Goldhawk Road, London

SuDS used

- *Engineered tree pits with underground storage*
- *Kerb inlets to intercept road runoff*

Benefits

- *Reduction in peak surface water runoff to the combined sewer system.*
- *Public realm improvements through urban greening*
- *Reduction of diffuse pollutants*
- *Raising awareness of SuDS to members of the public*
- *Creating a replicable SuDS feature for future use in highway schemes*
- *Drought resilience for urban street trees*

1. Location

Goldhawk Road, Shepherd's Bush, London Borough of Hammersmith and Fulham, W12 8DH; 51°30'10.2"N 0°13'31.0"W

2. Description

Goldhawk Road is a busy high street within Shepherd's Bush. The road runs east-west through the borough and is a major bus route, serving Shepherd's Bush and the White City Opportunity Area.

The SuDS project on Goldhawk Road formed part of a major scheme, the Shepherds Bush Town Centre Scheme. This is project was a major urban renewal scheme, widening footways, renewing carriageways, incorporating new street tree planting and improving links to the White City Opportunity Area.

The inclusion of SuDS within the major project was due to its location being within the Counters Creek sewer catchment and an internal push to include SuDS in all projects. The Counters Creek sewer catchment is well known for exceeding capacity and with increased growth/development expected within the catchment, the sewer system is nearing capacity. Following on from the sewer flooding incidents experienced within the borough, there has been a concerted effort within LBHF to start incorporating SuDS into schemes, trialling a variety of SuDS features in different street typologies. This will ultimately help LBHF understand what SuDS features work in the borough and how these SuDS features can be replicated for other highway projects.

3. Main SuDS components used

Engineered tree pits were the main SuDS feature used. The tree pits are constructed to attenuate surface water runoff by exploiting the inherent void within each tree's soil rooting zone which is contained within underground tree pit.

The primary reason for choosing this SuDS feature was related to the changes in street layout proposed as part of the Shepherd's Bush scheme, and the nature of the environment in Shepherd's Bush. One of the scheme's aims was increasing the amount of highway space for pedestrians, which meant widening footways. To do this the carriageway width was reduced, as such there was limited space within the carriageway for SuDS. As space was at a premium within the scheme, ground level SuDS, such as rain gardens and swales, were not applicable. Permeable and porous surfaces would have worked in the scheme, however they would not have been able to manage the most polluted runoff in this landscape – the road runoff. Neither would they have produced the wider benefits of SuDS and there was a clear streetscape guide to use large paving slabs to help visually widen the space. The current permeable blocks were deemed too small and porous asphalt was not suitable.

There was an aspiration for street tree planting to improve the street environment. Current best practice for street tree planting recommends between 20m^3 and 30m^3 of un-compacted soil be available for each tree to grow into. Because this un-compacted soil has approximately 25% void ratio there was the opportunity to modify these tree pits to receive, treat and attenuate runoff from adjacent surfaces. Therefore, tree planting accommodating underground storage, was thought to be the most applicable SuDS feature to deal with surface water at this location.

As noted earlier, the LBHF was also looking for a SuDS technique that could be easily replicated throughout the borough along the public highway. The borough had trialled permeable surfaces and soft green interventions, such as raingardens, however tree planting in terms of sustainable drainage had yet to be explored and would thought to be a key feature for the future of LBHF streets.

4. How it works

Tradition highway gullies were removed from the location and kerb inlets were installed. These inlets, were linked directly to the tree pits (beneath the tree grille) and directed surface water from the carriageway into the tree pits over the surface of the tree pit soil. This ensured that the trees receive rainwater everytime it rains (even in short summer rainfall events), and that litter and silt were managed in an accessible location, the surface of the tree pit, beneath the tree grille. Once the tree pit has filled with the polluted 'first flush' of runoff, it passes over a weir surrounding the tree pit and through a layer of Permavoid geocellular sub-base replacement beneath the pavement bedding layer. This allows the flow of runoff to spread over the whole root zone and infiltrate down into the soil therein. A perforated pipe running at the base of the root zone collects the runoff as it reaches the base of the installation and directs it to a Controflow orifice flow control chamber and which restricts discharge to the combined sewer. A second pipe connected to the upper level of the tree pit allows free overflow to the sewer once the storage capacity of the installation is exceeded.

The tree pits are designed to cope with a 1:30 year event discharging at 2l/s.

5. Specific project detail

The diagram below shows the general water movement through the system as described above.

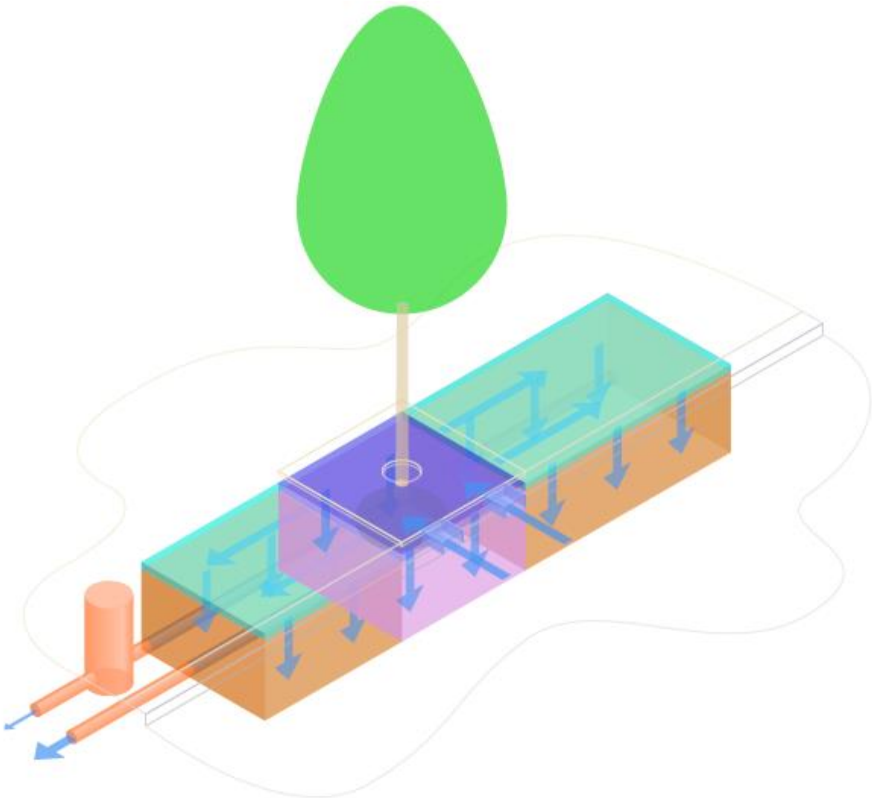

Fig 1.

6. Maintenance & operation

There are 3 elements of maintenance:

- Inlets: the inlets are swept and cleared of litter by the street cleansing team once a week
- Siltation: silt is cleared from the inlets to the tree pits once every 3 years. When doing this the 2-6mm grit is replaced, which covers the top of the tree pit
- Flow Control Chambers: these are inspected annually to ensure there are no blockages

7. Monitoring and evaluation

No long-term monitoring has been undertaken as part of the project. However regular visual inspections are undertaken during planned maintenance. These look at the health of the tree and the level of soil in the cells.

In February 2018, there was a major water burst at this location. As Thames Water tried to locate the water main, the trees were completely saturated in water for over 24 hours. It was noted that the trees took a large quantity of water during this time. On repairing that damage to the highway caused by the burst main, the footway surface had to be removed and the tree pit were exposed in two locations. The cells were found to be in good condition, however as precaution the tree pit were re-filled with soil, due to possible contamination. The tree was left in position, however the topsoil was replaced at the surface of the tree pit.

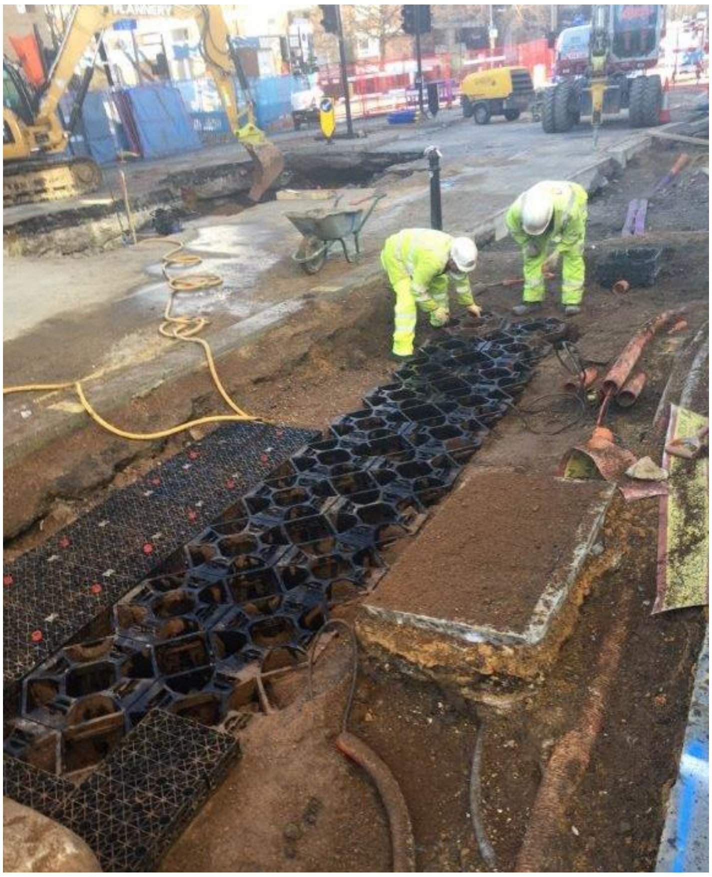

Fig 2: Investigating the tree pit after the burst water main

8. Benefits and achievements

The main benefit from this scheme was not the direct benefits to Goldhawk Road, such as urban greening and reduced surface water runoff, but the understanding of this SuDS technique and how it can be easily replicated throughout Hammersmith and Fulham. As of April 2018, the use of tree pits with additional underground storage has been delivered on four other roads with 3 more due to start in the next 6 months. Each time the tree pits are slightly adapted to suit that setting.

Without this first trial of tree pits at Goldhawk Road the other schemes would not have been as successful or happened so quickly. These engineered tree pits are now commonplace in tree planting schemes along the highway, reducing surface water runoff and allowing trees to thrive in the harsh highway environment by giving trees room to grow and a source of water. This increases the life of the tree and reduced the costs associated in dealing the trip hazards associated with tree roots. Furthermore, it negates the use of highway gullies and ultimately deals with surface water sustainably.

A major achievement of this scheme, is that it has survived a major flooding event. The burst water main in 2018, flooded the space for over 24 hours. The trees, tree pits and cells all were not damaged by this and still function as well as they did before.

9. Lessons learnt

A lesson learnt early on was communication between the delivery team and the design team. When the construction of the tree pits started, the delievry team were unsure on how to lay the tree pit, but failed to relay this to the design team manager. Consequently there was a delay in their installation which caused the costs to increase due to undue down time of the work on-site. From this, project managers in LBHF now manage both the design and construction element of schemes. To do this, all engineers have been given further training in sustainable drainage, and when a project is in its design phase a group of engineers will meet to discuss the SuDS/drainage element of the scheme, to share ideas and tackle any problems together.

Given that these tree pits were the first engineered tree pits in Hammermsith and Fulham, the cost was more than orginally estimated. Part of this was associated to the delay in construction, but also materials used and working within the footway. Recent engineered tree pits have been installed as build outs within the carriageway and these have proven to be lower in cost.

The main lesson learnt from Goldhawk Road is a postive one, that engineered tree pits are a simple and effective way of dealing with surface water runoff from the highway. They can be easily replicated and from this scheme in Goldhawk Road, LBHF have adapted and developed upon the deisgn to suit other streets. Proving that traditional street tree planting can be improved to be multi-functional, helping our urban environemnts adapt to an ever changing climate.

10. Interaction with local authority

The Local Authority was heavily involved in the scheme. The wider major project was designed and managed by the Local Authority. However, the SuDS scheme was designed by Robert Bray Associates and implemented by the LBHF measure term civil works contractor F.M Conway.

11. Project details

Construction completed: April 2016. *The SuDS scheme was built as part of the overall scheme.*

Cost: *Overall project costs, £3.66m. SuDS element, approx.* £60,000.

Extent: 1500m^2 /0.15Ha *of the scheme is drained via SuDS. Total project area 10,000m2/1Ha.*

12. Project team

Funders	• £2.45m TfL Major scheme • £200,000 TfL LIP funding • £880,000 Section 106 contributions • £130,000 Hammersmith & Fulham Council
Clients	London Borough of Hammersmith and Fulham
SuDS Designers	• Robert Bray Associates

Contractors civil works	• F. M. Conway Ltd
Other SuDS contractors	• Green Blue Urban
Design, consultation, and project management	• London Borough of Hammersmith & Fulham – Transport & Highways
Preliminary design and transport modelling	• PCL
Other Contractors	• Bouygues Lighting Ltd (Public lighting and signing works) • Chroma Vision CCTV services

13. Site images and illustrations

Fig 3: Tree pit cells being filled during construction

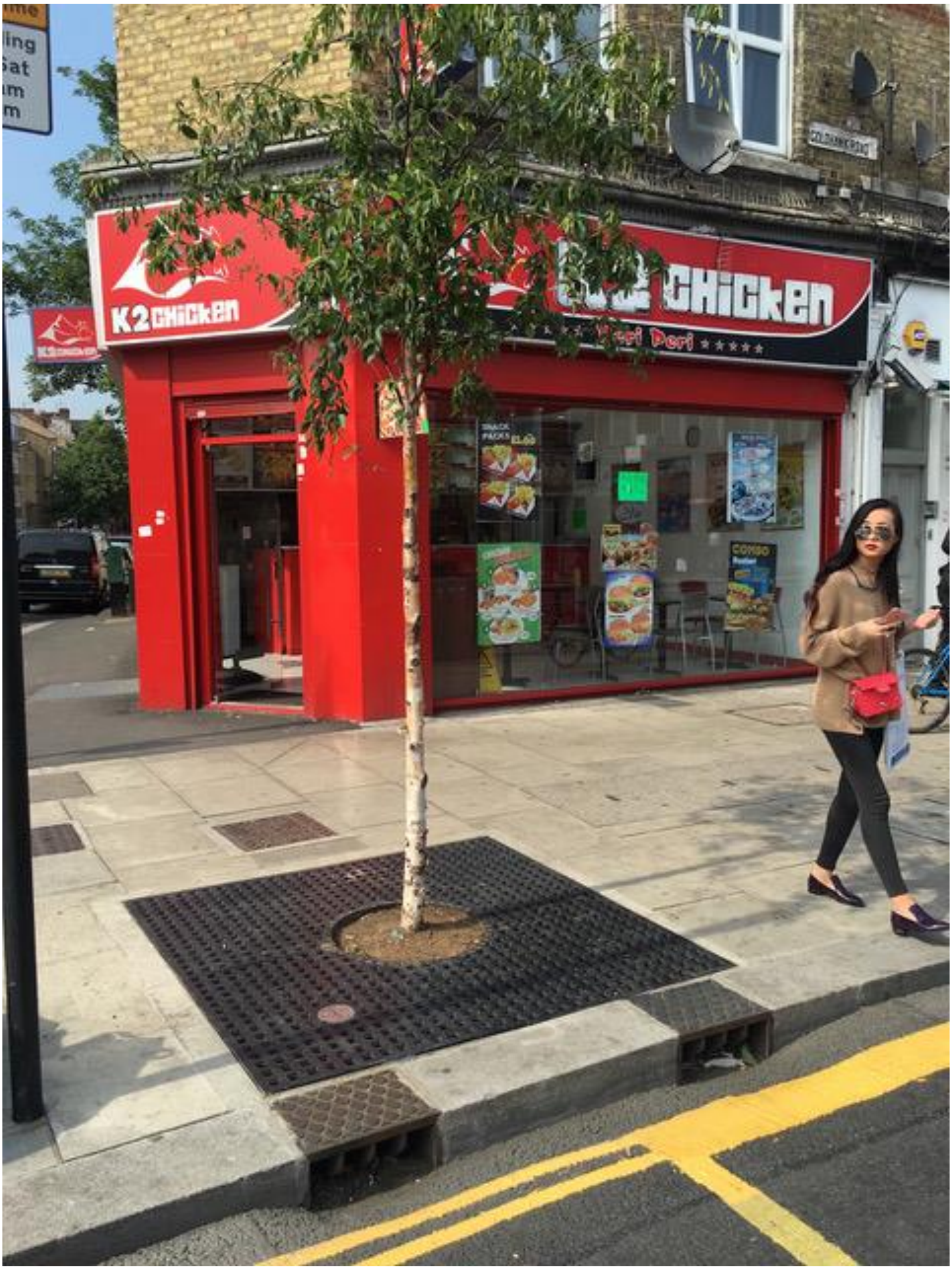

Fig 4

Fig 5

Fig 6: Kerb Inlets