

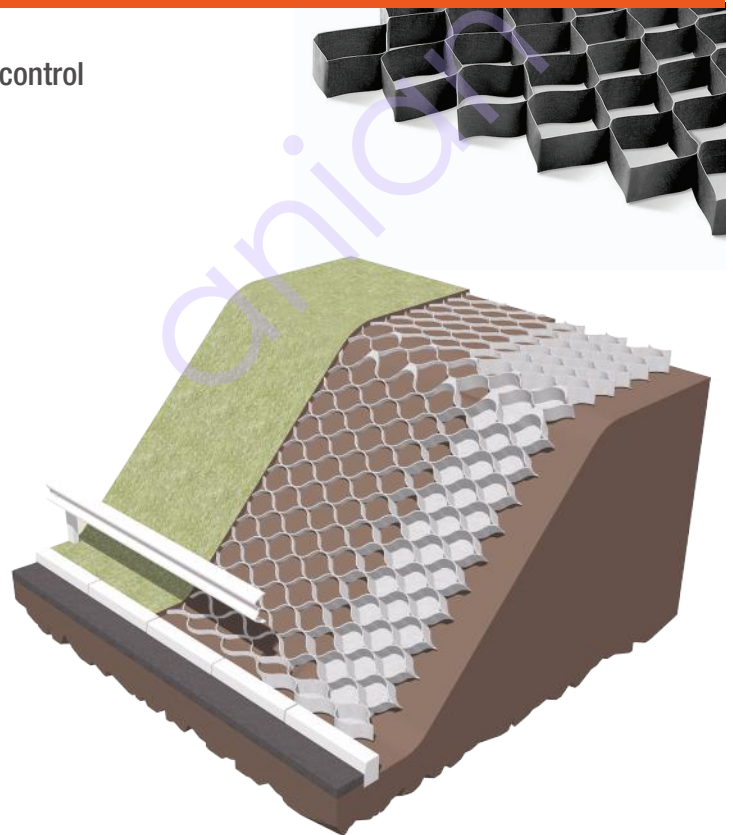
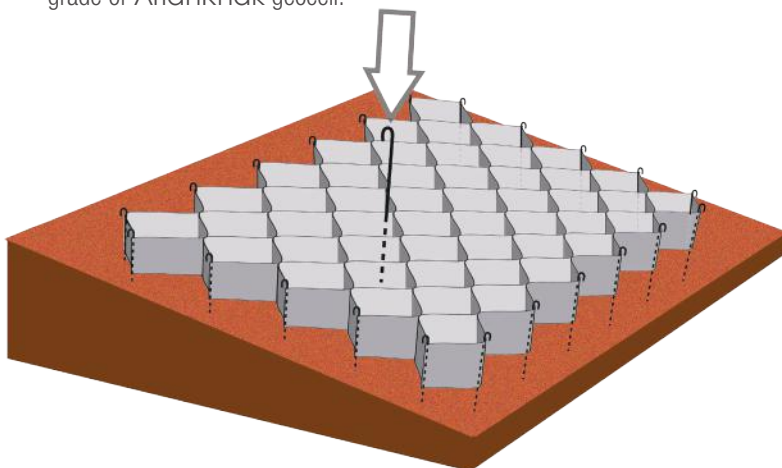
SPECIFICATION, DESIGN & INSTALLATION GUIDANCE

For Erosion Control



Installation method for ArianKhak Geocells slope erosion control

1. Ensure that the working area is free from buried services, all existing vegetation has been removed and the slope shaped to achieve a generally even gradient. If required anchor trenches to be excavated at the toe and crest of the slope generally 500mm wide x 500mm deep and set back 1000mm from the crest.
2. If a separation geotextile (ArianKhak standard T series) or a protection geotextile (ArianKhak RG series) below the ArianKhak Geocell is required (for non-vegetated slopes), install down the slope securing within the crest and toe anchor trenches, overlapping adjacent rolls by a minimum of 150mm. Hold the ArianKhak geotextile temporarily in place using pins or sandbags until the overlying ArianKhak Geocell layer is installed and the anchor trenches backfilled.
3. Partially open out the ArianKhak Geocell panel and initially pin in place using steel u-bars (or other approved fixings) along the crest of the slope within the anchor trench. Fully expand the ArianKhak Geocell panel down the slope manually pulling into tension so that the cells are fully open but without undue stress. Pin or infill several cells around the perimeter to hold the cells in an open and fully expanded position. Prior to filling fix every cell around the perimeter and generally on an orthogonal grid at 1m centres down and across the slope. (See figure 1, photo 2 and table 1). Spacing of the Geocell fixings will be determined by the scheme designer and is dependant on the slope gradient, cell size, soil infill depth and the sub grade soil parameters. Please contact ArianKhak for further guidance on fixings and the appropriate grade of ArianKhak geocell.



4. ArianKhak Geocell panels are very flexible and easily be installed around obstacles such as trees or structures. ArianKhak Geocell panels can easily be cut to suit using a sharp knife/scissors or joined together by heavy duty galvanised staples installed with a pneumatic heavy duty stapling plier or UV stabilised nylon cable ties. Changes in

gradient and curves can easily be accommodated by either allowing some variations in cell shapes and sizes (over or under expanding the cells) or cutting an entire panel at an angle and then stapling to form a taper or L-shape. (See figures 1 to 4).

Installation of Geocell on Curved or irregular surfaces

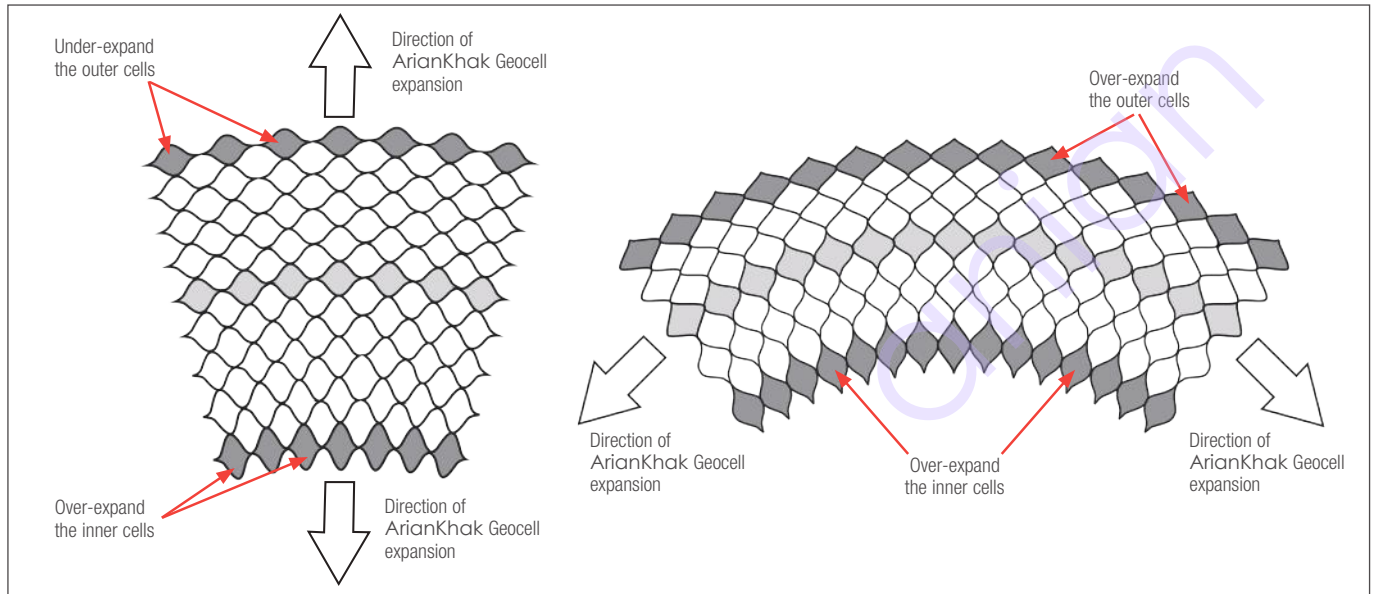


Fig: 1 Tapered expansion of section

Fig: 2 Curved expansion of section

Field cutting of ArianKhak Geocell to form tapers and "L"-shapes

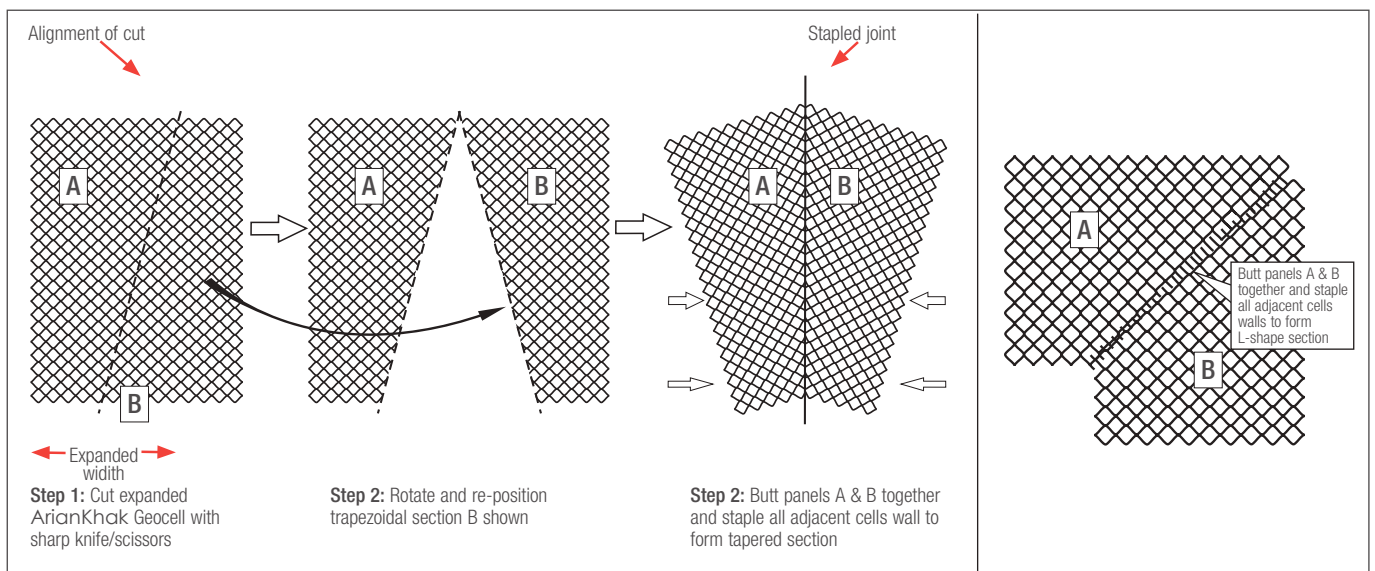


Fig: 3 Longitudinal cuts

Fig: 4 Transverse cuts

- Once the ArianKhak Geocell panels has been fixed and anchored in place, in-filling of the cells may be carried out. The infill material should be well graded and a good quality friable topsoil where a vegetated finish is required. The infill material should be carefully placed within the cells in a uniform manner ensuring there are no localised areas which are overloaded. Placement may be by mechanical or manual means preferably commencing at the crest (top) of the slope and progressing downwards. The final depth and compaction of the fill material should be controlled manually, using hand tools, to ensure the ArianKhak Geocells are fully filled and covered by a uniform layer of overburden (typically 20mm deep).



General Design Overview for ArianKhak Geocell slope erosion control

ArianKhak Geocell is a three dimensional geocellular confinement system designed for steep slopes, river banks, ditches, spillways, and other exposed areas that are often prone to damage caused by erosion due to wind or water.

A ArianKhak Geocell system can help to prevent erosion by confining soils and aggregates within the cell structure. Varying degrees of protection can be afforded by selecting alternative in-fill materials. Seeded topsoil provides protection for less exposed areas. Protection may be increased by introducing vegetation such as small shrubs. For greater protection, a

granular in-fill can be used in certain circumstances. Appropriate in-fills can also be chosen to give a desired surface appearance. The standard ArianKhak Geocell system for erosion protection is normally suitable for use on slopes with an incline of up to 45 degrees (1:1 Slopes). If the slope angle is greater than 45 degrees, additional considerations need to be given to the design of the cellular system and the standard ArianKhak Geocell may not be suitable. In these instances please contact ArianKhak for further assessment. ArianKhak Geocells are supplied flat packed and open to form a strong three dimensional geocellular structure.

Table 1 - ArianKhak Geocell grade selection for slope erosion control

| GEOCELL GRADE | CELL DIAMETER (mm) | TOP SOIL INFILL DEPTH (mm) | MAXIMUM SLOPE GRADIENT # | | | PANEL SIZE (m) | FIXING PINS/PEGS FOR SINGLE PANEL | | | |
|---------------|--------------------|----------------------------|--------------------------|-----|-----|----------------|-----------------------------------|--------------|-------------------------|-------|
| | | | V | H | % | | ANGLE (°) | 1m x 1m grid | Perimeter (every cell*) | Total |
| 35/10 | 350 | 100 | 1 | 2 | 50 | 26 | 7 x 5 | 24 | 64 | 88 |
| 25/10 | 250 | 100 | 1 | 1.5 | 67 | 33 | 7 x 5 | 24 | 64 | 88 |
| 35/15 | 350 | 150 | 1 | 1.5 | 67 | 33 | 7 x 5 | 24 | 90 | 118 |
| 25/15 | 250 | 150 | 1 | 1 | 100 | 45 | 7 x 5 | 24 | 90 | 114 |
| 22/20 | 220 | 200 | 1 | 1 | 100 | 45 | 6 x 3 | 18 | 52 | 70 |

These figures are a conservative guide for the selection of a suitable grade of ArianKhak Geocell based on a typical friable top soil for a vegetated finish. Steeper gradients can be achieved with infill materials with a higher natural angle of repose. Please note that the maximum slope gradient is ultimately determined by the underlying subgrade soil strength parameters and not the Geocell grade or infill material. A slope stability assessment should be carried out by a suitably qualified engineer to determine the maximum slope gradient. Please contact ArianKhak for further guidance on selection of the appropriate grade of ArianKhak geocell.

*Fixing pins/pegs spacings can be increased to 1m centres if every cells of adjacent panels are joined with staples/nylon cable ties.

Table 2 - ArianKhak Geocell specifications

| GEOCELL GRADE | PANEL SIZE | CELL DIAMETER | CELL DEPTH | MATERIAL | WALL PERMEABILITY (L/m ² s) | JOINT BOND |
|---------------|------------|---------------|------------|-------------------------|--|------------|
| 35/10 | 5m x 7m | 350mm | 100mm | Non-woven polypropylene | 20 | Chemical |
| 25/10 | 5m x 7m | 250mm | 100mm | Non-woven polypropylene | 20 | Chemical |
| 35/15 | 5m x 7m | 350mm | 150mm | Non-woven polypropylene | 20 | Chemical |
| 25/15 | 5m x 7m | 250mm | 150mm | Non-woven polypropylene | 20 | Chemical |
| 22/20 | 6m x 3m | 220mm | 200mm | Non-woven polypropylene | 20 | Chemical |

Table 3 - Supplementary Information

| DESCRIPTION | DATA |
|-----------------------|---|
| Geocell fill material | Good quality well draining friable topsoil (vegetated finish) Well graded angular aggregate |
| Fixing pins | 500mm long T8 steel u-bars (soft to firm ground) Reinforced plastic pegs, minimum 350mm long (soft or loose sandy ground) 400mm long T10 steel j-bars (hard ground) |
| Metal Staples | Heavy duty galvanised 25mm wide x 25mm long, 1.40 x 1.60mm wire diameter. Minimum 3/4/6 staples per join for 100/150/200 mm deep panels respectively. |
| Nylon cable ties | UV resistant minimum 500mm long x 4.8mm wide |

This guide is provided to assist in the installation and specification of ArianKhak Geocells for erosion control on slopes. The document is not a design manual and should not be used as a substitute for proper design, planning and specification of a steep slope with a ArianKhak Geocell stabilised surface.

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