

-
- New Government requirements
 - Now a planning issue
 - Urban design opportunities
 - Bringing water to landscaping
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SUDS + PERMEABLE PAVING TODAY



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Context

This discussion document is intended for all those involved with the development process – particularly architects, urban designers and developers, and local authority planning, flood risk, drainage, building control and highways officers. It explores the latest thinking on Sustainable Drainage Systems (SuDS) as a fundamental part of urban design and Government measures to deliver them now.

It also examines the expanded role of concrete block permeable paving as a key tool in urban design with SuDS. News of the latest developments in SuDS can be found at www.paving.org.uk/water where further guidance and various case studies are also available.

Why do we need SuDS?

There is ample research to demonstrate the link between growing urbanisation and flooding, notably the Pitt Review into the summer 2007 floods. Here, over two thirds of the 57,000 homes affected were flooded, not by swollen rivers but by surface water runoff or surcharge from overloaded drainage systems.

Again, the extensive 2013/14 winter flooding demonstrated the personal and social, as well as financial costs of these increasingly frequent events. In this case, flooding resulted from steady, long-lasting periods of rain from large-scale weather systems.

Worryingly, recent research using detailed modelling shows that extreme summer rainfall may also become more frequent in the UK due to climate change, with almost five times more events predicted to exceed 28mm in one hour in the future than currently.

Today, few would disagree with the principle that SuDS and techniques such as concrete block permeable paving are needed to help fight flooding and pollution – particularly with overloaded sewers, urbanisation and climate change. Now, there is also a growing realisation that SuDS can deliver far more, acknowledged by Government's latest move to implement them through the planning system.



Permeable and conventional concrete block paving at the award winning 'Abode' housing, Cambridge. Photo: Simon Bunn (also front cover left hand image)

Implementing SuDS



Permeable paving at Seven Acres (Skanska), Cambridge.

Government requirements for SuDS on developments in England came into force in April 2015 and are being implemented through the planning system. A ministerial statement now sits alongside the National Planning Policy Framework (NPPF) as additional policy, spelling out: *“the Government’s expectation ... that sustainable drainage systems will be provided in new developments wherever this is appropriate”*.

The new measures must be applied by local planning authorities (LPAs) through local policies and plans, as well as planning application decisions on ‘major developments’ of 10 or more dwellings and equivalent non-residential or mixed developments. However, this situation might change as the Government intends to *“keep this under review, and consider the need to make adjustments where necessary”*. The exemption for smaller developments fails to recognise their cumulative effect and is unjustified, as they can easily be provided with SuDS using permeable pavements.

Meanwhile, existing NPPF prioritisation of SuDS in areas of flood risk and requirements that developments should not make flood risk worse elsewhere – generally by utilising SuDS – still apply to developments of any scale. Also, permitted development rights for new or replacement hard surfaces, such as drives and car parks, around homes and non-domestic premises still only apply where permeable paving or similar solutions are used.

Under the new arrangements, ‘Lead Local Flood Authorities’ (at county or unitary level) will become statutory consultees on surface water management for planning applications. LPAs must satisfy themselves of minimum operational standards and ensure that maintenance is provided for the lifetime of the development using planning conditions or other obligations such as Section 106 agreements. SuDS designs must also be ‘economically proportionate’ in terms of operation and maintenance.

It is still unclear whether Defra’s far more extensive, June 2014 ‘Draft National Standards for SuDS’ and related guidance will be formalised. The guidance stipulates that SuDS: *“must consider requirements for urban design that may be specified by the Local Planning Authority, particularly in relation to landscape, visual impacts, aesthetics, biodiversity and amenity”*. It also recommends that SuDS:

“should aim to manage surface water within sub-catchments, close to source and at or near surface as reasonably practicable” – something that concrete block permeable paving is well-suited to as a source control feature.

The Government’s definition of SuDS is now included in the NPPF Planning Practice Guidance as follows:

“Sustainable drainage systems are designed to control surface water run off close to where it falls and mimic natural drainage as closely as possible. They provide opportunities to:

- *reduce the causes and impacts of flooding;*
- *remove pollutants from urban run-off at source;*
- *combine water management with green space with benefits for amenity, recreation and wildlife.”*

New Government guidance, in the form of ‘Non-statutory Technical Standards for SuDS’, albeit with a minimal level of information, has been published. However, guidance for LPAs, developers and designers, on various aspects of SuDS is already available from a number of sources, including ‘The SuDS Manual’, due to be re-published this summer, and the 2013 Code of Practice BS85823 (discussed on page 5).

It is also expected that LPAs will prepare local-level policies and guidelines, such as ‘Supplementary Planning Documents’, and the Government policy anticipates that stakeholders will be providing more detailed SuDS guidance. Interpave will continue to update its guidelines on all aspects of concrete block permeable paving – a key SuDS technique.

A different approach is taken in Scotland. The *Water Environment (Controlled Activities) (Scotland) Regulations 2011* require surface water drainage systems from new developments to discharge water to the environment through SuDS.



Permeable paving at Novo (Glebe Farm), Cambridge

Planning + SuDS

SuDS have been a part of national planning policy for some time. Nonetheless, a recent Committee on Climate Change ASC Progress Report² – which considers adaptation to avoid flooding - points out that: *“Less than half of the planning applications we reviewed considered sustainable drainage. This raises questions as to whether a large proportion of local planning authorities are following national planning policy on SuDS.”*

In addition, Permitted Development rules (**Interpave Guide available**) were put in place some years ago for homes and non-domestic properties. Despite this, the ASC report observes that: *“The low uptake of permeable paving in front gardens suggests that planning regulations for households ... are not being enforced by local councils.”*

The Government's 2015 changes to the NPPF are a clear reminder that local planning authorities should now prioritise sustainable drainage as a key element in development control.

Local authority engagement with SuDS

Having said that, for some local authorities - such as Oxfordshire County Council (**Interpave case study available**) - SuDS have been an important part of planning policy for decades and a growing number are embracing SuDS. Increasingly, local planning authorities are producing policies, guidance and Supplementary Planning Documents, making SuDS a local issue. At the same time, it is becoming clearer that SuDS is also an urban design issue.

June 2014 Government guidance¹ to the 'Draft National Standards for SuDS' requires that SuDS: *“must consider requirements for urban design that may be specified by the Local Planning Authority, particularly in relation to landscape, visual impacts, aesthetics, biodiversity and amenity”* and recommends that: *“early discussions ... can help the developer to maximise the biodiversity and recreational potential and save costs by making creative multifunctional use of space, including communal areas and public open space.”*

“Local planning authorities should now prioritise sustainable drainage as a key element in development control.”



At Trumpington Meadows, Cambridge, concrete block permeable paving is used extensively. However, opportunities have been missed throughout the Cambridge developments in areas adopted by the local highway authority, dominated by impermeable surfaces and gulleys.

Urban Design + SuDS

The Government's change in approach to implementation using the planning system is a clarion call for architects, master-planners and other designers to take the lead in developing multi-functional SuDS as an integral part of place shaping.

As the RIBA's 2014 report Building a Better Britain points out: *"For too long, we have been designing water out of our towns and cities when we should have been designing it in..."* and stresses the need to: *"start putting water at the heart of discussions about what makes places great to live in."*

Now is the time for a closer understanding of, and engagement with SuDS by designers and planners. With good design as a priority, drainage engineering becomes a supporting function, not an end in itself.

Supporting a design-led approach

This approach is also supported by the 2013 Code of Practice BS 8582³, as well as the 2014 draft National Standards Guidance¹. The Code seeks to integrate

SuDS with urban design in delivering amenity and community value as well as enhancing landscape and townscape character, and stresses the importance of linking surface water management and development planning from the very start with aims including:

- maximize opportunities for using space in a multi-functional way
- enable water storage and conveyance zones to form part of the character of the development
- provide the greatest opportunity for the drainage system to deliver multiple planning and environmental benefits.

It also looks for permeable surfaces and surface-based conveyance wherever possible.



These examples from Malmö in Sweden give a feel for the qualities that well-designed SuDS - with water conveyed and stored on the surface - can add to hard-landscaped urban areas. (Photos: Bob Bray)

The Nature of SuDS

SuDS technology is not new to the UK and is well established in other countries. Guidance has been available for some years in the *SuDS Manual* (currently being updated) and Interpave's own publications (via www.paving.org.uk), as well as the BS 8582:2013 Code of Practice³ and draft National Standards Guidance¹.

It is clear from all the guidance – but sometimes forgotten – that there is more to

SuDS than just water storage. SuDS should deliver:

- **QUANTITY** - minimising water runoff and reducing flood risks
- **QUALITY** – removing pollutants
- **AMENITY** – adding societal and biodiversity benefits.

However, some recent schemes in the UK demonstrate misconceptions about the nature of SuDS with a focus on quantity alone.

Conceptually, a SuDS scheme comprises a 'management train' of interconnected features, each delivering all three of these attributes wherever possible. SuDS manage surface water by attenuation and filtration with the aim of replicating, as closely as possible, the natural drainage from a site before development. That is not to say that all SuDS features have to be vegetated (for example, concrete block permeable paving is a well-used SuDS technique) or that urban projects need to take on a rural character with lower housing densities. As the draft National Standards Guidance¹ states,

At a high-density town-centre housing scheme in Stamford, most public areas between buildings are concrete block permeable paving which also accepts runoff from other hard areas and roofs. Stored, treated water then passes from the paving directly into planted rills and canals, which add interest and much-needed greenery to the courtyard environment, before passing into the nearby river.

(Interpave case study – Robert Bray Associates – available).

Photo: Roger Nowell



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At a hillside Co-housing scheme in Stroud, treated, stored water from concrete block permeable paved car parking feeds a 'waterfall' onto a planted swale, then via planted rills into a wildlife pond and existing stream.

(Interpave case study – Robert Bray Associates – available).



“For too long, we have been designing water out of our towns and cities when we should have been designing it in.”

SuDS: *“should aim to manage surface water within sub-catchments, close to source and at or near surface as reasonably practicable”* – something that permeable paving is well-suited to as a source control feature.

This means that water runoff, once suitably treated within SuDS features, is available for recycling, irrigation, biodiversity and amenity use within the landscape. SuDS offer imaginative designers opportunities, rather than just technical problems to be solved.

Taking a holistic approach, architects, landscape designers and master-planners are increasingly embracing SuDS as one of the key design considerations from the very start of their projects, exploring innovative solutions that form an integral part of an overall scheme. Drainage engineering then becomes simply a part of the process – not the primary driver.

Cambridge City Council is already gaining experience with SuDS on the ground through early phases of major city-fringe developments (**new Interpave case study available**). As the City Sustainable Drainage Engineer explained: *“Cambridge City Council took the decision to adopt SuDS in 2007 by way of preparation for major growth that was planned in and around the City. The adoption of SuDS within public open space was offered as a service to encourage the uptake of SuDS in the new communities.*

“Guidance was produced on the design and adoption of SuDS, which focused on a landscape-led design approach. The local plan is in the process of being reviewed and updated, and the principles of SuDS are woven into policy proposals with a focus on achieving high quality environments with high quality SuDS.

Permeable surfaces are encouraged on all external areas and are seen as an essential component in the delivery of the entire SuDS management train.”



Pedestrian 'green lanes' in concrete block permeable paving traverse 'Abode', Cambridge. Photo: Simon Bunn.



Concrete block permeable paving at the BRE Innovation Park.

Concrete Block Permeable Paving

This important and adaptable SuDS technique simply allows water to pass through joint filling material in gaps between each block into the underlying permeable sub-base. Here, it is stored and released gradually. At the same time, many pollutants are substantially removed and treated within the pavement itself. It is essential to remember that permeable paving can be used in three different systems, all with temporary storage and treatment:

- full infiltration to the ground where conditions allow (System A)
- partial infiltration with drainage of excess to the next SuDS stage (System B)
- full containment and drainage to the next SuDS stage (System C).

It is also capable of handling additional rainwater from adjacent roofs and impervious paving around twice its own area.



At the RIBA Award-winning and BREEM rated 'very good' St George's Primary School, Kiddeminster. **Interpave case study available.**



Retrofit concrete block permeable paving in Bristol.



Permeable and conventional concrete block paving characterise these innovative, urban shared-spaces in Craigmillar, Edinburgh. **Interpave case study available.**

The important role of permeable (aka pervious) paving as a SuDS source control technique is recognised in all the SuDS guidance. In fact, the Code of Practice³ states that conceptual designs should include: *“evidence that permeable surfaces and surface based conveyance and storage systems are to be used wherever practical.”* It also stresses the importance of multi-functional SuDS design, linked to other development infrastructure such as car parking, transport routes and public open space.

Urban Design

Concrete block permeable paving is uniquely placed to meet these and the other Code of Practice³ requirements discussed earlier. In terms of place-shaping and urban design (**Interpave Guide available**), the growing choice of concrete block permeable paving products available from Interpave

manufacturers - with numerous shapes, styles, finishes and colours - allows real design freedom. They can also be used in conjunction with conventional precast concrete paving products, sharing the same impressive performance including slip and skid resistance, durability and strength.

At the same time, permeable paving can provide completely level, well-drained, firm and slip-resistance ‘accessible’ surfaces without the need for cross-falls, channels, gulleys or other interruptions. Rainwater ‘ponding’ is eliminated, reducing the risk of ice forming on the surface and preventing splashing from standing water.

But its real strength is an ability to remove water-borne pollution offering the important – and often missed - opportunity of a gradual supply of treated water that can be exploited for landscape design, harvesting and ecology.

“Permeable paving offers a gradual supply of treated water that can be exploited for landscape design, harvesting and ecology”



At the pioneering Hazeley School in Milton Keynes, a terraced sequence of permeable paving car parks provides effective pollutant removal for water serving two ponds for wildlife - notably the ‘protected’ great crested newts indigenous to the site. In addition, the ponds offer a valuable teaching and learning resource for the school.



Other sections of concrete block permeable paving with a storage ‘box’ below, on level areas used for play, collect rainfall runoff from adjacent hard games surfaces and roofs. Here, the water is filtered and treated before being pumped to a header tank for toilet flushing in the school buildings.

(Interpave case study – Robert Bray Associates – available).





Adopting Permeable Paving

At the time of publishing this document, many issues surrounding adoption and maintenance of SuDS under the Government's 2015 measures have yet to be resolved. In the case of permeable paving, public highways are already the responsibility of the highway authority and individual properties maintained by their owners.

Concrete block permeable paving can play a key role in urban design, both delivering SuDS and meeting the aspirations of local design guides and master-plans, as well as *Manual for Streets 1 & 2*, and CABI's *Building for Life*. However, a consistent approach and understanding of concrete block permeable paving is essential amongst all project stakeholders and misplaced concerns about concrete block permeable paving addressed.

Unlike conventional road construction, water storage in permeable pavement construction is not an issue, as all the materials are specifically designed for this. Correctly designed concrete block permeable pavements can

also support heavy trafficking and loads (such as in container terminals). They are therefore ideal for all shared surfaces and residential roads, as well as car parks and hard landscaping. Concrete block permeable paving is established engineering technology and has predictable performance proven over decades in the UK and around the world – notably Germany since the mid-1980s. There, over 20,000,000m² of permeable pavements are installed annually and treated as standard highway construction.

Routine maintenance should be no more onerous than for impervious paving and the maintenance required for conventional below-ground gully and pipe drainage is eliminated. It is essential that joints are completely filled and topped-up at construction completion. Over time, detritus and silt collects in the upper part of the joint material, although studies have shown that long-term infiltration capability will generally substantially exceed UK hydrological requirements.

Performance is also not significantly affected by moss or weeds in the joints, or by leaves collecting on the surface. Any problems will be revealed on the surface by ponding and in the absence of these indications no remedial action is necessary. Current routine maintenance regimes for other paving can be applied including annual cosmetic cleaning and visual inspection. Maintenance guidance is available from www.paving.org.uk

There is therefore no need for highway authorities or other bodies to refuse adoption of correctly designed and constructed concrete block permeable paving. The latest report from the Committee on Climate Change² stresses the importance of addressing this issue.



Concrete block permeable paving characterises this high-density town-centre housing project in Abingdon, Oxfordshire (above).



Bicester in Oxfordshire, is home to major new developments making extensive use of permeable, in conjunction with conventional, concrete block paving. Under construction now are Kingsmere (above) and the North West Bicester Eco-town.

This modest scheme (right) in the Thames-side village of Standlake, Oxfordshire, is immediately adjacent to the river and several lakes. During its 10- year life, the permeable paving has been cleaned just once but it remains problem-free.



Oxfordshire County Council (**Interpave case study available**) has taken a positive and pragmatic approach to adopting streets and other areas using SuDS - particularly concrete block permeable paving - for around 15 years. SuDS are considered an essential component of any development and permeable paving as mainstream technology. Great Western Park, Didcot (**Interpave case study available**) is one example, eventually providing 3,300 new homes. Concrete block permeable paving is being used widely as a source control. In addition to both attenuation and pollution, it also provides amenity and water for irrigating allotments as well as feeding wildlife ponds.



References

- (1) Defra. **Draft Guidance for the National Standards and Specified Criteria for Sustainable Drainage.** Version 40 – July 2014.
- (2) Committee on Climate Change. **Managing climate risks to well-being and the economy. Adaptation Sub-Committee Progress Report.** 2014.
- (3) British Standards Institute. **BS 8582 – Code of practice for surface water management for development sites.** November 2013.

More information can be found in Interpave's **Understanding Permeable Paving** guide and on the www.paving.org.uk website, or contact us via info@paving.org.uk

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