

NYCHA Design Department

Division 32 Exterior Improvements SECTION 32 13 55 NATURAL STONE PERVIOUS PAVING (RESIN BOUND/STABILIZED GRAVEL SYSTEM)

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

- A. The Contractor is referred to the Instructions to Bidders and General Conditions, NYCHA Contracts; the Special Notice to Contractors; the Form of Proposal; the Form of Bid Bond; Division 01 - General Requirements of the Contract Specifications; the Contract Drawings and all Amendments and Addenda thereto; all of which govern the Work of this Section.

1.02 SECTION INCLUDES

- A. This section covers Cell-Tek Geosynthetics Gravel-Lok System. The system is comprised of four basic components: Gravel-Lok liquid, Load Support Stabilizer Grid (three dimensional geocellular material), one or more infill materials, and a geotextile fabric.

1.03 REFERENCE STANDARDS

- 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

1.04 SYSTEM DESCRIPTION

- A. Non-woven Geotextile Fabric
- B. Cellular confinement system involves a three-dimensional geocellular material into which specific infill materials are placed. It is composed of a set of virgin 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.
- C. Aggregates – clean, washed, angular stones must be used to infill geocells to maintain pervious properties of the system. Clean, washed, durable stones from 1/8" up to 2-1/2" should be used for the bonded layer. A mixture of stone sizes is workable. Avoid decomposing stones or stones which crush easily.
- D. Gravel-Lok brand liquid polymer, or equal – Amber and Clear versions are available.
- E. Edge restraints are optional. Edging material can be made of wood, metal, plastic, or masonry. Soil can also be used to create an edge for a natural trail, with the soil tapering down from the soil to the subgrade at the edge of the trail.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administration of Contracts and Project Procedures, for submittal procedures.

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- B. Product Data: Submit product data provided by manufacturer.
- C. Technical Drawings: Submit manufacturer's technical drawings, one copy of product literature, one copy of the SDS for Gravel-Lok liquid 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.
- E. Material Certification: Submit certifications of the polyethylene used to make the geocell material.
 - 1. Certification of polyethylene density (ASTM 1505) 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 landscaping and/or paving 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. Gravel-Lok containers must be full and unopened.
- B. Storage:
 - 1. Store materials per manufacturer's instructions.
 - 2. Store all materials out of direct sunlight. Gravel-Lok liquid must be stored in a dry environment, temperature not below 65 degrees Fahrenheit and not above 95 degrees Fahrenheit.
- 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.
- D. Expiration: Gravel-Lok must be used within 18 months of manufacture. Check outside of container for date of manufacture.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Cell-Tek Geosynthetics, LLC, 809 Barkwood Court, Suite M, Linthicum Heights, MD 21090. Toll Free (888) 851-0051. Phone (410) 721-4844. Fax (410) 721-3844. Email: info@celltekdirect.com, Website: www.celltekdirect.com
- B. Or equal.

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2.02 STABILIZER GRID CELLULAR CONFINEMENT SYSTEM

A. Base Materials:

1. Virgin, Colored, Polyethylene Stabilized with HALS:
 - a. Density, ASTM D 1505: 0.9526 g/cm³ (59.768 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: 1.45 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: 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.
2. Individual Cell Dimensions: LSG-3™-Cell Detail
 - a. Nominal Dimensions \pm 10%
 - b. Length 259 mm (10.2 inches)
 - c. Width 224 mm (8.8 inches)
 - d. Nominal Area plus or minus 1%: 290 cm² (44.9 square inches)
 - e. Nominal Depth: 75 mm (3 inches)
3. Individual Cell Dimensions: LSG-4™-Cell Detail
 - a. Nominal Dimensions \pm 10%.
 - b. Length 259 mm (10.2 inches).

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- c. Width 224 mm (8.8 inches).
- d. Nominal Area plus or minus 1%: 290 cm² (44.9 square inches).
- e. 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: 1065 N.
 - (239 lbf) for 75 mm (3 inch) depth, 1542 N (347 lbf).
 - for 100 mm (4 inch) depth, 2170 N (488 lbf) for 150 mm (6 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 seven (7) days.

E. Section Types and Sizes:

1. Cell Size: 75 mm (3") – LSG-3™

- a. Section Length: 2.74 m (9 feet).
- b. Section Width: 7.3m (23.9 feet).
- c. Section Area: 20 square meters (215 square feet).

2. 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).

2.03 RELATED GEOSYNTHETIC COMPONENTS

A. Geotextiles:

- 1. Non-woven geotextile, DuPont SF20 (suitable for plazas, patios, walkways).
- 2. Non-woven geotextile, DuPont SF40 (suitable for driveways).

2.04 CELL INFILL MATERIALS

- A. Cell infill materials must be clean, washed angular stone of 3/8" up to 3/4" in size.
- B. Bonded stone layer must be clean, washed, stone, 1/8" up to 2-1/2" in size

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2.05 SURFACE TREATMENTS

- A. Aggregates to be used in the top, bonded layer must be clean, washed and free from any fines, dirt, or dust, and must be 1/8" up to 2-1/2" in size. Must be dry.
- B. Gravel-Lok liquid is available in Amber or Clear. Choose Gravel-Lok Clear whenever using white or light colored stones.
 - 1. Gravel-Lok Amber, 1 gallon container.
 - 2. Gravel-Lok Amber, 5 gallon container.
 - 3. Gravel-Lok Amber, 50 gallon drum.
 - 4. Gravel-Lok Clear, 1 gallon container.
 - 5. Gravel-Lok Clear, 5 gallon container.
 - 6. Gravel-Lok Clear, 50 gallon drum.
- C. Coverage rates for Gravel-Lok liquid vary by application and installation method. Contact Cell-Tek Geosynthetics for guidance. Toll Free (888) 851-0051. Phone (410) 721-4844. Fax (410) 721-3844. Email: inof@celltekdirect.com.

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

3.02 INSTALLATION OF LOAD SUPPORT (STABILIZER GRID) SYSTEM

- A. Prepare subgrade and install according to manufacturer's instructions.
- B. Sub-grade 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.
 - 3. Install any drains or irrigation, if necessary, for proper drainage.
- C. Subbase, Load Support Grid (Cellular Confinement Base) and Edging Installation:

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1. Place geotextile over subgrade according to geotextile manufacturer's recommendations. Be sure to cover the entire bed of excavated area as well as all sides to prevent surrounding sediments from infiltrating the system.
 2. Use rebar spikes, expansion tools, or other suitable anchors, in selected outer cells to expand and maintain expansion of the Stabilizer Grid sections. Position grid sections as indicated on the drawings.
 3. Confirm each Stabilizer Grid section is expanded uniformly and that 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.
 4. Overfill cells with chosen infill per manufacturer's installation instructions and Engineer's recommendation. Clean, washed, angular stones of 3/8" to 3/4" are recommended. Level surface approximately 25 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.
 5. Compact infill to a minimum of 95 percent SPDD.
 6. Contour compacted surface to specified elevation and grade as indicated on the drawings.
 7. Install edging if desired. Be sure that non-woven geotextile fabric is installed to and beyond edging to prevent infiltration of surrounding sediments.
- D. Bonded Layer Installation (POUR METHOD) – install when there is no threat of rain and ambient temperature is 50 degrees Fahrenheit or above for a projected period of 12 hours.
1. Protect surrounding areas with polyethylene film to prevent staining.
 2. Cover base with 1 to 2 inches of clean, washed decorative or chosen stone. Stones can be cleaned in place if necessary. Be sure to clean to a 3" depth.
 3. Allow stones to dry.
 4. Read SDS. Wear proper eye and respiratory protective equipment and long sleeved pants, shirts, and closed toe footwear. Gravel-Lok will not wash out of clothing.
 5. Sprinkle Gravel-Lok liquid onto the stones in a small test area using a plastic watering pail or gravity wand. Apply just enough to cover the tops of the stones and allow it to migrate downward. Do not over pour. If foaming is noticed, stop pouring. This typically indicates over pouring of liquid or wet stones. Crush foam. Foam will not harm the integrity of the bond but it detract from the look of the finished surface. Wait one hour. If results are acceptable, repeat the process until all areas are treated.
 6. Allow 24 hours to cure. Rope off area to keep animals and pets away. Check stones to be sure they are not tacky before walking or driving on the treated area.
- E. ALTERNATIVE INSTALLATION METHOD: Bonded Layer Installation (MIXING METHOD) - install when there is no threat of rain and ambient temperature is 50 degrees Fahrenheit or above for a projected period of 12 hours.
1. Protect surrounding areas with polyethylene film to prevent staining.

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2. Read SDS. Wear proper eye and respiratory protective equipment and long sleeved pants, shirts, and closed toe footwear. Gravel-Lok will not wash out of clothing.
 3. Mix liquid with clean, washed, dry stones in a plastic bucket or wheelbarrow lined with polyethylene. Coat the stones until they are wet. (Approximately 20 – 24 oz. of Gravel-Lok liquid should properly coat a 5 gallon container of stones. It is advisable to do a mix ratio test beforehand, see instructions below.*) Mix slowly, turning the stones over to coat them until they are wet. Vigorous mixing is not recommended.
 4. Trowel out the treated stones. Take the time to carefully trowel to a smooth finish.
 5. Level.
 6. Allow 24 hours to cure. Rope off area to keep animals and pets away. Check stones to be sure they are not tacky before walking or driving on the treated area.
- F. Apply Roller Coat using a medium size nap paint roller to entire surface. Roller Coat is beneficial no matter which application method (pouring or mixing) was chosen. Allow 24 hours to cure. Rope off area to keep animals and pets away. Check stones to be sure they are not tacky before walking or driving on the treated area.
- G. MIXING RATIO TEST
1. In most cases, mixing 20 oz. of Gravel-Lok liquid with a 5 gallon bucket of stones* is ideal. To find out whether your best mix ratio is 20 oz. or more, follow these simple steps. Depending on the stone's absorbency and size it could take as much as 24 oz. of Gravel-Lok liquid with a 5 gallon bucket of stones to achieve the best bond.
 2. *Important: a plastic 5 gallon bucket is considered 'full' when the contents are filled 2" below the top of the bucket. Do not completely fill the bucket to the top with stones.
 3. STEP 1: Starting with a ratio of 20 oz. of liquid to 1 five gallon bucket of stone, mix the liquid with the stones and spread out at 1-1/2" thick on a piece of cardboard or wood.
 4. STEP 2: Allow to rest for 10 – 15 minutes.
 5. STEP 3: Remove gravel. If the liquid has dripped onto the cardboard or wood then the mixing ratio is correct.
 - a. If you do not see any liquid on the cardboard or wood then repeat the process using 22 oz. of liquid. Again, if you do not see any liquid on the cardboard or wood then repeat the process using 24 oz. of liquid.
 - b. Note: if you are using stones which are very small (1/8") then more liquid could be required.

END OF SECTION