Fleetwood Crescent, Peterborough

SuDS used

- *Permeable Paving*

Benefits

- *Controlled flow of water*
- *Cleans the water*
- *Adopted by the Local Highway Authority*
- *Takes private water as well as highway water*
- *Delivering SuDS on a traditional layout without the loss of building plots*

1. Location

Fleetwood Crescent, Eastfield, Peterborough

2. Description

Fleetwood Crescent is a 0.87 ha brownfield phased residential development in the Eastfield area of Peterborough. The first phase consists of 28 plots for Cross Keys Homes (CKH) properties, and utilises permeable paving in order to manage surface water runoff from the site. The estate road is a

trial site for the adoption of permeable paving by the Local Highway Authority (LHA); adopted under the 'Section 38' process and its performance monitored.

Formerly the location of a secondary school the ground consisted of 0.8m depth of made-up ground with underlying clay soils of a low permeability.

3. Main SuDS components used

Permeable paving is used on the private driveways and adoptable highway to collect, clean, store and convey the surface water from the site.

The pavement was designed for 'Load Category 4' and a low CBR subgrade of 1%, consisting of;

- 80mm depth paving blocks with 6.3-2mm jointing material
- 50mm depth laying course material of 6.3-2mm
- 150mm depth Dense Bitumen Macadam (DBM) running course with 75mm cored holes at 750mm intervals with 6.3-2mm clean stone in cored cavities
- 600mm depth sub-base of 20-4mm no fine aggregates
- Capping was required in places to increase the CBR values of the ground
- Private parking areas are designed with no DBM running course layer, reduced subbase depth and more rounded sub-base material

4. How it works

Rainfall from the roofs of the properties drain into the permeable sub-base of the private driveways where it is filtered and cleaned, the water from these driveways is then conveyed through a short connecting pipe into the sub-base of the highway where further water treatment can take place.

At the bottom of the sub-base in the adoptable highway there is a perforated pipe which then collects and conveys the water to an adjacent surface water sewer in Park Lane. The runoff then leaves the site is at a 'greenfield' runoff rate, and is restricted by a 43mm orifice plate flow control chamber.

5. Specific project details

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6. Maintenance and operation

The permeable paved road is yet to be adopted by the Peterborough City Council Highways Authority, under the section 38 process. This is due to the connected road, Park Lane, also not yet being adopted. The Highways authority hope that both roads will be adopted by the end of 2018.

The maintenance will be carried out by Peterborough City Council and will initially follow the maintenance regime set out by Interpave as best practice. Over time it is expected that maintenance could become risk based as experience of the asset and its performance increases.

7. Monitoring and evaluation

The engagement between officers from the Highway Control Team and the Sustainable Drainage Team continued with the developers and their agents as the team worked together to monitor the site construction as a part of the S38 Highway adoption process. This took place to ensure the site

replicated the approved design drawings and that any issues encountered on site could be discussed and provided with agreed solutions.

8. Benefits and achievements

- Helping Local Highway Authority to further develop understanding of permeable paving
- Inclusion of private water with source control upstream of adopted asset
- Helping to debunk some misconceptions that made ground and clay soils are a barrier to permeable paving
- Flows are restricted to less than misinterpreted 5l/s rule

9. Lessons learnt

Design stage

- The absence of CBR tests in the locations required for the highway construction meant that CBR values were assumed as being below two. This resulted in a depth of construction for the road that was dictated more by the structural needs of the highway rather than the attenuation requirements for surface water management. On sites where a higher CBR value is expected it could be economically beneficial to carry out full ground tests in advance of road construction to minimise material and excavation costs.
- Managing all surface water in one system allows for a much simpler design with minimal pipework and a more resilient conveyance method. However the likelihood for this type of approach being repeated in future is hindered by the absence of Schedule 3 of the Flood and Water Management Act 2010 as the adoption mechanisms remain convoluted
- Whilst the Peterborough City Councils Estate Road Construction Specification is being redeveloped to include permeable paving the Interpave Design and Construction information for permeable paved systems was essential reading for LHA engineers, along with advice from members of Interpave and use of the inline Permcalc tool.
- Green spaces within visibility splays were considered for further surface water storage or water treatment but were not utilised as the road structure provided sufficient storage
- By ensuring that surface water upstream of the outfall was filtered the risk of blockages is considerably reduced, this allows for the installation of an orifice plate rather than a vortex flow control device which helps to reduce future construction and replacement costs
- Having a good working relationship between the Sustainable Drainage Team, Highway Control Team, developers and their agents was essential. Initially this proved more time intensive than a road of standard construction as those involved went through a not

inconsiderable learning process. As the method of construction, its materials and constraints become better understood it is anticipated that the process will be more streamlined

- Original designs showed the kerb beam sat on top of the permeable sub-base with the sides of the permeable sub-base being supported by the soft clay soils. This was amended so the kerb beam was sat on a standard type 1 material, the intention is that this type 1 material and kerb beam then act as retaining features for the relatively loose permeable sub-base. The principle of placing kerb beams on top of the permeable sub-base could be explored more as this would increase the potential water storage capacity in such sub-bases
- It was possible to keep services out of the construction of the road, however a service crossing was required and this doubled up as a build out traffic calming feature. In two locations a deep, foul water system crosses under the sub-base of the road in the sub strata, whilst not ideal it is not expected to cause any complications for the permeable paving above given the levels of cover over the foul pipes.

Construction Stage

- There needs to be careful consideration of the phasing of the site construction, especially when the only site access is the route intended for the permeable paved system
- The original material supplied for the sub-base was a rounded aggregate rather than an angular aggregate and there were concerns around the long term stability and how this would behave under pressure in a regularly trafficked road. Replacement material was obtained for the highway portion of the permeable paving, this was more angular in nature which provides greater certainty that the stone can lock in place when compacted and is more consistent with the product described in the Interpave guidance
- The permeable sub base needs to be protected from ingress of fines from traffic and landscape runoff to minimise clogging before the DBM layer is laid
- When coring started there were concerns over the cleanliness of the road surface and the potential migration of silt into the road sub-base, as a result sacrificial grit was added to the cored holes, the road was cleaned again and then the grit was removed and refreshed. A ‘sock’ of geotextile can be used in the holes that are cored it activity and a risk of silt loading continues on site before the grit and bricks are laid
- Care needs to be taken to avoid storing landscaping materials such as soils and barks temporarily on the highway or driveways as this has a risk of reducing the performance
- Coring the tarmac layer is time consuming.

10. Interaction with local authority

Close engagement between the developer, their agents, appointed contractors and representatives of the Highway Development Control, Planning and Sustainable Drainage Team were essential throughout the project in order to achieve the best result. This engagement started before the site layout was even conceived and continues through design, construction and pre-adoption maintenance. Once the principles were agreed there were a significant amount of technical details such as materials, service locations and construction methods that had to be addressed to enable the potential adoption of the site by the local highway authority.

11. Project details

Construction completed: *June/July 2016*

Cost: *Unknown*

Extent: 0.87 Ha *site with approximately* 1,100m^2 *of permeable paving*

12. Project team

Funders	• Cross Keys Homes
Clients	• Cross Keys Homes
Designers	• The Design Partnership • Rossi Long Consulting
Contractors	• Parrott Construction
Other	• Peterborough City Council Planning, Highway Control and Sustainable Drainage Team

13. Project images and illustrations

Fig 1: Impermeable service corridor

Fig 2: Taping up of private water inlets in impermeable liner

Fig 3: Laying of permeable sub-base

Fig 4: Laying of DBM on permeable sub-base

Fig 5: DBM core showing permeable sub-base beneath

Fig 6: Laying the permeable blocks

Fig 7: The finished road and private parking area

Fig 8: One year on….