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PermCalc

PERMEABLE PAVEMENT DESIGN SUGGESTION

built on relationships

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DATE: **6 Jul 2017 12:10 PM**

Notes:-

This design suggestion is given on the basis that the recipient has read, understood and accepts the disclaimer at the end ofthis document.

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Brett Landscaping and Building Products is a trading name of Brett Landscaping Limited
Registered Company No: 227266

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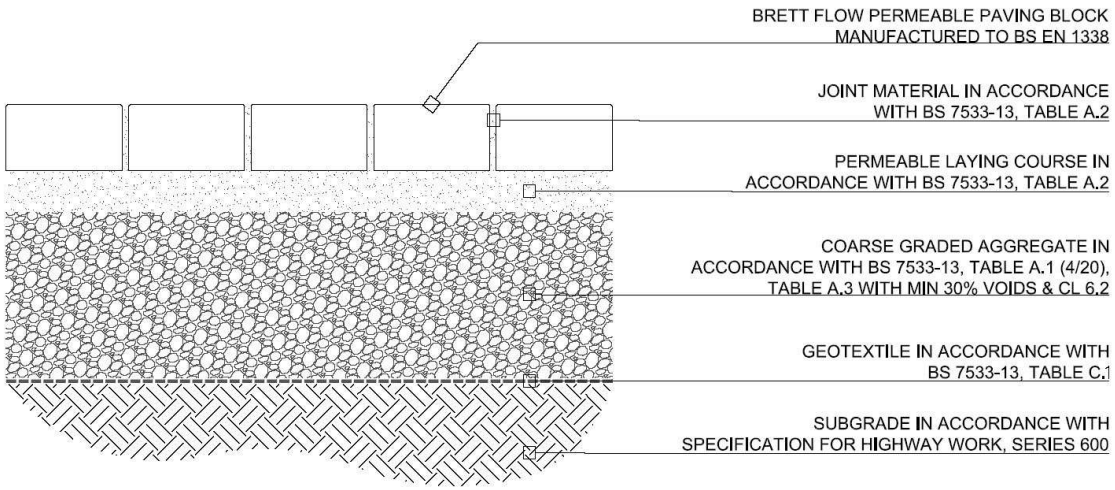
Suggested Pavement Solution

Permeable Pavement Design Suggestion

Alpha Flow	60 mm
Laying Course	50 mm
Coarse Graded Aggregate	250 mm
Lower Geotextile	Yes

System A



Summary of pavement requirements

Depth needed for Structural design	250 mm
Depth needed for hydraulic design	80 mm
Is there spare hydraulic capacity	Yes
Spare hydraulic depth	170 mm
Additional catchment area to fully ultilise spare hydraulic storage capacity	26 m²

Summary of hydraulic requirements

Available hydraulic storage	980 litres
Hydraulic storage require	310 litres
Spare hydraulic storage	670 litres
Half empty time	3.10 hours

Notes

The above calculations were based upon a level site.

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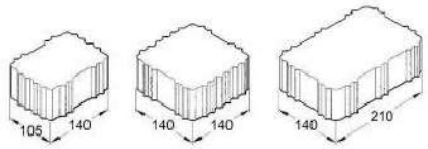
Block Specification

Alpha Flow Permeable Block Paving

Q24 12 115 117 119



Alpha Flow Block Plan Dimensions

Paving block available in three sizes specifically designed to create the appearance of a traditional aged pavement whilst the interlocking nib design provides enhanced permeability rates for use within Sustainable Drainage Systems.

Alpha Flow blocks come with a number of complimentary products including circle packs and kerbs as well as an impermeable option which can be machine laid.

The Alpha Flow range is manufactured and tested to comply with BS EN 1338: 2003.

When tested to BS DD 229: 1996 for Surface Permeability Alpha Flow achieved 3386 mm/h.

Brett Landscaping operate an integrated management system covering accreditation to BS EN ISO 9001: 2008 Quality Management System, a BS EN ISO 14001: 2004 Environmental Management System as well as an OHAS 18001: Health and Safety Management System.

Since 2010 Brett Landscaping also hold BES 6001 Responsible Sourcing of Construction Products certification to 'Very Good' which feeds into BREEAM along with the typical A+ / A Green Guide Rating for concrete block paving constructions.

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Permeable Construction Materials

Permeable Construction Materials	Quantity	Unit
Alpha Flow 60 mm	13.0	m²
Jointing aggregate	0.1	ton
Laying course	0.8	ton
Course Graded Aggregate	4.2	ton
Lower geotextile	18.2	m²

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Summary of design information

Site

Adjacent paving area draining onto permeable pavement	0 m²
Roof water draining onto Permeable Pavement	0 m²
Permeable area	13 m²
CBR Value	5%
Is there any history of pollution on site?	No
If so what is the classification of the waste material?	n/a
Has the water table been recorded within 1000mm below the top of formation? or Risk of contaminated water? or Sub grades susceptible to water infiltration and/or repeated loading?	No

Loading

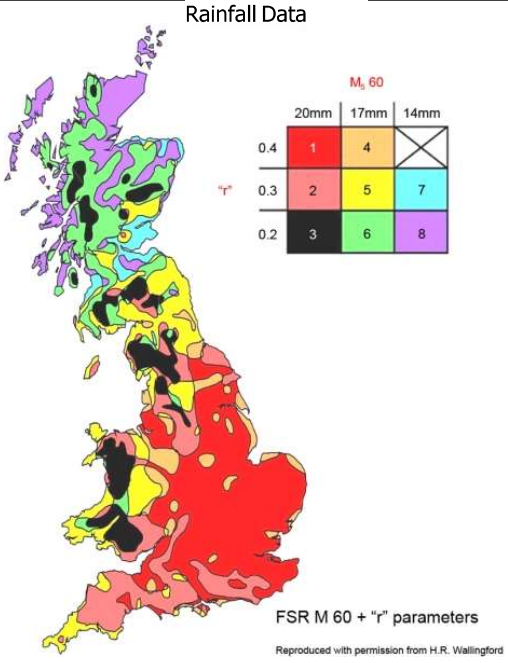
Traffic Loading category	Category 1, Zero Standard Axles
Is a DBM layer required for construction traffic to run on ?	No

System

Type of system	System A
Coefficient of permeability k (m/s)	0.0000010 m/s

Water Storage

Rainfall Data



Area Selected	2	M5-60 = 20mm, 'r'=0.3
Design return period	1 in 10 year event	
% for climate change	0%	

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Additional Comments

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Additional Comments Continued

Code for Sustainable Homes (CfSH)

The Code for Sustainable Homes is an environmental assessment method for rating and certifying the performance of new homes in England and Wales. It is a mandatory standard for use in the design and construction of new homes and is aimed at encouraging continuous improvement in sustainable home building as we move towards the target of Zero Carbon homes.

The Code for Sustainable Homes defines targets across a wide spectrum of new home construction and the use of permeable paving solutions can help to gain a significant number of points for the designer.

The most obvious of these comes from Category 4: Surface Water Run-off. This is a mandatory category and requires surface water drainage for housing developments which avoid, reduce and delay the discharge of rainfall run-off to watercoarses and public sewers using Sustainable Drainage techniques (SUDS). This will thereby protect receiving waters from pollution and minimise the risk of flooding as well as other environmental damage in watercoarses.

Compliance with Category 4 provides up to two credits, more importantly a failure to comply will render the whole project as unable to comply with the Code.

Additional credits can be achieved from other areas:

- One credit can be awarded by ensuring that there is no discharge from the developed site for rainfall depths up to 5 mm.
- One credit can be awarded by ensuring that the run-off from all hard surfaces shall receive an appropriate level of treatment in accordance with the CIRIA SUDS Manual to minimise the risk of pollution.
- Permeable paving can also be combined with other technologies such as water recycling or the development of natural habitats where it can play a part in improving the Code rating of the completed site.
- As a business Brett Landscaping are also able to supply information on the installation, operation and maintenance requirements of any permeably paved areas in a new development. This will then feed into the Site Management Plan which can help to gain additional points for the completed site.

These areas, allied to the typical A+ / A Green Guide Rating for concrete block paving products mean that these products can significantly help the developer to maximise the Code for Sustainable Homes rating for their project. Our Technical Support Team are always willing to assist in this aspect of design:

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Overview of PermCalc Software

Introduction

Concrete block permeable pavements have a dual role acting as the drainage system as well as supporting traffic loads. They allow water to pass through the surface (between each block) and into the underlying permeable sub-base (either coarse graded aggregate and/or hydraulically bound coarse graded aggregate) where it is stored and released slowly, either into the ground, to the next SUDS management stage or to a drainage system. In the case of System C, no infiltration, the water captured can be harvested, as encouraged by the Code For Sustainable Homes.

Pavement Types

There are three principal systems suitable for concrete block permeable pavements – described as Systems A, B and C as defined in BS7533:13 *Guide for the design of permeable pavements constructed with concrete paving blocks and flags, natural stone slabs and setts and clay pavers*, published by the British Standards Institute.

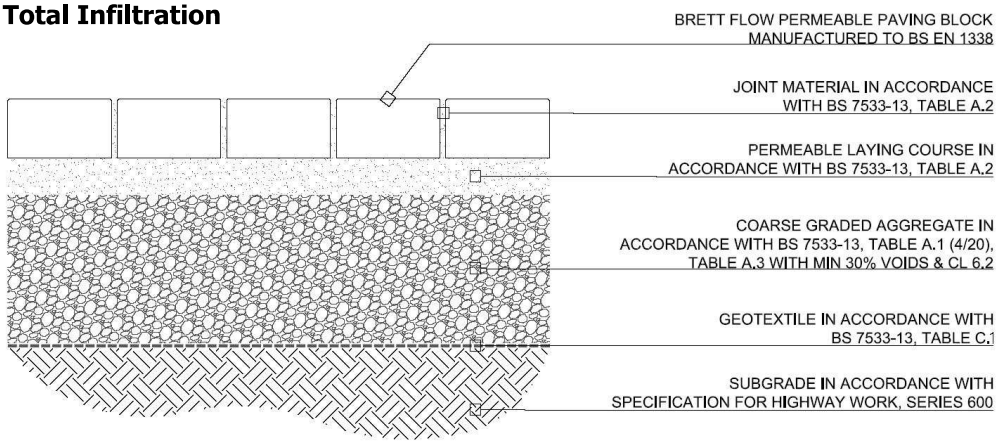
PermCalc can provide design suggestions for System A or System C permeable pavements.

System A is sometimes known as 'Zero Discharge' or total infiltration. This system allows all surface water on the pavement to infiltrate down through the joints between the blocks, passing through the sub-base layers below and eventually into the subgrade. Some retention of water will occur temporarily in the permeable sub-base layer allowing for initial storage before eventually infiltrating into the subgrade.

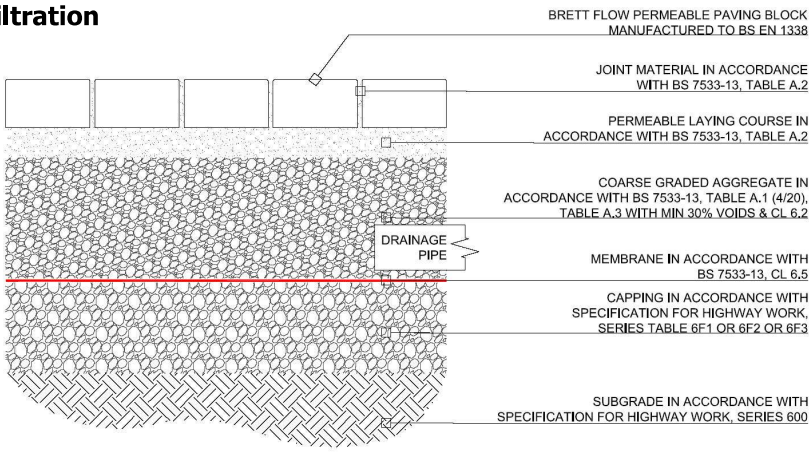
System C is sometimes known as no infiltration. This system allows for all surface water on the pavement to infiltrate down through the joints between the blocks, passing into the sub-base layers below complete, complete capture of the water is achieved using an impermeable, flexible membrane placed on top of the subgrade and up the side of the permeable sub-base to effectively form a storage tank.

System C is used in situations where the existing subgrade has a low permeability or low strength and would therefore be damaged by the introduction of additional water. It can also be useful for water harvesting or to prevent water soaking into the ground in sensitive locations such as water extraction zones. Outlet pipes are constructed through the impermeable membrane at suitable locations to transmit the water to sewers, watercourses or other parts of the SUDS management train.

System A - Total Infiltration



System C - No Infiltration



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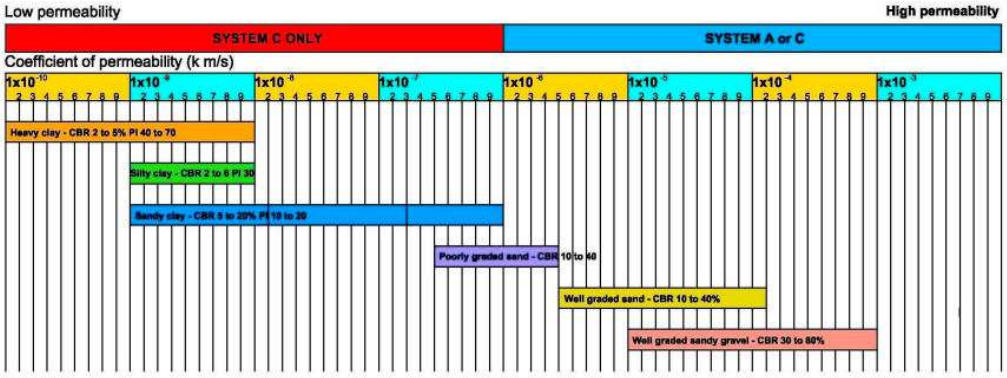
Selection of a Pavement System

One of the key criteria in selecting a pavement system is subgrade permeability which is established from appropriate tests on site.

The tables below give guidance on the appropriate selection of pavement systems (Systems A or C) for a range of sub-grade permeability, level of water table and the presence of pollutants in the ground.

		System A Total Infiltration	System C No Infiltration
Permeability of subgrade Coefficient of permeability k (m/s)	10^{-6} to 10^{-3}	✓	✓
	10^{-10} to 10^{-6}	✗	✓
Highest recorded water table within 1.0m of the formation level		✗	✓
Pollutants present in the ground		✗	✓



Design Methodology

Permeable pavements must be designed to achieve two aims:

Support the traffic loads over the design life of the pavement (structural design) and manage surface water effectively (hydraulic design). Therefore it is necessary to undertake a structural design and a hydraulic design and select the greater thickness of the permeable material from these calculations to determine the design thickness of the pavement. PermCalc automatically selects the design thickness.

Summary of the Permeable Pavement Design Procedure

Structural Design

- Assessment of traffic loading pre and post construction
- Assessment of sub-grade Californian Bearing Ratio (CBR) value
- Determination of sub bases thicknesses and material types
- If temporary access for construction traffic is to be provided, determination of the thickness of dense bitumen macadam (DBM)

Hydraulic Design

- Assessment of sub grade permeability *k*
- Selection of System A or System C
- Determine return period and rainfall characteristics
- Determine sub base thickness for water storage
- Allow for additional run off from adjacent areas and or roofs
- Check and if necessary increase the sub base thickness to allow for slopes
- Check and if necessary increase the sub base thickness to allow for a DBM layer

Select the greater permeable thickness

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Brett Landscaping Ltd Design Disclaimer:

The PermCalc Permeable Pavements Design Calculator, the property of Brett Landscaping is provided as a tool to provide permeable pavement design suggestions. It is not a substitute for engineering skill and judgment and in no way replaces the services of a suitable professional, experienced, competent designer or engineer.

The calculation methodology is based upon the information given in BS7533:13:2009 *Pavements constructed with clay, natural stone or concrete pavers Part 13: Guide for the design of permeable pavements constructed with concrete paving blocks and flags, natural stone slabs and setts and clay pavers*, published by The British Standards Institute.

The notes for guidance used within this tool have been taken from the Interpave document 'Permeable Pavements: Guide to the Design Construction and Maintenance of Concrete Block Permeable Pavements Edition 6'. If further clarification of any points is required the complete guidance document can be downloaded at no cost from http://www.paving.org.uk/permeable.php

To determine the hydraulic storage requirements of a permeable pavement, it uses mapping information supplied by HR Wallingford Ltd. Whilst Brett Landscaping has used all reasonable efforts to ensure that the information contained within PermCalc is accurate, up to date and complete at the date of publication, no representations (expressed or implied) are made as to the accuracy, reliability, or completeness of such information. Brett Landscaping and HR Wallingford Ltd cannot be held liable for any loss arising (directly or indirectly) from the use of, or any action taken in reliance on, the information contained within PermCalc or any output performance report generated from PermCalc.

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