MODULAR SYSTEM FOR MECHANICALLY STABILISED SLOPED EARTH WALLS

GEOFABRICS GEOMESH ROCK WIRE MESH SYSTEM

INSTALLATION GUIDE

Geofabrics® Geomesh™ Rock is manufactured from a double-twisted steel wire mesh that forms an inclined front face modular unit with an integrated tail section. Geomesh Rock incorporates a welded mesh panel with supporting brackets and is supplied with a geotextile separator. It is used with a uniaxial geogrid to form steep reinforced soil slopes.

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 Rock 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 Rock units are manufactured with all components mechanically connected at the production facility. Geomesh Rock has a 70-degree inclined face at 600 mm vertical height. Other steeper face inclination such as 80-degree and unit vertical height of 760 mm is available on project requirement basis. Units are delivered to site folded and compressed in bundles weighing approximately 610 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.

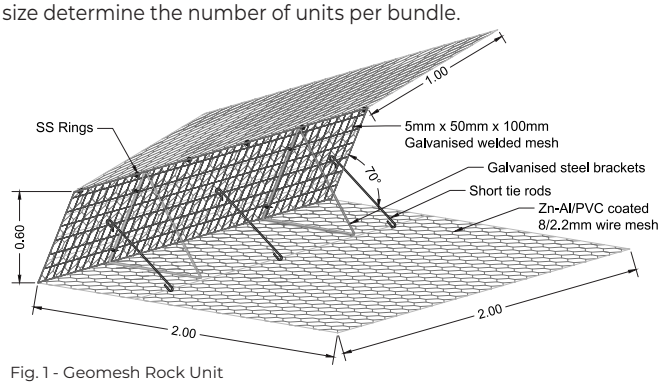

Fig. 1 - Geomesh Rock Unit

TIE RODS

Geomesh Rock units having 50 mm x 100 mm mesh face using rock fill in the range 40 to 80 are supplied with 3 short tie rods per unit. Tie rods are manufactured from 8 mm bar and are 630 mm long. Tie rods are optional with 80 to 200 mm gabion rock.

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 Rock coating.

GEOMESH	LACING WIRE
Zn-Al/PVC Geomesh Rock	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

GEOTEXTILE SEPARATOR

A nonwoven geotextile meeting TNZ F/7, NSW R63 & QLD MRTS27 Strength Class C and Filtration Class 1 is to be placed between the rock facing and structural fill for separation and filtration purposes.

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ROCK FILL

Rocks for the facing shall be obtained by any suitable quarrying method. Rocks shall be hard, angular to round, durable and of such quality that they do not lose their integrity on exposure to water or weathering during the life of the structure.

Rocks shall range between 80 mm and 200 mm. The range in sizes may allow for a variation of 5% oversize and/or 5% undersize rock, provided it is not placed on the exposed surface. The oversize rocks shall not be larger than 250 mm, while the undersize rock shall not be smaller than 50 mm. Sufficient hand manipulation of the rocks shall be performed to minimise voids and achieve a maximum density.

Rocks in the range 40 to 80 mm are suitable for 50 x 100 mm welded panels to bypass/reduce the manual arrangement of the stones. It is recommended to lightly tamp the 40 to 80 mm stone fill zone to limit settlement and avoid potential bulging.

The required stone volume for each Geomesh Rock unit is approximately 0.5 m^3 for m^2 of facing.

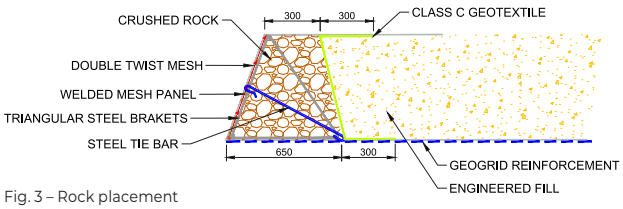

Fig. 3 – Rock placement

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 physical properties of geogrid. 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 Rock – 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 Rock 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 Rock 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 at the 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 Rock 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 lacing 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

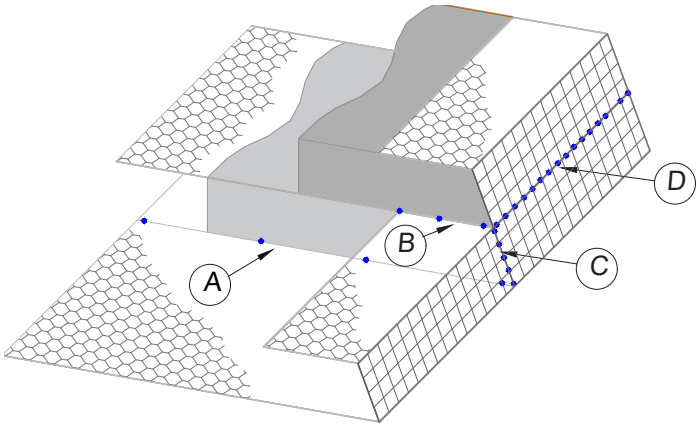

Fig. 10 – Connecting units with rings

VERTICAL ALIGNMENT

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

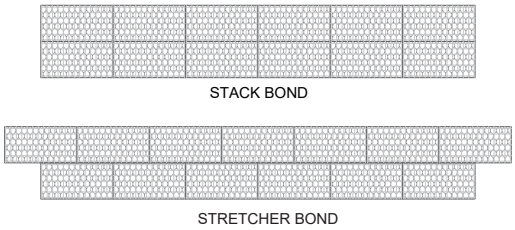

Fig. 11 – Vertical alignment options

CONNECTING GEOGRID

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.

TIE ROD INSTALL

Where required, rod ties have to be connected to welding point of the welded panel using their shaped edge while the opposite U-shaped end shall be connected to the shot transverse bar of the wire mesh base panel. The location of the tie rods as shown in figures 1 & 12.

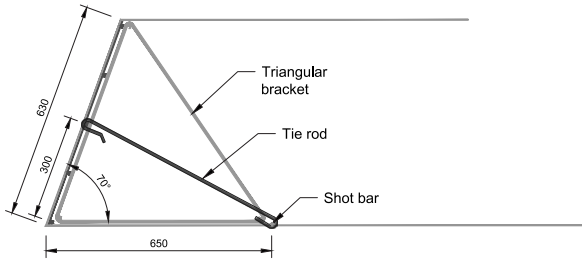

Fig. 12 – Position of tie rod

GEOTEXTILE PLACEMENT

A nonwoven geotextile is to be placed at the interface between the structural fill and rock. The width of the geotextile should be sufficient to cover the interface depth and extend 500 mm back top and bottom.

Fig. 13 – Laying out nonwoven geotextile

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 600 mm to 700 mm at the face is to be provided for placing of rock.

Fig. 14 – Fill placement and compaction

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.

Fig. 15 – Compaction close to the face

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.

ROCK PLACEMENT

Rocks in the range 80 to 200 mm will be positioned manually in order to have an average thickness of 40 to 50 cm. Sufficient hand manipulation of the rocks shall be performed to minimise voids and achieve a maximum density. It is recommended to lightly tamp the stones in the range 40 to 80 mm to avoid potential bulging. The use of timber boards between the rock and geotextile up against the structural fill can aid with the rock placement.

Fig. 16 – Rock 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	24	36