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Product Specification (CSI Format)

Specifier Notes: This product guide specification is written according to the Construction Specifications Institute (CSI) Format, including *MasterFormat* (1995 Edition), *SectionFormat*, and *PageFormat*, contained in the *CSI Manual of Practice*.

The section must be carefully reviewed and edited by the Engineer to meet the requirements of the project and local building code. Coordinate with other specification sections and the drawings.

Delete all "Specifier Notes" when editing this section.

SECTION 321243 POROUS FLEXIBLE PAVING

Specifier Notes: This section covers Presto Geosystems' GeoPave® Porous Pavement System. The system provides vehicular and pedestrian load support over a permeable aggregate or grassed surface while promoting natural storm water infiltration and, if vegetated, protection to grass from the harmful effects of traffic.

The major components of the complete system are the GeoPave unit, the porous aggregate base, if required, and the porous aggregate or an aggregate/topsoil engineered infill and selected vegetation (where applicable).

Consult Presto Products Co. for assistance in editing this section for the specific application.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Work Included: This Section includes providing all material, labor, tools and equipment for installation of GeoPave® porous pavement system as shown in the Contract Documents and as specified in this Section.

1.2 RELATED SECTIONS

- A. Section 312000 – Earth Moving.
- B. Section 334600 – Subdrainage.
- C. Section 321000 – Bases, Ballasts, and Paving

Specifier Notes: Edit the following list as required for the project. List other sections with work directly related to the porous pavement system.

- D. Section 323000 - Site Improvements.
- E. Section 329000 - Planting.
- F. Section 329200 – Manufacturers of Turfs and Grasses.

1.3 REFERENCES

- A. The American Society of Testing and Materials (ASTM)
- B. American Association of State Highway and Transportation Officials (AASHTO)
- C. American Society of Landscape Architects (ASLA)
- D. US Green Building Council (USGBC)

1.4 SYSTEM DESCRIPTION

- A. The GeoPave® porous pavement system creates a structural framework to stabilize open-graded aggregate or an aggregate/topsoil engineered infill for vegetated surfaces.
- B. Increases bearing strength and provides a permeable load support structure for vehicular or pedestrian traffic loading requirements using porous aggregate or structural infill material.
- C. When vegetated, protects grass from harmful effects of occasional traffic.
- D. Major Components of the Complete System include:
 - 1. GeoPave unit
 - 2. Porous aggregate or aggregate/topsoil engineered base (if required)
 - 3. Porous aggregate or aggregate/topsoil engineered infill

Specifier Notes: Choose between an aggregate or vegetated surface and delete the other option.

- E. *For aggregate surfaces*, the GeoPave unit, aggregate infill and aggregate base support soil (if required), work together to support imposed loading.
- F. *For vegetated surfaces*, the GeoPave unit, aggregate/topsoil engineered infill and aggregate/topsoil engineered base support soil (if required), work together to support imposed loading and contribute to vegetation support.

1.5 SUBMITTALS

- A. Submit manufacturer's shop drawings in accordance with Section 013000 including manufacturer's product data, general laying pattern and anchoring from the *GeoPave® Design and Construction Overview* (not site specific).
- B. LEED Submittals: Provide documentation of how the requirements of Credit will be met:
 - 1. List of proposed materials with recycled content. Indicate post-consumer recycled content and pre-consumer recycled content for each product having recycled content.
 - 2. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
- C. Certificates:
 - 1. Product certificates signed by the manufacturer certifying material compliance of polyethylene used to make GeoPave units.
 - 2. ISO Certificate certifying manufacturer's quality management system is currently registered to ISO 9001:2008 quality standards.
- D. Installation Instructions: Manufacturer's printed installation instructions. Include methods for maintaining installed products.
- E. Manufacturers warranty.
- F. Substitutions: No material will be considered as an equivalent to the GeoPave unit specified herein unless it meets all areas of this specification without exception. Manufacturers seeking to supply what they represent as equivalent material must submit records, data, independent test results, samples, certifications, and documentation deemed necessary by the Specifier to prove equivalency. The Specifier shall approve or disapprove other manufacturers materials within 60 days after all submitted information is studied and tested.

1.6 QUALITY ASSURANCE

Specifier Notes: Delete manufacturer's, manufacturer's field representative and installer and qualifications if not required.

- A. The porous pavement material shall be provided from a single Manufacturer for the entire project.
- B. The Manufacturer's Quality management system shall be certified and in accordance with ISO 9001:2008. Any substitute materials submitted shall provide a certification that their manufacturing process is part of an ISO program and a certification will be required specifically stating that their testing facility is certified and in accordance with ISO. An ISO certification for the substitute material will not be acceptable unless it is proven that it pertains specifically to the manufacturing operations for the specified substitute product.

- C. The Manufacturer shall provide certification of compliance to all applicable testing procedures and related specifications upon the customer's written request. Request for certification shall be submitted no later than the date of order placement. The Manufacturer shall have a minimum of 20 years experience producing porous pavement systems.
- D. Manufacturer's Field Representative Qualifications: The representative shall have at least 2 years experience installing the Manufacturer's porous pavement system and have installed a minimum of 10,000 square feet (1,000 square meters).
- E. Installer Qualifications: Experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
- F. Pre-Installation Meeting: Prior to installation of any materials, conduct a pre-installation meeting to discuss the scope of work and review the installation requirements. The pre-installation meeting shall be attended by all parties involved in the installation of the porous pavement system.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. The materials shall be stored in accordance with Manufacturer's instructions. The materials shall be protected from damage and out of direct sunlight.
- C. The materials shall be delivered, unloaded and installed in a manner to prevent damage.

1.8 MAINTENANCE SERVICE

- A. The surface should be inspected from time to time to identify signs of slight cell infill loss.
- B. With vegetated surfaces, follow proper turf maintenance practices. Once healthy turf has been established, the cell wall structure will have minimal visibility when proper turf maintenance practices are followed.
- C. Maintenance Service: As specified in Section 329200 Manufacturers of Turfs and Grasses.
- D. The pavement should be monitored to ensure traffic frequency and loading does not exceed the pavement design.

1.9 LIMITED WARRANTY

- A. Presto Geosystems warrants each GeoPave unit which it ships to be free from defects in materials and workmanship at the time of manufacture. Presto's exclusive liability under this warranty or otherwise will be to furnish without charge to Presto's customer at the original f.o.b. point a replacement for any unit which proves to be defective under normal use and service during the 10-year period which begins on the date of shipment by Presto. Presto reserves the right to inspect any allegedly defective unit in order to verify the defect and ascertain its cause.
- B. Materials submitted that do not offer a written 10-year warranty will be rejected.
- C. This warranty does not cover defects attributable to causes or occurrences beyond Presto's control and unrelated to the manufacturing process, including, but not limited to, abuse, misuse, mishandling, neglect, improper storage, improper installation or improper application.
- D. This warranty does not cover defects attributable to causes or occurrences beyond Presto's control and unrelated to the manufacturing process, including, but not limited to, abuse, misuse, mishandling, neglect, improper storage, improper installation or improper application. Presto makes no other warranties, express or implied, written or oral, including, but not limited to, any warranties or merchantability or fitness for any particular purpose, in connection with the GeoPave system. In no event shall Presto be liable for any special, indirect, incidental or consequential damages for the breach of any express or implied warranty or for any other reason, including negligence, in connection with the GeoPave system.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Presto Geosystems, PO Box 2399, Appleton, Wisconsin 54912-2399. Toll Free (800) 548-3424. Phone (920) 738-1328. Fax (920) 738-1222. E-Mail info@prestogeo.com, Website www.prestogeo.com.

2.2 GEOPAVE UNITS

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

A. Materials

1. Material shall be up to 97 percent recycled polyethylene.
2. Color shall range from dark shades of gray to black.
3. Color shall be uniform throughout all panels in pallet.
4. Chemical Resistance shall be superior.
5. Carbon Black content shall be 1.5 to 2 percent by weight, through addition of a carrier with ASTM D 1693.

B. Performance Properties

1. Empty unit minimum crush strength at 70°F (21 °C) shall be 175 psi (1,202 kPa).
2. Aggregate or aggregate/topsoil infilled unit minimum crush strength at 70 °F (21°C) shall be 1,000 psi (6,869 kPa).
3. Empty unit wall compressive strength (Simulated Loaded Tire Area) shall be 175 psi (1,202 kPa).
 - a. Test Procedure: Full single unit loaded to failure via 9 inches (228.6 mm) flat plate.
4. Aggregate or Aggregate/Topsoil Filled Unit Wall Compressive Strength (Simulated Tire Area Loaded): 138,240 pound-force (615 kN).
 - a. Test Procedure: Full single unit loaded to failure via 9 inches (228.6 mm) flat plate.

C. Dimensions

1. Nominal width shall be 20 inches (0.5 meter).
2. Nominal length shall be 40 inches (1 meter).
3. Nominal depth shall be 2.0 inches (50 mm).
4. Nominal area shall be 5.3 feet² (0.5 m²).
 - a. Small cell size shall be 3.25 inches by 3.25 inches (83 mm by 83 mm).
 - b. Large cell size shall be 3.25 inches by 6.50 inches (83 mm by 165 mm).
5. Nominal weight shall be 8 pounds (3.6 kg).
6. Top of panel open area shall be 90.5 percent.
7. Bottom of panel open area shall be 32.6 percent.
8. Bottom of panel mesh openings shall be 0.25 in by 0.25 in (6.35 mm by 6.35 mm).
9. Maximum end-to-end or side-to-side warpage shall be 0.25 inches (6 mm).

D. Runoff Coefficient is dependent upon the actual site conditions and GeoPave infill material.

1. For vegetated areas, typical run-off coefficients range from 0.10 to 0.35 for sandy and clay soils, respectively.
2. For aggregate areas, typical run-off coefficients range from 0.05 to 0.50. Since GeoPave® units are filled with an open-graded aggregate with limited fines, the run-off coefficient shall range from 0 to 0.15.
3. The actual run-off coefficient shall be based on site conditions, engineering judgment and the integrated effect of the drainage area.

2.3 GEOPAVE INFILL MATERIAL

Specifier Notes: Edit the following for infill type, aggregate infill or an aggregate/topsoil engineering infill for vegetated systems.

- A. The aggregate infill shall be a well-graded 0.375 inch to 0.5 inch (10 mm to 13 mm) crushed angular stone with a fine content less than 5%.
- B. The aggregate/topsoil engineered infill shall consist of a homogenous mixture consisting of 1) a clear-stone/crushed rock having an AASHTO #5 or similar designation blended with 2) pulverized topsoil and 3) a void component generally containing air and/or water. This homogenous mixture will promote vegetative

growth and provide required structural support. The aggregate portion shall have a particle range from 0.375 inch to 0.5 inch (10 mm to 13 mm). The percentage void-space of the aggregate portion shall be at least 30%. The pulverized topsoil shall equal 33% of the total volume and be added and blended to produce a homogenous mixture prior to placement.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions are as indicated on the drawings. Notify the Engineer if site conditions are not acceptable. Do not begin preparation or installation until unacceptable conditions have been corrected.
- B. Verify layout of panels is as indicated on the drawings. Notify the Engineer if layout of structure is not acceptable. Do not begin preparation or installation until unacceptable conditions have been corrected.

3.2 PREPARATION

- A. Subgrade Preparation:
 - a. Prepare subgrade as specified in Section 321000. Verify subgrade in accordance with porous paving system manufacturer's instructions.
 - 1. Proper subgrade preparation will enable the GeoPave units to connect properly and remain level and stationary after installation.
 - 2. Excavate area allowing for unit thickness and the base depth (where required).
 - 3. Provide adequate drainage from excavated area if area has potential to collect water, when working with in-place soils that have poor permeability.
 - 4. Ensure in-place soil is relatively dry and free from standing water.
 - 5. Uniformly grade base.
 - 6. Level and clear base of large objects, such as rocks and pieces of wood.
- B. Base Preparation:

Specifier Notes: The strength of the porous pavement system is determined, in part, by the support provided by the aggregate or aggregate/topsoil engineered base. Consult Presto Geosystems' *GeoPave Design and Construction Overview* for base details and thickness recommendations.

A minimum of 2 inches (50 mm) of base material is generally recommended for drainage even if not required by design for load support. Additional base depth may be added if required over a low-permeable base or to function as a storm water detention/retention layer.

For vegetated systems, proper aggregate/topsoil engineered base materials will promote vegetative growth and provide required structural support. If the topsoil is not present within the engineered base, grass growth may be impaired. Vegetated surfaces should be designed for infrequent or occasional traffic with a maximum H-10 loading.

- 1. Install Base as specified in Section 321000. Verify engineered base (if required) is installed in accordance with porous paving system manufacturer's instructions.
- 2. Coordinate base installation and preparation with subdrainage specified in Section 334600.
- 3. If required, place a geotextile separation layer between the natural ground and the specified base.
- 4. If required, install the specified sub-drain and outlet according to construction drawings.

Specifier Notes: The following applies to aggregate systems. Delete the following items if the surface will be vegetated.

- 5. *For aggregate systems*, place aggregate base thickness of [6 inches (150 mm)] [4 inches (100 mm)] [2 inches (50 mm)] [_____ inches (_____ mm)].
- 6. The base shall be a poorly-graded crushed aggregate with a fine content less than 5%, and compacted to 95% Standard Proctor Density.

Specifier Notes: The following applies to vegetated systems. Delete the following items if the surface will be aggregate.

- 7. *For vegetated systems*, place aggregate/topsoil engineered base thickness of [6 inches (150 mm)] [4 inches (100 mm)] [2 inches (50 mm)] [_____ inches (_____ mm)].
- 8. Place engineered base of clear stone or crushed rock, homogeneously blended with topsoil and a void component generally containing air and/or water.
- 9. Ensure aggregate portion of base is free from fines and has a known percentage void-space of 30% or greater when compacted. Particle size should range in size from 0.375 to 1.0 inch (10 to 25 mm).
- 10. Add and blend topsoil before placement equal to void percentage in aggregate.

11. The pulverized topsoil portion shall equal 33% of the total volume and be added and blended to produce a homogenous mixture prior to placement.
12. Compact the mixture to 95% Standard Proctor.

3.3 INSTALLATION

- A. Install and infill GeoPave units in accordance with porous paving system manufacturer's instructions.
 1. Ensure that all adjacent hard-surfaced paving work is completed before installing the GeoPave porous pavement system.
- B. Installing Units
 1. Place units with the mesh bottom to the ground.

Specifier Notes: Edit the installation requirements for the laying pattern as indicated on the drawings.

2. Lay units in the following pattern:
 - a. Install unit pattern as indicated on the drawings.
 - b. Offset pattern for pedestrian access lane applications
 - c. Standard running bond bricklayer pattern for pedestrian access lane applications
 - d. Herringbone pattern for large area with random traffic flow
3. For Herringbone pattern, place units with long direction of unit perpendicular to direction of traffic.
4. Develop staggered bricklayer pattern by using half units made by field cutting a full unit.
5. Field cut units with a hand or power saw to custom fit contours and around obstructions.
6. Place first row of GeoPave units against a stationary edge, when available. If the units are placed between two perpendicular stationary edges, allow for potential thermal expansion of the units by keeping the units away from the stationary edge.
7. Abut adjoining units to form the specified laying pattern. Units should not protrude above desired surface elevation.
8. Secure adjoining units together using the U-CLIP connection device. U-CLIPS shall be set in place by hammer in the half-wall locations such that adjacent sections have horizontally level profiles. U-CLIP locations are four on each unit long side and two on each unit short side.

Specifier Notes: Anchoring may be required when placing the GeoPave units on a slope (5-10% maximum). Stake length is generally 12 inches (305 mm) or longer depending on the slope, subgrade CBR and loading requirement.

- C. Anchoring of Units
 1. Anchors shall be placed per Manufacturer's recommendations.
 2. Anchor units in-place after installation of all the units within the defined area.
 3. Anchor units with 0.5 inch (13 mm) #4 rebar to prevent movement of the units.
 4. Anchor length shall be [12.0 inches (305 mm)] [_____ inches (_____ mm)].
 5. Drive the anchors through the GeoPave cell-wall vent holes either in the middle of the GeoPave units or along the perimeter as required.

Specifier Notes: The following applies to aggregate systems. Delete the following items if the infill will be topsoil/aggregate for vegetation.

- D. Infilling Units – *Aggregate Systems*:
 1. Infill units with the specified aggregate.
 2. Spread aggregate uniformly over the units with a skidsteer, small tractor or small loader.
 3. Hand rake the aggregate to assure that the final aggregate fill is just over the elevation of the top of the cell walls.

Specifier Notes: The following applies to vegetated systems. Delete the following items if the infill will be aggregate.

- E. Infilling Units – *Vegetated Systems*:
 1. Infill units with the specified aggregate/topsoil engineered infill.
 2. Spread aggregate/topsoil engineered infill uniformly over units to a level even with the top of the cell wall.
 3. If final vegetation is sod, the GeoPave units shall be under-filled by 1.0 inch (25 mm) to allow room to seat or press sod into GeoPave units.

4. Use spreading methods to prevent over-compaction of the infill.
5. Topsoil and Seed: As specified in Section 329200 Manufacturers of Turfs and Grasses.

3.4 DELINEATION

Specifier Notes: With vegetated systems, once healthy turf has been established, the GeoPave cell wall structure will have minimal visibility when good turf-maintenance practices are followed. Delineation may be desirable to create greater visibility for those using the access lanes.

- A. Delineate the installed GeoPave system one of with the following methods:
 1. In-ground curbing
 2. Above-ground curbing
 3. Shrubbery or vegetation
 4. Perimeter lighting
 5. Delineation markers

3.5 FINISHING

- A. Finish in accordance with manufacturer's instructions.

Specifier Notes: *Section B. Seeding* and *Section C. Sod* apply only to vegetated systems and should be deleted for aggregate systems.

- B. Seeding:
 1. Follow good seeding, fertilizing, and watering procedures for turf establishment based on regional practices as specified in Section 329200 Manufacturers of Turfs and Grasses.
 2. Seed shall conform with the requirements of the governing authority for seeding and restrictions on noxious weed seed.
 3. Increase water frequency when free draining base materials are used.

Specifier Notes: Specify sod for areas where immediate use is desired.

- C. Sod:
 1. Ensure units are under-filled to allow room to seat the sod.
 2. Install young sod free from netting materials. The sod should consist of dense, well-rooted growth of permanent and desirable grasses, indigenous to the locality where it will be installed.
 3. Press sod into partially emptied cells using a roller or other suitable equipment and follow normal watering procedures.
 4. Sod: As specified in Section 329200 Manufacturers of Turfs and Grasses.

3.6 MAINTENANCE

Specifier Notes: *Section A. Lawn Care* applies only to vegetated systems and should be deleted for aggregate systems. *Section B. Snow Removal* applies to climates where snow removal is required. When deeper ground freeze occurs, the system functions as a typical hard pavement surface. If a sharp metal plow-blade comes in direct contact with the surface during plowing, any portion of the GeoPave system that protrudes above the normal surface level could be damaged or removed by the blade.

- A. Lawn Care: Normal turf care procedures should be followed, including de-thatching and aerating. Some equipment may slightly scar or cut the GeoPave wall structure during some operations, but will not effect overall structural integrity of the system.
- B. Snow Removal: Remove snow using one of the following basic procedures:
 1. Keep a metal edged plow blade a minimum of 1.0 inch (25 mm) above the surface during plowing operations, or
 2. Use a plow blade with a flexible rubber edge, or
 3. Use a plow blade with skids on the lower outside corners so the plow blade does not come in contact with the units.

END OF SECTION