



Wrap Around Walls

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1. INTRODUCTION

This guideline provides the methods and procedures necessary for the correct installation of the RockGrid® PC composite geogrid as wrap-around facing in reinforced slopes. The document reflects minimum industry acceptable standards and general good practice procedures.

The guideline is to be used only in slopes steeper than 1:1 where some form of formwork for face containment is required. The details of the formwork may vary but generally the result will be a plane slope in the range of 60° to 70°. Slopes shallower than or equal to 1:1 generally do not require wrap-around faces. Refer to Kaytech’s appropriate “Installation Guidelines” where RockGrid® PC is used in other applications.

The installation of RockGrid® PC shall be in accordance with these the methods and procedures, and the project drawings provided by the Engineer. Where conflicting information arises between this document and the Engineer’s specifications or instructions, the Engineer’s specifications or instructions shall govern.

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2. MATERIALS

RockGrid® PC

RockGrid® PC is a factory manufactured composite geogrid used in reinforcement of soil fills and consists of high strength polyester yarns arranged in the machine and cross direction to form a grid which is mechanically bonded to a 150g/m² polyester, non-woven, needlepunched, staple filament geotextile. The following specifications shall apply

			50/50	100/100	200/200		
Material		Polyester, staple fibre 150 g/m ² needle punched, nonwoven / high strength polyester yarns					
Short Term Tensile Strength	Machine	kN/m	50	100	200	ISO 10319	
	Across	kN/m	50	100	200		
	Elongation	%	10	10	10		
Long Term Design Strength (LTDS*) 120 Years		kN/m	26	52	105	ISO 10319	
Creep Limited Strength 120 Years		kN/m	30	60	120	ISO 13431	
Water Flow Rate	Normal to Plane	ℓ/s/m ²	150			ISO 11058	
	In Plane 20 kPa	ℓ/s/m/hr	20			ISO 12958	
Roll Dimensions		m	5 x 100			ISO 12958	

Engineered Fill

Fill material shall comply with the engineers specification in the project drawings and placed in accordance with the *Standard Specification for Road and Bridge Works*, the relevant SANS 1200 or other international or national backfill specification.

Formwork

To avoid facing deformations due to poor workmanship, construction of wrap-around facings should be aided by formwork. Formwork consisting of a structural frame or cladding in steel or timber can used as a temporary shutter for support and shaping of the slope face during

construction. The formwork is incrementally moved up as construction of the wall / slope height progresses.

3. HEALTH SAFETY ENVIRONMENT

A safe working environment shall be provided and maintained by the contractor. This should be ensured by taking necessary steps to eliminate or mitigate any hazard or potential hazard to the safety or health of employees, before resorting to personal protective equipment.

Personal Protective Equipment

In the event that personal protective equipment (PPE) is required to reduce the risk of injury whilst at work, the following minimum PPE is required:

- Safety shoes with steel caps for handling operations
- Hard hats
- Gloves



Excavations

All retaining wall excavations are to be suitably shored during construction such that the excavated area is safe and secure for personnel, machinery and that adjacent structures are not undermined.

All excavations exceeding 1,5m in depth are to be shored such that all embankments are safe and secure

Shoring, battering back remains the responsibility of the contractor.

Machinery

The contractor shall ensure that work performed and plant or machinery used is under the general supervision of a trained person to understand the hazards associated with it and who has the authority to ensure that precautionary measures are taken.

4. HANDLING

4.1 Roll Weight

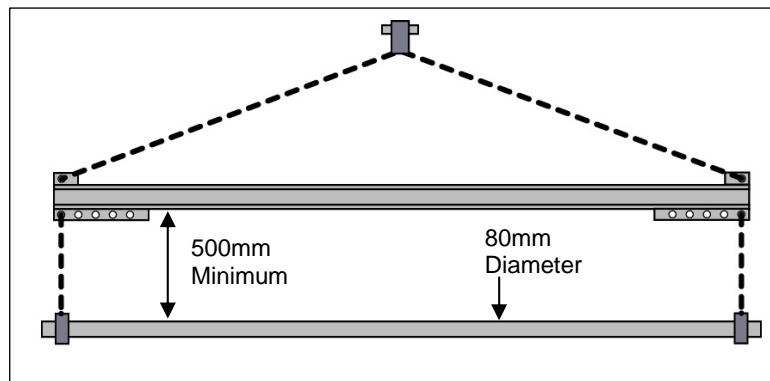
Item	Roll Dimension	Approximate Roll Weight
PC 50/50	100 m x 5 m	175 kg
PC 100/100	100 m x 5 m	258 kg
PC 200/200	100 m x 5 m	428 kg

4.2 Offloading Equipment

During offloading operations, RockGrid® PC must be supported to avoid product damage and worker injury. Workers handling the off loading operation must have the correct PPE. Suitable handling equipment is described below:

4.2.1 Spreader Bar Assembly-

A spreader bar assembly includes both a core pipe / bar and a spreader bar beam. When inserted through the PC core, the core pipe uniformly supports the roll, while the spreader bar beam prevents chains and straps from chafing the roll edges. A typical layout of a spreader bar is shown below.



4.2.2 Carpet Spike –

A carpet spike is a rigid pipe or rod with one end directly connected to a forklift or other handling equipment, and the other end rounded off to allow easy insertion into roll material cores.



4.2.3 Roller Cradles –

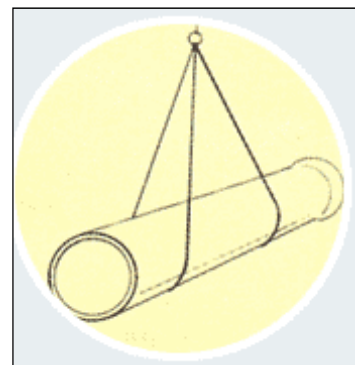
Roller cradles consist of two large diameter rollers spaced approximately 75 mm apart, which both support the RockGrid® PC roll and allow it to unroll freely.

4.2.4 Straps –

Straps may be used to support the rolls of material but caution must be exercised as straps may damage the RockGrid® PC where wrapped around the roll

Under no circumstances should the RockGrid® PC rolls:

- be dragged
- lifted from one end



- lifted with only the forks of a lift truck or
- dropped on to the ground from the delivery vehicle.

5. CONSTRUCTION SEQUENCE

Individual characteristics of various sites, installers and project specifics may dictate subtle differences and necessitate minor modifications in the construction sequence. However, all reinforced slopes with wrap-around facings must follow these basic steps in the construction process. Significant deviations from these procedures shall be pre-approved by the project Engineer or other designated party.

5.1 Foundation Soil

The plan area of the reinforced soil structure should be excavated to provide a level base foundation. The in-situ soil should be compacted before placing any engineered fill or reinforcement. Soft spots should be removed and replaced with well graded fill.

5.2 Engineered Fill

Care should be taken to avoid damaging the RockGrid[®] PC during any stage of the operation particularly in the presence of construction equipment during installation phases as described hereunder. Damaged RockGrid[®] PC should be discarded for use in the construction of reinforced soil slopes.

5.3 Placing and Compacting of Fill

The fill should be deposited, spread, levelled and compacted in horizontal layers of appropriate thickness as described in the project specifications. The placing and compaction of fill should be carried out so that all layers of reinforcement are fixed at recommended levels on top of the compacted fill. The spreading, levelling and compacting operation is usually carried out in the direction parallel to the slope face. Fill may be placed on the RockGrid[®] PC by using an advancing track dozer to push material out in front, or by carefully placing it with a loader or a backhoe.

The fill material should be well compacted to a minimum of 93% Mod AASHTO at $\pm 2\%$ of the optimum moisture, such that no rutting is caused by installation equipment or other construction vehicles that traffic the area of deployment.

The compacted fill should be rolled and graded away from the slope face at the end of each workday to prevent ponding of water. Compaction density testing of each soil layer is recommended to ensure compliance with the project specifications.

The rear of the reinforced soil structure should be adequately supported to ensure that contemporaneous deposition of the retained fill.

5.4 Compaction Equipment

Fill that has been spread and levelled is generally compacted using smooth steel drum rotating vibrators. Sheep foot drums are prohibited. Construction vehicles and equipment weighing more than 500kg shall be kept more than 2m away from the face of the slope. The fill within 2m of the face of the slope shall be compacted using one of the following methods;

- Vibro tamper
- Vibrating plate compactor having a mass not exceeding 500kg
- Vibrating roller having a mass not exceeding 500kg

Under no circumstance should vehicles (including rubber tyred) drive directly on the RockGrid® PC reinforcement. The use of construction machinery operating directly over the RockGrid® PC is strictly prohibited. Only where the RockGrid® PC reinforcement is covered with a compacted layer exceeding 150mm, may vehicles drive at slow speeds of less than 15 km/hr. Sudden starts, stops and braking and sharp turning shall be avoided.

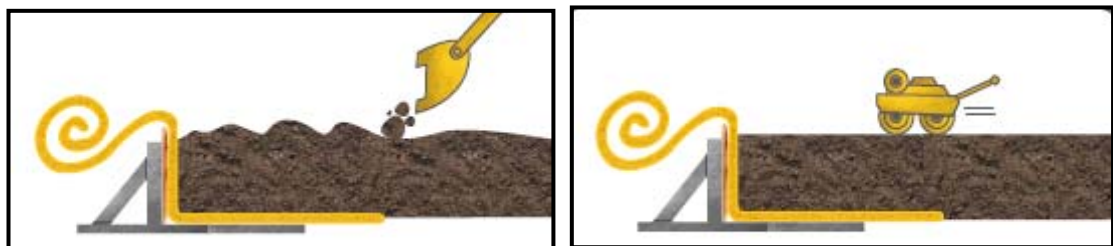
5.5 Placement of RockGrid® PC Reinforcement

Where RockGrid® PC is used simultaneously as reinforcement and to provide a wrap-around facing, it shall be placed in accordance with the following method:

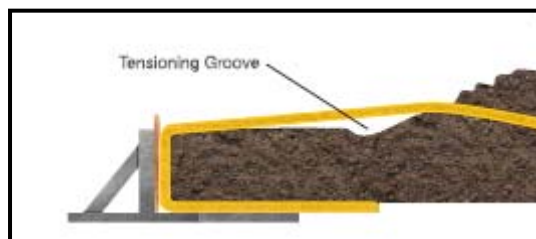
- To facilitate handling on site, it is recommended to cut the RockGrid® panels of prescribed length beforehand. The panel length shall take into account the design tieback (reinforcement length), the height / length of the slope face and the bottom length of wrap. In certain instances the length of the bottom wrap may be the same as the design tieback but only for the bottom most layer.
- Formwork shall be placed at the front of the slope face to provide containment and eventual form. The excess panel length shall be draped in the front over the formwork temporarily.



- Fill is then deposited, spread, levelled and compacted over the geogrid as described above. Loose material is usually placed in a thicker layer to allow for an eventual thickness of 150mm when compacted.



- Once the specified lift of fill has been placed and compacted, a tensioning groove shall be excavated. The groove shall be approximately 150mm deep.



- The ts,panel shall be pulled taught manually , be free of slack and wrinkles and held in with pegs at the rear prior to placing fill material along the back edge of the fabric length.

- Once the fabric has been pulled taught, 20mm (minimum) of granular material must be placed in the overlap areas before the formwork is raised and the next layer of RockGrid[®] PC is installed.



- The next layer of fill material can then be placed and the act of compacting the fill material will force the geogrid into the tensioning groove, thus tensioning the material further.
- Generally, the RockGrid[®] PC shall be placed with the geotextile component face up so as to minimise damage to the grid component.
- Jointing can be by way of a sewn seam or by overlapping. The overlap jointing method is to overlap adjacent panels by a minimum of 300 mm along panel edges. The overlaps shall be free of wrinkles, folds or "fish-mouths". A 20mm (minimum) thick layer of granular soil shall be placed between overlapped panel edges to increase the friction at the overlapped edges. Only joints perpendicular to the length of slope face are allowed.

Reinforcement joints or overlaps in the direction parallel to the face of the slope are strictly prohibited.

5.6 Drainage

In reinforced soil structure correct drainage at the top and foot of the slope / wall, and of the slope / wall itself is important if you want to prevent it from becoming waterlogged and the PC grid pulling out, overstressing or slope failure by sliding or bearing. Water can enter a structure in two ways:

- Water can percolate from the upper surface unless effective sealing details are provided
- Groundwater can flow into the structure from the retained ground.

For all reinforced slope structures details should be used to avoid water penetration from the upper surface and means of collecting and leading away rain water should be provided. For slopes supporting roads, the use of a sealed kerb and drainage channel at the back of the hard shoulder will normally be sufficient. Where there is no hard shoulder, a channel with flexibly sealed joints should be provided at the back of the hard strip/edge of carriageway.

For locations where water flow is expected from the retained soil, drainage trenches typically 300mm wide and a 1000mm high consisting of crushed 19mm stone wrapped in a geotextile should be placed at the rear of the reinforced soil mass. If necessary this blanket drain may be continued up along the face of the retained soil for as high as it is needed. For cases where downhill discharge is not possible a toe collector pipe may be used.

As an alternative to the crushed stone drain, drainage geo-composites such as the MegaFlo[™], Flo-Drain[®] are available from Kaytech to speed up installation and improve collection and discharge of groundwater.

6. FACINGS

Wrap-around facings should be protected against degradation due to natural or manmade causes including the effects of ultraviolet light and vandalism. The most usual method of protection is the seeding of the slope or planting of rooted cuttings or seedlings. In this case a wedge of topsoil should be placed directly behind facing during construction. Hydro-seeding may also be used to apply seed directly to the outside of the wrap-around facing although it is more successful with a reinforcement grid with an open aperture.

The grass roots penetrate into the topsoil through the PC Grid to form an effective protective layer. For seedlings or rooted cuttings, it may be necessary to make small holes into the wrap facing to allow planting directly into the topsoil. An alternative is to apply a seed impregnated layer just behind the facing.

7. MONITORING

All reinforced soil structures should be subjected to a regular programme of inspection and maintenance when completed. Records of inspections and any maintenance should be kept. Of particular importance when inspecting reinforced soil structures are:

- Excessive settlement, even or differential
- Horizontal displacement of the facing
- Damage to the facing
- Evidence of drainage problems
- Cracks in the embankment on top of the reinforced soil structure

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