australmasonry

Causeway
Permeable Pavers

New South Wales and Victoria

What's inside

A BRAND OF

BRICKWORKS

Causeway

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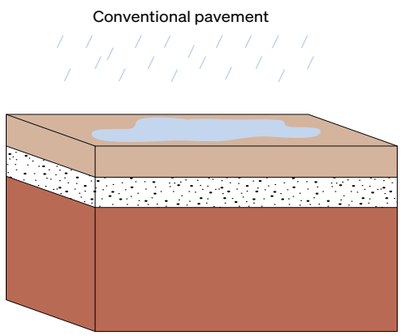
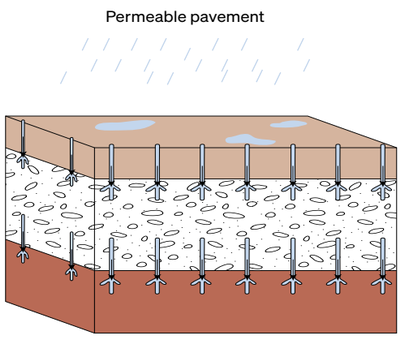
Products that last a lifetime

Overview

Causeway permeable paver systems provides an all-in-one hardstand and drainage solution.





The patented Causeway system allows rain water to infiltrate through small channels on each of the four sides of the concrete pavers, and flow to the prepared sub-base. The water is then detained, filter treated and dispersed, discharged or directed for re-use.

Rather than collecting water run off, channelling it through open drains and subsequently treating it, water engineers in many parts of the world are solving the problem at the source using permeable paving solutions as a more cost-effective and environmentally productive approach.

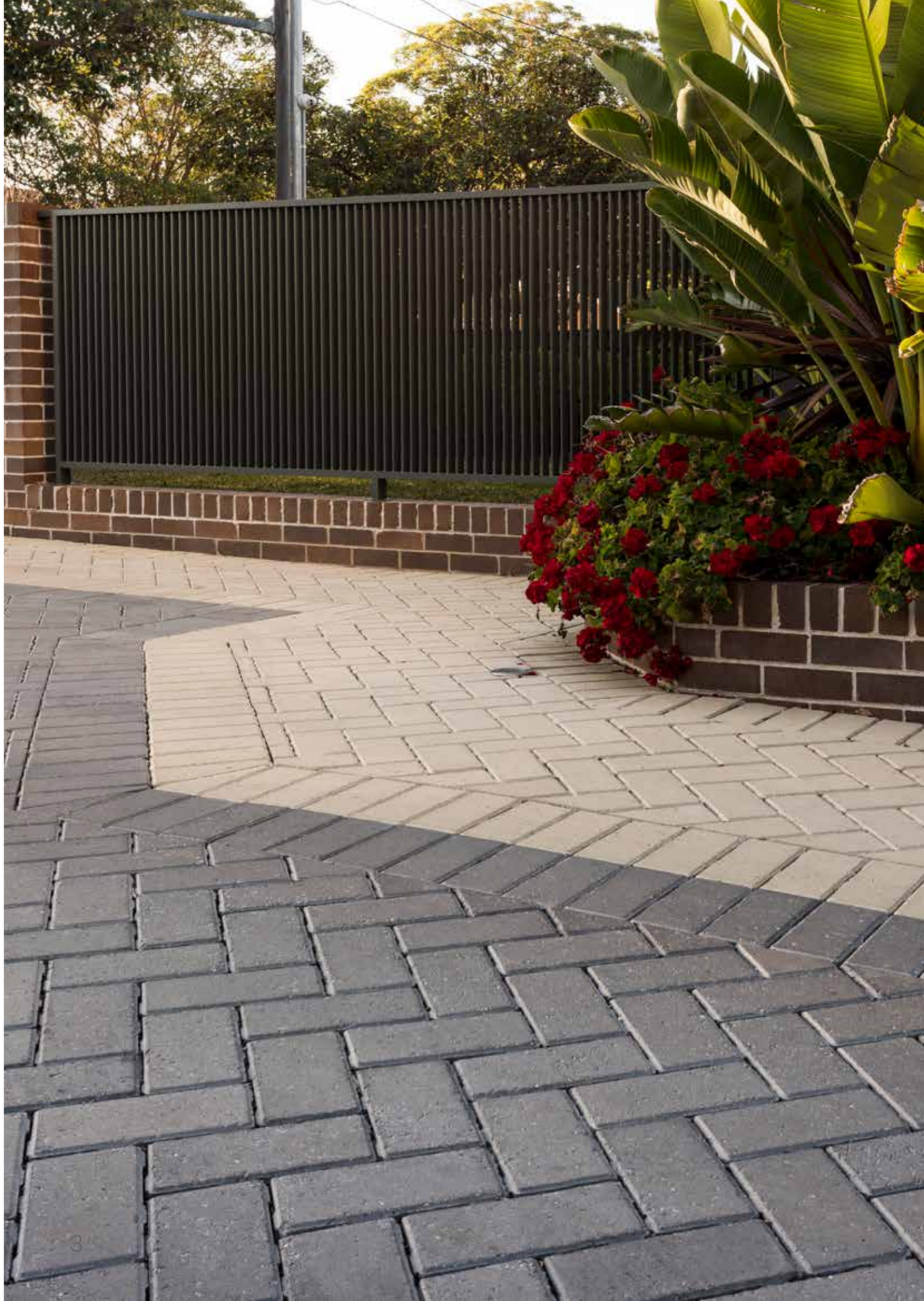
Depending on the projects requirements, the permeable pavement can either be designed to allow water to re-enter the natural water table through infiltration, once it has passed through the graded stone sub-base, or be captured, by tanking the sub-base, and reusing the water for irrigation and other applications.

Permeable paving systems can remove contaminants such as heavy metals and hydrocarbons from polluted stormwater run-off. As the water flows through the sub-base of graded aggregate, it gets filtered through microbial action, breaking down contaminants before re-entering the natural environment.

Field studies[1] conducted over the past 20 years of four different types of permeable pavements installed in a parking area found no oil, fuel or lead in the water infiltrated past the pavement sub-base, as they were broken down by microbes within the aggregate layers. This occured even though these pollutants were present in the direct surface runoff from the impermeable asphalt control sample. Field studies have also shown permeable pavements to be very effective at retaining dissolved metals.

A further study[2] found that the impervious area on a road surface reduced from 45% to 5% when permeable pavements were used. Subsequent monitoring found that surface run off water quality improved and there was no increase in groundwater contaminants.

[1] Brattebo, B. O. and Booth, D. B. 2003, 'Long-term stormwater quantity and quality performance of permeable pavement systems', Water Resources, vol. 37, No. 18, pp. 4369-4376, Elsevier Press.
[2] Rankin, K. and Ball, J.E. 2004, 'A review of the performance of permeable pavers', in Proceedings of the 2004 International Conference on Water Sensitive Urban Design, WSUD2004: Cities as Catchments, Adelaide, South Australia



Flooding and 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 putting our already overloaded drainage systems under greater pressure.

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. Such events are happening globally.

To minimise any increased surface run-off in new developments should be carefully designed and managed. Appropriate storm water source control measures, which also improve water quality, should be incorporated into the development proposal.

Permeable Paving

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The solution to flooding problems is the use of more sustainable methods of stormwater 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 and water quality improvement.

Water quality improvement

Permeable paving is very effective at removing pollution from water run-off. 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. This occurs through natural microbial action.

Four Elements of Permeable Paving

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Permeability

The infiltration rate through the joints of newly installed concrete block permeable paving is significantly higher than the typical rainfall rates in most areas.

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 hydrological requirements.

Detention

The sub-base thickness should be designed to detain rain falling throughout 24 hours and must provide at least 30% void space.

See further in this brochure for details on different sub-base infiltration and tanked options.

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.

Pollution

As water flows through to 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.

Structure

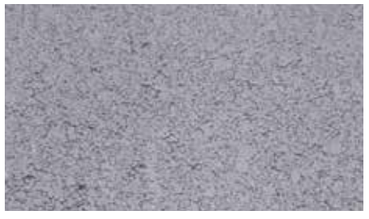
The specification of a permeable paving structure depends upon the hydraulic and traffic loading characteristics and upon the properties of the subgrade.

Product range

Choose from our range of standard colours below or discuss made to order options with your Austral Masonry representative.

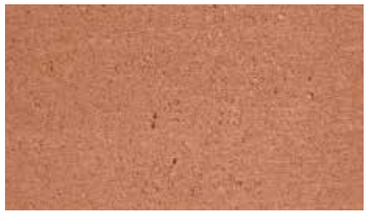
Applications	Parks | Tree Surrounds | Parking Lots | Low-Traffic Roads | Sidewalls Driveways | Shopping Centre Car Parks | Parking Bays near Creeks to collect surface polutants before entering waterways

Colours


Natural


Almond


Charcoal


Terracotta

Types


Causeway

Size: 230L × 115W × 80H mm

Weight (each): 4.3kg

Face Area: 38 units per m²

Benefits

Causeway permeable pavers offer a host of benefits including:

1.

Hardstand and drainage
Permeable pavers create a hardstand and drainage solution in one product.

2.

Reduce costs
Permeable paving can reduce the investment required in sub surface drainage infrastructure and remove the need to up-size culverts and water courses.

3.

Capture and reuse water
When used in a tanked system, water can be collected and reused. Permeable pavers offer safe collection, detention and discharge with no dangerous open drains or pits.

4.

Instant hardstand
No curing time is required with permeable pavers. They are supplied ready to be driven on once the joint aggregate is placed between the joints.

6.

Designed to last
Permeable paved hardstands are estimated to have a design life of 25+ years. At the end of this design life pavers simply need to be re bedded, with the same paver units re installed.

7.

Filter contaminents
A permeable paving system can be designed to filter contaminants and pollutants from water run off as it drains.

8.

Allows for ground movement
Because a permeable pavement is composed of many small units, it will allow ground movement without being damaged.

9.

Allows access to services
Underground services can be accessed by simply removing the desired section of pavers to access to the area below.

10.

Low embodied energy
Permeable pavers are cured in temperature controlled kilns which means their production requires less energy than some competing products.

11.

Rust, rot and termite resistant
Because they are made from concrete, permeable pavers are impervious to rust, rot and termites.

Technical Guide

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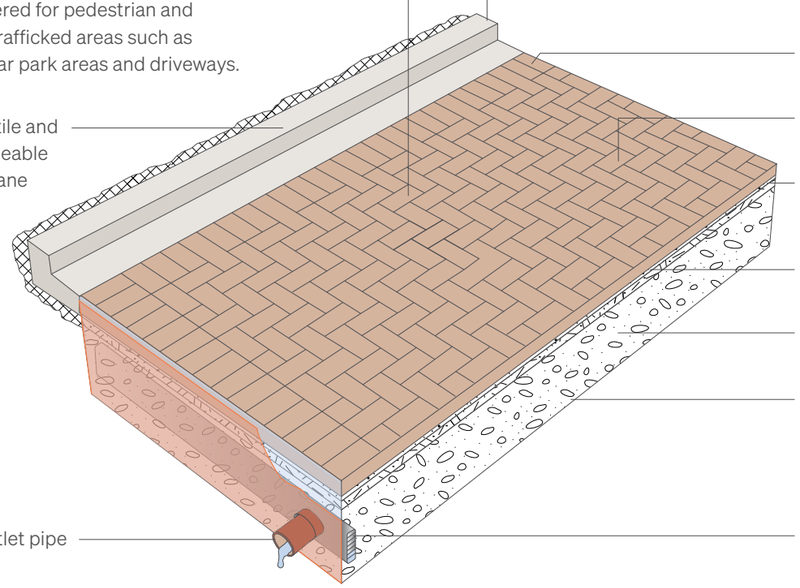
Permeable Paving
System Overview

System Overview

The Causeway paving system is engineered for pedestrian and lightly trafficked areas such as malls, car park areas and driveways.



Permeable Paving
System Overview

Cross Section

1.

Causeway Permeable Pavers
feature a unique edge chamfer and bevel which permits butt joining. A light dressing of 3mm diameter clean aggregate should be applied during compaction.

2.

Bedding Course
50mm thick layer of 5mm single size crushed aggregate.

3.

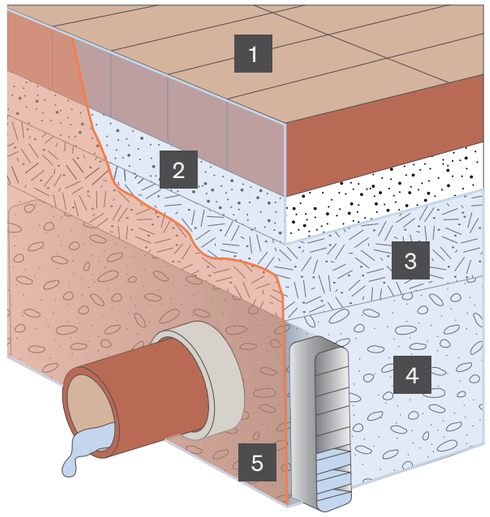
Fabric Filter
Geotextile, standard or heavy grade depending on pavement design.

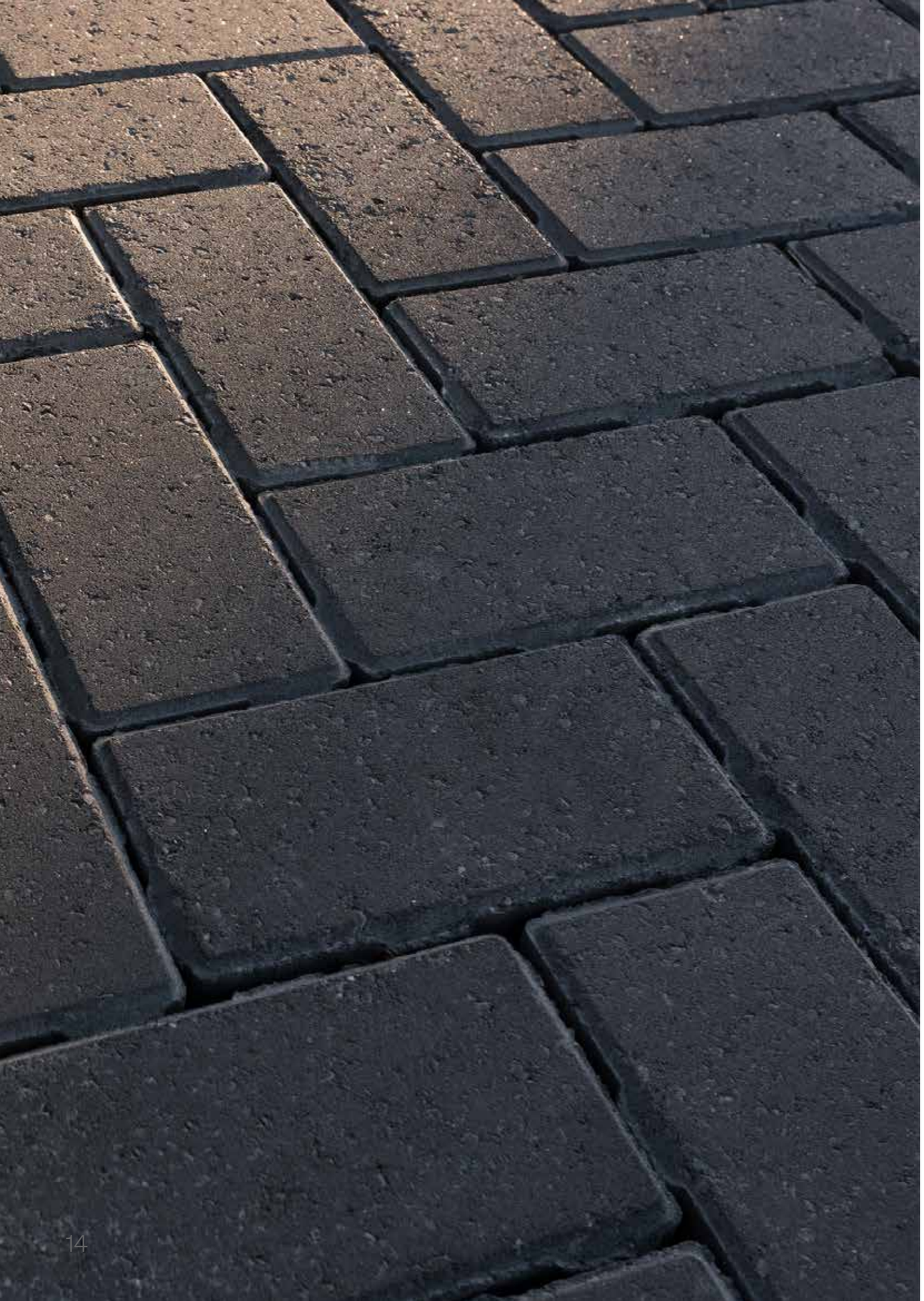
4.

Sub Base
Typically 350mm thick layer of single size 40mm crushed aggregate, gap graded, and yielding 30% voids. Thickness may be varied depending on pavement design.

5.

Perimeter Membrane
Either impermeable plastic membrane for tanked systems,





Permeable Paving
System Components

1.
Causeway permeable pavement systems permit the rapid infiltration of rainfall.

2.
The joints between the pavers must not be left empty but should be completely filled with a uniform aggregate of 3mm thickness. Sand must not be used instead of aggregate as it slows water ingress.

3.
Depending on the degree of infiltration that can be achieved for a particular design, it may be necessary to provide drainage at the perimeter of the paving to manage overflows. This can be achieved by using conventional gulley inlets to existing storm sewers or by constructing swales or bio-retention areas adjacent to the pavement.

4.
The permeable pavers are laid on a 20-40 mm bedding course of uniform aggregate typically 5 mm in size. Sand is not suitable as a bedding course and should not be used in permeable pavements because it does not allow water to infiltrate rapidly enough to cope with Australian rainfall.

5.
Beneath the bedding layer a permeable geotextile may be installed. This is optional. A review of pavements overseas, over the past decade, has shown that such geotextiles should not be used.

6.
A permeable base course normally consisting of a 250mm deep compacted unbound layer. This layer is composed of granular materials of larger size at the bottom, medium size in the middle and smaller sized granular material at the top. These varied layers of granular material, typically 63 - 10mm granular grading or to engineers specifications. This provides the main load-bearing layer . The thickness of this layer must be sufficient both to resist traffic loads and to provide adequate water storage.

For further design assistance go to www.cmaa.com.au where you can download the free permeable paving software program.

7.
On cohesive sub grades, a filter fabric must be provided under the base course to prevent clay migrating into the pavement. This is not needed where the sub grade is granular ie a sandy or gravelly material.

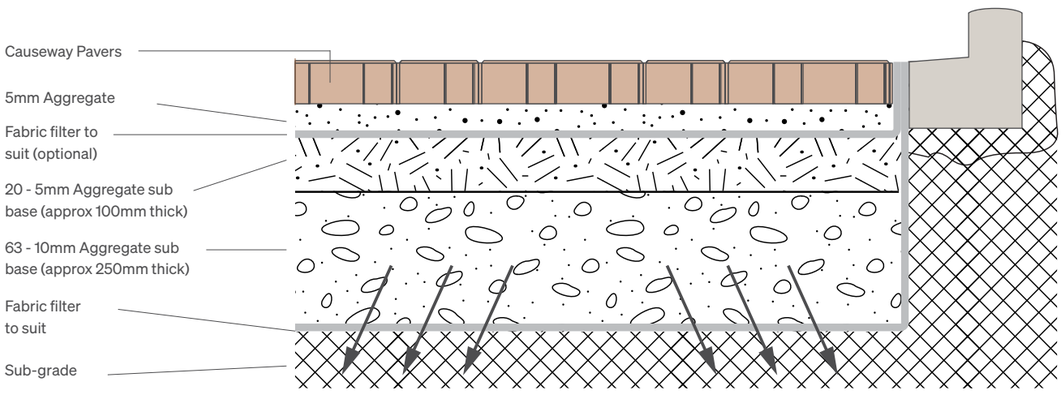
8.
Where the sub grade is contaminated, saline or expansive, an impermeable membrane must be provided under the base course to prevent water entering or leaving the pavement . This membrane will normally be run up the sides of the pavements.

9.
The in-situ soil at the pavement site is known as the sub-grade. The type of sub-grade determines what type of permeable pavement cross-section is feasible and how thick the pavement will need to be to resist traffic and to control stormwater. The sub-grade must always be compacted to a depth of at least 100 mm.

Permeable Paving
Infiltration System

Typical Infiltration System Design

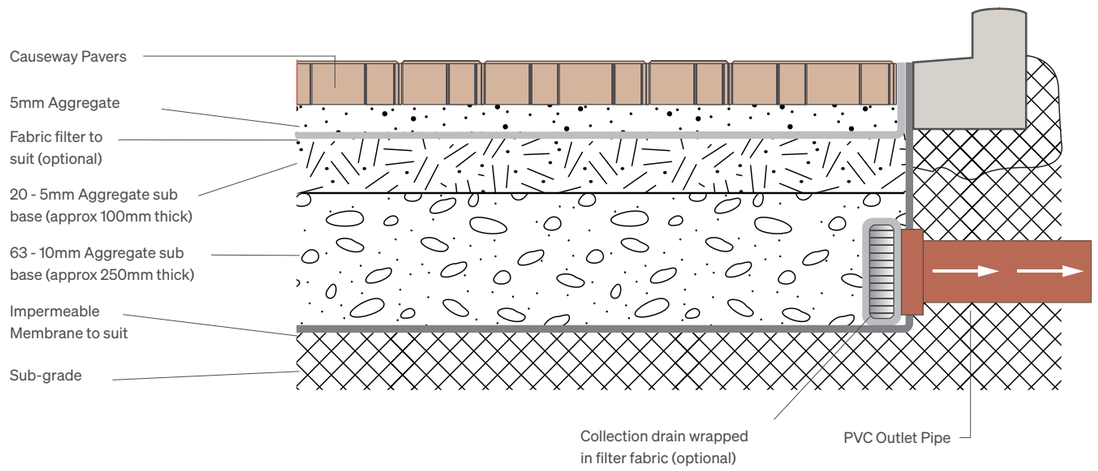
Water is allowed to drain between pavers with filtration through sub-base materials before entering naturally occuring ground water systems.



Permeable Paving
Tanked System

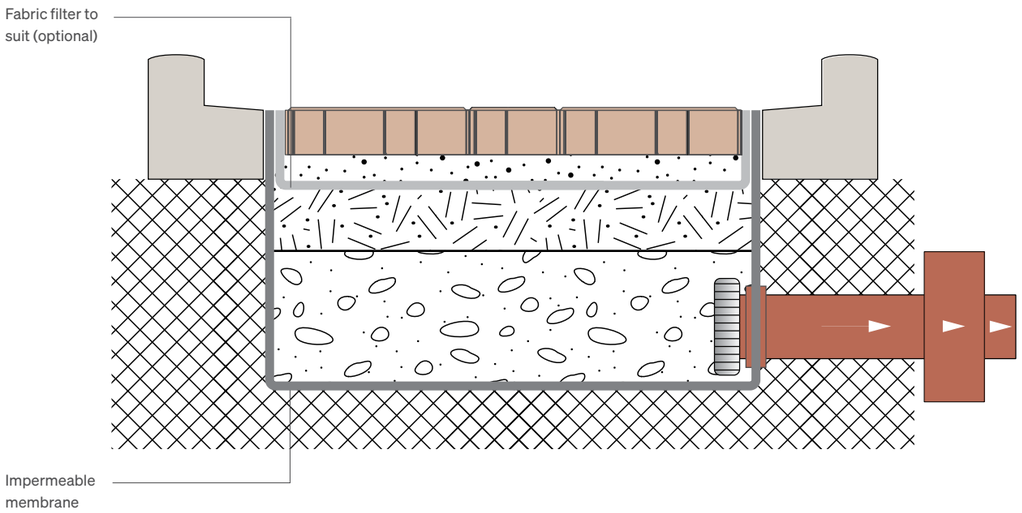
Typical Tanked System Design

Water drains between pavers with filtration through sub-base materials where it is captured wihtin the tanked system (due to the impermeable membrane at the bottom) and then directed through a PVC pipe for storage and reuse.

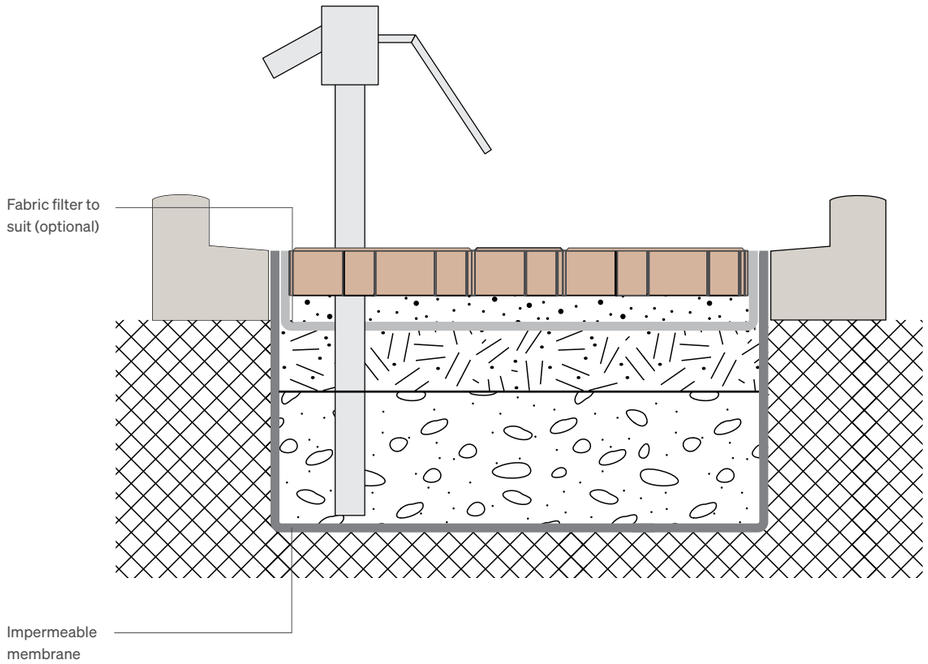


Permeable Paving
Tanked System

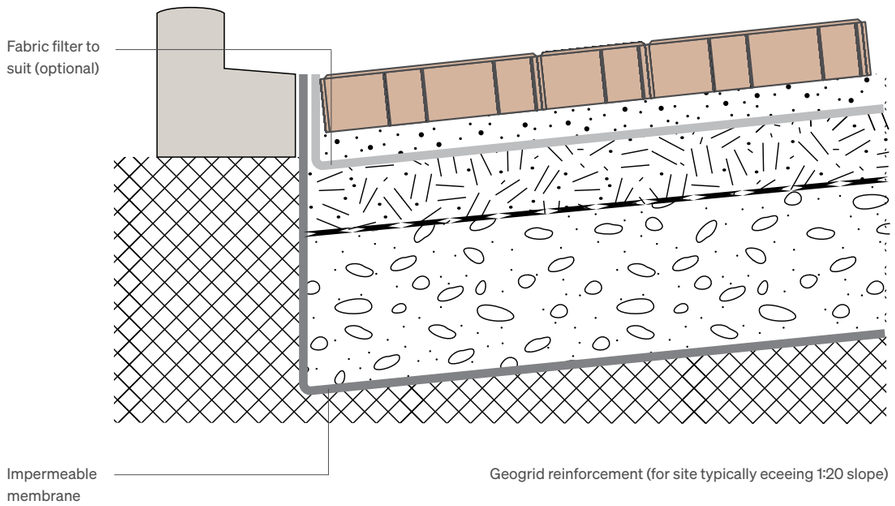
Infiltration and Overflow



Typical and Re-use



Tanked with Additional Treatment



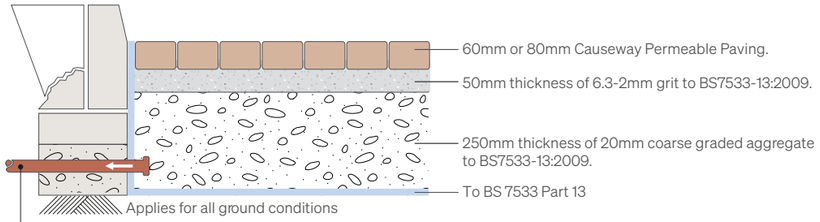
Attenuation Designs

The following cross sections are based on the British Standards as noted.
(In Australia there is no stand alone standard on paving, permeable or otherwise, and as such European and British standards are beneficial)

Loading Category A: 1-5% CBR

Conventional edge restraint

An upper geotextile is optional on this design.



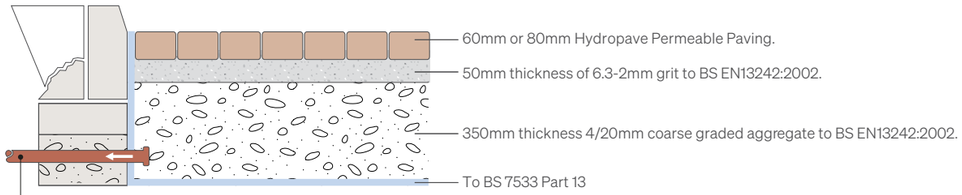
Sub-base & Capping Layers
Capping thickness to be sufficient to provide a firm working platform or in the case of low CBR subgrade ground stabilisation may be more cost effective.

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.



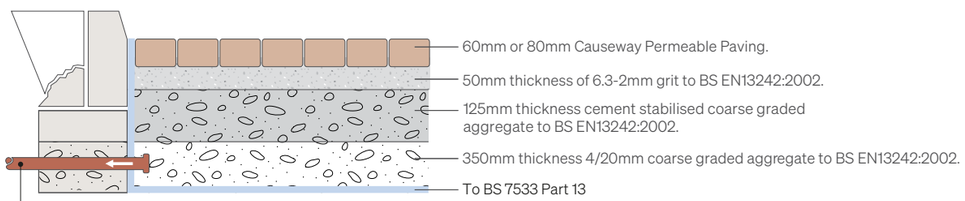
Sub-base & Capping Layers
Capping thickness to be sufficient to provide a firm working platform or in the case of low CBR subgrade ground stabilisation may be more cost effective.

Outflow pipe - diameter according to project requirements (with perforated End Cap to prevent blockage of the pipe and a Top 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

The following cross sections are based on the British Standards as noted.
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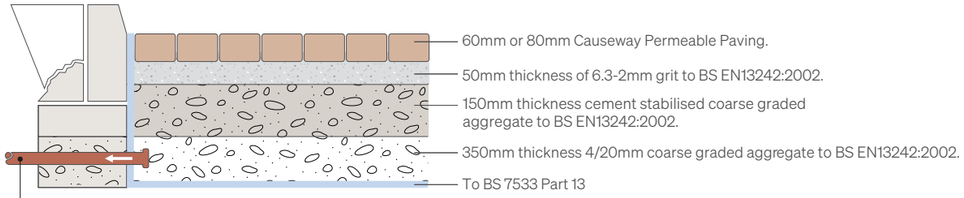
Loading Category D: 1-5% CBR

Conventional edge restraint

An upper geotextile is optional on this design.



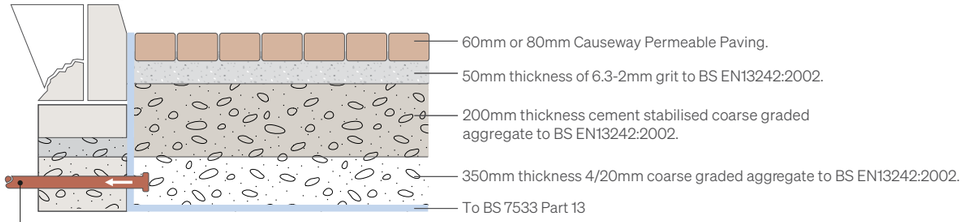
Sub-base & Capping Layers
Capping thickness to be sufficient to provide a firm working platform or in the case of low CBR subgrade ground stabilisation may be more cost effective.

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 E: 1-5% CBR

Conventional edge restraint

An upper geotextile is optional on this design.



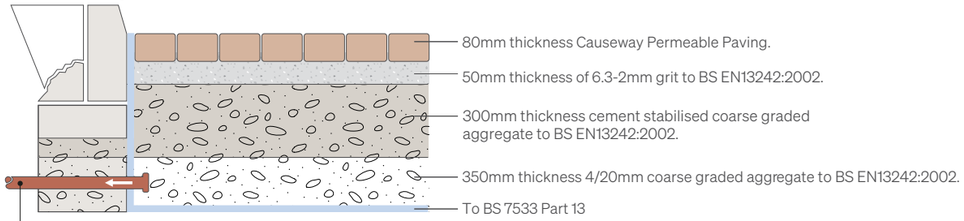
Sub-base & Capping Layers
Capping thickness to be sufficient to provide a firm working platform or in the case of low CBR subgrade ground stabilisation may be more cost effective.

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 F: 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)

The following cross sections are based on the British Standards as noted.
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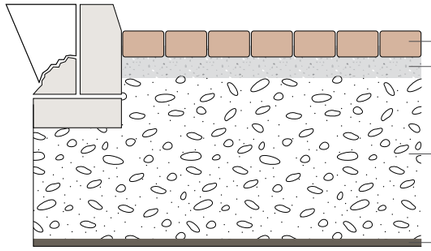
Infiltration Designs

Loading Category B: 3 & 4% CBR

Conventional edge restraint

An upper geotextile is optional on this design.



60mm or 80mm thickness Causeway Permeable Paving.

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

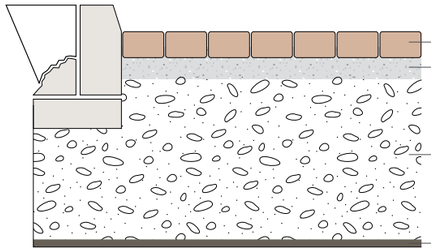
500mm thickness 4/20mm coarse graded aggregate to BS EN13242:2002.

Layer of geotextile to BS 7533 Part 13

Loading Category B: 5% CBR

Conventional edge restraint

An upper geotextile is optional on this design.



60mm or 80mm thickness Causeway Permeable Paving.

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

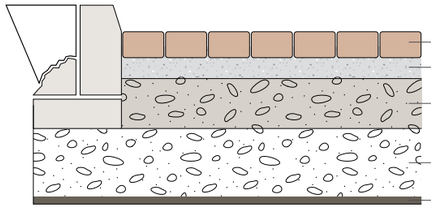
350mm thickness 4/20mm coarse graded aggregate to BS EN13242:2002

Layer of geotextile to BS 7533 Part 13

Loading Category C: 5% CBR

Conventional edge restraint

An upper geotextile is optional on this design.



80mm thickness Causeway Permeable Paving.

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

125mm thickness cement stabilised coarse graded aggregate to BS EN13242:2002.

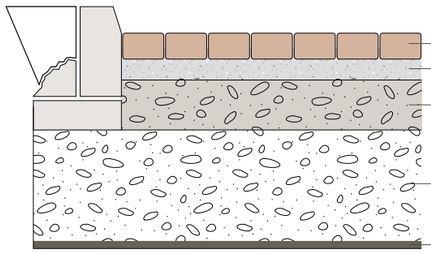
150mm thickness 4/20mm coarse graded aggregate to BS EN13242:2002

Layer of geotextile to BS 7533 Part 13

Loading Category D: 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.

150mm 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

The following cross sections are based on the British Standards as noted.
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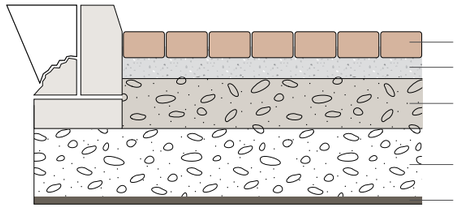
Loading Category D: 5% CBR

Conventional edge restraint

An upper geotextile is optional on this design.



80mm thickness Causeway Permeable Paving.

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

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

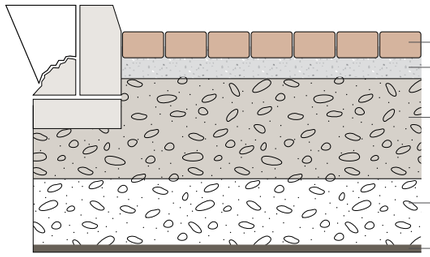
150mm thickness 4/20mm coarse graded aggregate to BS EN13242:2002

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 Causeway Permeable Paving.

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

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

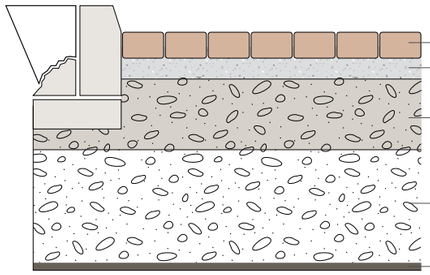
150mm thickness 4/20mm coarse graded aggregate to BS EN13242:2002

Layer of geotextile to BS 7533 Part 13

Loading Category E: 1-5% CBR

Conventional edge restraint

An upper geotextile is optional on this design.



80mm thickness Causeway Permeable Paving.

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

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

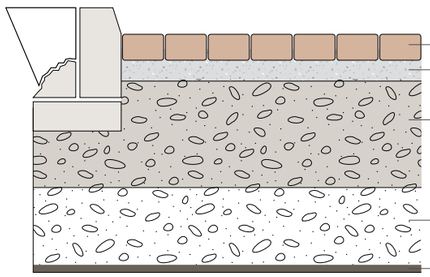
300mm thickness 4/20mm coarse graded aggregate to BS EN13242:2002

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.

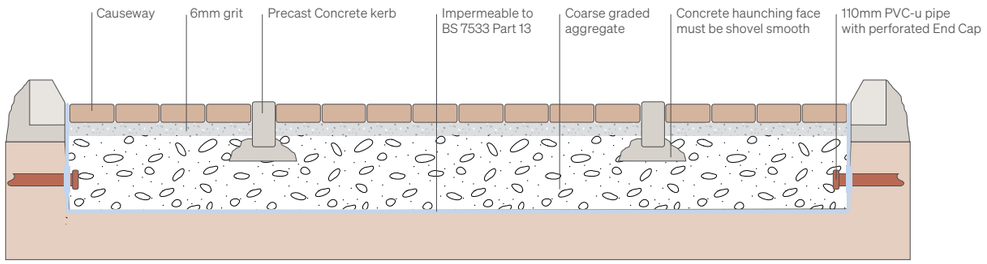
150mm thickness 4/20mm coarse graded aggregate to BS EN13242:2002

Layer of geotextile to BS 7533 Part 13

The following cross sections are based on the British Standards as noted.
(In Australia there is no stand alone standard on paving, permeable or otherwise, and as such European and British standards are beneficial)

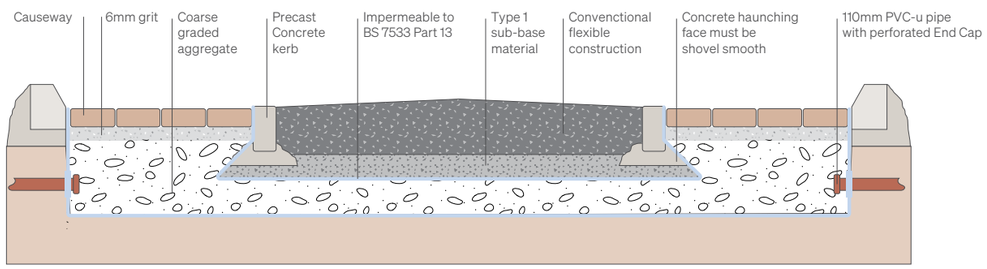
Road Attenuation

Causeway Road Attenuation System



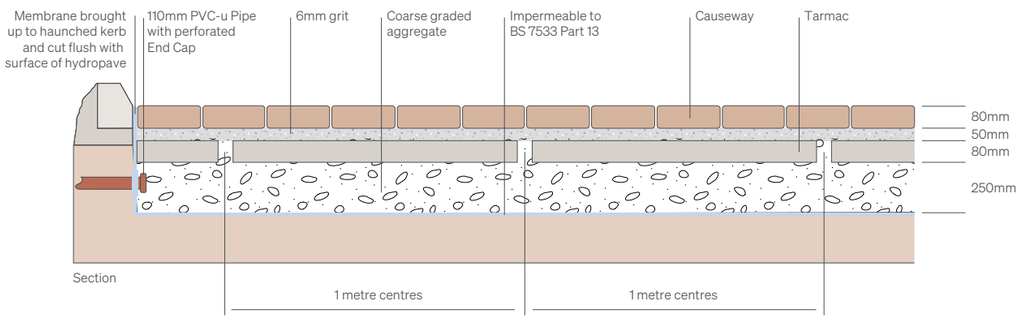
Section

Causeway Road Attenuation System



Section

Causeway Road Adoption/Temporary Running Service



Section

The following cross sections are based on the British Standards as noted.
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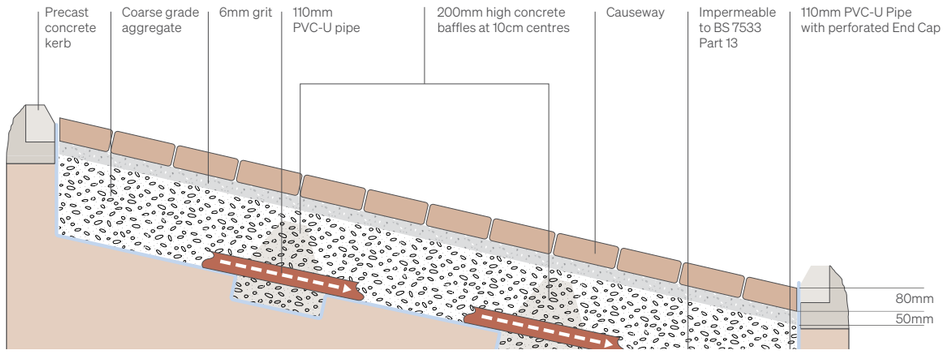
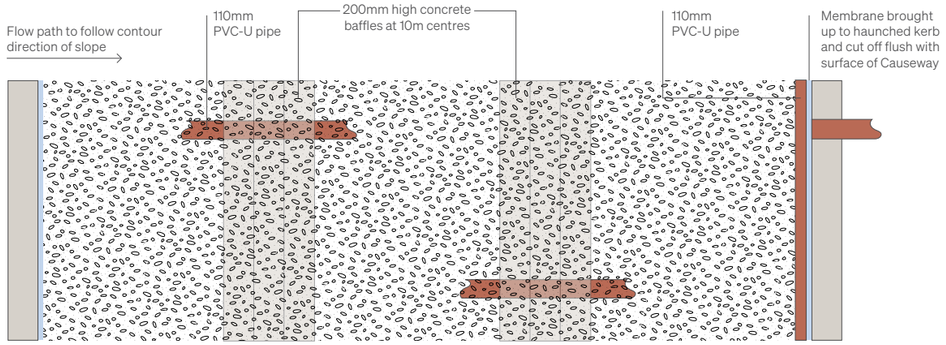
Sloping Site

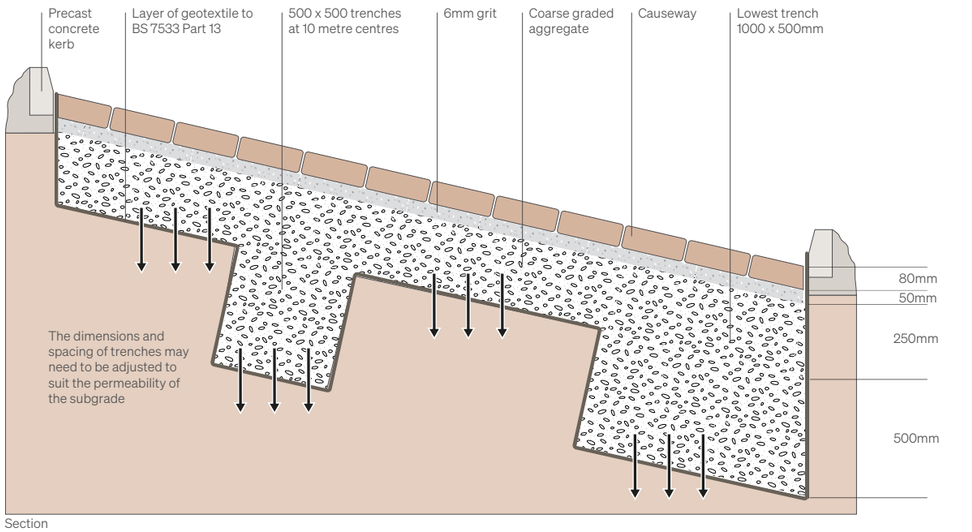
Sloping Sites Attenuation System





Plan

Sloping Sites Infiltration System



Section

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

The following cross sections are based on the British Standards as noted.
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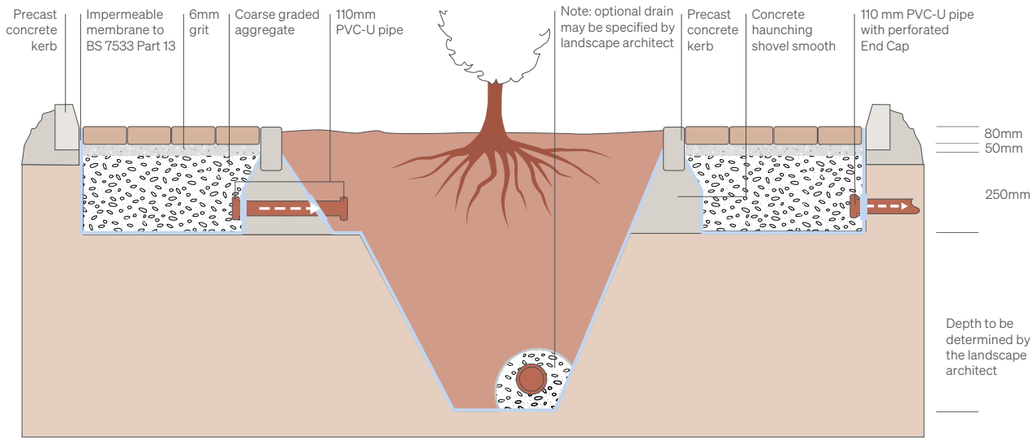
Tree Planting

Tree Planting Attenuation System



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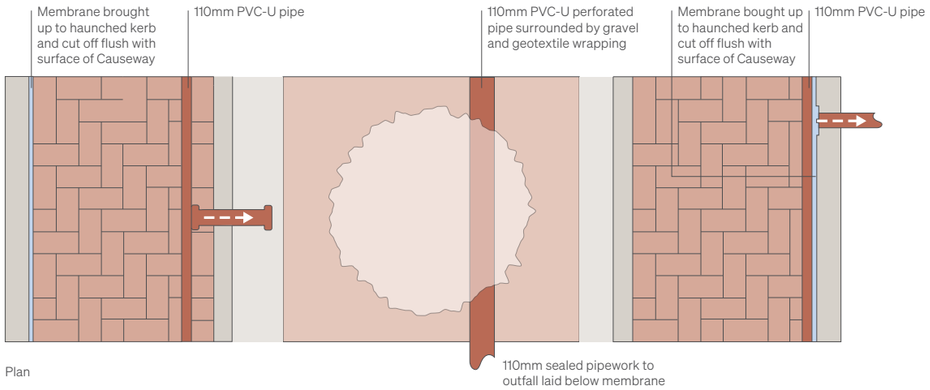
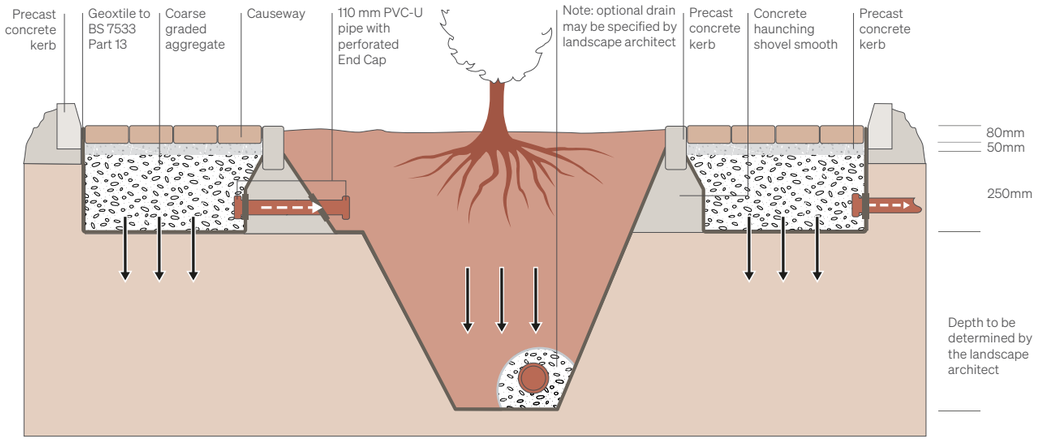


Plan

Tree Planting Infiltration System

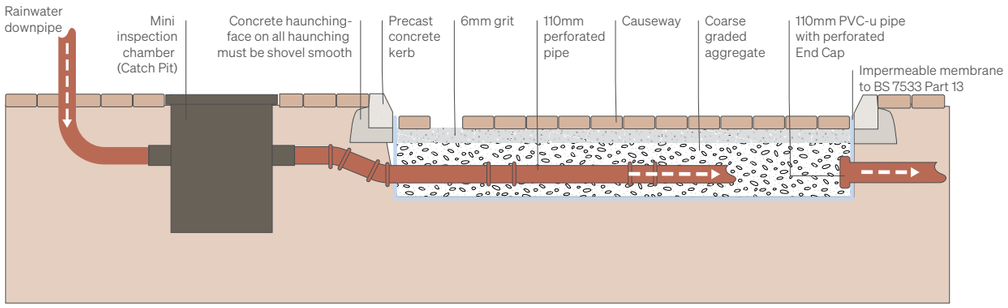


Section

The following cross sections are based on the British Standards as noted.
(In Australia there is no stand alone standard on paving, permeable or otherwise, and as such European and British standards are beneficial)

Rainwater Downpipe

Downpipe Drainage into Attenuation System



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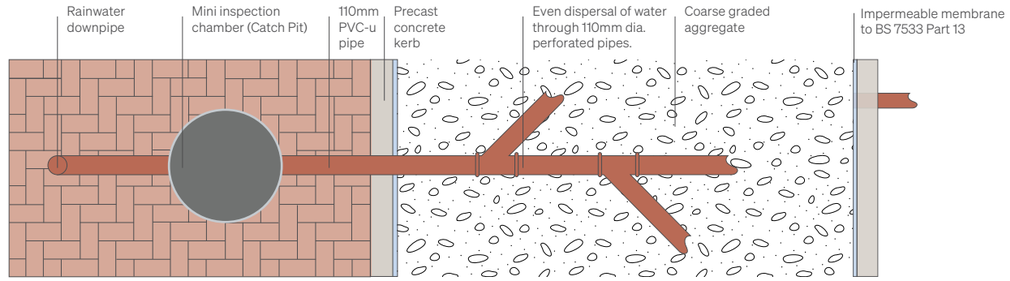
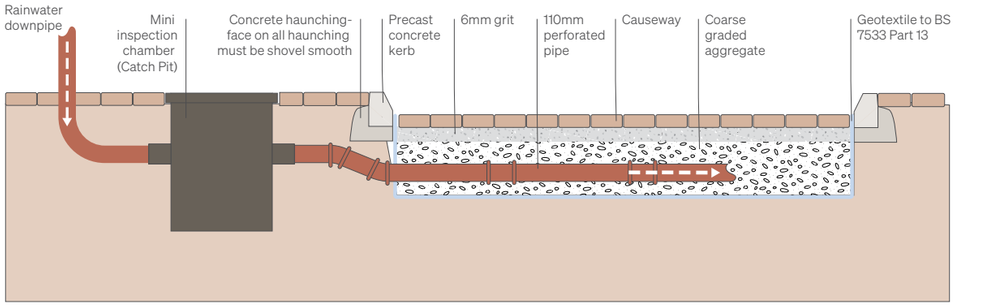


Plan

Downpipe Drainage into Infiltration System



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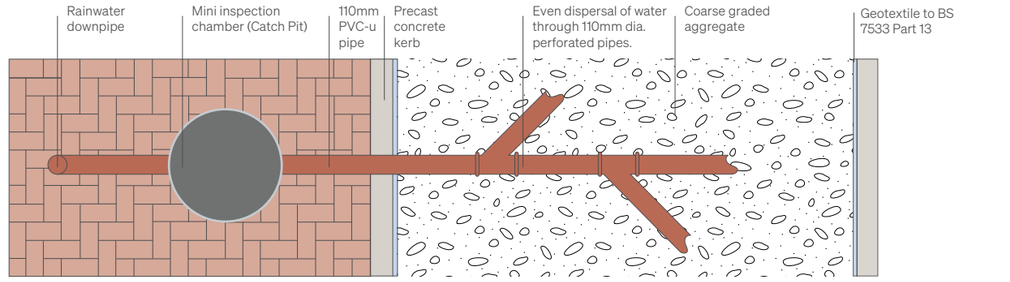

Plan

The following cross sections are based on the British Standards as noted.
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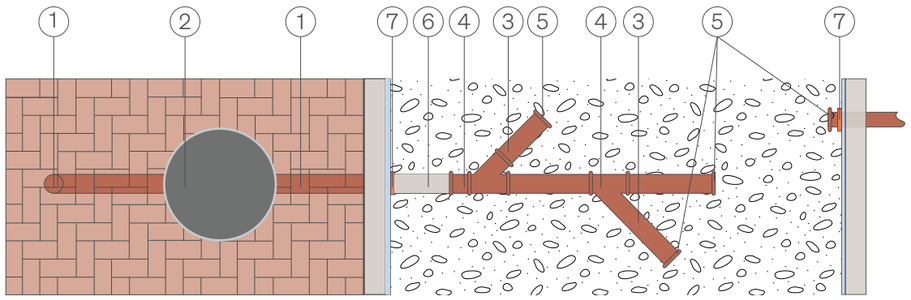
Paving Utility Systems

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.

Tree Planting Attenuation System



Products

1		UNIVERSAL' 110mm diameter UPVC SW pipe
2		450mm diameter mini inspection chamber 'Catch Pit' with plastic lid
3		100mm diameter Perforated Ridge Drain
4		100mm diameter Perforated Ridge Drain - 45º Junction
5		100mm diameter External End Cap - perforate on-site using 6mm drill
6		100mm diameter External End Cap - perforate on-site using 6mm drill
7		110mm Top Hat Seal Joint (Butyl Tape is used to seal the Top Hat to the polythene)

The following cross sections are based on the British Standards as noted.
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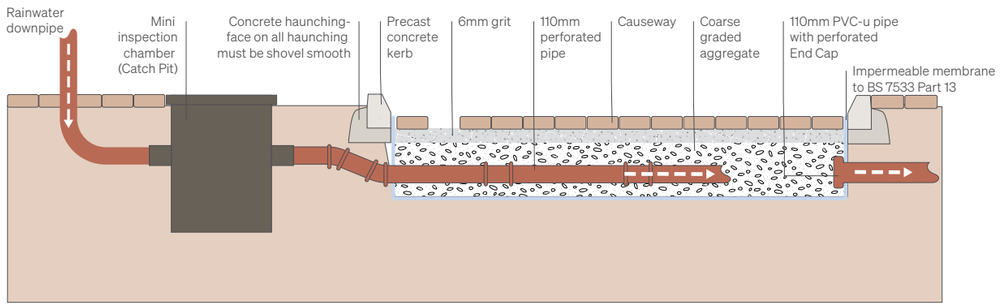
Water Harvesting

Austral Masonry Causeway 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.

Downpipe Drainage into Attenuation System



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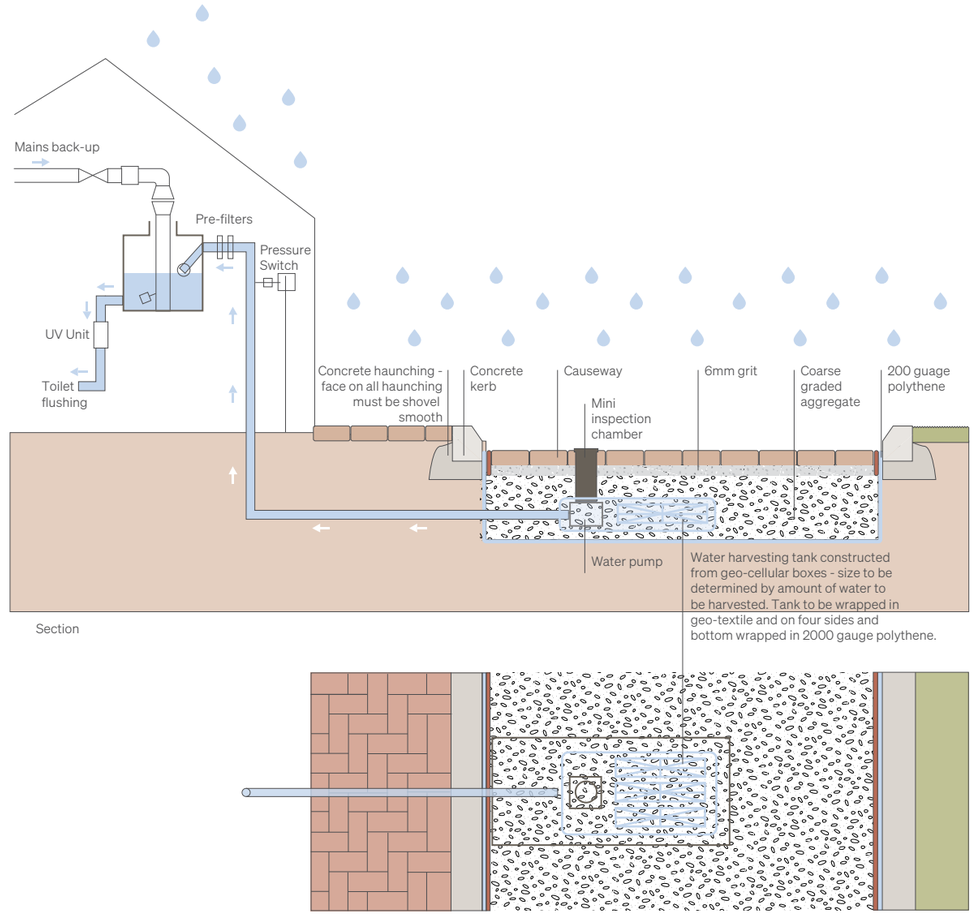

Section

Plan

The following cross sections are based on the British Standards as noted.
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Permeable Paving
Design Considerations

Things to consider when selecting a paving system include; traffic type (vehicle or pedestrian) and frequency, existing soil type, location, aesthetic preference and cost. Before installing porous paving in a driveway, path or patio area, you need to decide which type to install – loose gravel, structural gravel or grass, standard pavers or permeable pavers.

Traffic Type
Permeable pavement should be used for low volume parking and roads with light vehicle use. Sites with heavy vehicle use require further engineering to ensure the sub-base is suitably desinged to acommodate the heavier loading.

Soil Type
Permeable paving is most effective when installed in sandy areas where rainwater can easily drain away from the soil. If you are planning to install permeable paving in an area with heavy clay soil or poor drainage.

Underground Services
Be aware of any underground services (gas, electricity, water) before excavating the pavement area. Permeable paving should not be built over or in close proximity to a septic system.

Permeable Paving
Calculating Infiltration Rates

CMAA.COM.AU - PERMPAVE SOFTWARE

DesignPave has been developed in collaboration with the University of South Australia as a successor to LockPave, which was based on the works of Dr. Brian Shackel, a world-leading authority on pavement technologies. Many of LockPave's principles and methods can still be found within DesignPave, updated for modern pavement applications. Where PermPave was a separate software from LockPave, it is now an integrated feature within DesignPave, also updated for modern water storage and harvesting applications. The DesignPave package comes complete with the DesignPave software for mechanistic design, as well as the PermPave software for runoff control and together they form a comprehensive design package for any concrete block pavement applications.

The required infiltration capacity of a soil surface, vegetated area or pervious pavement for a selected design storm event (with zero overflow) is calculated by:

$$Q_{peak} = K_h A_{inf}$$

Where
Q_{peak} = peak design runoff rate from the contributing catchment (m^3/s)
k_h = design hydraulic conductivity (m/s)
A_{inf} = surface area available for infiltration (m^2)

Hence $$\frac{CiA}{1000 \times 60^2} = k_h A_{inf}$$

Where
C = runoff coefficient as defined in the Institution of Engineers Australia (2001)
i = probabilistic rainfall intensity (mm/hr)
A = total defined catchment area (m^2), e. the area of the treatment surface plus the surrounding contributing catchment area.

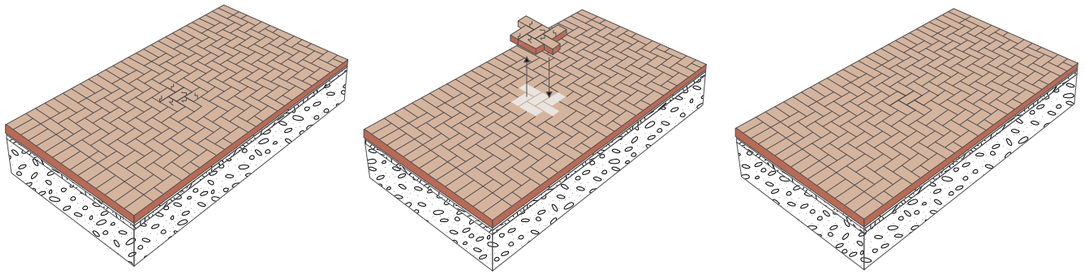
This equation applies where the infiltration surface is located within the total defined catchment area (A), as shown in Figure 4, the paving is uniformly porous and the overall value of the hydraulic conductivity for the product and its underlying sub-structure is known.

However, for permeable paving where part of the pavement area is impervious and this has not been accounted for in the overall value of the hydraulic conductivity, a blockage factor must be applied. The blockage factor accounts for the surface area of the pavement that is not contributing to infiltration.

Hence: $$\frac{CiA}{1000 \times 60^2} = k_h (1 - \psi) A_{inf}$$

Where:
ψ = infiltration surface blockage factor.

Permeable Paving
Remediation



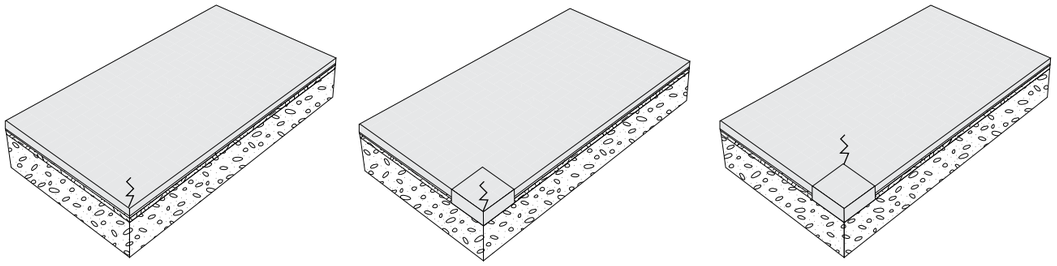
When pavers are cracked
The most common causes of cracked pavers are heavy impact or damage. Pavers are cured prior to delivery so there is minimal shrinkage or contraction of the material. Because there are several small units making up the pavement, with jointing sand in between, a segmental concrete pavement is unlikely to crack due to minor ground movement.

The affected pavers are removed and replaced with new pavers
The pavers can be pulled up from the existing pavement and disposed of.

The area where they are taken from should be rebedded and new pavers installed to complement the existing pavement.

The hardstand is restored to it's original strength and condition
After remediation, the hardstand is restored to its original strength. Use of a new product does not negatively impact the existing pavers.

Concrete Pavement
Remediation



A crack appears in one area of the pavement
The most common causes for cracking in concrete pavements/slabs is ground movement, shrinking or contraction of the material for various reasons, or impact/damage..

The cracked area is cut out and replaced
When a section of concrete pavement cracks, applying an adhesive to seal the crack merely hides the issue as the crack is likely to spread from this point.

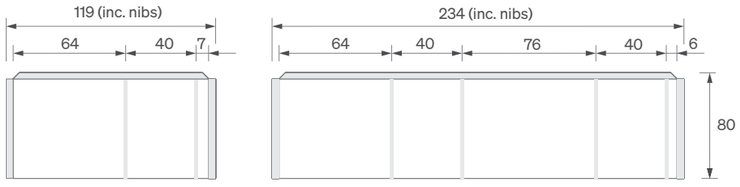
For this reason the cracked concrete section is generally removed by jackhammering to remove a square or rectangular segment with a new section poured and doweled into the existing hardstand.

At the corner where the concrete has been cut, a weak point is created
When a section of the concrete pavement is removed and a new section laid, the two sections have different properties (they don't create one solid unit).

The corner section where the concrete is cut has higher likelihood of cracking than other sections of the hardstand because it creates a 'fissure point'.

General Information

Paver Dimensions



Water run off treatment and management

The Causeway permeable paving system provides effective on-site water management and treatment in the following ways:

- Oils and heavy metals coat the surface of the organic matter and loam. Natural microbial filament growth in the sub-base digests low level hydrocarbon pollution.

  Severe hydrocarbon contamination can be treated by seeding with specialist microbes and slow release fertilisers

The Causeway permeable paving system provides water management assistance by:

- Minimising the volume of runoff from a development.
- Preserving re-development hydrology.
- Capturing and detaining, or infiltrating.
- Utilising water sensitive urban design techniques without compromising the hard standing surface requirements such as parking or traffic-ability.
- Enhancing groundwater recharge or preserving pre-development groundwater recharge.

Specifications and Additional Information

Content	Cement, sand, aggregate, colour oxide
Dimensional Category	DPB1
Characteristic Breaking Load (kN)	> 10
Abrasion Resistance Index	< 5 (for roads)
Slip Resistance Class	P5 tested to AS 4586
Salt Tested to AS/NZS4456.10	Exposure Grade
Liability to Effloresce	Nil to Slight
Manufacturing and Test Standard	AS/NZS4455, 4456 and 4586

Design Details

Permeable Pavers

Slip Resistance Classification

Class AS/NZS 4586 – 2004	Class AS 4586 – 2013	Four S	TRRL	Contribution of the pavement to risk of sliping when wet
V	P5	>54	>44	Very Low
W	P4	45-54	40-44	Low
X	P3	35-44	-	Moderate
Y	P2	25-34	-	High
Z	P1	<25	-	Very High

Application	Surface Conditions - Dry	Surface Conditions - Wet
Ramp steeper than 1:14	P4 or R11	P5 or R12
Ramp steeper than 1:20 but not steeper than 1:14	P3 or R10	P4 or R11
Tread or landing surface	P3 or R10	P4 or R11
Nosing or landing edge strip	P3	p4

* Not suitable for driveway applications.

Installation and maintenance

3

Installation Steps

1.

Data Collection

a. Determine the size, shape, and intended use of finished areas (i.e. residential driveway, secondary commercial parking, etc.).
b. Classify sub-grade soils.
c. Document all existing conditions (i.e. fixed points, existing grades, site contours, etc.).
d. Document soil type, location, and elevation of below grade and overhead utilities both public and private.
e. Ensure public utilities are marked through the use of a locating service.
f. Determine the cross section design of the system based on soil type and application, showing proposed sub-grade and finished grade elevations and all geotextiles and drainage pipes needed for the construction.
g. Establish the type, location, and elevation of relief structures if required (i.e. overflow pipe discharging to rain garden, etc.).
h. Determine the curb or edge restraint type, elevation, and location.
i. Choose a pattern appropriate to the application (traffic type and load).

2.

Excavation

a. Before digging, contact the concerned companies if wires or pipes are located in the area to be excavated.
b. Excavation depth is determined from the foundation thickness according to the project specifications (foundation thickness is determined by a qualified engineer based on structural and hydrological analyses).
c. Although the slope of the sub-grade will depend on the drainage design and infiltration type, a minimum slope of 0.5% 5mm per meter) is recommended.
d. The distance that the excavated area should extend beyond the area to be paved should be one to 1.5 times the thickness of the foundation. This extra space will ensure the stability of the pavers near the edge and the edge restraints.
e. Level the bottom of the excavated area with a rake. Compaction will reduce the permeability of the sub-grade and it should be executed according to the project specifications. If compaction is not specified, care should be taken to maintain undisturbed soil infiltration during excavation and construction. Stabilization of the sub-grade may be required with weak, continually saturated soils, or when subject to high traffic conditions. If the compaction or stabilization of sub-grade is necessary, reduced infiltration may require drainage pipes within the sub-base to conform to storm water drainage requirements.

3.

Geotextile, Impermeable Liners and Drain Pipes

Use the geotextile specified and install it according to project pecifications. The use of a woven geotextile with bi-axel strength that meets design criteria is recommended.

b. Place the geotextile on the bottom and sides of the soil sub-grade. Eliminate wrinkles in the geotextile and ensure it is not damaged during construction.
c. Overlap of geotextile should be a minimum of 600 mm in the direction of drainage. Overlapping should be “shingle” style with respect to any slope direction and base stone distribution direction. Keep properly tensioned, eliminate wrinkles, and avoid damaging fabric (no spikes).
d. If impermeable liners are required, install them according to project specifications and manufacturer’s instructions. Impermeable liners are used when full exfiltration from the reservoir (sub-base and base) into the underlying sub grade is not allowed (no infiltration design). Perforated drainage pipes are usually required in no infiltration and partial infiltration designs.
e. If drainage pipes are required, install them according to project specifications. The aggregate cover over drainage pipes should be at least 300mm to protect them from damage during sub-base or base compaction.

4.

Sub-base

For residential pedestrian applications, the sub-base may not be required and then only ASTM No. 57 aggregate base layer with a minimum thickness of 150 mm can be used (use a thicker base for additional water storage). When traffic load, soil conditions, and climate require greater than 300 mm of base or volume requirements for detention are higher, a sub-base may be required. Use sub-base ASTM No. 2 or No. 3 meeting the following requirements:

- 90% fractured symmetrical particles
- Less than 5% passing the 200 sieve
- Industry hardness tested

a. Moisten, spread and compact the ASTM No. 2 aggregate sub-base in minimum 150mm lifts (without distorting or damaging the geotextile) according to the project specifications.
b. Make at least two passes in the vibratory mode followed by at least two passes in the static mode with a minimum 10 tonne (9 metric tonne) vibratory roller, until there is no visible movement of the aggregate. Alternately, a 60 kN plate compactor can be used to compact the ASTM No. 2 aggregate sub-base.
c. Do not allow the compactor to crush the aggregate.
d. Surface tolerance of the ASTM No. 2 sub-base should be ± 2 64mm over 3m

.

5.

Excavation

a. Install edge restraint according to project specifications.
b. Depending on the design, the top of the edge restraint can be hidden or exposed.
c. Install Avignon, Belgik or Pietra edge units. Cast-in-place concrete or precast concrete curbs should be considered in vehicular use applications (commercial / industrial driveways, parking lots or streets).
d. Edge restraint may rest on an open-graded or dense-graded aggregate base

6.

Base

a. Moisten, spread and compact the ASTM No. 57 aggregate base layer in one 100 mm thick lift.
b. Make a minimum of two passes in vibratory mode followed by at least two in static mode with a minimum 10 tonne vibratory roller, until there is no visible movement of the aggregate. Alternately, a (60 kN) plate compactor can be used to compact the ASTM No. 57 aggregate base.
c. Do not allow the compactor to crush the aggregate.
d. Surface tolerance of the ASTM No. 57 base should be 25mm over 3m. Verify prior to setting bed installation.

Installation Steps

7.

Bedding Course

a. Moisten, spread and screed the ASTM No. 8 aggregate bedding layer in one 50 mm thick lift.

b. Surface tolerance of the ASTM No. 8 bedding course should be ± 10mm over 3m.

c. Construction equipment and pedestrian traffic on the screeded bedding course should not be permitted.

8.

Bedding Course

a. Pavers should be placed in the pattern shown on the drawings. Lay units hand tight to designated laying patterns. Units have lugs to maintain consistent joint width.

b. In sloped conditions, it is preferable to start laying from the bottom in an uphill direction.

c. The minimum slope recommended for permeable pavement surface is 1%.

d. Causeway pavers can be installed with a mechanical tool to expedite installation.

e. When subject to vehicular traffic, cut units should not be smaller than 1/3 of a whole paver. When using cut pieces, maintain joint.

f. In vehicular applications, pattern strength will increase if laying pattern is perpendicular to traffic flow.

9.

Joint Fill

a. Determine the size, shape, etc

a. Fill the paver joint openings with ASTM No. 8 aggregate (or No. 89, No. 9 depending on joint width). Sweep stone to fill joints. Surface must be swept clean prior to compaction.

b. Compact with a minimum 22 kN plate compactor (two passes minimum). The installation of a neoprene pad is recommended to protect the texture of the paving units.

c. Do not compact within 1.8m of unrestrained edges of the pavers.

d. Apply additional aggregate to fill the joint openings if needed and compact.

e. Surface tolerance of compacted pavers should be ± 10 mm over 3 m.

Maintenance

Maintenance of permeable pavement systems requires regular inspection and cleaning to maintain porosity, repair of pot holes and cracks, and replacement of clogged areas.

Regular vacuum sweeping can improve the efficiency of the system. It is recommended that cleaning be undertaken every 3 months. Overseas experience in the use of permeable paving has shown that complete clogging can occur between five and ten years after installation, so cleaning of the paving is essential.

Occasional light power cleaning may be used to remove unsightly surface contaminants.

Under normal conditions and appropriate light maintenance cycles as detailed above, a working life of 25 years can be expected. After this time, the pavers can be lifted and cleaned, the bedding materials and filter fabrics replaced, and the pavers re-laid to continue providing excellent service into the future.

Efflorescence

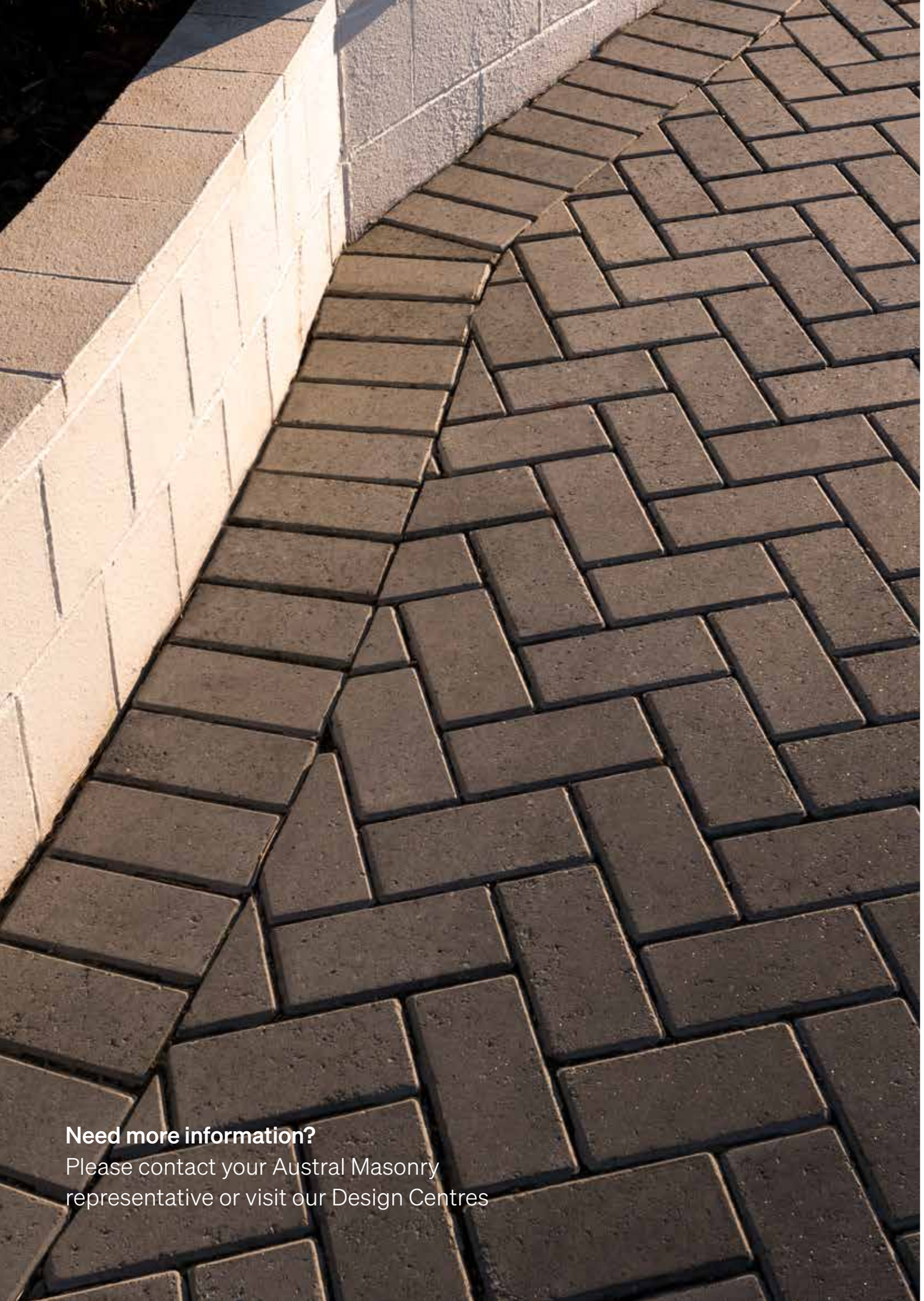
Efflorescence is a powdery deposit of salts (usually white or yellow) and is often found on the surface of concrete pavers after a period of rain. Efflorescence appears due to external sources from surrounding materials. For example, salty soils or fertilisers draw up through the pavers by the drying effect.

Prior to laying your pavers, make sure a clean bedding layer of 5mm granular material is the foundation of the paving – this will form a barrier to salts migrating to the pavers from below. Efflorescence can be removed by using either a dry brushing technique or wiping with a damp cloth making sure the salts are carried away from the pavers.

Organic Growths – Fungus, Mould and Moss

Porous masonry may provide an environment for organic growth when it is continuously moist, especially in light but shady conditions and when there are plenty of nutrients available.

Clean off the growth as much as possible with a dry bristle brush. Organic growths should be treated with liquid chlorine, or common household chemicals such as Exitmould and White King or a proprietary weed killer. The solution should be left for sometime before being brushed off with hot water and detergent.



Need more information?
Please contact your Austral Masonry representative or visit our Design Centres

Ideas for Inspiration

Whatever your ideas, we have the products to turn them into reality.

Coloured Masonry Blocks and Breeze Blocks
Our extensive range of architectural masonry products are available in a range of sizes, formats, and finishes from Austral Masonry and GB Masonry.

Grey Masonry Blocks
Austral Masonry offer an extensive range of sizes and formats with light weight options available in selected locations.

Retaining Walls
Choose from concrete retaining wall blocks or concrete sleepers suitable for DIY, general landscaping or large scale commercial retaining wall applications.

Engineered Stone Pavers
Offered exclusively from UrbanStone, the engineered stone range of pavers are the pinnacle in quality and style.

Natural Stone
Granite and Limestone flooring, and natural stone wall cladding are style solutions created by nature and perfected by UrbanStone.

Porcelain Stoneware*
Created in Italy by Keope Ceramiche, our porcelain stoneware collection is the epitome of style, designed to suit indoor and outdoor applications.

Concrete Pavers
For commercial and residential applications, our range includes a collection of sizes, textures and a plethora of colours.

Limestone Blocks*
The engineered limestone and natural limestone block range is sourced through quarries in Western Australia with two finishes available to complement the natural limestone colour.

Preblended Mortar and Accessories
From Mortex preblended mortar, to concrete sealers and mortar additives, Austral Masonry offers a host of installation accessories.

* These products are stocked in selected locations.

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–

Inspiration doesn't always come naturally, and your project is going to be there for a long time, so it’s worth taking your time to enjoy the creative process. From visiting us at our Design Studios, and exploring our iVisualise Tools online, to chatting in person or over the phone, we’re here to help.

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Colour Consultations
Building or renovating a home is a major investment – and it should be an enjoyable experience for you. We can help with a one-to-one colour consultation where our experts can guide you on colour trends, the right fit and style, and ideas that will give you a genuinely individual look.

Book.
brickworks.com.au/colour

Backed by Brickworks

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Local expertise. Global quality. Brickworks Building Products are one of Australia's biggest building material manufacturers. With heritage going all the way back to one of Australia's founding brick producers, we're proud of our reputation for design, innovation and sustainability.

BRICKWORKS

AUSTRALIA

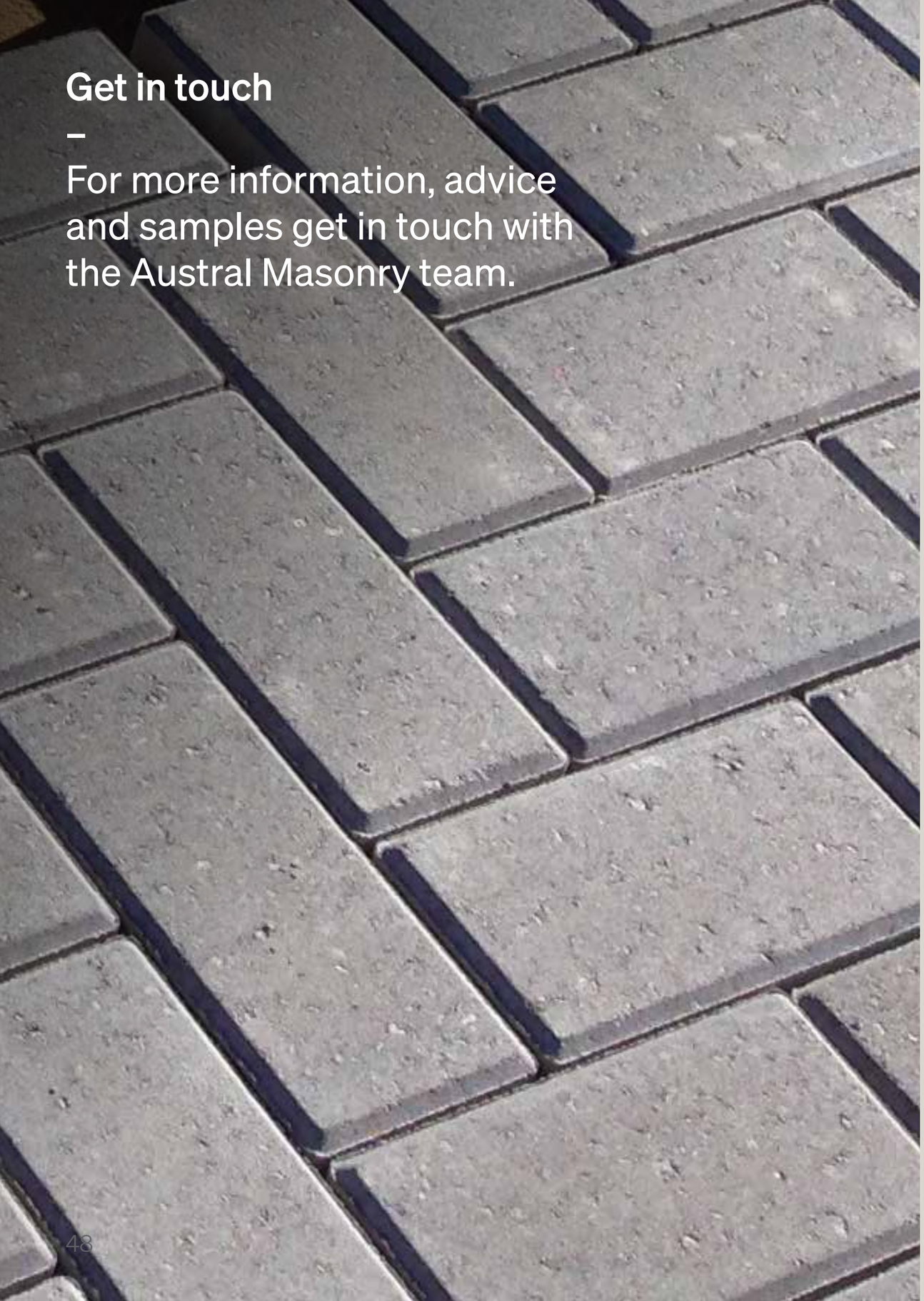
austral bricks · austral masonry · austral precast · bristile roofing · southern cross cement · Bowral Bricks · Daniel Robertson · NUBRIK · Terraçade · GB Masonry · Urban Stone · Capital Battens

NORTH AMERICA

Glen-Gery · Sioux City Brick (Since 1913) · Lawrenceville Brick · Cushwa Brick

EXCLUSIVE DISTRIBUTOR

La Escandella (Roofing the World) · S.Anselmo (vivere la differenza) · la paloma cerámicas · Ceramiche Keope



Get in touch

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For more information, advice and samples get in touch with the Austral Masonry team.

Visit. australmasonry.com.au
Call. 1300 Masonry

Design Centres and Studios

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2 Latitude Rd
Horsley Park NSW 2175

Albion Park
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Albion Park NSW 2527

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2 Yangan Drive
Beresfield NSW 2322

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Bowral NSW 2576

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Fyshwick ACT 2609

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62 Belmore Road North
Punchbowl NSW 2527

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Tel. 02 9611 4200
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Sydney NSW 2000

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The product images shown in this brochure give a general indication of product colour for your preliminary selection. Austral Masonry recommends all customers see actual product samples at a selection centre prior to making final selections. 1. Stock colours. Colours other than stock colours are made to order. Contact your nearest Austral Masonry office for your area's stock colours. A surcharge applies to orders less than the set minimum quantity. 2. Colour and texture variation. The supply of raw materials can vary over time. In addition, variation can occur between product types and production batches. 3. We reserve the right to change the details in this publication without notice. 4. For a full set of Terms & Conditions of Sale please contact your nearest Austral Masonry sales office. 5. Important Notice. Please consult with your local council for design regulations prior to the construction of your wall. Councils in general require those walls over 0.5m in height and/or where there is loading such as a car or house near the wall be designed and certified by a suitably qualified engineer. 6. Max wall heights disclaimer. The gravity wall heights are maximum heights calculated in accordance with CMAA MA-53 Appendix D guidelines and a qualified engineer should confirm the suitability of the product for each application. As such, due consideration must be given to but not limited to: Cohesion. Dry backfill, no ingress of any water into the soil behind the retaining wall. All retaining walls are designed for zero surcharge unless noted otherwise. These walls are intended for structure Classification A walls only as defined in AS4678 Earth Retaining Structures as being where failure would result in minimal damage and/or loss of access.

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