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GEOBLOCK®

GRASS POROUS PAVEMENT SYSTEM

DESIGN & CONSTRUCTION OVERVIEW

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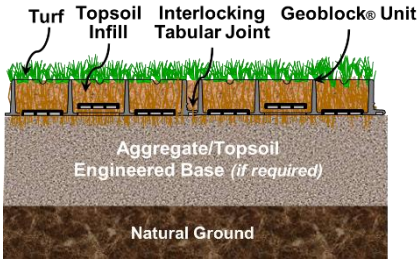
The GEOBLOCK® Porous Pavement System

The GEOBLOCK Porous Pavement System offers support for both vehicular and pedestrian loads over grass areas, ensuring the grass is protected from the damaging effects of traffic.

The porous pavement system includes the following components:

1. GEOBLOCK panel
2. geotextile separation layer (if required)
3. engineered base
4. topsoil panel infill
5. selected vegetation (seed or sod)
6. surface protection (if required)
7. panel anchorage (if required)
8. sub-drain system (if required)
9. delineation markers (if required)



GEOBLOCK® Porous Pavement System Components

NOTE: Aggregate systems should utilize the GEOPAVE® gravel porous pavement system.

DESIGN Considerations

FUNCTION of the GEOBLOCK System Components

Structure

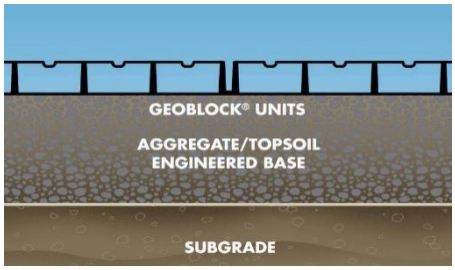
The function of the GEOBLOCK panel is to:

1. supports and dissipate design loads and tire pressures through rigid cell walls and tabular connections, exceeding AASHTO H/HS-25 loadings).
2. provide permeability and infiltration of stormwater.
3. provide a healthy environment for topsoil infill and vegetative cover.
4. provide high load distribution, requiring less base material compared to lighter-weight or rolled systems.

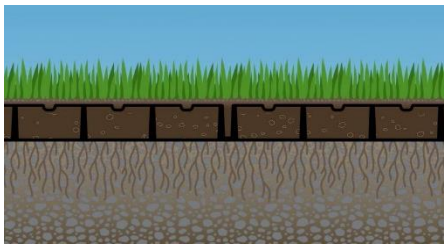
Engineered Base

For an applied load over an existing subgrade, both the engineered base and the GEOBLOCK panel provide support. The necessary base depth should be determined based on vehicle loading and subgrade strength as specified in Table 3.

The engineered base consists of 2/3 open-graded aggregate and 1/3 topsoil. When compacted, the aggregate portion provides structural support for the load, while the topsoil portion creates a healthy growing medium for vegetation.



Topsoil Infill & Vegetation



The topsoil infill within the cells of the GEOBLOCK panel serves as a nourishing medium, promoting the development of a healthy root system for the vegetative cover. The infill determines the permeability and controls the rate of water infiltration within the GEOBLOCK system. Therefore, it's important to use a high-quality, well-draining topsoil infill.

The system should maintain a healthy and visually appealing vegetative cover. Select vegetation that is resilient enough to withstand anticipated load frequencies. Excessive traffic, heat, and automotive fluids can stress the vegetation, requiring periodic maintenance. Proper lawn care is essential for maintaining healthy vegetation.

OPTIONAL Components

Geotextile Separation Layer (if required)

Most applications involve a non-woven or enhanced woven geotextile separator layer on the prepared subgrade. When required, geotextiles are critical to the system's performance. Non-woven geotextiles provide separation, while enhanced woven geotextiles offer separation, filtration, drainage, and reinforcement.

Sub-Drain System (if required)

If the panels are installed over non-porous soils and excavation creates a potential for water entrapment, a sub-drain system is recommended. The sub-drain system removes water accumulation ensuring that the engineered base and subgrade maintain their support capacity. If necessary, the subgrade should be sloped to enhance drainage.

SPECIFICATION Details:

Material Properties & Panel Dimensions

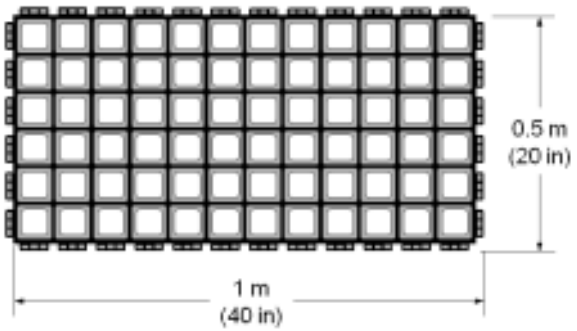
GEOBLOCK panels are made from materials with the physical and chemical characteristics outlined in Table 1. The GEOBLOCK panels shall have a minimum deflection without breakage of 1.0 in (25 mm) when panels are supported at 1.64 ft (0.50 m) centers at 70°F (21°C).

GEOBLOCK panels shall have the physical dimensions as specified in Table 1 and illustrated in Figure 2. The panels feature an interlocking offset tab system on all edges, as detailed in both Figures 2 and 3. The end-to-end or side-to-side warpage of the GEOBLOCK panels shall not exceed 0.25 in (6 mm).

Table 1 GEOBLOCK Specification Summary

Item	Specification & Details
Material	Up to 100% Recycled Polyethylene *
Color	Ranges Dark Shades Gray to Black
Chemical Resistance	Superior
Carbon Black for Ultraviolet Light Stabilization	1.5% - 2.0%
Minimum Crush Strength (Empty) @ 70°F (21°C)	420 psi (2,900 KPa)
Minimum Crush Strength (Sand-Filled) @ 70°F (21°C)	5,980 psi (41,285 KPa)
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)
Nominal Depth	1.2 in (30 mm)
Nominal Coverage Area	5.3 ft² (0.5 m²)
Cells per Panel	128
Cell Size	2.25 in x 2.25 in (57 mm x 57 mm)
Top Open Area	88%
Bottom Open Area	56%
Nominal Weight	4.7 lb (2.1 kg)
Runoff Coefficient @ 2.5 in/hr (64 mm/hr) Rainfall	0.15
Panels per Pallet	92

- * The percentage of recycled content may vary based on availability of recycled materials.
- Dimensions and weight are subject to manufacturing tolerances and can be influenced by recycled components.
- End-to-end or side-to-side warp of the GEOBLOCK panel shall not exceed 0.5 in (6 mm).
- Avoid specifications that state material compressive strength alone. Material compressive strength, with applied safety factors must be adequate to resist both compressive and lateral loads. Ultra-high compressive strength adds little value to a porous pavement system.



Panel Nominal Dimensions

Cell and Interlocking Offset Tab

Engineered Base Material

The recommended engineered base is a homogenous mixture consisting of 1/3 pulverized topsoil and 2/3 crushed aggregate with a void component generally containing air and/or water. The engineered base promotes vegetation growth and provides structural support.

The aggregate portion shall have particles ranging from 0.375 to 1.0 in (9.5 mm to 25 mm) with a D50 of 0.5 in (13 mm) and have at least 30% void space when compacted in accordance with Engineer's specification.

The edges of the base shall be constrained appropriately.

Table 1 GEOBLOCK Base Recommendation

Load Rating[1]	***Depth of Engineered Base***	
	CBR[2] 2 – 4	***CBR[2] > 4***
Heavy Fire Truck Access & H/HS-25, H/HS-20 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). Infrequent passes[4].	8 in (200 mm)	6 in (150 mm)
Light Fire Truck Access & H/HS-15 loading. Typical 85 psi (586 kPa) maximum tire pressure. Single axle loadings of 24 kips (110 kN). Gross vehicle loads of 60,000 lb (27.2 MT). Infrequent passes[4].	6 in (150 mm)	4 in (100 mm)
Utility & Delivery Truck Access & H/HS-10 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). Infrequent passes[4].	4 in (100 mm)	4 in (100 mm)
Cars & Pick-up 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). Infrequent passes[4].	2 in (50 mm)	2 in (50 mm)
Trail Use. Pedestrian, wheelchair, equestrian, bicycle, motorcycle, and ATV/UTV traffic.	2 in (50 mm)	2 in (50 mm)

[1] The GEOBLOCK system can be installed in areas where loadings exceed those listed above. In these situations, contact Presto Geosystems for specific recommendations.

[2] CBR stands for California Bearing Ratio (CBR). There are various methods for determining CBR, ranging from sophisticated laboratory methods to simpler field identification methods involving hand manipulation of the soil. Presto does not recommend any specific method, but it is important the user to have a high degree of confidence in the results obtained from the chosen method. If soil strength values other than CBR are available, use correlation charts to convert these to CBR.

[3] Infrequent passes refer to the number of passes over a period of time that do not cause lasting damage to the vegetation. This number depends on factors such as vegetation type and age, climatic conditions, and maintenance practices, rather than the GEOBLOCK material itself.

Topsoil Infill

The topsoil should be high-quality, well-draining, and not be over-compacted within the panels. The topsoil is crucial as it determines the permeability and controls the rate of water infiltration within the paver system.

Design Considerations for System Structural Integrity

Elements Important to Structural Integrity

To effectively support loads, The GEOBLOCK panel (or any other similar paver system) must have five primary characteristics as outlined below:

1. **SUITABLE WALL STRENGTH:** The wall strength must be capable of supporting wheel loads from the heaviest vehicles expected to travel over the porous pavement system. Vehicular loading will exert direct compression on the walls from tires and equipment outriggers, as well as lateral forces from breaking and acceleration. The walls should resist both vertical and lateral deformations under load. Exercise caution when using systems with thin walls.

2. **SUFFICIENT PANEL STIFFNESS:** The panel must be stiff enough to allow deflections without panel breakage or separation when subgrade soils yield under load. If the panel is too flexible, the subgrade will bear the vehicle load. Conversely, if the panel is too rigid, it may break under normal loads in low temperatures. Exercise caution when using systems that are either too flexible or too rigid.

3. **SIGNIFICANT JOINT STRENGTH:** The joint strength must effectively transfer load from panel to panel while remaining engaged under normal deflections. Some deflection is expected due to the inherent properties of plastics and soils. High joint shear-strength enhances load dissipation, reducing pressure on the base and subgrade. If the joint lacks sufficient shear strength, load support will occur through each panel causing the panel to act independently leading to potential failure. Exercise caution when using systems with minimal or no physical material in the joint.

4. **SUPPORTING BASE:** The supporting base must have adequate edge restraints and a large contact area with the subgrade to effectively reduce high wheel loads at the top of the panel when transferred to the subgrade. This will ensure a system with a greater stability. Exercise caution when using systems with minimal contact area between the panel and the subgrade.

5. **LARGE OVERALL AREA:** A large overall area, combined with the other characteristics, ensures maximum load dissipation. If panel separation occurs and any panel functions independently, larger panel areas will reduce the pressure on the subgrade. Exercise caution when using systems with smaller contact areas.

Elements Not Important to Structural Integrity

Avoid specifications that state material compressive strength only if a sand base is specified. The material compressive strength, including safety factors must be sufficient to withstand compressive and lateral loads. Ultra-high compressive characteristics offer minimal benefit to the porous pavement system. Table 3 lists the strength characteristics of the GEOBLOCK porous pavement system, ensuring a balanced systems that meets all essential criteria for the integrity and performance of a porous pavement system.

Table 3 Strength Characteristics of the GEOBLOCK® Panel

Test	Value
Wall Compressive Strength *(simulated tire area loaded)* Test Procedure - Circular plate, 6.5 in (165 mm) diameter, loaded to failure	420 psi (2,900 kPa)
Wall Compressive Strength *(full GEOBLOCK panel loaded)* Test Procedure - Full single panel loaded to failure via flat plate	138,240 lbf (615 kN)
Equivalent Elastic Stiffness Test Procedure - Simply supported GEOBLOCK panel loaded to 1 in (25 mm) deflection	48,000 lb-in² (140 N-m²)
Joint Shear Strength Test Procedure - Direct shear of tongue-and-groove using special apparatus (See **NOTE**)	20,000 lbf (89.0 kN)
NOTE: All tests were conducted by Bathurst, Jarrett and Associates Inc. at the Royal Military College in Kingston, Ontario, Canada on the wall of a different GEOBLOCK panel with an equivalent wall.	

Elements Important to Vegetation

The GEOBLOCK panel supports healthy vegetative cover by preventing excessive load-induced compaction of the topsoil layer. The wall system is designed with the necessary strength and spacing to support tire loads without affecting the topsoil. The open area at the bottom of the panel allows water and nutrients to pass through the soil layers. However, the GEOBLOCK panel alone cannot ensure healthy vegetation. Vegetation must grow in un-compacted soil and receive adequate water and nutrients to thrive.

Installing the GEOBLOCK® System

Prepare the Subgrade

Excavate and shape the subgrade to allow installation of the GEOBLOCK panels and base. Level and clear the area of large objects such as rocks, pieces of wood to ensure the GEOBLOCK panels to connect properly and remain stationary after installation. The subgrade 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.

Geotextile Separation Layer (if specified)

The geotextile should be installed in accordance with Manufacturer's recommendations, ensuring the specified overlaps are maintained. The overlap must be based on subgrade CBR and AASHTO M288 requirements.

Sub-Drainage Component (if specified)

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

Prepare the Engineered Base

Ensure the topsoil and aggregate are thoroughly blended to create a homogeneous mixture prior to placement. The engineered base must be compacted to the Engineer’s specifications, with the edges constrained to prevent movement during and after construction. Engineered base depth shall be as specified. The Engineer is responsible for the design and stability of the engineered base. Refer to Table 2.

Install the GEOBLOCK Panels

Orientation & Laying Pattern of Panels

Place the GEOBLOCK panels with the square hole to the ground. Install panel pattern as indicated on the drawings.

BRICKLAYER PATTERN:

For one-direction lanes, stagger the panels to create a bricklayer pattern. The pattern is positioned such that the length of the panel is perpendicular to the direction of traffic. See Figure 6.

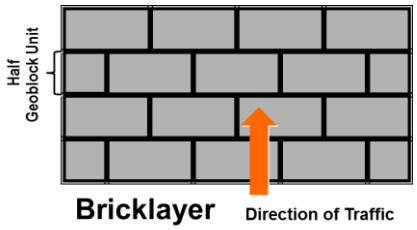


Figure 6 Bricklayer Pattern

HERRINGBONE PATTERN:

For areas with multi-directional traffic, stagger the panels to create a herringbone pattern. This pattern minimizes straight seams to one and a half block lengths. See Figure 7.

The staggered pattern is developed by using half GEOBLOCK panels by field cutting a full panel and placing them as shown. Cut the panels to fit contours and/ around obstructions. This final seam pattern ensures maximum load transfer and support.

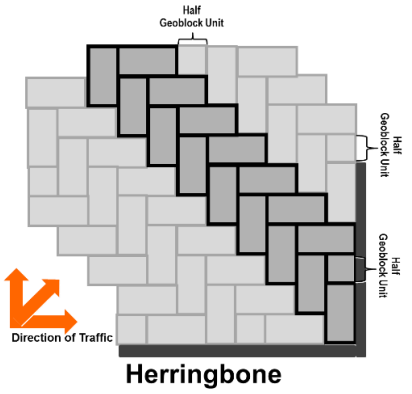


Figure 7 Herringbone Pattern

Other laying patterns are generally not recommended.

Positioning of Panels

If applicable, complete all adjacent hard-surfaced paving work around the perimeter before installing the GEOBLOCK panels.

Start by placing the first row of GEOBLOCK panels along a stationary edge, if available, leaving a gap for thermal expansion. Ensure that the corners and seams do not protrude above the desired surface elevation. About adjoining panels to create the desired laying pattern.

Slide the panels together so that the interlocking tab joint is fully engaged as illustrated in Figure 8. Field cut panels to fit around corners, curves, and obstructions. Edge restraints may be included to create a closed “cell” that can be infilled.

Alternatively, offset the GEOBLOCK panels such that the coverage approximates the corner or curve feature. Edge restraints may be included if desired.

Fixing Panels in Place

If construction traffic might cause shifting of the GEOBLOCK panels during installation, consider using one of the following methods:

a) Use wood or metal stakes through holes in the GEOBLOCK panels.
b) Use thread-forming tapping screws through perimeter interlocking tabs. Install 2 to 4 screws on the long side and 1 to 2 screws on the short side.

Contact Presto Geosystems for details.

Figure 8 The Interlocking Tab Joint

Anchoring Panels

To prevent movement during and after installation, decide whether to use temporary or permanent stakes and select the appropriate material. If anchoring is necessary, install anchors after placing all the GEOBLOCK panels in the defined area. Use 0.5 inch (13 mm) #4 rebar or wood stakes to secure the panels and prevent them from shifting.

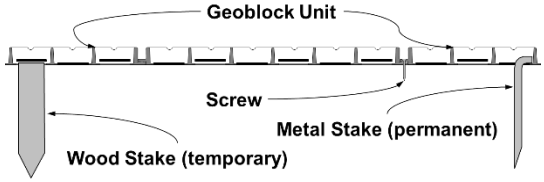


Figure 9 Anchoring Possibilities

Typical anchor length is 12 inches (300 mm) or as specified by the Engineer.

Drive the anchors through the holes in the GEOBLOCK panels along the perimeter as required.

Figure 9 illustrates some of the anchoring possibilities.

Thermal Expansion

GEOBLOCK panels are made from polyethylene stabilized with carbon black, which has a relatively high thermal conductivity and expansion rate. As a result, joint separation due to significant temperature changes is normal. Rejoining the GEOBLOCK panels should be a standard part of the construction process. If the panels are installed against a stationary edge, ensure enough room is provided for panel expansion. The distance between the stationary edge and the panel should be based on temperature and exposure to the sun and monitored during installation

Once infilled, thermal expansion is minimized. When the root system is fully developed, the vegetation provides all necessary anchoring of the system.

Infill the GEOBLOCK Panel

Fill the GEOBLOCK panels with a high-quality, well-draining topsoil. Ensure the topsoil is not compacted within the panels. Use spreading techniques that will keep the topsoil loose and un-compacted.

Use a broom or rotary sweeper to remove the top layer of topsoil infill from the GEOBLOCK cells, creating a meniscus like appearance as illustrated in Figure 10. Ensure the final topsoil level is slightly below the top of the GEOBLOCK cell walls.

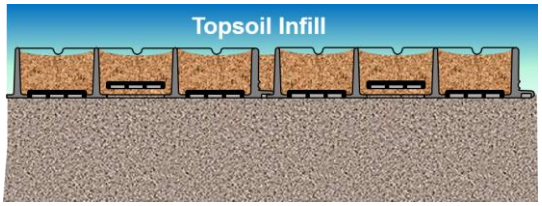


Figure 10 Sweep out topsoil infill

If sod is used for final vegetation, ensure proper installation including:

Avoid overfilling the cells, as vehicular traffic can cause unwanted compaction of the topsoil. Infilling should take place right after the panels are installed to minimize the potential of joint separation or upward buckling caused by thermal expansion and contraction.

NOTE: The GEOBLOCK panels can be driven on unfilled to allow panel infilling.

Vegetation & Finishing Procedures

Seeding/Hydroseed

Use the specified seed mix and adhere to regional practices for seeding, fertilizing, and watering to establish turf. Ensure the seed mix complies with the governing authority's requirements, including restrictions on noxious weed seeds. Provide surface protection to prevent washout before the vegetation is established.

Sod Application

Sod can be used for areas where immediate vegetation is desired. It is recommended to use young sod that is free from netting materials. Mature sod with a more developed root system and sod with netting may be difficult to press and cut into the GEOBLOCK cells.

NOTE: The grass or sod DOES NOT need to be established before allowing temporary traffic.

Above Ground, Post-Installation Delineation

Once healthy turf is established and maintained properly, the GEOBLOCK cell wall structure will have minimal visibility. If used for parking or drive lanes, delineation may be desirable to create greater visibility. Delineation methods can include above-ground curbing, shrubbery or vegetation, perimeter lighting or delineation markers.

Maintenance

Lawn Care

Normal turf care procedures should be followed, including watering, mowing, fertilization, thatch removal and aeration. Some equipment may slightly scar or cut the GEOBLOCK wall structure but will not compromise the structural integrity of the system.

Snow Removal

If snow removal is necessary, use standard methods including shovels, snowblowers and snowplows, ensuring the blades are kept 1-inch (25 mm) above the surface.

When snowplowing the units, use a plow blade with a flexible rubber edge and 1-inch skids on the corners to prevent direct contact with the grass and panels.

Limited Warranty

Presto Geosystems warrants each GEOBLOCK® panel 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 section 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 panel 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, improper alteration, 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 GEOBLOCK® 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 GEOBLOCK® SYSTEM.