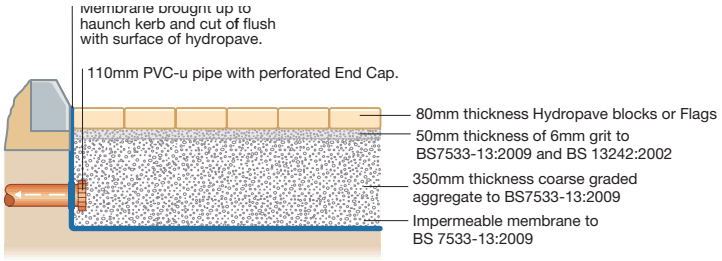
Tobermore

Guidelines for the installation of Tobermore **Hydropave Permeable Paving**

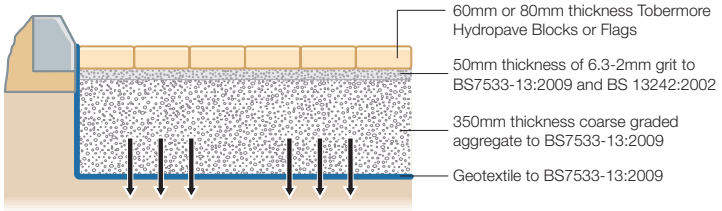
Typical Attenuation System (System C)

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, FI20 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.

Tobermore

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).

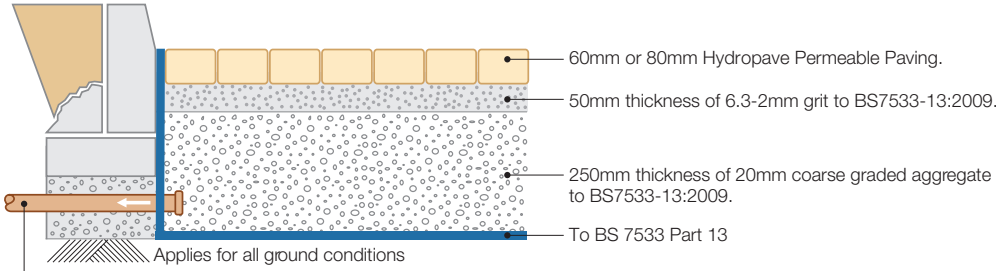
Loading Categories

Category/Application	No. of standard axles	Traffic Guide	Application
A/Domestic	0	No Large HGV	• Patio • Private Drives • Decorative Features • Enclosed Playgrounds • Footways with Zero overrun
B/Car Parking	100	Emergency vehicles only	• 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	• 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	• 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	• Industrial premises • Lightly trafficked public roads • Light industrial development • Mixed retail/industrial development • Town Square • Footway with regular overrun • Airport landslide
F/Heavy traffic	15msa	1000 large HGV/week	• Main road • Distribution centre • Bus station (bus every 5 minutes) • Roundabout • Bus lane

LOADING CATEGORY A: 1-5% CBR

Conventional edge restraint

An upper geotextile is optional on this design.



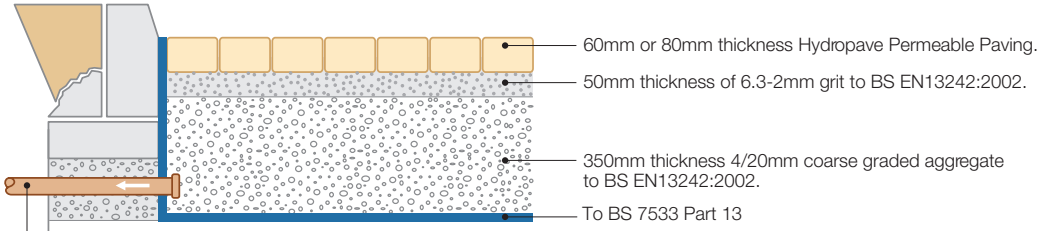
Sub-base & Capping Layers
Capping thickness to be sufficient to provide a firm working platform or in the case of low CBR subgrade ground stabilisation may be more cost effective.

Outflow pipe - diameter according to project requirements (with perforated End Cap to prevent blockage of the pipe and a Top Hat Seal is used to achieve a water tight connection)

LOADING CATEGORY B: 1-5% CBR

Conventional edge restraint

An upper geotextile is optional on this design.



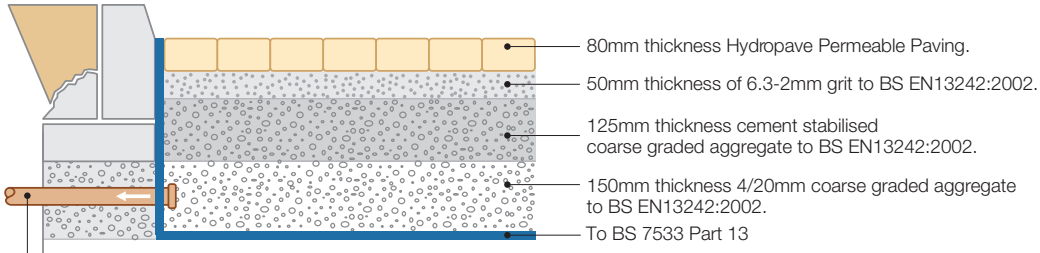
Sub-base & Capping Layers
Capping thickness to be sufficient to provide a firm working platform or in the case of low CBR subgrade ground stabilisation may be more cost effective.

Outflow pipe - diameter according to project requirements (with perforated End Cap to prevent blockage of the pipe and aTop Hat Seal is used to achieve a water tight connection)

LOADING CATEGORY C: 1-5% CBR

Conventional edge restraint

An upper geotextile is optional on this design.



Sub-base & Capping Layers
Capping thickness to be sufficient to provide a firm working platform or in the case of low CBR subgrade ground stabilisation may be more cost effective.

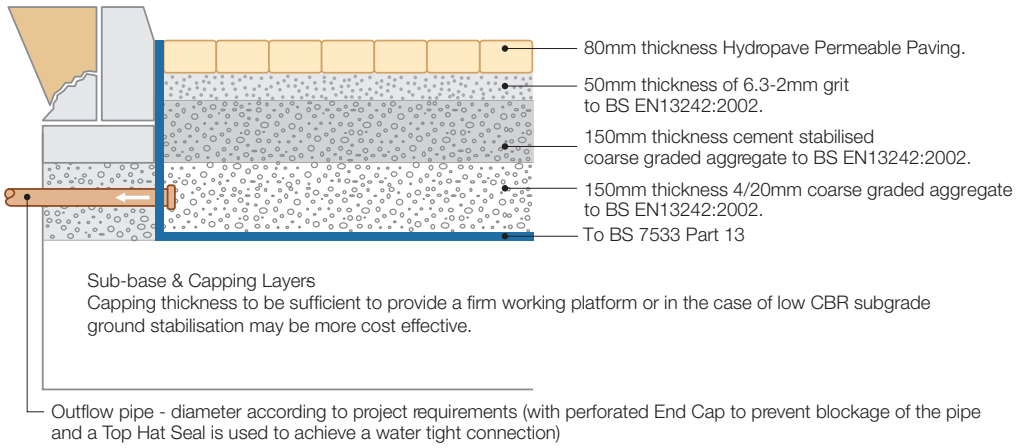
Outflow pipe - diameter according to project requirements (with perforated End Cap to prevent blockage of the pipe and a Top Hat Seal is used to achieve a water tight connection)

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

Conventional edge restraint

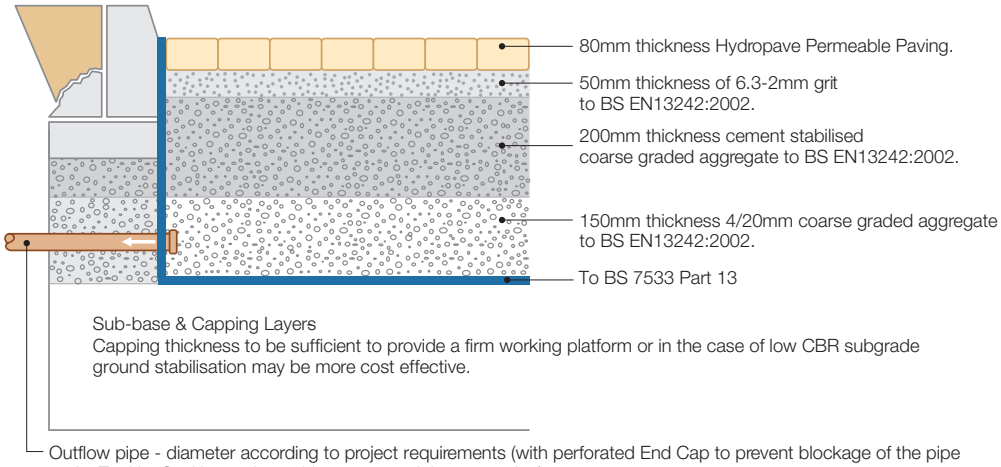
An upper geotextile is optional on this design.



LOADING CATEGORY E: 1-5% CBR

Conventional edge restraint

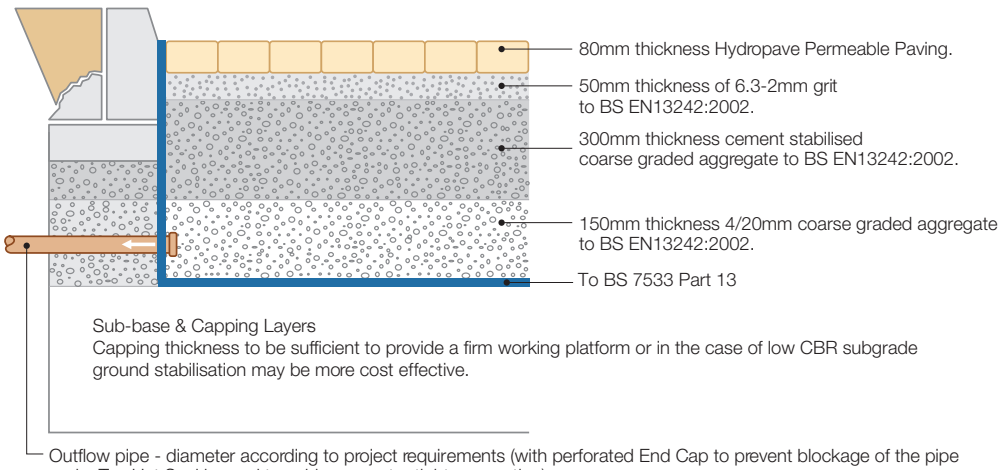
An upper geotextile is optional on this design.



LOADING CATEGORY F: 1-5% CBR

Conventional edge restraint

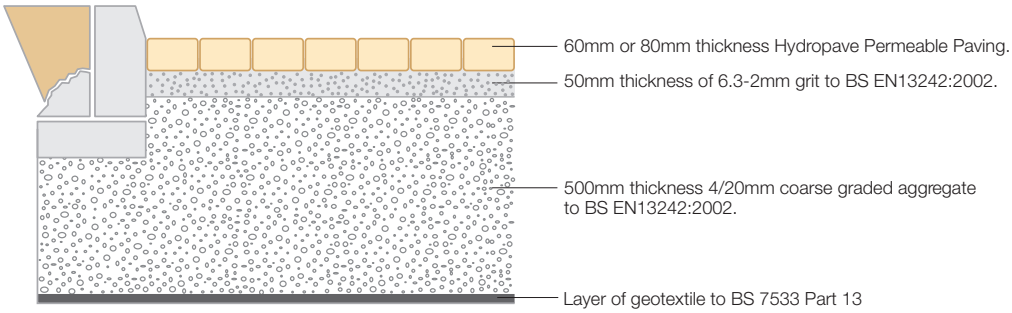
An upper geotextile is optional on this design.



LOADING CATEGORY B: 3 & 4% CBR

Conventional edge restraint

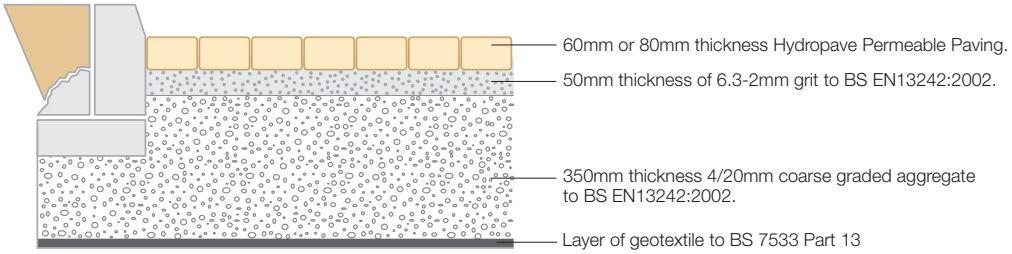
An upper geotextile is optional on this design.



LOADING CATEGORY B: 5% CBR

Conventional edge restraint

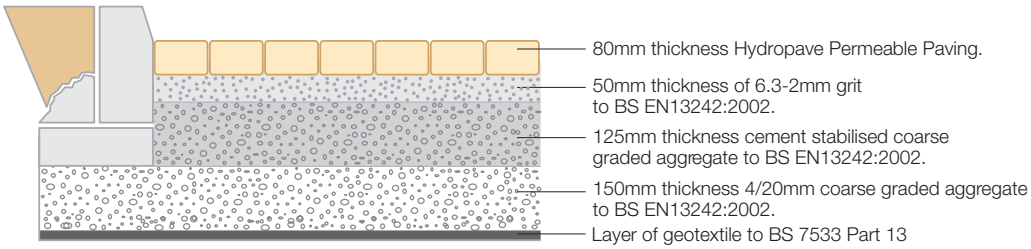
An upper geotextile is optional on this design.



LOADING CATEGORY C: 5% CBR

Conventional edge restraint

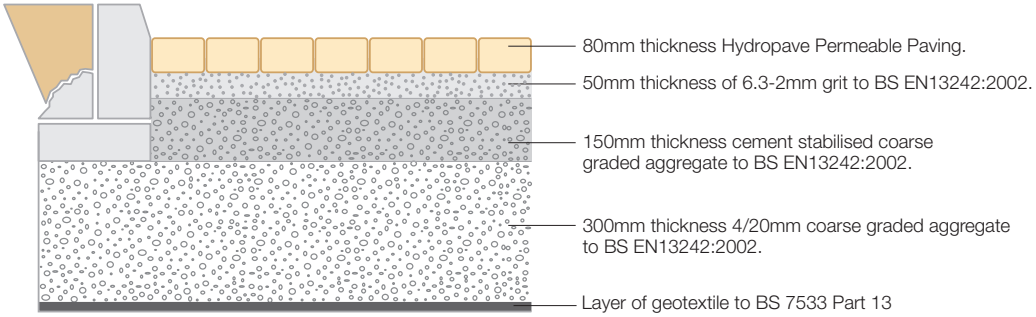
An upper geotextile is optional on this design.



LOADING CATEGORY D: 3 & 4% CBR

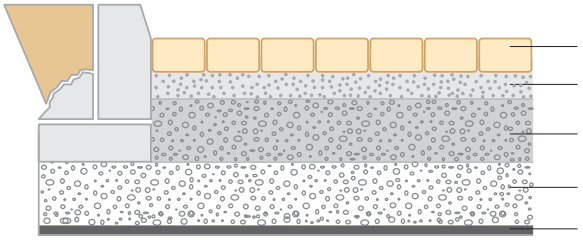
Conventional edge restraint

An upper geotextile is optional on this design.



LOADING CATEGORY D: 5% CBR

An upper geotextile is optional on this design.



80mm thickness Hydropave Permeable Paving.

50mm thickness of 6.3-2mm grit to BS EN13242:2002.

150mm thickness cement stabilised coarse graded aggregate to BS EN13242:2002.

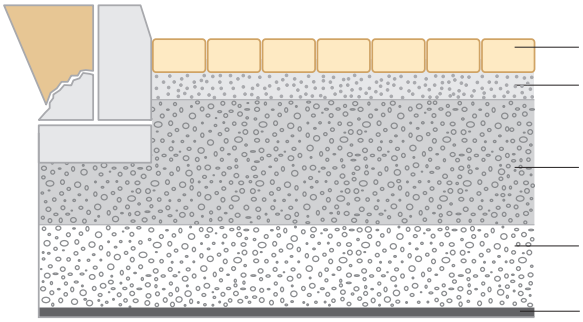
150mm thickness 4/20mm coarse graded aggregate to BS EN13242:2002.

Layer of geotextile to BS 7533 Part 13

LOADING CATEGORY E: 1-5% CBR

Conventional edge restraint

An upper geotextile is optional on this design.



80mm thickness Hydropave Permeable Paving.

50mm thickness of 6.3-2mm grit to BS EN13242:2002.

200mm thickness cement stabilised coarse graded aggregate to BS EN13242:2002.

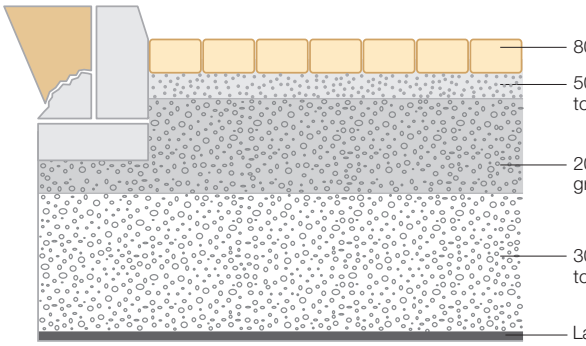
150mm thickness 4/20mm coarse graded aggregate to BS EN13242:2002.

Layer of geotextile to BS 7533 Part 13

LOADING CATEGORY F: 3 & 4% CBR

Conventional edge restraint

An upper geotextile is optional on this design.



80mm thickness Hydropave Permeable Paving.

50mm thickness of 6.3-2mm grit to BS EN13242:2002.

200mm thickness cement stabilised coarse graded aggregate to BS EN13242:2002.

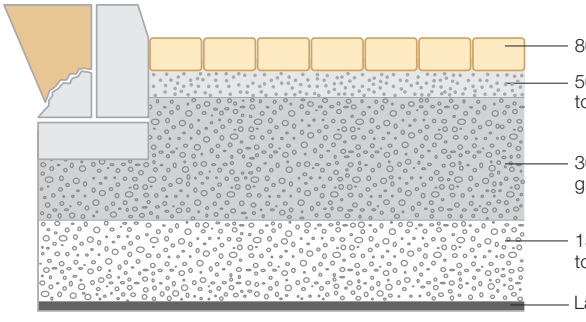
300mm thickness 4/20mm coarse graded aggregate to BS EN13242:2002.

Layer of geotextile to BS 7533 Part 13

LOADING CATEGORY F: 5% CBR

Conventional edge restraint

An upper geotextile is optional on this design.



80mm thickness Hydropave Permeable Paving.

50mm thickness of 6.3-2mm grit to BS EN13242:2002.

300mm thickness cement stabilised coarse graded aggregate to BS EN13242:2002.

150mm thickness 4/20mm coarse graded aggregate to BS EN13242:2002.

Layer of geotextile to BS 7533 Part 13

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

Instructions & Warnings

As referred to in Tobermore's Conditions of Sale

CORE TERMS (PAVING & WALLING)

Product
All products should be carefully inspected for defects or damage upon delivery and prior to being laid or fitted.

Product Information
Within Tobermore, design and development of products is a continuing process, and product information is subject to change without notice. Accordingly, please check with Tobermore to ensure that the product information you have represents the most up-to-date product information.

Delivery
Tobermore will ship your products as soon as they are ready, due to yard storage restrictions all products must be delivered within 28 days of the material being ready for delivery.

Prior to Installation
Prior to opening the packs check that all the batch code labels match. The batch code labels can be found on the outer packaging. For example, 04D22N. It is good practice to sort products to ensure consistency of colour, texture and dimensional tolerance. Any defects must be reported without delay. If products are installed with any form of defect which was clearly apparent prior to installation the installer will be responsible for all costs incurred to rectify the issue.

Installation
All products should be installed in accordance with the latest British Standard.

Colour & Texture
Tobermore produces paving and walling products with excellent density and durability. All products are manufactured in batches using naturally extracted raw materials including aggregates, pigments and cement etc. Products such Braemar, Sienna, Fusion, Mayfair Flags, Manhattan, City Pave and Fusion Kerbs are manufactured using premium naturally occurring granite aggregates. To achieve their final appearance some products undergo secondary processes, this involves shot blasting or grinding the surface of the product.

Whilst we have several factory procedures in place to help control shade, colour and texture within and between batches we cannot guarantee consistency. This is due to the natural materials and secondary processes. Therefore, slight variations in the finished products is normal between and within batches. These variations actually enhance the character and natural beauty of the products. Taking delivery of orders within 28 days can reduce the likelihood of variations.

To achieve the best possible finish we recommend the following advice is followed to evenly distribute any slight variations in shade, colour and texture over a large area.

When the circumstances allow complete one area of paving, one retaining wall or one house / building by using products taken from the same batch. This is achieved by checking the batch code label displayed on the packs.

Always, thoroughly mix products from a minimum of three packs.

Where products are supplied in packs with vertical slices always take them "vertically slice by slice" this ensures that colours are distributed evenly.

When the circumstances do not allow the use of products from the same batch then it is extremely important to minimise possible colour banding / shading by always, thoroughly mixing products from a minimum of three packs concurrently with some overlap between deliveries / batches.

Where products from different batches are being installed in the same area of paving, wall or building it is the installers responsibility to carry out a colour match check by comparing colours from each batch. If a noticeable variance in colour / shade or texture is visible, do not proceed with the installation and contact your supplier for further guidance.

Mixing thoroughly from a minimum of three packs is of particular importance when installing single colours such as Golden, Buff, Natural, Charcoal, Graphite, Silver, Mid-Grey, Sandstone, Alto Silver, Aaron Stone, Jura Grey and Innis Black. During installation the installer must make regular visual checks to ensure the blending of colours is consistent.

We would always recommend that when purchasing products, especially in larger quantities, that they are all ordered at the same time.

Please note that the colour of new products will inevitably vary compared to those that have been installed for a period of time as weathering does take place.

All colour illustrations are as accurate as the printing process will allow. For a more accurate colour match please refer to actual product samples, which can be provided.

Colours and textures illustrated are representations and therefore should not be expected to be an exact match.

The overall visual appearance of a completed installation should only be assessed from the normal viewing distance. Variations in colour/shade and texture are technically harmless, do not affect the products performance and are not deemed to be a product defect.

We will not be held liable for any discolouration or staining caused to product which has been stored incorrectly.

Note: Whilst we strive to ensure consistency, complimentary products such as Kerb Specials, Step Flags, Facing Brick Specials, Historic Circles etc. may not be an exact colour / texture or shade match to the standard version of the product as they will have been manufactured at varying times using different processes.

Tegula
Tegula is manufactured using a secondary process that distresses the edges and corners of the blocks to give the desired aged antique appearance. The process randomly distresses the blocks, therefore some blocks will be more distressed than others will, this is completely normal and does not affect the product performance.

Staining
Some chemicals that are commonly used in gardens such as lawn feed containing Ferrous Sulphate can stain concrete products. Any chemicals that are spilt must be removed immediately by rinsing away with clean water. Please check the information on the instruction label of the container holding the chemical.

Moisture
Occasionally, after installation, some units may show variations in shade and have a patchy appearance. This is due to the varying amounts of moisture within the concrete and the ground. The drying out process of concrete continues in-situ after installation. Some units may also retain more moisture than neighbouring units and take longer to dry out. This is caused by the variations in density of the naturally extracted aggregates used in the manufacturing process. Given time and natural weathering, the capillaries within the surface of the concrete will gradually close and any patches or moisture retention will dissipate as the product matures. This does not affect long-term performance.

Efflorescence
Efflorescence is a crystalline deposit that occurs naturally on the surface of concrete materials. It usually appears as white deposit but can also be brown or yellow in appearance. Tobermore use market-leading technology to significantly suppress the occurrence of efflorescence, however, if it occurs, it may mask the colour of the product for a period of time, but tends to be washed away gradually by rain. Tobermore do not replace products with efflorescence. Packs of products which have had packaging removed should always be re-covered with appropriate packaging to prevent the occurrence of secondary efflorescence.

Surface Scratches
Minor scuffs or bruises may occur during delivery, movement onsite, and installation (for example, during any plate vibrating process). In Tobermore's experience, these marks usually weather off through time. (EasyClean products are protected with a glue dot)

To reduce the risk of surface scratches we strongly recommend the use of a vibrating plate with a rubber protective mat.

Ordering
To avoid waste, please ensure that your contractor accurately measures the area on site before ordering products. In Tobermore's experience, dimensions taken from a project plan can vary significantly from the final layout.

Depending on the layout of the project, we recommend ordering an additional 2 - 5% of material to allow for cutting, detailing and wastage.

Manufacturing & Quality Systems
Tobermore is a BS EN ISO 9001, BS EN ISO 14001 and BES 6001 registered company. Tobermore uses an integrated management system to manage all health & safety and environmental issues.

Product Maintenance
Routine cleaning and maintenance is required to keep the overall appearance of products in pristine condition.

All concrete products can develop algae, lichen, and moss growths due to environmental conditions and may require cleaning. Areas adjacent to plant borders and trees may discolour from transfer of plant-life. Tobermore cannot accept responsibility for any of these conditions.

Queries & Complaints
Please contact one of Tobermore's Paving & Walling Centres or offices (contact details at www.tobermore.co.uk) with any queries or complaints. Any complaints must be notified to Tobermore without delay.

CORE TERMS (PAVING ONLY)

Paving installed unbound should have a close joint width of 2-5mm to allow for the dimensional tolerances of products and to create a gap to allow the brushing in of kiln dried jointing sand. The straightness of lines will be dependent on workmanship and product tolerances. String lines must be used to help achieve straight lines.

Tobermore do not recommend Butt jointing as this will make achieving straight lines more difficult.

Product Maintenance
Light coloured paving blocks and flags emphasise tyre marks and oil spills on the driveway. Please note that these products will need more maintenance if overall appearance is to be maintained.

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

General Cleaning
Paving requires regular maintenance, including regular sweeping to prevent the build up of detritus. Tobermore recommends that paving is cleaned 2-3 times per year.

Instructions & Warnings

As referred to in Tobermore's Conditions of Sale

For general cleaning of dirt and algae, vigorous brushing with a stiff yard brush with plenty of hot detergent solution (washing up liquid or non-bio washing powder), thoroughly rinsed with clean water, should suffice. Repeated treatment may be required for paved areas sited beneath trees or in permanent/near permanent shade.
A light power hose at medium pressure is generally all that is required to clean general dirt and grime. Any jointing material which is removed must be replaced. Do not use high pressure powerwashers as aggressive power-washing can damage the product surface. A trial area should be tested before large scale powerwashing takes place.
(Important: EasyClean products should not be pressure washed. Please refer to specific EasyClean information)

Moss, Lichen and Algae
Thick growths of moss or lichen must be removed first by scraping out the joints and then treating the area with a moss killer such as anti-moss paving cleaner. Anti-moss is designed to remove moss, lichens and algae. It is best applied in dry weather. After being applied it will take a few days to be fully effective. Once the moss and lichens have been killed, they can easily be brushed off. Anti-moss also leaves a residue in the sand joint which will help reduce the likelihood of re-growth. The manufacturer's instructions should always be followed when using any cleaning agent.

Weeds
Large weeds should be removed by hand and then the area treated with a weed killer (available from any good garden centre). Smaller weeds can then be treated directly with weed killer and these weeds should start to die within days. The manufacturer's instructions should always be followed when using any weed killing agent.

Block Paving Sealer
It is possible to seal block paving with a resin material which combats staining and weed growth and which also enhances colour and appearance. The acrylic sealer is sprayed onto the block paving and forms a 'skin' on top of the paving and the jointing material giving an easily maintained finish. The manufacturer's instructions should always be followed when using any sealing agent. (Important: Do not use sealers on EasyClean products)

FOR HYDROPAVE PRODUCTS

Installation - Hydropave
Tobermore recommends that its Hydropave products be installed in conjunction with a BS EN 7533-13:2009 designed permeable paving system.

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.

Joint Filling
All joints must be filled to the top with 6.3 – 2mm grit to prevent movement and spalling of the blocks. We recommend that after a few weeks use, 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 one tonne 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.

Hydropave Maintenance
Please refer to Tobermore's detailed 'Permeable Paving Maintenance Guidelines' available on our website: www.tobermore.co.uk