

Construction Specifications

Base Stabilization • Granular Pavements

08/13/09 REV

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PART 1 GENERAL

1.01 SECTION INCLUDES

- A. The work covered by this section includes the furnishing of all labor, materials, equipment and incidentals for construction and installation of the Cellular Confinement System as shown on the Construction Drawings and described by the Contract Specifications.
- B. Use of the Cellular Confinement System to enhance the long-term load-deformation performance of paved roads, granular pavements, tracks, runways, aprons and access structures
- C. Products and materials which form the system include: geocells (or cellular confinement sections); select infill and granular base course materials; woven & nonwoven geotextiles; drainage composites; surface treatments; integral tendons (for low water crossings); straight stake rebar anchors; galvanized staples.

1.02 RELATED WORK

- A. Section [] - Earthwork, Subgrade preparation.
- B. Section [] - Subsurface Drainage. Install drainage materials, as required, in areas where in-situ soils have poor permeability.

1.03 REFERENCES

- A. AASHTO Specification M-288-96, T-99 and relevant CSI (Construction Specifications Institute) Spec Data Documentation
- B. US Army Corps of Engineers Technical Report GL-86-19, Appendix A, including Seam Strength Hang Test and current Peel Strength Test.
- C. American Society for Testing and Materials (ASTM).
- D. Manufacturer's Technical Notes and Design and Installation Guidelines.

1.04 QUALITY ASSURANCE AND CERTIFICATION

- A. Product manufacturers shall provide certification of compliance to all applicable testing procedures and related specifications upon written request.
- B. Geocell manufacturer shall be a specialist in the manufacturing of geocell material with at least 5 years experience producing geocell products for base stabilization and shall have earned ISO 9002 certification for its quality management system of manufacturing for all processes from base resin through finished product.

1.05 SYSTEM DESCRIPTION

- A. The Cellular Confinement System consists of geocell material into which specific infill material may be placed. The Cellular Confinement System section is an assembly of high-density polyethylene sheet strips, connected by a series of ultrasonic welded seams. When expanded, the interconnected strips form the walls of a flexible, three-dimensional, honeycomb like, cellular structure.
- B. The Cellular Confinement System is produced in a range of cell depths. Standard cell depths are: 75 mm (3 in.), 100 mm (4 in.), 150 mm (6 in.) & 200 mm (8 in.)

1.06 SUBMITTALS

- A. Submit shop drawings.
- B. Submit product data, drawings and samples.
- C. Submit current product quality assurance test data and independent laboratory test results indicating compliance with specified performance.
- D. Product manufacturers shall provide certification of compliance to all applicable testing procedures and related specifications upon written request.

PART 2 PRODUCTS

2.01 MANUFACTURER and AVAILABILITY

- A. SSP Geocell is supplied by Soil Stabilization Products Co., Inc., PO Box 2779, Merced, CA 95344. Phone: (800) 523-9992.



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2.02 CELLULAR CONFINEMENT SYSTEM

A. Polyethylene Composition and System Properties

PROPERTY	Value & Test Method
1. Specific Gravity	0.935 - 0.965 ASTM D 1505
2. Carbon Black	1.5 - 2.0% By Weight
3. Sheet Thickness	1.27 mm (50 mil) -5% + 10% ASTM D5199
4. Minimum ESCR <->	3000 hr ASTM D1693
5. Seam Peel Strength	Min 450 lbs for 8" wide seam U.S. Army Corps of Engineers, Technical Report
6. Seam Hang-Strength Test 1	A 4" wide seam sample shall support a 160 lb load for 7 days minimum in a temperature controlled environment undergoing a temperature change on a 1-hour cycle from ambient room temperature to 130 F (54 C) per ASTM E41. Ambient room temperature is defined as 74 F ± 6 F (23 ± 3 C).
7. Seam Hang-Strength Test 2	A 4" wide seam sample shall support a 160 lb load for 30 days minimum at ambient room temperature per ASTM E41. Ambient room temperature is defined as 74 F ± 6 F (23 C ± 3 C)
8. Textured Surface Treatment	Strips used to make Geocell sections shall have a sheet thickness per paragraph 2.2A.3 above. Thickness shall be determined in the flat, before any surface disruption. The surface texturing shall be a multitude of rhomboidal (diamond shape) indentations. The rhomboidal indentations shall have a surface density of 22 - 31 per cm ² (140 - 200 per in ²). The thickness of the textured sheet shall be 1.52 mm +/- 0.15 mm (60 mil. +/- 6 mil.)
9. Perforated Surface Treatment	The perforations shall be horizontal rows of 10 mm (0.391 in) diameter holes. Perforations within each row shall be 19 mm (0.75 in) on-center. Horizontal rows shall be staggered and separated 12 mm (0.50 in) relative to the hole centers. The edge of strip to the nearest edge of perforation shall be 8 mm (0.312 in) minimum and the centerline of the spot weld to the nearest edge of perforation shall be 6 mm (0.25 in) minimum. The quantity of perforations shall remove 14% +/- 1% of the cell wall area.

The polyethylene strips shall be perforated and textured surface such that the peak friction angle between the surfaces of the perforated plastic and a #40 silica sand at 100% relative density shall be no less than 85% of the peak friction angle of the silica sand in isolation when tested by direct shear method per ASTM D 5321.

ESCR - Environmental Stress Crack Resistance

B. Assembly

Standard Geocell sections (or cellular confinement system sections - CCS) are fabricated using strips of sheet polyethylene each having a length of 142 inches (3.61m) and a width equal to the cell depth. The polyethylene strips shall be connected using uniformly-spaced, full-depth ultrasonic spot-welds. Welds shall be off-set and aligned perpendicular to the longitudinal axis of the strips. Weld spacing shall be 14 in. ± 0.10 in. (356 mm ± 2.5 mm). The ultrasonic weld melt-pool width shall not exceed 1.0 in. (25 mm).

C. Geocell Dimensions and Weights

1. Individual cells of the standard Geocell section shall be uniform in shape and size when expanded. The nominal cell dimension, in expanded configuration, shall measure 9.6" in length (in the direction of expansion) with 0.25" tolerance and 9.35" in width. Expanded section size is 7.78' wide x 20' long.

- a. Cell Area: 48.09 in cell expanded (nominal area)
- b. Product Code: GC 20V61034P
- c. Cell depth: 6.0" (150 mm)
- d. Section weight: 62.65 lb (38.65 kg)
- e. Section width 7.78 ft (2.65 m)
- f. Section length 20 ft (7.39 m)

2.03 ANCHORING COMPONENTS

A. Integral High-Tenacity Polymer Tendons (for water crossing applications)

Geocell sections can be supplied with a series of aligned holes, pre-formed in the cell walls, to accommodate insertion of polymer tendons throughout their length. Hole dimensions are matched to the required tendon type. Standard tendons consist of knitted multi-filament high-tenacity polyester core with an optional polyethylene sheath coating. The polyester tendon shall be manufactured from bright, high-tenacity, industrial-continuous-filament polyester yarn woven into a braided strap.



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Elongation shall be 9-15% at break. The tendon reference name and ultimate break strength shall be per the following:

1. Tendons:

a. Product Code:	b. Minimum Break strength
TP-31	700 lbs
TPP-44	990 lbs
TP-67	1506 lbs
TK-89	2000 lbs
TP-93	2090 lbs
TK-133	3000 lbs

B. Straight Stake Anchors

Standard construction rebar, minimum diameter of 1/2"

C. Galvanized Staples

1/2" Ribbon wire staples, galvanized, Stanley Bostitch #SB103020 using Stanley Bostitch P50-10B pneumatic Stapler.

2.04 RELATED GEOSYNTHETIC COMPONENTS

A. Geotextiles

Select the geotextile components of cellular confinement structures in accordance with either, AASHTO Specification M 288-96, or, equivalent local standards. Functions include: drainage, filtration, separation and reinforcement. Design review and careful consideration of local conditions are recommended.

B. Geo-composite Drainage Systems

Geo-composite drainage systems, including geotextile wrapped perforated pipes and sheet drainage cores, may be incorporated as sub-drains and interceptor drains. Product selection and application shall be determined by the design engineer.

C. Geogrid and Geotextile Sheet Reinforcement

Sheet reinforcement materials shall meet appropriate durability, long-term strength, and soil interaction requirements. In the absence of local design and selection standards, the recommendations given in Task Force 27 (1990), In-Situ Improvement Techniques, "Design Guidelines for Use of Extensible Reinforcements for Mechanically Stabilized Earth Walls in Permanent Applications," Joint Committee of AASHTO-AGC-ARTBA, AASHTO, Washington, D.C., shall be followed.

2.05 GRANULAR BASE COURSE MATERIALS

- A. The granular base material shall be well graded crushed rock with a maximum particle size of 1-1/2" and no greater than 8% passing the #200 sieve.

2.06 CELL INFILL MATERIALS

- A. Selection of infill materials is based primarily on the nature and magnitude of design loads, quality of subgrade soil and pavement surface desired. Combinations of infill types can be specified to meet a range of performance requirements.
- B. Standard infill materials include:
1. Sand
 2. Gravel or crushed rock with a maximum particle size of 1-1/2" (38 mm).
 3. Concrete and soil-cement mixes.

PART 3 INSTALLATION

3.01 EXAMINATION

- A. Verify that site conditions are as indicated on Construction Drawings. Examine subgrade (native soil) conditions to ensure soil is structurally adequate to support base course materials and design loads. Do not start base course soil placement until unsatisfactory conditions are corrected. Check for insufficient compaction, slumping areas, improper gradients, debris, and improper drainage.
- B. Verify that all materials required for the work and delivered to site comply with contract specifications. Contact the project engineer for resolution of unsatisfactory conditions. Installation of materials constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 SITE and SUBGRADE PREPARATION

- A. Start site preparation by removing debris and vegetative cover from the installation area.
- B. Excavate, shape and/or fill the subgrade soils to the grades, elevations and dimensions shown on the Construction Drawings. Ensure that the grade and permeability of the subgrade soils will provide adequate subsurface drainage.
- C. Proof roll and examine the subgrade soil to ensure that it meets minimum strength requirements assumed for the design. Remove unacceptable materials and replace with approved compacted fill.

3.03 SEPARATION and DRAINAGE

- A. Where specified, install a suitable geotextile separation layer prior to placement of the base material. Secure in position according to manufacturer's recommendations.



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- B. Where specified, install appropriate drainage materials. Ensure that the system is functional and connected to appropriate drain system.

3.04 BASE COURSE INSTALLATION

- A. Place, shape and compact specified granular subbase materials to the line and grade shown on construction drawings. Compact to a minimum of 95% Standard Proctor Dry Density (SPDD, ASTM D-698, AASHTO T-99). Lifts not to exceed 6" before compacting.

3.05 GEOCELL SECTION INSTALLATION

- A. Expand Geocell sections to proper dimension and position, as indicated on construction drawings. Hold sections into position using either a stretcher frame or rebar stakes, or by infilling several peripheral cells.
- B. Check the dimensions of each section to ensure it is properly expanded.
- C. Align interleaf edges and/or butt joints of adjoining sections as detailed in the construction drawings. Ensure that upper surfaces of adjoining sections are flush. Fasten sections together by stapling the interleaf and butt joints with pneumatic stapler.
- D. Geocell sections, with or without tendons, shall be anchored in accordance with the construction drawings. Rows of straight stakes with, shall engage and/or bear against the cell walls or engage and hold the integral tendons against the subgrade soil. The size, type and distribution of stake anchors shall be as specified in the construction drawings and varied to suit site conditions and geometry.

3.06 PLACEMENT OF INFILL

- A. Place specified infill into expanded cells with suitable equipment such as front-end loader, dozer or backhoe. Limit drop height to a maximum of 3 ft.
- B. Overfill the cells and level the surface approximately 2 in. (50mm) above cell walls. Maintain sufficient granular cover to ensure that material handling equipment trafficking over the geocell does not damage the cell walls.
- C. Compact the fill in the cells to a minimum of 95% Standard Proctor Dry Density (T-99) using suitable compaction equipment. Using a straight edged bucket or dozer blade, shape the compacted surface to the required elevation

3.07 FINISHING PROCEDURES

- A. Apply specified surface treatments following placement of infill in accordance with manufacturer's recommendations.

