May 2022

Uniclass L534:L217

- An exemplar for 'Healthy Streets' with SuDS and green infrastructure
- Transformative interventions with modular concrete permeable paving
- Innovations to optimise synergy between permeable paving and trees

INNOVATIVE PUBLIC REALM REGENERATION TOTTENHAM

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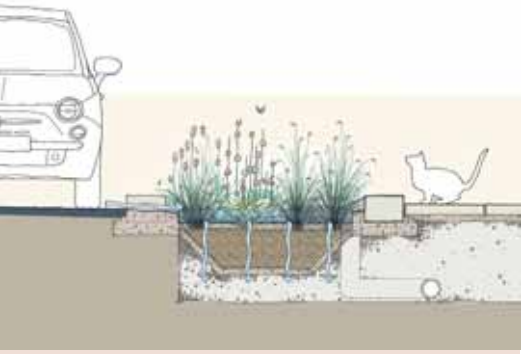
Interpave
THE PRECAST CONCRETE PAVING AND KERB ASSOCIATION

INTRODUCTION



Completed in 2018, the regeneration of White Hart Lane in north Tottenham, by muf architecture/art, was a pilot designed using 'Healthy Streets' principles, which are to create: *'streets that feel pleasant, safe and attractive. Streets where noise, air pollution, accessibility and lack of seating and shelter are not barriers … streets with seating, shade and greenery, and reduced dominance of vehicles by designing for slower vehicle speeds.'*

The project delivers these aspirations and was one of the first to use the Healthy Streets indicator as a metric. But it also applies innovative sustainable drainage (SuDS) techniques introduced by design collaborators Robert Bray Associates. This approach reduces flooding and pollution of the hidden Moselle River through the integration of bioretention raingardens to collect and treat polluted road runoff. In addition, extensive concrete block permeable paving (CBPP) surfaces not only act as SuDS elements – attenuating and treating rainwater runoff – but also enable essential gas exchange and optimised water supply for tree roots, using various techniques.

Under construction at the time of publication, at the renovation of Broad Lane Square in south Tottenham the same designers take forward these principles with further innovations. In particular, 'inverted raingardens' protect existing trees and new green infrastructure, supplied with a gradual supply of clean water from extensive CBPP catchments.

Between them, these projects exemplify the growing, multifunctional potential of CBPP in the hands of innovative designers.

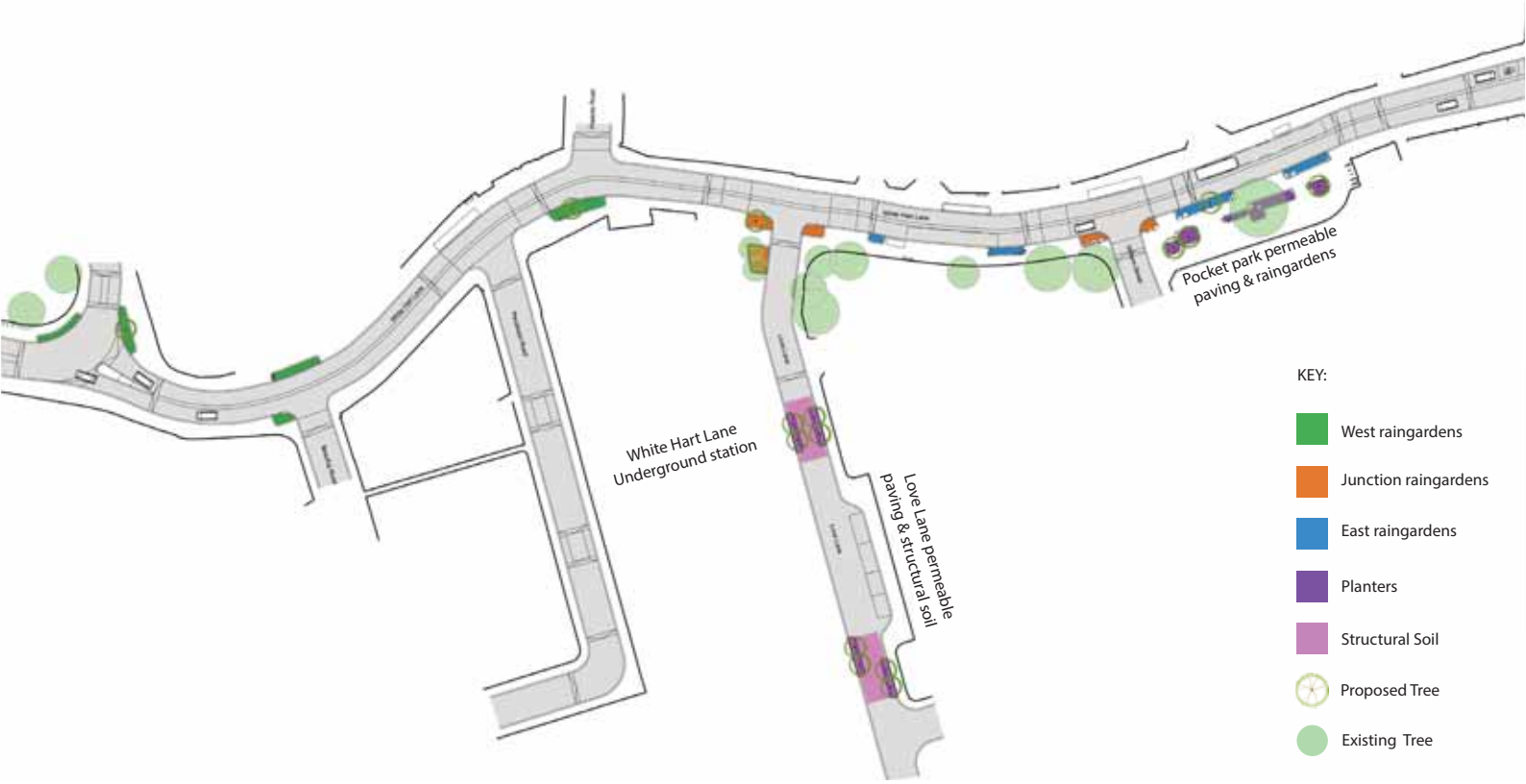
WHITE HART LANE

This pilot infrastructure improvement scheme for London Borough of Haringey – funded by TfL as part of a wider masterplan and subject to value for money scrutiny – resulted in a dramatic improvement in the public realm, creating significant new planted features and introducing improved accessibility and comfort for pedestrians. Nominated for various awards, the project is now considered to be the standard for future regeneration schemes.

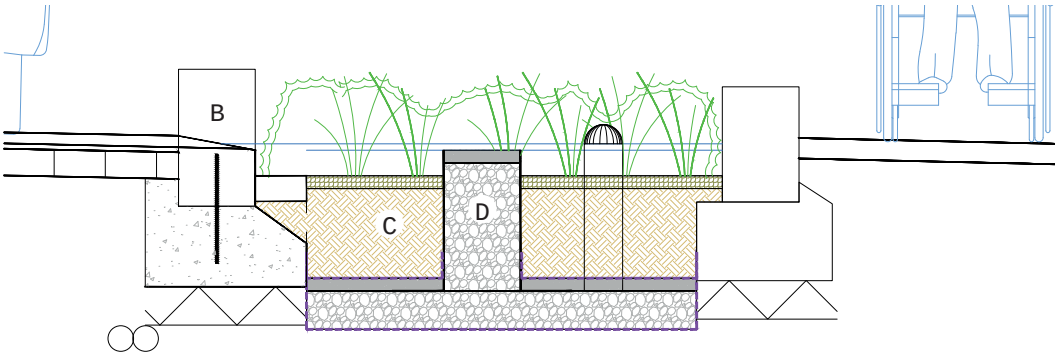
The scheme also had to address a number of challenges including retention of bus routes and management of football match crowds moving between the Underground station and Tottenham Hotspur Stadium, while still focusing on the day-to-day lives of the local community.

The road was remodelled to deliver modal change with a narrower carriageway and prominent central lane-divider zone. New visual patterning and changes in road level reduce the tendency to speed and keep traffic within the 20mph limit. Road space is reallocated to people and planting, creating a place where walking and the social life of the street is more pleasant: a destination, not just a place to speed through by car on the way somewhere else.

The design also responds to the Moselle River, below the street. In its highly-polluted state, it was not possible to open it to daylight yet. But raingardens mark the line of the river and protect it from highway runoff, looking to the future return of the river to the surface for the enjoyment of local people and biodiversity, in line with Haringey policy.



Bioretention Raingardens



Strategically-placed, small bioretention raingardens accept polluted highway runoff through gaps [B] in granite kerbs. An innovative, two-tier approach was applied to bioretention design, incorporating a particular soil blend (known as 'RBA SuDS Soil'). This approach responds to the pollution hierarchy of smaller rainfall events and the first flush of larger events, whilst ensuring healthy and resilient plant growth suitable for demanding urban environments.

The first flush of runoff containing most pollutants is dealt with in the raingarden soil [C], then prolonged rainfall with less pollutants is treated in gravel-filled infiltration tubes [D]. The raingardens were designed to work in both infiltrating soils as well as non-infiltrating soils, with the latter using a simple orifice flow control discharge from the gravel base of the raingarden.

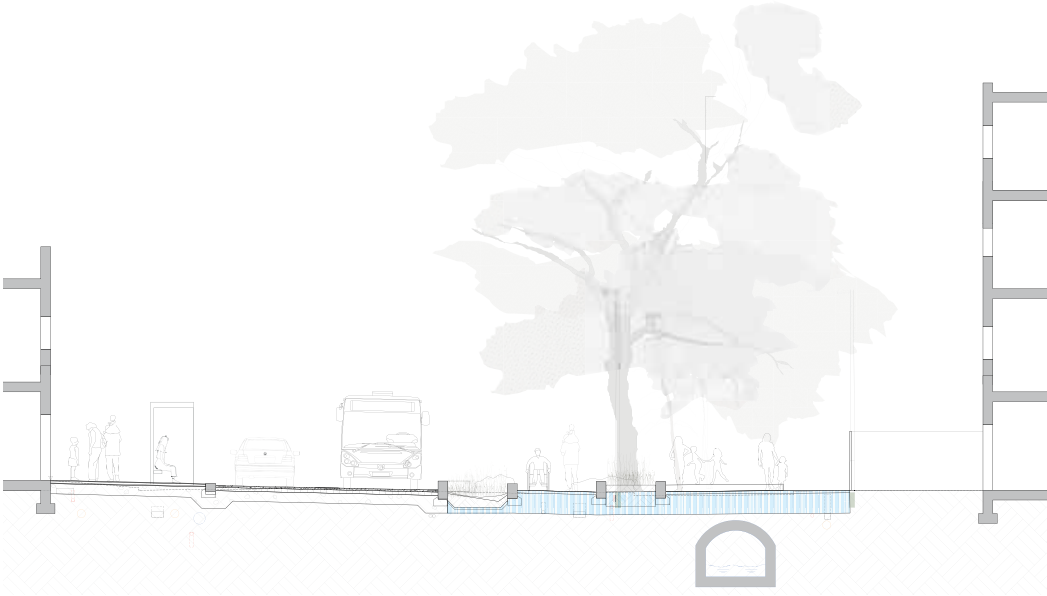
A mature Plane tree was liberated from asphalt by a new planter.

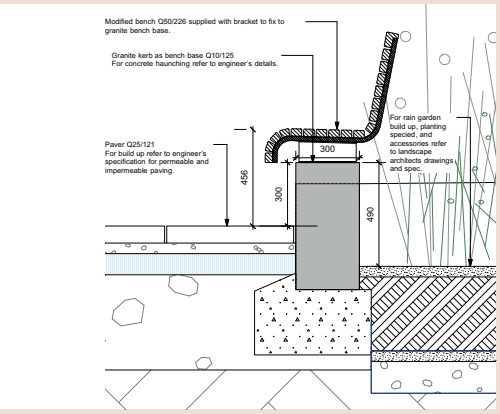
Pocket Park and Permeable Paving

A focal point of the scheme is a new Pocket park, enabled by relocation of a bus stop and removal of extensive asphalt paving. The park is separated from the highway by bioretention raingardens, intercepting runoff from the whole width of the 'side-hung' road which acts as a catchment. It also includes long planters to accommodate mature and new trees, and other green infrastructure, incorporating seating. This also enabled de-paving around a mature but suffocated and asphalt-locked Plane tree.

Section before regeneration

Section through the Pocket Park after regeneration



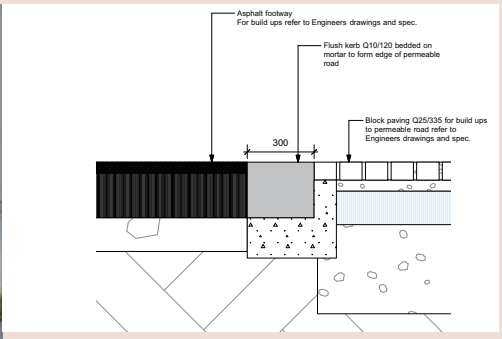


Raingarden with Seat

Permeable paving – using 600x300mm small-element concrete flags designed specifically for CBPP – was employed throughout pedestrian areas to the south side of the street facing shops, including the pocket park. It provides an attractive, safe and puddle-free accessible surface for all. In addition to providing a key SuDS feature, the CBPP between planters also provides a source of treated water and invaluable gas exchange (air in/CO_2 out) to the tree's root zone.

The infiltration ability of the underlying soils allowed structural CGA sub-base to vary in depth to accommodate existing utility constraints, creating a blanket infiltration zone capable of receiving runoff from areas where significant CGA sub-base depths were not achievable, such as above very shallow services. Surface water flooding – even during heavy rainfall events – has ceased completely along the length of White Hart Lane.

The project designers worked in conjunction with an Interpave manufacturer member to develop the 600x300mm small-element CBPP flag module – now available as standard. Muf partner Katherine Clarke commented: '*The small-element flags provide an enhanced backdrop to the street, particularly with the light sparkle of the Mica aggregate surface that we selected, which lifts the tonal quality. The flags will form the basis for a family of modular paving for use throughout the Borough.*'



White Hart Lane to Love Lane

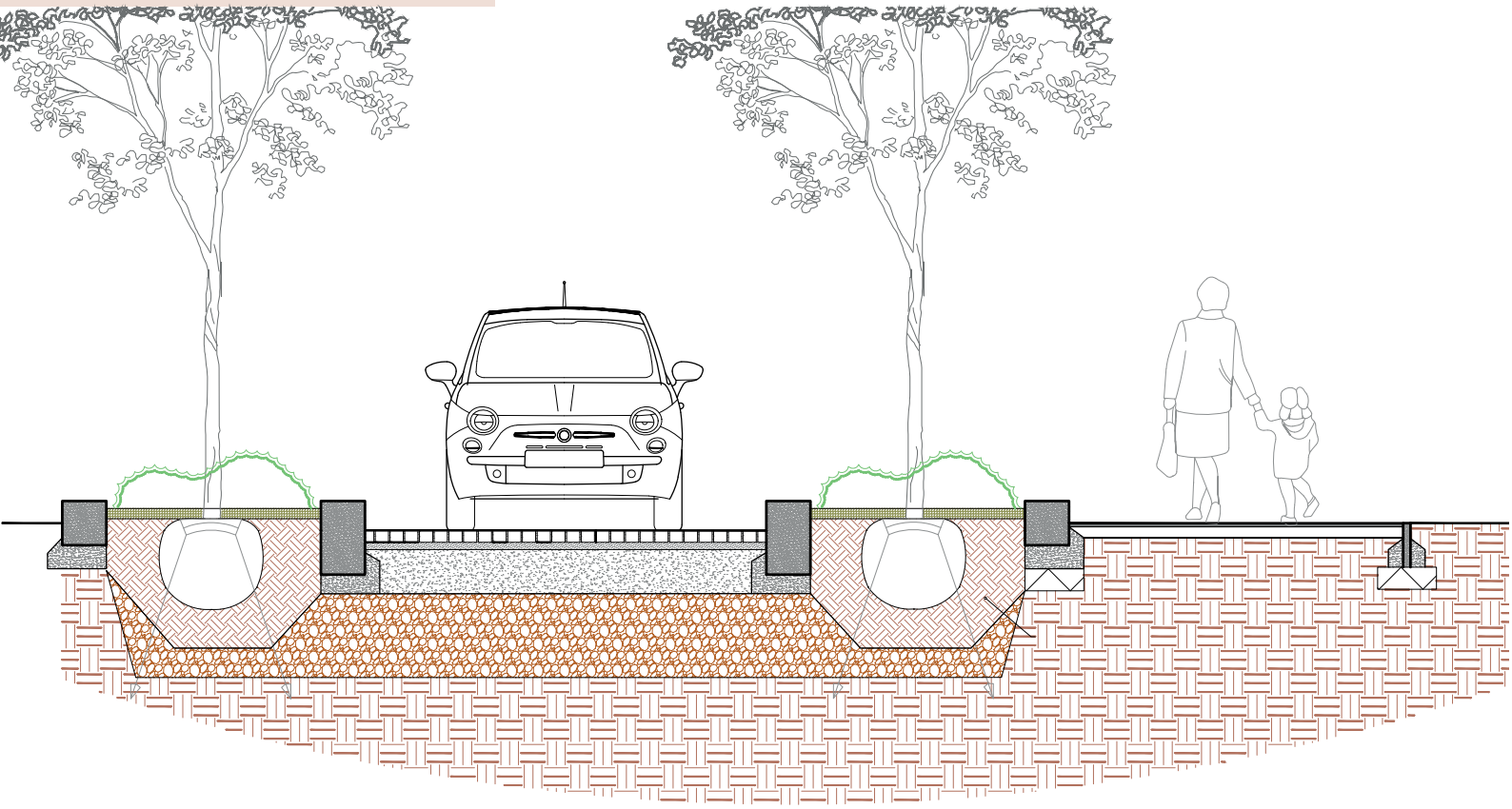
The CBPP paved highway withstood heavy construction traffic during the new station construction.

Love Lane Permeable Paving with Structural Soil

Love Lane, which runs perpendicular to White Hart Lane in front of the new landmark Underground station, is now a concrete block permeable paved adopted highway. The CBPP can also accept runoff from the road and other impermeable surfaces (additionally up to double its own area). At two points, structural tree pits span the full width below the road surface connecting road-narrowing tree planters on each side, in readiness for future planting. Based on the 'Stockholm Solution' for urban tree planting, the deep structural soil zones – comprising compacted stone and 'RBA SuDS Soil' – form sumps which are hydraulically connected to the CGA sub-base of the permeable paving.

This means that in heavy or prolonged rain, once percolated runoff begins to move laterally along the interface between the sub-base and subgrade, it moves toward the structural tree pits where it begins to be attenuated. Once the pits fill to the level of the base of the road sub-base, the attenuation and infiltration spread out over the whole road zone. This pattern of flow and attenuation means that the trees benefit from rainwater collected from an extended catchment making them healthier and more resilient to drought.

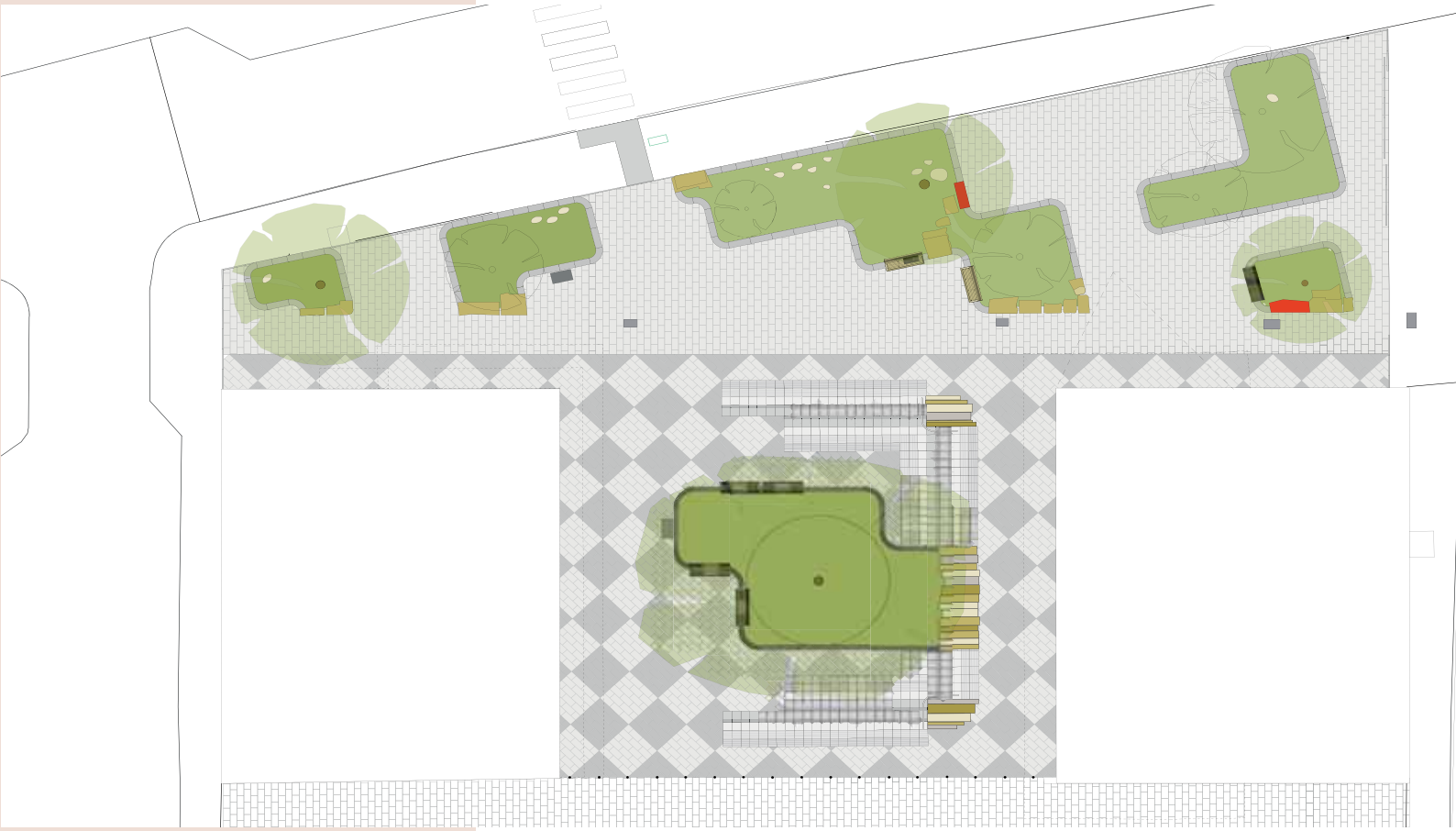
Although initially unfamiliar with the structural tree pits, with support and advice the installation contractors soon became comfortable and are now installing them elsewhere.



BROAD LANE

An existing tree is rescued from impermeable paving (above) by CBPP in the square's rejuvenation (below).

In south Tottenham, some 1.7 miles south of White Hart Lane, muf and RBA have developed further multifunctional SuDS principles to regenerate a public square surrounded by shops and cafes, creating a community hub. The same paving material palette as White Hart lane is being used but with added light/dark grey checkerboard paving. Under construction during Spring 2022, the scheme will make extensive use of CBPP to capture, clean and convey as much water as possible to nurture green infrastructure, including existing mature trees.



Monotonous impermeable paving (above) is replaced with a checkerboard of light/dark grey CBPP

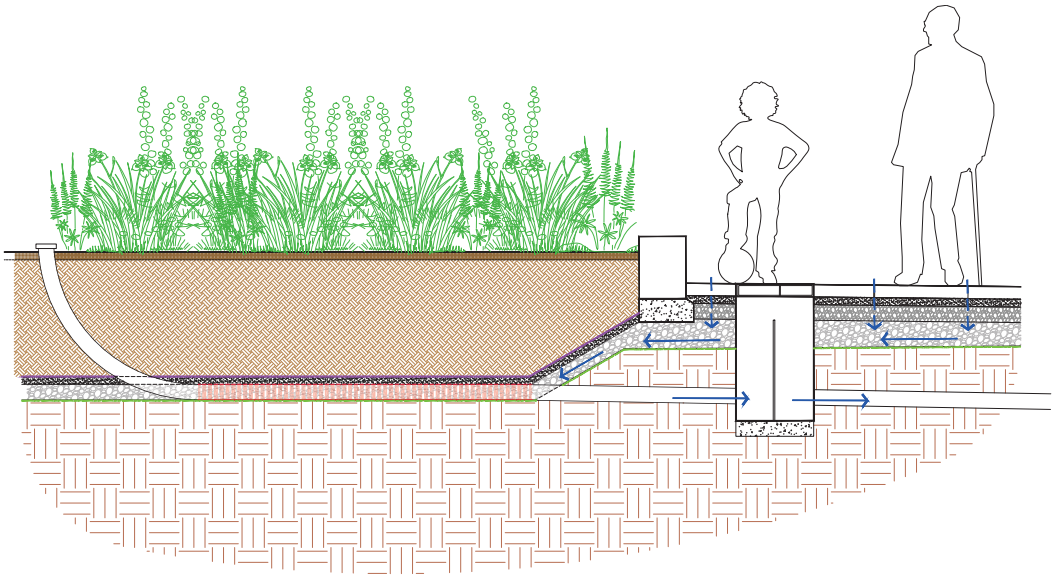
Permeable Paving & Inverted Raingardens

RBA Director Kevin Barton explains: *'Instead of directing water over the surface, we're using the adjacent concrete block permeable paving as our extended rainwater catchment and its sub-base to feed valuable irrigating rainwater under the edging wall and into the drainage layers and soil of the raingarden. Here, it can be stored in storms then taken up by trees and planting. Permeable paving is the ideal inlet in this scenario as it ensures that the water is cleaned and filtered in a diffuse, low maintenance way. So the void space in the raingarden gravels and soils does not get silted over time as can happen with piped inlets.*

'In smaller rainfall events, the green infrastructure gets watered and in extreme events water storage can spread out within the permeable paving. A series of flow controls ensures that the whole system drains down slowly over time but we anticipate large volume losses through soils, plants, evaporation and infiltration/ rehydration of clay subsoils.

'We wanted to demonstrate how raised landscape features could also be designed to be climate resilient, blue-green infrastructure. So, not all raingardens managing runoff from adjacent surfaces need to be sunken. Raised planting and features can have more presence in the landscape and become informal seating or play'.

This project demonstrates a different approach to another RBA scheme – Bridget Joyce Square, Australia Road, London – where extensive CBPP, applied as an overlay on an existing road-base, collects, treats and conveys water before discharging laterally into sunken raingardens. This project is explored in a separate Interpave case study.



MODULAR CONCRETE PERMEABLE PAVING

Concrete Block Paving technology is based on high-strength, interlocking units installed with granular material filled joints and laying course. It enables small displacements between blocks, while retaining interlock, to create a particularly durable wearing course over structural layers below and forming a 'flexible pavement'. Decades of use internationally have demonstrated its suitability for the most taxing paving applications. A wide choice of shapes, styles, colours and finishes – including natural aggregates – add a richness, diversity, visual interest and a human scale to the urban realm.

Concrete Block Paving is slip resistant, durable, strong and sustainable. Modular concrete paving delivers fast, low-cost installation using weather-independent, 'dry' construction methods. There are no curing, hot-work or noxious fume issues and only small plant and equipment is needed, with noise and disturbance minimised. With an extremely long lifespan, blocks can be taken up and re-used without processing for repairs, changing demands and layouts, or new schemes – saving carbon and meeting 'circular' economy' criteria.

Permeable Paving

CBPP enhances this technology as a well-established, multi-functional sustainable drainage (SuDS) technique, used frequently at the head of the SuDS management train. It simply combines self-drained, safe and attractive surfaces for a wide range of applications with attenuation, storage, pollution treatment and conveyance of rainwater runoff. The essential difference with CBPP is the block surface layer with angular aggregate (2/6.3mm) – not sand – used as a laying course and to fill joints designed for permeability, generally maintained by spacer nibs.

This CBPP surface construction has generally been used with pavement layers of voided material (typically 4/20mm) below to accommodate water for SuDS and provide the required structural performance. However, the highly adaptable CBPP surface is being applied to a growing range of other constructions, including:

- permeable 'structural soils' and tree pits – to nurture green infrastructure, replicating natural vegetated surface infiltration
- lattice cellular units – for additional storage, inlets and outlets
- impermeable sub-bases – for services to facilitate access
- existing impermeable road bases – a low-intervention overlay for regeneration, maximising re-use of existing assets and their embodied carbon, optimising the original drainage regime for SuDS but below the surface and with minimal impact on services access.

By its very nature, CBPP requires no additional land-take for water storage or management, and no gulleys with related pipework. It can also accept additional runoff from adjacent impermeable paving and roofs up to twice its own area. Its unique capabilities include source control and delivering a gradual flow of clean water, for example to open SuDS features, for amenity or biodiversity, to drainage systems or into the ground. More than 25-years usage has proven it to be a robust, resilient and adaptable technology, used on projects ranging from footpaths to container terminals, with the reassurance of proven engineering design solutions.

Project Credits

Muf architecture/art - design
Robert Bray Associates - landscape and SuDS design
Civic Engineers - highway and civil engineering
Dekka - lighting

LB Haringey - project delivery managers - Peter Watson; Dana Rasheed; Dave Butcher

Marlborough - contractors

Acknowledgements

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Photos and drawings courtesy of: Robert Bray Associates and muf architecture/art.

Case study prepared by Hodsons.
www.hodsons.com

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Both construction and whole-of-life costs of CBPP have been shown to be lower than for conventional paving and drainage, and it requires only limited, straightforward maintenance without clogging problems. It's important to remember that CBPP is unlike – and not to be confused with – permeable materials, which behave very differently. The infiltration rate of CBPP will decrease due to the build-up of detritus in the jointing material but then stabilise with age, substantially above the most onerous UK requirements.

CBPP provides numerous benefits including:

- Attractive, popular surfaces with no puddles or potholes, for user safety
- Low-intervention, low carbon, no-heat installation
- Long-life with minimal maintenance and low whole-of-life cost
- No open gulleys and wildlife-safe
- Interception losses, managing runoff during regular rainfall events
- Integral water filtration, with debris/litter remaining on the surface
- Sustainable re-use of blocks for reinstatement or changed layouts.

Permeable Paving in Harmony with Trees

CBPP and trees have been proven to work together in synergy. CBPP – whether full-construction or in overlay form – can collect rainfall away from the canopy and convey it to the tree. It can then simply discharge horizontally into a raingarden, perhaps with overflow into an existing adapted gulleys. The raingarden stores water during heavy rain for SuDS, retains soil moisture during dry weather and provides additional water quality 'polishing', as well as irrigation.

Alternatively, CBPP can be used over standard tree pits, proprietary tree planters, Stockholm System or other structural soil installations, enabling irrigation and simple gas (oxygen/carbon dioxide) exchange essential to trees – without additional reservoirs or pipes. CBPP also avoids tree root disruption common with other paved surfaces.

Interpave represents the UK's leading manufacturers and is a part of MPA Precast

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