

PRODUCT SPECIFICATION CSI FORMAT
Slope and Channel Grid Systems
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This specification utilizes the Construction Specifications Institute (CSI) Format, including MasterFormat (2004 Edition), SectionFormat, and PageFormat, contained in the CSI Manual of Practice. Optional text is indicated by brackets [], delete optional text in your final copy. Delete Specifier Notes which precede some sections. Each section must be carefully reviewed by the Engineer to meet the requirements of the project and local building code.

SECTION 31 32 00
SOIL STABILIZATION SYSTEM

Specifier Notes: This section covers Cell-Tek Geosynthetics Slope and Channel Grids (geocell) Cellular Confinement Systems. The systems are comprised of the following basic components: Slope Grid or Channel Grid (geocell), one or more infill materials, a geotextile fabric, earth anchoring devices, polymer tendons, geogrids, geomembranes, geocomposite drainage materials, and possibly surface treatments.

PART 1 GENERAL

Specifier Note: Revise any part of the sections below to suit project requirements.

1.01 SUMMARY

A. Cellular confinement system utilized for slope protection or channel protection.

1.02 RELATED SECTIONS

- A. Section 31 24 00 - Embankment
- B. Section 31 25 00 - Erosion and Sedimentation Control

1.03 REFERENCES

- A. AASHTO M 218 - Steel Sheet, Zinc-Coated (Galvanized) for Corrugated Steel Pipe
- B. AASHTO M 288 - Geotextile Specification for Highway Applications
- C. ASTM D 1505 - Density of Plastics by the Density-Gradient Technique
- D. ASTM D 1693 - Environmental Stress-Cracking of Ethylene Plastics
- E. ASTM D 5199 - Measuring Nominal Thickness of Geotextiles and Geomembranes
- F. ASTM E 41 - Terminology Relating to Conditioning

1.04 SYSTEM DESCRIPTION

Specifier Note: Edit the following as required for the project.

A. Cellular confinement system involves a three-dimensional geocell material into which specific infill materials are placed. It is composed of a set of recycled polyethylene strips which are ultrasonically welded together at certain intervals, creating seams aligned perpendicular to longitudinal axis of strips. When expanded, this structure creates a flexible, three-dimensional matrix of connecting cells.

B. Complete slope and channel protection systems includes Slope or Channel Grid sections, cell infill materials and some or all of the following items: [geotextiles], [geogrids], [geomembranes], [geocomposite drainage materials], [tendons], [stake anchors], and [surface treatments].

1.05 SUBMITTALS

A. Product Data: Submit product data provided by manufacturer.

B. Technical Drawings: Submit manufacturer's technical drawings including section layout, direction of expansion, tendon locations, and anchor stake locations.

C. Samples: Submit manufacturer's samples.

1. Geocell sections
2. Tendons
3. Geotextile swatch
4. Stake anchors
5. Any geosynthetic components, if required
6. [Specimen of infill materials, if required]

D. Material Certification: Submit certifications of the polyethylene material used to make geocell material.

1. Certification of percentage of HALS provided by manufacturer
2. Certification of polyethylene density (ASTM D1505) and ESCR (ASTM D1693) provided by manufacturer

1.06 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Quality management system certified to ISO 9001:2000.

B. Installation: Choose an installer with a satisfactory record of performance on projects of comparable size, complexity, and quality.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials in manufacturer's original packaging with identification labels clearly intact.

B. Storage:

1. Store materials per manufacturer's instructions.
2. Store materials out of direct sunlight.

C. Handling: Use care when unwrapping, handling, expanding, and infilling grid sections.

1. Be certain to overfill cells prior to any load bearing or vehicular traffic.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Cell-Tek Geosynthetics LLC, 2431 Crofton Lane, Suite 9, Crofton, MD 21114
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2.02 Cell-Tek Slope Grid and Channel Grid CELLULAR CONFINEMENT SYSTEM

Specifier Note: All measurements are subject to manufacturing tolerances, unless otherwise specified.

A. Base Materials:

1. Recycled Polyethylene Stabilized with HALS:

- a. Density, ASTM D 1505: 0.9526 g/cm³ (59.47 pounds per cubic foot)
- b. Environmental Stress Crack Resistance (ESCR), ASTM D 1693: 3,500 hours
- c. Ultra-Violet Light Stabilization: Certified 1% HALS (Hindered Amine Light Stabilizer) content by weight, homogeneously distributed throughout material

B. Strip Properties:

1. Perforated and Textured Strip/Cell:

- a. Strip Sheet Thickness, ASTM D 5199: 1.78 mm, minus 5 percent, plus 10 percent
- b. Polyethylene Strips: Textured surface with a multitude of rhomboidal (diamond shape) indentations
- c. Polyethylene Strips: Perforated with horizontal rows of 9.5 mm (0.37 inch) diameter holes
- d. Perforations Within Each Row: 20 mm (0.79 inch) on-center
- e. Horizontal Rows: Staggered and separated 13 mm (0.51 inch) relative to hole centers
- f. Edge of Strip to Nearest Edge of Perforation: 7.4 mm (0.29 inch) minimum
- g. Centerline of Spot Weld to Nearest Edge of Perforation: [45.45 mm (1.79 inches) minimum for Slope Grid series] and [26.25 mm (1.03 inches) minimum for Channel Grid series]

2. Weld Spacing:

- a. Weld Spacing for [Slope Grid Sections: 432 mm plus or minus 2.5 mm (17.0 inches plus or minus 0.10 inch)]
- b. Weld Spacing for [Channel Grid Sections: 711 mm plus or minus 2.5 mm (28.0 inches plus or minus 0.10 inch)]

C. Cell Properties:

1. Individual Cells: Uniform in shape and size when expanded.

Specifier Notes: Specify either SLP300™ Slope Grid, SLP400™ Slope Grid, SLP600™ Slope Grid, SLP800™ Slope Grid, CR300™ Channel Grid, CR400™ Channel Grid, or CR800™ Channel Grid. Consult Cell-Tek Geosynthetics, LLC for suitable product type and cell size.

2. Individual Cell Dimensions: SLP300™-Cell Detail

Nominal Dimensions ± 10%

- a. Length 315 mm (12.4 inches)
- b. Width 271 mm (10.7 inches)
- c. Nominal Area plus or minus 1%: 427 cm² (66 square inches)
- d. Nominal Depth: 75 mm (3 inches)

3. Individual Cell Dimensions: SLP400™-Cell Detail

Nominal Dimensions ± 10%

- a. Length 315 mm (12.4 inches)
- b. Width 271 mm (10.7 inches)
- c. Nominal Area plus or minus 1%: 427 cm² (66 square inches)
- d. Nominal Depth: 100 mm (4 inches).

4. Individual Cell Dimensions: SLP600™-Cell Detail

Nominal Dimensions ± 10%

- a. Length 315 mm (12.4 inches)
- b. Width 271 mm (10.7 inches)
- c. Nominal Area plus or minus 1%: 427 cm² (66 square inches)
- d. Nominal Depth: 150 mm (6 inches).

5. Individual Cell Dimensions: SLP800™-Cell Detail

Nominal Dimensions ± 10%

- a. Length 315 mm (12.4 inches)
- b. Width 271 mm (10.7 inches)
- c. Nominal Area plus or minus 1%: 427 cm² (66 square inches)

d. Nominal Depth: 200 mm (8 inches).

6. Individual Cell Dimensions: CR300™-Cell Detail

Nominal Dimensions \pm 10%

a. Length 508 mm (20 inches)

b. Width 475 mm (18.7 inches)

c. Nominal Area plus or minus 1%: 1206.50 cm² (187 square inches)

d. Nominal Depth: 75 mm (3 inches).

7. Individual Cell Dimensions: CR400™-Cell Detail

Nominal Dimensions \pm 10%

a. Length 508 mm (20 inches)

b. Width 475 mm (18.7 inches)

c. Nominal Area plus or minus 1%: 1206.50 cm² (187 square inches)

d. Nominal Depth: 100 mm (4 inches).

8. Individual Cell Dimensions: CR800™-Cell Detail

Nominal Dimensions \pm 10%

a. Length 508 mm (20 inches)

b. Width 475 mm (18.7 inches)

c. Nominal Area plus or minus 1%: 1206.50 cm² (187 square inches)

d. Nominal Depth: 200 mm (8 inches).

D. Cell Seam Strength Tests:

1. Short-Term Seam Peel-Strength Test:

a. Cell Seam Strength: Uniform over full depth of cell.

b. Minimum Seam Peel Strength: 1030 N (233 lbf) for 75 mm (3 inch) depth, 1390 N (314 lbf) for 100 mm (4 inch) depth, 2090 N (472 lbf) for 150 mm (6 inch) depth, 2760 N (623 lbf) for 200 mm (8 inch) depth

2. Long-Term Seam Peel-Strength Test:

a. Conditions: Minimum 7 days in a temperature-controlled environmental chamber that undergoes fluctuation on a 1-hour cycle from room temperature (per ASTM E 41) to 54 degrees C (130 degrees F)

b. Testing is conducted on the seam of 100 mm (4 inch) cell depth specimens.

c. Test Method: Seam shall support a 72.5 kg (160 pound) load for a minimum of 7 days.

E. Section Types and Sizes:

Specifier Note: Consult Cell-Tek Geosynthetics for assistance in specifying appropriate product type and cell depth.

1. Cell Depth: 75 mm (3") - SLP300™

a. Section Length: 8.7 m (29 feet)

b. Section Width: 2.4 m (8 feet)

c. Section Area: 20.88 square meters (232 square feet)

2. Cell Depth: 100 mm (4") - SLP400™

a. Section Length: 8.7 m (29 feet)

b. Section Width: 2.4 m (8 feet)

c. Section Area: 20.88 square meters (232 square feet)

3. Cell Depth: 150 mm (6") - SLP600™

a. Section Length: 8.7 m (29 feet)

b. Section Width: 2.4 m (8 feet)

c. Section Area: 20.88 square meters (232 square feet)

4. Cell Depth: 200 mm (8") - SLP800™

a. Section Length: 8.7 m (29 feet)

b. Section Width: 2.4 m (8 feet)

c. Section Area: 20.88 square meters (232 square feet)

5. Cell Depth: 75 mm (3") - CR300™
 - a. Section Length: 15.58 m (47.85 feet)
 - b. Section Width: 3.02 m (9.9 feet)
 - c. Section Area: 47.05 square meters (474 square feet)
6. Cell Depth: 100 mm (4") - CR400™
 - a. Section Length: 15.58 m (47.85 feet)
 - b. Section Width: 3.02 m (9.9 feet)
 - c. Section Area: 47.05 square meters (474 square feet)
7. Cell Depth: 200 mm (8") - CR800™
 - a. Section Length: 15.58 m (47.85 feet)
 - b. Section Width: 3.02 m (9.9 feet)
 - c. Section Area: 47.05 square meters (474 square feet)

2.03 TENDON REQUIREMENTS

Specifier Notes: Specify tendons required to meet design requirements by tendon style for the application. Consult Cell-Tek Geosynthetics for assistance.

A. Tendon Style:

1. [TES-1600] [TES-2100] [TES-3000]*

*Specifier Note: If engineer has specified break strength other than what is listed please consult Cell-Tek Geosynthetics for the proper tendon style.

- a. Material: High-strength, continuous-filament polyester yarns woven into flat webbing
- b. Elongation: 9 to 15 percent at break
2. [TPP-2000]
 - a. Material: Fibrillated polypropylene yarns woven into flat webbing
3. [TKS-Style]
 - a. Material: Kevlar® Aramid tendon is woven from polyimide yarns into flat webbing

2.04 ANCHORING COMPONENTS

Specifier Notes: Specify required anchoring components and delete the others. Choose from options for galvanizing and rod diameter for the steel stakes. Provide data for the wood stakes. Consult Cell-Tek Geosynthetics for assistance.

A. Steel J-Pin Stakes:

1. Material: Mild steel or reinforced steel rod
2. [Galvanizing: AASHTO M 218]
3. Return: Minimum-radius, 180-degree return at one end
4. Rod Diameter: [10 mm (0.375 inch)] [13 mm (0.50 inch)] [16 mm (0.625 inch)] [19 mm (0.75 inch)]
5. Stake Length: As indicated on the drawings

B. Straight Steel Stakes:

1. Material: Mild steel or reinforcing steel rod
2. [Galvanizing: AASHTO M 218]
3. Rod Diameter: [10 mm (0.375 inch)] [13 mm (0.50 inch)] [16 mm (0.625 inch)] [19 mm (0.75 inch)]
4. Stake Length: As indicated on the drawings

C. Wood Stakes:

1. Wood Type: _____, free of knots that may diminish strength
2. Cross Section: _____ by _____
3. Length: _____

2.05 RELATED GEOSYNTHETIC COMPONENTS

Specifier Notes: Specify related geosynthetic components required for the application. Consult Cell-Tek Geosynthetics for assistance in determining requirements.

- A. Geotextiles: AASHTO M 288
- B. Geocomposite Drainage Materials:
- C. Geogrid and Geotextile Sheet Reinforcement:
- D. Geomembrane and Impervious Barriers:

2.06 CELL INFILL MATERIALS

Specifier Notes: Specify cell infill materials based on nature and size of design loads. Specify combinations of infill types to meet required range of performance requirements. Consult Cell-Tek Geosynthetics LLC for assistance in determining requirements.

A. Cell infill materials include one or a combination of the following:

- 1. Sand
- 2. Gravel and crushed rock or stone with a maximum particle size of 75 mm (3 inches) for erosion control applications
- 3. Concrete and soil-cement mixes
- 4. For slope surface stabilization and erosion control applications, infill with screened topsoil, free of foreign material

2.07 SURFACE TREATMENTS

Specifier Notes: Specify surface treatments of infilled geocell system.

A. Surface treatment includes one or a combination of the following:

- 1. Vegetation
- 2. Degradable revegetative blankets
- 3. Turf reinforcement mats
- 4. Sprayed emulsions and binders
- 5. Asphalt
- 6. Concrete
- 7. Aggregates

PART 3 EXECUTION

3.01 EXAMINATION

A. Evaluate site conditions. Notify the Engineer and refrain from excavation until site conditions have been corrected.

B. Evaluate the layout of the project as indicated on the drawings. Notify the Engineer and do not proceed until the layout of the project matches the drawings.

Specifier Notes: Edit the installation requirements as required for the project. Consult Cell-Tek Geosynthetics for assistance in determining requirements.

3.02 INSTALLATION OF SLOPE AND CHANNEL PROTECTION SYSTEMS

A. Prepare subgrade and install according to manufacturer's instructions.

B. Subgrade Preparation:

1. Excavate and shape foundation soils in order for installed Slope Grid or Channel Grid sections to be flush with or slightly lower than surrounding terrain or final grade as indicated on the drawings or as directed by the Engineer.

2. Install non-woven geotextile underlayer, if specified, confirming required overlaps are maintained and outer edges of geotextile are buried a minimum of 150 mm (6 inches) below grade.

C. Positioning and Anchoring without Tendons:

1. Anchor Slope Grid or Channel Grid sections at crest of slope. Use type of anchor and frequency of anchoring as indicated on the drawings or as directed by the Engineer.

2. Expand Slope Grid or Channel Grid sections down slope. Confirm each section is expanded uniformly to required dimensions and outer cells of each layer are correctly aligned. Interleaf or overlap edges of adjacent sections in each layer, joining the grid sections per manufacturer's installation instructions to create a continuous matrix of cells. Confirm upper surfaces of adjoining sections are flush at joint and adjoining cells are fully anchored. Anchor with specified anchors in a prescribed pattern throughout slope surface.

D. Placement and Anchoring with Tendons:

1. Feed precut lengths of tendon material through holes in cell walls of Slope Grid or Channel Grid section before expanding individual sections into position. Secure tendons so that tendons remain in place while sections are being expanded.

2. Anchor tendons and Slope Grid or Channel Grid sections at the crest of the slope and expand down slope.

3. In cases where penetration of subgrade is allowed, anchor tendons and Slope Grid or Channel Grid sections with specified anchors in prescribed pattern throughout slope surface.

E. Placement of Infill:

1. Put specified infill materials into expanded cells with suitable material handling equipment, such as a backhoe, front-end loader, conveyor, or crane-mounted skip. Drop height must not exceed 1 m (3 feet). Avoid displacement of Slope Grid or Channel Grid sections by infilling from crest to bottom of slope. Overfill and compact infill according to the consistency of material and cell depth as follows:

a. Overfill screened topsoil between 25 to 50 mm (1 to 2 inches) and lightly tamp or roll so that soil is even with top edge of cell walls. Apply specified surface treatment.

b. Overfill loose granular materials approximately 25 mm (1 inch) and compact with a plate tamper or backhoe bucket. Remove loose surface material so infill is even with top edges of cells.

c. Manually compact or vibrate concrete. Screed surface of cast-in-place concrete infill to guarantee finished surface is even with top edges of cells.