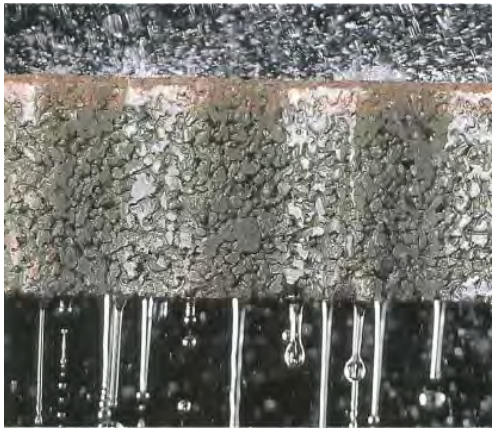
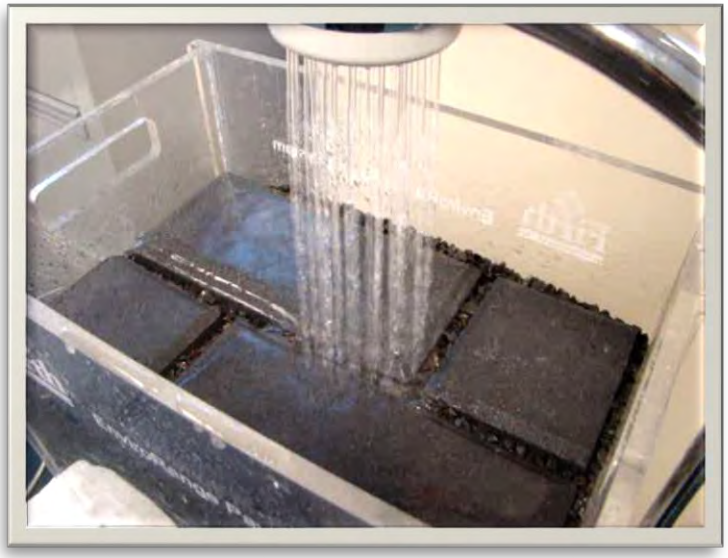
Permeable Pavements





By Stuart Girvan

Topics

- Permeable systems available in NZ
- Pervious Concrete as a wearing course
- Maintenance of permeable pavement update
- Stormwater documents update
- Specifying Paving
- Helpful documents/papers

Permeable Paving

Advantages of the Permeable Pavement Systems

- **Reduce rainfall runoff** from hard surfaces, decreasing the demand on drainage systems.
- **Recharge natural ground** aquifers when using the infiltration system.
- Improved hydrological management of **storm water peak flow** by holding and releasing in a controlled manner.
- **May filter runoff water** by removing heavy metals such as Zinc and Copper through cationic exchange when using greywacke base course aggregates.
- **Reduce the need for retention structures** (e.g. ground sumps, ponds or dams) and maximise land use by retaining water within the system.
- This process can also assist in **reducing the temperature of the run off water** before it reaches the rivers

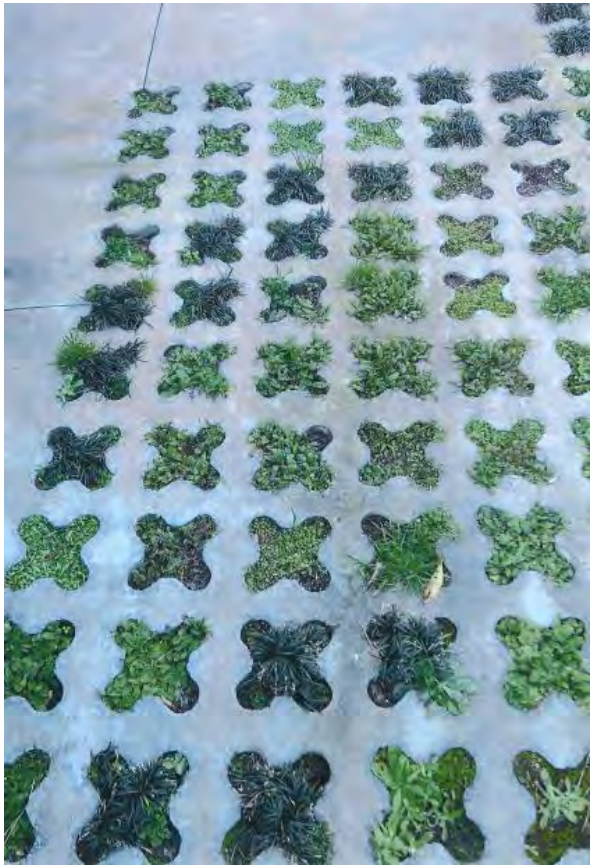
Types of Applications Suitability

Single base course system for the residential market for:

Driveways
Walkway / patio
Light vehicular parking
Access roads into Townhouse developments

Permeable Pavement Surfaces

Cast on site cellular reinforced concrete system with voids created by plastic void formers.

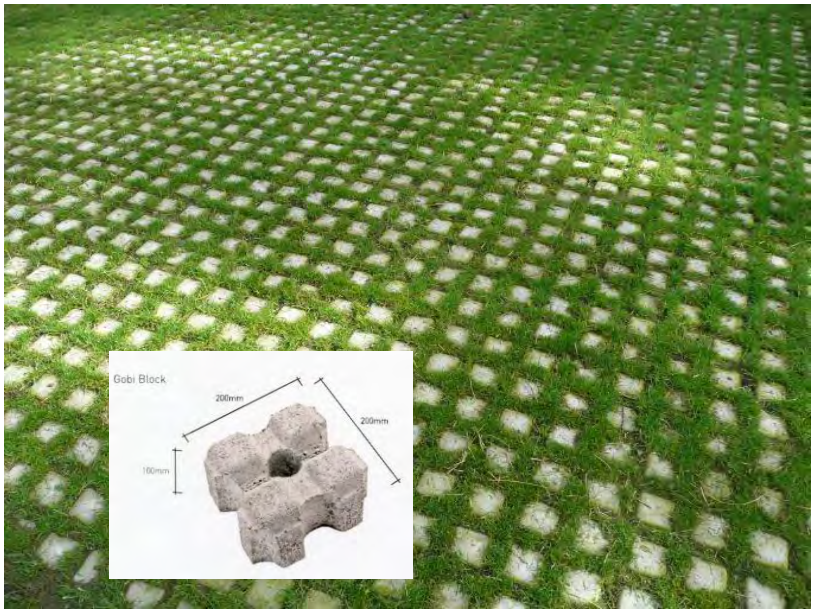


Suitable for light and heavy vehicles.

Permeable Pavement Surfaces

Suitable for light vehicles only.

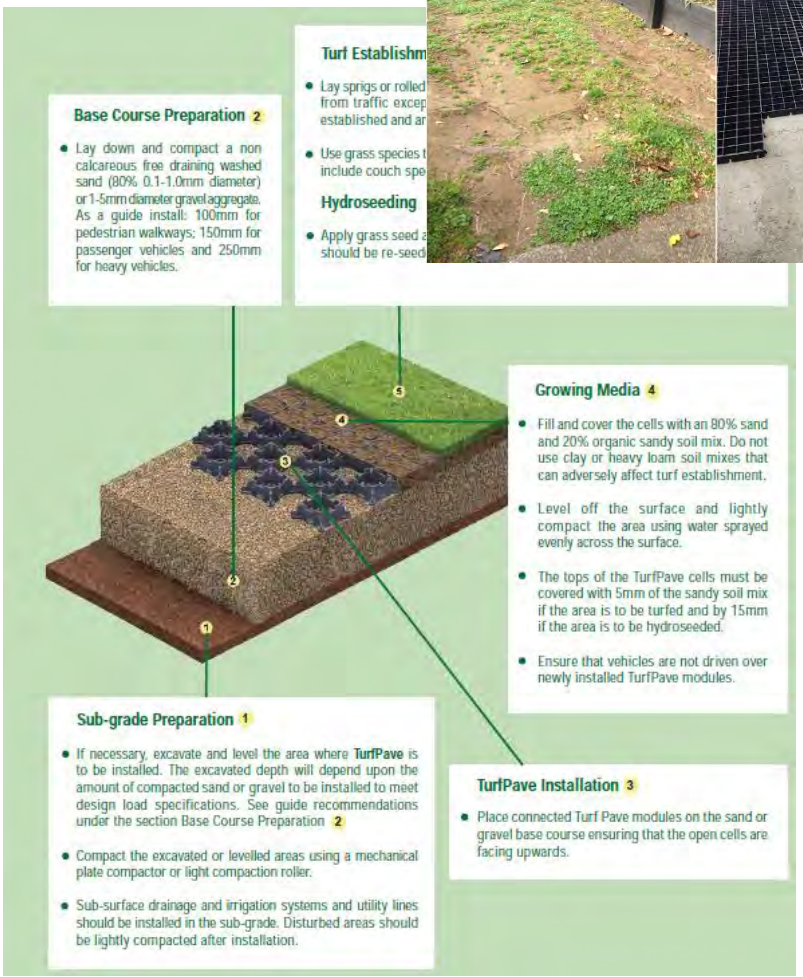
Concrete Grass Pavers



Suitable for light vehicles and occasional medium size trucks.

Permeable Pavement Surfaces

High strength plastic module



Suitable for light vehicles.

Permeable Pavement Surfaces

Pervious Concrete

Suitable for light vehicle applications. Driveways parking areas footpaths.

No NZ standards for production and installation

Permeable Pavement Surfaces

Coloured and Sanded Pervious Concrete

Permeable Pavement Surfaces

Resin Bound Aggregate.

Suitable for
light vehicles.

Permeable Pavement Surfaces

Suitable for light vehicles.

Ceramic permeable pavers

Product compressed at 1600 tonnes and baked at 1200° C.

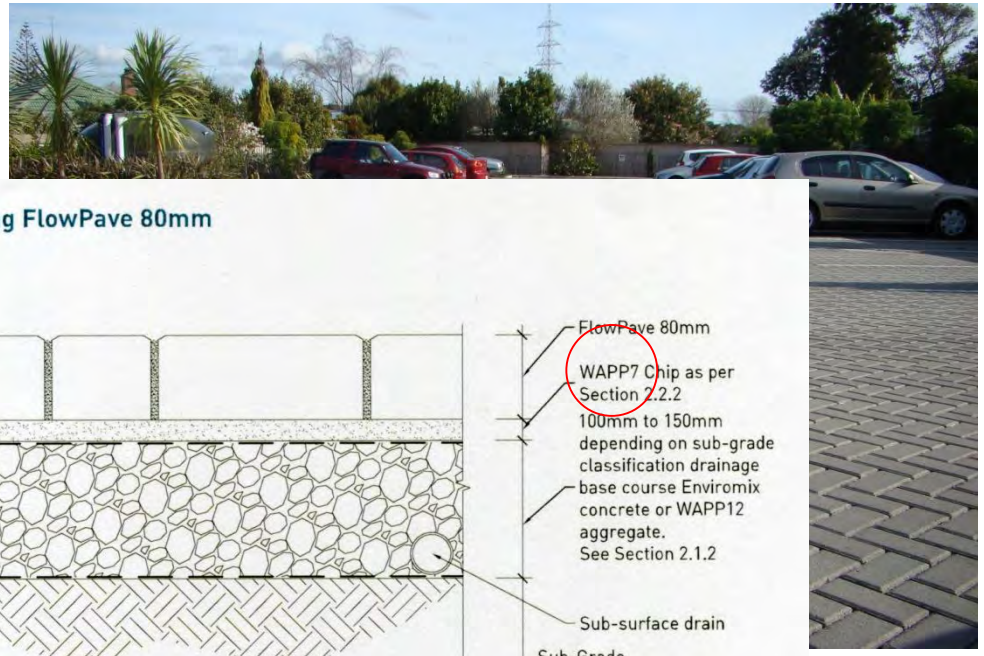
Permeable Pavement Surfaces

Suitable for light vehicle applications. Driveways parking areas footpaths.

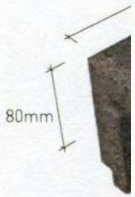
Concrete Pavers

Installation Guide

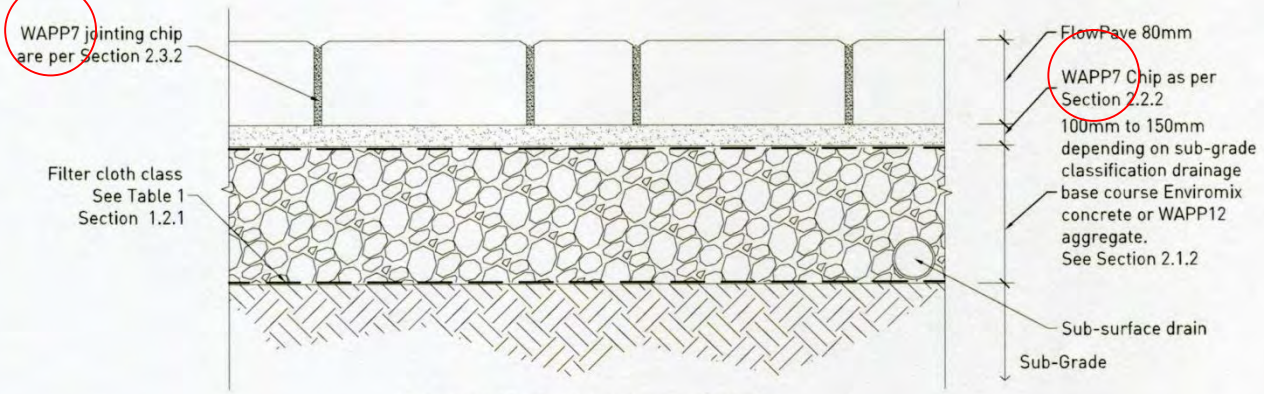
Permeable Surfaces Available



Firth FlowPave
Number per m²: 5(
Manufactured in 8(



1.2.4 Installation Cross section drawing FlowPave 80mm



Note: Weak Sub-Grade requires specific design

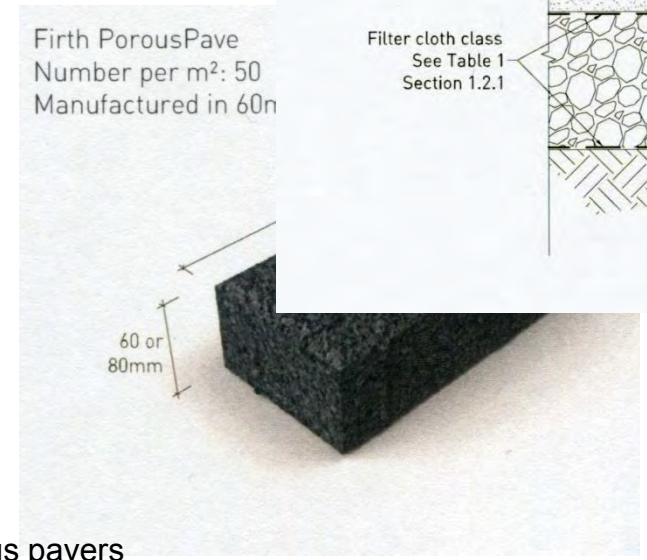
Solid pavers wi
Application: Ca
driveways, roads in town house developments

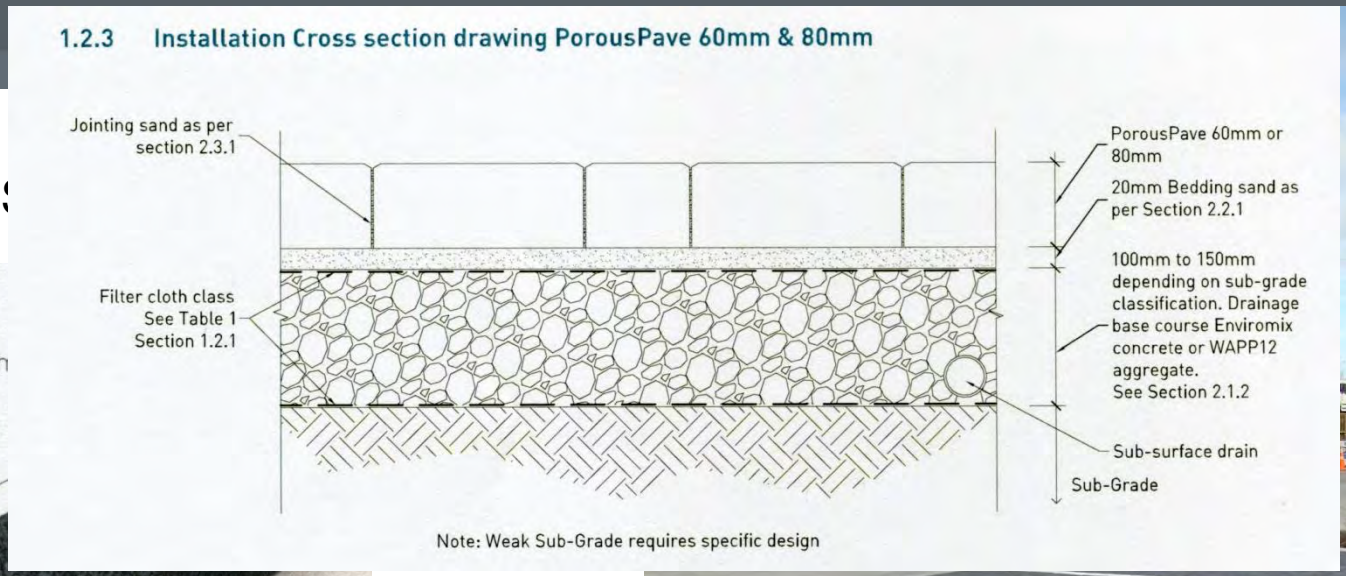
Laid on drainage chip with the same in the joints

Paver Compliance: NZS3116:2002
Table 1, application 4, Roads

Installation Guide

Permeable S





Porous pavers
(similar to a no fines Concrete)
Laid with bedding sand and joint sand

Application: Car parks, Driveways, roads in town house developments
Paver Compliance: NZS3116:2002
Table 1, application 4, Roads

Permeable Sub Base

Materials below the Permeable Surface

Permeable Sub Bases

Types of permeable Base Course:

1. No fines concrete.
2. Suitable drainage aggregate that will perform under loading when fully saturated. WAPP12

NB Permeable pavers need to be laid on a suitable permeable base course, not normal GAP type aggregate as the pavement will fail soon as the water gets into it. NB

Installation

Permeable aggregates behave differently when compacted:

My experience is that mechanical rollers with and without vibration don’t work.

Installation

Plate compactors do work but too many passes and the top layer of the aggregate vibrates loose.

Maintenance of Permeable Pavement Update

Remember !!!

Be careful of organic sediment (leaves) as we are finding they are the most detrimental sediment to the systems. Customers must be made aware to use leaf blowers in Autumn months.(Covered in Ecopave Maintenance Plan)

Maintenance of Permeable Pavement Update

Remember !!!

Timing of Installation

Plan the installation of the pavement till after any heavy earthmoving operations to avoid tracking mud into the system or take measures to protect it.

Maintenance of Permeable Pavement Update

- Infiltration rates of permeable paving decreases with time
- Regular cleaning prolongs life of infiltration rates
- Sweeping of pavers bi annually for smaller drive patio areas
- Use of regen sweep trucks on larger areas
- If infiltration rates are badly compromised a wash and vacuum using the new Hydrovac cleaning head can be undertaken, involves removal and replacement of existing jointing material. (No need to uplift paving)

Ecopave Permeable Paving Maintenance Plan

Eco Pave Permeable Paving Maintenance plan

For small "In Lot" installations (such as driveways)

- End of first year and every ten years- top up joint chip or sand between pavers May 2016
- Organic sediment (leaves, pine needles etc). 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 permeable pavement**
- Every year- general cleaning/weed/moss control with a
  Rotary head cleaner or hosing

0800 Karchar

- Assume no corrective maintenance to uplift and dispose of bedding sand and geotextile due to low contamination levels

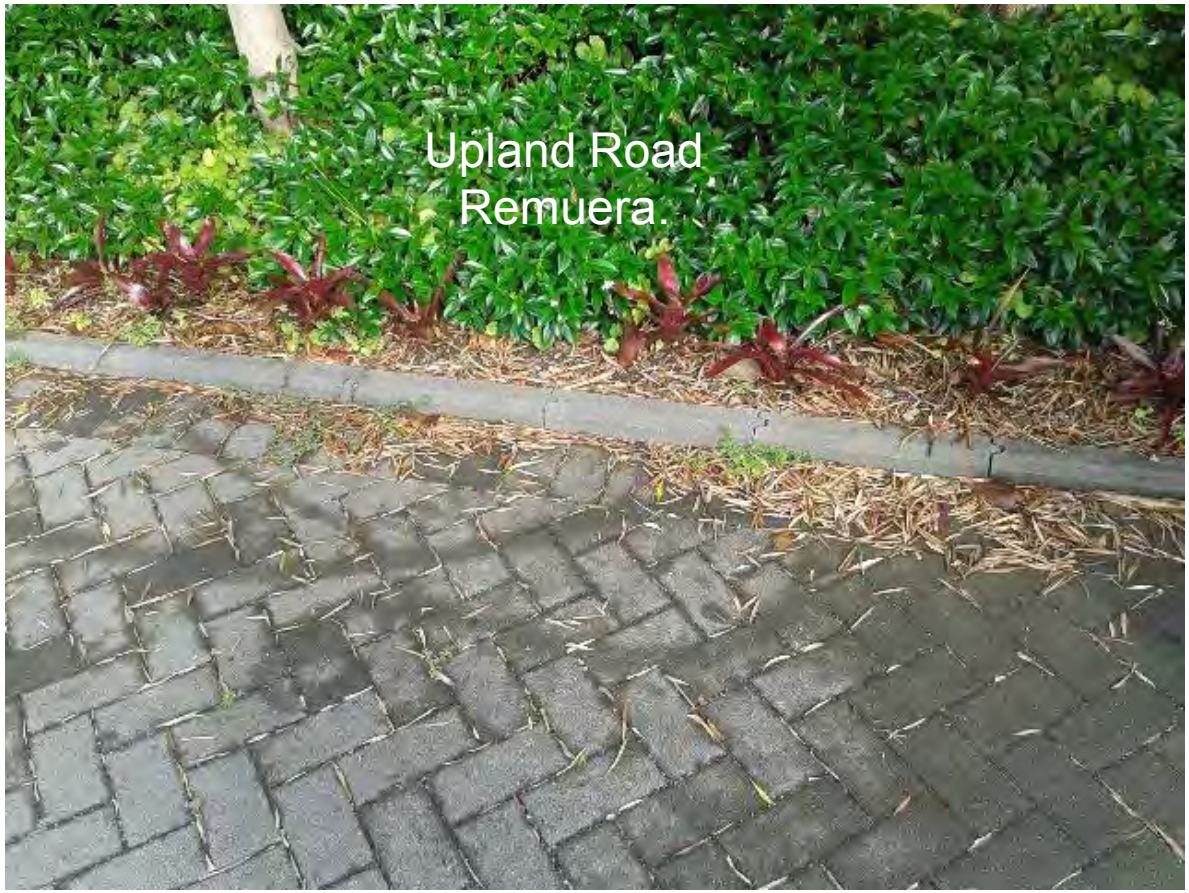
Ecopave Permeable Paving Maintenance Plan

For Larger installations (such as parking lots of +- 1000m2)

- End of first year and every five years alternating with 10 year corrective maintenance – Top up joint chip or sand between pavers.
- Every year – general inspection
- Every year General cleaning/weed/moss control. (Rotary head cleaning system.)
- Every ten years – check the permeability of the system. (Firth offer a free service for testing) If the water stands for 1hr or has a permeability rate of less than 250mm/hr proceed with the corrective maintenance which involves the extraction of joint chip or sand and replacement using Hydrovac cleaning system.

HydroVac ENVIRONMENTAL SUPPORT 0800 004 331

Cleaning Permeable Surfaces



Residential driveway 12yrs old never been cleaned. Organic sediment.

Tested at 10 yrs permeability 310mm/hr.

Council requirement 120mm/hr

Cleaning Permeable Surfaces

New Cleaning Head designed with Hydrovac specifically to clean permeable pavers and pervious concrete. After cleaning permeability rate 5,500mm/hr

For more information read “The long-term performance of Pervious Paving paper”

Stormwater Documents

https://admblog.co.nz/two-key-stormwater-documents-are-now-live-on-the-adm/

Stormwater Documents

Revised SWCoP - Stormwater Code of Practice

Chapter 4 of Auckland Councils Code of Practice for land development & sub-division (minimum standards for design and construction of stormwater systems)

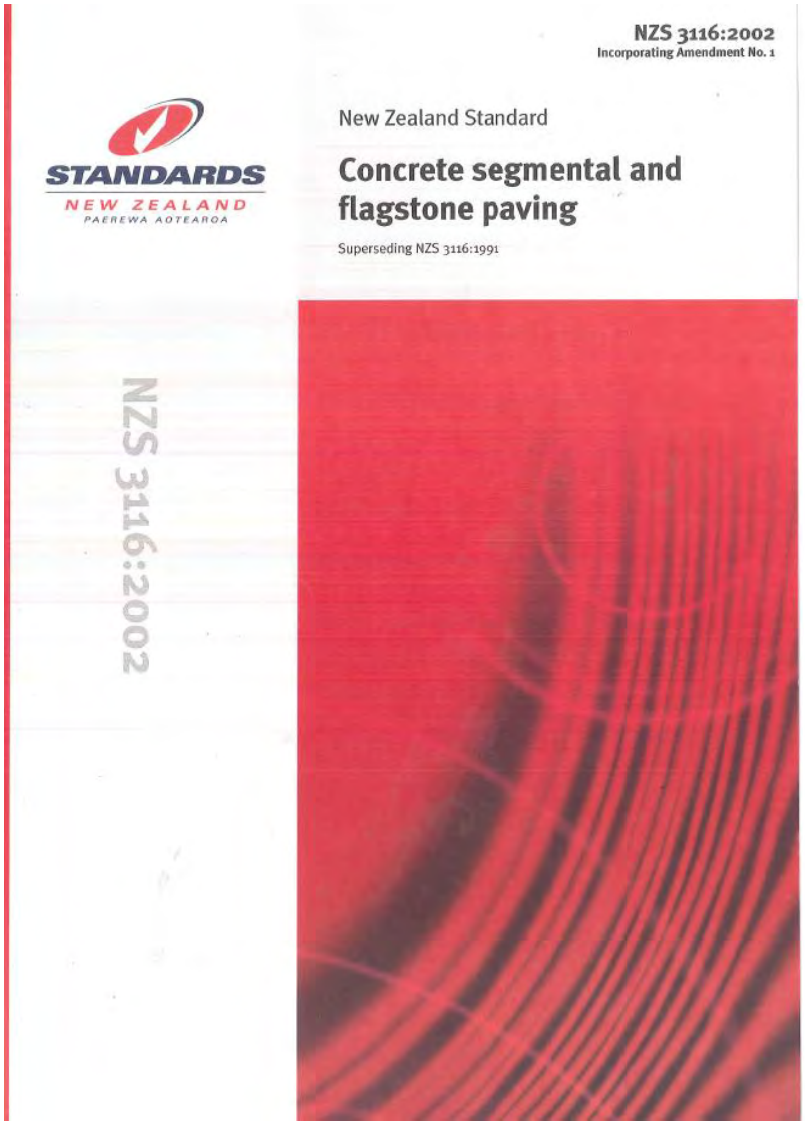
GD04 introduces the principles and objectives of Water Sensitive Design to help guide a design for land development

SWCoP and GD04 are currently supported by the Auckland Regional Council technical publication TP10

but

GD01: Stormwater Management in Auckland region is currently being developed and will replace TP10

Specifying Paving



When specifying paving refer to NZS3116:2002 for all aspects of the products, materials and installation.

Specifying Paving

The plan size of the products are classified in two tables

101.5

Pavers used in this Standard are of a plan size not exceeding 0.08 m^2, a width to length ratio not exceeding 2 and thicknesses ranging from 40 mm to 80 mm.

Table 1

Flagstones used in this Standard are of a plan size exceeding 0.08 m^2, a width to length ratio not exceeding 2 and thicknesses ranging from 40 mm to 60 mm.

Table 1A

So basically a 300x300 paver and larger are considered a Flagstone which is Table 1A

Specifying Paving

Strength

Table 1 – Paver selection

Applications	Characteristic breaking load (1) (kN) per 100 mm width	Minimum thickness (2) (mm)	Shape (3)	Dimensional tolerances (4)	Edge detail (5)	Abrasion resistance (6) at 56 days mean	Minimum slip resistance classification (8)
Relevant AS/NZS	**4456.5**	–	–	**4455/4456.3**	–	**4456.9**	**4586**
1 **Residential** Pedestrian	3.0	40	Any	DPB1	SQ/SC/R/CH	Not required	W
2 **Residential driveways** Light Traffic	5.0	50	Any	DPB2	CH/R	Not required	W
Medium Traffic	Follow provisions of application 4 Roads: Minor						
3 **Public footpaths**							
Low Impact	5.0	50	Any	DPB2	SQ/SC/CH	6.0	W
High Impact	5.0	50	Any	DPB2	SQ/SC	3.5	W
4 **Roads**							
Minor	6.0	60	Rr/Dd	DPB2	CH	Not required	W
Local	12.0	80	Rr/Dd	DPB2	CH	Not required	W
Main	12.0	80	Rr/Dd	DPB2	CH	Not required	W
5 **Industrial pavements**	Specific engineering design (7)	80	Rr/Dd	DPB3	CH	See Note (7)	W

NOTES to table 1

(1) The characteristic breaking load to AS/NZS 4456.5, as amended by clause 202(b), is carried out on a 150 mm actual paver width in mm. The figures quoted are based on a 100 mm width, i.e. actual breaking load x the ratio of 100 mm divided by the actual paver width mm. The modulus of rupture value of any

Specify commercial mix in tender document

High heel shoes are the most abrasive

Specifying Paving

Strength

Table 1A – Flagstone selection

Pavement applications	Characteristic breaking load kN per 100 mm width (1)	Nominal size (mm)	Minimum thickness (mm)	Dimensional tolerance (2)	Flatness tolerance (mm)	Edge detail (3)	Abrasion resistance at 56 days (mean) (4)	Minimum slip resistance (5)
Relevant AS/NZS	**4456.5**	–	–	**4455/4456.3**	**4456.19**	–	**4456.9**	**4586**
1 **Residential pedestrian**	2.6	600x600	40	DPB1	2.5	SQ/SC/CH	Not required	W
		500x500	40		2.2			W
		450x450	40		2.0			W
		400x400	40		1.5			W
		300x300	40		1.0			W
2 **Residential driveways** Light Traffic	3.8	300x300	60	DPB2	1.0	CH	Not required	W
3 **Public footpaths**	3.8	450x450	60	DPB2	2.0	SQ/SC/CH	Low impact 6.0	W
Low Impact		400x400	60		1.5		or	W
High Impact		300x300	60		1.0		High impact 3.5	W

Note: nothing bigger than 300x300x60 for driveway

Specify commercial mix in tender document

"How to lay Flagstones on a concrete slab"

Related information

- Pervious Concrete Trials in New Zealand paper
- The long-term performance of Pervious Paving paper
- Ecopave Permeable Paving Maintenance plan
- How to lay Flagstones on a mortar bed on a concrete slab
- PDF copy of this presentation

Currently talking with Auckland Council and software designer in the USA about the “Design Pro” package to assist with Permeable Pavement Designs.

ICPI's Permeable Design Pro Software for Permeable Interlocking Concrete Pavement (PICP) Design that integrates hydrologic and structural solutions.
Provides base thickness solutions from calculating PICP inflow/outflow and traffic loads.
Design sustainable storm water management with PICP for pedestrian areas, parking lots, alleys and streets.