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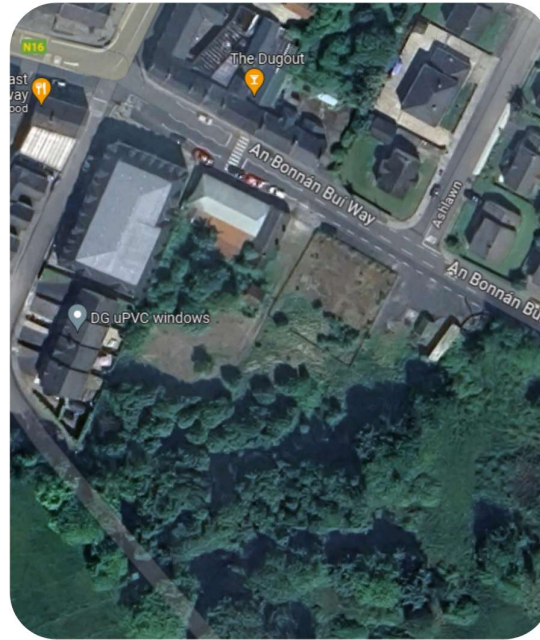
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Consulting Engineers Ltd.



23-242

CAVAN COUNTY COUNCIL

**PROPOSED DEVELOPMENT AT
MOONEY'S HALL & FAIR GREEN,
AN BONNAN BUI WAY, BLACKLION,
CO. CAVAN**

**Surface Water, Foul Water & Watermain
Design & Details**



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1.0 Introduction

Alan Traynor Consulting Engineers Ltd have been engaged by Cavan County Council to carry out engineering services design for the proposed development at Mooney's Hall & Fair Green, An Bonna Bui Way, Blacklion, Co. Cavan. This report addresses the foul and surface water drainage and water supply for this application.

1.1 Site Description

The site is brownfield with an existing hall located along the road at the north side of the site, has an area of circa 0.63 hectares and is located just southeast of the junction of the N16 and An Bonnan Bui Way roads. The site is adjoined by apartments to the west, farmland to the south and east, and across the road to the north is commercial and residential units.

2.0 Surface Water Drainage

2.1 Surface Water Drainage - Existing

The roof of the existing hall discharges to a surface water sewer running in the road along the northern boundary of the site.

2.2 Surface Water Drainage – Proposed

The surface water from the roofs of the two new buildings, paved pedestrian areas and carpark will be collected in a suitably sized network via downpipes, permeable paving, and road gullies. The paved pedestrian areas will be constructed from permeable paving which will allow surface water to drain to perforated pipes running underneath them. Please refer to Drawing No. 23-242-100 for proposed layout of surface water sewer.



3.0 Foul Drainage

3.1 Foul Drainage – Existing

There is a foul sewer running in the road along the northern boundary of the site. The existing hall appears to discharge to this sewer.

3.2 Foul Drainage – Proposed

It is proposed to collect the foul water from the two new buildings in a suitable sized gravity sewer and discharge it to the foul sewer running in the road along the northern boundary of the site. Please refer to Drawing No. 23-242-100 for proposed layout of foul water sewer.

4.0 Water

4.1 Water - Existing

There is an existing watermain running in the road along the northern boundary of the site.

4.2 Water - Proposed

It is proposed to make two connections to the existing watermain in the public road to service the new buildings. Please refer to Drawing No. 23-242-100 for the proposed connection points.

Appendix A – Surface Water Calculations & Details

Storm Sewer loadings for Development at Mooney's Hall Fair Green, Blacklion Co. Cavan

DATA		STORM WATER FLOW Modified Rational Method						Cr = 1.3 Cv = 0.7		SEWER DESIGN Ks = 0.60								
SEWER REFERENCE		Roads	Roofs/yards	Impervious Area	Cumulative Impervious Area	Rainfall : I (mm/hr)	Storm Water Flow	Size of drain (mm)	Gradient (1 in x)	Length (m)	Capacity (l/sec)	Pipe full Velocity (m/sec)	Actual Velocity (m/sec)	Half full velocity (m/sec)	Max Velocity (m/sec)	Depth of flow (mm)	Reserve capacity (l/sec)	
From Manhole	To Manhole	Area A1	Area A2				$Q=Ap \cdot I \cdot Cr \cdot Cv \cdot 2.78$ l/sec											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		
S1	S2	0.008	0.039	0.047	0.047	50.00	5.91	225	200	14.142	36.57	0.92	0.68	0.92	1.04	60.64	30.66	
S2	S3	0.001	0.035	0.036	0.083	50.00	10.49	225	200	4.814	36.57	0.92	0.80	0.92	1.04	82.62	26.08	
S3	S5	0.013	0.018	0.031	0.114	50.00	14.39	225	200	23.339	36.57	0.92	0.87	0.92	1.04	98.00	22.17	
S4	S5	0.063	0.018	0.080	0.163	50.00	20.64	225	200	21.035	36.57	0.92	0.95	0.92	1.04	121.29	15.93	
S5	S6	0.002	0.000	0.002	0.279	50.00	35.28	300	200	8.391	78.24	1.11	1.08	1.11	1.25	141.21	42.96	
S6	OUTFALL	0.000	0.000	0.000	0.279	50.00	35.28	300	200	10.817	78.24	1.11	1.08	1.11	1.25	141.21	42.96	

Appendix B – Foul Water Calculations

Foul Sewer loadings for Development at Mooney's Hall Fair Green, Blacklion Co. Cavan

DATA							SEWER DESIGN										
KDU = 0.7							Ks = 1.50										
SEWER REFERENCE				DU	Cumulative DU	Total Flow	Size of drain (mm)	Gradient (1 in x)	Length (m)	Capacity (l/sec)	Pipe full Velocity (m/sec)	Actual Velocity (m/sec)	Half full velocity (m/sec)	Max Velocity (m/sec)	Depth of flow (mm)	Reserve capacity (l/sec)	
From	To	No.	No.	No.	l/s	l/s											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
F1	F2			6.0	6.0	1.71	150	150.0	11.580	12.612	0.71	0.50	0.71	0.81	37.50	10.897	
F2	F3			0	6.0	1.71	150	150.0	4.870	12.612	0.71	0.50	0.71	0.81	37.50	10.897	
F3	F4			11.5	17.5	2.93	150	150.0	24.055	12.612	0.71	0.58	0.71	0.81	49.22	9.684	
F4	Fext			0	17.5	2.93	150	150.0	9.700	12.612	0.71	0.58	0.71	0.81	49.22	9.684	

Room Type	DU/Item	WHB	WC	Sink	Shower	Urinal	WHB	WC	Sink	Shower	Wash.M	DU/Room
	Sewer Reference	0.4	1.6	1	0.5	0.6						
Building 1	F1	3	3	0	0	0	1.2	4.8	0	0	0	6
Building 2	F3	5	5	1	1		2	8	1	0.5	0	11.5

Appendix C – Permeable Paving Details



Hydropave

Permeable Paving



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Hydropave

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A Proud History

TOBERMORE
SAND & GRAVEL Co.

75 Years & counting

Behind every remarkable company lies a story of vision and exceptional determination.

At Tobermore our inspirational story began over 75 years ago when Sam Henderson returned from the war as a young man. His mother had saved £500 during his time away and this was quickly invested in a fledgling family business. Sam went on to lead the business into pioneering production of concrete products before subsequent developments laid the foundations for the Tobermore brand.

Today, Tobermore remains family owned and managed, with the same vision, determination and values which are driving the business forward as one of

the UK and Ireland's leading manufacturers of concrete paving and walling products. We are now trusted suppliers to some of the country's most prestigious schemes in partnership with leading contractors and housebuilders.

At Tobermore "average" is never acceptable. Our recent £4m investment in the world's most advanced manufacturing equipment is indicative of our determination to always serve our chosen markets with excellent quality and service.

In 2019 we launched a fresh new face for Tobermore reflecting the energy and spirit which drives our people to bring market-beating solutions to designers and contractors across the country. Innovation fuels our growth as we find new ways to further enhance product performance, making us enthusiastic about Tobermore's future in a market which recognises the true value of our 'right first time', responsive service.



Tobermore

“ Our continual investment in people and new technology is securing Tobermore's excellence for both quality and service.

David Henderson
Managing Director



Technical Excellence

PrimeTop is the high performance feature which differentiates Tobermore from standard concrete paving. Tobermore's PrimeTop is manufactured with a premium, hard-wearing surface layer which adds significant performance benefits.

PrimeTop Layer

Hard-wearing Surface

The PrimeTop surface layer has a dense composition of finer aggregates, hard sand and a higher percentage of cement. This hardened surface layer has enhanced strength and increased resistance to wear and tear, for both pedestrian and vehicular traffic.

We produce two different material mixes; the PrimeTop layer and a robust base layer formulated for optimum structural performance. Both layers are formed simultaneously, producing an inseparable bond that stands the test of time.

Aesthetic appeal & enhanced weathering

The PrimeTop surface layer contains a high concentration of pigment creating vibrant colour and exceptional UV performance, leading to enhanced weathering properties.

Tobermore PrimeTop is renowned for its superior long-term retention of colour and visual appeal.



PrimeTop
Look for products with the PrimeTop logo



- Excellent wear resistance
- Refined over 25 years
- Superior frost resistance
- Long lasting colour

- ✓ More
Cement
- ✓ More
Pigment
- ✓ Finer
Aggregates

Product Performance

Ef-Stop®


Combatting efflorescence

Every aspect of our product's performance is researched and optimised to provide an excellent long-lasting appearance. In respect to the challenge of efflorescence, we have invested in manufacturing technology which enables us to produce virtually efflorescence free paving.

Efflorescence is perhaps the single biggest problem encountered with decorative concrete paving products. The cause of efflorescence is simply a chemical reaction between the cement in the concrete and rainwater causing the formation of calcium carbonate. This white, crystalline substance stains the surface and spoils the appearance of the paving.

In the Tobermore manufacturing process, we cure our products in a warm vapour atmosphere for 12 hours, which ensures that efflorescence is dramatically reduced. Moreover, the vapour curing also enhances the colour, improves the strength and cures the products much faster, allowing products to be used almost immediately.



 **Ef-Stop®**
Look for products with the Ef-Stop logo



Competitor's paving



Vapour Cured
The Ef-Stop protection includes an intense vapour curing process. Vapour penetrates to the core of the paver.

Reliable Partner

ServiceSure

ServiceSure is Tobermore's unique package of customer service benefits developed to ensure an efficient, consistent and streamlined experience. This unbeatable, seamless service follows your project from initial enquiry to delivery and beyond, keeping you fully informed at every stage.

Delivery Excellence

You can trust Tobermore to fulfil your order on time and in full as agreed. This industry leading service is proven week in week out and in 2018 we achieved outstanding delivery performance with 99.47% of orders on time and in full.

99.4%
ON TIME IN FULL

Easy Spec

Our specification team is on hand across the UK and Ireland to support you with technical advice, design support and samples. Tobermore's comprehensive website provides additional access to useful information. This is backed up by a package of the industry's leading specification tools including NBS Plus/Create and BIM Level 2.



NBS
Plus & Create



BIM
Level 2



Design
Services

Fast Quote

We always turn around quotes within one working day.

Unrivalled Availability

With more stock on the ground and a faster turnaround on batch controlled orders we offer market leading availability on a full range of paving and walling products. Because we manufacture everything on one site we can combine mixed product loads for customer friendly logistics.



Flooding & Pollution

As urban and industrial areas throughout the country have continued to expand, the total area of impermeable surfaces such as roofs, roads, pavements and car parks has increased.

This means that rainfall cannot infiltrate naturally into the ground quickly enough and put our already overloaded drainage systems to an even greater test. The ageing traditional drainage systems are high maintenance and no longer able to cope.

Rainwater which would normally recharge groundwater or wetlands is now washed directly into water courses via conventional drainage systems. With global warming leading to increased levels of rainfall, our ageing drainage systems are no longer able to cope with high volumes of storm water run off. This leads to flash flooding and increased pollution.



Pollution Risk

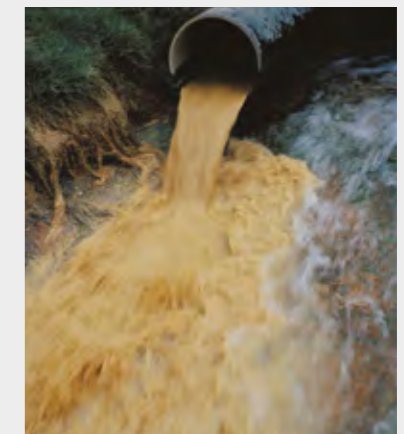
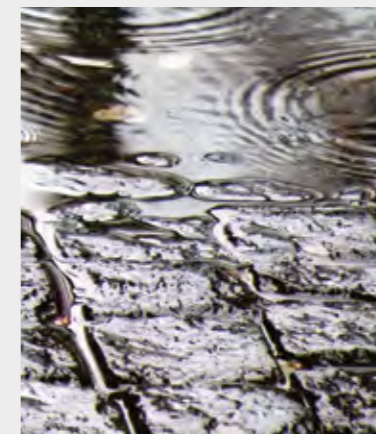
During periods of dry weather heavy metals, hydrocarbons, oil, rubber and other pollutants are deposited on impermeable surfaces. When it rains these pollutants are washed into drainage systems and end up further downstream in rivers where they damage wildlife habitats.



Flooding Risk

The Environment Agency report on the Autumn 2000 floods in the UK, entitled "Lessons Learned, Autumn 2000 Floods" concluded that an estimated 1.85 million homes, 185,000 commercial properties and 5 million people in the UK are now at risk from flooding. The Environment Agency's publication "Policy and practice for the protection of floodplains" states that: "Inappropriate development within floodplains should be

resisted where such development would itself be at risk from flooding or may cause flooding elsewhere." To minimise any increased surface run off, new developments must be carefully located and designed. Where appropriate, storm water source control measures, which also improve water quality, should be incorporated into the development proposal.



Permeable Paving

The solution to flooding problems is the use of more sustainable methods of storm water drainage which take into account quantity, quality and social issues.

These are now referred to as SuDS (Sustainable urban Drainage Systems).

SuDS are made up of a number of structures, which include:

- Permeable pavements
- Swales and filter strips
- Basins and wetlands
- Infiltration devices

Sustainable urban Drainage Systems

SuDS are more sustainable because they:

- Deal with run off close to where it falls
- Manage potential flooding at its source
- Protect or enhance water quality
- Provide a habitat for wildlife in urban areas
- Protect water resources from accidental spills and pollution
- Allow new development in areas where existing sewerage systems are at full capacity, enabling new development within existing areas
- Are sympathetic to the environmental setting and the needs of the local community
- Encourage natural groundwater recharge

The inclusion of a permeable paving surface as part of a SuDS solution will not only increase the likelihood of planning proposals being approved but may also offer the developer a 10-15% cost savings over traditional methods due to a significant reduction in drainage costs (pipes, manholes, petrol interceptors etc).

Water quality improvement

Permeable paving is very effective at removing pollution from runoff. The pollutants may remain on the surface or may be flushed into the underlying pavement layers where a very high percentage of the pollutants are filtered, trapped or degrade over time. Expensive petrol interceptors, which are used in traditional drainage schemes, are generally no longer required due to the natural removal of pollutants through the permeable paving sub-base. For more detailed information on water quality please refer to the Guide to the design, construction and maintenance of concrete block permeable pavements:

Design & Construction of Concrete Block Permeable Pavements, edition 7 produced by Interpave available for download on www.paving.org.uk

Four Elements of Permeable Paving

1. Permeability

The infiltration rate through the joints of newly installed concrete block permeable paving is significantly higher than the typical rainfall rates in the UK and Ireland. Therefore even after allowing for some joint clogging overtime there is still a huge factor of safety built in. Studies have shown that even without maintenance the long term infiltration capability of permeable paving will exceed UK and Ireland hydrological requirements.

2. Detention

The sub-base thickness should be designed to detain rain falling throughout 24 hours and must provide at least 30% void space. A 4/20mm coarse open graded crushed rock to BS EN13242:2002, value of 100kN or more must be used. If the designer opts to specify alternative materials, a site trial must be undertaken to ensure that the laying course material does not invade the sub-base material. The laying course and jointing material must be a 6.3-2mm grit to BS EN13242:2002. This has been proven in tests to perform best and will not invade the sub-base material. In ground conditions

where water cannot infiltrate into the subgrade, an impermeable membrane must be laid between the subgrade and sub-base and wrapped up the sides to detain the water.

3. Pollution

As water flows slowly into the sub-base it collides with individual aggregate components and deposits pollutants on their surface. The large surface area of the aggregates will ensure effective filtering of the pollutants which are then broken down by natural microbial action.

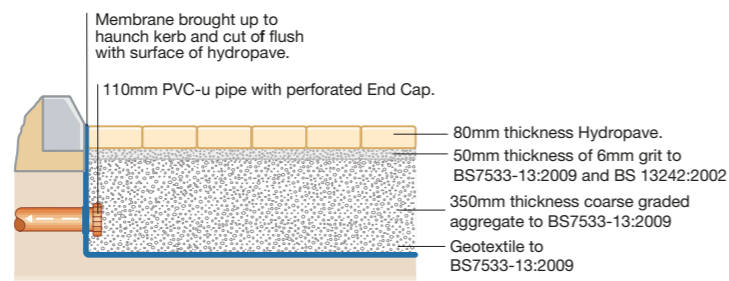
4. Structure

The specification of a permeable paving structure depends upon the hydraulic and traffic loading characteristics and upon the properties of the subgrade. Most pavements in the UK will be required to have a water detention capability rather than infiltration because of the subgrade types. It is recommended to design a permeable paving system to store rainfall occurring during 24 hours.

System Design & Install

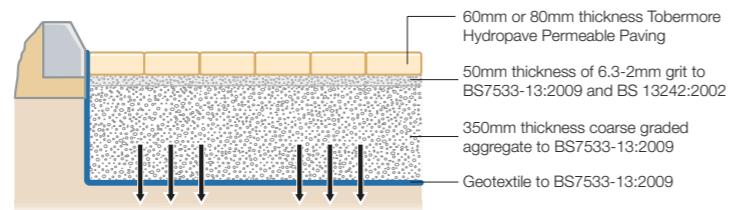
Typical Attenuation System (System C)

The Attenuation system temporarily stores the water in the crushed stone beneath the paving before being slowly released back into the drainage systems. This therefore reduces the peak downstream flow from a result of heavy rainfall.



Typical Attenuation System (System A)

The Infiltration system allows the water to flow slowly through the crushed stone beneath the paving before being slowly released back into the ground through a geotextile.



Bedding layer	The blocks are jointed using a 6.3-2mm grit to BS EN7533-13:2009*.
Sub-base	A clean 4/20mm coarse graded aggregate** to BS EN13242:2002 must be used for this component. A crushed rock angular stone works best.

* In particular, the material should be categorised as LA30, F120 and MDE20 according to table A.3 within this standard. The grit should be insoluble in dilute hydrochloric acid and should be naturally occurring material.

** You must ensure the grit and coarse graded aggregate are compatible. For example, if you use a finer grit it may percolate into the sub-base and may destabilise the pavement. Please refer to the following source of information – BS7533-13:2009 Pavements constructed with clay, natural stone or concrete pavers. Guide for the structural design of permeable pavements.

*Please refer To BS 7553 Part 13 for details of system B (Partial infiltration)



Design

What types of systems are available?

There are two common types of permeable paving systems: Attenuation and Infiltration.

What system should I use?

Tobermore can introduce you to specialist engineers who can provide design advice for your permeable paving project.

What are the key components of a permeable paving system?

The key components of the system are the sub-base, the bedding layer, the paving blocks and the jointing grit. As long as the system has been adequately designed for the site the most important next step is to get these components right.

How do I design a permeable paving system?

Please refer to the following source of information:

- BS7533-13:2009 Pavements constructed with clay, natural stone or concrete pavers. Guide for the structural design of permeable pavements.

If you require specialist advice Tobermore can put you in contact with experienced design consultants.

Upper geotextile

An upper geotextile may be used between the sub-base and the bedding layer. Please refer to BS7533-13:2009 for further information.

What if the ground is poor or there will be significant vehicles on the paving?

Various improvement layers can be installed below the permeable paving to ensure the system can meet the structural load on the project. The engineer on the project will design these into it based on the loading category required. The two most common types of improvement layers are Dense Bitumen Macadam (DBM) and Cement Stabilised Coarse Graded Aggregate (CSCGA). Specifications for Dense Bitumen Macadam and Cement Stabilised Coarse Graded Aggregate can be found in BS7533-13:2009. Method statements on how to install these layers can be supplied on request.

What is the ratio required of permeable area (Hydropave) to impermeable to areas (roads, roofs etc)?

Sometimes, water from building roofs or nearby impermeable areas is fed into permeable paving. It is best to do this only in the case of attenuation systems when a typical ratio of 2:1 can be used between impermeable and permeable zones.

Note: A permeable paving design relies heavily on using the correct aggregates. Prior to installation, we would ask you to test both the 4/20mm coarse graded aggregate and also the 6.3-2mm bedding and jointing grit as per the relevant British Standard specification (BS EN 13242:2002). In particular, the material should be categorised as LA20 according to Table 9, SZ18 according to Table 10 and MDE15 according to Table 11 within this standard. The grit should be insoluble in dilute hydrochloric acid and should be naturally occurring material. In our experience, incorrect use of aggregates is one of the most common reasons for failure of a permeable paving system.

Install

How to install a permeable paving system

Please refer to the following sources of information - BS 7533-3:2005 Pavements constructed with clay, natural stone or concrete pavers. Part 3: Code of practice for laying precast concrete paving blocks and clay pavers for flexible pavements.

- Sub-base: 4/20mm aggregate**
After putting the required depth of stone in position, it needs to be re-orientated using either a tandem roller or a plate vibrator.
- Bedding layer:** 6.3-2mm laying course material. The bedding layer should be screeded over the 4/20mm.
- Paving blocks**
When the blocks are placed to the chosen pattern they should be plate vibrated before the 6.3-2mm grit is brushed into the joints until they are completely filled.
- Joint filling**
All joints must be filled to the top with 6.3-2mm grit. Joints which are not fully filled can lead to possible movement of the blocks after use. We recommend that after a few weeks use that any joints, which have settled and are not full are topped up with grit. Joints should be kept filled at all times. You will need approximately 1 ton of grit for every 100m² of 80mm paving.

Note: Care should be taken that the permeable joints do not become contaminated as work on the scheme is completed. Special care needs to be taken when soft landscaping is carried out so that soil does not enter the joints. When this type of work is being carried out, the surface of the permeable paving should be protected by an appropriate cover to protect the joints from being contaminated.

Adverse weather

Due to the superior drainage capabilities of Hydropave it is possible to install the product in more adverse weather conditions compared to standard paving.

Maintenance

Even after allowing for clogging studies have shown that the long-term infiltration capability of permeable paving will normally substantially exceed UK hydrological requirements. The infiltration rates of permeable paving does decrease but it stabilises over time and even allowing for clogging long term infiltration rates substantially exceed UK rainfall requirements.

Note: For optimum performance we recommend that paving is cleaned twice a year.

Initial cleaning

When an area has just been paved, allow it to settle for a few weeks. After this, you may wish to lightly hose down the paving to remove any excess dirt. The area should then be treated with a weed killer suppressant, two or three times a year as required.

General dirt

Regular sweeping to prevent the build up of detritus is recommended. Light coloured blocks emphasise tyre marks and oil spills on the pavement. It must be accepted that these products will need more maintenance if the overall appearance is to be maintained. A light power hose at medium pressure is generally all that is required to clean general dirt and grime. Any jointing grit which is removed must be replaced. Do not use high pressure power-washers as aggressive power-washing can damage the product surface. A trial area should be tested before large scale power-washing takes place. Please do not use vacuum sweepers as jointing grit may be removed. Please refer to the following sources of information - Guide to the design, construction and maintenance of concrete block permeable pavements Edition 6 produced by Interpave available for download on www.paving.org.uk

How to clean clogged joints

After several years use, joints may become clogged with detritus and it may be necessary to clean them. This can be done as follows:

- Remove existing jointing grit and detritus by high pressure water jet.
- Reset the pavers which will have become displaced.
- Replace any damaged pavers at this time since they will have been loosened.
- Apply 6.3-2mm single size grit to the joints, using a stiff brush to sweep the material in ensuring joints are filled.
- Finish off as above.

Product Range

BLOCK PAVING

Hydropave Fusion

Permeable paving with natural granite aggregates.

- Functions as a SuDS paving system
- Manufactured with natural granite aggregates
- Superb hard-wearing granite surface
- Vibrant long-lasting colours
- Creates a striking, contemporary look

Sizes

- 200 x 100 x 80mm
- 300 x 200 x 80mm
- 300 x 300 x 80mm
- 600 x 300 x 80mm

Colours Available

- Graphite
- Mid Grey
- Silver



Hydropave Shannon

Permeable paving with smooth surface.

- Functions as a SuDS paving system
- Superb hard-wearing smooth surface
- Vibrant long-lasting colours

Duo Sizes

- 208 x 173 x 60mm
- 173 x 173 x 60mm

Colours Available

- Bracken
- Charcoal
- Heather



Hydropave Sienna

Striking textured permeable paving.

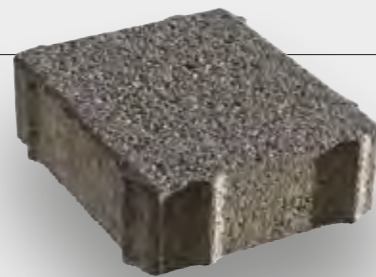
- Functions as a SuDS paving system
- Granite appearance
- Manufactured with natural granite aggregates
- Superb hard-wearing granite surface
- Vibrant long-lasting colours
- Creates a striking, contemporary look

Duo Sizes

- 208 x 173 x 60mm
 - 173 x 173 x 60mm
- *Both sizes in one pack

Colours Available

- Graphite
- Sandstone
- Silver



Hydropave Pedesta

Versatile permeable paving.

- Functions as a SuDS paving system
- Superb hard-wearing smooth surface
- Vibrant long-lasting colours

Sizes

- 200 x 100 x 60mm
- 200 x 100 x 80mm

Colours Available

- Bracken
- Charcoal
- Brindle
- Natural
- Heather



Hydropave Tegula

Permeable paving with traditional styling.

- Functions as a SuDS paving system
- Processed to give an antique appearance
- Vibrant long-lasting colours
- Suitable for both modern or traditional projects

Single Sizes

- 240 x 120 x 80mm

Duo Sizes

- 208 x 173 x 60mm
 - 173 x 173 x 60mm
- *Both sizes in one pack

Colours Available

- Bracken
- Charcoal
- Slate
- Cedar
- Heather



Hydropave 240

Efficient, large format permeable block paving.

- Functions as a SuDS paving system
- Superb hard-wearing smooth surface
- Vibrant long-lasting colours

Sizes

- 240 x 120 x 80mm

Colours Available

- Bracken
- Charcoal
- Natural



Product Range

PAVING FLAGS

✓ PrimeTop ✓ Ef-Stop

Hydropave Mayfair Flags

Granite finish permeable paving flags.

- Functions as a SuDS paving system
- Manufactured with natural granite aggregates
- Superb hard-wearing granite surface
- Vibrant long-lasting colours
- Creates a striking, contemporary look

Sizes

- 400 x 400 x 65mm

Colours Available

- Graphite
- Mid Grey
- Silver



Hydropave Textured Flags

Permeable paving flags with a modern textured surface.

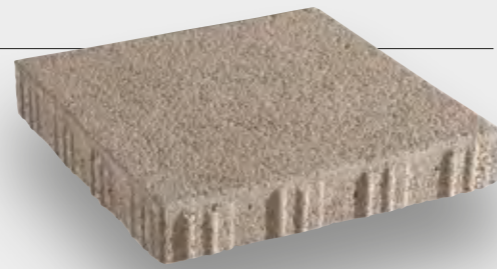
- Functions as a SuDS paving system
- Superb hard-wearing textured surface
- Vibrant long-lasting colours
- Natural appearance

Sizes

- 400 x 400 x 65mm

Colours Available

- Charcoal
- Natural



Hydropave Standard Flags

Non-slip Affordable Permeable Paving.

- Functions as a SuDS paving system
- Superb hard-wearing textured surface
- Vibrant long-lasting colours
- Natural appearance

Sizes

- 400 x 400 x 65mm

Colours Available

- Charcoal
- Natural



Catalogue of Designs

Although a full engineering approach will be needed for virtually all pavements, Tobermore's experience suggests that the following standard solutions will be suitable in most circumstances and can therefore be used at project appraisal stage.

Sub-base & Capping Layers

Capping thickness to be sufficient to provide a firm working platform or in the case of low CBR subgrades ground stabilisation may be more cost effective. If CBR is 5% or greater then capping layers are not required. It is advised that all sites need independent inspection and assessment by a suitably qualified engineer prior to project commencement.

Capping thickness may need to be adjusted upwards to achieve a firm working platform which can sustain loads from construction traffic without deforming excessively and which can offer sufficient reaction to allow the overlying materials to be fully compacted. All pavements must meet the requirements of BS7533 Part 3 in terms of installation.

The thicknesses of coarse graded aggregate will be suitable for the traffic conditions shown and in the case of Attenuation Designs should be sufficiently thick to meet the attenuation requirements. However, a site specific hydraulic analysis should be carried out.

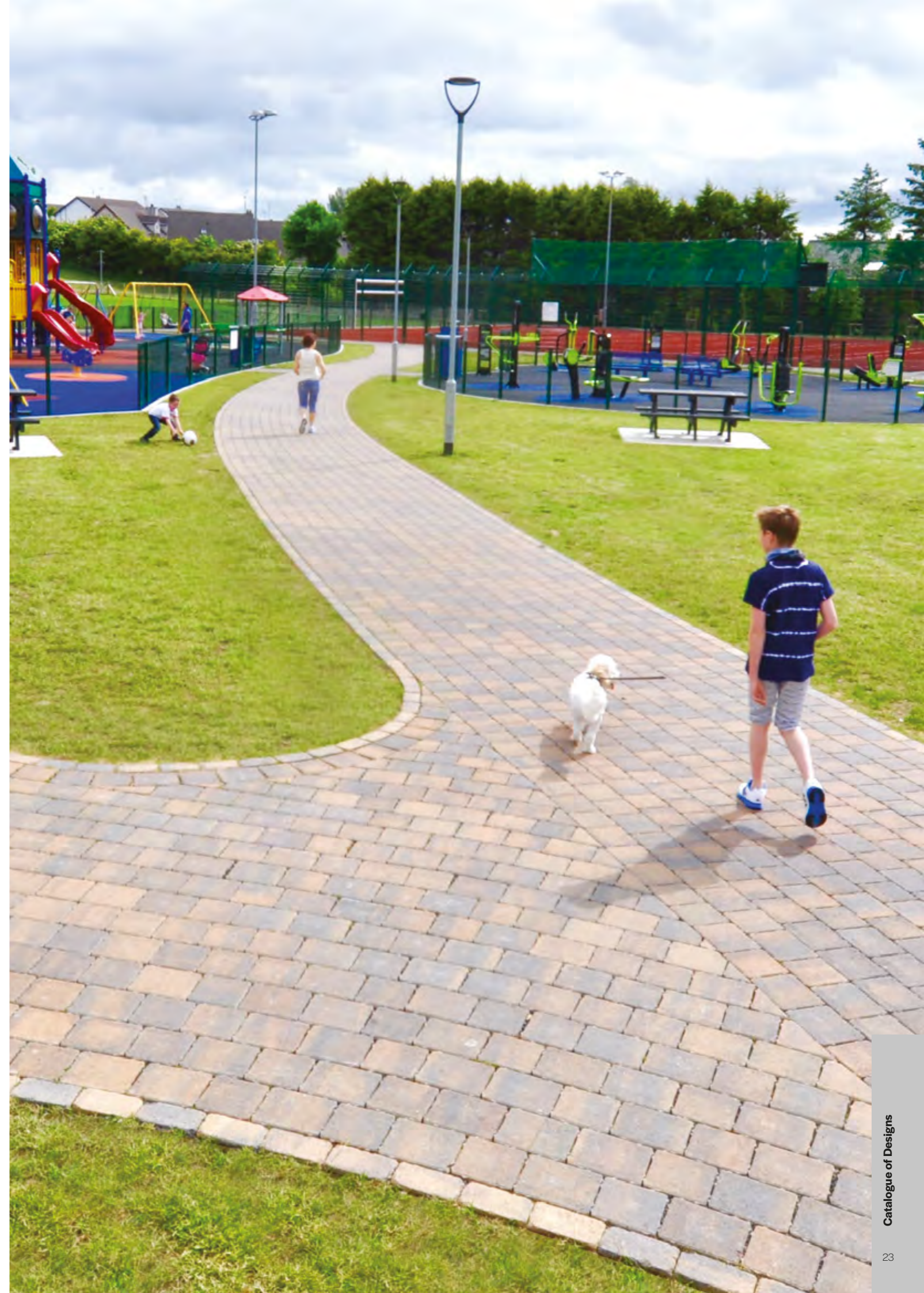
In the case of Infiltration designs, there is usually no need to check hydraulic capacity but a check must be made on the infiltration capacity of the ground. The ground must be proven to accept 20mm of water in one hour which will have to be scaled up if the pavement is infiltrating water draining towards it from impermeable paving or from downpipes.

Where traffic weights exceed those commonly encountered on public highways, specialised design advice should be sought. Contact the Tobermore Sales Office. Where light vans are included, their maximum capacity is 15kN (300cwt).

Loading Categories

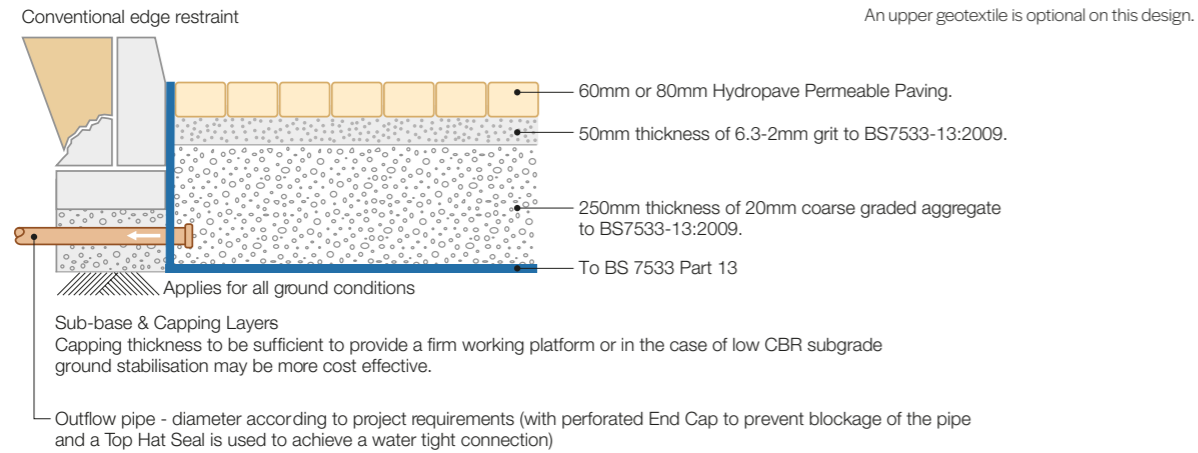
Category/Application	No. of standard axles	Traffic Guide	Application
A/Domestic	0	No Large HGV	<ul style="list-style-type: none"> Patio Private Drives Decorative Features Enclosed Playgrounds Footways with Zero overrun
B/Car Parking	100	Emergency vehicles only	<ul style="list-style-type: none"> Car parking bays and aisles Railway station platforms External car showrooms Sports stadium pedestrian routes Footways with occasional overrun Private drives Footway crossover
C/Pedestrian	0.015msa	Large HGV/week	<ul style="list-style-type: none"> Town/City pedestrian street Nursery access Parking areas to residential development Motel parking Garden centre external displays Cemetery/Crematorium Airport car park (no bus pick-up) Sports centre
D/Shopping	0.15msa	10 large HGV/week	<ul style="list-style-type: none"> Retail development delivery access route School/college access route Office block delivery route Garden centre delivery route Deliveries to small residential development Fire station yard Airport car park with bus to terminal Sports stadium access route/forecourt
E/Commercial	1.5msa	100 large HGV/week	<ul style="list-style-type: none"> Industrial premises Lightly trafficked public roads Light industrial development Mixed retail/industrial development Town Square Footway with regular overrun Airport landside
F/Heavy traffic	15msa	1000 large HGV/week	<ul style="list-style-type: none"> Main road Distribution centre Bus station (bus every 5 minutes) Roundabout Bus lane

Note: In the case of Attenuation designs, subgrade CBR values are equilibrium moisture content values. In the case of Infiltration designs, subgrade CBR values are soaked values.

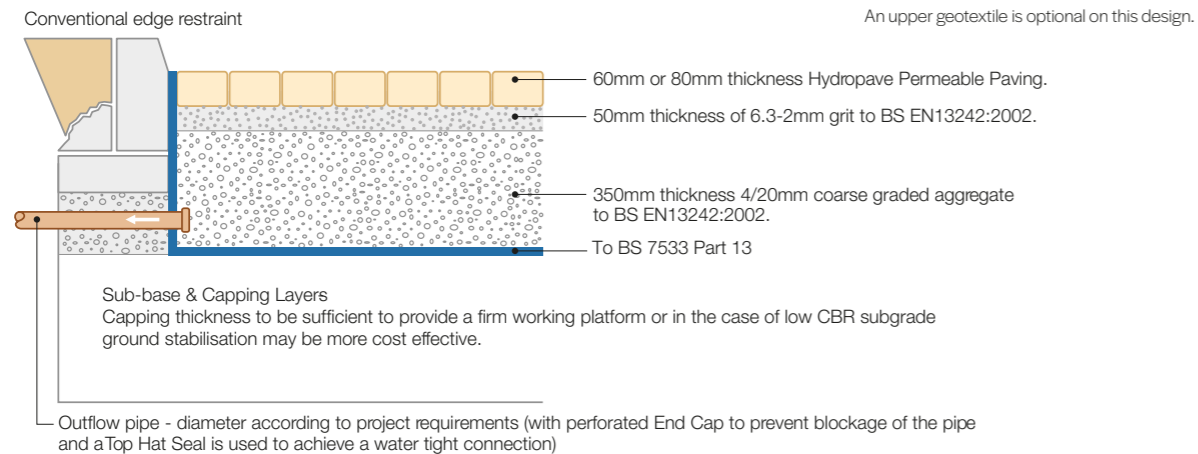


Attenuation Designs

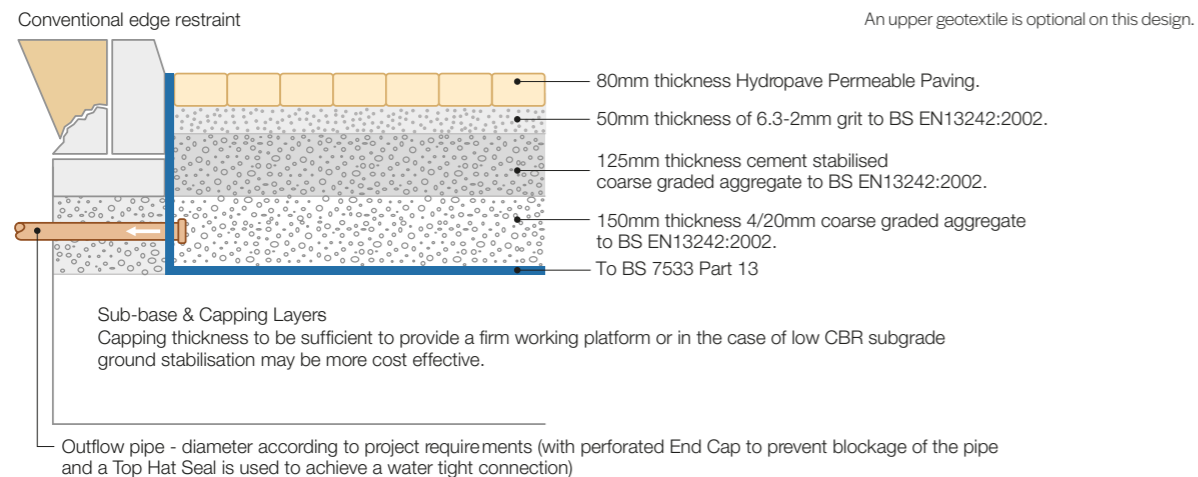
LOADING CATEGORY A: 1-5% CBR



LOADING CATEGORY B: 1-5% CBR

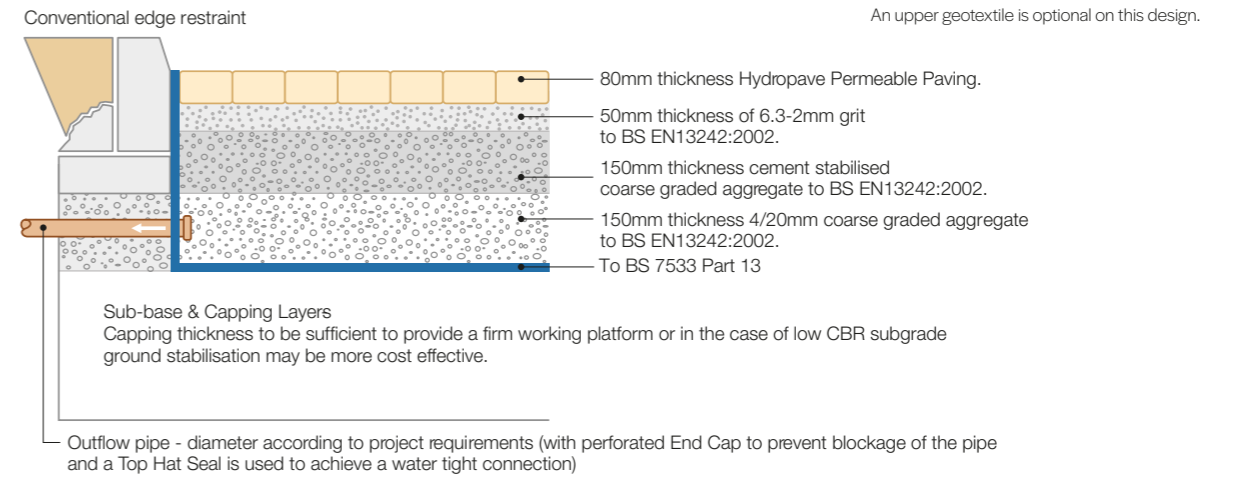


LOADING CATEGORY C: 1-5% CBR

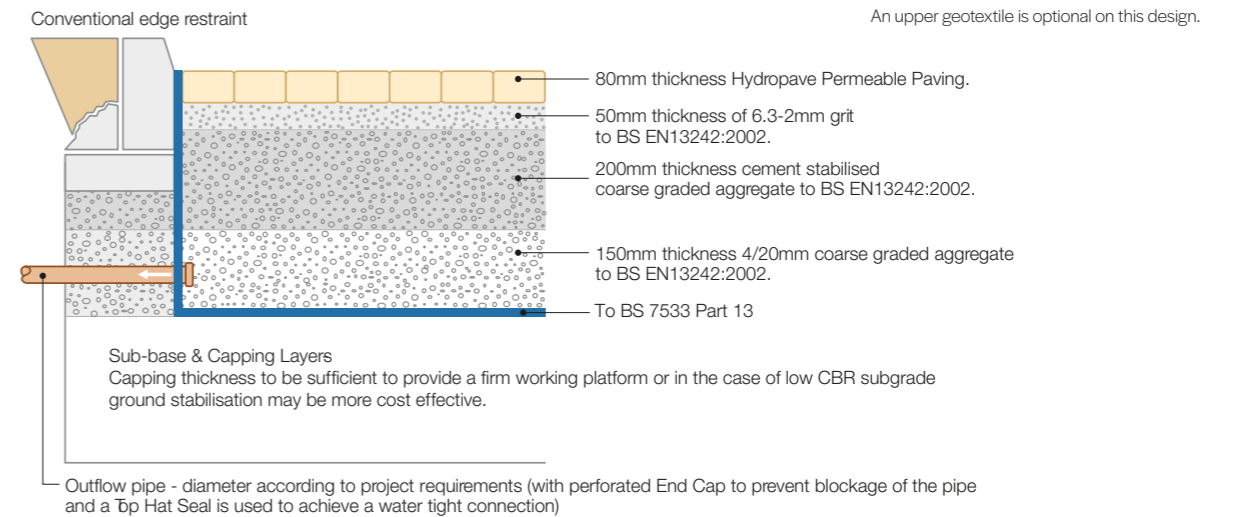


DBM (Dense Bitumen Macadam) can be used as an alternative to the cement stabilised coarse graded aggregate. Please refer to BS 7553 Part 13

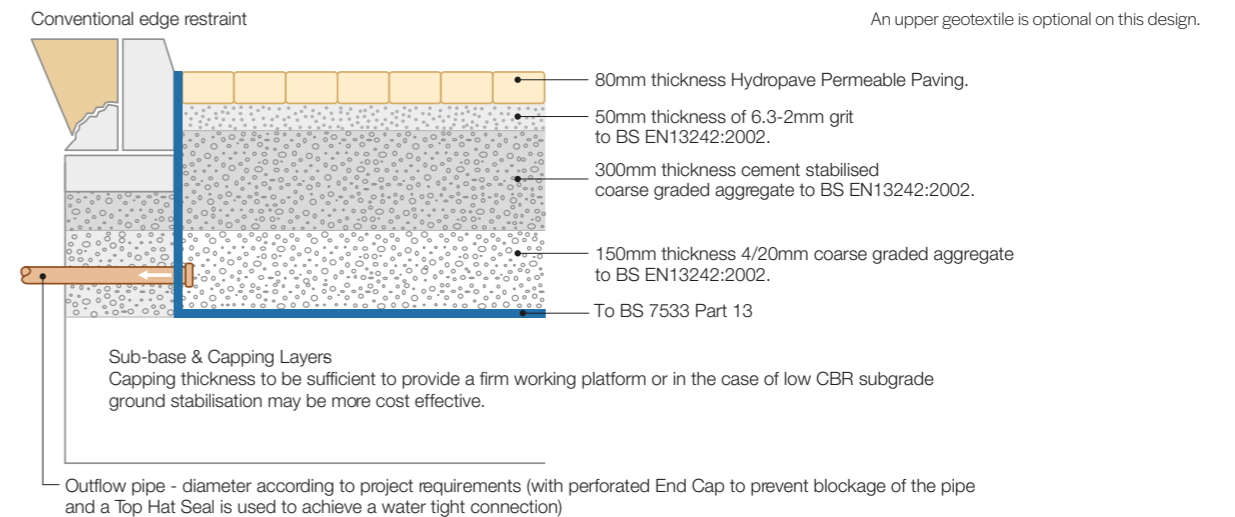
LOADING CATEGORY D: 1-5% CBR



LOADING CATEGORY E: 1-5% CBR

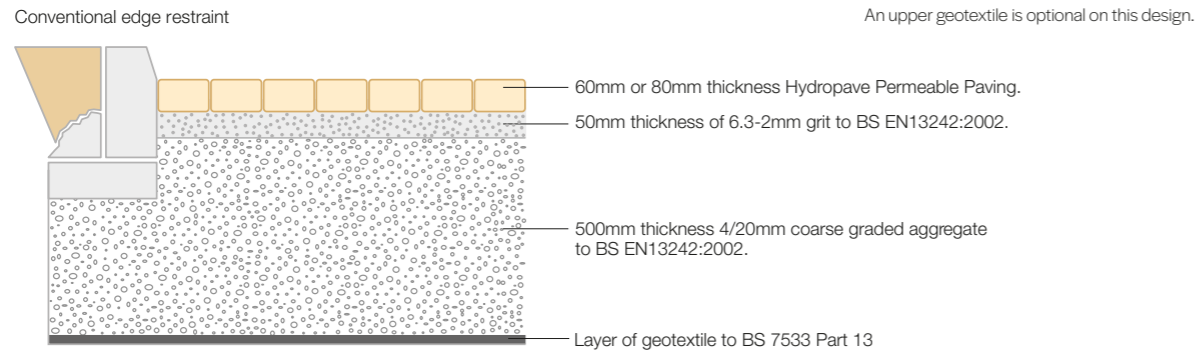


LOADING CATEGORY F: 1-5% CBR

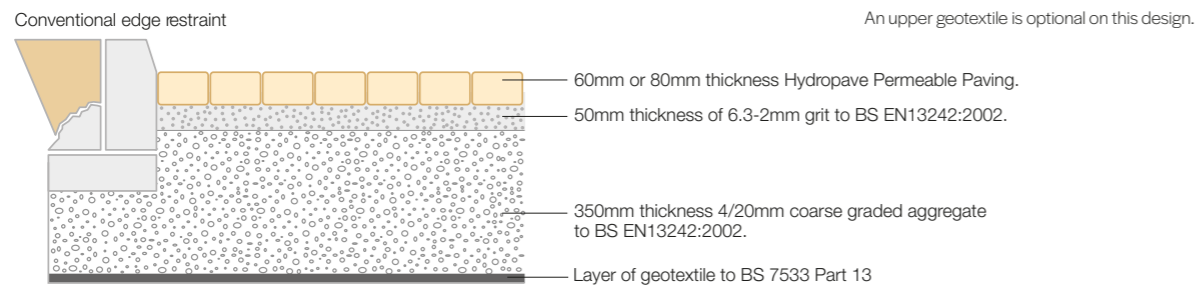


Infiltration Designs

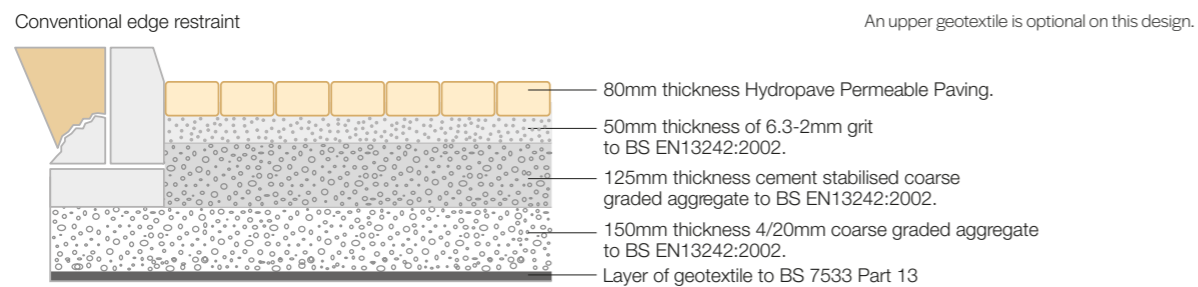
LOADING CATEGORY B: 3 & 4% CBR



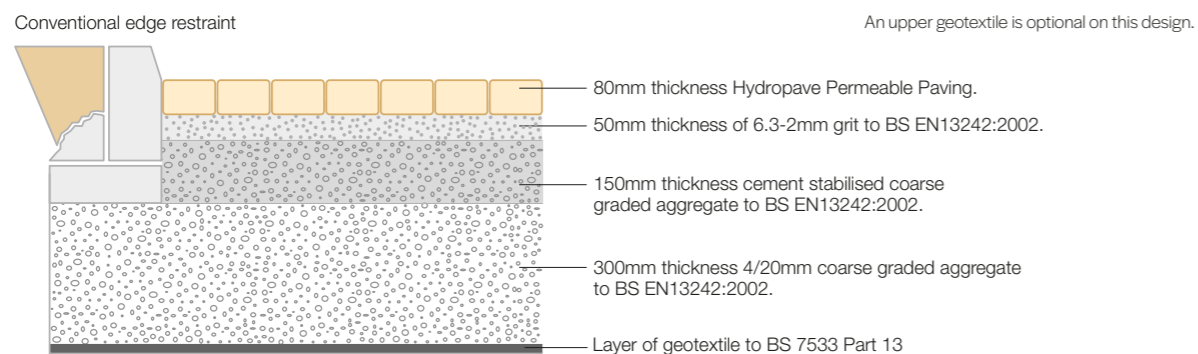
LOADING CATEGORY B: 5% CBR



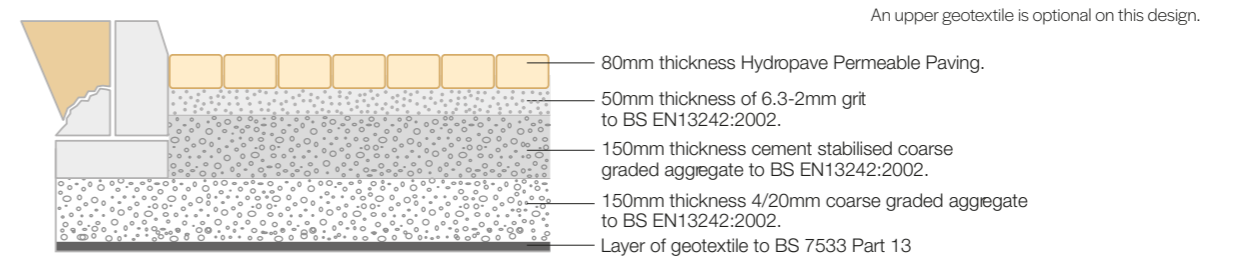
LOADING CATEGORY C: 5% CBR



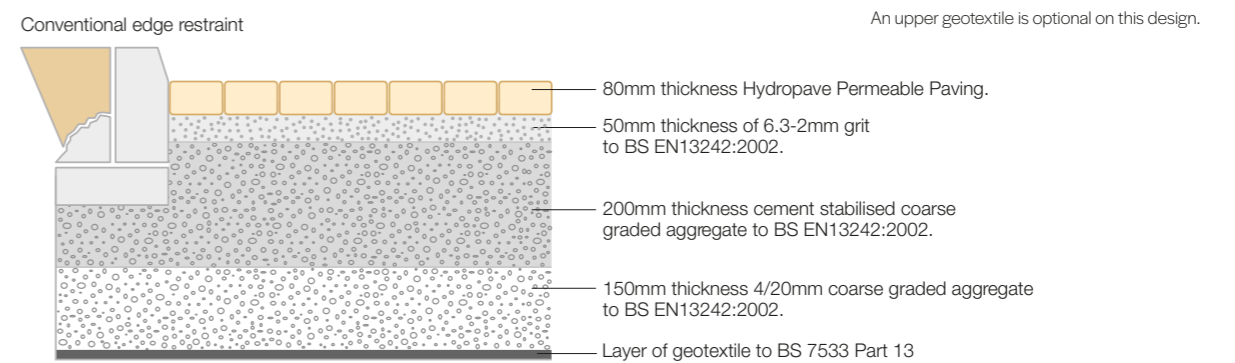
LOADING CATEGORY D: 3 & 4% CBR



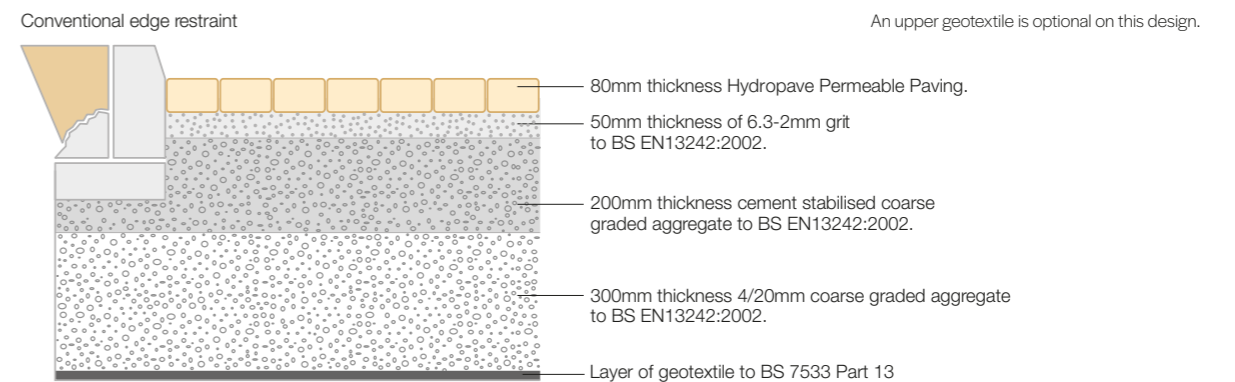
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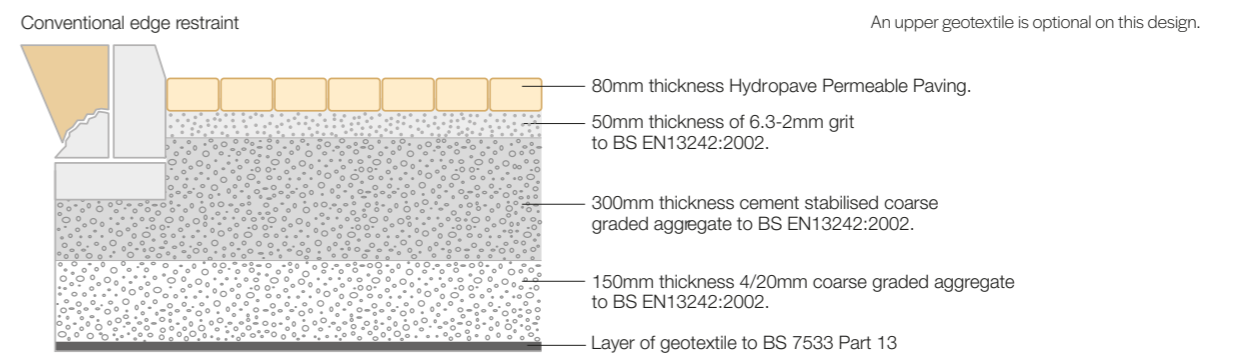
LOADING CATEGORY E: 1-5% CBR



LOADING CATEGORY F: 3 & 4% CBR



LOADING CATEGORY F: 5% CBR



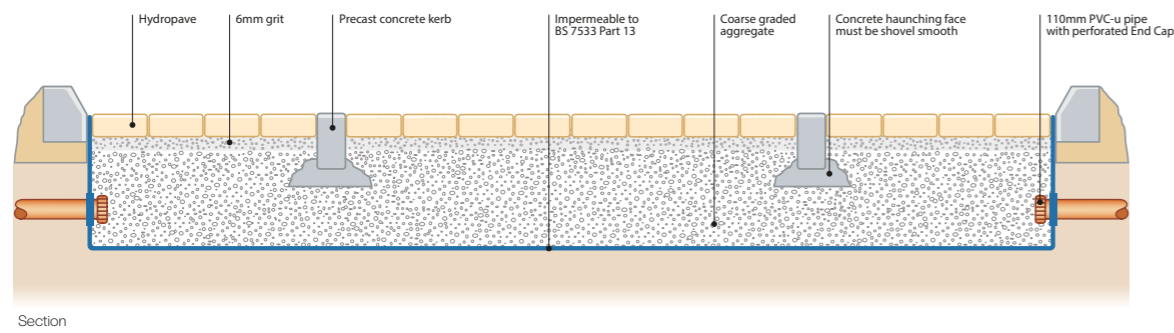
Note: 1 & 2% CBR - ground not suitable.

Road Attenuation

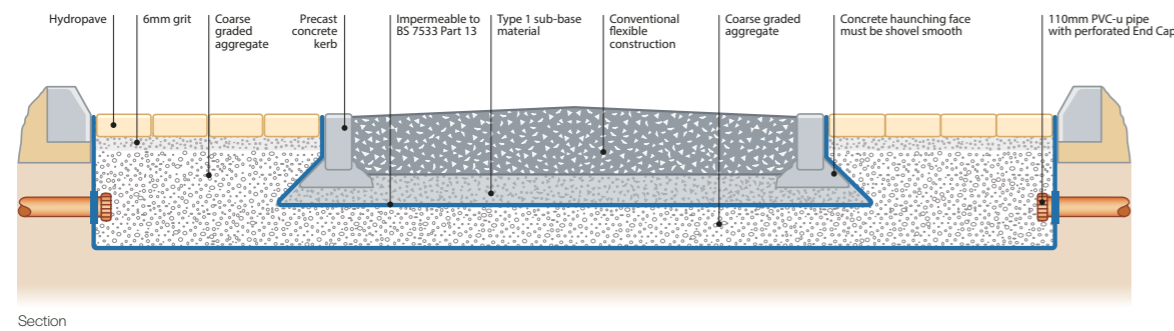
There is no specific provision for the adoption of SUDS techniques such as permeable pavements. Existing legislation, such as Section 38 of the Highways Act, 1980 and Section 106 of the Town and Country Planning Act, 1990, can provide a mechanism for their adoption in some cases. Whatever route is taken it is recommended that early

consultation be undertaken with the relevant stakeholders to ensure responsibilities for long term maintenance are agreed. Further information can be found in BS7533-13:2009 Pavements constructed with clay, natural stone or concrete pavers guide for the structural design of permeable pavements.

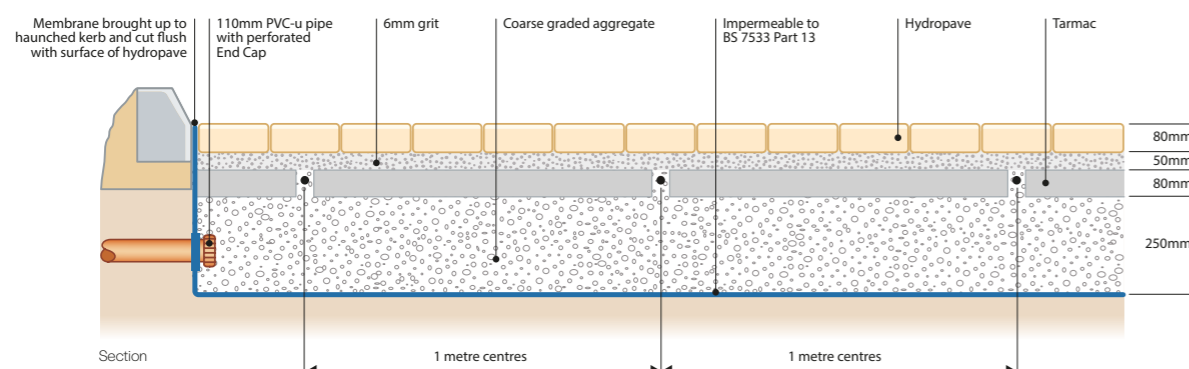
HYDROPAVE ROAD ATTENUATION SYSTEM



HYDROPAVE ROAD ATTENUATION SYSTEM

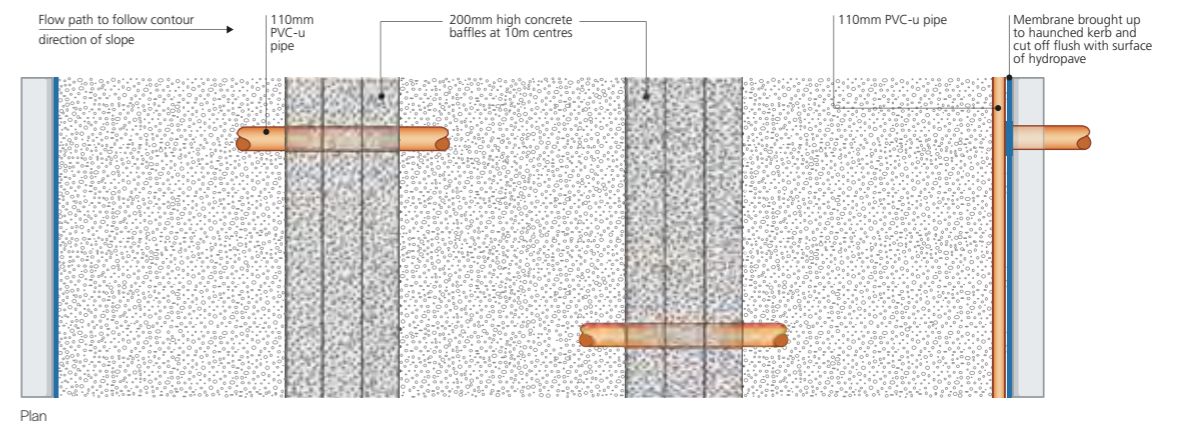
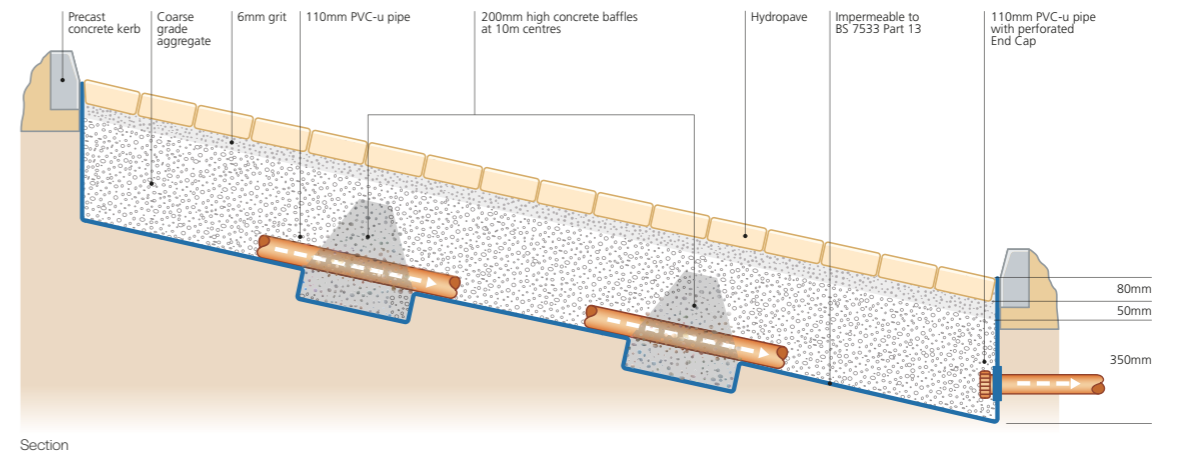


HYDROPAVE ROAD ADOPTION/TEMPORARY RUNNING SERVICE

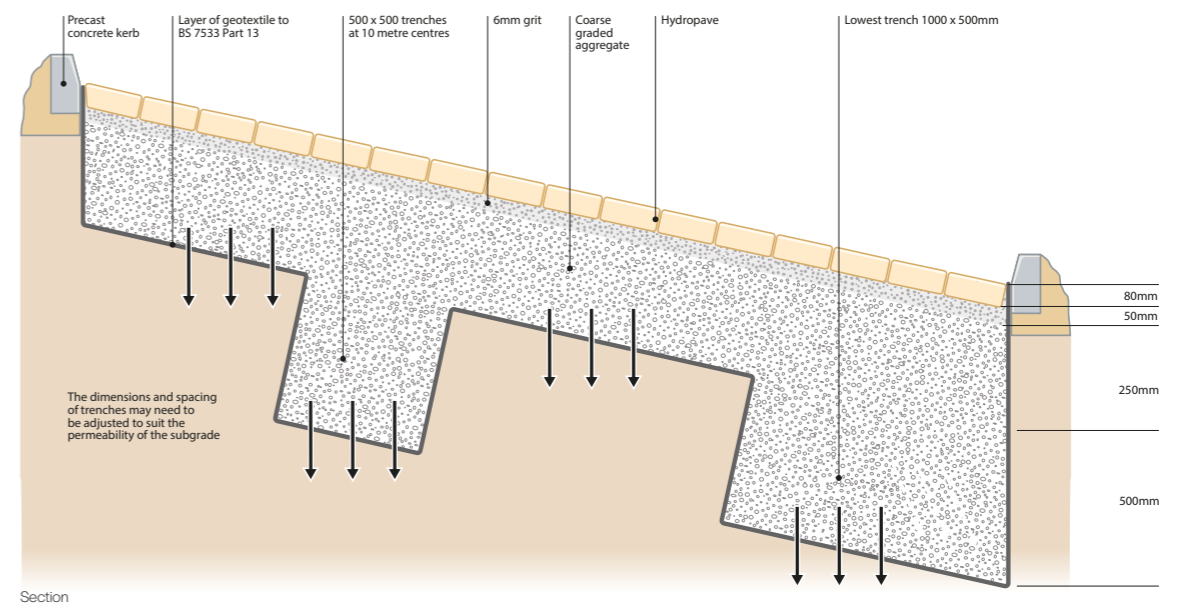


Sloping Site

SLOPING SITES ATTENUATION SYSTEM



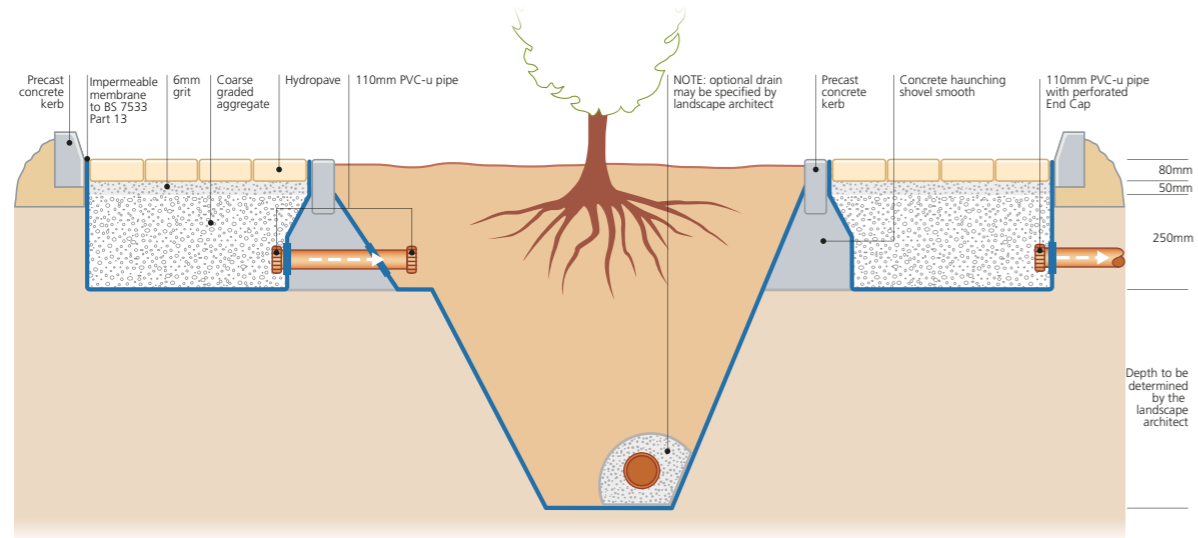
SLOPING SITES INFILTRATION SYSTEM



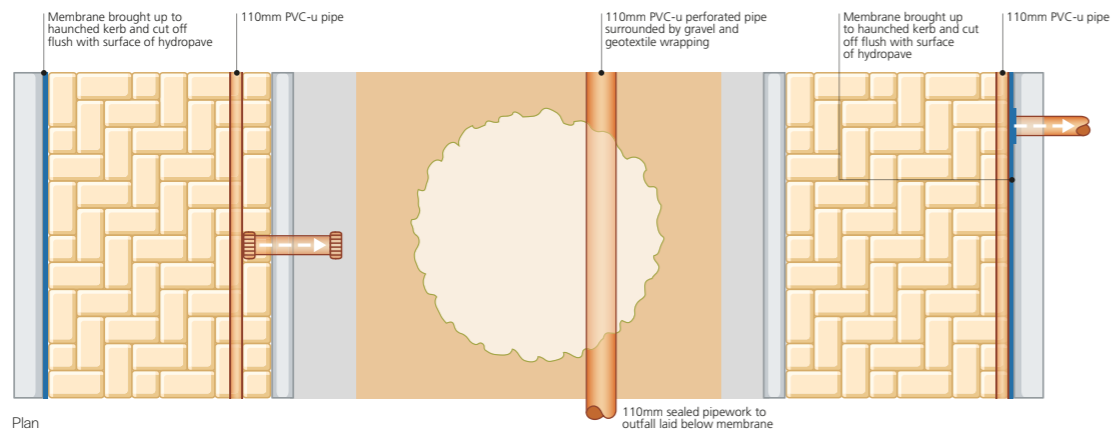
Note: Lateral restrains are recommended on sloping sites greater than 1 in 20.

Tree Planting

TREE PLANTING ATTENUATION SYSTEM

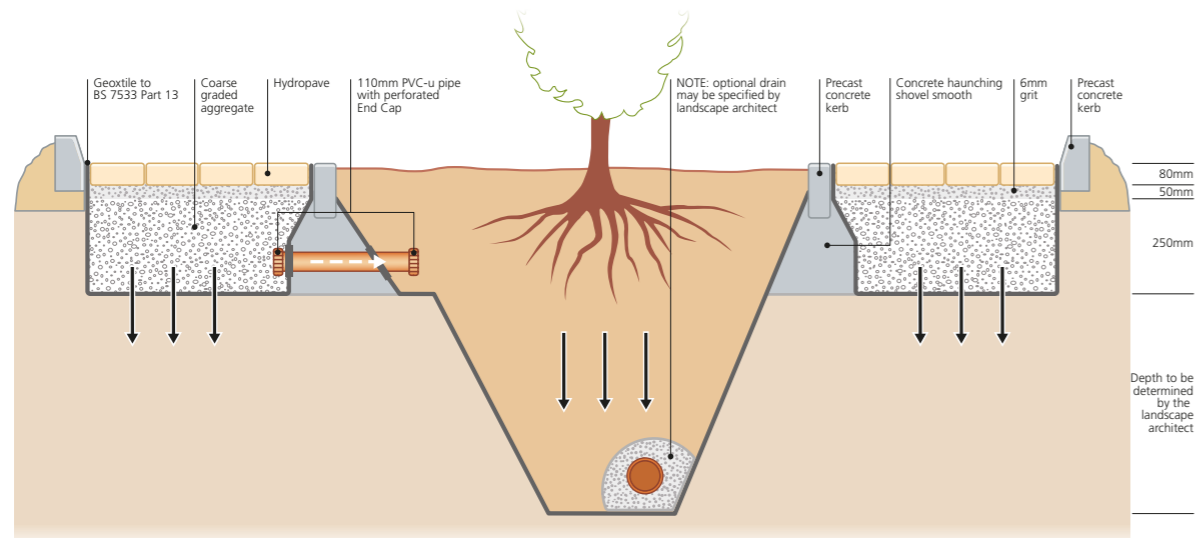


Section



Plan

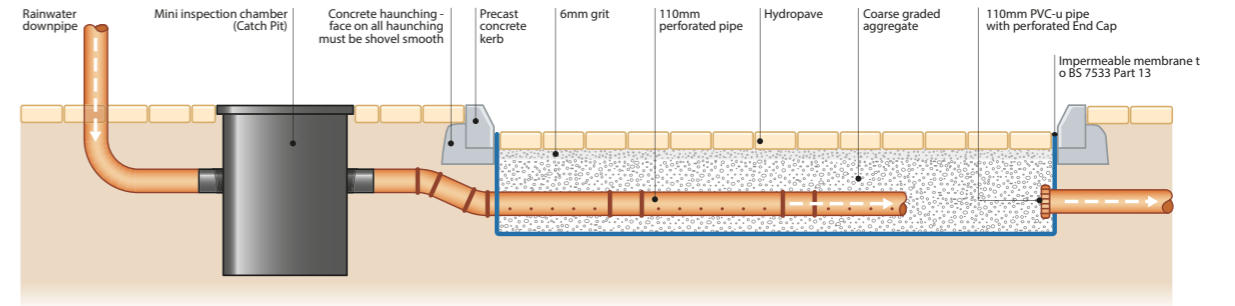
TREE PLANTING INFILTRATION SYSTEM



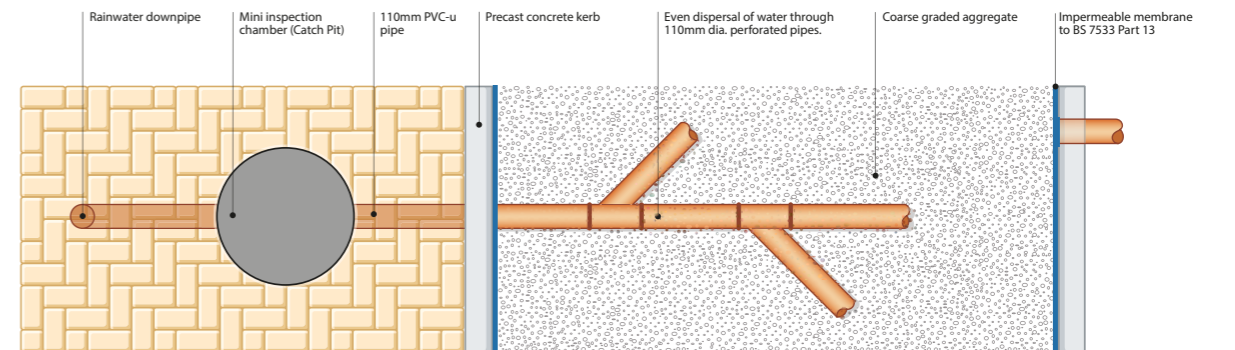
Section

Rainwater Downpipe

DOWNPIPE DRAINAGE INTO ATTENUATION SYSTEM

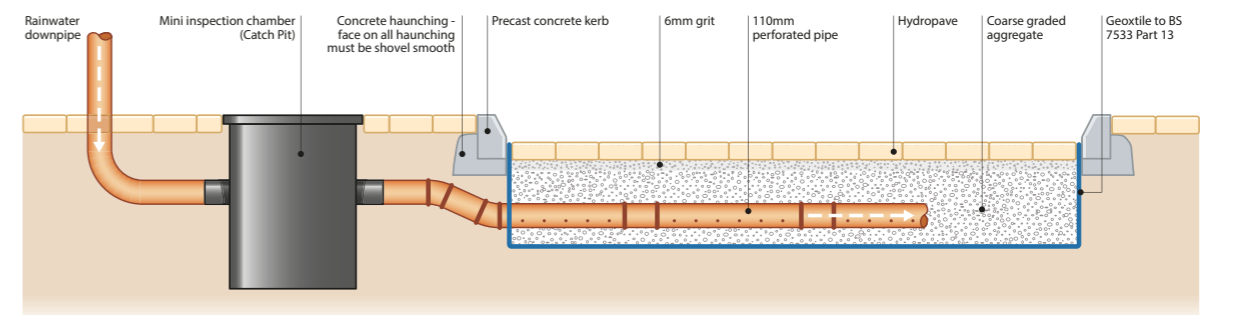


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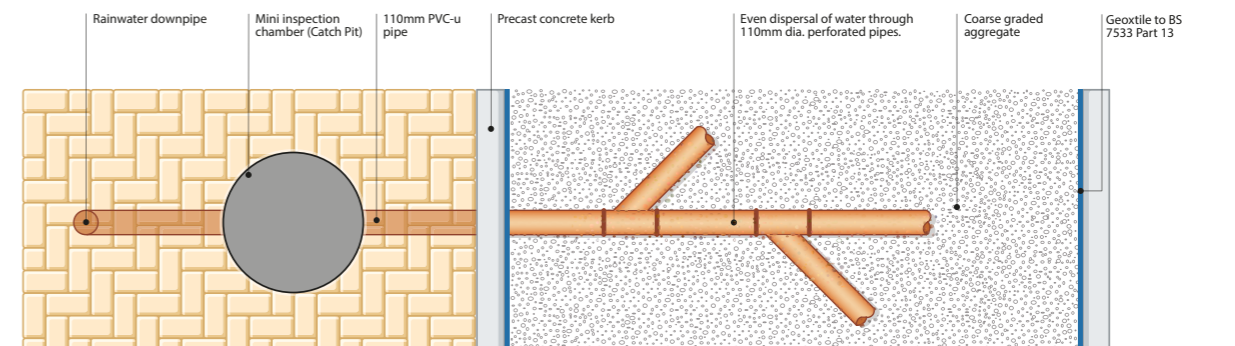


Plan

DOWNPIPE DRAINAGE INTO INFILTRATION SYSTEM



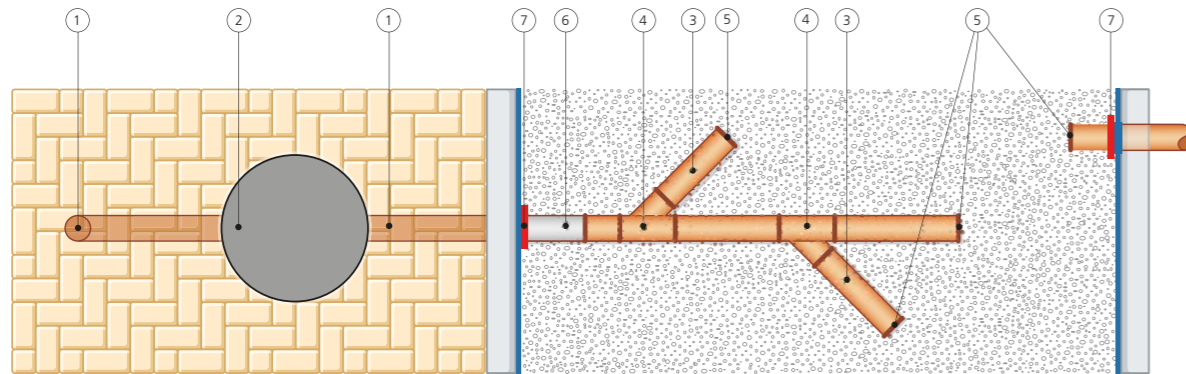
Section



Plan

Paving Utility Items

We have detailed a list of utility items that may be required on certain permeable paving schemes. In this example we have used products and codes from Polypipe. However, other equal or approved items can be used.



APPROVED PRODUCTS

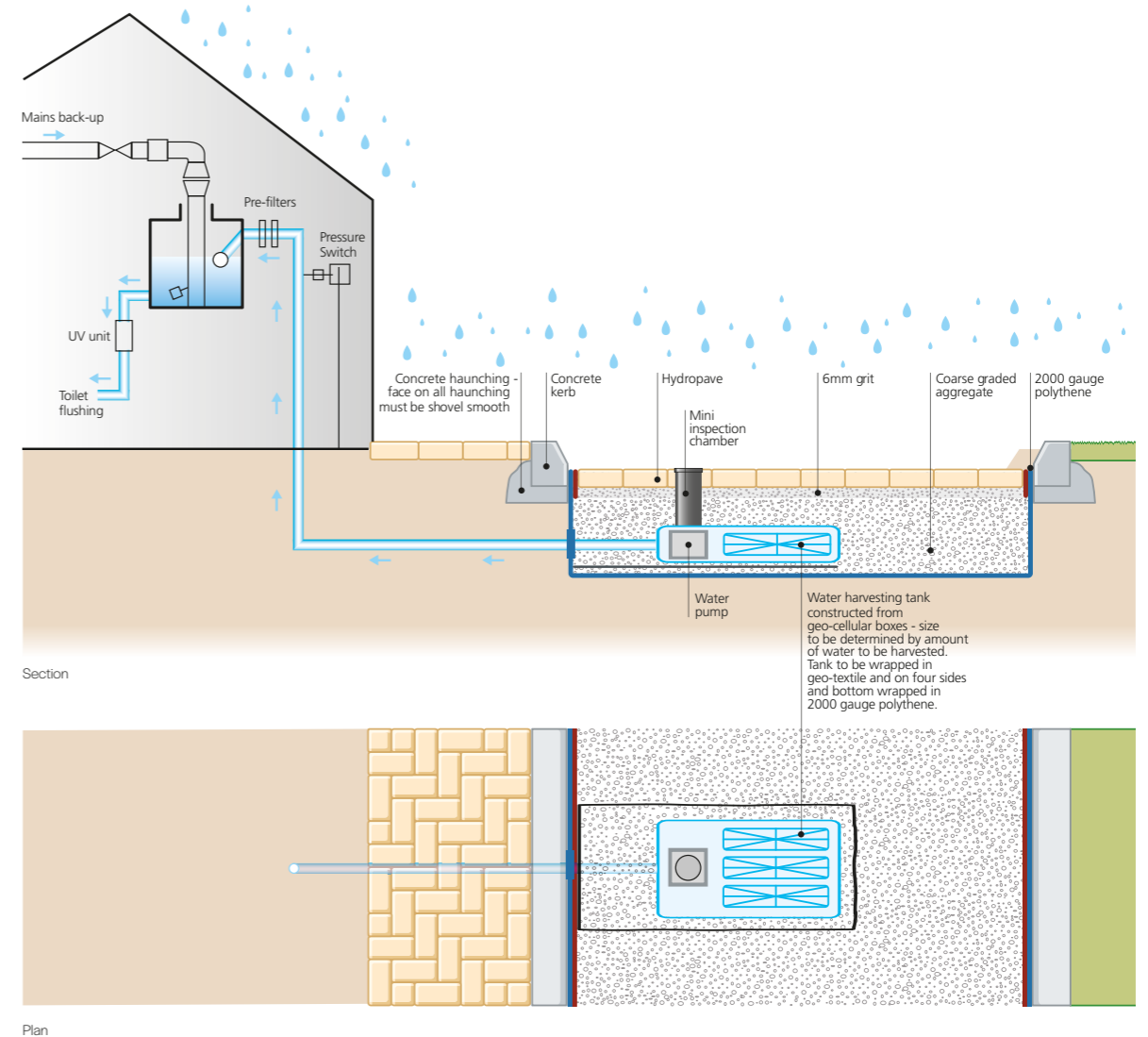
1		UNIVERSAL 110mm diameter UPVC SW pipe	Available from all builders merchants
2		450mm diameter mini inspection chamber 'Catch Pit' with plastic lid	Polypipe reference code: CP450TOB
3		100mm diameter Perforated Ridge Drain	Polypipe reference code: RD100X6PEP
4		100mm diameter Perforated Ridge Drain - 450 Junction	Polypipe reference code: JRD100100Y
5		100mm diameter External End Cap - perforate on-site using 6mm drill	Polypipe reference code: EC1059INT
6		110/100mm diameter Adapter	Polypipe reference code: ARD100110
7		110mm Top Hat Seal Joint (Butyl Tape is used to seal the Top Hat to the polythene)	www.radon.co.uk

Water Harvesting

Tobermore Hydropave products can also successfully be used in rainwater harvesting projects. Rainwater harvesting is a system where the rainwater from roofs and hard surfaces is collected through geo-cellular boxes under the paving.

This water is then distributed around the buildings and used for toilet flushing and watering gardens. Permeable paving provides the necessary filtration to remove debris and sediments which will improve the quality of the water. A Rainwater Harvesting system needs to be specially designed.

WATER HARVESTING SYSTEM





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Paving



Walling & Retaining Walls



Facing Brick

