097.13 DPWH
03-18-2019

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

19-1326

MAR 0 4 2019

DEPARTMENT ORDER No. 29 Series of 2019 03.18.19

SUBJECT : Inclusion to Item 311 – Portland Cement Concrete Pavement of Items 311(7) and 311(8) - Macro Synthetic Fiber, Unreinforced and Reinforced, Respectively

This Department Order prescribes the Standard Specification for Macro Synthetic Fibers for use as additive to Portland Cement Concrete Pavement, which was developed through successful research studies and various pilot trials conducted by the Bureau of Research and Standards.

A Certificate of Product Accreditation has been issued by this Department recognizing the use of BarChip (Macro Synthetic Fibers) in various DPWH projects.

This Standard Specification shall form part of Item 311, Portland Cement Concrete Pavement of the DPWH Standard Specifications for Highways, Bridges and Airports, Volume II, 2012 Edition and will be included in the Project and Contract Management Application (PCMA).

This Order supersedes Department Order No. 110, Series of 2014 (*DPWH Specification on the Use of Elasto Barchip - Synthetic Fibers in Portland Cement Concrete Pavement*) and shall take effect immediately.

Department of Public Works and Highways
Office of the Secretary
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MARK A. VILLAR
Secretary

Encl.: a. Inclusion to Item 311 – Portland Cement Concrete Pavement; DPWH Standard Specifications for Item 311(7) - Macro Synthetic Fiber (Unreinforced) and Item 311(8) – Macro Synthetic Fiber (Reinforced)

b. Certificate of Product Accreditation for BarChip48 (Macro Synthetic Fibers)

14.1.2 FET/RGT

DPWH Standard Specifications for Items 311(7) and 311(8) - Macro Synthetic Fiber, Unreinforced and Reinforced, Respectively

1.0 Description

This Item shall consists of furnishing and placing of Macro Synthetic Fiber in Portland Cement Concrete Pavement (PCCP), with or without reinforcement, constructed on the prepared base in accordance with this specification and in conformity with the lines, grades, thickness and typical cross-section shown on the Plans.

Macro Synthetic Fiber is an additive to Portland Cement Concrete Pavement to create concrete composites that are more durable than plain concrete. It can provide improved flexural ductility and toughness, fatigue capacity, and abrasion and impact resistance. It impedes crack development and slows crack growth, while it also provides increased load capacity in pavements that have already cracked. It can be used in areas prone to flooding and where traffic is heavy. It can also reduce spalling at contraction joints by keeping them tighter and more stable than the regular PCCP.

2.0 Material Requirements

PCCP with Macro Synthetic Fibers shall conform to the requirements of Subsection 311.2, Material Requirements of Item 311, Portland Cement Concrete Pavement

2.1 Macro Synthetic Fiber

Macro Synthetic Fibers is a monofilament polypropylene extract fiber, non-toxic and not hazardous to health and is resistant to acid and alkali designed to enhance the overall quality of concrete.

Properties of Macro Synthetic Fibers

Type of Certification	-	Non-metalic high performance macro synthetic fibers shall have a CE Mark and a valid up-to-date Certificate of Conformity to Class II Fibers
Material	-	Modified Olefin
Design	-	Macro monofilament
Fiber Length	-	48 mm (Min.)
Diameter	-	0.72 mm
Shape	-	Rectangular – Fully embossed
Color	-	White
Specific Gravity	-	0.90 – 0.92
Tensile Strength	-	640 MPa (Min.)
Young's Modulus	-	10 GPa (Min.)
Melting Point	-	159 °C – 179 °C
Matrix Bonding	-	Excellent

2.2 Admixture

Air-entraining admixture shall conform to the requirements of AASHTO M154, Standard Specification for Air-Entraining Admixtures for Concrete.

Chemical admixture, if specified or permitted, shall conform to the requirements of AASHTO M194, Standard Specification for Chemical Admixtures for Concrete.

Fly Ash, if specified or permitted as a mineral admixture and not exceeding 20% partial placement of Portland Cement in concrete mix shall conform to the requirement of ASTM C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

Admixture/s maybe added to the concrete mix to produce some desired modifications to the properties of concrete if necessary, but not as partial replacement of cement. If specified, monofilament polypropylene synthetic fibers, which are used as admixture to prevent the formation of temperature/shrinkage cracks and increase impact resistance of concrete slabs shall be applied in the dosage rate recommended by its manufacturer.

2.3 Calcium Chloride

It shall conform to AASHTO M144, Standard Specification for Calcium Chloride.

2.4 Packaging, Dispensing and Storage of Macro Synthetic Fibers

Macro Synthetic fibers are packaged in the desired measured quantities in either degradable paper bags, plastic bags and/or bulka bags. Paper bags can be put directly into the concrete track or opened and the loose fiber dispensed. The plastic bags is not degradable and will need to be opened before dispensing into the concrete track.

All boxes of fibers shall be stored immediately upon delivery at the site, on a clean dry surface, under cover and in the place.

3.0 Construction Requirements

PCCP with Macro Synthetic Fibers shall conform to the requirements of Subsection 311.3, Construction Requirements of Item 311, Portland Cement Concrete Pavement.

3.1 Addition, Mixing and Pumping of Macro Synthetic Fibers in Concrete Mix

The amount of Macro Synthetic Fiber to be added in a concrete mix shall not be less than 1.25 kg per cubic meter of concrete. The total fiber requirement shall be added first to the mixer with the initial batch water to achieve optimum fiber distribution during mixing operation. The bag will release the fiber which will be homogenously distributed throughout the mix after five (5) minutes of mixing.

The fiber shall be pumped through 50 mm rubber hoses without difficulty. Precaution should be taken to ensure the fibers pass freely through the pump hopper grate.

3.2 Curing

It shall conform to the requirements of Subsection 311.3.15, Curing, Item 311 – Portland Cement Concrete Pavement.

If steam curing at a temperature in excess of 160 °C is to be used, polypropylene fibers should not be used.

4.0 Method of Measurement

The area to be paid for under Items 311 (7) and 311 (8) shall be the number of square meters (m^2) of concrete pavement placed and accepted in the completed pavement. The width for measurement will be the width from outside edge to outside edge of completed pavement as placed in accordance with the Plans. The length will be measured horizontally along the center area of concrete pavement measured.

Macro Synthetic Fiber will be measured in kilogram (kg) as stipulated in the Detailed Unit Price Analysis.

5.0 Basis of Payment

The accepted quantity, measured as prescribed in Section 4, Method of Measurement shall be paid for at the contract unit price for Portland Cement Concrete Pavement and Macro Synthetic Fibers, which price and payment shall be full compensation for preparation of roadbed and finishing of shoulders, unless otherwise provided by the Special Provisions, furnishing all materials, for mixing, placing, finishing and curing all concrete, for furnishing and placing all joint materials, for sawing weakened plane joints, for fitting the prefabricated center metal joint, for facilitating and controlling traffic, and for furnishing all labor, equipment, tools and incidentals necessary to complete the item.

Payment shall be made under:

Pay Item (Number)	Description	Unit Of Measure
311 (7) a1	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Unreinforced), 0.20 m thick, 14 days	Square Meter
311 (7) a2	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Unreinforced), 0.23 m thick, 14 days	Square Meter
311 (7) a3	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Unreinforced), 0.25 m thick, 14 days	Square Meter
311 (7) a4	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Unreinforced), 0.28 m thick, 14 days	Square Meter
311 (7) b1	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Unreinforced), 0.20 m thick, 7 days	Square Meter
311 (7) b2	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Unreinforced), 0.23 m thick, 7 days	Square Meter
311 (7) b3	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Unreinforced), 0.25 m thick, 7 days	Square Meter
311 (7) b4	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Unreinforced), 0.28 m thick, 7 days	Square Meter
311 (7) c1	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Unreinforced), 0.20 m thick, 3 days	Square Meter
311 (7) c2	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Unreinforced), 0.23 m thick, 3 days	Square Meter

Pay Item (Number)	Description	Unit Of Measure
311 (7) c3	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Unreinforced), 0.25 m thick, 3 days	Square Meter
311 (7) c4	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Unreinforced), 0.28 m thick, 3 days	Square Meter
311 (8) a1	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Reinforced), 0.20 m thick, 14 days	Square Meter
311 (8) a2	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Reinforced), 0.23 m thick, 14 days	Square Meter
311 (8) a3	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Reinforced), 0.25 m thick, 14 days	Square Meter
311 (8) a4	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Reinforced), 0.28 m thick, 14 days	Square Meter
311 (8) b1	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Reinforced), 0.20 m thick, 7 days	Square Meter
311 (8) b2	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Reinforced), 0.23 m thick, 7 days	Square Meter
311 (8) b3	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Reinforced), 0.25 m thick, 7 days	Square Meter
311 (8) b4	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Reinforced), 0.28 m thick, 7 days	Square Meter
311 (8) c1	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Reinforced), 0.20 m thick, 3 days	Square Meter
311 (8) c2	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Reinforced), 0.23 m thick, 3 days	Square Meter
311 (8) c3	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Reinforced), 0.25 m thick, 3 days	Square Meter
311 (8) c4	Portland Cement Concrete Pavement with Macro Synthetic Fibers (Reinforced), 0.28 m thick, 3 days	Square Meter

References:

1. Department Order No. 110, Series of 2014 - DPWH Specification on the Use of Elasto Barchip - Synthetic Fibers in Portland Cement Concrete Pavement
2. Final Report on Large Scale Pilot Trial on the Use of BarChip 48 (Macro Synthetic Fiber) in PCCP; Agbannawag – Bulo – Callagdao Section K0506+000 to K0507+000 Tabuk City, Kalinga, August 2018.
3. Product Data Sheet of Barchip48 from Elasto Plastic Concrete (https://barchip.com/wp-content/uploads/2017/11/EPC_PDS_BarChip48_2017_email.pdf)
4. ISO 2062:2009 - Textiles – Yarns from packages – Determination of single-end breaking force and elongation at break using constant rate of extension (CRE) tester

Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
CENTRAL OFFICE
Manila

Certificate of Product Accreditation

This is to certify that

BarChip

(Macro Synthetic Fibers)

Supplied by:

Blue Ocean Chemtrade, Inc.

2/F 1260 Juan Luna St., Tondo, Manila

is duly accredited for use in DPWH projects as an additive to paving concrete subject to its specifications (hereto attached) pursuant to the provisions of DPWH **Department Order No. 189, series of 2002**.

Accreditation Number	:	**0010**
Date Issued	:	**December 6, 2018**

EMIL K. SADAIN, CESO I
Undersecretary for UPMO Operations and Technical Services