

PRODUCT SPECIFICATION (CSI FORMAT)
Gravel-Lok System
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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 32 13 55
NATURAL STONE POROUS PAVING SYSTEM

Specifier Notes: This section covers Cell-Tek Geosynthetics Gravel-Lok Natural Stone Porous Paving System. The system is comprised of three basic components: a non-woven geotextile fabric, Load Support Stabilizer Grid (geocell), infill materials, Gravel-Lok moisture-curing liquid, and optional edge restraints.

PART 1 GENERAL

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

1.01 SUMMARY

A. The Gravel-Lok system is a rigid, permeable pavement suitable for pedestrian pathways, walkways, patios, plazas, and residential driveways.

1.02 REFERENCES

- A. ASTM D 1505 - Density of Plastics by the Density-Gradient Technique
- B. ASTM D 1693 - Environmental Stress-Cracking of Ethylene Plastics
- C. ASTM D 5199 - Measuring Nominal Thickness of Geotextiles and Geomembranes
- D. ASTM E 41 - Terminology Relating to Conditioning

1.03 SYSTEM DESCRIPTION

A. The Gravel-Lok system is a combination of our cellular confinement system utilized for load support (LSG series) filled and topped with a layer of clean, washed aggregates bonded with Gravel-Lok, a single-component moisture curing liquid. See separate CSI for the Load Support Grid series as it can be used alone as a foundation for any pavement.

B. Complete system includes non-woven geotextile, Load Support Stabilizer Grid, aggregates for infilling the cells, a layer of aggregates for the top layer, Gravel-Lok liquid, and optional edge restraints.

1.04 SUBMITTALS

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

B. Submit a copy of the MSDS for Gravel-Lok.

C. Technical Drawings: Submit manufacturer's technical drawings including section layout, direction of expansion, and any other relevant information.

D. Samples: Submit representative samples provided by the manufacturer.

1. Geocell sections

2. Geotextile swatch

3. [Specimen of infill materials, if required]

4. A sample of aggregates bonded with Gravel-Lok liquid

1.05 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 landscaping and/or paving projects of comparable size, complexity, and quality.

1.06 DELIVERY, STORAGE, AND HANDLING

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

B. Storage:

1. Store all materials per manufacturer's instructions.

2. Store all materials out of direct sunlight.

3. Gravel-Lok must be stored in original, unopened containers.

4. Gravel-Lok must be stored in a dry place with temperature between 60 and 100 degrees Fahrenheit.

5. Gravel-Lok should be used within one year of expiration date indicated on outside of container.

C. Handling: Use care when unwrapping, handling, expanding, and infilling LSG series 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.
Toll Free (888) 851-0051. Phone (410) 721-4844. Fax (410) 721-3844.
E-Mail info@celltekdirect.com. Website www.celltekdirect.com.

B. For spill or emergency/first aid questions related to Gravel-Lok liquid, contact Chemtrec 800-424-9300.

2.02 Gravel-Lok Liquid - Read MSDS before use, available at www.celltekdirect.com, tel. 888-851-0051

A. Available in two forms: Clear Bond or Amber Bond

1. Amber Bond

- a. Contains polymeric Diphenylmethane Diisocyanate CAS#9016-87-9; 1,3-Dioxolan-2-one, 4-methyl- CAS# 10832-7
- b. Amber in color
- c. Available in one gallon, five gallon, and fifty gallon containers.

2. Clear Bond

- a. Contains Isophorone Diisocyanate CAS#4098-71-9; 1,3-Dioxolan-2-one, 4-methyl- CAS# 108-32-7
- b. Clear in color
- c. UV stable
- d. Available in one gallon, five gallon, and fifty gallon containers.

B. Coverage rates depend upon application and installation method. See www.celltekdirect.com for additional information.

2.03 LOAD SUPPORT GRID CELLULAR CONFINEMENT SYSTEM

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

A. Base Materials:

1. Recycled, Colored, 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: 26.5 mm (1.04 inch) minimum

2. Weld Spacing:

- a. Weld Spacing for Cell Sections, LSG-2 and LSG-3: 330 mm plus or minus 2.5 mm (13.0 inches plus or minus 0.10 inch)
- b. Weld Spacing for Cell Sections, LSG-4 and LSG-6: 356 mm plus or minus 2.5 mm (14.0 inches plus or minus 0.10 inch)

C. Cell Properties:

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

[Specifier Notes: Specify required cell depth and delete others. Consult Cell-Tek Geosynthetics for suitable size. Specify either LSG-2™-Cell Size, LSG-3™-Cell Size, LSG-4™-Cell Size, LSG-6™-Cell Size.]

2. Individual Cell Dimensions: LSG-2™-Cell Detail

Nominal Dimensions \pm 10%

- a. Length 254 mm (10 inches)
- b. Width 152 mm (6 inches)
- c. Nominal Depth: 50 mm (2 inches)

3. Individual Cell Dimensions: LSG-3™-Cell Detail

Nominal Dimensions \pm 10%

- a. Length 259 mm (10.2 inches)
- b. Width 224 mm (8.8 inches)
- c. Nominal Depth: 75 mm (3 inches)

4. Individual Cell Dimensions: LSG-4™-Cell Detail

Nominal Dimensions \pm 10%

- a. Length 259 mm (10.2 inches)
- b. Width 224 mm (8.8 inches)
- c. Nominal Depth: 100 mm (4 inches)

5. Individual Cell Dimensions: LSG-6™-Cell Detail

Nominal Dimensions \pm 10%

- a. Length 259 mm (10.2 inches)
- b. Width 224 mm (8.8 inches)
- c. Nominal Depth: 150 mm (6 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: 670 N (151 lbf) for 50 mm (2 inch) depth, 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. Test Samples: Testing is conducted on the seam of 100 mm (4 inch) cell depth specimens.
- c. Test Method: Seam shall support a 72.5 kgs (160 pound) load for a minimum of 7 days.

E. Section Types and Sizes:

Specifier Notes: Consult Cell-Tek Geosynthetics for assistance in specifying appropriate cell depth for the specific application.

1. Cell Depth: 50 mm (2") - LSG-2™
 - a. Section Length: 3.96 m (13 feet)
 - b. Section Width: 3.96 m (13 feet)
 - c. Section Area: 15.68 square meters (170 square feet)
2. Cell Size: 75 mm (3") - LSG-3™
 - a. Section Length: 3.96 m (13 feet)
 - b. Section Width: 3.96 m (13 feet)
 - c. Section Area: 15.68 square meters (170 square feet)
3. Cell Size: 100 mm (4") - LSG-4™
 - a. Section Length: 7.3 m (23.9 feet)
 - b. Section Width: 2.74 m (9 feet)
 - c. Section Area: 20 square meters (215 square feet)
4. Cell Size: 150 mm (6") - LSG-6™
 - a. Section Length: 7.3 m (23.9 feet)
 - b. Section Width: 2.74 m (9 feet)
 - c. Section Area: 20 square meters (215 square feet)

2.04 NON-WOVEN GEOTEXTILE FABRIC

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

A. Non-Woven Geotextiles:

1. DuPont brand SF20 - suitable for pathways, walkways, patios, plazas (pedestrian traffic only)
2. DuPont brand SF40 - suitable for residential driveways (light vehicular traffic)

2.05 CELL INFILL MATERIALS

Specifier Notes: Consult Cell-Tek Geosynthetics for assistance.

A. For a permeable system, fill cells with clean, washed, angular gravel.

2.06 SURFACE TREATMENTS

Specifier Notes: Consult Cell-Tek Geosynthetics for assistance.

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

1. Clean, washed gravel (can be decorative, can be angular or rounded), size 1/8" up to 2-1/2". Choose harder stones for increased durability in residential driveway applications.

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 that the layout of the project is 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 GRAVEL-LOK NATURAL STONE POROUS PAVING SYSTEM - MIXING METHOD for a pavement

[Specifier's Note: It is highly recommended that a sample be made prior to starting any new installation.]

A. Subgrade Preparation:

1. Excavate and shape foundation soils to grades, elevations, and dimensions as indicated on the drawings. Be sure water will flow away from any structures. Install moisture barrier if projects meets a foundation with a basement.
2. Confirm foundation soil meets specified compaction through proof rolling or other conventional method and is examined by the Engineer. If unacceptable foundation soils are encountered, excavate affected areas and replace these areas with suitable quality material as directed by the Engineer.

B. Subbase and Base Installation:

1. Place geotextile over subgrade being sure to overlap when necessary to provide 100% coverage and to extend geotextile fabric up on all sides so that soil cannot infiltrate the system from the sides. We recommend DuPont SF20 or SF40 to insure porosity.
2. Install Load Support Grid. Confirm each grid section is expanded uniformly to correct 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. Use rebar spikes, expansion tools, or other suitable anchors, in selected outer cells to expand and maintain expansion of the grid sections. Position grid sections as indicated on the drawings.
3. Overfill cells with chosen infill. Maximum particle size of granular infill material must not exceed 65 mm (2.5 inches). Minimum particle size should be 19 mm (0.75 inches) to allow for maximum porosity. Level surface approximately 25.4 mm (1 inch) above cell walls. Cell walls must be sufficiently covered with infill to prevent any equipment or load bearing vehicular traffic from damaging the grid.
4. Compact infill to a minimum of 95 percent SPDD.

5. Contour compacted surface to specified elevation and grade as indicated on the drawings.
6. Install drainage as necessary.

D. Install edge restraint if desired. Standard aluminum or plastic edge restraints or concrete curbing may be used.

E. Clean stone thoroughly. Allow to dry. Aggregates must be free from any fines or dirt. The cleaner the stone, the stronger the bond.

F. Do a test to determine correct mixing ratio. Ratio should be approximately 18 oz. - 20 oz. to 1 five gallon bucket of stones. Starting with a ratio of 18 oz. liquid per five gallon bucket of clean, dry stone, mix liquid with stones and spread out at 1-1/2" thick on a piece of cardboard or wood. Allow to rest for 10 – 15 minutes. Remove gravel. If the liquid has dripped onto the cardboard or wood then the mixing ratio is correct. If you do not see any Gravel-Lok on the cardboard or wood then repeat the process using 20 oz. of liquid. Note: larger stones will typically require 18 oz. liquid and smaller stones will typically require 20 oz. liquid. Note: If you see foaming, it is a sign that too much liquid is being used. Crush foam and reduce quantity being applied.

G. Using the mixing ratio determined from the last step, mix stones with liquid to coat them until they are wet. Mix stones in a five gallon plastic bucket, wheelbarrow or cement mixer. Cement mixer can be cleaned up with acetone before liquid cures.

H. Working in small areas, pour out the coated stones, level and trowel to finish to desired thickness (at least 1-1/2"). Rope off treated area to protect it from people and animals. Do not install if rain is expected within 12 hours. Do not cover area with plastic. Store Gravel-Lok at 68 degrees or above. Install when outdoor temperature is 50 degrees or above and will not drop below 50 degrees F for at least 12 hours. Allow 24 hours to cure. If the temperature is around 50 - 50 degrees F then it may take up to 48 hours to cure.

I. Apply roller coat using the same Gravel-Lok liquid and medium sized paint roller. This replenishes some liquid that has migrated downward during the curing process due to gravity and provides a 'double bond' effect. Rope off treated area to protect if from people and animals. Do not apply roller coat if rain is expected within 12 hours. Do not cover area with plastic. Apply roller coat when outdoor temperature is 50 degrees or above and will not drop below 50 degrees F for at least 12 hours. Allow to cure 24 hours.

3.03 INSTALLATION OF GRAVEL-LOK NATURAL STONE POROUS PAVING - MIXING METHOD for stone scaping, joints between flagstones or concrete pad layovers, planters, or for any other small, hard to pour areas.

[Specifier's Note: It is highly recommended that a sample or test area be made prior to starting any new installation.]

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

B. Subgrade Preparation:

1. Excavate and shape foundation soils to grades, elevations, and dimensions as indicated on the drawings.
2. Confirm foundation soil meets specified compaction through proof rolling or other conventional method and is examined by the Engineer. If unacceptable foundation soils are encountered, excavate affected areas and replace these areas with suitable quality material as directed by the Engineer.

C. Subbase and Base Installation:

1. Place geotextile over subgrade according to geotextile manufacturer's recommendations.

D. Clean stone thoroughly. Allow to dry. Aggregates must be free from any fines or dirt. The cleaner the stone, the stronger the bond.

E. Mix stones with liquid to coat them until they are wet. Ratio should be approximately 18 oz. - 20 oz. : 1 five gallon bucket of stones. Mix stones in either a five gallon plastic bucket, wheelbarrow or cement mixer. Cement mixer can be cleaned up with acetone before liquid cures.

F. Do a test to determine correct mixing ratio. Ratio should be approximately 18 oz. - 20 oz. to 1 five gallon bucket of stones. Starting with a ratio of 18 oz. liquid per five gallon bucket of clean, dry stone, mix liquid with stones and spread out at 1-1/2" thick on a piece of cardboard or wood. Allow to rest for 10 – 15 minutes. Remove gravel. If the liquid has dripped onto the cardboard or wood then the mixing ratio is correct. If you do not see any Gravel-Lok on the cardboard or wood then repeat the process using 20 oz. of liquid. Note: larger stones will typically require 18 oz. liquid and smaller stones will typically require 20 oz. liquid. Note: If you see foaming, it is a sign that too much liquid is being used. Crush foam and reduce quantity being applied.

G. Using the mixing ratio determined from the last step, mix stones with liquid to coat them until they are wet. Mix stones in a five gallon plastic bucket, wheelbarrow or cement mixer. Cement mixer can be cleaned up with acetone before liquid cures.

H. Pour out the coated stones placing them into the desired areas at least 1-1/2" thick. Trowel can be used if necessary to smooth it out. Be careful to not get the coated stones on any surrounding pavements, flagstones, etc. It can stain those areas permanently. Rope off treated area to protect it from people and animals. Do not install if rain is expected within 12 hours. Do not cover area with plastic. Install when outdoor temperature is 50 degrees or above and will not drop below 50 degrees F for at least 12 hours. If the temperature is around 50 - 50 degrees F then it may take up to 48 hours to cure.