PRESTO GEOSYSTEMS

GEOPAVE®

POROUS PAVEMENT SYSTEM

DESIGN & CONSTRUCTION OVERVIEW

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The GeoPave® Porous Pavement System Components

The GeoPave Porous Pavement System with aggregate or an aggregate/topsoil engineered infill provides a permeable, stabilized surface for vehicular and pedestrian load support.

The complete system has three major components:

(1) the GeoPave unit

(2) the porous aggregate or aggregate/topsoil engineered base, *if required*

(3) the porous aggregate or an aggregate/topsoil engineered infill.

Other components may include a geosynthetic separation / reinforcement layer between the subgrade and base materials and sub-drain components.

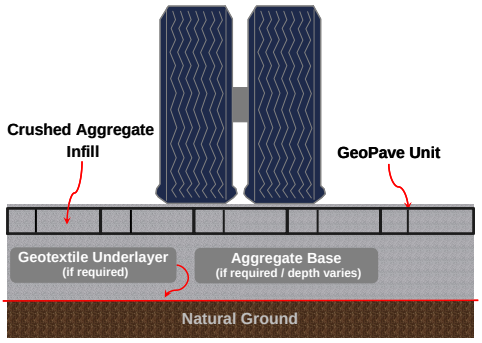


Figure 1 The GeoPave Porous Pavement System

Function of the GeoPave System Components

Function of the GeoPave Unit

The function of the GeoPave unit is to 1) create a structural framework to stabilize open-graded aggregate or an aggregate/topsoil engineered infill and to 2) increase bearing strength for vehicular or pedestrian traffic loading requirements using porous aggregate or other structural infills.

Function of the Base Material

For a given applied load over an existing subbase soil, both the base material, *if required,* and the GeoPave unit with crushed aggregate or a structural infill provide support. The depth of the base material should be determined using both loading requirements and subbase strength (Reference Table 1).

Function of the Optional Geosynthetic Layer

Under some conditions, a geosynthetic layer may be a required component between the in-situ soil and the required base layer in the porous pavement system. Generally, the geosynthetic component will serve one or more of the following functions and be one or more of the following materials:

- Tensile Reinforcement Geosynthetics: ... Woven geotextiles, Geogrids
- Separation Geosynthetics:..... Non-woven geotextiles, Woven geotextiles
- Drainage / Separation Geosynthetics: .... Non-woven geotextiles, Geonet / geotextile separation / drainage materials

Function of the Optional Sub-drain Component

If the porous pavement system is built over non-porous soils and an excavation is required such that water could be trapped, sub drainage becomes a required component of the system. Sub-drainage will remove harmful water accumulation that will cause degradation of the in-situ soils resulting in loss of support capacity. See **Optional Sub-Drainage Component** under **Installing the GeoPave System** for additional details.

GeoPave Material Properties & Unit Dimensions

GeoPave units shall be made from materials with physical and chemical characteristics described in Table 1. The manufactured GeoPave unit shall have a minimum deflection without breakage of 1.0 in (25 mm) when units are supported at 40 in (0.50 m) centers at 70°F (21°C). The color shall be uniform throughout all units in any given pallet.

GeoPave units shall have physical dimensions as specified in Table 1 and shown in Figure 2. GeoPave units shall contain a herringbone-type cell pattern consisting of small and large cells with a mesh bottom and vented side-walls. The monolithic mesh bottom is comprised of a series of square 0.25 in by 0.25 in (6.35 mm by 6.35 mm) openings. The small cells contain 1.0 in (25 mm) high and 0.50 in (12 mm) wide vented cell-wall openings, either 4 or 6 per cell for infill lock-up and lateral drainage between cells. The large cells contain vented cell-wall openings, 12 per cell.

The GeoPave units shall be connected with U-CLIPS side-to-side and end-to end where the short cell side-walls of adjacent units align. The connection points vary depending on chosen laying pattern (See Figure 8 Laying Patterns). End-to-end or side-to-side warping of the GeoPave unit shall not create a greater opening between adjacent outside walls than 0.25 in (6 mm). The finished GeoPave pavement is a uniformly connected, laterally integrated porous pavement system.

Table 1 GeoPave Unit Material Properties & Unit Dimensions

Item	Specifications & Details
Material	Up to 97% Recycled Polyethylene*
Color	Ranges from dark shades of gray to black
Chemical Resistance	Superior
Carbon Black for Ultraviolet Light Stabilization (ASTM D1693)	1.5% - 2.0%
Empty Unit Minimum Crush Strength @ 70°F (21°C)	175 psi (1,202 kPa)
Aggregate or Aggregate/Topsoil Filled Unit Minimum Crush Strength @ 70°F (21°C)	1000 psi (6,869 kPa)
Nominal Dimensions (width x length)	20 in x 40 in (0.50 m x 1.00 m)
Nominal Unit Depth	2 in (50 mm)
Nominal Coverage Area	5.38 ft² (0.50 m²)
Cells per Unit	50
Cell Size (small cell)	3.25 in x 3.25 in (83 mm x 83 mm)
Cell Size (large cell)	3.25 in x 6.5 in (83 mm x 165 mm)
Top Open Area per unit	90.5%
Bottom Open Area per unit	32.6%
Bottom Mesh Openings	0.25 in x 0.25 in (6.35 mm x 6.35 mm)
Nominal Weight per Unit	8.0 lb (3.6 kg)
Runoff Coefficient @ 63.5 mm/hr (2.5 in) Rainfall with Open-Graded Aggregate	(0 - 0.15)
Runoff Coefficient @ 63.5 mm/hr (2.5 in) Rainfall with Engineered Infill	(0.10 – 0.35)
Units per Pallet	46

Strength Characteristics of the GeoPave Unit	
***Empty Unit* Wall Compressive Strength** (simulated tire area loaded) Test Procedure - Full single unit loaded to failure via 9 inch flat plate	175 psi (1,202 kPa)
***Aggregate or Aggregate/Topsoil Filled Unit* Wall Compressive Strength** (simulated tire area loaded) Test Procedure - Full single unit loaded to failure via 9 inch flat plate	1000 psi (6,869 kPa)

Avoid specifications that state material compressive strength only. Material compressive strength, with applied factors-of-safety, must be sufficient to resist compressive and lateral load application. Beyond that, ultra-high material compressive strengths add little to any porous pavement system.

* The percentage of recycled content may vary depending on availability of recycled materials.

NOTE: Dimensions and weight are subject to manufacturing tolerances (± 5%) and are influenced by recycled component characteristics.

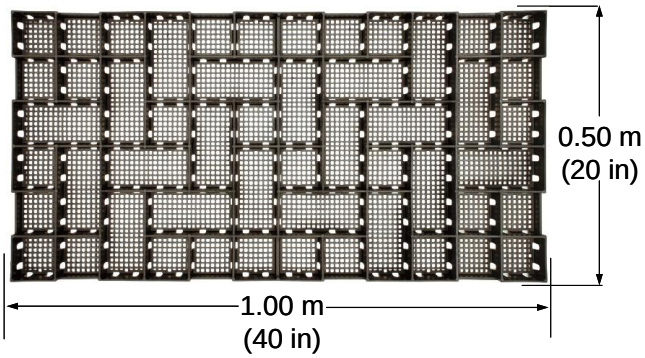


Figure 2 Full Size GeoPave Unit

Figure 3 The GeoPave Cell Configuration

Design Guideline

Table 2 Base Recommendations for the GeoPave Porous Pavement System

LOAD DESCRIPTION	DEPTH OF BASE		DEPTH OF BASE	
	AGGREGATE		ENGINEERED AGGREGATE / TOPSOIL[2]	
	CBR[1] 2 – 4	*CBR[1] >4*	*CBR[1] 2 – 4*	*CBR[1] >4*
Heavy Fire Truck Access & H-20 Loading Typical 110 psi (758 kPa) maximum tire pressure. Single axle loadings of 32 kip (145 kN), tandem axle loadings of 48 kip (220 kN). Gross vehicle loads of 80,000 lb (36.3 tonne).	6 in (150 mm)	6 in (150 mm)	Not Recommended	Not Recommended
Light Fire Truck Access & H-15 Loading Typical 85 psi (586 kPa) maximum tire pressure. Single axle loadings of 24 kip (110 kN). Gross vehicle loads of 60,000 lb (27.2 tonne).	6 in (150 mm)	4 in (100 mm)	Not Recommended	Not Recommended
Utility & Delivery Truck Access & H-10 Loading Typical 60 psi (414 kPa) maximum tire pressure. Single axle loadings of 16 kip (75 kN). Gross vehicle loads of 40,000 lb (18.1 tonne).	4 in (100 mm)	2 in (50 mm)	4 in (100 mm)	2 in (50 mm)
Cars & Pick-up Truck Access. Typical 45 psi (310 kPa) maximum tire pressure. Single axle loadings of 4 kip (18 kN). Gross vehicle loads of 8,000 lb (3.6 tonne).	2 in (50 mm)	None[3]	2 in (50 mm)	None[3]
Trail Use Loading for pedestrian, wheelchair, equestrian, bicycle, motorcycle and ATV traffic.	None[3]	None[3]	None[3]	None[3]

[1] CBR is the abbreviation for California Bearing Ratio. Methods for determining CBR vary from more sophisticated laboratory methods to simple field identification methods that use hand manipulation of the soil. Presto does not recommend one method over the other, however, the user must have a high degree of confidence in the results produced by the chosen method. If other-than-CBR soil strength values exist, use available correlation charts to relate the value to CBR.

[2] With the aggregate/topsoil mix and a vegetative surface, infrequent/occasional passes are recommended. Infrequent/occasional passes are defined as the number of passes over any period of time that causes no lasting damage to the vegetation. This number will be a function of vegetation type and age, climatic conditions, and maintenance practices. This number is not a function of the GeoPave material.

[3] A minimum of 2 in (50 mm) of aggregate base should be placed below the GeoPave units as a drainage layer and an infiltration storage area. Greater depth may be required depending upon design rainfall needs and subbase permeability.

Infill Materials

The recommended infill shall be an aggregate or an aggregate/topsoil engineered infill for aggregate and vegetated pavements respectively. When specifying infill type, consideration should be given to appropriateness of infill for loading requirements, traffic frequency, and subgrade strength.

Aggregate Infill

The aggregate infill shall be a well-graded 0.375 in to 0.5 in (10 mm to 13 mm) crushed angular stone with a fine content less than 5%.

Aggregate/Topsoil Engineered Infill

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 in to 0.5 in (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.

Choice of vegetation shall be determined based upon local climate and proposed use.

Base Materials

If necessary for loading requirements, the recommended base shall be aggregate or an engineered aggregate/topsoil mixture, and should be consistent with the chosen infill type.

Porous Base for Storage

A minimum of 2 in (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.

Under some conditions, a geotextile separation layer may be required between the natural ground and the base material. See **Optional Geosynthetic Separation Layer**, **Optional Sub-Drainage Component,** and **Base Preparation** for information relative to installation. Care shall be exercised in choosing this layer to assure that it does not impede permeability.

Aggregate Base

When the specified infill is aggregate, the aggregate base shall be a poorly-graded crushed aggregate with a fine content less than 5%. The aggregate shall be compacted to 95% Standard Proctor Density. After compaction, the surface shall be uniform with no protrusions from larger aggregate particles.

Base Particle Size Passing Sieve Analysis

Sieve Size	% Particles Passing Opening
½ in	95-100%
3/8 in	15-20%
#4	0-5%

Aggregate/Topsoil Engineered Base

When the specified infill is an aggregate/topsoil engineered mix for vegetated surfaces, the base material shall be an aggregate/topsoil engineered mixture. A free-draining aggregate base is not recommended for porous pavements intended to be vegetated. The aggregate/topsoil engineered base ensures proper moisture retention and the nutrient component required to maintain healthy vegetation.

The aggregate/topsoil engineered base 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 in to 1.0 in (10 mm to 25 mm) with a D_{50} of 0.5 in (13 mm). The percentage void-space of the aggregate portion when compacted 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. The mixture shall be compacted to 95% Standard Proctor Density.

Key Porous Pavement System Characteristics

Elements Important to Structural Integrity

The GeoPave unit (or any other similar material) must have five primary characteristics to adequately support loads, eliminate expansion-related failures, and to enable fast and efficient construction. Those characteristics are:

(1) suitable wall strength
(2) sufficient unit stiffness
(3) a supporting base, if required
(4) a large overall area and
(5) a monolithic mesh bottom

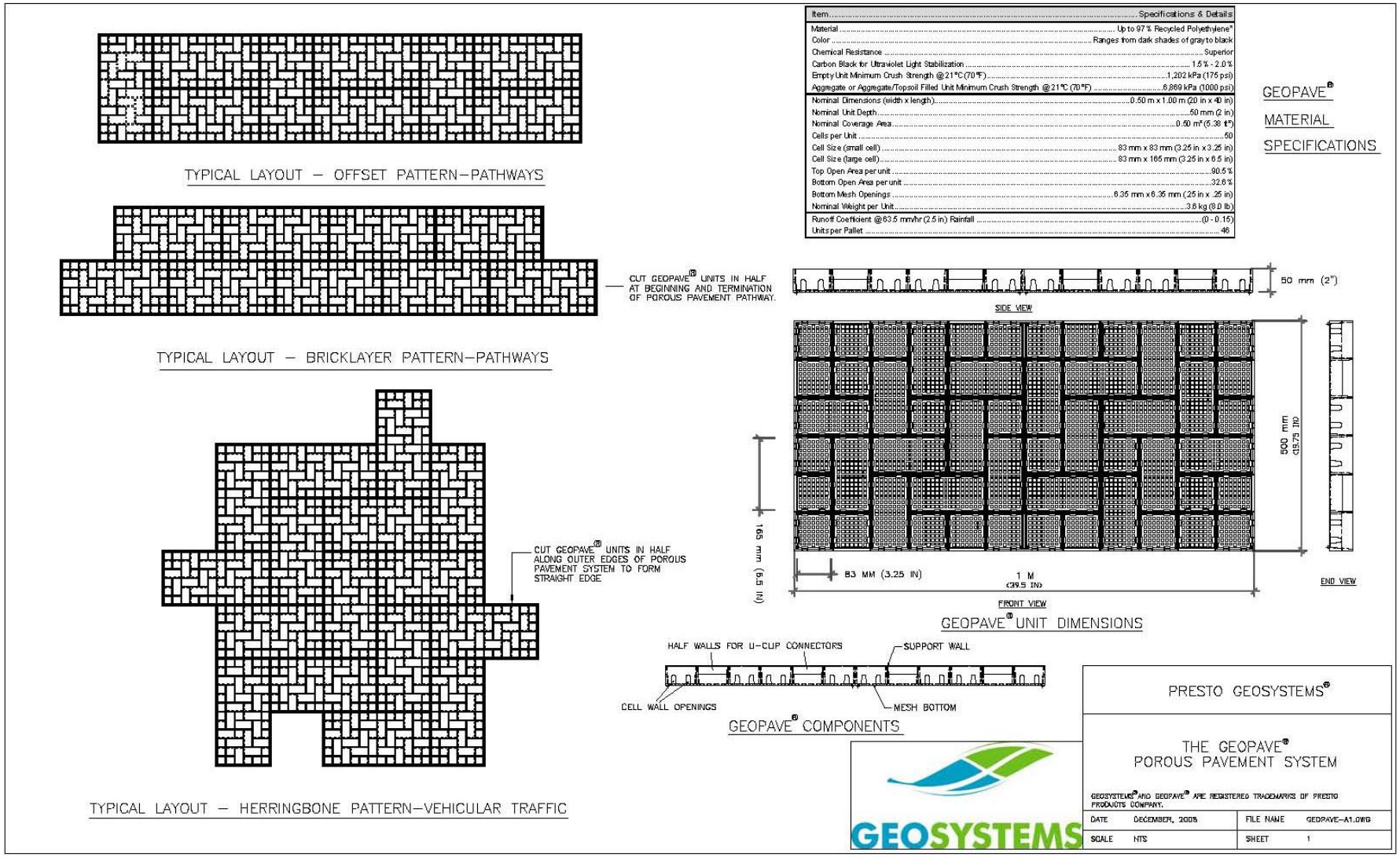
1) **Suitable Wall Strength:** The wall strength must support wheel loading from the heaviest anticipated vehicles that will travel over the porous pavement system. Vehicular loading will create direct wall compression from tires and equipment outriggers as well as lateral forces from vehicle breaking and acceleration. The wall should resist vertical and lateral deformations when loaded. **Caution** should be exercised when using systems with thin walls.

2) **Sufficient Unit Stiffness:** The unit stiffness must allow deflections without unit breakage or separation when subbase soils yield under loading. When the unit is too flexible, the base soils support the complete load. When the unit is too rigid, it could break under normal loading in low temperature conditions. **Caution** should be exercised when using systems that are either too flexible or too rigid.

3) **Supporting Base *if required:*** The unit support base must have a large enough area-of-contact with the base soil so high wheel loads at the top of the unit are reduced sufficiently when transferred to the base soil. This will provide a system with a greater range of stability. **Caution** should be exercised when using systems that have little contact area between the porous pavement unit and the base soil.

4) **Large Overall Area:** A large overall area, in conjunction with the other characteristics, ensures maximum load dissipation. If unit separation should occur and any given unit functions independently, larger unit areas will lower the pressure on base and subgrade soils. **Caution** should be exercised when using systems that have smaller contact areas.

5) Monolithic Mesh Bottom: The unit should contain a monolithic mesh bottom for encapsulating the aggregate infill and preventing material loss from the bottom of the units when exposed to repeated loading and freeze-thaw cycles. **Caution** should be exercised when using systems without monolithic mesh bottoms.



Item	Specifications & Details
Material	Up to 97% Recycled Polyethylene*
Color	Ranges from dark shades of gray to black
Chemical Resistance	Superior
Carbon Black for Ultraviolet Light Stabilization	1.5% - 2.0%
Empty Unit Minimum Crush Strength @ 21°C (70°F)	1,202 kPa (175 psi)
Aggregate or Aggregate/Topsoil Filled Unit Minimum Crush Strength @ 21°C (70°F)	6,869 kPa (1000 psi)
Nominal Dimensions (width x length)	0.50 m x 1.00 m (20 in x 40 in)
Nominal Unit Depth	50 mm (2 in)
Nominal Coverage Area	0.50 m² (5.38 ft²)
Cells per Unit	50
Cell Size (small cell)	83 mm x 83 mm (3.25 in x 3.25 in)
Cell Size (large cell)	83 mm x 165 mm (3.25 in x 6.5 in)
Top Open Area per unit	90.5%
Bottom Open Area per unit	32.6%
Bottom Mesh Openings	6.35 mm x 6.35 mm (.25 in x .25 in)
Nominal Weight per Unit	3.6 kg (8.0 lb)
Runoff Coefficient @ 63.5 mm/hr (2.5 in) Rainfall	(0 - 0.15)
Units per Pallet	46

Figure 4 GeoPave System Material Specification and Layout

Load Description	Depth of Base		Depth of Base	
	AGGREGATE		ENGINEERED AGGREGATE/TOPSOIL[2]	
	CBR[1] 2 – 4	CBR[1] >4	CBR[1] 2 – 4	CBR[1] >4
Heavy Fire Truck Access & H-20 loading. Typical 758 kPa (110 psi) maximum tire pressure. Single axle loadings of 145 kN (32 kip), tandem axle loadings of 220 kN (48 kip). Gross vehicle loads of 36.3 tonne (80,000 lb).	150 mm (6 in)	150 mm (6 in)	Not Recommended	Not Recommended
Light Fire Truck Access & H-15 loading. Typical 586 kPa (85 psi) maximum tire pressure. Single axle loadings of 110 kN (24 kip). Gross vehicle loads of 27.2 tonne (60,000 lb).	150 mm (6 in)	100 mm (4 in)	Not Recommended	Not Recommended
Utility & Delivery Truck Access & H-10 loading. Typical 414 kPa (60 psi) maximum tire pressure. Single axle loadings of 75 kN (16 kip). Gross vehicle loads of 18.1 tonne (40,000 lb).	100 mm (4 in)	50 mm (2 in)	100 mm (4 in)	50 mm (2 in)
Cars & Pick-up Truck Access. Typical 310 kPa (45 psi) maximum tire pressure. Single axle loadings of 18 kN (4 kip). Gross vehicle loads of 3.6 tonne (8,000 lb).	50 mm (2 in)	None*	50 mm (2 in)	None*
Trail Use. Loading for pedestrian, wheelchair, equestrian, bicycle, motorcycle and ATV traffic.	None*	None*	None*	None*

A minimum of 50 mm (2 in) of aggregate base should be placed below the GeoPave units as a drainage layer and an infiltration storage area. Greater depth may be required depending upon design rainfall needs and subbase permeability.

[1] CBR is the abbreviation for California Bearing Ratio. Methods for determining CBR vary from more sophisticated laboratory methods to simple field identification methods that use hand manipulation of the soil. Presto does not recommend one method over the other, however, the user must have a high degree of confidence in the results produced by the chosen method. If other-than-CBR soil strength values exist, use available correlation charts to relate the value to CBR.

[2] With the aggregate/topsoil mix and a vegetative surface, infrequent/occasional passes are recommended. Infrequent/occasional passes are defined as the number of passes over any period of time that causes no lasting damage to the vegetation. This number will be a function of vegetation type and age, climatic conditions, and maintenance practices. This number is not a function of the GeoPave material.

BASE MATERIAL:
IF NECESSARY FOR LOADING REQUIREMENTS, THE RECOMMENDED BASE SHALL BE AGGREGATE OR AN ENGINEERED AGGREGATE/TOPSOIL MIXTURE, AND SHOULD BE CONSISTENT WITH THE CHOSEN INFILL TYPE.

A MINIMUM OF 50 MM (2 IN) 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.

RECOMMENDED AGGREGATE INFILL:
THE AGGREGATE INFILL SHALL BE A WELL-GRADED 10 MM TO 13 MM (0.375 TO 0.5 IN) CRUSHED ANGULAR STONE WITH A FINE CONTENT LESS THAN 5%

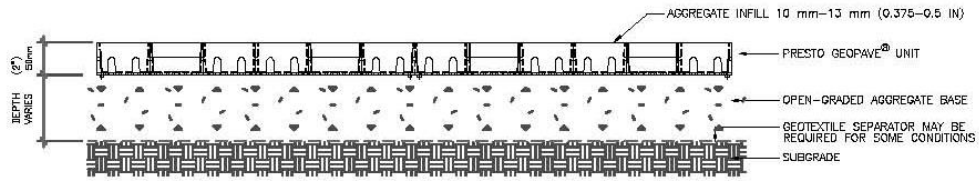
RECOMMENDED ENGINEERED BASE FOR VEGETATED SOLUTIONS:
SUPPORT SOIL SHALL CONSIST OF A HOMOGENEOUS MIXTURE CONSISTING OF 1) A CLEAR-STONE/CRUSHED ROCK HAVING AN AASHTO #5 OR SIMILAR DESIGNATION BLENDED WITH 2) PULVERIZED TOPSOIL AND 3) A VOID COMPONENT GENERALLY CONTAINING AIR AND/OR WATER. THIS HOMOGENEOUS MIXTURE WILL PROMOTE VEGETATIVE GROWTH AND PROVIDE REQUIRED STRUCTURAL SUPPORT. THE AGGREGATE PORTION SHALL HAVE A PARTICLE RANGE FROM 10 MM TO 25 MM (0.375 TO 1.0 IN) WITH A D_{50} OF 13 MM (0.5 IN). THE PERCENTAGE VOID-SPACE OF THE AGGREGATE PORTION WHEN COMPACTED SHALL BE AT LEAST 30%. THE PULVERIZED TOPSOIL SHALL EQUAL 25% OF THE TOTAL VOLUME AND BE ADDED AND BLENDED TO PRODUCE A HOMOGENEOUS MIXTURE PRIOR TO PLACEMENT. ONCE PLACED, THE MIXTURE SHALL BE COMPACTED TO 95% STANDARD PROCTOR DENSITY.

RECOMMENDED ENGINEERED INFILL FOR VEGETATED SOLUTIONS:
SAME AS ENGINEERED BASE BUT WITH A PARTICLE RANGE FROM 10 MM TO 13 MM (0.375 TO 0.5 IN)

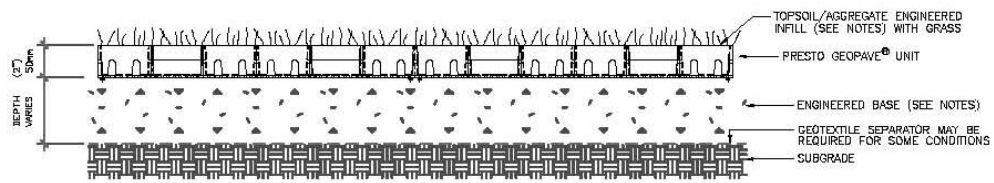
GEOPAVE® SYSTEM USAGE GUIDELINES

Item	Specifications & Details
Material	Up to 97% Recycled Polyethylene*
Color	Ranges from dark shades of gray to black
Chemical Resistance	Superior
Carbon Black for Ultraviolet Light Stabilization	1.5% - 2.0%
Empty Unit Minimum Crush Strength @ 21°C (70°F)	1,202 kPa (175 psi)
Aggregate or Aggregate/Topsoil Filled Unit Minimum Crush Strength @ 21°C (70°F)	6,869 kPa (1000 psi)
Nominal Dimensions (width x length)	0.50 m x 1.00 m (20 in x 40 in)
Nominal Unit Depth	50 mm (2 in)
Nominal Coverage Area	0.50 m² (5.38 ft²)
Cells per Unit	50
Cell Size (small cell)	83 mm x 83 mm (3.25 in x 3.25 in)
Cell Size (large cell)	83 mm x 165 mm (3.25 in x 6.5 in)
Top Open Area per unit	90.5%
Bottom Open Area per unit	32.6%
Bottom Mesh Openings	6.35 mm x 6.35 mm (.25 in x .25 in)
Nominal Weight per Unit	3.6 kg (8.0 lb)
Runoff Coefficient @ 63.5 mm/hr (2.5 in) Rainfall	(0 - 0.15)
Units per Pallet	46

GEOPAVE® MATERIAL SPECIFICATIONS



AGGREGATE SOLUTION



VEGETATED SOLUTION

GEOSYSTEMS

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THE GEOPAVE® POROUS PAVEMENT SYSTEM

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Figure 5 GeoPave System Usage Guideline

Installing the GeoPave System

Subgrade Preparation

Excavate the area, allowing for the GeoPave unit thickness and the base material depth (where the base material is required). When working with in-situ soils that have poor permeability, provide adequate drainage from the excavated area if the area has the potential to collect water. The in-situ soil should be relatively dry and free from any standing water. Finish-grade the surface of the in-situ soil specifically when the GeoPave unit is to be installed without additional base material. Level and clear the area of large objects such as rocks, pieces of wood, etc. to enable the GeoPave units to connect properly and remain stationary after installation.

Subbase or base, when required, shall be compacted and fine graded as appropriate. Caution should be exercised to assure that porous subbases not be over compacted such that porosity is hindered.

Optional Geosynthetic Separation Layer

If required and/or specified by the project engineer, the geosynthetic layer shall be rolled out over the prepared subgrade along the alignment of the reinforced surface. The geosynthetic shall be pulled taut to ensure that there are no folds. Geosynthetic layer overlaps, if required, shall be according to plans and manufacturer's recommendations.

Optional Sub-Drainage Component

If required and/or specified by the project engineer, install the specified sub-drain and outlet according to construction drawings. Ensure that a proper slope is maintained throughout the drainage system and that the outlet is free from any obstructions preventing free drainage.

Base Preparation

If required, the specified base material is spread over the prepared base, compacted to 95% Standard Proctor Density and fine graded as appropriate. Caution should be exercised to assure that porous subbases not be over compacted such that porosity is hindered. Refer to **Table 2 Base Recommendations for the GeoPave Porous Pavement System** for base depth recommendations.

GeoPave Unit Installation

Orientation & Laying Pattern of Units

Place the GeoPave units with the mesh bottom to the ground.

When the application is a narrow pedestrian access lane, stagger the units to produce the bricklayer or the offset pattern.

When the application is a large area, stagger the units to produce the herringbone pattern. This pattern reduces straight seams to one and a half block lengths and allows for better disguise of the unit seams.

The staggered pattern is developed by using half GeoPave units made by field cutting a full unit and placing the units as illustrated. Cut the units with a hand or power saw to custom fit both contours and/or around obstructions. These final seam patterns assure maximum load transfer and support and improved aesthetics.

Other laying patterns are generally not recommended.

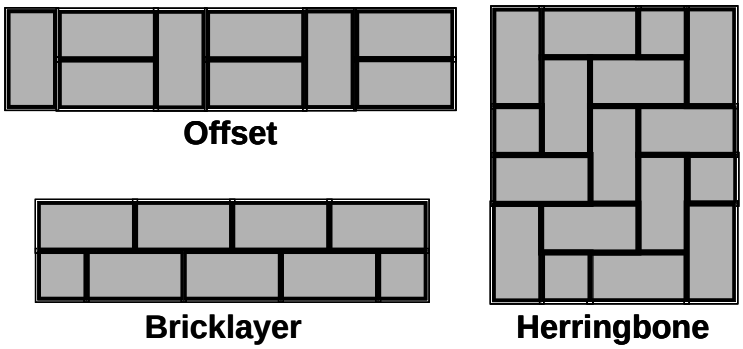

Figure 6 Laying Patterns

Positioning of Units

If required, ensure that all adjacent hard-surfaced paving work is completed before installing the GeoPave porous pavement system.

Place the first row of GeoPave units against a stationary edge when available. Units should be placed such that corners and seams do not protrude above the desired surface elevation. Abut adjoining units to form the desired laying pattern.

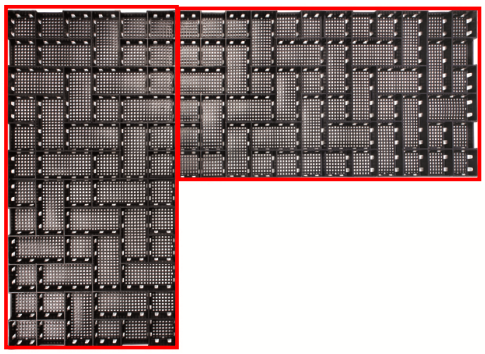

Figure 7 Joining GeoPave Units

Secure adjoining GeoPave units together using the U-CLIP connection device. U-CLIPS shall be set in place by hammer in the half-wall locations. There are four locations on each long side and two locations on each short side. They shall be driven completely so that adjacent sections have horizontally level profiles. Caution should be exercised to assure that no material is trapped between adjacent sections prior to the placement of U-CLIPS.

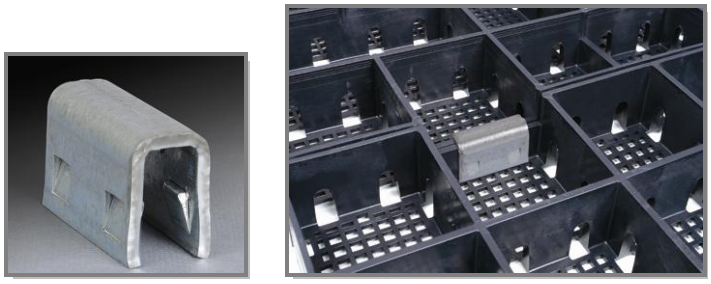

Figure 8 The U-Clip Connection Device

Optional Anchoring of Units

The GeoPave units can be fixed in-place with 0.5 in (13 mm) #4 rebar to prevent movement of the units. Anchoring may be necessary if the GeoPave units are placed on a slope (5-10%).

The anchors can be driven through the cell-wall vent holes either in the middle of the GeoPave units or along the perimeter as required.

Anchoring of units in-place should occur after installation of all the units within the defined area.

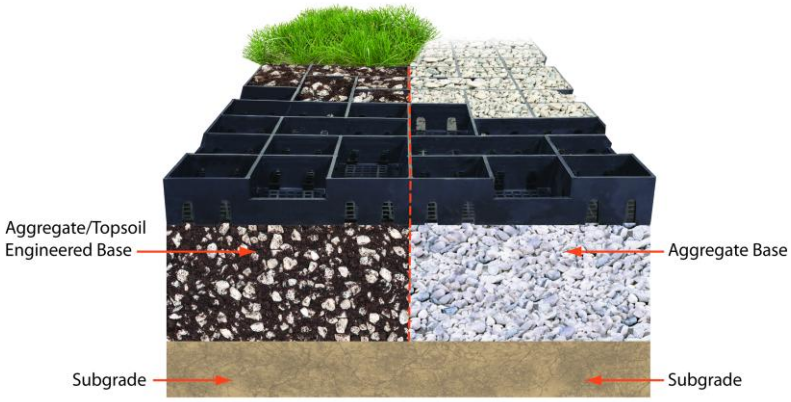

Figure 9 Optional Stake Anchoring

Infilling the GeoPave Unit

Infill the GeoPave units with the specified material for the intended application. Infilling should take place immediately after the units are installed to minimize movement of the units.

Infill shall be placed with each successive pile of aggregate or aggregate/topsoil mixture to be placed at the edge of previously filled GeoPave units and spread with a skidsteer, small tractor or small loader. Spread the infill material uniformly over the units. Hand ranking will be performed to assure that the final aggregate fill is just over the elevation of the top walls.

For aggregate surfaces, approximately 0.5 in (13 mm) overfill should be maintained over the top of the GeoPave cell walls. Follow procedures for applying seed or sod. No specific compaction will be required, but traffic will allow for the slight settlement of the infill material under ordinary use.

Upward buckling of the GeoPave area is generally not an issue if the units have been installed using the recommended laying patterns and infilled appropriately.

Seed or Sod for Vegetated Systems

Once the aggregate/topsoil engineered mixture is evenly spread in the GeoPave units, either grass seed or sod may be applied. If using sod, the GeoPave units should be underfilled by 1.0 inch (25 mm) to allow room to seat or press the sod within the GeoPave units.

Follow good seeding, fertilizing, and water procedures for turf establishing based on regional practices.

Delineation for Vegetated Systems

With vegetated systems, once healthy turf has been established, the GeoPave structure will have minimal visibility when good turf maintenance practices are followed. Delineation may be desirable to create visibility for access lanes. Delineation methods include in-ground curbing, above-ground curbing, shrubbery or vegetation, perimeter lighting or delineation markers

Maintenance

Aggregate Surface Wear Course

When the pavement surface is aggregate, the surface should be inspected from time to time to identify signs of slight cell infill loss. If cell infill loss occurs, additional infill material should be added.

Vegetated Surface

When the pavement surface is vegetation, lawn care should follow normal watering, fertilizing and mowing procedures. Vegetated surfaces are intended for infrequent or occasional traffic with a maximum H-10 loading. The pavement should be monitored to ensure traffic frequency and loading does not exceed the pavement design.

Snow Removal

If required, snow removal should be done using one of the following basic procedures:

- Keep a metal edged plow blade a minimum of 1.0 in (25 mm) above the surface during plowing operations, or
- Use a plow blade with a flexible rubber edge, or
- Use a plow blade with skids on the lower outside corners so that the plow blade does not come in direct contact with the porous pavement system.

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.

Estimating Time and Cost of Installation

Typical Crew Size and Responsibilities

2 Crew to set the GeoPave units in place.

2 Crew to spread and level the specified infill.

1 Equipment operator for the front-end loader.

NOTE: Adding or subtracting one or two people to the crew may result in a cost-effective productivity increase depending on local work efficiencies.

Equipment Needed and Purpose

- Saws, U-clips (may be purchased from Presto's distributors/representatives) and anchors (if required) – all or some of these are used for cutting and securing the GeoPave units as required per the plans or as needed during construction.
- A small tractor/backhoe or loader for infilling of the GeoPave units.
- Rakes and shovels for final leveling of the infill material.

Typical Construction Sequences and Times

Productivity is a variable and the ranges below are typical. Select an installation rate through personal experience or after discussion of project details with Presto or one of its qualified distributors.

1.	Place the GeoPave units on the prepared base and install connecting U-clips.	60-75 units/man-hr
2.	Fill the in-place GeoPave units using the small loader or backhoe to evenly distribute the specified infill.	100 - 120 units/man-hr
3.	Level the infill using rakes and shovels. If aggregate, overfill the top of the cell walls 0.5 in (13 mm). If aggregate/topsoil mixture, rake flush with the top of the cell walls.	75 - 100 units/man-hr

NOTE: The above three sequences can be in progress at the same time if workspace is adequate.

Table 3 Approximate Quantities of Infill Material Required for GeoPave Unit

Depth of unit	Volume of Aggregate Required per unit	Volume of Aggregate Required per 1000 ft² (100 m²)
2 in (50 mm)	0.0293 yd³ (0.0224 m³)	5.447 yd³ (4.48 m³)

General Notes

1. The tractor/backhoe loader must be sized so it can distribute the fill material per time/productivity requirements.
2. Experience shows that the above installation rates would be considered typical rates of installation.
3. As is with all construction operations, placement of material stockpiles, crew productivity, jobsite conditions, special installation requirements such as cutting and custom fitting of the GeoPave units, etc. significantly affect overall productivity, therefore actual results may be different than the estimates above.

Total Time and Materials Required

Area of installation = length x width of site

(_____) ft (m) long x (_____) ft (m) wide = (_____)ft² (m²) Area

GeoPave units required = ft² (m²) (Area ÷ 5.38 ft² (0.50 m²)/unit
[the GeoPave unit is 20 in x 40 in (0.50 m x 1.00 m) nominal]

(_____) ft² (m²) Area ÷ 5.38 ft² (0.50 m²)/unit = (_____) units

Man-hr required for installation of GeoPave units = GeoPave units ÷ 75 units/man-hr

(_____) units ÷ 75 units/man-hr = (_____) man-hr

Infill material quantities = GeoPave units x yd³ (m³)/unit (see Table 3)

(_____) units x (_____) yd³ (m³)/unit = (_____) yd³ (m³)

Man-hr required for placing infill = GeoPave units ÷ 120 units/man-hr

(_____) units ÷ 120 units/man-hr = (_____) man-hr

Man-hr required for leveling of infill = GeoPave units ÷ 100 units/man-hr

(_____) units ÷ 100 units/man-hr = (_____) man-hr

Man-hr required for placing base material = GeoPave units ÷ 100 units/man-hr

(_____) units ÷ 100 units/man-hr = (_____) man-hr

Total Cost of Time and Materials

GeoPave unit cost	$_____/unit	x	_____units	=	$ _____
Cost of Infill	$_____/yd³ (m³)	x	_____yd³ (m³)	=	$ _____
Cost of Labor	$_____/man-hr	x	_____man-hr	=	$ _____
Cost of Equip. Operator	$_____/man-hr	x	_____man-hr	=	$ _____
Cost of Front-end Loader	$_____/hr	x	_____hr	=	$ _____

APPROXIMATE TOTAL COST $ _____

Limited Warranty

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.

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. Contact Presto Products Company, Ph: 800-548-3424; 920-738-1328 or Email: info@prestogeo.com.

Disclaimer

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Project specifications take precedence over all manufacturers' recommendations.