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02.20.2012

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

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DEPARTMENT ORDER)
No. 06)
Series of 2012 02.20.12)
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SUBJECT: **DPWH Standard Generic Specification for Coconet Bio-Engineering Solutions, Item 622**

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 increasing application of coconet bio-engineering solutions in our projects, the attached **DPWH Standard Generic Specification for Coconet Bio-Engineering Solutions, Item 622** is hereby prescribed, for the guidance and compliance of all concerned.

This specification shall from part of the revised edition of the DPWH Standard Specification (Volume II – Highways, Bridges and Airports).

This Order shall take effect immediately.

ROGELIO L. SINGSON
Secretary

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DPWH GENERIC SPECIFICATION FOR

ITEM 622 - COCONET BIO-ENGINEERING SOLUTIONS

622.1 Description

This item covers installation of coconut coir fiber made into geonets such as coconets, coco-logs, coco twines and coco peat as bioengineering materials for controlling soil erosion and slope stabilization in accordance with the cross section shown on the Plans or as directed by the Engineer.

622.2 Definition

For the purpose of this item, the following terms shall be defined:

a) Coconut Geonets - Any coconut coir fiber-based material such as Coconets, Cocologs, Coco peat, placed in sloping lands and embankments to hold the vulnerable soil and permit vegetative growth to control surface erosion and conserve the productivity of the soil.

b) Coconet - Handspun Coconut coir fiber twine woven into blankets of different density.

c) Coco-log - a tubular structure of coconut coir fiber blankets of different diameter filled with coco coir, and/or coco peat.

d) Coco coir twine - a string made of coconut coir strands twisted together.

e) Coco coir peat - a natural and residual materials from coconut coir which serves as soil conditioner

622.3 Material Requirements

622.3.1 Coconut Coir

Coconut coir fiber materials for use in fabrication of coconut geonets shall be a multi-cellular fiber with 12 to 24 microns in diameter and the ratio of length to diameter shall be 35. The fiber shall also be hygroscopic, with moisture content of 10% to 12% at 65% humidity and 22% to 55% at 95% relative humidity.

622.3.2 Coco-net and Coco-log/Fascine

Coco-net and Coco-log shall conform to Table 1 and Table 2 respectively.

Table 1
Physical Properties of Coco-net

PROPERTIES		COCONET 400	COCONET 700	COCONET 900
Thickness, mm		10.0 Min.		
Width, m		1.0 Min.		
Length, m		25.0 Min.		
Unit Weight 1 g/m^2		400±20	700±35	900±45
Diameter of Twine, mm *Hand spun*		5.0 mm ± 0.50 mm		
No. of Twines/m	*Crosswise Direction*	40 Min	40 Min	70 Min
	Lengthwise Direction	40 Min	70 Min	70 Min
Material		Woven Netting made from High Strength 100% Coconut fiber twine		
Color		Natural Earth Tone		
Tensile Strength, N/twine		150 Min.		
Elongation	*(Machine Direction), %*	26 Min.	34 Min.	42 Min.
	(Cross Machine Direction), %	32 Min.	38 Min.	32 Min.
"C" Factor		0.002		
Water Velocity, m/sec		2.7 Min.	3.35 Min.	4.26 Min.
Water Absorption, %		163 Min.	146 Min.	132 Min.
Slope Inclination, H : V		≤ 1:1	1:1 to 60^o	75^o

"C" Factor – Safety factor

Table 2
Physical Properties of Coco-log

Type of Coco-log/Fascine	Diameter (mm)	Weight (min.) (Kg/m)
Cocolog 100	100	2.0
Cocolog 200	200	4.5
Cocolog 300	300	10
Cocolog 400	400	20
Cocolog 500	500	30

622.3.3 Backfill

Backfill shall be in accordance with the approved Plan and shall conform to the requirements of Item 104 – Embankment.

622.3.4 Bamboo Stakes

Bamboo stakes shall be mature and shall be 30 to 40 mm in width and 300 mm long.

622.3.5 Live Plant Stakes (Live Kakuate or Ipil-ipil or Equivalent Species)

Live plant stakes shall be kept moist and installed the same day they were prepared and shall be 50 to 150 mm in diameter and 500 mm to 1000 mm in length.

622.4 Construction Requirements

622.4.1 Quality Control

The coconut geonets manufacturer shall be responsible for establishing and maintaining a quality control program to assure compliance with the requirements of this specification.

622.4.2 Equipment

Equipment and tools necessary for handling materials and performing all parts of the works shall be approved by the Engineer as to design, capacity and mechanical condition. The equipment shall be at the jobsite sufficiently ahead of the start of construction operations.

622.4.3 Site Measurement

Site measurements shall be done to prepare specific lengths of the coco-nets to conform the necessary area requirements and the necessary length for coco-logs to be installed/placed.

622.4.4 Preparation of Bed

Site for net installation shall be graded and sloped to the approved design and any runoff control such as diversions, dikes and berms shall be completed prior to installation. All depression/gullies and eroded portions shall be backfilled for the coco-nets to snugly come in contact with the soil surface. The face of the slope shall be smoothened. Rocks, clods, vegetation (deemed detrimental to the erosion control system to be installed), and other obstructions shall be removed from tip to toe of the slope to ensure complete contact of the coco-nets with the soil.

Existing vegetations that are considered not detrimental shall be retained, but shall be trimmed down to facilitate the installation of the coconut geonets.

622.4.5 Anchoring

1. Common Soil

   The coconut geonets shall be secured to the ground using bamboo pegs. An average of 3 pegs per square meter shall be used to ensure uniform contact of coco-net to the ground surface. For loose soils, longer pegs shall be used to have sufficient ground penetration to resist pullout.

2. Compacted Soil

   A combination of bamboo pegs and U-shaped wire staples may be used for compacted, hard to penetrate soil. An average of 3 pegs/staples per square meter shall be used to ensure uniform contact of coco-net to the ground surface.

3. Hard Rock

   The coconut geonets shall be anchored to solid rock surfaces using metal stake pins with a minimum diameter of 8.0 mm and length of 200 to 300 mm.

622.4.6 Installation/Placing of Coconut Geonets

The coconut geonets shall be used on critical cut slopes, embankments and disturbed soils generally steeper than 3:1, where water velocities are likely to wash out soils and new vegetation. Coco-nets shall be placed and anchored on the graded surface of the slope to maximize net contact with the slope surface. Installation shall begin at the top of the slope with the coco-net laid down and securely anchored 1.0 meter from the edge of

the slope by folding underneath the leading edges of the coco-net to ensure that no twines would come loose. After which the coco-nets shall then be unrolled downslope in the direction of the water flow. Adjacent coco-nets shall be installed side-by-side and shall be sewn together using coco coir twine. The coco-nets shall be laid loosely (not stretched) on the ground. Coco-net shall then be fastened and secured firmly to the ground in accordance to Subsection 622.4.5, Anchoring. Anchoring shall be at right angle to the ground surface.

When necessary, coco-log/fascines shall be used in conjunction with coco-nets installation to reduce long slopes and as major stopper of downward movement of soil as rainwater carries them downslope. It shall be placed across the slope on contour and shall be pegged with lives stakes (622.3.5) to the ground at 1.0 m intervals. For slopes with loose soil, the coco-logs/fascines shall be installed on trenches. The trench shall be deep enough to accommodate half the diameter of the coco-logs. Contour interval shall be 1.0 m to 8.0 m depending on the steepness of the slope and the erodibility of the soil.

622.4.7 Placing of Coco Coir Peat (Soil Conditioner)

After the installation of coconut geonets, coco coir peat-soil mixture shall be distributed evenly on the net protected slope. Thumping and raking shall follow to make the mix settle underneath to ensure appropriate soil moisture and nutrient release as grasses and other planting materials shall be planted.

622.4.8 Vegetation

1. Vetiver Grass Hedgerow

Live hedgerow of vetiver grass (or any local suitable species) slips shall be planted on the slopes at 150 mm plant interval depending on the erosivity of the soil, the steepness of the slope, and the design waterflow. Row distance shall likewise depend on the steepness of the slope, and shall range from 1.0 to 4.0 m.

2. Grass cover

Fast growing leguminous creeping/twining grass cover shall be used for slope faces requiring immediate vegetative cover. It shall be applied to the soil at a rate depending on the desired plant density and the calculated on-site mortality rate of the plants.

3. Trees

If trees shall be used to stabilize a slope, species that have sturdy, long, and deep-penetrating roots shall be selected.

Whereas, in water channels or rivers, appropriate plants that can thrive in water or water saturated condition, while functioning to prevent bank erosion shall be used. Numerous other considerations shall be taken into account in choosing the proper planting materials. These plant properties shall include, drought resistance, effect on local ecology, aesthetics, etc.

622.4.9 Performance Monitoring

Post project monitoring shall include checking on any breaks of the installed coconut geonets especially at the point of junctions, the growth of grasses and the manifestation of any failure of germination of plants and the sudden outburst of rain that might have inflicted damaged to some sections. Repair works shall be done on damaged sections of the slope and replacement shall be done in case of plant mortality.

Watering, weeding and fertilization may be done subject to the discretion of the contractor's bioengineer or plant specialist. Maintenance activities shall be terminated upon the recommendation of the bioengineer and approval of the owner.

622.5 Certification

The manufacturer shall file with the purchaser a certificate stating the name of the manufacturer, the composition of the coconut geonets as bioengineering materials and other pertinent information so as to fully describe the coir materials. The manufacturer shall include in the certificate a guarantee stating that the bioengineering materials that are furnished meet the required specifications. The certificate shall be attested by a person having legal authority to bind the company. Either mismarking or misrepresentation by the manufacturer shall be reason to discontinue acceptance under these specifications. The discontinuance of acceptance will be considered to be notice to all wholesaler, jobbers, distributors, agents and other intermediates handling the manufacturer's product.

622.6 Method of Measurement

The area to be paid for under this Item shall be the number of square meter (m^2) of coco-net, linear meter for coco-log, square meter (m^2) of live vetiver grass hedgerow and square meter (m^2) of effective vegetative growth for grass cover, installed/placed and accepted into the completed project.

622.7 Basis of Payment

The accepted quantity, measured as prescribed in Section 622.6 shall be paid for at the contract unit price for coconut geonets, which price and payment shall be full compensation for preparation of bed and furnishing of all materials for placing/installation of coconut geonets and for furnishing all labor, maintenance of plants, equipment, tools and incidentals necessary to complete the Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
1	Coco-net	Square meter
2	Coco-logs/Fascine	Linear meter
3	Vegetation	Square meter