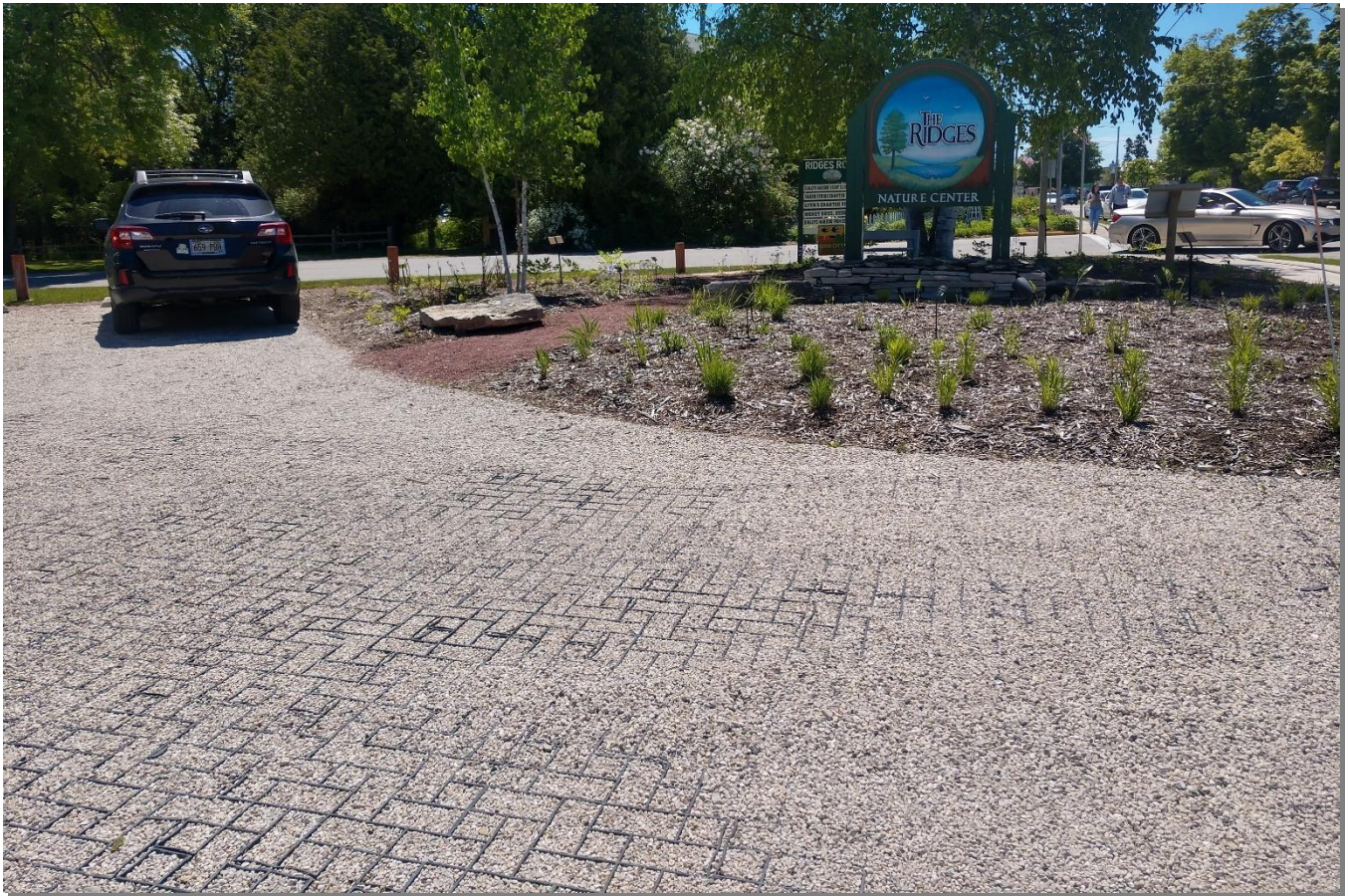


GEOPAVE®

GRAVEL POROUS PAVEMENT SYSTEM

DESIGN & CONSTRUCTION OVERVIEW



The GEOPAVE® Porous Pavement System Components

The GEOPAVE Porous Pavement System with open-graded 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) if required, open graded aggregate or aggregate/topsoil engineered base

Other components may include a geosynthetic separation layer, sub-drain, and delineation marker.

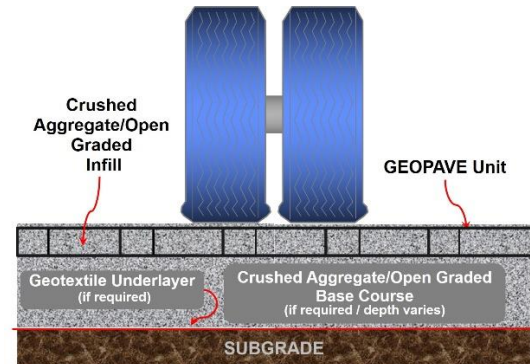


Figure 1 The GEOPAVE Porous Pavement System

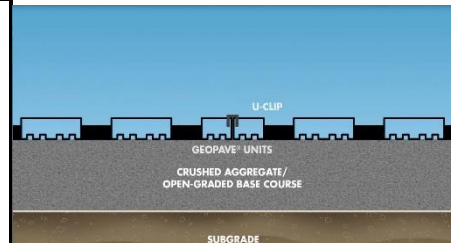
DESIGN Considerations

FUNCTION of the GEOPAVE System Components

Function of the Paver Structure

The function of the GEOPAVE unit is to:

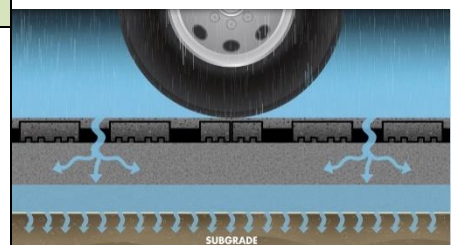
- 1) create a structural framework to contain and stabilize open-graded aggregate that will provide permeability and infiltration of stormwater.
- 2) keep aggregate from migrating through the bottom of the panels monolithic mesh bottom.
- 3) increase bearing capacity for vehicular (up to AASHTO H/HS-25) or pedestrian loading requirements using open-graded aggregate.
- 4) The GEOPAVE panels are semi-rigid pavers with interconnected cell walls. The GEOPAVE panels are connected with strong U-CLIP devices. This interconnected cell wall and U-CLIP provides high load distribution allowing for less base material than lighter-weight or rolled systems.



Function of the Base Material

For an applied load over an existing subgrade, both the base material, *if required*, and GEOPAVE unit with open-graded aggregate provides support. If required, the base depth should be determined based on vehicle loading and subgrade strength. Refer to Table 3 for base depth based on subgrade CBR and vehicle loading. The base also performs like an on-site stormwater retention system allowing stormwater to be stored, and infiltrate slowly. The Engineer shall determine if edge restraint for the base is required to ensure the base is stable during installation, compaction, and under expected vehicle loads.

For aggregate pavement surfaces, the gradation of the base material, and infill are different. Refer to Table 2.



Function of the Infill

Aggregate Pavement Surface

The recommended infill is an open graded, crushed aggregate with low fine content to provide a highly permeable system that infiltrates stormwater quickly.



OPTIONAL Components

Function of the Geosynthetic Layer (if required)	Function of the Sub-drain (if required)
Under some conditions, a geosynthetic layer may be required between the sub grade and base. Generally, the geosynthetic component will serve one or more of the following functions and be one or more of the following materials: 1) reinforcement (enhanced woven geotextiles), 2) separation/filtration (woven or non-woven geotextiles) and 3) drainage geosynthetics (geonets, piping). The geotextile shall be installed in accordance with Manufacturer recommendations. Slit tape woven geotextiles are not recommended due to lack of drainage.	If the GEOPAVE panels are installed 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 subbase resulting in loss of bearing capacity.

SPECIFICATION Details:

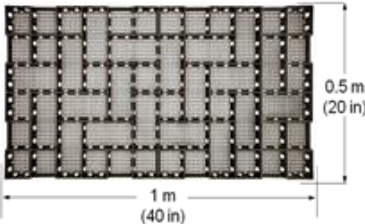
GEOPAVE Material Properties & Unit Dimensions

GEOPAVE panels 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 panels are supported at 40 in (0.50 m) centers at 70°F (21°C). The color shall be uniform throughout all panels in any given pallet.

GEOPAVE panels shall have physical dimensions as specified in Table 1 and shown in Figure 2. GEOPAVE panels shall contain a herringbone-type cell pattern consisting of small and large cells with a mesh bottom and vented sidewalls. 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 panels shall be connected with U-CLIPS side-to-side and end-to-end where the short cell sidewalls of adjacent panels align. A total of 12 U-CLIPS are required for each unit. The connection points vary depending on chosen laying pattern (See 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 SPECIFICATION of the GEOPAVE Porous Pavement Unit

Item	Specification & Details	Paver Unit Details
Material	Up to 100% Recycled Polyethylene ¹	 Figure 2 GEOPAVE Unit Nominal Dimensions
Color	Ranges Dark Shades Gray to Black	
Chemical Resistance	Superior	
Carbon Black for Ultraviolet Light Stabilization	1.5% - 2.0%	
Unit Minimum Crush Strength (Empty) @ 70°F (21°C)	175 psi (1,202 KPa)	 Figure 3 GEOPAVE Cell and Interlocking Offset Tab
Unit Minimum Crush Strength (Aggregate or Aggregate/Topsoil - Filled) @ 70°F (21°C)	5,160 psi (35,625 KPa) ²	
Flexural Modulus @ 70°F (21°C)	35,000 psi (240,000 kPa)	
Nominal Dimensions (width x length)	20 in x 40 in (0.5 m x 1.0 m) ³	
Nominal Unit Depth	2.0 in (50 mm)	
Nominal Coverage Area	5.38 ft ² (0.5 m ²)	
Cells per Unit	50	
Small Cell Size	3.25 in x 3.25 in (83 mm x 83 mm)	
Large Cell Size	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 Opening Size	0.25 in x 0.25 in (6.35 mm x 6.35 mm)	
Weight per Unit (nominal)	7.6 lbs (3.4 kg)	
Runoff Coefficient @ 2.5 in/hr (64 mm/hr) Rainfall with Aggregate	(0-0.15)	
Panels per Pallet	46	

NOTES: 1) The percentage of recycled content may vary depending on availability of recycled materials. 2) Avoid specifications that state material compressive strength only. Material compressive strength, with applied factors of safety must be sufficient to resist compressive and lateral loads. In addition, ultra-high compressive strength adds little value to a porous pavement system. 3) Dimensions and weight are subject to manufacturing tolerances and are influenced by recycled components.

Orientation & Laying Pattern of Panels

The Engineer shall specify the laying pattern Offset, Bricklayer, or Herringbone in accordance with anticipated traffic type and flow.

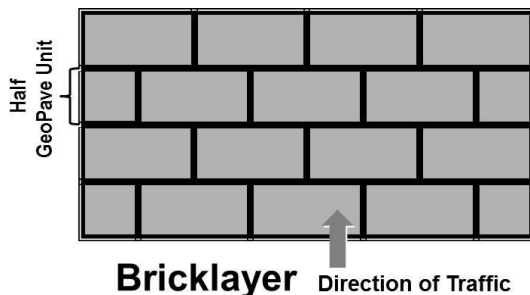
When the application is a narrow access lane, the recommended pattern is the **offset pattern**.



Offset

Figure 4 Offset Laying Pattern

When the application is **one-direction vehicular traffic**, the recommended pattern is the **bricklayer pattern**.

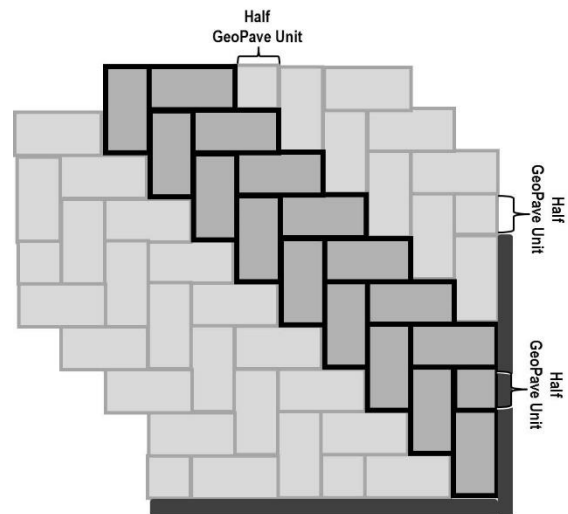


Bricklayer

Direction of Traffic

Figure 5 Bricklayer Laying Pattern

When the application is a large area with **multi-directional traffic**, the recommended pattern is the **herringbone pattern**. This pattern reduces straight seams to one and a half block lengths and allows for better disguise of the unit seams.



Herringbone

Figure 6 Herringbone Laying Pattern

Optional Anchoring of Panels

If required, the Engineer shall specify anchoring the GEOPAVE panels in-place with ATRA® speed stakes, earth anchors, or No. 4 rebar to prevent movement of the panels. Anchoring may be necessary if the GEOPAVE panels are placed on a slope (5-10%). Actual anchorage pattern will be based on the vehicle loading, sub grade strength, and slope angle. Contact Presto Geosystems for anchorage recommendations.

Curve or Corner Fit

If necessary, the Engineer shall specify either offsetting the GEOPAVE panels or cutting the GEOPAVE panels to fit around curves or corners. The GEOPAVE panels shall be cut to accommodate existing obstacles, such as manhole covers. Edge restraints shall be specified by the Engineer and are required around both internal and external borders, in order to create closed "cells" that will contain the infill material. The offset or cut panels shall be connected in the usual manner.

Base Materials

If necessary for loading requirements, the recommended base shall be crushed aggregate and should be consistent with the chosen infill type. Refer to Table 2 for base material specification. Refer to Table 3 for base depth recommendations.

GEOPAVE Infill Materials

The recommended infill shall be an open-graded, crushed aggregate. Round aggregate is not allowed. Aggregate pavement surfaces are suitable for all types of traffic and frequencies (up to AASHTO H/HS25 loading).

Table 2 Base and Infill Recommendations

AGGREGATE Pavements		
AGGREGATE Surface	BASE Material	INFILL Material
	Open Graded/Crushed Aggregate	Open Graded/Crushed Aggregate
	The <u>base material</u> shall be an open graded crushed aggregate with a particle range from 0.375 in to 1.0 in (10 mm to 25 mm) with a fines content less than 5%. The aggregate shall be compacted to the Engineer's specifications. After compaction, the surface shall be uniform with no protrusions from larger aggregate particles. The edges of the base shall be constrained appropriately.	The <u>infill material</u> shall be an open-graded crushed aggregate with a particle range from 0.375 in to 0.5 in (10 mm to 13 mm) and a fines content less than 5%. Round stone should not be used.

Under some conditions, a geotextile separation layer (non-woven or enhanced woven) may be required between the sub grade and the base material. Care shall be exercised in choosing the proper geotextile to ensure that it does not impede permeability. Slit tape woven geotextiles are not recommended due to lack of drainage. The geotextile shall be installed in accordance with Manufacturer's recommendations including overlaps.

Design Guideline

Specify base depth based on vehicle load, subgrade CBR based on recommendations in Table 3.

Table 3: Base Depth Recommendations for the GEOPAVE® Unit

The Engineer shall be responsible for the design and stability of the aggregate base and edges.

LOAD DESCRIPTION ¹	DEPTH OF BASE ²	
	AGGREGATE	
	CBR 2 – 4	CBR ¹ >4
Heavy Fire Truck Access & H/HS25, H/HS20 loading. Typical 110 psi (758 kPa) maximum tire pressure. Single axle loadings of 40 kips (178 kN), tandem axle loadings of 48 kip (220 kN). Gross vehicle loads of 90,000 lbs (40.1 MT).	6 in (150 mm)	6 in (150 mm)
Light Fire Truck Access & H/HS15 loading. Typical 85 psi (586 kPa) maximum tire pressure. Single axle loadings of 24 kips (110 kN). Gross vehicle loads of 60,000 lbs (27.2 MT).	6 in (150 mm)	4 in (100 mm)
Utility & Delivery Truck Access & H/HS10 loading. Typical 60 psi (414 kPa) maximum tire pressure. Single axle loadings of 16 kips (75 kN). Gross vehicle loads of 40,000 lbs (18.1 MT).	4 in (100 mm)	2 in (50 mm)
Cars & Pickup Truck Access. Typical 45 psi (310 kPa) maximum tire pressure. Single axle loadings of 4 kips (18 kN). Gross vehicle loads of 8,000 lbs (3.6 MT).	2 in (50 mm)	None ²
Trail Use. Loading for pedestrian, wheelchair, equestrian, bicycle, motorcycle, and ATV traffic.	None ²	None ²

¹ The GEOPAVE system can be applied in areas where loading is greater than those listed above. In these situations, contact Presto Geosystems or an authorized Presto Geosystems' representative for specific recommendations.

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

Design Considerations for System Structural Integrity

Elements Important to Structural Integrity

The GEOPAVE unit (or any other similar material) must have five primary characteristics to adequately support loads, and to enable fast and efficient construction as shown below: 1) SUITABLE WALL STRENGTH: The wall strength shall 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 and lateral forces from vehicle braking 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 shall allow deflections without unit breakage or separation when subgrade soils yield under loading. When the unit is too flexible, the subgrade supports the vehicle 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 <i>if required</i>: The supporting base shall have sufficient edge restraints and a large enough area-of-contact with the subgrade so high wheel loads at the top of the unit are reduced sufficiently when transferred to the subgrade. 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 subgrade. 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 the subgrade. Caution should be exercised when using systems that have smaller contact areas. 5) MONOLITHIC MESH BOTTOM: The unit shall contain a properly sized monolithic mesh bottom for encapsulating the aggregate infill and preventing material loss from the bottom of the panels when exposed to repeated loading and freeze-thaw cycles. Caution should be exercised when using systems without monolithic mesh bottoms as the panels may lift over time.
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Elements Not Important to Structural Integrity

Avoid specifications that state **material compressive strength** especially if a sand base is required. Material compressive strength, with applied factors of safety must be sufficient to resist compressive and lateral load applications. Ultra-high material compressive strengths add little to the porous pavement system. Table 1 provides a listing of strength characteristics of the GEOPAVE porous pavement system. These values provide a balanced system meeting all criteria important to the integrity and performance of a porous pavement system.

Engineer Specification Checklist

The Engineer shall specify the following:

Specification Item	Description
Paver Unit	Specify GEOPAVE Porous Pavement System
Optional Layers	Specify Geosynthetic Layer (enhanced woven or non-woven) and or Subdrain, if required.
Paver Unit Orientation	Specify Offset, Bricklayer, or Herringbone Pattern according to anticipated traffic type and flow.
Paver Unit Connection	Specify the GEOPAVE panels shall be connected with U-CLIPS side-to-side and end-to end where the short cell sidewalls of adjacent panels align. The connection points vary depending on chosen laying pattern.
Anchorage of Paver Panels	Specify anchorage of GEOPAVE panels with ATRA Speed Stakes, No. 4 rebar, or earth anchors if the system will be on a slope or as applicable. Contact Presto Geosystems for anchorage recommendations.
Curve or Corner Fit	Specify offsetting the GEOPAVE panels or cutting the GEOPAVE panels to accommodate corners, curves, existing structures, or obstacles.
Pavement Surface	Specify Aggregate Pavement Surface. Specify the appropriate <u>base</u> and <u>infill</u> materials as recommended in Table 2 .
Base Depth	Specify the base depth depending on vehicle loading, sub grade CBR value and additional stormwater capacity. Refer to base depth recommendation in Table 3 .
Delineation	Specify a delineation method such as GEOPAVE SNAP delineators, in-ground or above-ground curbing, shrubbery, vegetation, or perimeter lighting as needed.
SPECMaker® Specification Development Tool	Presto's SPECMaker Tool is a quick, easy online resource to make customizable, CSI GEOPAVE specifications. Click for the SPECMaker Program

Figure 7 GEOPAVE System Dimensions and Layout

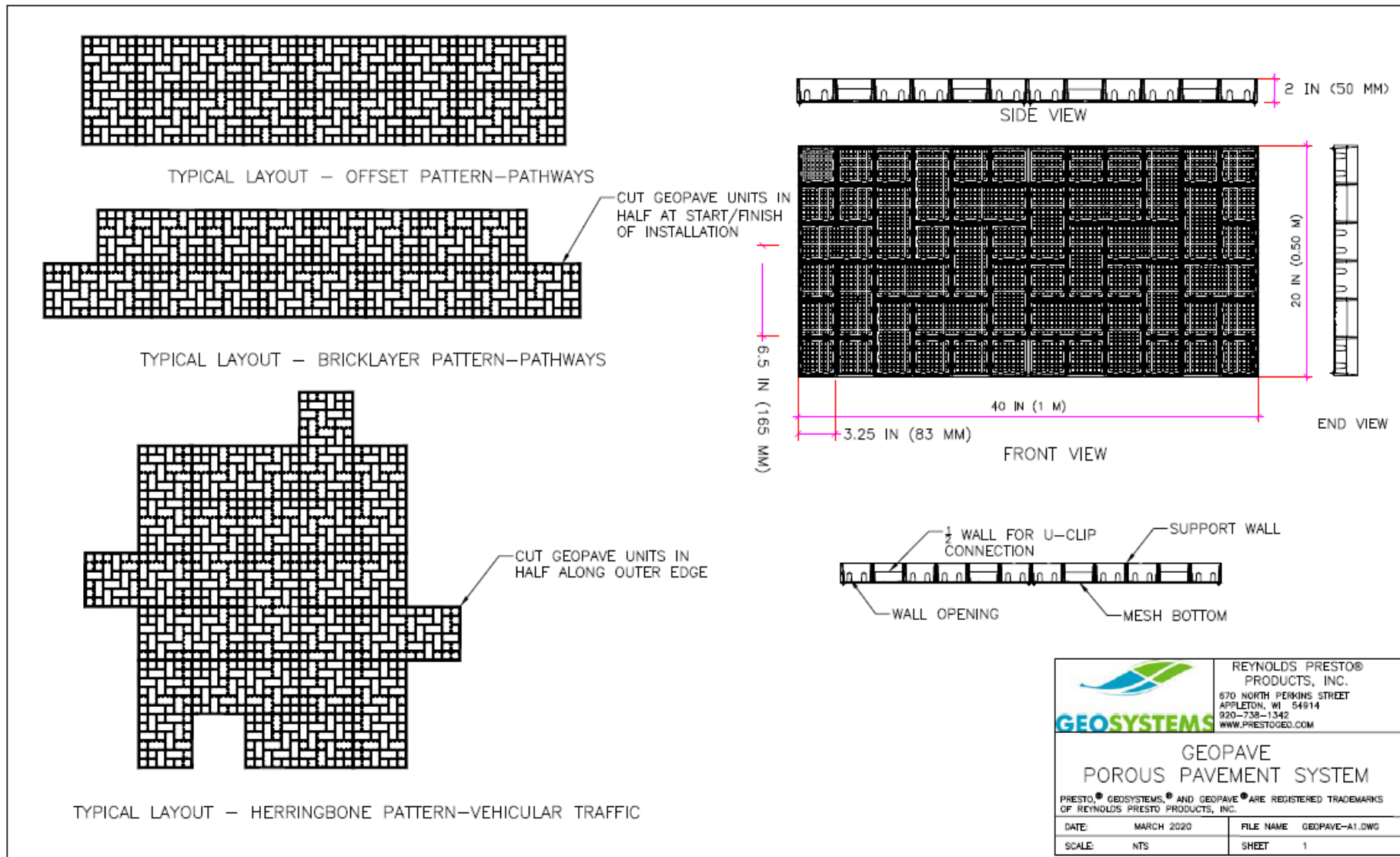
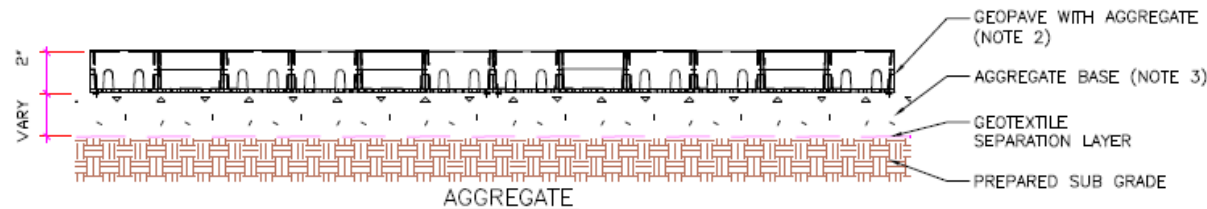


Figure 8 GEOPAVE System Material Properties and Usage Guideline

DESIGN GUIDELINES – BASE DEPTH			GEOPAVE MATERIAL SPECIFICATION	
LOAD DESCRIPTION	CBR 2 – 4%	CBR > 4%	MATERIAL	UP TO 100% RECYCLED POLYETHYLENE
			COLOR	RANGES DARK SHADES GRAY TO BLACK
Heavy Fire Truck Access & H/HS25 loading. Typical 110 psi (758 kPa) tire pressure. Single axle loadings of 40 kips (178 kN). Gross vehicle weight of 90,000 lbs (40.1 MT).	6 IN (150 MM)	6 IN (150 MM)	CHEMICAL RESISTANCE	SUPERIOR
			CARBON BLACK FOR UV STABILIZATION, %	1.5 TO 2.0%
Heavy Fire Truck Access & H/HS20 loading. Typical 110 psi (758 kPa) tire pressure. Single axle loadings of 32 kips (145 kN). Gross vehicle weight of 80,000 lbs (36.3 MT).	6 IN (150 MM)	6 IN (150 MM)	UNIT MIN CRUSH STRENGTH – EMPTY @ 70F (21C)	175 PSI (1,202 KPa)
			UNIT MIN CRUSH STRENGTH – FILLED @ 70F (21C)	5,160 PSI (35,625 KPa)
Light Fire Truck Access & H/HS15 loading. Typical 85 psi (586 kPa) tire pressure. Single axle loadings of 24 kips (110 kN). Gross vehicle loads of 60,000 lbs (27.2 MT).	6 IN (150 MM)	4 IN (100 MM)	FLEXURAL MODULUS @ 70F (21C)	35,000 PSI (240,000 KPa)
			NOMINAL DIMENSIONS – WIDTH X LENGTH	20 X 40 IN (0.5 X 1.0 M)
Utility & Delivery Truck Access & H/HS10 loading. Typical 60 psi (414 kPa) tire pressure. Single axle loadings of 16 kips (75 kN). Gross vehicle loads of 40,000 lbs (18.1 MT).	4 IN (100 MM)	2 IN (50 MM)	NOMINAL UNIT DEPTH	2.0 IN (50 MM)
			NOMINAL AREA	5.38 SQFT (0.5 SQMTR)
Cars & Pick-up Truck Access. Typical 45 psi (310 kPa) tire pressure. Single axle loadings of 4 kips (18 kN). Gross vehicle loads of 8,000 lbs (3.6 MT).	2 IN (50 MM)	NONE	CELLS PER UNIT	50
			SMALL CELL SIZE	3.25 X 3.25 IN (83 X 83 MM)
Trail Use. Loading for pedestrian, wheelchair, equestrian, bicycle, motorcycle and ATV traffic.	NONE	NONE	LARGE CELL SIZE	3.25 X 6.5 IN (83 X 165 MM)
			TOP OPEN AREA PER UNIT	90.5%
			BOTTOM OPEN AREA PER UNIT	32.6%
			BOTTOM MESH OPENING SIZE	0.25 X 0.25 IN (6.35 X 6.35 MM)
			NOMINAL WEIGHT PER UNIT	7.6 LBS (3.4 KG)
			RUNOFF COEFFICIENT @ 2.5 IN/HR (64 MM)	0 – 0.15
			RAINFALL WITH AGGREGATE INFILL	46
			UNITS PER PALLET	46

Notes:

1. This information is based on the use of GeoPave manufactured by Reynolds Presto Products, Inc. All rights reserved. Any use of this information for any rigid porous paver product other than that manufactured by Reynolds Presto Products, Inc. is strictly prohibited and makes this information invalid.
2. Aggregate infill shall be 0.375 to 0.5 inch (10 to 13 mm) open graded crushed aggregate with fine content less than 5% to allow for free drainage.
3. Aggregate base shall be 0.375 to 1.0 inch (10 to 25 mm) open graded crushed aggregate with fine content less than 5% to allow for free drainage.
4. A minimum 2 inch (50 mm) of aggregate base should be placed below the units to act as drainage layer and infiltration area. The Engineer of Record shall be responsible for the design and stability of the open graded base course.
5. Provide a non-woven geotextile separation layer and install in accordance with Manufacturer recommendations including overlaps based on sub grade CBR.
6. Connect GeoPave panels with the U-CUP connection device at all half wall locations, and driven completely so that adjacent sections have horizontally level profiles.
7. Refer to the GeoPave Design and Construction Overview for a complete description of the design and construction methods.





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**GEOPAVE AGGREGATE INFILL
POROUS PAVEMENT SYSTEM**

PRESTO®, GEOSYSTEMS®, AND GEOPAVE® ARE REGISTERED TRADEMARKS
OF REYNOLDS PRESTO PRODUCTS, INC.

DATE: MARCH 2020	FILE NAME: GEOPAVE-B1.DWG
SCALE: NTS	SHEET: 1

INSTALLATION Procedures

Prepare the Subgrade

Excavate the area, allowing for the GEOPAVE unit thickness and the base depth (where base material is required).

- When working with a subgrade that has poor permeability, provide adequate drainage from the excavated area if there is the potential to collect water.
- The subgrade should be relatively dry and free from any standing water.

Finish-grade the surface of the subgrade 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 panels to connect properly and remain stationary after installation.

The sub grade shall be compacted to the Engineer's specifications. Caution should be exercised to ensure that the porous subbase not be over compacted such that porosity is hindered.

Install Optional Components (if specified)

Geotextile Layer (if specified)

If required, the geotextile shall be rolled out over the prepared subgrade along the alignment in the direction of traffic. The geosynthetic shall be pulled taut to ensure that there are no folds. The geotextile shall be installed in accordance with Manufacturer recommendations including overlaps based on subgrade CBR.

Sub-Drainage (if specified)

If required, install the specified geonet, sub-drain and outlet piping 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.

Prepare the Base

If required, install the specified base material over the prepared sub grade, compact in accordance with the Engineer's specifications. Refer to Table 3 for a description of aggregate.

The Engineer shall determine if edge restraint is required to ensure the base is stable during installation, compaction and under expected vehicle loads. The Engineer shall be responsible for the design and stability of the base. Refer to Table 3 Base Depth Recommendations.

Install GEOPAVE Panels

Orientation & Laying Pattern of Panels

Place the GEOPAVE panels with the mesh bottom to the ground using the specified laying pattern shown below (Offset, Bricklayer, and Herringbone).

OFFSET PATTERN:

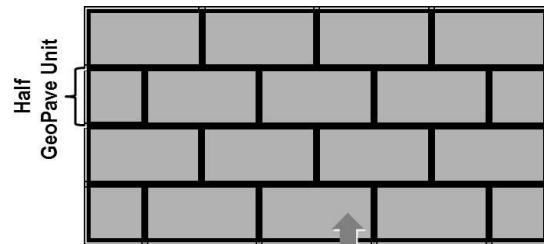
When the application is a **narrow access lane**, stagger the panels to produce the offset pattern.



Offset

BRICKLAYER PATTERN:

When the application is a **one-direction vehicular driveway**, follow the bricklayer pattern.

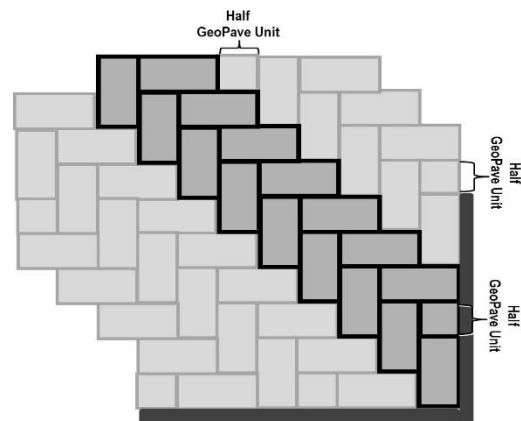


Bricklayer Direction of Traffic

HERRINGBONE PATTERN:

When the application is a **large area with multi-directional traffic**, stagger the panels 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 panels** made by field cutting a full unit and placing the panels as illustrated. Cut the panels 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.



Herringbone

Position GEOPAVE Panels

If applicable, ensure that all adjacent hard-surfaced paving work around the perimeter is completed before installing the GEOPAVE panels.

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

Fully installed GEOPAVE panels should be at or below the existing elevation

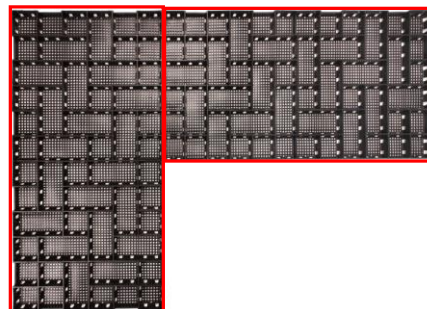


Figure 9 Joining GEOPAVE Panels

Fit GEOPAVE Panels to Corners and Curves

If applicable, the GEOPAVE panels can be field cut with a saw to fit around corners and curves. Edge restraints are required to create a closed “cell” that can be infilled.

If cutting the panels is not desired, the panels can be offset such that the GEOPAVE coverage approximates the corner or curve feature. Edge restraints are required.

GEOPAVE panels can be cut to fit around existing structures, such as manhole covers. Connect the cut GEOPAVE panels as usual.



Connect Panels with U-CLIPS

Secure adjoining GEOPAVE panels together using the U-CLIP connection device. A total of 12 U-CLIPS are required for each unit. Refer to Figure 10. U-CLIPS shall be set in place by hammer at all the half-wall locations and 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 10 The U-Clip Connection Device

Optional Anchoring of Panels

If specified, secure the GEOPAVE panels with ATRA Speed Stakes, No. 4 rebar, or earth anchors to prevent movement of the panels. Refer to Figure 11. Anchoring may be necessary if the GEOPAVE panels are placed on a slope (5-10%). Actual anchorage pattern will be based on the vehicle loading, sub grade strength, and slope angle. Contact Presto Geosystems for anchorage recommendations.

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

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

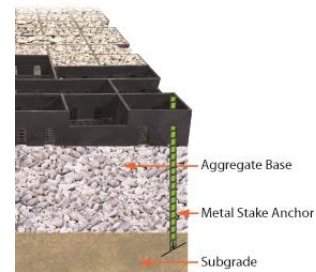


Figure 11 Optional Stake Anchoring

Optional SNAP Delineators

If specified, install GEOPAVE SNAP Delineators as required in the panels to indicate parking lines. Refer to Figure 12.

The delineators are snapped in to GEOPAVE panels and are held in place with tabs that match vents in the GEOPAVE cells. Delineators may be placed in the square or rectangle cells. Place the delineators as frequently as required to meet visual and local agency requirements.

SNAP Delineators should be placed after installation of the panels and before installation of the infill material.

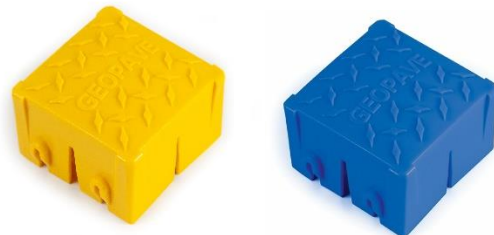


Figure 12 Optional SNAP Delineators

Infill the GEOPAVE Panels

Infill the GEOPAVE panels with the specified material for the intended application. Refer to Table 2. Infilling should take place immediately after the panels are installed to minimize movement of the panels. **During periods of hot weather, the GEOPAVE panels shall be filled immediately after being placed to avoid thermal expansion of the panels.**

Infill shall be placed with each successive pile of aggregate to be placed at the edge of previously filled GEOPAVE panels and spread with a skid steer, small tractor, or small loader. Spread the infill material uniformly over the panels. Hand raking should be performed to assure that the infill is at the top of the cell walls. The panels can be driven on without being filled.

Delineation

In addition to the GEOPAVE SNAP delineator, other delineation may be desired to create visibility and can include the following: delineation markers, in-ground or above ground curbing, shrubbery, vegetation, perimeter lighting, or other suitable systems.

Maintenance

Aggregate Surface Wear Course

The surface should be inspected from time to time to identify signs of cell infill loss. If cell infill loss occurs, additional aggregate material should be added.

Snow Removal

If required, snow removal should be performed 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 panels.

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. NOTE: Damage can occur to the surface if plowing abuse is prevalent.

Estimating Time and Cost of Installation

Typical Crew Size and Responsibilities

2	to set the GEOPAVE panels in place.	NOTE: Adding or subtracting one or two people to the crew may result in a cost-effective productivity increase depending on local work habits.
2	to spread and level the specified infill.	
1	Equipment operator for the front-end loader.	

Equipment Needed and Purpose

- GEOPAVE panels U-clips and ATRA speed stakes (if required) can be purchase from Presto's distributors/representatives.
- Saws for cutting the GEOPAVE panels as required for installation.
- A small tractor/backhoe or loader for infilling of the GEOPAVE panels.
- 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 or representatives. The estimates below do not include base preparation.

1.	Place the GEOPAVE panels on the prepared base and install connecting U-CLIPS.	35 - 45 panels/man-hr
2.	Fill the in-place GEOPAVE units using a small loader or backhoe to evenly distribute the specified infill.	100 - 120 panels/man-hr
3.	Level the infill using rakes and shovels. If aggregate, overfill the top of the cell walls 0.5 in (13 mm).	75 - 100 panels/man-hr

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

Table 2 Approximate Quantities of Infill Material Required for GEOPAVE Unit

Depth of unit	Volume of Aggregate Required per unit	Volume of Aggregate Required per 1000 ft ² (100 m ²)
2 in (50 mm)	0.0293 yd ³ (0.0224 m ³)	5.447 yd ³ (4.48 m ³)

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 panels, 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	=	()ft ² (m ²) Area
GEOPAVE panels required = ft ² (m ²) (Area ÷ 5.38 ft ² (0.50 m ²)/unit [the GEOPAVE unit is 20 in x 40 in (0.50 m x 1.00 m) nominal]				
() ft ² (m ²) Area	÷	5.38 ft ² (0.50 m ²)/unit	=	() panels
Man-hr required for installation of GEOPAVE panels = GEOPAVE panels ÷ 40 panels/man-hr				
() panels	÷	40 panels/man-hr	=	() man-hr
Infill material quantities = GEOPAVE panels x yd ³ (m ³)/unit (see Table 2)				
() panels	x	() yd ³ (m ³)/unit	=	() yd ³ (m ³)
Man-hr required for placing infill = GEOPAVE panels ÷ 110 panels/man-hr				
() panels	÷	110 panels/man-hr	=	() man-hr
Man-hr required for leveling of infill = GEOPAVE panels ÷ 85 panels/man-hr				
() panels	÷	85 panels/man-hr	=	() man-hr

Total Cost of Time and Materials

GEOPAVE unit cost	\$_____/unit	x	_____ panels	=	\$ _____
Cost of Infill	\$_____/yd ³ (m ³)	x	_____ yd ³ (m ³)	=	\$ _____
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	=	\$ _____
NOTE: Does not include base material or preparation	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

This document has been prepared for the benefit of customers interested in the GEOPAVE Porous Pavement System. It was reviewed carefully prior to publication. Presto assumes no liability and makes no guarantee or warranty as to its accuracy or completeness. Final determination of the suitability of any information or material for the use contemplated, or for its manner of use, is the sole responsibility of the user.

Project specifications take precedence over all manufacturers' recommendations.

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- Grated Inlet, Curb Inlet, Area Inlet Protection

Ditch Checks

- Triangle Silt Dike
- GeoRidge

Perimeter Protection

- High and Low-Porosity Silt Fence, Straw Wattles, Silt Socks
- Safety Fence

Flocculants & Water Treatment

- Polymer-Based & Natural Flocculants

Sediment Basin Skimmers

Dewatering Bags

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- FODS
- Rumble Grates

Turbidity Curtains

EROSION CONTROL

Basic Hydraulically Applied Mulches

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- Paper
- Blends
- Straw

High-Performance Hydraulically

Applied Products

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- FGM
- Additives & Tackifiers

Temporary Erosion Control Blankets

- Coir & Jute Mat/Nettings
- Short-Term ECBs
- Extended-Term ECBs

Permanent Erosion Control Blankets

- Turf Reinforcement Mats
- HP-TRMs
- Anchor Reinforced Vegetation System

Structural BMPs

- Transition Mats
- Geoweb Cellular Confinement
- Composite Vegetated Armor System
- Flex MSE Vegetated Wall System
- Articulated Concrete Block
- Gabions
- Grout-Filled Geotextile Mats

Vegetation Establishment

- Native Seed & Turf Seed
- Fertilizers
- Organic Soil Additives
- Stratavault Soil Cells

STORMWATER MANAGEMENT

Water Quality

- Inlet Filter Boxes
- Pre-Treatment Chamber
- Nutrient Separating Baffle Boxes
- High-Flow Biofiltration Media
- Hydrodynamic Separators
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- Modular Underground Storage Systems
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- Pipe & Fittings
- Drainage Composites
- Strip Drain

Inlet Structures

- PVC
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- Permeable Articulating Concrete Block
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