Techo-Bloc

PERMEABLE
INTERLOCKING CONCRETE PAVEMENT

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1. INTRODUCTION

One of the direct consequences of urban development is an increase in impervious surface area. Over the years, vast areas that used to be covered by vegetation and natural permeable surfaces have been replaced by parking lots, streets and roofs, disrupting the natural process of water infiltration into the soil. One of the effects of this is increased runoff and flow during precipitation.

The higher flow and rising water levels in storm sewer pipe systems and streams can cause problems including flooding, erosion, sedimentation and pollution. In addition, with global warming, the frequency of events involving heavy rains and accelerated snowmelt is more pronounced. It is therefore important to rapidly seek new solutions.

TECHO-BLOC permeable paver systems reduce the volume of water directed to the municipal system and, as such, are viable solutions for better stormwater management. Permeable paver systems reduce runoff and improve the quality of water returning to the environment. Water seeps through the paving stone joints and is then directed into the ground, or stored temporarily in the base/subbase structure.

Both the U.S. Environmental Protection Agency (EPA) and the Ontario Ministry of Environment recognize permeable pavers as a management practice for stormwater and a low impact development (LID) practice.

TECHO-BLOC is a company engaged in the development and innovation of new green products to support sustainable development.

2. OPERATING PRINCIPLE

The role of a permeable paver system is to allow water from precipitation to pass through the paving stones joints and seep into the ground naturally or to be retained in the base/subbase structure rather than turning into runoff headed directly into the sewer system.

The base/subbase structure consists of a clean washed, porous stone that can collect and store water for some time. The water can then seep into the ground in a more natural process.

In cases where soil permeability is insufficient, the water is intercepted by a network of perforated drains before being routed to the drainage system; in this case, the system acts primarily as an underground reservoir.

The system is designed to promote water detention and infiltration. Three types of systems are used, depending on soil permeability:

COMPLETE INFILTRATION

Recommended in the case of soils with an infiltration rate of at least 12.5 mm/h. All water seeps directly into the soil; a subbase drainage pipe system is not required.

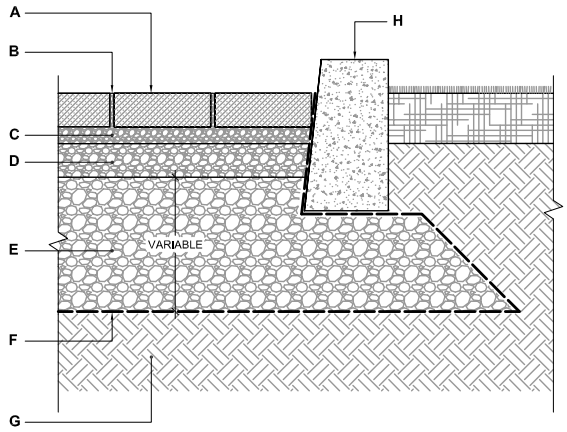
PARTIAL INFILTRATION

Water does not infiltrate fully. A perforated pipe system in the subbase is required to allow the residual water to be evacuated to the network.

PARTIAL INFILTRATION WITH FLOW RESTRICTOR (INFILTRATION NEAR ZERO)

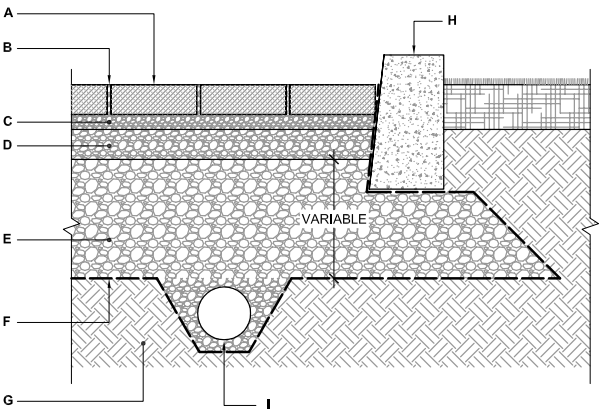
Recommended when soil infiltration capacity is too low or the water table is too high. Water is discharged through a system of perforated pipes and a flow restrictor to control the entry of water into the municipal network. The system essentially acts as an underground reservoir.

CASE No 1 - **FULL INFILTRATION**



- **A.** PERMEABLE PAVER FROM TECHO-BLOC, 60 TO 100 mm (2 3/8" TO 3 15/16") THICK INFLO, MISTA RANDOM, PURE, VICTORIEN PERMEABLE OR VILLAGIO
- **B.** JOINT FILLING MATERIAL, 2.5-10 mm (1/8"-3/8") (FOR INFLO, PURE AND VILLAGIO) OR 2.5-5 mm (1/8"-1/4") STONE (FOR MISTA RANDOM AND VICTORIEN PERMEABLE)
- **C.** BEDDING COURSE, 50 mm (2") THICK 2.5-10 mm (1/8"-3/8") STONE
- **D.** BASE COURSE, 100 mm (4") THICK 5-28 mm (1/4"-1 1/8") STONE
- **E.** SUBBASE COURSE, THICKNESS AS PER DESIGN 40-80 mm (1 5/8"-3 1/8") STONE
- **F.** GEOTEXTILE
- **G.** SUBGRADE
- **H.** EDGE RESTRAINT

CASE No 2 - **PARTIAL INFILTRATION**



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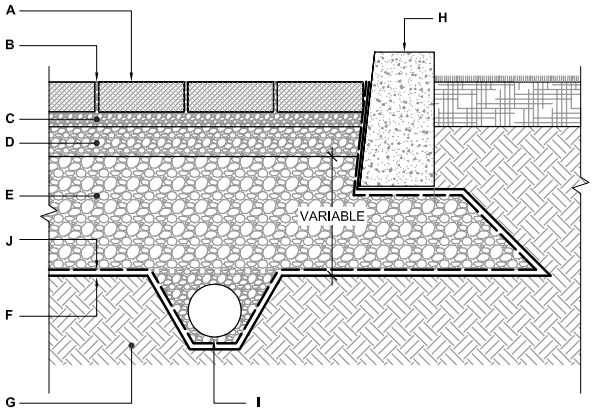
- **F.** GEOTEXTILE
- **G.** SUBGRADE
- **H.** EDGE RESTRAINT
- **I.** PERFORATED DRAIN SPACED AND SLOPED TO DRAIN STORED WATER TO STORM SEWER SYSTEM OR RETENTION BASIN

CASE No 3 – **NO INFILTRATION**



- **A.** PERMEABLE PAVER FROM TECHO-BLOC, 60 TO 100 mm (2 3/8" TO 3 15/16") THICK INFLO, MISTA RANDOM, PURE, VICTORIEN PERMEABLE OR VILLAGIO
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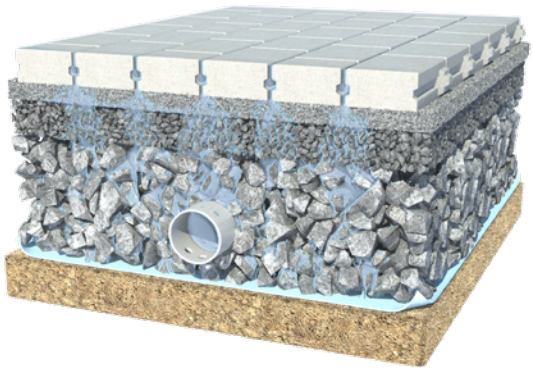
- **E.** SUBBASE COURSE, THICKNESS AS PER DESIGN 40-80 mm (1 5/8"-3 1/8") STONE
- **F.** GEOTEXTILE (OR IMPERMEABLE MEMBRANE)
- **G.** SUBGRADE (IMPERMEABLE)
- **H.** EDGE RESTRAINT
- **I.** PERFORATED DRAIN SPACED AND SLOPED TO DRAIN STORED WATER TO STORM SEWER SYSTEM OR RETENTION BASIN
- **J.** GEOTEXTILE TO PROTECT IMPERMEABLE MEMBRANE (OPTIONAL)

3. BENEFITS OF THE PERMEABLE PAVER & SLAB SYSTEM



- Reduce the construction of additional impervious surfaces
- Contribute to maintaining hydrologic conditions that existed prior to development
- Reduce runoff volume
- Reduce peak flow (discharge to sewer is spread over a longer period)
- Reduce network overload;
- Reduce wastewater treatment costs
- Reduce the need for expensive underground retention basins and surface retention ponds
- Use in confined spaces in existing areas requiring additional stormwater management
- Reduce potential risk of erosion and flooding associated with increased runoff rates and volumes
- Improve water quality
- Contribute to replenishing the water table
- Reduce heat island effects (light color, high solar reflectance index (SRI), cools and humidifies surrounding air)
- Gain credits for LEED certification
- Improve the aesthetic quality of urban landscape

4. IMPROVED WATER QUALITY

When it rains, water runoff takes on pollutants (suspended solids, nutrients, heavy metals and other contaminants) that are then directed to the municipal network before ending up in the waterways.

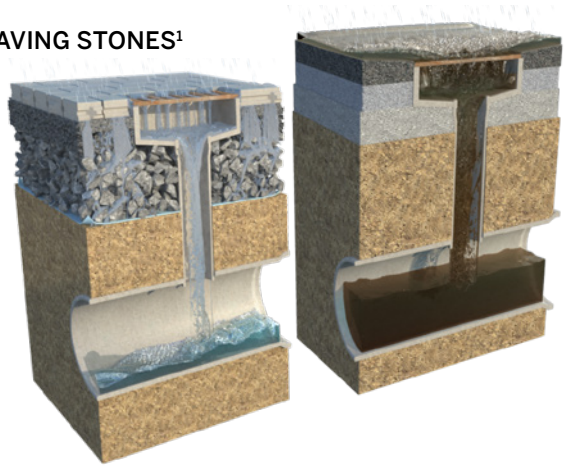
Pollutants carried by runoff have a significant impact on water quality, affecting the water supply, fish and wildlife habitat, recreational usage and aesthetic aspects.

Permeable pavers are known for their high pollutant removal potential, which contributes to improving water quality. Pollutants are reduced mainly by infiltration, and through several other processes. The permeable paver system is effective for removing sediment, nutrients and heavy metals. Some studies have also shown potential for bacterial treatment of oils.

PERCENTAGE OF POLLUTANT REMOVAL BY PERMEABLE PAVING STONES[1]

POLLUTANT	AVERAGE (%)
Total suspended solids	81
Total phosphorus	53
Total Kjeldahl nitrogen	53
Total copper	13
Total zinc	72

The data were measured on King Campus at Seneca College in King City, Ontario. The Interlocking Concrete Pavement Institute presents several data from the various sites that show lower levels of pollutants where permeable pavers were used.



[1] .Van Seters, T., Performance Evaluation of Permeable Pavement and Bioretention Swale Seneca College, King City, Ontario, Interim Report #3, Toronto and Region Conservation Authority, Downsview, Ontario, May, 2007.

5. TECHO-BLOC PERMEABLE PAVERS & SLABS

TECHO-BLOC permeable pavers are an alternative to traditional impervious cover. They reduce stormwater runoff to sewer systems by promoting water detention and infiltration. They are an effective way to control stormwater at source on residential, commercial and industrial lots. They can also minimize the need to build larger sewer systems downstream of vacant lots being developed in an existing urbanized sector.

The permeable paver system is the type that has been the most successful among the various types of permeable paving available today. It can be used successfully in a winter climate and is less prone to clogging compared to pervious concrete or porous asphalt.

TECHO-BLOC permeable pavers and slabs meet the requirements of CSA A231.1 & CSA A231.2.

PAVERS	CSA A231.2 STANDARD	**Compressive strength**		**50 MPa (min)**
		Freeze-thaw durability with use of de-icing salt	Loss of mass after 28 cycles	225 g/m² (max)
			Loss of mass after 49 cycles	500 g/m² (max)
		Water absorption (Techo-Bloc requirement)		**5 % (max)**
		Dimensional tolerances	Length and width	- 1 mm to + 2 mm
			Height	± 3 mm

SLABS	CSA A231.1 STANDARD	**Compressive strength (Techo-Bloc requirement)**		**6 500 psi [45 MPa] min.**
		Flexural strength		650 psi [4.5 MPa] min.
		Freeze-thaw durability with use of de-icing salt	Loss of mass after 28 cycles	0.102 lb/pi² [500 g/m²] max.
			Loss of mass after 49 cycles	0.246 lb/pi² [1200 g/m²] max.
		Water absorption (Techo-Bloc requirement)		**5 % (max)**
		Dimensional tolerances	Length and width	- 1/32" [1 mm] to + 1/16" [2 mm]
			Height	± 1/8" [3 mm]
		Warpage	± 1/16" [2 mm] Dimension of 17 11/16" [450 mm] and less ± 1/8" [3 mm] Dimension over 17 11/16" [450 mm]	

BARRIER-FREE DESIGN

On a path with no obstacles, walkways should not have any gaps allowing the passage of a sphere greater than 13 mm in diameter. The openings of the permeable paver joints are filled with clean stone and thus comply with barrier-free design requirements under the Ontario Building Code.

TECHO-BLOC PERMEABLE **PAVERS**	PERCENT OF SURFACE OPENING (%)	JOINT WIDTH (mm)	INFILTRATION RATE[1] (mm/h)
ANTIKA[2]	Variable	Variable	993 in./hr (25 227 mm/hr)
INFLO[1]	5.8	1/2" (13 mm)	837 in./hr (21 267 mm/hr)
MISTA RANDOM[1]	6.3	3/16" (4 mm) to 9/16" (14 mm)	610 in./hr (15 505 mm/hr)
PURE[2]	5.0	3/8" (10 mm)	726 in./hr (18 440 mm/hr)
VICTORIEN 60 mm PERMEABLE[1]	9.6	3/8" (10 mm)	909 in./hr (23 085 mm/hr)
VILLAGIO[1]	8.0	3/8" (9 mm) to 9/16" (15 mm)	896 in./hr (22 750 mm/hr)
TECHO-BLOC PERMEABLE **SLAB**	PERCENT OF SURFACE OPENING (%)	JOINT WIDTH (mm)	INFILTRATION RATE[1] (mm/h)
BLU 60 mm[2]	3.0	9/32" (7 mm)	570 in./hr (14 475 mm/hr)

[1] Measurements were taken at various sites in conformity to the standard ASTM C 1701-09.
[2] Measurements were taken at various sites in conformity to the standard ASTM C 1781.

PAVERS

ANTIKA

Unit Dimensions

Various sizes, height of 2 3/8 inches (60 mm)

Techo-Bloc provides contractors a machine specially designed for the installation of Inflo permeable pavers.

INFLO

Unit Dimensions	Inches	mm
Thickness	3 15/16	100
Width	7 7/8	200
Length	11 13/16	300

PURE

	Unit Dimensions	Inches	mm
A	Thickness	3 1/8	80
	Width	9	228
	Length	9	228
B	Thickness	3 1/8	80
	Width	9	228
	Length	12	305
C	Thickness	3 1/8	80
	Width	9	228
	Length	15	381

VICTORIEN 60 mm permeable

Unit Dimensions	Inches	mm
Thickness	2 3/8	60
Width	4 1/4	108
Length	8 1/2	216

MISTA random

		Unit Dimensions	Inches	mm
A		Thickness	2 9/16	65
		Width	7 7/8	200
		Length	3 15/16	100
B		Thickness	2 9/16	65
		Width	7 7/8	200
		Length	7 7/8	200
C		Thickness	2 9/16	65
		Width	7 7/8	200
		Length	11 13/16	300

VILLAGIO

		Unit Dimensions	Inches	mm
A		Thickness	2 3/8	60
		Width	5 1/8	130
		Length	5 1/8	130
B		Thickness	2 3/8	60
		Width	5 1/8	130
		Length	6 5/16	160
C		Thickness	2 3/8	60
		Width	5 1/8	130
		Length	7 5/16	185
D		Thickness	2 3/8	60
		Width	5 1/8	130
		Length	8 7/16	215

SLAB

BLU 60 mm SLAB COMES IN DIFFERENT FINISHES:
SLATE (DISPLAYED), SLATE AGED AND SMOOTH.

BLU 60 mm

		Unit Dimensions	Inches	mm
A		Thickness	2 3/8	60
		Width	13	330
		Length	6 1/2	165
B		Thickness	2 3/8	60
		Width	13	330
		Length	13	330
C		Thickness	2 3/8	60
		Width	13	330
		Length	19 1/2	495

6. DESIGN CRITERIA

The design of a permeable paving system is based on site conditions, including, without limitation, rainfall data, topography, soil characteristics, the height of the water table and bedrock surface, tributary runoff surface and proximity to water supply wells.

The main factors to be considered are:

- Soil infiltration rate should be at least 12.5 mm/h where the system is designed for complete infiltration
- The underside of the system must be at least 0.6 m above the water table and bedrock
- The permeable pavement system should be located at a distance of at least 30 m from water supply wells
- The paved surface must have a grade of at least 1% and most preferably not more than 5%. The slope of tributary runoff area should not be greater than 20%
- The ratio between the tributary runoff area and the permeable pavement area should not exceed 5 to 1
- The porosity of the clean stone composing the base and subbase should be no less than 32%, but preferably 40%
- The percolation rate measured in situ should be understated by at least 2 to account for the long-term reduction of the soil's absorption capacity
- A maximum drain time of 48 hours is recommended

In situations where rainfall is greater than the design flow rate, an overflow system directs runoff to the drainage network.

7. LEED

The Canada Green Building Council (CaGBC) is a non-profit organization promoting the implementation of sustainable projects through the Leadership in Energy and Environmental Design (LEED®) certification program.

TECHO-BLOC permeable pavers can directly contribute to obtaining LEED credits in the following categories:

SUSTAINABLE SITES			
CREDIT 6.1	STORMWATER MANAGEMENT	Rate and quantity	**1 POINT**
CREDIT 6.2	STORMWATER MANAGEMENT	Treatment	**1 POINT**
CREDIT 7.1	HEAT ISLAND EFFECT	Non-roof	**1 POINT**
MATERIALS AND RESOURCES			
CREDIT 5.1	REGIONAL MATERIALS	20% Extracted & Manufactured Regionally	**1 POINT**
CREDIT 5.2	REGIONAL MATERIALS	30% Extracted & Manufactured Regionally	**1 POINT**

TECHO-BLOC permeable pavers can contribute to obtaining up to 3 points in the Sustainable Sites category and up to 2 points in the Materials & Resources category.

8. FAQ

1. *For what type of traffic can permeable pavers be used?*

In general, permeable pavers are suitable for use in low speed areas not exposed to heavy vehicles, such as parking areas, driveways, bike paths, walking paths, patios and playgrounds.

However, TECHO-BLOC Inflo permeable pavers are designed for applications in larger areas with higher traffic, such as residential streets, parking lanes, storage areas and sidewalks.

2. *How much water can be absorbed by a permeable paver system?*

The absorption capacity of the system is based on the infiltration rate of the soil on the site and the clean stone materials (joints, bedding, base and subbase). The soil infiltration rate is an indicator of potential water infiltration directly into the soil and determines the type of system design (complete or partial infiltration). The materials used in the construction of permeable pavers have higher infiltration rates than natural soil. The initial surface infiltration rate of the permeable pavers is very high. The system allows the infiltration of precipitation with intensity lower than the surface infiltration rate or until the water storage capacity in the clean stone reservoir is reached. In a well-designed system, water storage capacity is rarely reached.

3. *Can the permeable paver system perform well in a winter climate?*

Yes, in order to ensure their performance in winter weather, TECHO-BLOC permeable pavers are manufactured to meet CSA A231.2-06 requirements for withstanding freezing and thawing with de-icing salt. Experience with permeable pavers in cold climates has demonstrated the absence of heaving. A maximum drain time of 48 hours is recommended and the water that may have accumulated in the clean stone reservoir should be evacuated within this time frame. In the event that water freezes before it is evacuated, the space between reservoir aggregates allows sufficient room to accommodate the expansion caused by freezing water and the risk of heaving is thereby minimized. Ultimately, the permeable paver system is flexible enough to tolerate minor movements.

4. *What kind of maintenance is recommended for the permeable paver system?*

Regular cleaning will help maintain a high enough surface infiltration rate to allow rainwater to soak through the joints. At least one inspection and cleaning should be performed during the first year of service and thereafter as required. Cleaning is recommended when the surface infiltration rate is less than 250 mm/h. Cleaning can be done with a vacuum adjusted to minimize the removal of joint filling material. In winter, snow removal can be done as for any other type of paving, but it is still recommended that snow removal blades be covered with a protective coating and raised 25 mm. Permeable pavers require less de-icing material than conventional pavement. Since melted water does not accumulate, it will not re-freeze on the surface. It is not recommended to spread sand for traction, as this may clog the joints; instead, spread the aggregate used for filling joints.

COLOR THROUGH & THROUGH | DE-ICING SALT RESISTANT | STRENGTH & DURABILITY | TRANSFERABLE LIFETIME WARRANTY

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