

# MODULAR SYSTEM FOR VEGETATED REINFORCED SOIL SLOPES

## GEOFABRICS GEOMESH NATURAL WIRE MESH SYSTEM

### INSTALLATION GUIDE

Geofabrics® Geomesh™ Natural is manufactured from a double-twisted steel wire mesh that forms an inclined front face modular unit with an integrated tail section. Geomesh Natural incorporates a welded mesh panel with supporting brackets and is supplied with an erosion control blanket to encourage vegetation. It is used with a uniaxial geogrid to form steep reinforced soil slopes up to 70 degrees.

### IMPORTANT INFORMATION

#### RESPONSIBILITIES

The contractor is fully responsible for carrying out the works in accordance with the construction design documents, technical specifications, and contract documents (which are not provided to Geofabrics). To support the contractor, Geofabrics has included recommendations in this guide; however, these do not absolve the contractor from adhering to all applicable safety regulations and procedures.

Geofabrics accepts no liability for any inaccuracies or omissions in the execution of the works, nor for any resulting consequences.

It is the responsibility of both the contractor and the client to ensure that all site personnel involved in the work have access to this guide and are familiar with its contents.

#### MATERIALS REQUIREMENTS BEFORE STARTING

This work shall consist of furnishing, assembling and filling Geomesh Natural units and uniaxial geogrid as specified in the contract to the dimensions, lines and grades shown on the plans, or determined by the engineer.

#### GEOMESH

Geomesh Natural units are manufactured with all components mechanically connected at the production facility. Geomesh Natural has a 70-degree inclined face at 600 mm vertical height. Units are delivered to site folded and compressed in bundles weighing approximately 540 kg and measuring approximately 2 x 1 m in plan and 0.5 m in height; type and size determine the number of units per bundle.

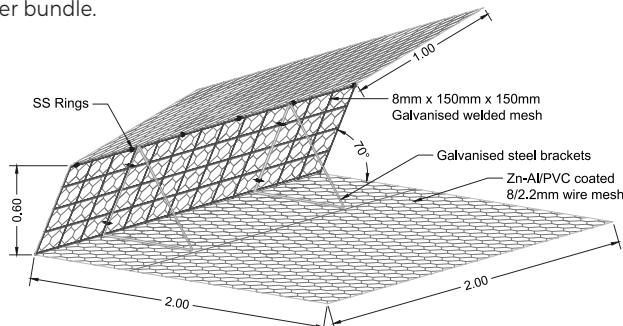


Fig. 1 - Geomesh Natural Unit

#### LACING WIRE

Lacing wire is supplied in coils and is used to assemble and interconnect the units, and for facing support. Refer to Table 1 for the correct lacing wire to match the Geomesh coating.

GEOMESH	LACING WIRE
Zn-Al/PVC Geomesh Natural	Zn-Al/PVC lacing wire

Table 1 – Lacing wire type

#### RING FASTENERS

To increase the installation productivity, steel ring fasteners are used to assemble and connect units (Fig 2).



The rings shall comply with EN 10223-3 and are supplied in box (1600 rings/box); these rings are stainless steel for use with polymer coated mesh. The indicative quantity of rings required is listed in table 2.

Fig. 2 - Fastening Rings

#### EROSION CONTROL BLANKET

An erosion control blanket is supplied in rolls of sufficient width to fully cover the mesh face.

## VEGETATIVE SOIL

Vegetative soil should be loamy type soil without lumps and capable of good compaction and should typically contain 3% to 20% of organic material suitable for long term sustainability of vegetation. The soil should be fertile and friable and should come from 200 mm to 300 mm depths in the field. Vegetative soil should be free from wood and stones larger than 50 mm in maximum dimension. Placement is made to the specified thickness and profile into the face of the unit prior to the placement of the structural backfill.

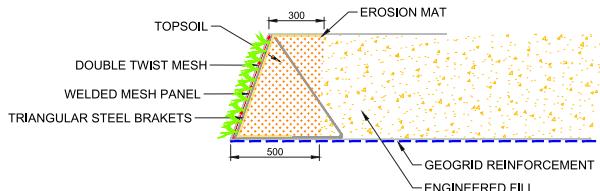


Fig. 3 – Topsoil placement

## STRUCTURAL FILL

Reinforced soil structures shall be constructed from either good quality, free draining granular fill or selected frictional fill. The structural soil shall be in accordance with the geotechnical characteristics specified by the engineer.

## GEOGRID REINFORCEMENT

A uniaxial geogrid shall be supplied that satisfies the design strength requirements as specified by the engineer after considering the application of all material reduction factors for creep, mechanical damage, chemical and environmental effects.

The geogrid shall be supplied wrapped with a plastic covering to protect it from damage during shipping and handling and shall be identified with a label showing the product name, grade and the roll number. All geogrids shall be stored in a manner that ensures the integrity of the wrapping, core, and label, as well as the geogrid's physical properties. This can be accomplished by elevating the geogrid off the ground on dunnage and ensuring that the protective wrapping remains intact until use.

## TOOLS

Pneumatic lacing tool (refer to Fig. 4) is suitable for lacing with stainless-steel rings. Pneumatic lacing tool is to be connected to an air compressor using an air pipe (max 10 mm and max length 30 m).

The air compressor regulator should be set at 100 to 105 psi (690 to 720 kPa). Never operate above 115 psi (795 kPa). A 15 CFM air compressor is capable of a minimum delivery of 10 CFM with an air tank capacity of at least 48 litre.



Fig. 4 – Pneumatic lacing tool

## REQUIRED MACHINERY FOR INSTALLATION

**Geomesh Natural** – The individual units can be transported by a minimum of two workers. Their unloading from trucks shall be carried out with mechanical equipment (telehandler etc.)

**Backfilling** – The backfill soil shall be transported by trucks and unloaded with the help of mechanical excavators. The choice of the machinery is left to the contractor as it depends on the condition of access to the site and the volume of soil fill. It is strictly prohibited to use the heavyweight machinery close to the facing (within 1.5 m from the facing).

**Compaction** – Vibratory rollers of adequate dimensions compatible with the filling material shall be used. For uniformly distributed fine sand, it is suggested using non vibrating rollers. For the compaction of the backfill soil close to the facing, within a minimum width of 1.5 m, lightweight handheld compaction devices, such as vibratory plate compactors and small vibratory rollers shall be used.

## INSTALLATION

### FOUNDATION PREPARATION

The foundation on which the geogrid and Geomesh Natural are to be placed shall be level and graded to the elevations as shown on the project construction drawings (Fig. 5).

The foundation for Geomesh Natural shall be smooth, and free from surface irregularities, loose material and vegetation, in accordance with the project specifications.

The foundation should be compacted to the engineer's specification to ensure uniform bearing capacity and minimise differential settlements. When founding on a rock, a concrete levelling pad is recommended.



Fig. 5 – Prepared foundation

### SETTING OUT

Points marked should be start of the slope, end of slope and any internal/ external angle changes or steps. Points required to be marked out must be at the front of the toe i.e. front base of slope at top of foundation level.

### GEOGRID PLACEMENT

The geogrid reinforcement shall be laid out in a manner so that the strength direction (roll direction) is perpendicular to the slope face. Proper geogrid orientation is of extreme importance due to the difference in geogrid strengths in either direction. The contractor will be responsible for proper geogrid orientation. All geogrids shall be cut to correct lengths and placed at the correct elevation as shown on the construction drawings.



Fig. 6 – Placing geogrid

## GEOMESH PLACEMENT AND ASSEMBLY

Each individual Geomesh Natural will be removed from the bundle and carried to and placed in their final position. Unfold on level ground and press out the unit to remove all factory folds.



Fig. 7 – Placing units in position

Raise the unit's facing, turn the triangular stiffening brackets perpendicular to the face and connect to the base panel with lacing wire or steel fasteners.



Fig. 8 – Raising panels into position

### CONNECTING UNITS

Adjoining units must be securely joined together using lasting wire or steel ring fasteners, along the facing, top edges and along the reinforcing panel to avoid movement during backfilling.



Fig. 9 – Connecting adjacent units with rings

Whenever a structure requires more than one layer of units, the upper unit shall also be connected to the top of the lower layer along the front reinforced bar using the same connecting procedures.

The indicative quantity of rings for connecting units is listed in table 2.

LOCATION	RING SPACING	NO. OF RINGS
A. 2m tie back	500mm	4
B. 1m return	500mm	3
C. 0.6m vertical facing	120mm	5
D. 2m horizontal facing*	120mm	17

\* Rings connecting top and bottom unit to be 100mm back from the front face

Table 2 – Quantity of rings

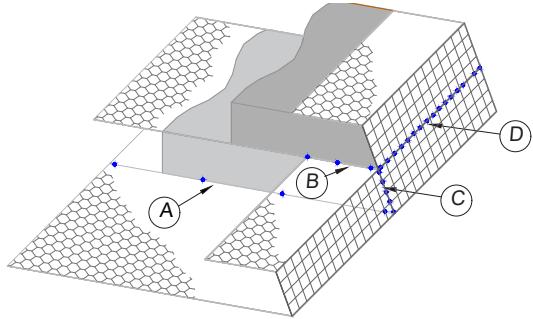
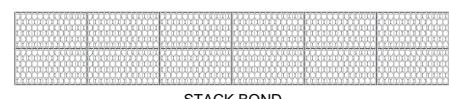


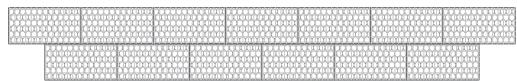
Fig. 10 – Connecting units with rings

### VERTICAL ALIGNMENT

Non-staggered (stack bond) Geomesh units have the same performance as staggered (stretcher bond) units, from a structural perspective.



STACK BOND



STRETCHER BOND

Fig. 11 – Vertical alignment options

### CONNECTING GEORIGID

Connecting the geogrid to the facing units is non-structural and has the purpose of holding the geogrid in position at the face allowing the free end to be pulled taut to remove any slack in the geogrid. The geogrid is to be held in tension until a layer of about 150 mm thickness of fill covers most of the geogrid.

### EROSION CONTROL BLANKET PLACEMENT

The biodegradable erosion control blanket is rolled out, placed through the triangular brackets located behind the front face of the Geomesh Natural units and fixed top and bottom to the mesh face.



Fig. 12 – Placing erosion control blanket

Slitting of the erosion control blanket in line with the triangular brackets is required to ensure that it extends horizontally back against the horizontal mesh by at least 300 mm top and bottom.



Fig. 13 – Slitting erosion control blanket

## PLACEMENT OF STRUCTURAL FILL

The approved specified fill shall be installed in accordance with the engineer's specification for the appropriate site conditions. Where no specific details are indicated then the fill used within the reinforced soil zone shall be in keeping with the particle grading selected for the design and placed in maximum 300 mm vertical loose lifts and compacted to a minimum of 95% of Standard Proctor Density.

Fill should be placed by plant such as an excavator bucket or a dozer with an opening bucket which causes the fill to cascade onto the grids and in a manner to eliminate geogrid wrinkles and/or geogrid movement or geogrid damage. A gap of 300 mm to 500 mm at the face is to be provided for placing of topsoil.

Compaction is to proceed parallel to the slope face, ensuring that the compacting machine does not come in contact with the mesh panel or within 1.5 m of the face element. Lighter compaction equipment should be used towards the front face zone.

Track equipment shall not operate directly on any exposed reinforcement. A minimum of 150 mm thick cover of fill must be maintained between the tracks of any plant and the reinforcement to avoid damage. Rubber-tired equipment may pass over the exposed reinforcement at low speeds without sudden braking or turning.



Fig. 14 – Compaction of structural fill

## VEGETATIVE SOIL PLACEMENT

Vegetative soil shall be placed in the 300 mm to 500 mm zone behind the Geomesh units and erosion control blanket to enable long-term sustainable vegetation growth. The soil should be firmly compacted by small machine compactor to ensure local settlement of the vegetative soil will not occur.



Fig. 15 – Topsoil placement

## TOLERANCES

Good earthworks construction practice should ensure meeting the specified tolerance limits. These includes structural soil fill selection, compaction methodology, moisture content control at each compacted layer and provision of a sloping gradient away from front face at the end of each construction day. For Geomesh reference can be made on the standard EN 14475 "Execution of special geotechnical works" (table C.9), considering the limits specified for reinforced soil structures having steel mesh as facing elements (Table 3).

	TOLERANCE
Alignment	± 100 mm
Longitudinal differential settlement	2 %
Compressibility	5 %

Table 3: Construction tolerances

## INSTALLATION PRODUCTIVITY

The installation productivity is dependent on volume, geometry and access to working area.

By referencing to a typical 5 men working team (1 foreman, 1 backhoe loader operator, 3 workers) operating 8 hours a day including filling and compaction, the following installation rates can be assumed:

GEOMESH HEIGHT (m)	CREW	AVERAGE PRODUCTIVITY PER CREW	
		MINIMUM FACE AREA	MAXIMUM FACE AREA
0.6	5	36	60

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