PERMEABLE PAVEMENTS

SOURCE CONTROL

Traditional road surface drain permeable parking bays

PRIMARY CONSIDERATIONS	
Construction Cost	LOW
Maintenance Requirements	HIGH
Land Take	MEDIUM

BENEFITS	
☑Water Quality Control	YES
☑Water Quantity Control	YES
☒Amenity Value	NO
☒Habitat Creation Value	NO
☒Biological Treatment	NO

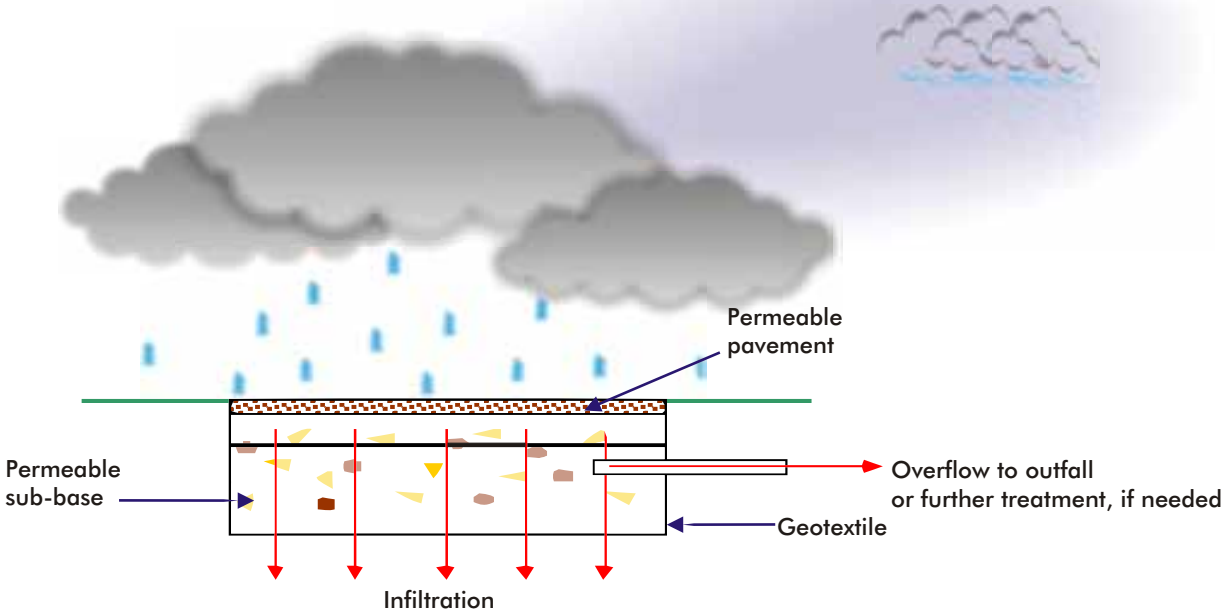
DESCRIPTION

Permeable pavements are designed to reduce imperviousness, consequently minimizing surface run-off. They vary in type from porous asphalt, porous concrete, or modular paving (large gaps between impervious areas allows infiltration) and are suited to lightly trafficked areas.

Run-off infiltrates to an underlying stone reservoir which is capable of removing pollutants, before discharge in a controlled manner into a nearby watercourse or infiltrating directly.

DESIGN

- The bottom of the stone reservoir should be flat to allow infiltration across the whole structure.
- The depth / volume of sub-base storage zone needs to relate to the design rainfall depth, taking into account the voids ratio of around 30 per cent.
- Appropriate geotextiles should be used to prevent the sub-base from clogging.
- Granular sub-base should be stabilised to prevent deformation under traffic loads.
- Soils should have at least moderate infiltration rates.
- Construct base of device at least 1.5m above the maximum groundwater level and only where the groundwater classification allows.
- Line the device or underdrain to discharge to sewer, where groundwater is at risk.
- Hydraulic design should avoid flooding for a "once in 30 year storm".
- For 100 year events, property flooding should not take place and overland flows should not pass from the site and cause flooding to other areas.
- Minimum carpark gradients should be used to minimise excessive loading at the lower edges of the paving / surface.
- Soil levels to be lower than the kerb level around landscaped features (avoid mounding).
- Avoid point inflows to the sub-base.
- Outfall pipe to be designed as a throttle for extreme events.
- A relief pipe is recommended to cope with excess volume (overflow).
- Blocks must be tightly packed and securely laid to prevent movement or cracking under load.



PERMEABLE PAVEMENT USED FOR INFILTRATION

MORE OVERLEAF - 1 of 2

PERMEABLE PAVEMENTS

SOURCE CONTROL

POLLUTANT REMOVAL

Research undertaken by the University of Abertay, Scotland suggests that permeable paving is effective in attenuating flow and improving the quality of the run-off.

The Water Research Centre at the University of Australia has also carried out research which involved simulating rainfall of 580mm per annum with a loading of 200ppm silt. The results suggest that after 30 years the permeability of the surface would be reduced by about 25%.

Pollutant	Removal
Nutrients	High
Heavy Metals	Unknown
Sediment	High
Bacteria & Viruses	High
Oxygen Demand	High
Toxic Materials	High
Floatable Material	High
Oil & Grease	High

MAINTENANCE CONSIDERATIONS

- Vacuum brushing or jetting is recommended twice a year, in Spring and in late Autumn.
- Results of research indicate clean job every seven years. Current experience suggests that permeable pavements might operate with routine maintenance for 15-20 years. After this period the pavement may become clogged with silts and toxins, so the porous surface or the inlets to the permeable pavement sub-base should be cleaned or individual areas treated. If this fails, it may be necessary to lift the surface and possibly remove and replace the bedding gravel and / or porous bricks and geotextile fabric (refer CIRIA, 2000).

Permeable paving - South Dublin

INTERNATIONAL EXPERIENCE

Scotland

In Scotland, system failure has occurred due to inappropriate landscaping in the surrounding area. In one case during the construction phase of the development, top soil for landscaping was stored on the surface of the permeable paving. Many local authorities have been reluctant to adopt permeable paving due to concerns over their performance. However, systems have been operating effectively in lightly trafficked private developments. Instances of failure have mainly been due to incorrect construction or inappropriate use.

Rest of U.K.

Grasscrete has been used in other parts of the UK to drain areas such as overflow car parks. Grasscrete options include modular paving blocks or grids which have a series of gaps planted with turf grass to allow for infiltration. These systems are not appropriate for areas subjected to heavy pedestrian or vehicular traffic.

A "GRASSCRETE" Access Road in the U.K.

Attentuation levels for traditional stone filled lined permeable pavements have been tested for 100 year storm events. It was found that even in the wettest periods, the runoff rate was usually below 2l/s/ha and in general 1l/s/ha was the maximum flow rate.

ADVANTAGES

- ☑Reduces peak run-off rates and volumes, i.e., recharges groundwater.
- ☑Retains pollutants prior to discharge to the drainage or groundwater system.
- ☑Reduces ponding and flooding.
- ☑Valuable option in spatially constrained urban sites.
- ☑Reduces the amount of impervious area in a development.
- ☑Roof water can be discharged directly into its sub-base.
- ☑Water available for secondary uses such as watering plants or toilet flushing (option).
- ☑Oil spillages can be treated in situ.
- ☑Minimal safety risks: sub-bases can act as a heat blanket in winter preventing ice formation on the surface.
- ☑Can visually enhance site.
- ☑Can be used to assist the successful establishment and future growth of trees in urban areas.
- ☑Only slightly more expensive than conventional surfaces.
- ☑Specially designed blocks can eliminate the need for other drainage structures such as pipes and gulleys.

LIMITATIONS

- ☒No habitat or amenity value provided.
- ☒Risk of failure due to clogging.
- ☒Requires frequent maintenance (i.e. cleaning to prevent clogging).
- ☒Not ideal for highly trafficked areas due to high potential for sediment and pollution to clog the system and potential failure to support heavy traffic loads.
- ☒Groundwater contamination and low dissolved pollutant removal may occur in coarse soils unless appropriate design is incorporated.
- ☒Not suitable where groundwater levels are high, i.e. likely to come within 1.5m of the base of the device.
- ☒Limited use in industrial estates, due to the potential groundwater contamination.
- ☒Unsuitable in steeply sloping sites.
- ☒Surface is unsuitable for gritting/sanding in winter as sediment will clog surface.

FROM PREVIOUS - 2 of 2