PERMEABLE PAVING PRINCIPLES

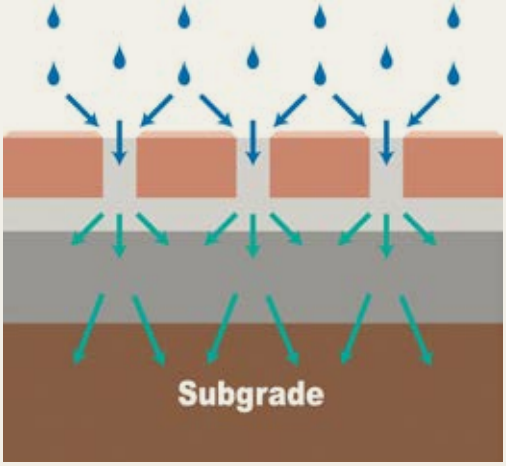
THE FOLLOWING IS AN INTRODUCTION TO CONCRETE BLOCK PERMEABLE PAVING (CBPP) FROM INTERPAVE (THE PRECAST CONCRETE PAVING AND KERB ASSOCIATION) IN THE UK. IT IS SUGGESTED THAT INTERPAVE'S DOCUMENT *UNDERSTANDING PERMEABLE PAVING*, WHICH PROVIDES ESSENTIAL INFORMATION ON ALL ASPECTS OF PERMEABLE PAVEMENTS, IS ALSO CONSULTED – WWW.PAVING.ORG.UK

PRINCIPLES

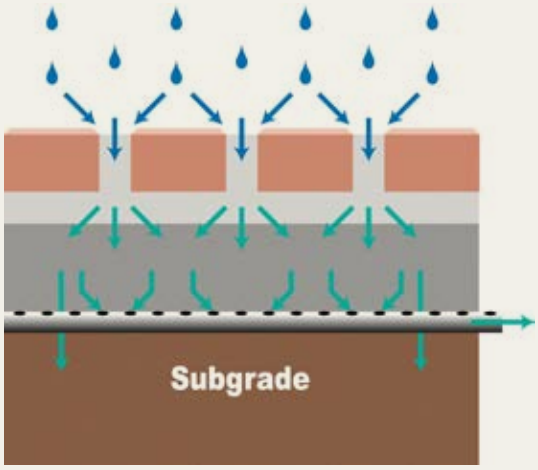
CBPP has a dual role, acting as the drainage system as well as supporting traffic loads. CBPP allows water to pass through the surface – between each block – and into the underlying permeable sub-base where it is stored and released slowly, either into the ground, to the next SuDS management stage or to a drainage system. Unlike conventional road constructions, the permeable sub-base aggregate is specifically designed to accommodate water. At the same time, many pollutants are substantially removed and treated within the CBPP itself, unlike attenuation tanks.

PRODUCTS

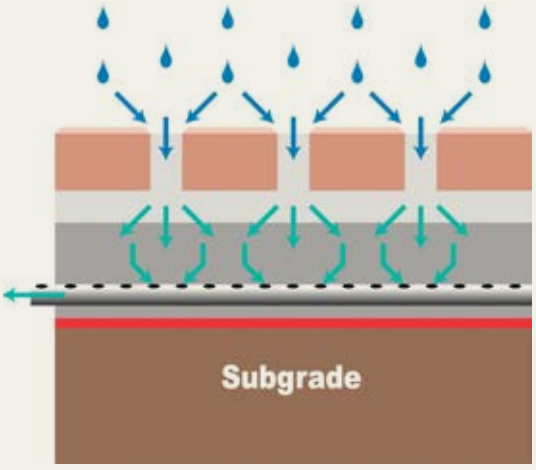
There is a growing choice of concrete blocks and flags available from Interpave manufacturers, designed specifically for permeable paving. Essentially they have the same impressive performance as conventional precast concrete paving products, including slip and skid resistance, durability and strength. The difference with CBPP is enlarged joints created by larger than conventional spacer nibs on the sides of each unit. These joints are subsequently filled with a joint filling material specific to each product, which is an angular aggregate, water will continue to pass through the joints over the long-term.



SYSTEM A – FULL INFILTRATION



SYSTEM B – PARTIAL INFILTRATION



SYSTEM C – NO INFILTRATION

SYSTEMS

There are three different CBPP systems, described as Systems A, B and C in all Interpave guidance. These systems were initially identified by Interpave and their designations have now been adopted in British Standards, The SuDS Manual (CIRIA 2007) and elsewhere. There is no difference between the surface appearances of the different Systems but each has unique characteristics making it suitable for particular site conditions.

SYSTEM A – FULL INFILTRATION

Suitable for existing subgrade (ground) with good permeability, System A allows all the water falling onto the pavement to infiltrate down through the constructed layers below and eventually into the subgrade (ground). Some retention of the water will occur temporarily in the permeable sub-base layer allowing for initial storage before it eventually passes through. No water is discharged into conventional drainage systems, completely eliminating the need for pipes and gulleys, and making it a particularly economic solution.

See page 29 for a case study demonstrating System A – Full Infiltration.

SYSTEM B – PARTIAL INFILTRATION

Used where the existing subgrade (ground) may not be capable of absorbing all the water. A fixed amount of water is allowed to infiltrate – which, in practice, often represents a large percentage of the rainfall. Outlet pipes are connected to the permeable sub-base and allow the excess water to be drained, via a flow-control device, to other drainage devices, such as swales, ponds, watercourses or sewers. This is one way of achieving the requirement for reducing the volume and rate of runoff and will most likely remove the need for any long term storage.

SYSTEM C – NO INFILTRATION

Where the existing subgrade (ground) permeability is poor or contains pollutants, System C allows for the complete capture of the water. It uses an impermeable, flexible membrane placed on top of the subgrade (ground) level and up the sides of the permeable subbase to effectively form a storage tank. Outlet pipes are constructed through the impermeable membrane to transmit the water to other drainage devices, such as swales, ponds, watercourses or sewers. Importantly, the outlet pipes are designed to restrict flow so that water is temporarily stored within the pavement and discharge slowed.

New Zealand Concrete Masonry Association Inc.

David Barnard, Executive Officer for the New Zealand Concrete Masonry Association (NZCMA) comments that while this Interpave article presents an excellent example of using permeable paving, products manufactured by members of the NZCMA are available in New Zealand supported a 'Firth Ecopave System – Installation Guide' available from Firth Masonry.

Other references to New Zealand applications can be found in the New Zealand Concrete Masonry Manual – www.nzcma.org.nz.

CASE STUDY

MARTLESHAM PARK & RIDE SUFFOLK

Designed by: Suffolk County Council Environment and Transport

Architects: Mouchel

Landscape Designers: The Landscape Partnership

PROJECT DESCRIPTION

The Park and Ride facility at Martlesham was one of Suffolk County Council's top priority transport schemes and the third park and ride to be built serving Ipswich, offering sustainable transport alternatives to the car. It was also the first large-scale concrete block permeable pavement (CBPP) project to be undertaken by the Authority. Following extensive public consultation the park and ride scheme formed part of Suffolk County Council and Ipswich Borough Council's Transport Strategy, which included plans for five park and ride schemes around the town aiming to dramatically reduce the level of traffic congestion within Ipswich.

The Martlesham site was chosen for its prime location on the eastern side of town and accessibility to the junction of the Ipswich eastern bypass. This choice followed extensive consultation and a detailed examination at a public enquiry. The location and access advantages of the site outweighed any potential adverse environmental effects that development might have had on the site and surrounding area: the site is part of a designated 'Special Landscape Area' and also part of a 'County Wildlife Site' with areas of acid grassland.

Since completion, the number of people using the park and ride scheme is gradually rising and there is already a high level of regular customers. The local residents are pleased with the new service and have been extremely complimentary about the site design and facilities.

DESIGN PHILOSOPHY

The site occupies a total of 3.2ha with space for 530 cars. The key challenge for the project was to mitigate the adverse environmental and landscape effects of the development by incorporating SuDS techniques into the overall design to reflect the sustainability credentials of the Park and Ride concept. A complete paving solution was also required to create a surface of high industrial strength to withstand heavy vehicles, as well as attractive and accessible pedestrian areas.

Overall design objectives included:

- Visually attractive CBPP capable of full infiltration of rainwater to the ground
- A terminal building with a green roof for low-impact on the landscape and rainwater attenuation, feeding a reedbed and pond to treat the water
- Effective car park lighting with minimum impact on surrounding landscape and wildlife habitats, and optimised energy use
- Landscaping with extensive planting of indigenous trees to complement local flora and habitats, and a layout to accommodate the existing trees
- Provision of bat and bird boxes to encourage colonisation within the site.

The project utilised 14,000 square metres of CBPP for circulation, parking and pedestrian areas, and local conditions allowed for a 'System A' form of construction with total infiltration of surface water to the ground. Here, all rainwater falling on the CBPP, and adjacent impervious areas draining onto it, infiltrates through jointing material, the constructed layers below and eventually into the subgrade. This effectively eliminates the requirement for additional drainage systems whilst also recharging the natural groundwater.

Recent performance tests at the Martlesham Park and Ride replicated a 20-year in-service lifespan and demonstrated that the stability of the surface remained with CBPP construction. In addition to the CBPP, some 1,400 square metres of impermeable block paving for bus access areas and 1,300 square metres of flag paving for pedestrian areas were also installed.

KEY POINTS

This is a substantial and impressive example of CBPP forming part of a completely sustainable facility aiming for minimal impact on the local environment. At the same time, the large area of total infiltration (System A) permeable pavement does not need to form part of a SuDS 'management train' and operates in isolation. The project clearly shows:

- Elimination of traditional drainage components including pipes, gullies and soakaways
- Potential for total cost savings over other pavement types, including asphalt with traditional drainage
- Maintenance of stability of CBPPs under traffic and in different applications
- Ability for CBPP to replicate original drainage before intervention, therefore minimising impact on the environment
- Compliance with planning guidance (PPG25) and the Building Regulations, requiring local infiltration wherever possible.

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