# PERMCON

# CONTINUOUS POUR PERMEABLE CONCRETE PAVING SYSTEM | 2024

## INSTALLATION GUIDE

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# WHAT IS PERMCON PERMEABLE CONCRETE?

**Permeable or pervious concrete, which can also be referred to as porous concrete, is specialist concrete with a high porosity. This product allows water to pass directly through it, reducing the runoff and facilitating ground water recharge.**

Types of porous 'systems' include porous asphalt, pervious cement, permeable concrete, concrete paving blocks, grid paving systems and resin pavement systems, among others.

Permcon continuous pour permeable concrete reduces the runoff from paved areas due principally to the void content within the product, usually in the range of 20-25%. This feature enables the filtration of stormwater through the product, mitigating the need for stormwater retention pits and rain gardens. In addition, Permcon naturally filters stormwater and reduces pollutants from entering into rivers, streams, natural aquifers and the ocean.

It also has the added benefit of being beneficial to the environment as it provides for the transfer of air and water to tree root systems to allow trees to continue to flourish – even in highly developed urban areas.

This guide is for the installation of Permcon New Zealand's permeable concrete system and should be used in consultation with an Engineer, Architect or Landscape Architect in order to ensure compliance with local council or regulatory authority requirements, and any site-specific conditions. Installation should only be undertaken using accredited installers.

# PERMEABLE CONCRETE BENEFITS

### – REDUCES RAIN FALL RUN OFF

as Permcon's runoff coefficient of 0.3 decreases demand on existing stormwater systems

### + RECHARGES NATURAL GROUND AQUIFERS

as per natural filtration in the predeveloped environment

### – REDUCES STORMWATER PEAK FLOWS

by detaining the stormwater and releasing it in a controlled manner

### + FILTERS STORMWATER

by removing up to 70% of heavy metals, hydrocarbons, detritus and suspended solids

### – REDUCES THE SIZE OF RETENTION STRUCTURES

and maximises land use by retaining water within the system

### – REDUCES THE STORMWATER RUNOFF TEMPERATURE

thereby mitigating damage to receiving streams, rivers and waterways

### + MAXIMISES LAND USE

because, in a passive system, permeable surfaces are considered as 'grass' for design purposes

# TERMINOLOGY

**WEARING COURSE** The Permcon permeable concrete layer, the thickness of which will depend upon application required.

**PERMEABLE BASECOURSE** An open-graded aggregate that provides support for the Wearing Course and a storage medium for the detained stormwater.

**EXTENDED PERMEABLE BASECOURSE** Increased depths of open-graded basecourse included where larger volumes of stormwater need to be managed.

**SUB BASE** Sometimes referred to as a gravel raft and normally GAP40 or GAP65, a sub base is used to create a stable platform to sit the Permcon System on in low CBR (definition below) situations.

**SUB SURFACE DRAIN** Normally a 110mm Novaflo pipe or similar, this drainage system can be designed to drain excess stormwater in a controlled fashion into the local stormwater network reducing peak flows.

**FILTER CLOTH** A non-woven geotextile which allows water to pass through into the sub grade but prevents soils from punching up into the open-graded permeable basecourse.

**SUB GRADE** The undisturbed soil at the base of the Permcon System, the condition of this layer (CBR) influences the basecourse and sub base requirements.

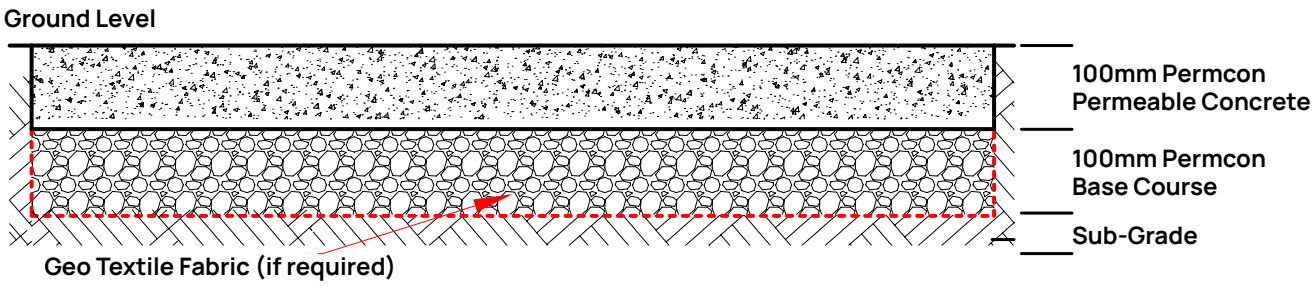
**GEOGRID** Engineered Polymeric materials with an open grid like appearance used to reinforce the sub base layer in low CBR environments.

**CBR** The California Bearing Ratio, a measure of the strength of the sub grade.

# APPLICATIONS

## FOOTPATHS (TYPICAL DESIGN)

**Common applications for Permcon are right-of-way, joint-ownership access lanes, footpaths, domestic driveways, carparks, private open spaces, tree protection zones, balconies and patios.**



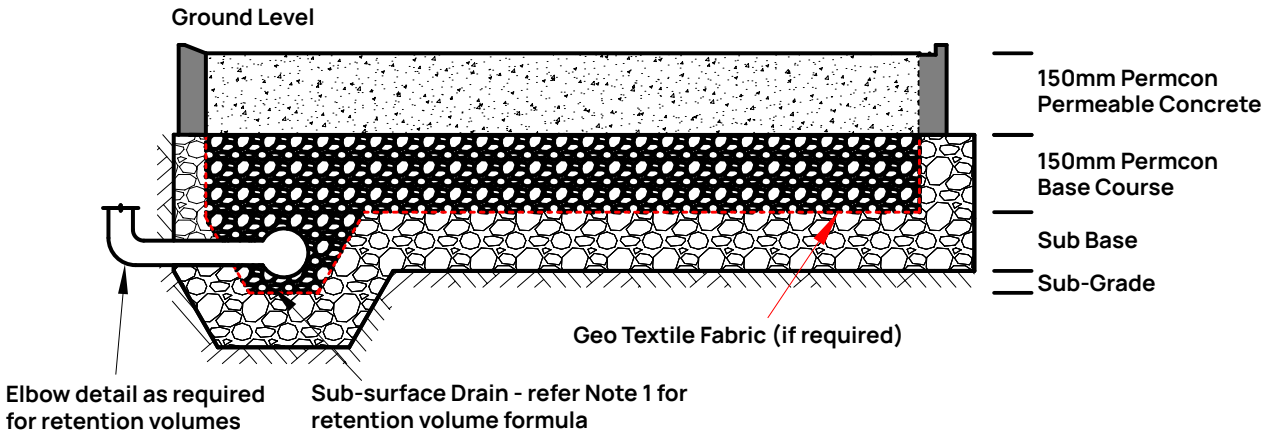

**SURFACE/WEARING COURSE** – The top surface or wearing course of the footpath is a layer of Permcon permeable concrete at a thickness of 100mm.

**PERMEABLE BASE COURSE** – The base course, or structural drainage layer directly below the wearing course, should consist of a washed drainage aggregate. This layer acts as temporary storage prior to natural filtration into the sub grade.

**SUB BASE** – A GAP gravel raft if required to ensure a stable even platform for the Permcon system to sit on.

**FILTER CLOTH** – Normally a non-woven geotextile which is a polypropylene fabric that allows water to pass through it and prevents the bedding sand from migrating into the sub-base drainage aggregates. Also assists in stopping contamination of the sub base drainage aggregates when surrounded by clay soil.

# RIGHT-OF-WAY / JOINT-OWNERSHIP ACCESS LANES / DRIVEWAY (TYPICAL DESIGN)




**SURFACE/WEARING COURSE** – The surface or wearing course of the vehicular access consists of 150mm permeable concrete.

**PERMEABLE BASE COURSE** – The structural drainage layer supporting the driveway surface will consist of a 150mm layer of drainage aggregate, usually a Greywackie rock DM40/20 or similar.

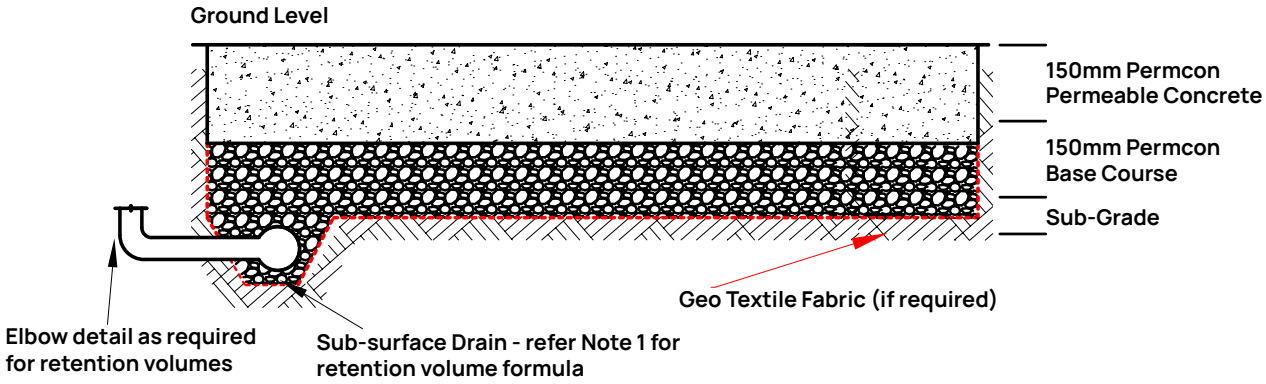
**SUB BASE** – A GAP gravel raft if required to ensure a stable even platform for the Permcon system to sit on ensuring a minimum CBR of 5+.

**SUB-SURFACE DRAIN** – A drainage system which allows water to enter it so it can be directed out of the permeable base course in larger storm events. Assists with removing water in impermeable clay sub grades and can be designed to reduce the stormwater peak flow

**FILTER CLOTH** – The filter cloth is a non-woven geotextile fabric. Whilst it facilitates the flow of water through it, it provides a barrier for organic materials to punch up into the permeable base drainage aggregates.

# APPLICATIONS

## DRIVEWAY (TYPICAL DESIGN)




**SURFACE/WEARING COURSE** – The roadway surface is typically poured at a thickness of 150-200mm of permeable concrete.

**PERMEABLE BASE COURSE** – The structural drainage layer supporting the driveway surface will consist of a 150mm layer of drainage aggregate, usually a Greywackie rock DM40/20 or similar. Normal gap types of aggregate are not suitable as base course material.

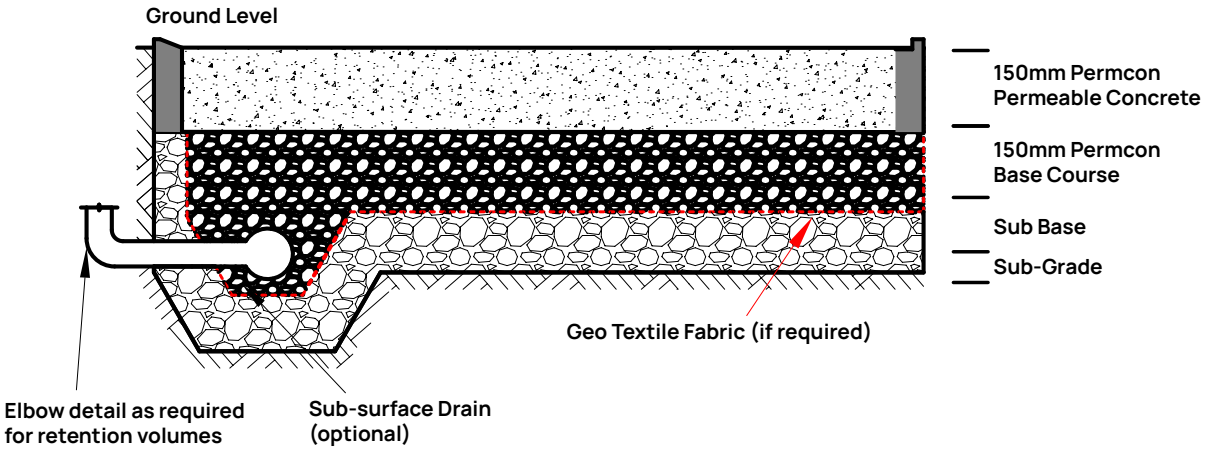
**SUB BASE** – A GAP gravel raft if required to ensure a stable even platform for the Permcon system to sit on ensuring a minimum CBR of 5+.

**SUB GRADE** – The undisturbed soil at the bottom of the Permcon system. The strength of this influences the thickness of structural support layer of the sub base course.

**SUB-SURFACE DRAIN** – A drainage system which allows water to enter it so it can be directed out of the permeable base course in larger storm events. Assists with removing water in clay sub grades and can be designed to reduce the stormwater peak flow.

**FILTER CLOTH** – Normally a non-woven geotextile which is a polypropylene fabric which allows water to pass through. It also assists in stopping contamination of the sub base drainage aggregates when surrounded by clay soil.

# CARPARK (TYPICAL DESIGN)




**SURFACE/WEARING COURSE** – The surface or wearing course of the carpark should consist of 150-200mm thickness of Permcon – permeable concrete. The determination of actual thickness of this layer should be done in consultation with a civil engineer and follow engineer designed civil/drainage specifications.

**PERMEABLE BASE COURSE** – The structural drainage layer directly under the permcon top surface should be a suitable drainage aggregate, usually a Greywackie rock DM40/20 or similar. This layer is also referred to as 'storage medium' as it can act as a storage tank once the storm water run off has dissipated into it.

**SUB BASE** – A GAP gravel raft if required to ensure a stable even platform for the Permcon system to sit on ensuring a minimum CBR of 5+.

**SUB-SURFACE DRAIN** – A drainage system which allows water to enter it so it can be directed out of the permeable base course in larger storm events. Assists with removing water in clay sub grades and can be designed to reduce the stormwater peak flow.

**FILTER CLOTH** – Normally a non-woven geotextile which is a polypropylene fabric which allows water to pass through it. It also prevents organic materials from punching into the permeable aggregates.

# APPLICATIONS

# CBR – CALIFORNIA BEARING RATIO

**On site assessment the following steps can be used for an on site Sub Grade assessment, this does not replace the need for a proper Geo Tech report it just provides a guide.**

## ONCE THE SUB GRADE IS EXPOSED, WET THE GROUND AND THEN WALK ACROSS THE SUB GRADE.

**Weak**

- Walking leaves a strong / complete imprint, this indicates a weak CBR and is generally a clayey /silty soil type.

**Medium**

- Walking leaves a heel imprint only, this indicates a medium CBR and is generally a silty or clayey sand soil type.

**Strong**

- Walking leaves no imprint, this indicates a strong CBR.

## BOLTING IN PERMCON

Carstop and pool fencing can be installed through Permcon's permeable concrete as per standard concrete designs.

# INSTALLATION SURROUNDING / COVERING TREE PROTECTION ZONES (TPZ) (TYPICAL DESIGN)

**Permcon is, in some circumstances, suitable for installation immediately adjacent to trees and tree root zones.**

When installed properly, Permcon will contribute significantly to the long-term sustainability of the tree. Any installation that will cover a tree root zone should be designed in conjunction with an arborist.

Please note the following specific requirements:

## 1. THE TREE PROTECTION ZONE SHOULD NOT BE EXCAVATED [ie, the roots should be preserved].

This pertains only to installations surrounding trees and designed to specifically preserve the tree root zone.

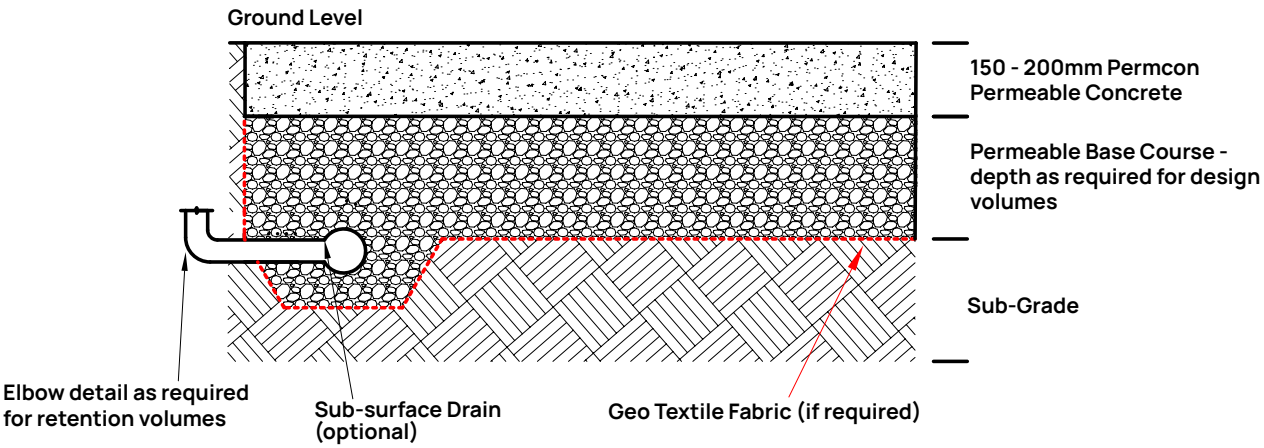
## 2. THE FOLLOWING CONDITIONS CAN BE MET:

- The topsoil is not prone to settling/subsiding and
- The maximum weight of vehicles is limited [Ie, residential light traffic c/single unit residential driveways].

Then it is acceptable to install Permcon on top of the existing top soil. However, it is recommended that the advice of an engineer be sought.

# APPLICATIONS

# EXTENDED WATER STORAGE




If higher water volumes are required to be detained/retained in the permeable basecourse, additional depth of permeable basecourse can be added. Each 100mm added will add 25L of stormwater storage. The layer depth is designed to hold the required water volumes, the permeable basecourse should be installed and compacted at maximum 150mm layers to ensure adequate compaction in the system.

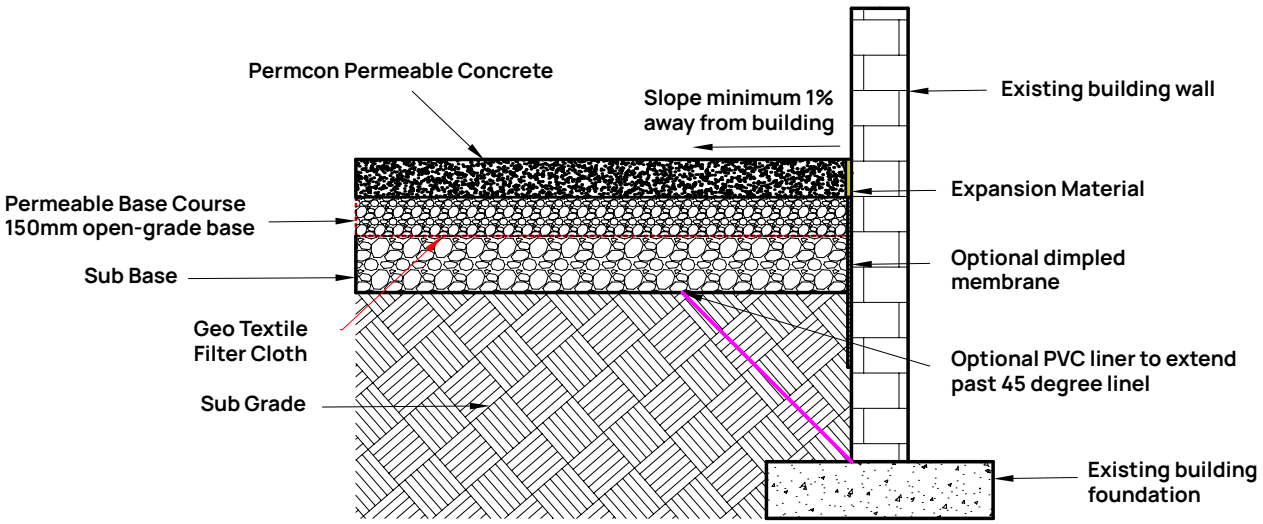
| LOADING CONDITION | SUB GRADE CLASSIFICATION | | |
|---|---|---|---|
| | WEAK CBR <5 | MEDIUM CBR 6-10 | STRONG CBR 10+ |
| Residential<br>Pedestrian<br>Patio/Pathway<br>Geotextile Filter Cloth | 100mm permeable basecourse<br>Class C | 100mm permeable basecourse<br>Class B | 100mm permeable basecourse<br>Class A |
| Residential Light Traffic*<br>Single Unit<br>Residential<br>Driveways<br>Geotextile Filter Cloth | *CBR <3 requires specific design<br>150mm permeable basecourse<br>Class D | 150mm permeable basecourse<br>Class C | 150mm permeable basecourse<br>Class B |
| Residential Light to Medium Traffic<br>Multi Unit<br>Residential<br>Driveways<br>Geotextile Filter Cloth | CBR <5 requires specific design | 150mm permeable basecourse<br>Class D | 150mm permeable basecourse<br>Class C |
| Public Footpath<br>Low and High Impact<br>Geotextile Filter Cloth | 150mm permeable basecourse<br>Class D | 150mm permeable basecourse<br>Class C | 150mm permeable basecourse<br>Class B |

Table 1

**Geotextile Fabrics**

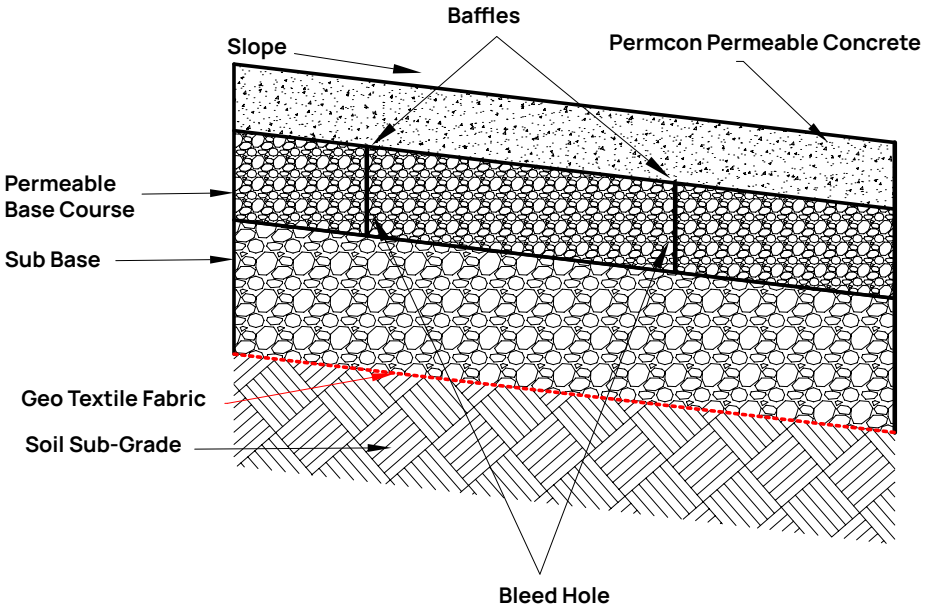
Class A - BIDIM A14 or similar
Class B - BIDIM A19 or similar
Class C - BIDIM A29 or similar
Class D - BIDIM A39 or similar

# FOUNDATION WALL PROTECTION




# SLOPES

Maximum slopes before specific engineering required is 12%. For slopes over 5%, a baffle is recommended every 15m of slope length if the length exceeds 28m.



# CONSTRUCTION MATERIALS
## (NEW ZEALAND)

### PERMEABLE BASE COURSE MATERIAL
The base course material shall be drainage aggregate – a clean greywackie crushed rock.

DM40/20 will store approximately 400litres/$m^3$, we work on 85% to allow for regional variations in the aggregate when laid 100mm thick, will store approximately 34L/$m^2$. See Table overleaf.

### PERMCON CONTINUOUS POUR PERMEABLE CONCRETE PAVING SYSTEM
Is specifically designed mix with strict batching controls.

### BASE COURSE THICKNESS AND GEOTEXTILE FILTER CLOTH CLASSIFICATION
See Table 1 under Applications – Sub grades weaker than a CBR of 5 will require specific design.

### GEOTEXTILE FILTER CLOTH
Non-woven Polypropylene Geotextile fabric type set out as in Table 1 under Applications.

### GEOGRID (SUB GRADE REINFORCEMENT)
For pavement construction using geogrids over very soft subgrade (CBR below 5), it is recommended not to use vibrating compaction equipment. This is to reduce the possibility of 'livening' of the soft sub grade and pumping of soil particles up into the basecourse before sufficient interlock has been achieved with geogrid.

If the subgrade is livened as a result of over-compaction and (or) excessive water, roading construction should be put on hold to allow constructed work to set up before proceeding with subsequent layers.

Installation should be in layers not more than 150mm thick for each layer to ensure adequate compaction. Truck loads of sub base shall be tipped into stockpiles on the sub grade and not tipped directly on geogrids.

## CONSTRUCTION MATERIALS CONT.

The sub base stockpiles should be spread by mechanical plant, such as loader with an opening bucket or excavator bucket. The first layer should be carefully static rolled with a small number of passes using a light roller to create a grid/aggregate interlock. If pavement was designed for multi layers of geogrids, all additional layers should also be carefully static rolled a small number of passes. If construction is taking place in wet conditions and pumping is likely, a layer of geotextile should be placed beneath layer of geogrid.

Considering the fact that tri-axial geogrids have triangular apertures, they may be placed on the subgrade either parallel to the road centre line or in the transverse direction. The width of overlap between adjacent rolls is dependent upon grading and the thickness of sub base and the stiffness of the sub grade. The minimum overlap shall be 300mm and maximum shall be 600mm, or as specified by the engineer. Overlaps must be maintained during the filling operation. This is generally achieved by placing small heaps of fill locally over the overlaps ahead of the main filling operation. No traffic or site plant shall be permitted to travel on the geogrids prior to placing sub-base aggregate.

Compaction of unbound materials for sub base and road bases shall normally be carried out in accordance with specifications for sub base aggregate.

| PROPERTY | | STANDARD | TEST METHOD | RESULT |
|---|---|---|---|---|
| SOURCE | Solid Density | NZS 4407:1991 | Test 3.7.2 | 2.72t/m³ |
| | Abrasion Resistance | NZS 4407:1991 | Test 3.12 | ~11% |
| | Weathering Quality | NZS 3111:1986 | Test 15 | AA |
| | Crushing Resistance | NZS 3111:1986 | Test 14 | 450≥ |
| PRODUCTION | Permeability | Volume 2, Section 10.6<br>Method of soil laboratory testing by K. H. Head | | k = 7.0 -3m/s |
| | Broken Face Content | NZS 4407:1991 | Test 3.14 | 100% |
| | Cleaness Value | NZS 3111:1986 | Test 13 | 70≥ |
| OTHER | Maximum Dry Density | NZS 4402:1986 | Test 4.2.2 | WPB12~1.65 t/m³ |
| | | | | WPB7~1.60 t/m³ |
| | Maximum Dry Density | NZS 4402:1986 | Test 4.1.1 | WPB12~1.45 t/m³ |
| | | | | WPB7~1.45 t/m³ |
| | Total Voids % (From Maximum Dry Density Data) | | | >40% |

# PLANNING AND PREPARATION

**Before commencing installation, assess the nature of the project. In particular, consider how Permcon Continuous Permeable Concrete System will manage rain, stormwater and runoff.** On large surfaces, it may be necessary to get the system hydrologically engineered to ensure the pavement can manage the required runoff capacity from a water management point of view. Ensure that each of the following is understood and completed prior to the actual start of the job.

1. LOCATE AND MARK THE AREA TO BE PAVED.

2. **VERIFY THE LOCATION, TYPE AND ELEVATIONS OF EDGING AROUND THE PERIMETER.**

3. EXCAVATE ENSURING THAT THE SUB-BASE FOUNDATION IS APPROPRIATE FOR THE AMOUNT OF TRAFFIC IT WILL BE SUBJECTED TO. The required excavation depth for either the Detention or Infiltration system will need to be calculated based on a combination of Table 1 and the amount of water the system is expected to store (refer to section 2, for the storage capacity of the chosen base material, such as Winstone's drainage aggregate). Ensure the sub grade (soil) is compacted to the specified density and moisture content.

   *Note: Compaction of the soil sub grade should be to a minimum of 5% CBR for pedestrian areas and residential driveways, and a minimum of 10% CBR for vehicular areas. Stabilisation of the soil and/or base material may be necessary with weak or saturated soils, or when subject to high wheel loads. Compaction will reduce the permeability of soils. These conditions may require the use of drains in open-graded bases.*

4. ON SITE SUB GRADE CBR CAN BE DETERMINED BY SCALA PENETROMETER TEST AS PER NZS 4402:1986.

5. **ONCE EXCAVATION IS COMPLETE, ENSURE THAT THE SUB GRADE IS FREE FROM STANDING WATER, UNIFORM AND EVEN.** There should be no organic material or debris on the site prior to the start of the job.

6. WHERE NECESSARY, IT IS ACCEPTABLE TO APPLY BEDDING SAND IMMEDIATELY ON TOP OF THE SUB GRADE [prior to applying the geotextile] in order to even out any undulations/holes on the surface of the sub grade.

7. THE SITE IS NOW READY FOR INSTALLATION.

   *Note: A sloping site will have less storage capacity than a level site as water will resurface at the lowest point. This can be overcome by encouraging crossflow (through the installation of weirs) or concentrating storage capacity at the lowest point of the design. Alternatively, a drainage coil can be incorporated into the design allowing water to disperse to another drainage system.*

# INSTALLATION

## 1. PREPARE SITE

Mark or peg out area where Permcon is to be installed ensuring the relevant erosion and sediment control measures are in place, if required. Excavate to required depth.

## 2. LAY SUB BASE IF REQUIRED AND UNDER DRAIN

If specified, lay sub base over the entire area. If included, lay underdrain (with filter sock, if specified), with 0.5% slope. Connect to stormwater outlet with watertight fit. Backfill carefully over underdrain with 50mm permeable basecourse.

## 3. FIT GEOTEXTILE

Place geotextile over subgrade material, or over impermeable layer and underdrain to prevent clogging by fine sediment in runoff.

## 4. PLACE PERMEABLE BASECOURSE

Place gravel permeable basecourse material to level and depth specified. Permeable basecourse gravel to be washed crushed rock (not scoria) with 30% minimum voids. Place layer of geotextile over permeable basecourse.

## 5. INSTALL FORMWORK

Place formwork to height and dimensions as detailed, ensuring falls as required by the Building Code.

## 6. INSTALL PERMCON

Ensure Permcon permeable concrete is installed by certified PCNZ permeable concrete installers as per PCNZ specification.

## 7. RESTORE SITE

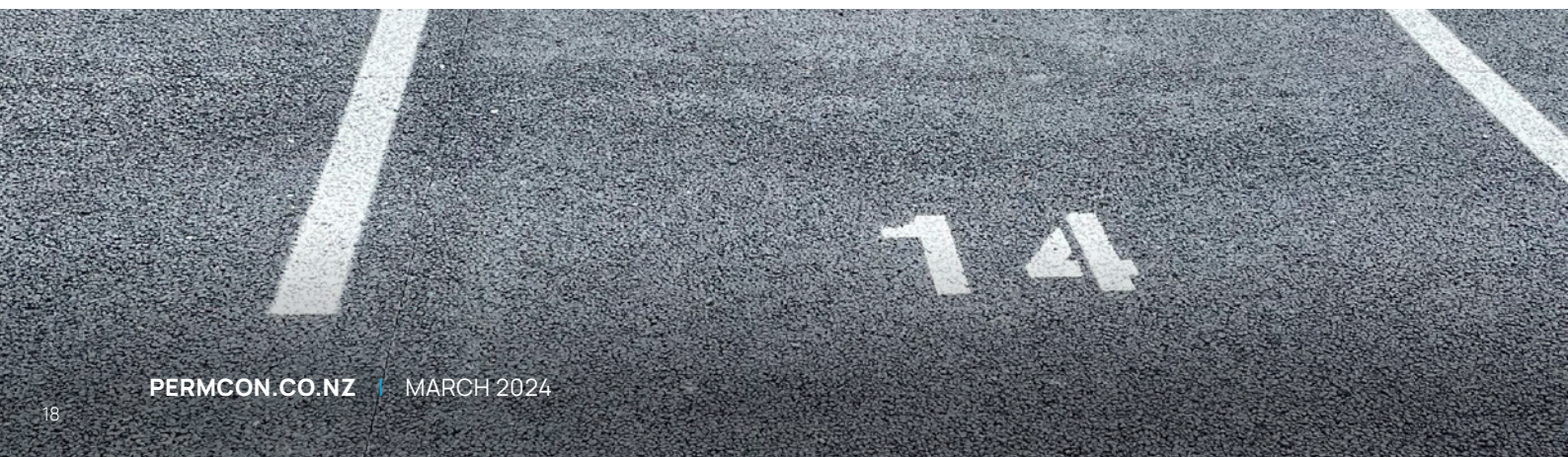
Remove construction materials and reinstate surrounding area, regrassing distrubed areas. Remove sediment and erosion controls. Check underdrain connections to stormwater are clear of blockages.

# DRIVEWAYS, FOOTPATHS AND PATIOS

- **Sweep surface regularly**.
- **In locations where the leaves drop on the pavement**, regular cleaning/blowing of leaves to stop organic sediment decomposing on the surface and joints. This is the most important activity in maintaining your Permcon permeable concrete paving system.
- **Every year** – general cleaning/weed/moss control with a Rotary head cleaner or hosing.
- **Once a year, inspect after a rain event.** If there is standing water or puddles on pavement, then permeability has been compromised, and the local representative should be contacted for information on restorative actions.

# CAR PARKS

- **Every year** – general inspection.
- **Every year** – general cleaning with regen sweep truck or similar.
- **Every ten years** – check the permeability of the system. If the water stands for one hour or has a permeability rate of less than 250mm/hr, proceed with the corrective maintenance.
- **Once a year, inspect after a rain event.** If there is standing water or puddles on pavement, then permeability has been compromised, and the local representative should be contacted for information on restorative actions.



# FREQUENTLY ASKED QUESTIONS

1. **HOW LONG DOES PERMEABLE CONCRETE LAST?**
   Permeable/pervious concrete, when properly installed and maintained, can last 25-30 years.

2. **CAN PERMEABLE CONCRETE CLOG UP?**
   A general maintenance regime of sweeping or surface washing will minimise the opportunity for the product to clog. In situations where this does occur, an industrial vacuum can be used to clear the void.

3. **HOW LONG DOES IT TAKE BEFORE THE SYSTEM CLOGS UP?**
   It's difficult to be specific due to every location being different and dependant on if it's located in the right position and how much sediment there is in the runoff. The location of where Permcon is installed plays an important role with the sediment loading, and hence the life span of the system. Areas that will be subject to organic loading (leaves from trees) should be carefully considered together with a sweeping (without vacuum) regime. Other locations which will have a high clay content in the runoff should be avoided.

4. **WHAT KIND OF AGGREGATES CAN I USE FOR THE BASE COURSE?**
   Drainage aggregates that are structurally sound when fully saturated/submerged with water. Normal GAP types of aggregate are not suitable and will lead to pavement failure.

5. **WHAT IS THE VOID RATIO IN PERMEABLE CONCRETE?**
   The amount of void in permeable concrete can vary in the range of 15-30%. Permcon usually has a consistent void structure of 20-25%.

6. **WHAT IS THE TYPICAL INFILTRATION RATE FOR PERMCON AND HOW DOES THIS COMPARE TO RECOGNISED STANDARDS?**
   Permeable pavements have a very high permeability and are approximately tenfold the requirement to allow for sediment loading to achieve longevity.

7. **HOW CAN I TEST THE PERMEABILITY OF MY PAVEMENT SYSTEM?**
   One of the test methods is ASTM C1701/C 1701M -09 'Standard Test Method for Infiltration Rate of In Place Pervious Concrete'. It is simple and easy to conduct in on site locations.

8. **CAN PERMEABLE CONCRETE BE PUMPED INTO AN INSTALLATION?**
   Like traditional concrete, there are a variety of different methods used to install the product. However, given that permeable concrete is a low slump product, it cannot be pumped into place like traditional concrete.

# CONTACT DETAILS

## NEW ZEALAND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# OUR MARKET FOCUS

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