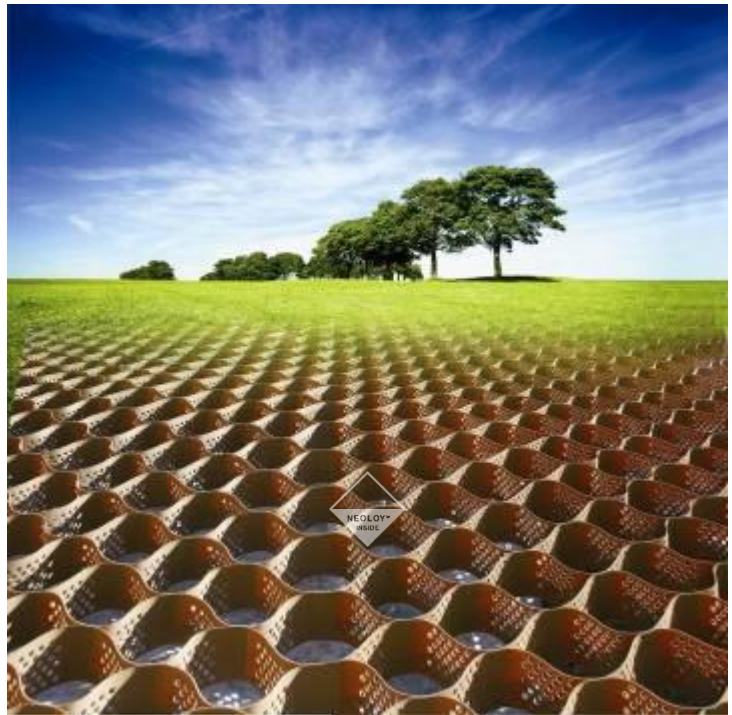


# NEOLOY® GEOCELLS INSTALLATION

## Load Support Applications



PRS-EN-TD-LS-3000  
Version 2019 Revision 1

Technical Document

**Purpose of this Document:**

This guide describes the procedures for installing Neoloy® Geocells in structural load support applications.

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**Appendix: Pre-Installation Checklist**



# Key Points Before Starting – Do’s & Don’ts

<b>Site Preparation</b>	<b>DO:</b>	<input type="checkbox"/> Confirm that site is cleared, ready for installation <input type="checkbox"/> Verify specified Neoloy Geocells are onsite <input type="checkbox"/> Make sure you have approved final design and construction plans
	<b>DON'T:</b>	<input type="checkbox"/> <b>DO NOT verify conditions onsite without visual confirmation</b>
<b>Required Tools</b>	<b>DO:</b>	<input type="checkbox"/> Fill out Required tools checklist – verify all equipment onsite and ready for use
	<b>DON'T:</b>	<input type="checkbox"/> <b>DO NOT begin installation until all equipment is onsite</b>
<b>Training</b>	<b>DO:</b>	<input type="checkbox"/> Make sure installation team receives training from supervisor
	<b>DON'T:</b>	<input type="checkbox"/> <b>DO NOT install geocells without training</b>
<b>Layout</b>	<b>DO:</b>	<input type="checkbox"/> Mark route with rope <input type="checkbox"/> Anchor stakes equally spaced along road/rail right of way (every 49 / 52 cm depending on geocell size)
	<b>DON'T:</b>	<input type="checkbox"/> <b>DO NOT skip any stakes</b>
<b>Fastening</b>	<b>DO:</b>	<input type="checkbox"/> Use the correct number of staples per panel (1 staple / 2.54 cm of cell height, e.g., 5 staples in 12 cm height cell)
	<b>DON'T:</b>	<input type="checkbox"/> <b>DO NOT use less than the required number of staples</b>
<b>Opening Sections</b>	<b>DO:</b>	<input type="checkbox"/> Verify that cells are aligned in the correct direction
	<b>DON'T:</b>	<input type="checkbox"/> <b>DO NOT walk or drive vehicles on empty cells</b>
<b>Infill Placement</b>	<b>DO:</b>	<input type="checkbox"/> Confirm specified infill soil is as specified in design <input type="checkbox"/> Install on dry subgrade only to achieve optimal moisture <input type="checkbox"/> <b>Verify that infill soil (with high percentage of fines/cohesive) is dry; In rainy weather, cover infill materials with tarps, covers</b> <input type="checkbox"/> Verify that all cells overfilled by 7 cm <b>before</b> grading/compaction <input type="checkbox"/> Remove large rocks or debris
	<b>DON'T:</b>	<input type="checkbox"/> <b>DO NOT infill wet soil – may cause project failure</b>
<b>Compaction</b>	<b>DO:</b>	<input type="checkbox"/> Verify full compaction for each layer according to specifications – <b>full compaction is critical to project success</b> <input type="checkbox"/> Verify that all cells overfilled by at least 2 cm <b>after</b> compaction
	<b>DON'T:</b>	<input type="checkbox"/> <b>DO NOT compact wet soil – may cause project failure</b>
<b>Safety &amp; Environment</b>	<b>DO:</b>	<input type="checkbox"/> Adhere to safety standards and procedures <input type="checkbox"/> Adhere to environmental protection guidelines
	<b>DON'T:</b>	<input type="checkbox"/> <b>DO NOT deviate from safety and environmental procedures</b>



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# Safety

Adhere to all applicable standard construction work safety procedures associated with site construction, power tools and construction vehicles (e.g., EU Directive 92/57<sup>1</sup> and US OSHA standards<sup>2</sup>).

## Site Preparation Procedures

- 1) **Preplanning excavation work** – consider all possible jobsite conditions and consult with the appropriate authorities about traffic, nearby structures, soil, water supplies, underground utilities and weather – that may be reasonably expected prior to excavation.

## Traffic control signs, signals, barricades or devices

- 1) **Safety Standards** – The use of appropriate traffic signs, signals and barricades where installation takes place near public roadways is mandatory to protect workers and equipment, as well as the vehicular traffic itself.

## Personal Protective Equipment

- 1) **Personal protective equipment** – installers should wear **reflective vests** and protective gear for on-site safety including: helmets, work shoes, gloves, and safety glasses where applicable.

## Power Tools and Air Supply

- 1) **Equipment** – operate pneumatic tools, compressor and generator according to the manufacturer's instructions, and only if properly trained in its use and alerted to its potential hazards.
- 2) **Eye protection** – all members of installation team operating with or in proximity to power tools should wear safety glasses with side protection that conform to industry standards.
- 3) **Air supply and connections** – shall be secured to the hose in a positive manner to prevent accidental disconnection. Never use oxygen or other bottled gases for air supply. Do not exceed the PSIG indicated on the tool label. Disconnect when making adjustments or when not in use.
- 4) **Operation of power tools (e.g., pneumatic stapler)** – care must be taken during fastening, particularly to hands and fingers to avoid serious personal injury.

**NOTE: Make sure to disconnect the air supply to the compressor when adding staples to the pneumatic stapler – accidental discharge may cause serious personal injury.**

## Vehicles and Mechanized Equipment

- 1) Make sure that personnel are in the clear before driving in reverse, dumping, shoveling or lifting.
- 2) Do not drive directly on empty geocells.

## Fill, Cover and Paved Layers

- 1) Employees and vehicle operators will be properly trained in the use of concrete pouring equipment and asphalt paving equipment if applicable, and alerted to potential hazards of the process, vehicles and fumes.

<sup>1</sup> EU Council Directive 92/57/EEC of 24 June 1992 on the implementation of minimum safety and health requirements at temporary or mobile construction sites, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31992L0057:EN:HTML>

<sup>2</sup> US Occupational Safety & Health Administration (OSHA) Regulation 1926, Safety and Health Regulations for Construction, [http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=10593](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10593)



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# Required Tools and Equipment

<p><b>Palletized Neoloy Sections</b></p>	<p><b>Stakes – iron, wood, other material &amp; Neo-clip™ (optional)</b></p>
<p><b>Pneumatic Stapler &amp; 1/2" (13 mm) Galvanized Staples</b></p>	<p><b>Air Compressor and Generator (60 psi /4 bar pressure) &amp; Pneumatic Hammer with Head (optional)</b></p>

## Additional Geosynthetics

- a) Geotextiles (if specified in the project design)
- b) Geogrids (if specified in the project design)

## Standard Construction Tools

- c) Hand Tools – shovels, rakes, sledge hammers and nails, utility knives
- d) Lumber – long planks and/or rectangular boards used for walking over empty cells

## Mechanical Construction Equipment

- a) Front-end loaders with buckets for the infill process, although excavators or dozers may be used.
- b) Compaction equipment includes rammers, vibratory plates and rollers.
- c) Water trucks and graders according to need.



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# Storage and Handling

## Dimensions and Weights

Neoloy Geocell sections are folded, shrink-wrapped and palletized for delivery to the site. The following table provides typical dimensions and weights of the palletized sections. The amount and size of the sections and cells varies according to Neoloy type and height.

TABLE 1. MINIMUM AND MAXIMUM WEIGHTS AND DIMENSIONS OF PALLETIZED NEOLOY SECTIONS

Minimum Pallet Size Length x Width x Height	Maximum Pallet Size Length x Width x Height	Minimum Pallet Weight	Maximum Pallet Weight
100 x 100 x 100 cm	112 x 110 x 115 cm	420 kg	615 kg

## Transport and Storage

1. Take care that protective wrapping, labels and the Neoloy Geocell sections are undamaged during transport, handling and storage.
2. If the Neoloy Geocells are to be stored on or off site for an extended amount of time, make sure the palletized sections are protected from UV radiation (sunlight), chemicals, fire or welding sparks), high temperatures and damage from people or equipment.



FIGURE 1. PALLETIZED SECTIONS

## Off-loading Sections On-site

Slings and fork attachments can be utilized to off-load palletized sections on-site. After removing wrapping, individual sections can be lifted and carried by one individual.

1. Ensure that all specified materials are delivered to the site, undamaged, and ready for use.



FIGURE 2. OFF-LOADING SECTIONS ON-SITE



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# Site Preparation

## Prepare Subgrade Layer

Prepare subgrade per construction drawings or Engineer.

1. **PREPARE SITE AND SUBGRADE.**
  - a) Clear and grub vegetative cover, debris, stumps, roots.
  - b) Replace unacceptable foundation soils if specified.
2. **COMPLETE EARTHWORK.**
  - a) Level surface to planned elevations and grades.
  - b) Compact subgrade according to specifications.



FIGURE 3. PREPARE SUBGRADE LAYER

## Layout Geotextile / Geogrid (if specified)

1. Install geosynthetic layers according to the manufacturer's directions.
2. Ensure required overlap between rolls or pre-sewn seams according to project specification.



FIGURE 4. LAYOUT GEOTEXTILE

# Anchor Stakes

## Anchor Stakes along Route

**NOTE: Take care not to damage underground infrastructure such as geomembranes, cables or pipes.**

Stakes or pins are used to position and anchor the outer cells of the Neoloy sections prior to infill. Use pointed wood, iron or steel j-hooks according to the subbase hardness.

1. Anchor the stakes firmly in the ground.
  - a) **Geotextiles** (if applicable) – penetrate the geotextile fabric with the stakes; or if a non-permeable geomembrane is used, anchor the stakes on the sides.
  - b) **Intervals** – typical spacing between stakes is ~50 cm when fully opened; depending on the cell size, project specifications, or on-site Engineer.
  - c) **Marking** - string or chalk line may be used to align staking locations and borders.



FIGURE 5. INSERTING STAKES/ANCHORS ALONG ROUTE

**NOTE: Leave at least 10 cm of the stakes exposed as they will be removed before compaction and paving.**



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# Layout Neoloy Geocell Sections on Site

## Direction of the Geocells

1. The closed section “length” is to be aligned in the direction of the road course.
2. The section will be opened (expanded) across the road width.

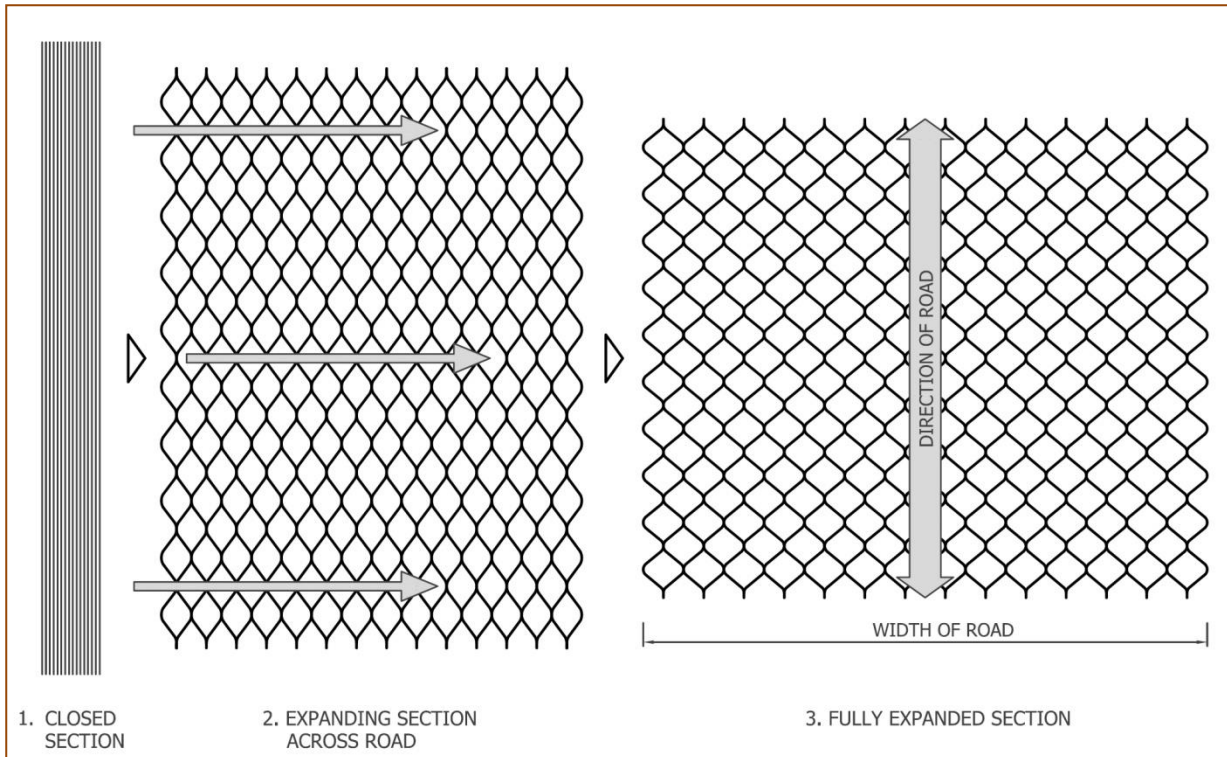


FIGURE 6. LAYOUT & DIRECTION OF SECTIONS & CELLS

3. The result will be a fully expanded section with the cells at the nominal recommended openings. For example, the typical fully expanded section dimensions of PRS-330 are ~2.5m “long” by ~8m “wide”.

**NOTE:** In some load support applications, the “length” may be laid out across the road width (perpendicular) and the cells expanded in the direction of the road course.

## Layout Sections

1. Disperse sections along road course.
  - a) Calculate the open section size and the road width and length
  - b) Disperse the folded (closed) sections along the road course in series (on top of the installed geotextile) to facilitate connecting one to another.
  - c) Cut section width (or length) as necessary.

**NOTE:** Save cut sections to be used elsewhere or to be disposed of properly at end of project.



FIGURE 7. LAYOUT SECTIONS ALONG ROAD LENGTH





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# Fasten Neoloy Geocell Sections

Sections are fastened in series before opening and expanding the cells. The ends of adjoining sections are typically fastened the length of their long dimension (when closed), while the face (walls) of adjoining sections are fastened together typically across the road in the direction of the cell expansion.

**CAUTION:** It is recommended that 2 people perform the fastening. Observe all safety precautions when using the pneumatic stapler to prevent serious injury to hands and body.

## Use the Correct Number of Staples

1. Fasten using the number of staples required by the cell height (see Figure 8):
  - ≤ PRS 075 mm – 3 staples (minimum)
  - ≤ PRS 100 mm – 4 staples
  - < PRS 120 mm – 4 staples
  - ≤ PRS 150 mm – 5 staples
  - ≤ PRS 200 mm – 6 staples

**NOTES:** Correct positioning of the top and bottom staples is critical. Use ½ inch (13 mm) galvanized staples. Verify that staples penetrate all strips and/or seams.

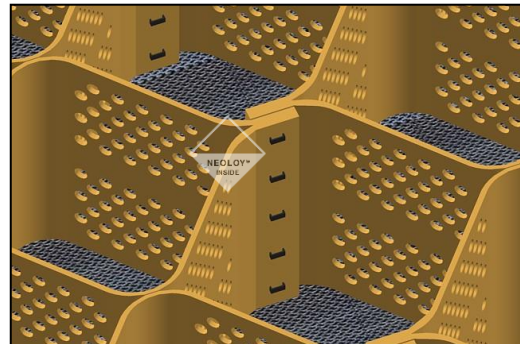


FIGURE 8. STAPLES FASTENING SECTIONS  
END TO END— PRS 150 MM

## Staple Sections End to End (Figure 12)

- 1) Fasten each end of the 2 sections:
  - a) The staples must penetrate the seams (2 strips) on each section (total of 4 strips).
- 2) Align and interleaf the ends of adjoining sections.
  - a) Overlap the end seams of the two adjoining sections by 3 cm and ensure that their surfaces are flush.
- 3) Fasten the edges of adjoining sections at the seams using the pneumatic stapler.
  - a) Overlap the end seams of the two adjoining sections by 3 cm and ensure that their surfaces are flush.
  - b) Make the overlap uniform for the entire section.

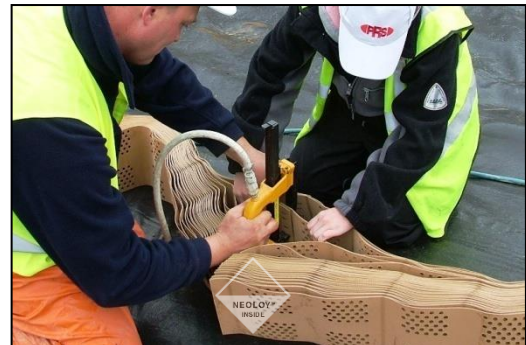


FIGURE 9. FASTENING END TO END

## Fasten Sections Face to Face (Figure 10)

1. Align 2 adjacent sections face to face (the “long” sides).
  - a) The ends and perforations (if exist) should be aligned.
2. Continue fastening the sections by stapling the middle of each cell (unperforated area) along the entire length of the strip until completed.

**NOTE:** Each cell (seam) must be fastened properly – do not skip any cells, as this may cause failure of the entire section.



FIGURE 10. FASTENING SECTIONS FACE TO FACE

# Expand Neoloy Geocell Sections

## Expand Sections over Anchors

1. Place the outer cells of the joined sections over the anchors on one side of the road.
2. Open and expand the sections to the opposite side and “hook” over the anchors (stakes).
3. Verify that the expanded sections are flush on the ground and opened to their nominal dimensions (see Figure and Table below).

**NOTE: Do not walk on empty cells as this may bend the cell walls and damage the system. Spread planks or boards over the empty cells to walk over the Neoloy Geocell sections if necessary.**

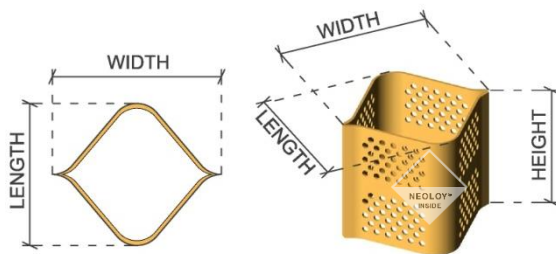


FIGURE 11. CELL DIMENSIONS/DIRECTION



FIGURE 12. EXPANDING SECTIONS OVER ANCHORS

TABLE 2. NOMINAL DIMENSIONS OF CELLS

CELL & SECTION NOMINAL DIMENSIONS			
CELL PROPERTIES	DESCRIPTION	SECTION PROPERTIES	DESCRIPTION
Cell Distance between Weld Seams	330 mm ( $\pm 2.5\%$ )	No. of Cells/m <sup>2</sup>	40
Cell Wall Heights	65, 75, 100, 120, 125, 150 mm	Section Size (Expanded)	2.50 x 8.00 m ( $\pm 3\%$ )
Cell Dimension (Expanded)	250 x 210 mm ( $\pm 3\%$ )	Section Area (Expanded)	20 m <sup>2</sup>



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# Expand Neoloy Geocell Sections (cont.)

## Optional Use of Stretcher Frames

Frames can be used for extreme climatic and soil conditions.

1. Expand the section over the dowels of the dimensioned stretcher frame.
2. Invert the fame.
3. Fill with infill and repeat for next section.



FIGURE 13. USE OF STRETCHER FRAMES

## Curved Sections

Neoloy Geocells can be easily adapted to moderate curves by varying the degree of cell expansion.

1. Vary the cell dimensions by over-expanding the outer cells and under-expanding the inner cells.
2. Cell expansion may be according to the long axis (road direction) or perpendicular to the road axis.

**NOTE: Under or over expanded cell size on curves must not exceed 15% of nominal cell dimensions.**



FIGURE 14. INSTALLING SECTIONS ON CURVES

# Infill Placement

## Before Operating Vehicles on the Cells

1. Before construction vehicles go over Neoloy Geocells, ensure the following:
  - a) Minimum overfill (above cell) of 7 cm is required.
  - b) Verify that the outside border cells are completely covered with infill.
  - c) Minimize turning, avoid sudden braking and limit speed to less than 15 km/h.
  - d) No vehicle (or pavement layer) is permitted over exposed geocells.



FIGURE 15. SPREADING INFILL

## Place Infill

1. Mechanically (or manually if necessary) infill the first (outer) rows of the expanded sections using the designated granular fill material according to the construction plans.

**NOTE: Limit drop height of infill to 1m (100 cm) to prevent damage to the cell walls.**

2. Overfill the Neoloy Geocells to at least 7 cm above the cell walls.
  - a) This is to allow for settling before trafficking or compacting.
3. Continue infilling in the direction of the road.
  - a) Use the loader blade (back of shovel) to compact the infill.



FIGURE 16. INFILL PLACEMENT

**NOTE: Visually inspect infill and remove any large pieces of debris, soil or rock – larger than one cell – to prevent damage to the cell walls.**

4. Manually spread the infill if necessary, to ensure uniform infill and that no cell walls are exposed. Do not walk on empty cells. Use planks or boards to walk over empty cells.
5. After infill is complete, remove stakes/anchors before compacting.
  - a) Stakes/anchors may be reused.

# Grading and Compaction

## Grading and Compaction

Grading and compaction should be carried out according to standard procedures and in full compliance with the project specifications. The following are key points.

**NOTE: Full compaction is critical to the performance of the Neoloy load support mechanism. Do not use heavier compaction equipment than is necessary, as this may cause “waves” in the surface that prevent full compaction.**

1. Before Starting:
  - a) To ensure full compaction, determine the correct type of equipment before starting the project.
  - b) Verify that there are no large pieces of debris, soil or rock that may damage cells.
2. If total fill layers exceed 20 cm, compact separately (depending upon the type of infill, site and application):
  - a) First compact Neoloy infill layer.
  - b) Then compact cover layer.
3. Do not leave any Neoloy Geocell wall exposed. Verify that overfill is at least 2 cm above cell height **after** compaction.
4. Water spray trucks may be used to suppress dust, if required.
5. Shape compacted surface to required elevation and grade with conventional graders and compactors.



FIGURE 17. GRADING



FIGURE 18. COMPACTION



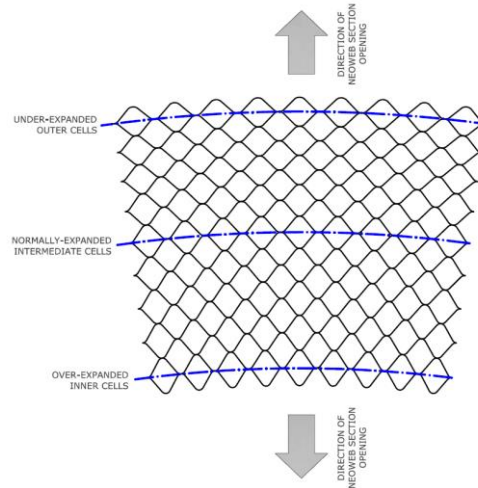
# Installation on Curves

## Curved Sections

Neoloy Geocells can be easily adapted to moderate curves by varying the degree of cell expansion.

3. Vary the cell dimensions by over-expanding the outer cells and under-expanding the inner cells.

**NOTE: Under or over expanded cell size on curves must not exceed 15% of nominal cell dimensions (see Table 2). If exceeding this value, use tapered trapezoidal sections as below.**



## Tapered Trapezoidal Sections

A series of trapezoidal sections are the preferred method for covering wide curves or right angles.

1. Expand one section downslope at the beginning of the curve on the curve.
2. Expand the next adjacent section downslope and lift it over the previous section so that it overlaps and part of it lies on top of the previous section.
3. Cut only the part of the overlapping section on top diagonally using a utility knife.
4. Align the walls of the 2 adjacent sections and fasten together.
5. Repeat this procedure to make sufficient tapered sections to cover the entire radius of the curve.

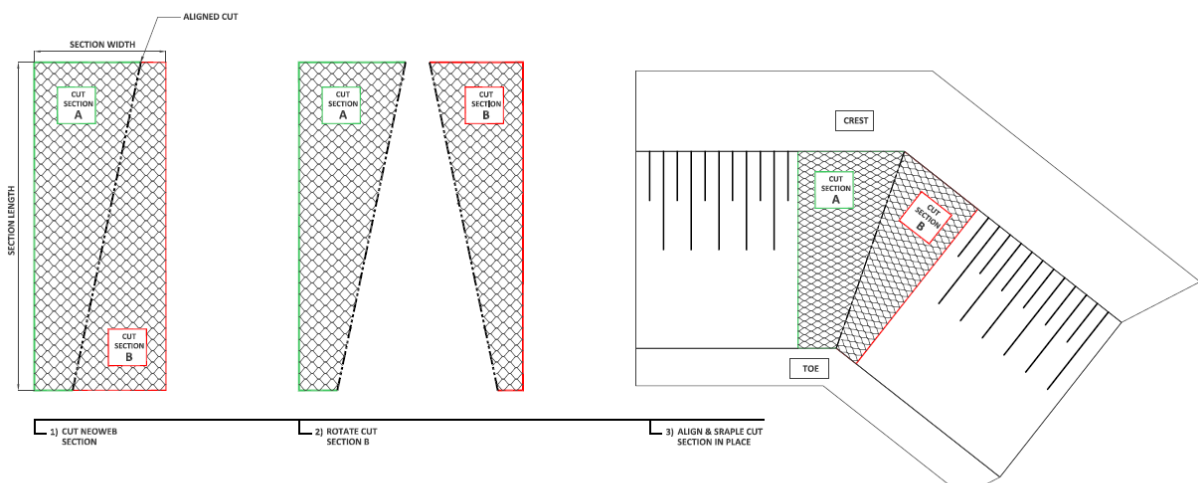


FIGURE 19. TAPERED EXPANSION OF SECTIONS ON CURVE

**NOTE: Save cut sections to be reused or disposed of properly at end of project.**




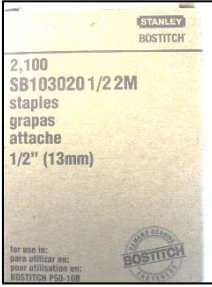



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# Appendix: Neoloy Geocells: Pre-Installation Site Preparation –Mandatory Items Checklist




No.	Description	Responsibility		Images	Required	Status
		Client	PRS			
<b>Preinstallation - General</b>						
1	Leveling, Drying and compaction of installation area	✓				
2	Preparing site for installation according to plan	✓				
3	Design approval		✓			
4	Filling material: quantity, quality (strength), and grading according to design requirements	✓				
5	Confirmation of laboratory results		✓			
6	Installation Supervision		✓			
7	Delivery and reading installation guide	✓	✓			
8	Installation Team	✓				
9	Supply of geotextile fabrics	✓				
10	Monitoring and supervision	✓	✓			
11	Ready-for-installation tools:	✓				



Installation Equipment						
12	Pneumatic staple guns	✓				
13	Staples for staple guns	✓				
14	Compressor (2 hp) + compatible generator + adequate fuel	✓				
15	Air-pressure hose suited for 2 hp / 4.5 Bar	✓				
16	Fastening device for geotextile fabrics	✓				











17	<b>Installation anchors (wood / iron)</b>	✓				
18	<b>Marking rope</b>	✓				
19	<b>Hammers - Minimum weight 2 kg</b>	✓				
20	<b>Safety equipment</b>	✓		<p>Shall be provided in accordance with the requirements of the site supervision</p>		



### Heavy Engineering Equipment for Installation:

No.	Description	Responsibility		Images	Required	Status
		Client	PRS			
21	<b>Dump trucks</b>	✓				
22	<b>Front-end and/or Backhoe Loader/s</b>	✓				
23	<b>Road Grader/s</b>	✓				
24	<b>Water Truck/s</b>	✓				
25	<b>Compactor/s</b>	✓				
26	<b>Excavator/s for infilling material in cells (slope and wall projects)</b>	✓				



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### Installation Manpower

No.	Description	QTY	Responsibility		Status
			Client	PRS	
1	Site engineer		✓		
2	Soil sampling tester		✓		
3	Laboratory tester		✓		
4	Installation supervisor			✓	
5	Installation teams One team consists of 4 people		✓		
6	Project supervisor		✓		
7	Surveyor		✓		
8	QA/QC Tester		✓		