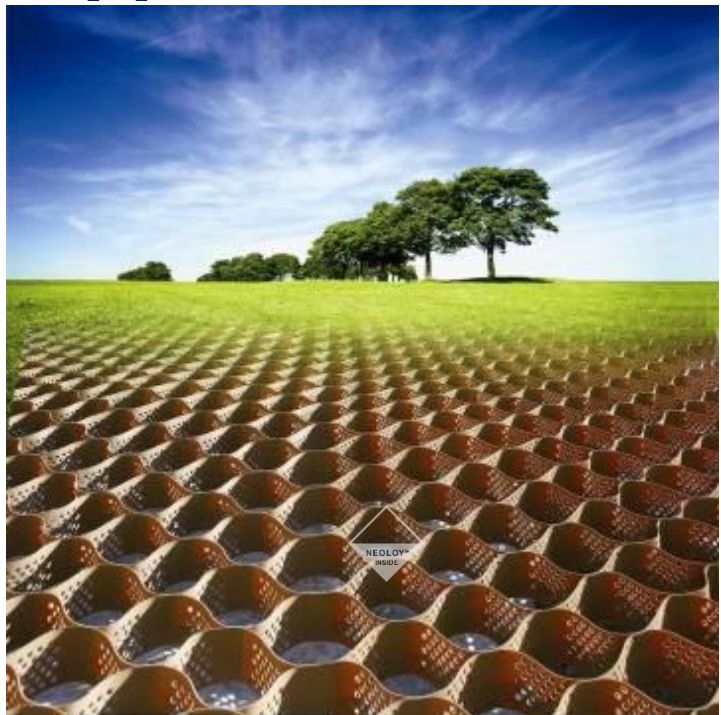


NEOLOY® GEOCELLS INSTALLATION

Channel Protection Applications



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

INSTALLATION GUIDE

Purpose of this Document:

This guide describes the procedures for installing Neoloy® Geocells in channel protection applications.



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Contents

| | |
|----------|--|
| ① | Key Points Before Starting |
| ② | Safety |
| ③ | Required Tools / Storage & Handling |
| ④ | Site Preparation |
| ⑤ | Layout Sections |
| ⑥ | Fasten Sections |
| ⑦ | Anchor Stakes |
| ⑧ | Expand Sections Downslope |
| ⑨ | Infill Placement |
| ⑩ | Special Conditions, Curves, Tendons |
| ⑪ | Appendix: Pre-Installation Checklist |



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

| | | |
|---------------------------------|---------------|---|
| Site Preparation | DO: | <input type="checkbox"/> Confirm that site is cleared, ready for installation <input type="checkbox"/> Verify the specified Neoloy Geocells are onsite <input type="checkbox"/> Make sure you have approved final design and construction plans |
| | DON'T: | <input type="checkbox"/> DO NOT verify conditions onsite without visual confirmation |
| Required Tools | DO: | <input type="checkbox"/> Fill out Required Tools Checklist – verify all equipment onsite and ready for use |
| | DON'T: | <input type="checkbox"/> DO NOT begin installation until all equipment is onsite |
| Training | DO: | <input type="checkbox"/> Make sure installation team receives training from certified supervisor |
| | DON'T: | <input type="checkbox"/> DO NOT install geocells without training |
| Layout | DO: | <input type="checkbox"/> Layout section in correct direction, alignment |
| | DON'T: | <input type="checkbox"/> DO NOT open downslope yet |
| Fastening | DO: | <input type="checkbox"/> Use the correct number of staples per panel (1 staple / 2.54 cm of cell height, e.g., 8 staples in 20 cm height cell) |
| | DON'T: | <input type="checkbox"/> DO NOT use less than the required number of staples |
| Anchoring | DO: | <input type="checkbox"/> Anchor sections at top of slope crest as specified |
| | DON'T: | <input type="checkbox"/> DO NOT expand downslope until sections are anchored |
| Opening Sections | DO: | <input type="checkbox"/> Make sure that they are opened downslope in correct orientation <input type="checkbox"/> Verify that geocells are fully opened |
| | DON'T: | <input type="checkbox"/> DO NOT walk or drive vehicles on empty cells |
| Infill Placement | DO: | <input type="checkbox"/> Confirm specified infill soil is as specified in design <input type="checkbox"/> Verify that all cells overfilled by 5 cm before grading <input type="checkbox"/> Remove large rocks or debris |
| | DON'T: | <input type="checkbox"/> DO NOT infill if rain or runoff water is flowing downslope |
| Compaction | DO: | <input type="checkbox"/> Verify infill is compacted according to specifications <input type="checkbox"/> Verify that all cells overfilled by at least 2 cm after compaction |
| | DON'T: | <input type="checkbox"/> DO NOT compact if there is rain or flowing runoff water |
| Safety & Environment | DO: | <input type="checkbox"/> Adhere to all safety standards and procedures <input type="checkbox"/> Adhere to all environmental protection guidelines |
| | DON'T: | <input type="checkbox"/> DO NOT deviate from safety and environmental procedures |



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Safety Standards

Adhere to all applicable standard construction work safety procedures associated with site construction, power tools and construction vehicles (e.g., EU Directive 92/57¹ and US OSHA standards²). Safety procedures are part of the planning process and should be incorporated before actual construction begins; however, specifics are dependent upon project specifications and on-site supervision.

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.
- 2) **Underground utilities** – determine the approximate location of utility installations -- such as sewer, telephone, fuel, electric, water lines – that may be reasonably expected prior to excavation. Proceed with caution, and protect, support or remove underground utilities, in coordination with the appropriate owners wherever possible.
- 3) **Excavations and trenches** – make sure that steep temporary earthwork has stable slopes or protective structures to prevent cave-ins or failure, including protection from weather and water hazards during construction.

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 (PPE)

- 1) **Personal protective equipment** – installers should wear protective gear for on-site safety including, but not limited to, helmets, work shoes, gloves, and protective safety glasses where applicable.
- 2) **Reflective vests or garments** – installers should wear visibility clothing, such as orange vests, and if worn for night work, must be of reflective material.

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.

¹ 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>

² 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



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- 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)** – read and understand the tool labels and manual. Care must be taken to keep finger away from trigger when not using. Never point tool at yourself or others. Care must be taken during fastening, particularly to hands and fingers to avoid serious personal injury. Do not overlap staples or drive staples close to the edge of the material, as this may cause deflection of the fasteners. Open pneumatic stapler magazine cover fully to relieve stable feed load before removing magazine to load staples.

Vehicles and Mechanized Equipment

Observe all standard safety procedures for mechanized construction equipment including, but not limited to the following:

- 1) Do not operate vehicles on steep slopes. Perform earthmoving operations from the top or from the bottom of the slope.
- 2) Check vehicles before each shift to assure that all parts and accessories are in safe operating condition.
- 3) Do not drive a vehicle in reverse gear with an obstructed rear view, unless it has an audible reverse alarm, or another worker signals that it is safe.
- 4) Make sure that personnel are in the clear before dumping, shoveling or lifting.
- 5) Haulage vehicles that are loaded by cranes, power shovels, loaders etc., must have a cab shield or canopy that protects the driver from falling materials.
- 6) Lower or block blades, buckets, dump bodies, etc., when not in use, and leave all controls in neutral position, with parking brake set.

Infill and Cover Layers

- 1) All site preparation, infill, cover and landscape work will be in full compliance with detailed work plans and applicable industry standards.
- 2) Employees will be properly trained in the use of concrete pumps if applicable and alerted to potential hazards of poured concrete.



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Overview

This guide describes the procedures for installing Neoloy® Geocells (formerly known as PRS-Neoweb) in shoreline erosion control and channel slope protection applications. The following are the basic stages:

- Tools and handling
- Site preparation
- Layout sections
- Fasten sections
- Anchor stakes
- Expand sections
- Infill
- Special situations



FIGURE 1. TYPICAL CHANNEL PROTECTION

Key Points before Starting

1. **Materials** – ensure that all specified materials and the correct Neoloy Geocell type/width are delivered to the site, undamaged, and ready for use.
2. **Tools** – verify that you have the appropriate materials and required tools – such as, anchors, pneumatic stapler (and staples), air compressor and electricity source; geogrids and geotextiles as specified.
3. **Plans** – make sure that you have approved project construction plans and specifications.
4. **Layout** – when laying out the Neoloy strips, make sure the sections and cell openings are in the direction, alignment and elevation as shown on the construction drawings.
5. **Empty cells** – do not walk on exposed cells. Although the cell walls are stiff, Neoloy Geocells are a composite system that works only when infilled with soil. Walking on empty cells may bend the cell walls, such that the performance of the system is damaged. Use boards and planks to walk over empty cells if necessary.
6. **Vehicles** – vehicles may not be operated directly on exposed Neoloy Geocells at any time; during the infill process make sure that the Neoloy Geocells are not damaged by mechanical equipment.
7. **Safety** – ensure that employees are familiar with and adhere to safety standards and procedures.
8. **Environment** – if natural stream environments are involved, minimize environmental impacts of construction activities on fish habitat, sediment, pollutants and bank vegetation, according to relevant guidelines.

Typical Applications

The following are typical channel protection applications relevant to this installation guide:

- Stormwater and drainage channels
- Water treatment facilities and conduits
- Energy plant intake-channels, cooling ponds
- Stream protection - bank (slope) erosion, flood containment, seasonal crossings
- Reservoirs, dams, protection of hydraulic structures
- Environmental protection - sediment control /diversions during construction
- Pipeline and utility waterway crossings
- Marine facilities and boat ramps
- Shoreline and canal protection

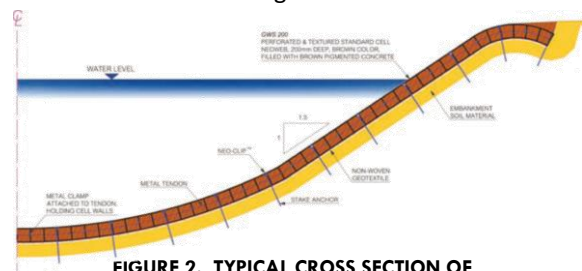


FIGURE 2. TYPICAL CROSS SECTION OF CHANNEL SLOPE PROTECTION



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Required Tools and Equipment

| | | |
|--|---|--|
|  |  |  |
| Neoloy Geocell Sections Palletized | Neoloy Geocell Sections Expanded on-site | Neo-anchor™ stakes, & Neo-clips™ & tendons (optional) |
|  |  |  |
| Geotextile (if specified) | Pneumatic Stapler and 1/2" (13 mm) Galvanized Staples | Air Compressor and Generator (60 psig /4 bar pressure) & Pneumatic Hammer with Head for Driving Stakes (optional) |

Optional Standard Construction Tools

In addition to the required and optional tools and equipment above, standard construction tools typically used during installation include the following:

- Hand Tools – shovels, rakes, sledge hammers, utility knives, and nails
- Lumber – long planks and/or rectangular boards used for walking over empty cells
- Power Tools – drills, saws, hammers
- Concrete Finishing – floats, trowels, tamping rods
- Surveying Equipment – levels, tripod, rod, laser beacons, receivers, survey stakes, string markers

Mechanical Construction Equipment

- Conventional excavators are the most suitable equipment for the installation infill and compaction processes.
- Optionally front-end loaders, skid-steer loaders, conveyors, dumpers and chutes may be used for the infill process.



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Material 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 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 3. PALLETED 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 4. OFF-LOADING SECTIONS ON-SITE



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Site Preparation

Prepare Channel and Slope Subgrade

The channel foundation soil/subgrade shall be prepared as indicated on the construction drawings or as directed by the Engineer, dependent on the application and subsoil conditions.

1. Prepare site and subgrade.
 - a) Clear and grub vegetative cover, rocks, debris, stumps, roots, and unacceptable soils.
 - b) Dewater the channel.
 - c) Perform excavation and/or fill operations.
2. Complete earthwork.
 - a) Shape and trim channel to planned grade and elevations.
 - b) Verify that no voids exist under the soil.
 - c) Ensure that the top soil layer is smooth without large stones or rock outcrops.
3. Mark channel for leveling and final elevations.



FIGURE 5. CLEAR AND SHAPE CHANNEL & SLOPES

Prepare Crest Trench/Shoulder at Top of Slope

Create a trench or shoulder at the crest (top) of the channel slope for anchoring the Neoloy Geocell system according to the project specifications. Typically, 80-100 cm wide, it may be excavated as a trench or a flat surface (shoulder), depending on the channel design and conditions.

1. Dig trenches/shoulders at the crest and channel invert as required by the project specifications.



FIGURE 6. FLAT SHOULDER ON CREST TO ANCHOR TOP OF SYSTEM



FIGURE 8. OPTIONAL TRENCH TO ANCHOR SYSTEM AT TOP OF CREST



FIGURE 7. TRENCH AT TOE OF CREST TO ANCHOR BOTTOM OF SYSTEM

Layout Sections

Direction of the Geocells

1. Orient the sections in the proper direction.
 - a. The closed sections are parallel to the channel (length).
 - b. The sections will be expanded down slope (width).

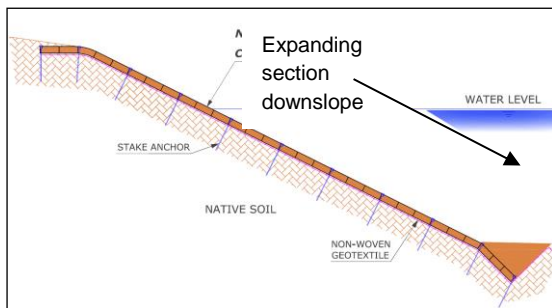


FIGURE 9. SECTION VIEW EXPANDING SECTION DOWNSLOPE

NOTE: Orientation of the sections is critical to the system performance and shall be verified by the contractor and/or engineer.

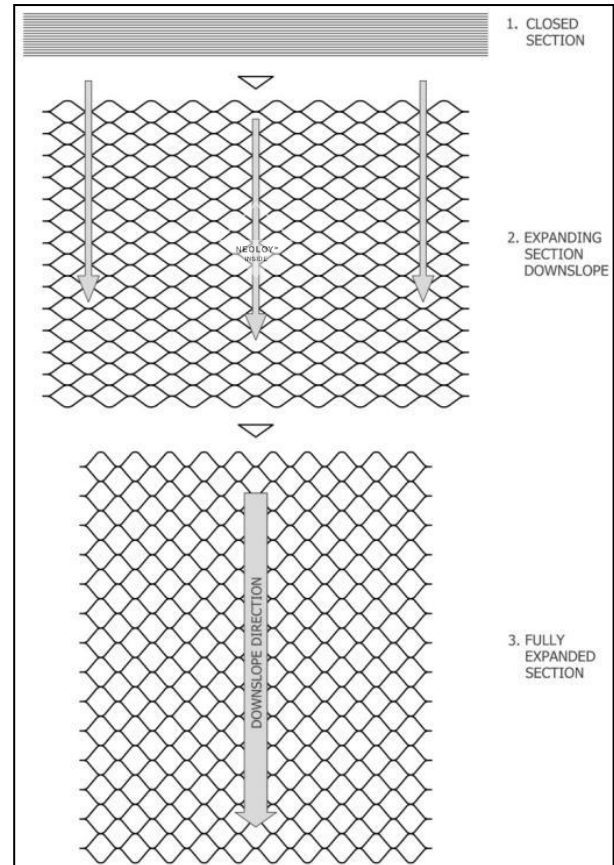


FIGURE 10. PLAN VIEW - LAYOUT & DIRECTION OF SECTIONS & CELLS

Disperse Sections along Top of Crest

1. Calculate the open section size and the channel slope width and length. This will enable you to plan the number and location of the sections to be connected.
 - a. Example: The channel slope width (downslope dimension) is 20m and section width is 8m. You will need to connect 3 Neoloy sections together, and then cut 4m off the section at the bottom of the channel.
2. Disperse the closed sections along the shoulder crest of the channel slope in series to facilitate joining them together:
 - a. Parallel to the crest (length) in series.
 - b. Back to back for the downslope dimension (width).



FIGURE 11. LAYOUT SECTIONS ALONG CREST SLOPE



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Fasten Sections

Fasten the sections spread out along the top of the channel slope. Connect multiple sections (length) end to end along the crest of the channel slope. However, the sections to be expanded downslope (width) must be connected face to face (and cut to appropriate dimension) before expanding downslope.

CAUTION: 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 with the number of staples required by the cell height (see Figure 12):
 - ≤ 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.

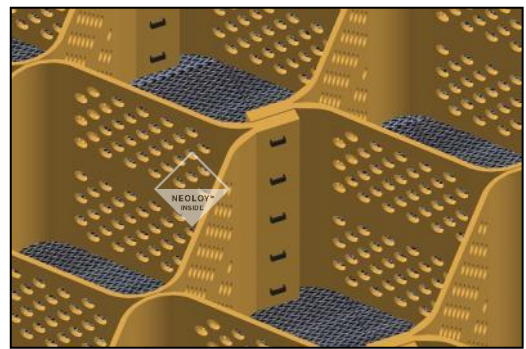


FIGURE 12. STAPLES FASTENING SECTIONS END TO END– PRS 150 MM

Staple Sections End to End (Figure 13)

- 1) 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.
- 2) Two people should operate the pneumatic stapler – one to hold the section open, while the other staples.
- 3) Fasten the edges of adjoining sections at the seams with the pneumatic stapler.
 - a) The staples must penetrate the seams (2 strips) on each section (total of 4 strips).
 - b) Staple in a straight line from top to bottom.

NOTE: Verify that staples penetrate all strips and/or seams – failure to do may cause entire section to fail.



FIGURE 13. FASTENING END TO END

Fasten Sections Face to Face (Figure 14)

1. Align 2 adjacent sections face to face (lengthwise).
 - a) Align the ends and perforations (if exist).
2. Fasten the middle of each cell (the non-perforated area) of the two strips. Continue fastening along the entire length of the two strips.

NOTE: Verify that each cell is fastened – failure to do so may cause entire section to fail.



FIGURE 14. FASTENING SECTIONS FACE TO FACE

Anchor Stakes at Top of Channel Crest

Before Anchoring Stakes – Layout Geotextile (if specified)

Geotextiles are used as an option to separate the subgrade and Neoloy system, particularly if the subgrade is different from the subbase material.

1. Install geotextiles according to the manufacturer’s directions.
2. Pin down geotextile or place edge in crest trench.
3. Unroll geotextile down the channel slope and invert.
4. Ensure required overlap between rolls or pre-sewn seams according to project specification – and to prevent movement.



FIGURE 15. LAYOUT TEXTILE

Anchor Stakes along Crest

Stakes anchor the Neoloy Geocell section along the top of the crest. A row of stakes are driven in along the top crest of the channel slope **prior to** opening and expanding the sections (and geotextile, if applicable) downslope.

Stakes can be Neo-clips, wooden or iron or steel j-hooks. Stake dimensions are typically 40-80 cm long (height) and 10-12 mm in diameter (depending on site and soil conditions).

1. Anchor the stakes firmly in the ground along the length of the crest deep enough to reach solid subbase:
 - a) **Geotextiles** (if applicable)
 - i) Geotextile fabrics – pin the stakes through the fabric.
 - ii) Non-permeable geomembrane – according to the manufacturer’s instructions.
 - b) **Intervals** – insert stakes in the center of every cell (when fully expanded) at the top of the crest to secure the sections. Typical spacing (dependent upon cell size) is 25 cm.
 - c) **Marking** – string or chalk line may be used to align staking locations and borders.



FIGURE 16. ANCHORING STAKES

NOTES:

Additional may be driven on the channel slope and at the toe of the channel slope after the sections have been expanded downslope to anchor the Neoloy Geocell system to the channel slope. The quantity, intervals and locations are specified in the project specifications. If applicable to project, see the section on Tendons in this document.



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Expand Sections Downslope

Place Outer Cells over Anchors and Pin Down

NOTE: Make sure there are no underground utilities – such as sewer, telephone, fuel, electric, water lines – before driving in stakes.

1. Place the outer row of cells of the joined sections over the anchors at the top of the crest.
2. Drive the J-hook stake down to pin the cells and section in place or optional special clips for the top of the anchors may be used to pin down the cells and section.



FIGURE 17. PLACING SECTION ON ANCHORS IN CREST TRENCH



FIGURE 18. NEO-CLIPS FASTEN SECTIONS IN PLACE ON FLAT CREST SHOULDER

Open Sections Downslope and Anchor

1. Open and expand the sections downslope.
2. Secure with stakes at density according to specifications.

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 Neology Geocell sections if necessary.

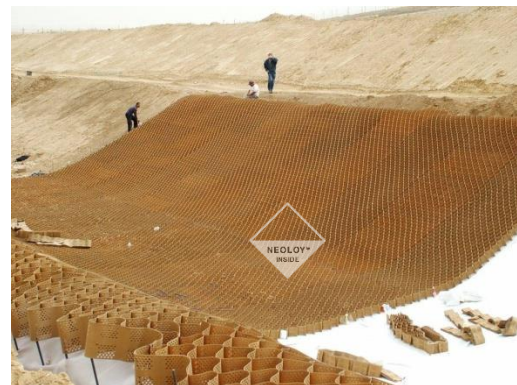


FIGURE 19. NEOLOGY EXPANDED DOWNSLOPE AND OVER CHANNEL BED



FIGURE 20. EXPANDING SECTION DOWNSLOPE

Expand Sections Downslope (cont.)

Anchor End of Section in Channel Bed

1. Anchor the bottom of the expanded sections in the toe-trench of the channel slope according to the project specifications.
2. The trench will be infilled with the designated soft or hard surface cover to protect the Neoloy Geocells from hydraulic forces in the channel.



FIGURE 21. ANCHORING END OF SECTION IN TOE-TRENCH IN CHANNEL BED (INFILL WITH BOULDERS)

Open Sections Downslope

1. Verify that the expanded sections are flush on the surface and opened to their nominal dimensions as illustrated in the figure and table below.

NOTE: Full cell expansion to the recommended dimensions is critical to the system performance and shall be verified by the contractor and/or engineer.

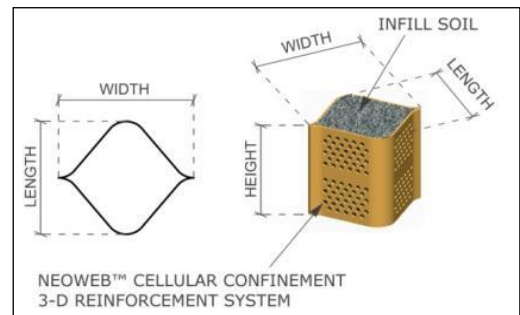


FIGURE 22. CELL GEOMETRY

TABLE 2. NOMINAL DIMENSIONS OF CELLS AND SECTIONS

| CELL & SECTION NOMINAL DIMENSIONS | | | |
|-----------------------------------|--------------------|---------------------|--------------------|
| PROPERTIES | DESCRIPTION | | |
| Cell Distance between Weld Seams | 356 mm (±2.5%) | 445 mm (±2.5%) | 712 mm (±2.5%) |
| Cell Wall Heights | 65, 75, 120 mm | 65, 75, 100, 120 mm | 100, 120 mm |
| Cell Dimension (Expanded) | 260 x 224 mm (±3%) | 340 x 290 mm (±3%) | 520 x 448 mm (±3%) |
| No. of Cells/m ² | 35 | 22 | 8 |
| Section Size (Expanded) | 2.7 x 7.4 m (±3%) | 2.8 x 10.7 m (±3%) | 2.7x 14.8 m (±3%) |
| Section Area (Expanded) | 20 m ² | 30 m ² | 40 m ² |



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Infill Placement – Soil

Mechanically backfill the Neoloy sections using the designated infill material according to standard earthworks procedures and in full compliance with the project specifications.

Place Infill Soil

NOTE: Do not operate vehicles on exposed Neoloy Geocells.

1. Before starting infill operations:
 - a) Visually inspect and remove any large pieces of debris, soil or rock (1/3 size of cell) to prevent damage to the cell walls.
 - b) Check that all stakes are driven down to the top of the cell wall edge – to pin down cells/ sections down in place either J-jook or other types of stakes with special clips).

2. Fill the top crest rows of the cells first.
3. Place and spread the infill from the top down until all the cells are filled.

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

4. Overfill the Neoloy Geocell walls (4-6 cm) to allow for consolidation and compaction.
5. Compact the soil. The back of an excavator (backhoe) shovel blade may be used to compact the infill downslope.
6. The compacted soil should be at least 1-2 cm above the cell walls.

7. Manually spread the soil with hand tools as 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.

NOTE: Add backfill up-slope of the channel crest and compact such that water does not pond or flow downslope during construction and after project completion.



FIGURE 23. SOIL INFILL DOWNSLOPE BY EXCAVATOR



FIGURE 24. BLADE COMPACTION

Landscape Cover and Vegetation (optional)

If the shoreline protection plan includes vegetation on the channel banks, it is a critical element of the soil stability and erosion control solution. Implement the planting plan according to project specifications in order to retain soil structure and promote vegetative growth. Fast growing species suitable for channel-stream environments are recommended. If specified, meshes or hydro-seeding may provide additional protection until the vegetation establishes itself.



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Infill Placement – Hard Cover

Granular Infill

Gravel and crushed stone aggregate are used for channels and slopes exposed to moderate sheet flows.

The procedures for infill of granular material are similar to those for soil infill. However, the infill placement, spread and compaction should be more controlled. Care should be taken to prevent the formation of voids and to prevent damage to the Neoloy Geocell walls. Granular material size shall not exceed the 1/3 of the cell size.

Concrete Infill

Concrete infill is used for steep slopes and for high flow rate channels. Infill operations with concrete are typically performed using a concrete pump or chute. No forms are necessary.

Use industry standard procedures for handling and pouring concrete and in full compliance with the project specifications.

1. Fill the top crest rows of the cells first and progress downslope.
2. Manually rake the concrete to ensure uniform distribution in the cells before hardening.

NOTE: Do not step on exposed cells to prevent damage.



FIGURE 25. CONCRETE INFILL OF TRENCH

Hydrostatic Pressure

If the site is subject to high hydrostatic pressure (high groundwater tables) the project specifications may specify the following solution:

1. Place permeable sacks filled with gravel in the cells/locations designated in the project plan.
2. Do not pour concrete over these sacks and leave exposed.

The sacks permit the outflow of groundwater, thereby relieving the pore water pressure in the channel slope.



FIGURE 26. CONCRETE INFILL OF CHANNEL BED



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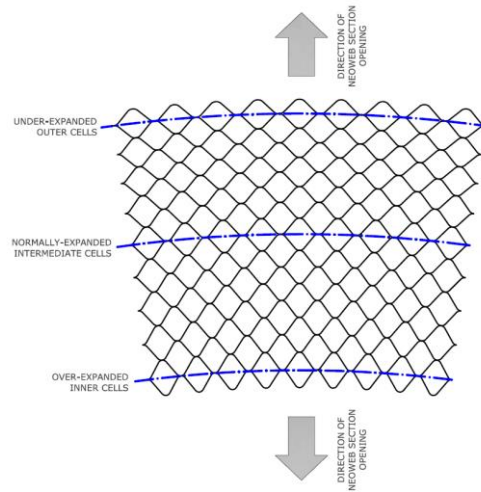
Installation on Curves

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.

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 cut sufficient tapered sections to cover the entire radius of the curve.

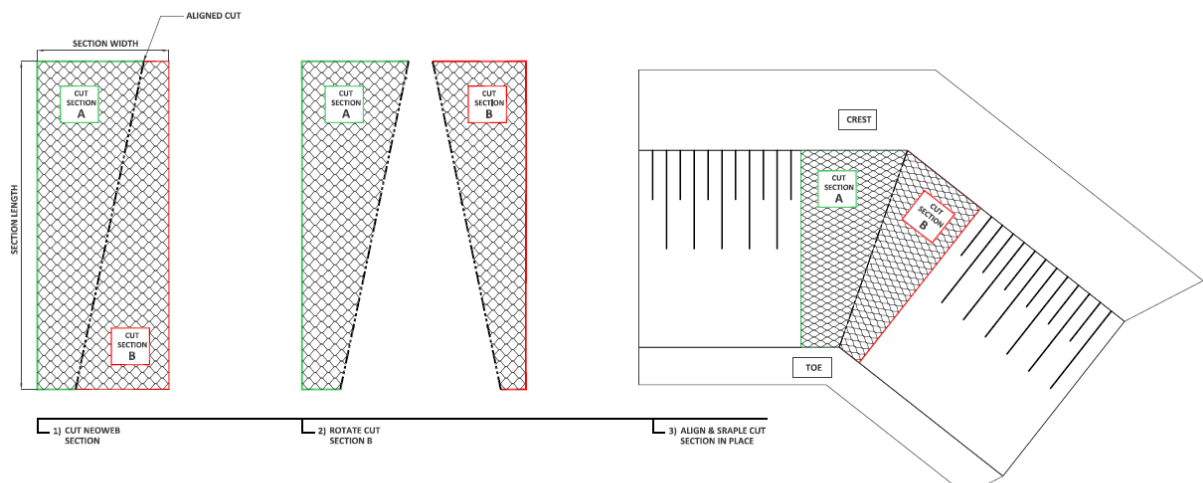


FIGURE 27. TAPERED EXPANSION OF SECTIONS ON CURVE

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



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Special Situations

Crest Drainage Systems (if specified)

Although Neoloy provides excellent soil protection, excessive storm run-off under the Neoloy Geocells at the crest can undermine the system. Depending upon site and project conditions, additional drainage systems (collection drains, spillways or drainage sluices) may be specified to drain heavy water flows.

These include:

1. Collection drains along the length of the slope shoulder crest to prevent run-off underneath the Neoloy Geocells.
2. Spillways or drainage sluices down the slope face and/or trenches to channel heavy water flows from the slope surface.

The engineered drainage systems should be carried out according to the project specifications.

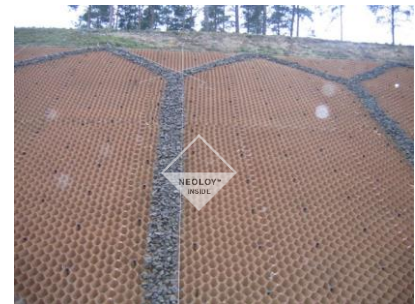


FIGURE 28. OPTIONAL SLOPE DRAINAGE SYSTEM

Environmental Considerations of Construction Activities in Natural Streams

- 1) Perform all activities in accordance with all applicable guidelines to minimize the environmental impacts of construction activities on fish habitat, passage barriers, release of sediment or pollutants, and removal of stream bank vegetation.
- 2) Preserve natural vegetation of stream banks where possible and limit disturbances to one side at a time.
- 3) Perform dewatering and construction during low water periods. Start downstream and work upstream one segment at a time.
- 4) Implement re-vegetation schemes immediately after construction.



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Tendons (Optional)

Tendons are an option for further reinforcement in the case of very steep slopes or when a non-permeable geomembrane is used. Their use, quantities and locations shall be according to the project specifications.

Use of Tendons (if specified)

1. The tendons may be threaded through the existing perforations in the Neoloy Geocell walls or through holes drilled on site through the closed sections according to the project plans.
2. Calculate the entire length of the slope from the top to bottom and cut the tendon to the appropriate length.
3. Thread the tendon through the hole drilled in the Neoloy before expanding the Neoloy Geocell sections downslope.
4. Attach and tie the tendon to an anchor in the trench along the crest of the slope.
5. Expand the Neoloy Geocell sections downslope while stretching out the tendon with the open Neoloy sections.
6. The tendons may be tied around anchors or looped around the perforations or holes with a knot according to the project specifications.



FIGURE 29. TENDONS THREADED THROUGH PERFORATIONS



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






| No. | Description | Responsibility | | Images | Required | Status |
|----------------------------------|--|----------------|-----|--------|----------|--------|
| | | Client | PRS | | | |
| Preinstallation - General | | | | | | |
| 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: | ✓ | | | | |






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



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Heavy Engineering Equipment for Installation:

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



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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 | | ✓ | | |