface & Base		Heavy Traffic Surface & Base	
	Min.	Max.	Min.	Max.
Compaction, no. of blows	50		75	
Marshall Stability (N)	5338		8006	
(lbs.)	1200	-	1800	-
Flow, 0.25 mm (0.01 in.)	8	16	8	14
Air Voids, %	3	5	3	5
Voids in Mineral Aggregate, %	-		-	
Voids filled with asphalt, %	65	78	65	75
Immersion Compression Test	For Item 310			
Stability, Kpa				
Dry	1400 min.			
Wet	-			
Index of Retained Strength, %	70 min.			
Dynamic Stability, pass/mm	-			
Rate of Deformation, mm/minute	-			
Draindown Test, %	0.3% max.			

Method of Measurement

The bituminous mixture (Stone Mastic Asphalt) will be measured by square meter (sq. m.). 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 will not be permitted as a method of measurement.

Basis of Payment

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

Payment will be made under:

Payment Item Number	Description	Unit of Measurement
SPL-SMA	Stone Mastic Asphalt Surface Course Hot-Laid	Square Meter

References:

1. DPWH Standard Specification for Highways, Bridges and Airports, Volume II (1995)

2. Specification for Stone Mastic Asphalt Material, New Zealand Bitumen Contractors Association

3. Research on Stone Mastic Asphalt (SMA) with Technocell 1004/Topcel Cellulose Fibers by RDD-BRS-DPWH

Department of Public Works and Highways

Product Accreditation Scheme

CERTIFICATE OF CONDITIONAL APPROVAL

This is to certify that

Technocel 1004/Topcel Cellulose Fiber

which is supplied by

Henkel Philippines, Inc.
3/F Alabang Business Tower,
Acacia Road, Madrigal Business Park,
Alabang, City of Muntinlupa

is accredited for use in DPWH projects as an additive to Stone Mastic Asphalt (SMA), subject to the specifications for Stone Mastic Asphalt (hereto attached) as well as 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 provisions of the aforementioned Department Order.

Conditional Approval No. : *001*
Date Issued : *May 2003*
Expiry Date : *May 2008*

FLORANTE SORIQUEZ
ACTING Secretary