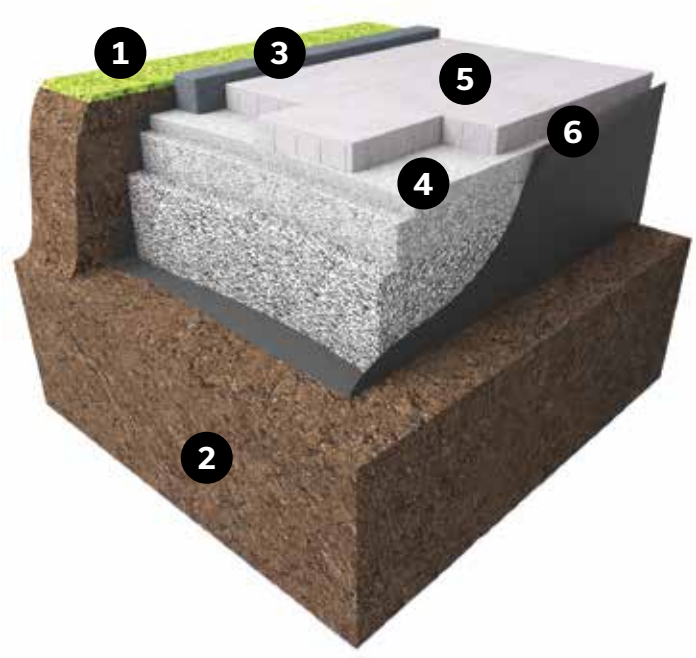
Pavers

PAVER INSTALLATION (GENERIC)



TOOLS REQUIRED

> 1 wheelbarrow
> A few pegs
> 2 rigid pipes with a diameter of 25 mm - 1 in x 3 m - 10 ft
> 1 plank: 25 mm x 150 mm x 2.4 m - 1 in x 6 in x 8 ft.
> 1 plumb line
> 1 level
> 1 bricklayer's line: 15 m long - 50 ft
> 1 shovel
> 1 chalk line
> 1 measuring tape
> 1 broom
> 1 rake
> 1 guillotine or concrete saw (available from rental stores)
> 1 vibrating plate (compacting tool available from tool rental stores)

OPTIONAL TOOLS

> Jumping jack

The jumping jack should not be used to compact pavers. It should only be used for the foundation.

1 EXCAVATION

If pipes or wires are located in the area to be excavated, contact the representatives of the company concerned before the work is started.

To ensure adequate drainage, excavate the soil to obtain a minimum 2% slope (20 mm per metre or 1/4 inch per foot). The slope can be reduced to 1% if the drainage of all the landscaping is well controlled. In case of doubt, obtain an expert's assistance for a detailed analysis of everything concerning drainage (slopes of the ground, soil type, landscaping, etc.).

The excavation contour should extend beyond the surface to be paved by at least 300 mm - 12 in. Ideally, this distance should be 1 to 1 1/2 times the thickness of the foundation. The stability of the project depends on this measurement, which ensures that the paving stones at the edge will be as well supported as those in the centre.

Level the bottom of the excavation with a rake and if the soil is sandy, compact it with a vibrating plate or roller. It is preferable not to pack clay soil at this stage. in this case, the use of a geotextile membrane placed between the natural soil and the foundation is recommended to prevent foundation contamination by clay and ensure greater stability. Refer to the chart EXCAVATION DEPTH AND MINIMUM FOUNDATION to get the minimum excavation required (ref: photo #1).

2 FOUNDATION

Spread and compact the 0 to 20 mm - 0 to 3/4 in. stone in 100 mm - 4 in. layers. Lightly water the 0 to 20 mm - 0 to 3/4 in. stone to make tamping easier. To ensure an adequate foundation, compact the stone several times with a vibrating plate, roller, or a jumping jack (ref: photo #2). Once this stage is completed, you will be able to see what the final result will look like. You can verify the final level of the pavers by placing a paver on a guide (ref: photo #3). Refer to the typical installation drawings (see page 6).

3 CURB

If you install a Novo curb type, proceed with installation of the curbs immediately before completing the foundation. Start by laying the first side of the curb. Before installing the other side of the curb, temporarily place a row of pavers on the ground to determine the ideal distance and the position of the other curb, and thus minimize the size of the pavers. If you install a Melville curb, a Lafitt curb, a Celtik curb or even a plastic curb, refer to LAYING PAVERS.

4 INSTALLATION BED

Spread between 15 mm - 5/8 in. and 25 mm - 1 in. of concrete sand or screening (ref: photo #4). Bear in mind that a 25 mm - 1 in. bed will be reduced down to 15 mm - 5/8 in. in thickness once compacting is completed and after the paving stones are installed.

Level the concrete sand using two (2) 25 mm - 1 in. diameter pipes and a straight plank (ref: photo #5). Any significant variation in bed thickness may cause irregularities in the paved surface.

Make sure you do not compact the screenings or the sand before laying the pavers on the installation bed. Fill the holes left by the pipes.

5 LAYING THE PAVERS

Arrange the paving stones according to the pattern chosen with a 90° angle if possible. Proceed by walking on the paving stones (ref: photo #6).

Paving stones are manufactured with side spacers that will set a space of 3 mm - 1/8 in. between each paver. A space of 2 mm must be allowed for paving stones without spacers.

To obtain an even distribution of colour and texture, it is recommended that you choose paving stones from more than one cube at a time. Moreover, working across each cube always gives the best results.

Check the alignment of the pavers (after every five rows installed) and adjust them, if necessary, using a screwdriver.

Install paving stones up to the last row. To avoid having to cut paving stones later, determine the position of the curbs to finish with a complete paving stone.

If necessary, you can cut the paving stones using a cold chisel or specialized tool such as guillotine or a concrete saw (ref: photo #7). It is recommended that you use a chalk line to mark the paving stones to be cut. If you have to use a guillotine to cut the stones, make sure that the cut is at a slight angle as pavers cut this way are much easier to install. If you use a concrete saw, keep away from the paving stones already installed, since the dust and dirt from the sawing will permanently stain them. Wear safety glasses when cutting concrete products.

Proceed immediately with installation of Melville curbs, Lafitt curbs, Celtik curbs or plastic curbs on the perimeter of the paved surface (ref. photo # 8). The curbs are laid directly on the densified granular foundation.

6 FILLING THE JOINTS

Once you have finished laying the paving stones, stabilize them using a vibrating plate (ref: photo #9). This operation will settle the stones into the bed while levelling the surface. Begin by brushing a thin uniform layer of joint-filling sand over the paving stones and into the joints (ref: photo #10), and then use a vibrating plate. For best results, run the plate two or three times in each direction. This operation will allow the sand to penetrate suitably into the joints and the paving stones to settle approximately 10 mm - 3/8 in. into the bed. (For improved performance, use Techniseal polymeric sand in accordance with the instructions provided on the bag).

The installation of a detachable neoprene sole (or layer) has been proven to be an additional protection against the risk of concrete spalls when filling the joints of paving stones.

Repeat the sand-spreading and vibrating procedures until all of the paving-stone joints have been filled. Remove the excess sand with a brush. The final level of the sand in the joints should be about 3 mm - 1/8 in. lower than the level of the paving stones.

If, after a few days, some joints are not properly filled, repeat the procedure. It is recommended to perform an annual maintenance of the joints between the paving stones.

WE SUGGEST SETTING ASIDE A NUMBER OF PAVING STONES FOR REPLACEMENT.


1


2


3


4


5


6


7


8


9


10

Permeable Pavement

SPECIFIC DETAILS

ROLE OF PERMEABLE PAVEMENT

The objective, when building a permeable pavement system, is to allow rainwater to infiltrate the underlying soil. The stormwater will be stored in the subbase of the paved area instead of running off to the sewer system. The open graded subbase material will provide storage for the runwater that is collected and will be held for a period of time.Subsequently, the natural permeability of the soil beneath the subbgrade will allow the accumulated water to gradually return to the ground table, thus pursuing its natural cycle.

CONCRETE PAVERS USED IN THE CONSTRUCTION OF PERMEABLE PAVEMENT

Specifically designed concrete pavers can be used for the construction of a permeable pavement. The joints between the pavers, which are filled with a permeable granular material, have the required porosity to channel water into the system.

DESIGN AND CONSTRUCTION

Before undertaking any construction work, an engineer experienced in the field of hydrology should be consulted, in order to obtain an accurate history of local precipitation and the amount of rainwater or drainage from neighbouring surfaces that will run through the permeable paved area.

MONDRIAN PLUS PAVERS

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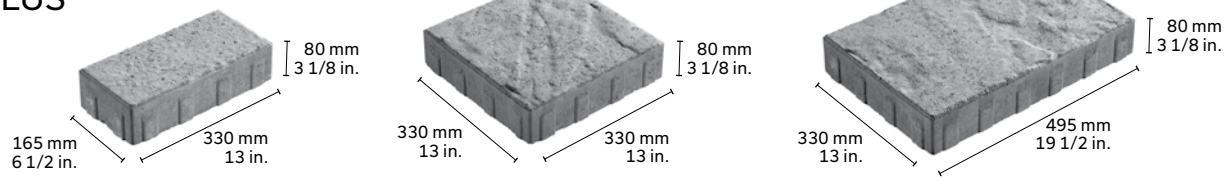

TRAFALGAR 60 PAVERS

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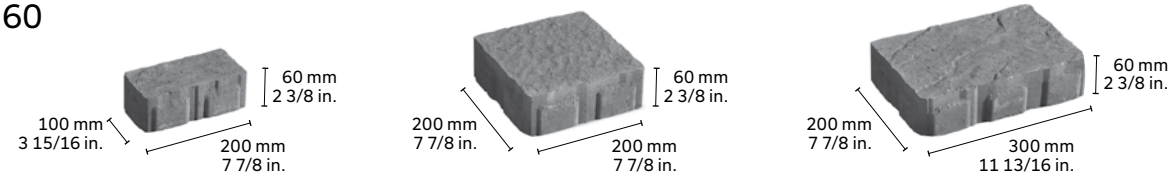

VENDOME PAVERS

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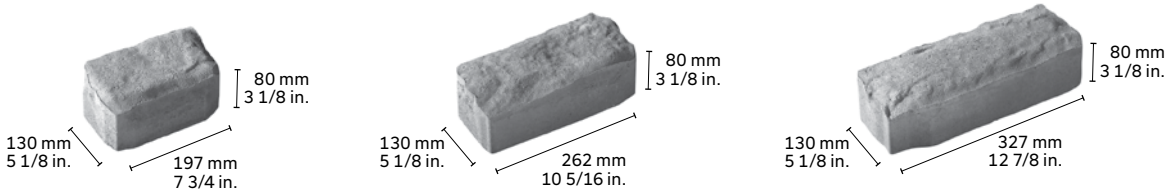
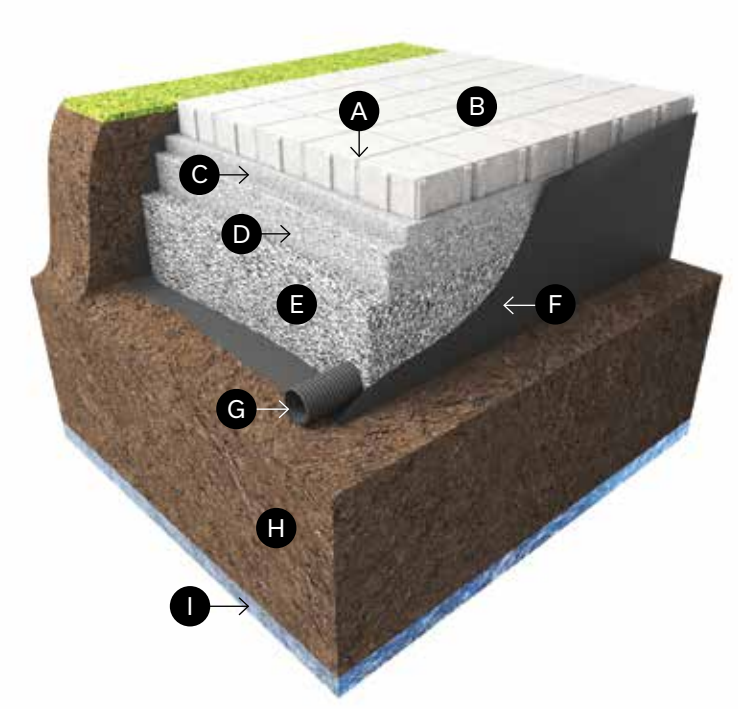


TECHNOLOGY - DESIGN AND CONSTRUCTION

A detailed study is also required to determine the permeability of the undisturbed soil present beneath the permeable materials, as well as proximity to the groundwater table, rock bed, etc. The technical data gathered will make it possible to design effective permeable pavement**, i. e., pavement where the volume of the subgrade's intergranular basin is sufficient to collect the projected amount of rainwater, and where the permeability of the soil is adequate (permeability coefficient exceeding 2x10-6m/sec. or 0. 27 inches/hour) to allow the water to return naturally to the groundwater table before another major rainfall. Failing this, it will be necessary to build a drainage system into the subbase, perhaps even on the surface of the pavement (which should always have a minimum 1% slope) as a complementary measure to evacuate residual rainwater and avoid any overflow or flooding of the structure in service. Melting snow and winter rains must also be taken into account.

Construction must be carried out by a competent contractor in strict compliance with plans and specifications. Moreover, materials must be selected with considerable care to obtain the required permeability. (The minimum requirement for the permeability of the pavers is 100 in/hr).

TYPICAL CROSS-SECTION OF A PERMEABLE PAVEMENT



- A Joint filler - 2.5 to 5 mm clean stone
- B Permeable paver
- C Compacted bedding (50 mm max.) 2.5 to 10 mm clean stone
- D Compacted upper subbase (100 to 150 mm) 14 to 28 mm clean stone
- E Compacted lower subbase (min. 300 mm) 40 to 80 mm clean stone
- F Geotextile
- G Optional perforated drain (see ICIPI recommendations)
- H Subgrade (thickness: min. 600 mm)
- I Groundwater table (or cliff)

* Permacon strongly recommends the CMHA website (Concrete Masonry & Hardscapes Association): *www.masonryandhardscapes.org/technical-resources/#hardscapes-tech* before undertaking any studies or work on permeable pavement using concrete pavers.
** Application software has been developed for this purpose. See the CMHA website.

ADVANTAGES AND BENEFITS

These can be summarized as follows:

> Excellent way of avoiding the construction of new impermeable surfaces

> Significantly reduces the volume of rainwater channelled to a storm sewer

> Eliminates the need to dig catch basins for surface water

> Reduces the quantity of toxic and suspended matter in the storm system

> Improves the comfort and safety of users during rainfalls (survival of the natural environment, plants, trees, etc.)

> Actively contributes to reloading the groundwater table

> Reduces occasional risk of flooding paved areas

> Reduces the risk of soil erosion by reducing the runoff speed of surface water

> Reduces development costs in new sectors, by avoiding oversized rainwater management works

> Provides a durable concrete paver structure capable of withstanding freeze-thaw cycles and deicing salts

> Favours sustainable development - possibility of earning 2 LEED points (Leadership in Energy and Environmental Design) from the Canada Green Building Council) - in the area of ecological site development, paragraph 6. 1 *Flow and Quantity* and paragraph 6. 2 *Water Treatment*

A MINIMAL SEASONAL MAINTENANCE ALLOWS AN ADEQUATE PERFORMANCE OF THE STRUCTURE THAT CAN EXCEED 25 YEARS.

PERMEABLE PAVEMENT LIMITATIONS

While permeable pavement provides many advantages, it should be recalled that it is not the solution for every project that comes up. It does have its shortcomings, as shown below:

> Requires greater design and construction expertise

> A solution that should be avoided in the presence of rock or a groundwater table too close to the surface [distance of less than 600 mm - 24 in.)

> A solution that should be avoided where there are steep slopes near the permeable pavement (slopes exceeding 20%)

> A solution that should be avoided when the permeable pavement's slope exceeds 5%

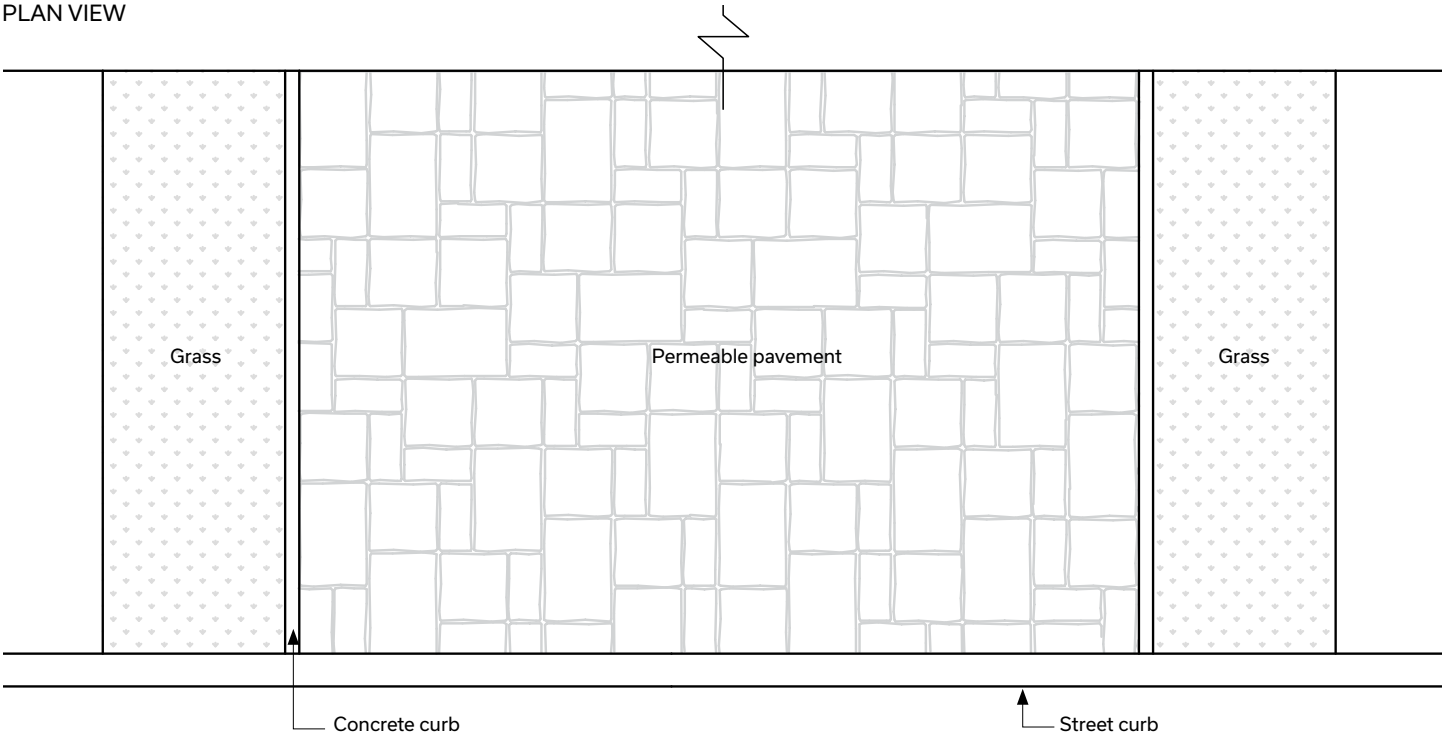
> High risk of contaminating the groundwater reservoir near the draining subgrade (minimum 30-metre protective strip required, in keeping with prevailing regulations)

> High risk of progressive clogging of the drainage layers over the long term, because of the significant quantity of fine particles in suspension. These result in particular from the application of road abrasives rich in fine particles, and which could, over time, reduce the structure's permeability. With a minimum of seasonal maintenance, the structure could perform effectively for more than 25 years.

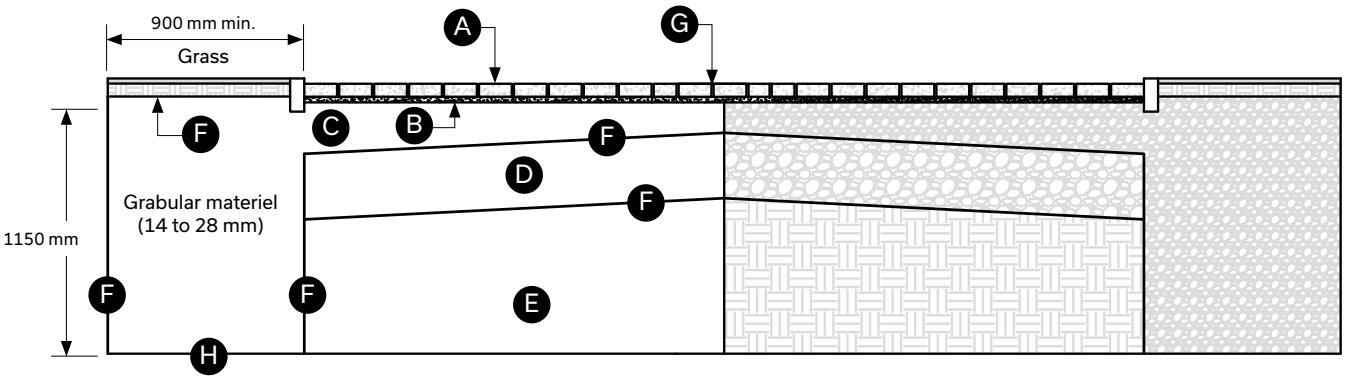
> A solution that should be avoided when a road's standard base course is too close to the drainage layer (minimum 6 m protective zone required)

PERMEABLE PAVEMENT CROSS-SECTION (RESIDENTIAL)

PLAN VIEW



CROSS-SECTION



- A Permeable paver 60, 80 or 100 mm (Mondrian Plus, Trafalgar, Vendome, AquaPave, Boulevard Drain)
- B Open-graded bedding course 25 to 50 mm (open-graded aggregate 2.5 to 5 mm)
- C Upper base, open-graded aggregate 100 to 150 mm (clean stone 14 to 28 mm)
- D Lower aggregate base 300 to 450 mm (0 to 20 mm clean stone) compacted to 95% modified Proctor density
- E Existing soil with adequate bearing capacity (minimum of 150 kN/m^2)
- F Geotextile membrane (with 2% minimum slope, if required)
- G Permeable joint material (open-graded aggregate 2.5 to 5 mm)
- H Existing soil with a minimum infiltration rate of 3 in/hour (to be validated with tests)