April 2012





# paving for rain



## responsible rainwater management around the home – guidance for householders

Interpave

THE PRECAST CONCRETE PAVING AND KERB ASSOCIATION

www.paving.org.uk

# Introduction

**When you are planning a new drive, patio or path for your garden, you probably don't think about where the rainwater landing on it will end up. But taking a responsible approach to drainage is important to help in the fight against flooding and pollution – and also to meet new rules, which could otherwise result in action by your local authority or make selling your home more difficult.**

## How to use this Guide

**Part 1** explains the rules, why we need them and how you can make the most of sustainable, precast concrete paving around your home to satisfy them and still create a beautiful garden. It also tells you where to get help with choosing the right paving products and installers, as well as what to look out for to make sure they meet the rules.

**Part 2** provides more detailed design and construction guidance for designers and domestic paving contractors, as well as experienced DIY enthusiasts. It covers alternative sustainable drainage solutions using precast concrete paving based on design calculations using sound engineering principles.



# About Interpave

Interpave is the trade association for precast concrete paving and has been involved with sustainable drainage and permeable paving from the start, working alongside governmental and other organisations. In fact, the government's 'Guidance on the permeable surfacing of front gardens' refers specifically to the Interpave website and guidance. We represent leading concrete paving manufacturers and you can find more about them and their latest products to make the most of paving around your home on our Domestic website at **www.paving.org**.uk or via the links below.

| | |
|---|---|
| Brett – built on relationships | **http://www.brett.co.uk/landscaping** |
| CEMEX | **http://www.cemex.co.uk** |
| CHARCON | **http://www.aggregate.com** |
| Hanson HEIDELBERGCEMENT Group – Formpave | **http://www.heidelbergcement.com** |
| Marshalls | **http://www.marshalls.co.uk** |
| Plasmor CONCRETE PRODUCTS | **www.plaspave.co.uk** |

# Background

**To begin with, it's worth explaining what the problems are with drainage today, how they came about and why the government has introduced new rules to solve them.**

## What's wrong with our drainage?

Continuing growth of our towns and cities is causing an increasing amount of rainwater to be captured on streets, car parks, building roofs and drives, and to flow into sewers causing flooding of rivers and streams. Existing drainage systems cannot cope. This problem is even worse during heavy storms and more of them are predicted in future with climate change.

## Why are our rivers and streams polluted?

Roads, car parks and even driveways collect pollution – from car exhausts, tyre-wear, oil leaks and other sources – and when it rains this gets washed into sewers, rivers and streams. Older 'combined sewers' carrying both rainwater and 'foul water' from toilets, baths, sinks, etc., often have overflows that operate in heavy rain, diverting all the flows – including raw sewage – into rivers and streams. With more rainwater running into these sewers, the overflows operate more often.

## What other problems are being caused?

'Sealing up' our towns and cities stops rainfall soaking into the ground. The water table levels drop causing more water shortages, streams and ponds to dry up, and trees to be deprived of water. It could also affect the foundations of your home, particularly on clay soils, as they dry out and shrink.

## What difference could your drive make?

All these problems are made worse if you cover your garden with impermeable paving and just let the water run straight onto the road or connect into the sewers. Of course, a small area of paving in isolation is not going to cause major flooding – but it is the cumulative impact of lots of gardens being sealed up that creates real problems. For example, the area of paving in front gardens for car parking that has already occurred in London is estimated as equivalent to around 5,200 football pitches. Just imagine the rainwater runoff in a storm from impermeable paving that big.



## Why do we need to act now?

Climate change means more frequent and heavy rainstorms, particularly in summer.

Simply allowing rainwater to run straight off roofs and impermeable paving into drains is no longer an option. Remember the summer floods of 2007? The Environment Agency estimated that over two thirds of the 57,000 homes affected were flooded not by swollen rivers but by water running off paving or overloaded sewer systems.

## So, what can be done about it?

It is now well recognised that Sustainable Drainage Systems (or SuDS) technology must play an essential role in curbing flooding and pollution from rainwater runoff. SuDS manages surface water by slowing it down (known as attenuation) and cleaning it up (by filtering). It uses techniques that aim to replicate, as closely as possible, the natural drainage from a site before any building work or paving took place.

# The New Rules

**A government-backed report (The Pitt Review) which looked at the 2007 summer floods and government strategy (Future Water) both made various recommendations for use of SuDS and new controls to paving and drainage – some affecting private gardens and drives. These recommendations have been taken up with changes to planning rules in both England and Scotland.**

### How will SuDS be implemented?

For some time now there has been wide-ranging encouragement to use SuDS. Government planning policy throughout the UK already requires SuDS on all developments wherever possible, as does the new draft 'National Planning Policy Framework', and SuDS are an important part of the 'Code for Sustainable Homes'. The new Planning Permission rules aim to apply simple SuDS techniques to paving around existing homes and they, along with Interpave's guidance, are based on established SuDS principles.

## Planning Permission

Before the changes, paving anywhere in a garden with any aggregates was considered to be 'permitted development' – effectively, an automatic planning permission without needing a planning application. The changes take away permitted development rights from new or replacement drives or other paving between a house and the street, unless it is permeable paving or drains water onto a permeable garden area within the property. Otherwise, you will need to apply for planning permission.

In England, these measures took effect in October 2008 and apply to new or replacement of existing paving:

- over $5m^2$
- in the front garden only.

In Scotland, similar measures apply to work initiated after 6 February 2012 and apply to new or replacement of existing paving:

- of any size
- between the house and any street (therefore not just front gardens).

Both English and Scottish governments refer to a guide on permeable paving from the Department of Communities and Local Government, which can be downloaded from: **http://www.communities.gov.uk/publications/planningandbuilding/pavingfrontgardens**, and this, in turn, refers to the Interpave website and this guidance for more information.

### What happens if I decide to apply for permission?

If your proposed paving does not meet the 'permeable' requirements for permitted development, you will need to submit a planning application, along with drawings and a fee, which could take at least 8 weeks to process. Anyway, government planning policy encourages planners to insist on SuDS (such as permeable paving), so an application should be rejected.



### What if I go ahead anyway?

If you go ahead without permission, the local authority Planning Enforcement Officer could take action demanding that you make an application or remove the paving. Increasingly, local residents and Parish Councils concerned about flooding are alerting Enforcement Officers about unauthorised, sealed-up front drives in their areas.

### What happens when my house is sold?

When it comes to selling your home, the buyer's solicitor will want to make sure that all necessary planning permissions are in place, otherwise this could be a problem for the buyer in future. Solicitors are becoming more aware of the new rules and will be making specific pre-contract enquiries about driveways. Without planning permission, a new or replacement drive that doesn't meet the rules could delay or even stop a house sale, and add to costs. Where permeable paving or other SuDS systems have been used in front gardens, permitted development will apply and solicitors' enquiries will simply be satisfied. Valuers and surveyors should also check the lawfulness of paving around the home when inspecting a property.

## Flood and Water Management Act

New legislation, covering England and Wales, will include requirements for SuDS on any construction work which affects the ability of the ground to absorb water, when it takes effect (probably in October 2012). Related draft National Standards and other regulations are still under discussion at the time of publishing this guide and include some proposed exemptions.

In particular, the requirements will not apply to the 'permitted development' discussed earlier (using permeable paving or draining water onto a permeable garden area), as long as the work does not cover 100m$^2$ or more. If your proposed paving does not meet the 'permeable' requirements for permitted development, you will need to apply for permission – just like planning approval – which could well be turned down. There will also be enforcement procedures if unapproved work is actually carried out and the same problems with selling your home discussed earlier could occur.



# Concrete Paving and SuDS Solutions

**When it comes to drives, patios and paths, you can't beat real concrete block and slab paving products from Interpave manufacturers for good looks and performance. They open up a world of choice with colours, textures, scales and shapes to suit any style of garden and home.**

The latest concrete products can match – and often exceed – the visual qualities of more expensive aggregates such as stone or clay brick. Better still, real concrete block and flag paving is sustainable and will give the long-term performance that asphalt – or 'tarmac' – and imprinted concrete cannot match. For example, in the BRE 'Green Guide to Specification' all the concrete block and flag paving for pedestrian and lightly trafficked areas gained the highest A+ or A ratings. But it's also worth remembering that precast concrete paving products from Interpave members are manufactured locally on modern, automated manufacturing plant. Interpave manufacturers form an essential part of the local economy – generating sustainable employment – and community.

Whichever style of concrete block or slab paving you choose for your home, it's actually straightforward to comply with all the rules discussed earlier using SuDS principles. And you will be taking a responsible, sustainable approach, helping to curb flooding and pollution – both in your local community and further downstream. Two different types of SuDS are covered here, and in more detail in Part 2: Concrete Block Permeable Paving and Conventional Concrete Paving Blocks or Flags with Rain Gardens.



- **Concrete Block Permeable Paving** – this is different to conventional block paving because it allows rainwater to filter through gaps or joints between the blocks into a permeable sub-base below with enough space to store the water for a short time. Cellular concrete units are also available, designed for grass to grow through, which work in a similar way (for more information visit individual Interpave Members' websites).





We should also remember that water is an increasingly rare asset and we need to take a more sustainable approach to using it. Rainwater can be captured and stored for some time below permeable paving then pumped up for plant watering and car washing – even during hosepipe bans – or to flush toilets.

- **Conventional Concrete Paving Blocks or Flags with Rain Gardens** – here, water from conventional concrete block or slab paving simply runs off into a landscaped depression in the garden to allow the water to be stored temporarily. Then, the water can soak into the ground or evaporate. Concrete channel units can help collect and direct the water towards the rain garden. The same principle applies to taking water from the paving into a soakaway on site.







## Sustainable Drainage in Operation

In both systems, water is held back during heavy storms to avoid flooding and filtered to remove or trap pollution. What happens to the water after that depends on the ability of the ground to absorb water (known as permeability) and whether you want to make use of the rainwater. Part 2 includes a straightforward test that you can carry out to determine how permeable your ground is

With good ground permeability (such as sandy soil), the water can simply soak away into the ground. This is the cheapest option and helps replenish the water table and sustain trees. With poor ground permeability (such as heavy clay), some of the stored water is collected and gradually soaks away or discharges into sewers or streams but with far less impact than direct drains.

# Concrete Block Permeable Paving

There is a growing choice of concrete blocks available from Interpave manufacturers, designed specifically for permeable paving. Essentially they have the same impressive performance as conventional precast concrete paving products, being slip resistant, durable, strong and sustainable. And today there are more shapes, styles, finishes and colours than ever to give you real freedom of choice, as you can see in this guide.

The difference with permeable paving is its enlarged joints, filled with a permeable aggregate specifically chosen for each product – but never sand (which is used with conventional block paving). This ensures that water will continue to pass through the joints over many years. The aggregates used below the blocks are also specifically selected to accommodate water, unlike conventional drive and road construction. Local authorities may ask homeowners for evidence that their new permeable paving is installed correctly to meet the rules, such as a letter of confirmation from a reputable contractor. To be sure, use a paving contractor who is a member of Interlay: **www.interlay.org.uk** or who is registered with an Interpave manufacturer member's scheme.





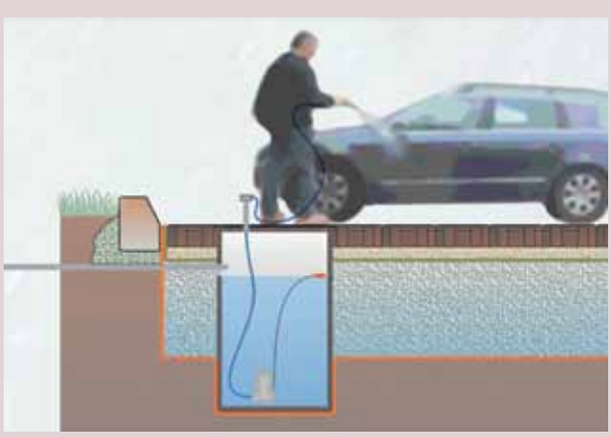
## How does permeable paving work?

Permeable paving is specifically designed for a dual role, acting as the drainage system as well as supporting vehicles. At the same time, many pollutants are substantially removed and treated within the paving layers before the water leaves it. Concrete block permeable paving can be laid level and still avoids puddles without the need for drainage gulleys and pipes. It also provides a safe, firm surface for everyone, including wheelchair users and people pushing prams, unlike gravel and other loose aggregates that may also satisfy the permeability rules. But the Accessibility Building Regulations don't allow these loose aggregates for entry paths and drives to new homes.



Around this home, rainwater runoff collected from all impermeable surfaces including roofs and paths, together with the 60m$^2$ permeable drive itself, passes into the lined permeable pavement which contains a concealed sump. Here, a small pump is used to draw off the harvested water, in this case for outside uses, via a tap and hosepipe.





This is a more sustainable approach to car washing with most of the water automatically treated for reuse as it passes through the permeable paving.

## How can you tell the difference?

Conventional block paving is not designed to be permeable. Its sand filled joints soon clog up to provide a sealed-up surface and the aggregate below is not intended to handle water. Although looking similar to conventional block paving, permeable paving should have permeable aggregate (looking like coarse, sharp or crushed stone) filling the joints and under the blocks, not sand. In addition, a recent planning appeal decision highlights that a permeable sub-base must also be used below to comply, not standard 'Type 1' aggregate, (as shown).



Type 1 aggregate for conventional block paving is not permeable when compacted.



Typical permeable sub-base aggregate has voids between for water.

## Where can you find out more about permeable paving?

Each Interpave manufacturer Member offers a specific permeable paving system with impressive choice of designs, surfaces and colours to suit every style of property. Simply select Interpave members from the table on page one and visit their websites for more information. Part 2 provides more information on how to design and construct permeable paving.

# Conventional Concrete Paving Blocks or Flags with Rain Gardens

Conventional concrete block and slab paving provides an attractive, safe and functional surface for drives and patios. But rather than using traditional gullies and drains leading to sewers, the paving is designed to direct water onto the garden. A depression in the garden is formed to allow the collected water enough time to soak into the ground: this is known as a 'rain garden'. Small areas can, in most cases, be drained straight onto garden areas without a rain garden. Concrete dished channel units are useful to collect and direct the water towards the rain garden.



Rain gardens can simply be shallow grass depressions or can, with the right planting, offer the extra benefit of attractive and robust green spaces that require little, if any, watering. Where ground conditions demand, rain gardens can have stone filled trenches below the depression. There is also potential for drains to collect the water for re-use or connection to sewers. If you are connecting to a mains drain, permission may be needed. The rain garden can be planted with a wide range of appropriate plant varieties available from garden centres or decorative stones laid over the surface.





## Where can you find out more about rain gardens?

Part 2 provides more information on how to design rain gardens for conventional precast concrete paving around the home.

# Domestic SuDS Design & Construction Guide

**This Guide aims to provide straightforward, practical guidance for designers and domestic paving contractors, as well as experienced DIY enthusiasts. It only applies to private driveways, patios and other lightly trafficked paving around the home. It includes design and construction information and our maintenance advice will help you keep your finished paving and garden in good condition for years to come.**

For other applications, fully engineered solutions are available in the Commercial section of **www.paving.org.uk**. The Interpave website also contains extensive detailed information for construction professionals on all types of precast concrete paving.

We strongly recommend that you engage an Interlay member contractor to install all types of precast concrete paving – visit **www.interlay.org.uk** – or a contractor registered with an Interpave manufacturer member's approved scheme: use the links to visit members' websites.

| | |
|---|---|
| Brett built on relationships | **http://www.brett.co.uk/landscaping** |
| CEMEX | **http://www.cemex.co.uk** |
| CHARCON | **http://www.aggregate.com** |
| Hanson HEIDELBERGCEMENT Group Formpave | **http://www.heidelbergcement.com** |
| Marshalls | **http://www.marshalls.co.uk** |
| Plasmor CONCRETE PRODUCTS | **www.plaspave.co.uk** |

The following guidance is for the design of **driveways and other larger (over 18m$^2$) paved areas** around the home, based on calculations using sound engineering principles. Generally, smaller areas and long, narrow paths can simply be drained onto adjacent garden areas with falls away from the house – although care should be taken not to affect neighbouring properties. However, if the existing ground (before you start work) tends to become waterlogged during rain, additional drainage measures may be needed.

## Building Regulations

Paved areas and drainage associated with new buildings and extensions will probably be subject to The Building Regulations (or Building Standards in Scotland) and need to be checked with your local authority – although just laying paving around your home does not. Sustainable drainage – as dealt with in this guide - is encouraged by the Regulations and infiltration of water into the ground the preferred option wherever possible.

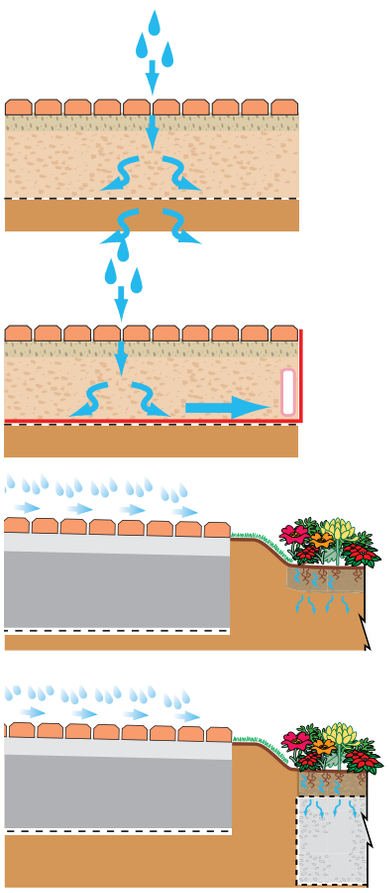
The Regulations are concerned about the possible effects of infiltration close to buildings. So, they require soakaways and other devices handling a lot of water to be at least 5m away. Your local authority might also apply this to rain gardens or infiltrating permeable paving handling water from elsewhere – but not to permeable paving just draining itself. In some parts of the country there are problematic ground conditions where infiltration could adversely affect foundations to houses. If in doubt seek advice from a specialist or the local authority building control department.

For rain gardens and permeable pavements, the '5m rule' should apply to any size drive where roof water runs onto the drive from the downpipe. If the site has had a previous use before housing was constructed (known as a 'brownfield site'), or the site is on a very steep hillside or there is a history of instability in the area (e.g. sink holes), seek specialist advice. The following guidance includes this '5m rule', although local conditions might justify reducing or removing it.

# Selecting the Right System

## Potential Systems

In this Guide, four alternative systems are considered – two each for Concrete Block Permeable Paving and Conventional Concrete Paving Blocks or Flags with Rain Gardens. Drawing Notes explaining how these are constructed follow later.



**Infiltrating** concrete block permeable paving

**Tanked** concrete block permeable paving ↺

Rain garden System 1

Rain garden System 2

## Step 1 – Check Soil Permeability

The type of soil around your home and its ability for water to drain through (known as permeability) can be estimated using this simple test:

1. Dig a hole at the location of the permeable pavement or rain garden. The bottom of the hole should be at the same level that water will drain out of the system into the ground and should be in the same soils that will accept most of the water. Avoid locating the hole in any areas that are not truly representative of general conditions in your garden. Beware of gravel or other aggregate which could have been buried when your house was built. The hole should be 300mm x 300mm, by 300mm deep.
2. Fill the hole with water and allow it to drain away (this may take several hours), to soak the area.
3. Fill the hole with water again and record the time it takes for the water to drain away on this occasion.
4. Read off the Soil Permeability for the time taken:

| Time to drain | Permeability |
|---|---|
| Less than 30 seconds | Excellent 💧💧💧💧 |
| Between 30 seconds and 13 minutes | Good 💧💧💧 |
| Between 13 minutes and 11 hours | Fair 💧💧 |
| Greater than 11 hours | Poor 💧 |

## Step 2. – Identify Options Available

Note all the potential systems available for the Permeability you estimated in Step 1 from the table:

| Potential Systems Available | | | | |
|---|---|---|---|---|
| | Permeable Paving | | Rain Garden Systems | |
| Permeability | Infiltrating | Tanked | 1 | 2 |
| Excellent 💧💧💧💧 | ✔ | ↺ | ✔ | ? |
| Good 💧💧💧 | ✔ | ↺ | ✗ | ✔ |
| Fair 💧💧 | ✔ | ↺ | ✗ | ✔ |
| Poor 💧 | ✗ | ↺ | ✗ | * |

↺ Use for water harvesting or if other constraints prevent infiltration, with specialist advice

✔ OK

? Use only if other constraints prevent infiltration (eg adjacent slopes)

✗ Not suitable

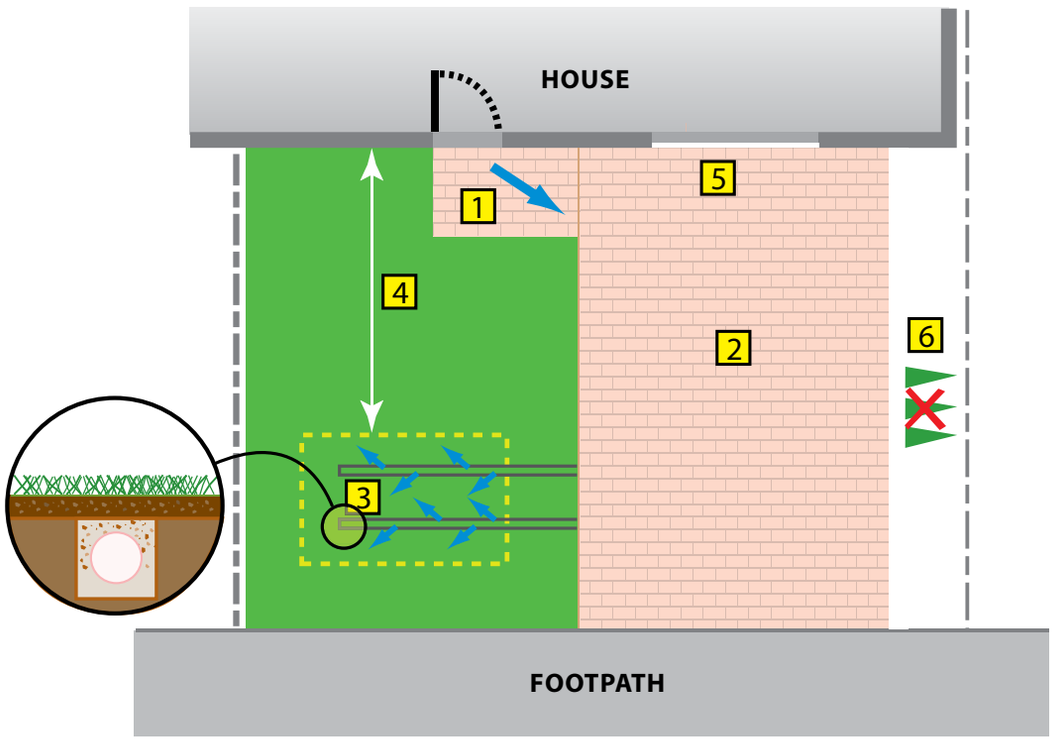
* Obtain specialist advice

## Step 3 – Refine Your Choice

You should now have one or more options for both permeable paving and rain garden solutions generally suitable for your garden. Now consider each of these options in more detail on the following pages to choose the best for you, taking particular note of the other rules which apply.

## Concrete block permeable paving systems

A typical layout is shown below for either system of permeable paving. Check that the systems appropriate for your garden comply with the rules shown on this page.



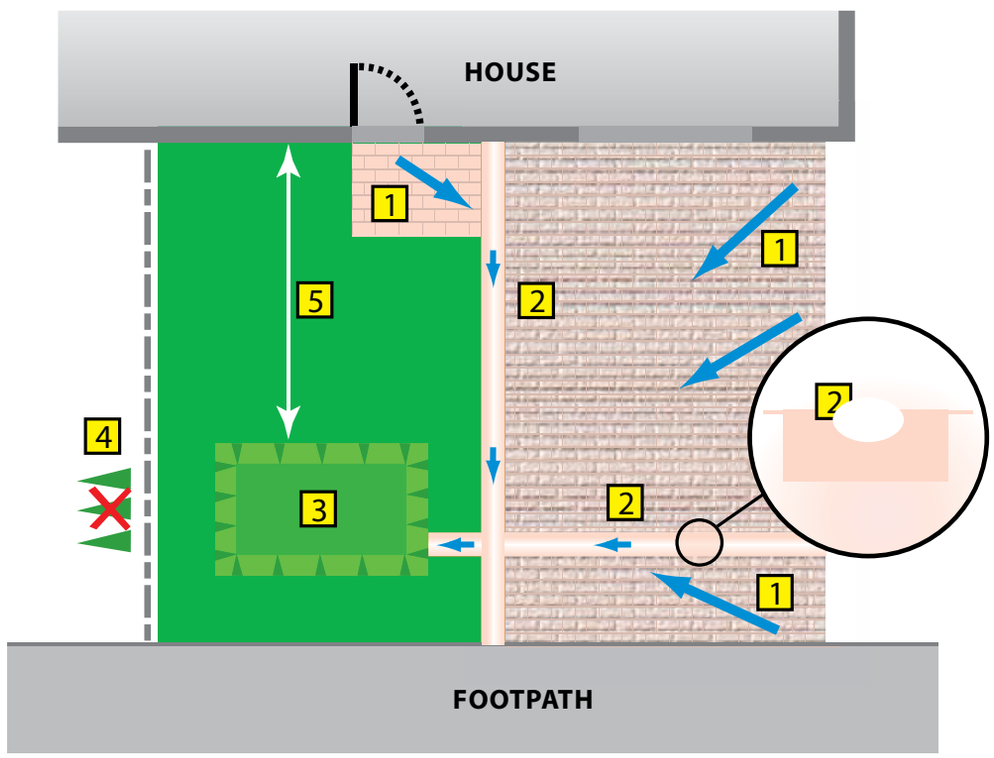

### Drawing Notes

1. Conventional block paving sloping away from the building and towards permeable paving.
2. Permeable paving driveway. Both systems can be used right up to the building (unless roof water is collected as well with infiltrating permeable paving). The 5m rule should apply to any size of permeable paving drive where roof water runs onto the drive from the downpipe.
3. Optional infiltration area beneath garden, if needed, for either system. This can also help with irrigation.
4. Infiltration areas must be at least 3m (for a single drive) or 5m (for a double drive) away from building foundations.
5. Normally, driveway and garden must slope away from the house towards the road. A slight slope towards the house (up to 1:25) is acceptable with a dished channel at the bottom connected to the rainwater drain.
6. For infiltrating permeable paving there must not be any steep drops to adjacent properties within a distance from the driveway equal to the height of the drop. Neither system should slope towards neighbouring properties.
7. As with other drainage measures, permeable paving should have an emergency overflow route away from or around the house.

## Conventional Concrete Paving Blocks or Flags with Rain Gardens 1 2

In its simplest form, a rain garden is a depression in the ground, with a surface overflow, to temporarily store water before it soaks into the ground or evaporates. It can include water-tolerant plants. A typical layout is shown below with sizes calculated for each rain garden system. Check that the systems appropriate for your garden comply with the rules shown on this page.

Look around your garden. A simple assessment of the topography around your home will help you identify if a rain garden is possible. Is there room in the front garden for a rain garden at least 5m away from buildings (this distance can be reduced in some circumstances)? If not, is it possible to fit a drain pipe from the drive/paving to the back or side garden areas for a rain garden there 5m from buildings? If not, a rain garden may not be an option. The land where a rain garden is installed should also not slope back towards the house.




### Drawing Notes

1 Conventional block paving sloping away from the building and towards channels.

2 Dished channel units laid to falls to collect water into rain garden and avoid runoff onto the road.

3 Rain garden shallow depression covered with decorative stone aggregate or plants (see page seventeen for system details).

4 There must not be any steep drops to adjacent properties close to system 1 or 2 rain gardens.

5 The minimum distance between rain gardens and buildings is shown opposite:

### Minimum distance from buildings

| System: | 1 | 2 |
|---|---|---|
| For Single Driveway | 3m | 3m |
| For Double Driveway | 5m | 5m |

The 5m rule should apply to any size drive where roof water runs onto the drive from the downpipe or where unusual ground conditions might apply.

6 Normally, driveway and garden must slope away from the house towards the road.

7 As with other drainage measures, rain gardens should have an emergency overflow route away from or around the house.

# Design and Construction

**The next step is to design and carry out the construction with the help of the following pages. We strongly recommend that you consult an Interlay member contractor to install all types of precast concrete paving – visit www.interlay.org.uk.**

The following pages give construction design and advice for concrete block permeable paving, conventional concrete block paving and rain gardens. Advice on installing decorative concrete paving slabs, dished channels and other products can be found on the Interpave website **www.paving.org.uk** or from manufacturer members of Interpave.

For conventional or permeable block paving, an estimate of soil strength is needed based on simple tests according to whether your soil is clay or sand/gravel. Use the soil strength for your garden from the table to select the correct paving construction.



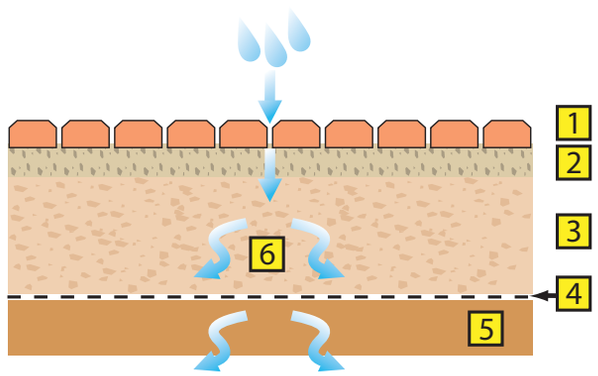
## Determining soil strength

| Soil strength | Good | Poor |
|---|---|---|
| Clay | Stiff – cannot be moulded by fingers and thumb; cannot make surface impression | Firm – can be moulded by fingers and thumb; can easily be pushed to make a surface impression |
| Sand or gravel | Compact – a 50mm square peg is hard to drive into the soil with a 1.8kg hammer | Loose – a 50mm square peg is driven into the soil easily, with one or two blows from a 1.8kg hammer |

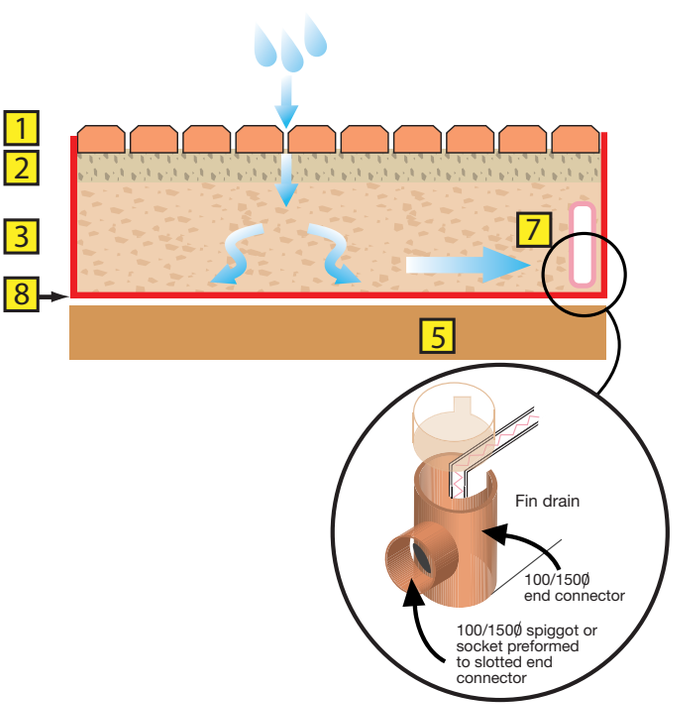


# Concrete Block Permeable Paving

## Infiltrating to the ground




## Tanked with pipes to drains or water harvesting system



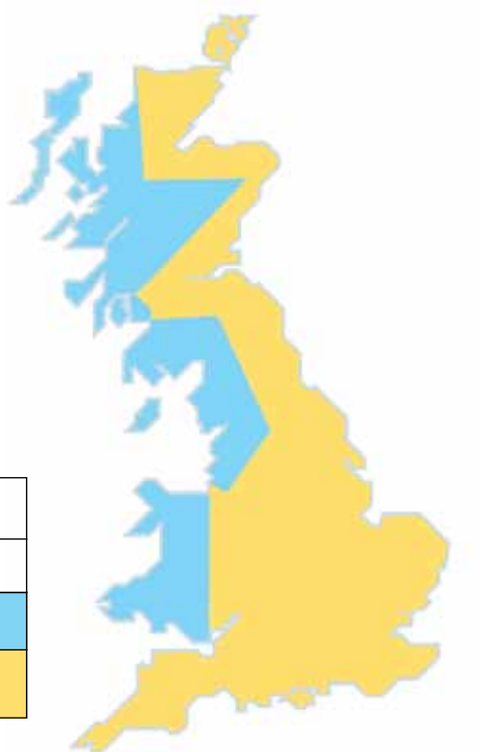

## Drawing Notes

1. Concrete block permeable paving (usually 80mm).
2. Grit (2–6mm) laying course (50mm) and joint filling.
3. Permeable crushed stone sub-base (see below for thicknesses).
4. Geotextile if installed (see page nineteen).
5. Existing sub-soil which is compacted.
6. With infiltrating permeable paving water gradually passes through to the ground.
7. With tanked permeable paving water is carried away by a plastic fin-drain connected to roof water drain or an infiltration area. Fin-drains could also be used with infiltrating permeable paving as an overflow.
8. Membrane liner to contain water, below and up the sides of the construction.

## Sub-base thickness

For both permeable paving systems, the thickness of sub-base needed for a driveway depends on two things:

- The rainfall levels expected in your area. This is summarised on the map below from which you can select which of the two areas you live in.
- The strength of the soil in your garden. This can be estimated from the simple tests on the previous page.



### Permeable Sub-base Thickness

| **Soil strength** (see page fourteen) | **Good** | **Poor** |
|---|---|---|
| **Area from map:** | | |
| Wetter | 250mm | 500mm |
| Drier | 200mm | 450mm |

The sub-base thickness should be sufficient to create a firm working platform and to ensure that the ground remains stable when trafficked by construction plant. The work should be undertaken by a skilled groundworks contractor with experience in evaluating the sub-base thickness required. If infiltrating permeable paving is used on clay soils the soil should be assumed to have poor strength.

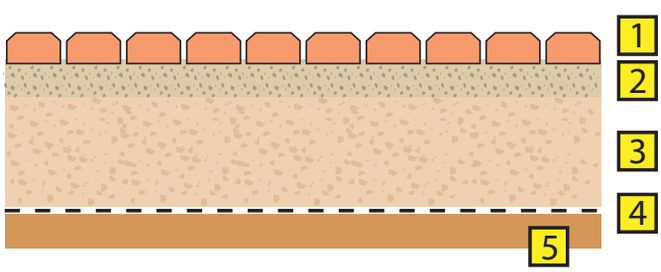
Landscaped areas should not be sloped towards concrete block permeable paving if possible. If it cannot be avoided, a strip of flat gravel or turf should be provided between the landscaping and the paving to catch any soil that is washed off. This is to prevent the soil clogging the spaces between the blocks.

The above guidance applies to driveways for car traffic only. For heavier traffic such as large 4 x 4s and removal lorries, refer to the Interpave website **www.paving.org.uk**

# Conventional Concrete Block Paving

Select one of the two construction designs below according to soil strength. Guidance on construction can also be found at:
**www.paving.org.uk/commercial/cbp/bc.htm**

| **Soil strength** (see page fourteen) | **Good** | **Poor** |
|---|---|---|
| Sub-base thickness | 150mm | 200mm |




## Drawing Notes

1. Conventional block paving (usually 50mm).
2. Sand laying course (30mm) and joint filling.
3. 'Type 1' crushed stone sub-base, see table for thickness.
4. Geotextile if installed (see page nineteen).
5. Existing soil which is compacted.

The above guidance applies to driveways for car traffic only. For heavier traffic such as removal lorries, refer to the Interpave website **www.paving.org.uk**

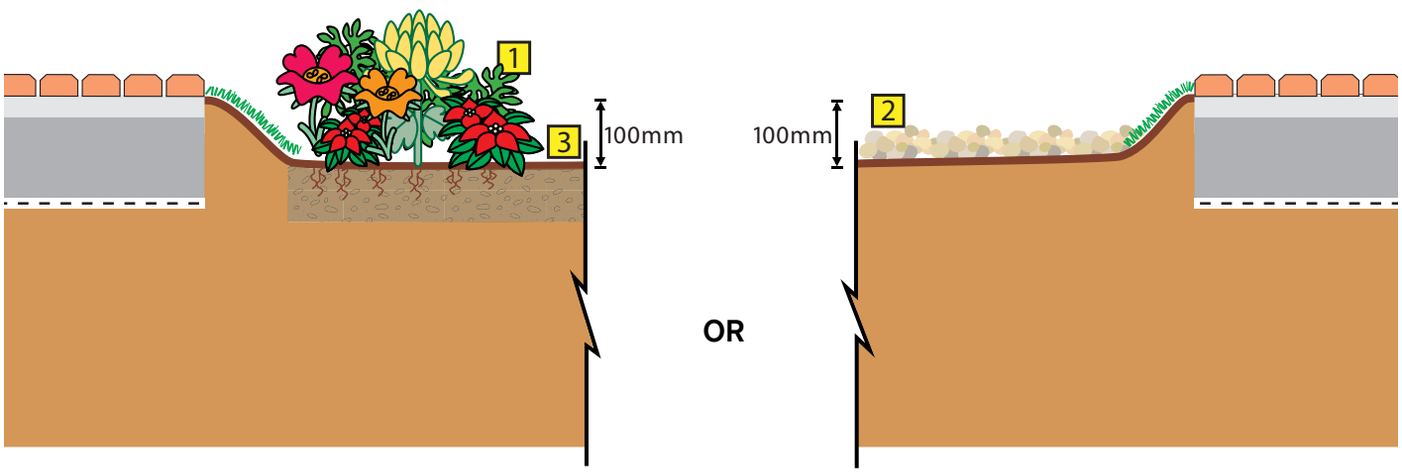
# Rain Gardens

The two rain garden systems for draining conventional concrete block (slab and other impermeable) paving are shown here. Sizes of rain gardens and depth of pea gravel filled trenches are shown on the next page.

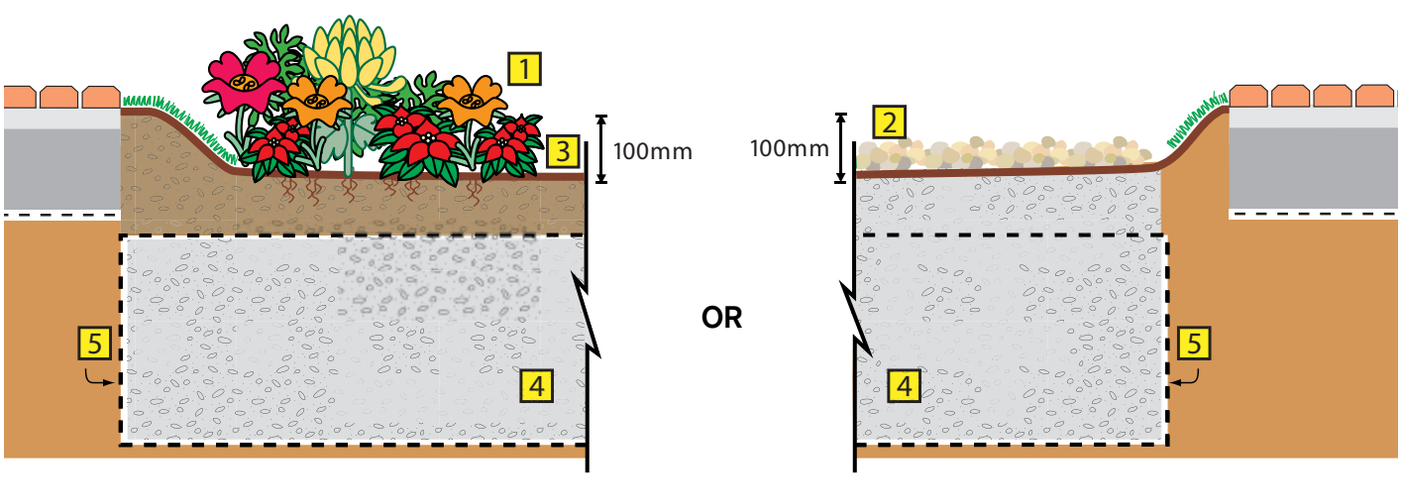
## Drawing Notes

1. Plants in 60/40 rootzone aggregate or mulch (100mm deep) or
2. Decorative stone finish (for example, 25-75mm cobbles or slate pieces).
3. Shallow depression within rain garden (100mm).

**System 1** infiltration to the ground




**System 2** with trench infiltration to the ground




**System 2 Rain Gardens**

| Area of paving draining into the rain garden | Depth of pea gravel filled trench 4 | | | |
|---|---|---|---|---|
| | 100mm | 200mm | 300mm | 400mm |
| | Surface area of raingarden for depths shown above: | | | |
| 5m² | 2m² | 1m² | 0.7m² | 0.5m² |
| 10m² | 4m² | 2m² | 1.3m² | 1m² |
| 50m² | 20m² | 10m² | 6.7m² | 5m² |

4. Pea gravel filled trench (see table for depth).
5. Geotextile (see page nineteen) wrapped over pea gravel/under rootzone aggregate or 150mm below decorative stone finish.

# Combined systems and water harvesting

On the previous pages we have looked at five different sustainable paving drainage systems but there may be good reasons to combine different techniques, if they are suitable for your particular situation.

They can also be used to store water for irrigation of gardens by pumping out or using infiltration areas where irrigation is needed. It is best to obtain expert help to design these systems as they may require pumps and the storage design is more complicated.

# Maintaining sustainable paving drainage systems

## Rain Gardens

A rain garden is an extremely reliable and easy-to-look-after means of drainage but simple precautions should be taken with both the garden and paving sloping onto it.

**Do…**

- keep it clear of litter

**Don't…**

- let wet concrete run on it as this will block it
- store things in the rain garden as this will stop it working.



## Concrete block permeable paving

A concrete block permeable pavement is a very robust drainage system and requires little maintenance, apart from the following.

**Do…**

- keep it well swept

**Don't…**

- mix concrete on it as this will block it
- put piles of soil on it as this will block it.





## Note:

Every effort has been made to ensure that the statements made and the opinions expressed in this publication provide a safe and accurate guide; however, no liability or responsibility of any kind (including liability for negligence) can be accepted in this respect by the publishers or the authors.

## Definitions of terms

**Sub-base aggregate** (for conventional concrete block paving) – A dense mixture of sand and gravel compacted to give a hard surface on which to build the driveway. Often referred to as DoT 'Type 1' aggregate.

***Type 1 Aggregate – see above.***



**Permeable pavement sub-base aggregate** – Crushed rock or similar material that does not have fine material in the spaces between rock pieces, allowing water to flow easily through the voids. Proprietary coarse graded aggregates specifically for permeable paving are available from many suppliers.

***Permeable Aggregate – see above.***



**Attenuation** – Slowing down and temporarily storing rainwater flow from hard surfaces, so it can enter the drains more slowly, as it would from grassed areas.

**Permeability** – A measure of how fast water can flow through the ground.

**Water table level** – The level at the top of the water in the ground. If a hole is dug in the ground that goes below the water table it is the level of standing water in the hole after it has stabilised.

**Conventional concrete block paving and flags** – Block paving and slabs that do not allow water to soak through them into the sub-base.

**Concrete block permeable paving** – Strictly speaking, this is the surface of block paving with special gaps between each block that allows water to soak into the sub-base. Sometimes it also describes a concrete block permeable pavement – The whole construction including the concrete block permeable paving, laying course and the layer of permeable pavement sub-base aggregate.

**Laying course aggregate** – A layer of fine aggregate that is placed over the sub-base to make it easier to lay the blocks to the required levels and falls. For Conventional concrete block paving and flags this is sand. For Concrete block permeable paving it must allow water to flow through it easily and so a fine (nominal 6mm) aggregate is used.

**Impermeable Membrane Liner** – A plastic sheet that is water tight. It should be 0.5mm thick (2000 gauge).

**Surface Water Sewer** – A pipe in the ground that conveys collected water and removes it from a site. Older sewers remove sewage (known as foul water) as well as rainwater and are known as combined sewers. New developments have separate sewers for foul and rainwater.

**Drain** – Common name for smaller sewers that are located within the boundary of a house. Connect into main sewers that are usually (but not always) in the street.

**Conventional drainage system** – The network of sewers below an area, including private drains, main sewers and ancillary structures such as manholes and gullies.

**Dished channel** – U-shaped precast concrete units available from Interpave members in a range of colours which can match the paving if desired.

**Fin Drain** – A flat drainage system which channels water through a filter into a drainage core before it enters a drainage pipe, thereby reducing the likelihood of the pipe becoming blocked with silt. Fin drains take up little room and work efficiently.

**Geotextile** – A fabric, made of plastic fibres, that is permeable to water but stops soil being washed through.

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