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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 SectionFormat*, and *PageFormat*, contained in the *CSI Manual of Practice*.

The section shall be carefully reviewed and edited by the Engineer to meet all specific project and applicable code requirements. Coordinate with corresponding specification sections, details and drawings.

Contract Documents shall refer to the drawings and specifications prepared and approved by the Engineer.

Delete all "Specifier Notes" when editing this section.

SECTION _____ 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® porous pavement unit, the porous aggregate base, if required, the porous aggregate, or an aggregate/topsoil engineered infill and selected vegetation (where applicable).

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

PART 1 GENERAL

1.1 SUMMARY

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

1.2 RELATED SECTIONS AND DIVISIONS

- 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. CBR – California Bearing Ratio Method.
- B. ASTM D1693 – Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.
- C. ASTM F 1951-08 Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment.
- D. American Association of State Highway and Transportation Officials (AASHTO).
- E. U.S. Green Building Council, LEED® Building Design and Construction (BD+C) version 4.0 Rating System. (LEED v4.0).

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® porous pavement unit
 - 2. GeoPave® U-CLIP connectors
 - 3. Porous aggregate or aggregate/topsoil engineered base (if required)
 - 4. Porous aggregate or aggregate/topsoil engineered infill
 - 5. GeoPave® SNAP Delineators

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

- E. *For aggregate surfaces*, the GeoPave® porous pavement unit, aggregate infill and aggregate base support materials (if required), work together to support imposed loading.
- F. *For vegetated surfaces*, the GeoPave® porous pavement 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.
- 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.



- C. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
- D. Certificates:
 - 1. Product certificates signed by the manufacturer certifying material compliance of polyethylene used to make GeoPave® porous pavement units.
 - 2. ISO Certificate certifying manufacturer's quality management system is currently registered to ISO 9001:2015 quality standards.

Specifier Note: Delete installer and Manufacturer's field representative qualifications if not required.

- E. Submit qualifications certifying installer experience in the installation of Geopave® Porous Pavement Systems.
- F. Submit qualifications of Manufacturer's field representative certifying field representative experience in the installation of Geopave® Porous Pavement Systems.
- G. No material will be considered as an equivalent to the GeoPave® porous pavement unit specified herein unless it meets all requirements of this specification, without exception. Manufacturers seeking to supply equivalent material must submit records, data, independent test results, samples, certifications, and documentation deemed necessary by the Engineer to prove equivalency. The Engineer shall approve or disapprove other Manufacturers materials in accordance with the General Conditions after submission and review of provided information. All substitute materials submitted shall be subject to independent lab testing at the contractor's expense.

1.6 QUALITY ASSURANCE AND CONTROL

- A. The GeoPave® porous pavement unit 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 9001:2015. Substitute materials submitted shall provide a certification that the manufacturing process is part of an ISO program. Certification is required specifically stating that the testing facility is certified and in accordance with ISO. An ISO certification for the substitute material will not be acceptable unless it is proven it pertains specifically to the Geopave® manufacturing operations.
- 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.

Specifier Note: Delete requirement for pre-installation meeting if not required.

- D. Pre-Installation Meeting: Prior to installation of any materials, conduct a pre-installation meeting to discuss the scope of work and review installation requirements. The pre-installation meeting shall be attended by all parties involved in the installation of the GeoPave® porous pavement system.

Specifier Note: Delete Manufacturer's field representative qualifications if not required.

- 1. Manufacturer shall provide a qualified field representative on site at the start of construction to ensure the system is installed in accordance with the Contract Documents.
- 2. Manufacturer's field representative shall have a minimum 5 years installation experience with the specified products in the specified application.
- 3. Manufacturer of any substitute materials to be used shall certify that a representative can meet the above criteria and will be on site for initial construction start up. Manufacturers other than specified GeoPave® porous pavement system will be required to provide proof the representative meets these

qualifications.

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 WARRANTY

- A. The Manufacturer warrants each GeoPave® porous pavement unit that it ships to be free from defects in materials and workmanship at the time of manufacture. The Manufacturer's exclusive liability under this warranty or otherwise will be to furnish without charge to 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. The Manufacturer reserves the right to inspect any allegedly defective unit in order to verify the defect and ascertain its cause.
- B. This warranty shall not cover defects attributable to causes or occurrences beyond the Manufacturer's control and unrelated to the manufacturing process, including, but not limited to, abuse, misuse, mishandling, neglect, improper storage, improper installation, improper alteration or improper application.
- C. In no event shall the Manufacturer 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® porous pavement 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® POROUS PAVEMENT SYSTEM COMPONENTS

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

A. GeoPave® Units:

- 1. Base Materials:
 - a. The material shall be up to 100 percent recycled polyethylene.
 - b. The color shall range from dark shades of gray to black.
 - c. The color shall be uniform throughout all units in pallet.
 - d. The chemical resistance of the GeoPave® porous pavement units shall be superior.
 - e. The Carbon Black content shall be 1.5 to 2 percent by weight, through addition of a carrier with ASTM D 1693.
- 2. Performance Properties:
 - a. The empty unit minimum crush strength at 70°F (21 °C) shall be 175 psi (1,202 kPa).
 - b. The aggregate or aggregate/topsoil infilled unit minimum crush strength at 70 °F (21°C) shall be 5,160 psi (35,625 kPa).
 - c. The empty unit wall compressive strength (Simulated Loaded Tire Area) shall be 175 psi (1,202 kPa).
 - 1. The test procedure shall be full single unit loaded to failure via 9 inches (228.6 mm) flat

- plate.
- d. The aggregate or Aggregate/Topsoil filled unit wall compressive strength (Simulated Loaded Tire Area) shall be 138,240 pound-force (615 kN).
 1. The test procedure shall be full single unit loaded to failure via 9 inches (228.6 mm) flat plate.
3. Dimensions:
- a. The nominal product width shall be: 20 inches (0.5 meter).
 - b. The nominal product length shall be: 40 inches (1 meter).
 - c. The nominal product depth shall be: 2.0 inches (50 mm).
 - d. The nominal product area shall be: 5.38 feet² (0.5 m²).
 1. Small cell size shall be 3.25 inches by 3.25 inches (83 mm by 83 mm).
 2. Large cell size shall be 3.25 inches by 6.50 inches (83 mm by 165 mm).
 - e. The nominal product weight shall be: 7.6 pounds (3.4 kg).
 - f. The top open area per unit shall be 90.5 percent.
 - g. The bottom open area per unit shall be 32.6 percent.
 - h. The bottom of panel mesh openings shall be: 0.25 inch by 0.25 inch (6.35 mm by 6.35 mm).
- B. GeoPave® U-Clip Connectors: The GeoPave® U-CLIP shall be a 12 gauge G90 plated steel locking clip with internal barbs to connect two adjacent GeoPave® units. The U-CLIP is designed specifically for connecting GeoPave® units. No other connection device shall be used.

<p>Specifier Note: Delete delineator information if not required.</p>

- C. GeoPave® SNAP Delineators: The GeoPave® SNAP Delineators shall be UV-resistant polymer with a diamond plate, non-skid pattern on the surface. The GeoPave® SNAP Delineators are connected with locking tabs designed to fit in the GeoPave® porous pavement unit square or rectangular cells.

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 structure 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

<p>Specifier Note: If required, specify the number of days required for the on-site manufacturer's field representative. Delete this section if not required.</p>

- A. Field Representation:
 1. On-site time for installation assistance by the Manufacturer's field representative shall be ____ day(s) with one trip. All travel and expense costs for Manufacturer's field representative installation assistance shall be included in the base bid price.
- B. Subgrade:
 1. Prepare subgrade and install porous pavement system in accordance with the Drawings and Manufacturer's instructions.
 2. Subgrade Preparation
 - a. Excavate and shape foundation soils as indicated on the drawings.
 - b. Ensure foundation soil meets minimum strength requirements through proof rolling or other

conventional method and is approved by the Engineer. If unacceptable foundation soils are encountered, excavate and replace with suitable quality material as directed by the Engineer.

Specifier Note: Delete this section if a geotextile separation layer is not required.

- c. Install geotextile separation layer on prepared surfaces ensuring required overlaps are maintained and outer edges of the geotextile are buried in accordance with the Manufacturer's recommendations and sub grade CBR.

C. 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. The Engineer shall design the base to ensure stability of the open graded material.

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. Verify base is installed in accordance with porous paving system Manufacturer's instructions.
2. If required, place the geotextile separation layer as specified in the contract documents between the natural ground and the specified base.
3. If required, install the specified sub-drain and outlet according to contract documents.

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

4. For aggregate systems, place aggregate base to a depth of _____, or as specified in the contract documents.
 - a. The base shall be an open graded crushed aggregate with a particle range from 0.375 inch to 1.0 inch (10 mm to 25 mm) and a fine content less than 5%.
 - b. Compact the aggregate to the Engineer's specifications. After compaction, the surface shall be uniform with no protrusions from larger aggregate particles.

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

5. For vegetated systems, place aggregate/topsoil engineered base to a depth of _____, or as specified in the contract documents.
 - a. Place engineered base of open graded crushed aggregate homogenously blended with pulverized topsoil and a void component generally containing air and/or water.
 - b. 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 inch to 1.0 inch (10 mm to 25 mm), with a D₅₀ of 0.5 inch (13 mm).
 - c. Add and blend topsoil before placement equal to void percentage in aggregate.
 - d. The pulverized topsoil portion shall equal 33% of the total volume and be added and blended to produce a homogenous mixture prior to placement.
 - e. Compact the mixture to the Engineer's specifications.

6. Constrain the edges of the base appropriately to prevent movement.

3.3 INSTALLATION OF POROUS PAVEMENT SYSTEM

- A. Install and infill GeoPave® porous pavement 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.
 2. GEOPAVE UNITS ARE CAPABLE OF BEARING LOAD IMMEDIATELY after placement, once fully connected with U-CLIPs. and the base depth is appropriate to support the loading. GeoPave® porous pavement units can be driven on with no infill necessary. No barriers are required to prevent passenger cars and trucks or construction equipment from driving on the GeoPave® porous pavement units during installation.
- B. Installing GeoPave® 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 or one-direction vehicular driveway applications
 - d. Herringbone pattern for large area with multi-directional traffic flow.
3. For bricklayer pattern, place units with long direction of unit perpendicular to direction of traffic.
4. Develop staggered herringbone pattern by using half units made by field cutting a full unit.
5. Field cut units to custom fit contours and around obstructions. Edge restraints are required to create a closed "cell" that can be infilled. Alternatively offset the GeoPave® units such that the coverage approximates the corner or curve feature. Edge restraints are required.
6. Abut adjoining units to form the specified laying pattern. Units shall not protrude above desired surface elevation.
7. Secure adjoining units together using the U-CLIP connection device. A total of 12 U-CLIPS are required for each unit. 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.
8. Place first row of GeoPave® porous pavement units against a single 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.

Specifier Notes: Anchoring may be required when placing the GeoPave® porous pavement units on a slope (5-10% maximum). Stake length is generally 12 inches (300 mm) or longer depending on the slope, subgrade CBR and loading requirement. Edit the anchor length as required. Delete this section if anchoring is not required.

- C. Anchoring of Units
 1. Units shall be anchored in-place after installation of all the units within the defined area.
 2. Anchor units with 0.5 inch (13 mm) #4 rebar to prevent movement of the units.
 3. Anchor length shall be 12 inch (300 mm) or as specified by the Engineer.
 4. Anchors shall be placed per Manufacturer's recommendations.
 5. Drive the anchors through the GeoPave® porous pavement unit cell-wall vent holes either in the middle of the units or along the perimeter as required.



Specifier Notes: Delineators may be required by local agencies for visual identification of parking spaces, drive lanes, center lines or other delineation. Delete the following items if in-unit delineation is not required.

D. Installing the GeoPave® SNAP Delineators

1. Insert the GeoPave® SNAP delineators into the GeoPave® unit's square or rectangular cells to mark delineation.
2. GeoPave® SNAP delineators are placed after installation of the GeoPave® porous pavement units and before installation of the infill material.
 - a. If the SNAP delineators are desired after infill placement, infill may be removed with a vacuum to allow insertion of delineators at select locations.
3. The placement density of the GeoPave® SNAP delineators shall be as required to meet visual and local agency requirements.

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

E. Infilling the Units for *Aggregate Systems*

1. Infill units with the specified aggregate.
2. The aggregate infill shall be a well-graded 0.375 inch to 0.5 inch (10 mm to 13 mm) open graded crushed angular stone with a fine content less than 5%.
 - a. Runoff Coefficient is dependent upon the actual site conditions and GeoPave® porous pavement system infill material.
 - b. For aggregate areas, typical run-off coefficients range from 0 to 0.15 for sandy and clay soils, respectively.
 - c. The actual run-off coefficient shall be based on site conditions, engineering judgment and the integrated effect of the drainage area.
3. Spread aggregate uniformly over the units with a skid steer, small tractor or small loader. Overfill the cells to allow for settlement of the infill. The overfill height will be determined by the size of the infill material.
4. 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.

F. Infilling the Units for *Vegetated Systems*:

1. Infill units with the specified aggregate/topsoil engineered infill.
2. 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.
 - a. Runoff Coefficient is dependent upon the actual site conditions and GeoPave® porous pavement system infill material.
 - b. For vegetated areas, typical run-off coefficients range from 0.10 to 0.35 for sandy and clay soils, respectively.
 - c. The actual run-off coefficient shall be based on site conditions, engineering judgment and the integrated effect of the drainage area.
3. Spread aggregate/topsoil engineered infill uniformly over units to a level even with the top of the cell wall.

4. If final vegetation is sod, the GeoPave® porous pavement units shall be under-filled by 1.0 inch (25 mm) to allow room to seat or press sod into GeoPave® porous pavement units.
5. Use spreading methods to prevent over-compaction of the infill.
6. Topsoil and Seed: As specified in Section 329200 Manufacturers of Turfs and Grasses.

Specifier Notes: With vegetated systems, once healthy turf has been established, the GeoPave® porous pavement cell wall structure will have minimal visibility when good turf-maintenance practices are followed. Delineation may be desirable to create greater visibility for access lanes or parking areas. Delete this section if not required.

3.4 ABOVE GROUND, POST-INSTALLATION DELINEATION

- A. Delineate the installed GeoPave® porous pavement system above ground, after installation is complete, with one of the following methods:
 1. Above-ground curbing
 2. Shrubbery or vegetation
 3. Perimeter lighting

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. The seed mix shall be as shown on the drawings or as specified in the contract documents.
 2. Follow good seeding, fertilizing, and watering procedures for turf establishment based on regional practices as specified in Section 329200 Manufacturers of Turfs and Grasses.
 3. Seed shall conform with the requirements of the governing authority for seeding and restrictions on noxious weed seed.
 4. Increase water frequency when free draining base materials are used.

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

- C. Sod:
 1. The sod shall be free from netting material, and as specified in the contract documents.
 2. Ensure units are under-filled to allow room to seat the sod.
 3. 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.
 4. Press sod into partially emptied cells using a roller or other suitable equipment and follow normal watering procedures.
 5. 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® porous pavement system that protrudes above the normal surface level could be damaged or removed by the blade.

- A. Aggregate Surfaces: Surface should be inspected quarterly to identify signs of slight cell infill loss.
- B. Lawn Care: Normal turf care procedures should be followed, including de-thatching and aerating. Some



equipment may slightly scar or cut the GeoPave® porous pavement wall structure during some operations, but will not affect overall structural integrity of the system as specified in section 329200 Manufacturers of Turfs and Grasses.

- C. 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