The Many and Varied uses of Asphalt

Sustainable Drainage Systems (SuDS)

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Presentation Objectives

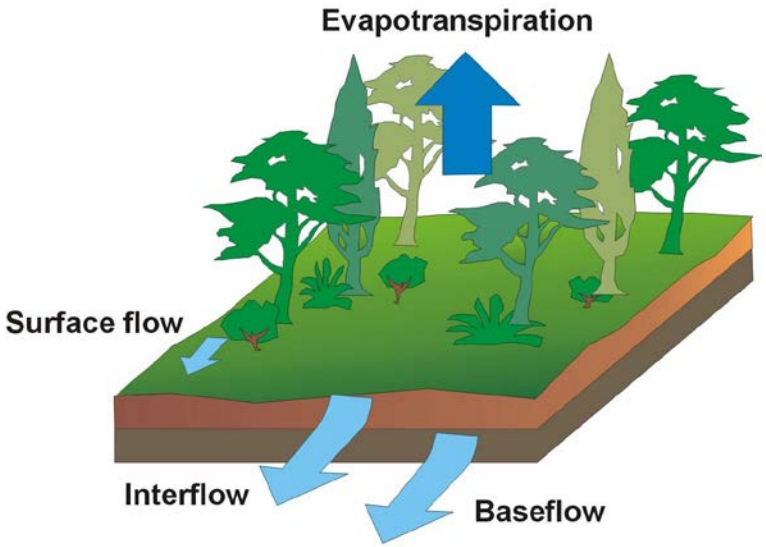
An introduction to:

- Sustainable Drainage Systems (SuDS)
- The concept of source control
- Source Control SuDS pavements
  - Surfacing Options
  - Water Storage Options
- Source Control SuDS in action

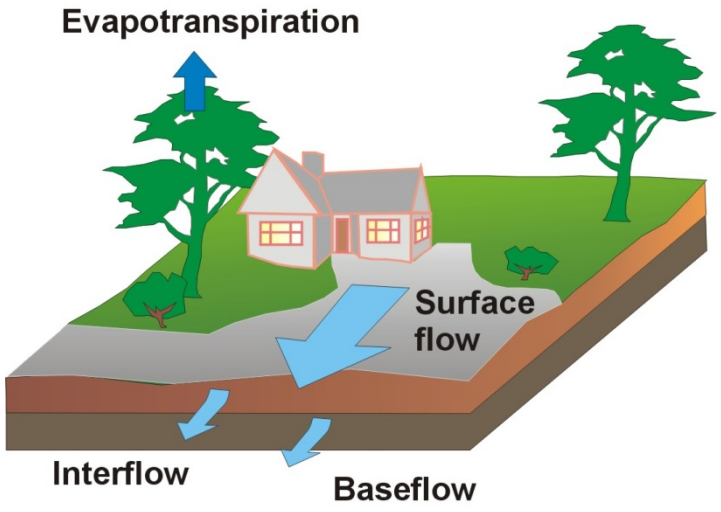
Surface Water Run Off – The Problem

WATER QUALITY

Natural Catchment



Developed Catchment



WATER RUNOFF

Why use SuDS?

- Reduce volume and rate of runoff (reduces flood risk)
- Reduce adverse impact of development on watercourses
- Reduce pollution by treating runoff
- Provides amenity value via water features, open space and wildlife habitat

Examples of SuDS

- Swales
- Filter Strips
- Green Roofs

Examples of SuDS

- Ponds
- Detention Basins
- Wetlands

Examples of SuDS

- Water Storage Structures
  - Oversized Pipes
  - Plastic Boxes
  - Concrete tanks

Source Control

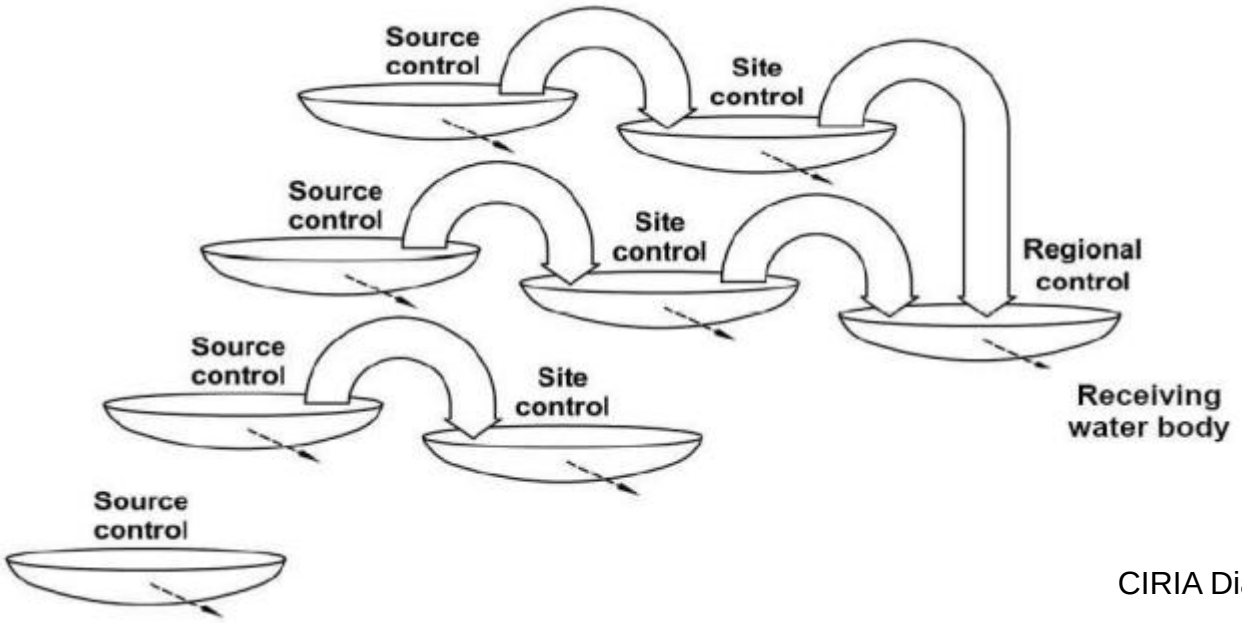
But hard landscaped surfaces don't have to contribute to the problem of surface water run off, when designed as part of a Source Control SuDS they can be the solution too!

Source Control - SuDS Management Train

- **Source Control** – Controlling run off close to where the rain hits the ground

- **Site Control** – Management of water from several sub catchments into one large soak away or infiltration basin

- **Regional Control** – Management of run off from several sites typically in detention pond or wetland

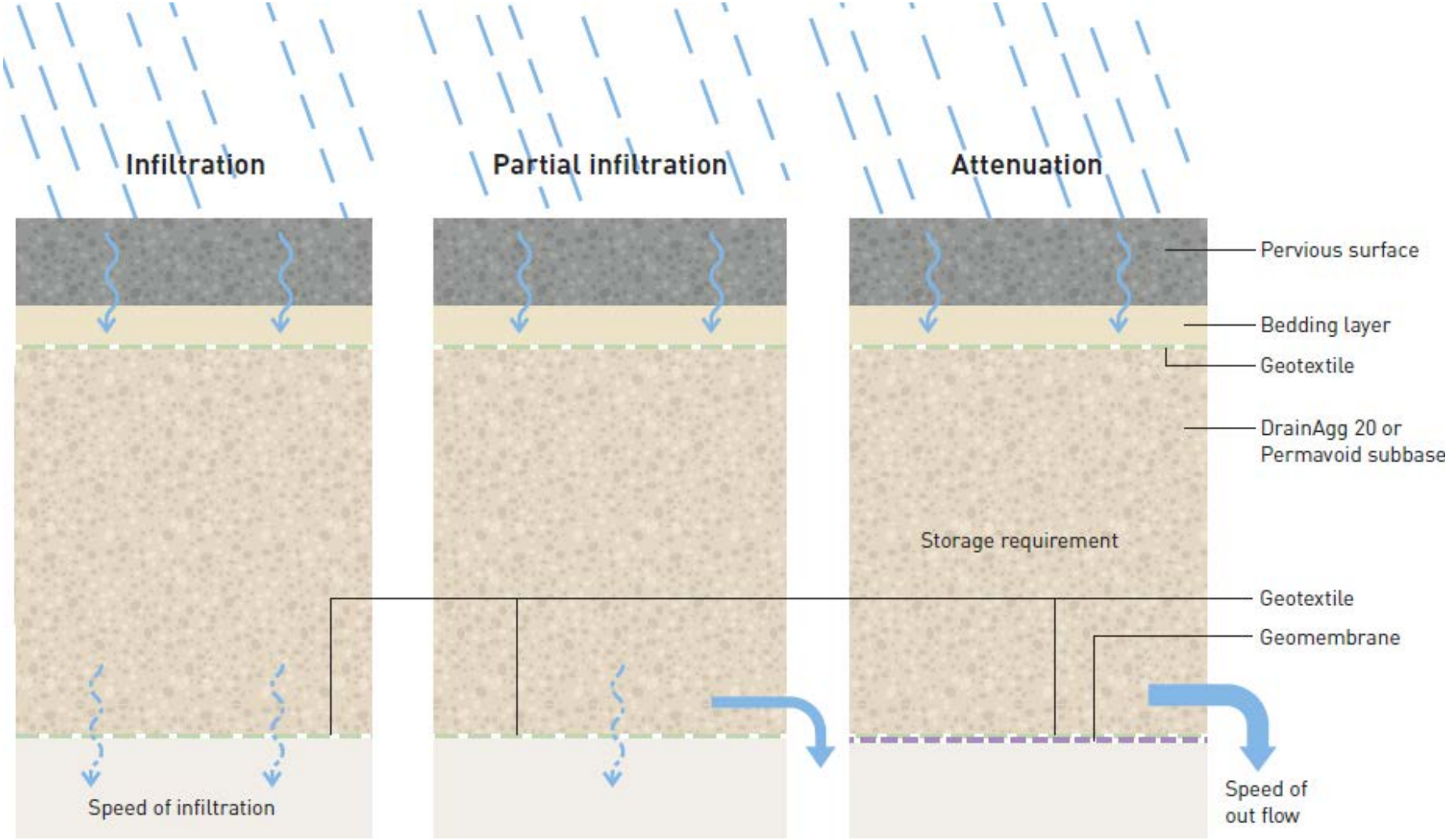


CIRIA Diagram

Source Control - How and Why?

- **Shallow construction**
  - Reduced excavation
  - Shallow outfalls allow Integration with green SuDS (swales, ponds etc.)
  - H&S benefits
- **Flood Prevention**
  - Store water as close to the source of run off as possible
  - Micro catchments avoid flooding and reduce risk of catastrophic failure
  - Low flow velocities and flows stilled at source
  - Elimination of deep pipes and manholes
- **Pollution Prevention**
  - Silt and oil interception at source
  - Micro catchments – low flow velocities, less risk of emulsification
- **Amenity**
  - Retrofit opportunities
  - Green Cities
  - Sport and leisure facilities

Design Elements of a Pervious Pavement



Pervious Pavements - Water Entry Options

- Aggregate
- Concrete Block Permeable Paving
- Grass grids
- Porous Concrete
- Porous Asphalt

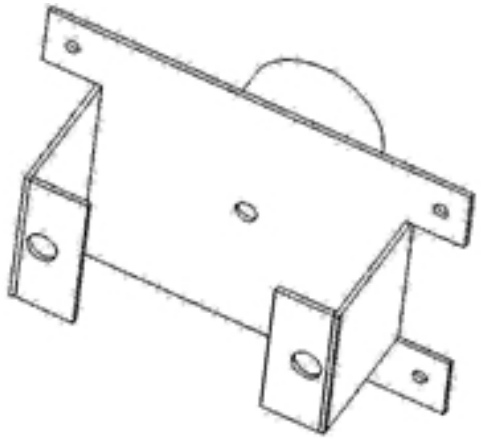
- Choice dependant upon aesthetic, cost, hydraulic and structural design considerations

Pervious Pavements – Porous Asphalt

- Porous asphalts, such as Bardon DrainAsphalt, have been developed specifically for use in SUDS applications to provide a draining surface layer.
- Produced using a polymer-modified bitumen combined with open graded aggregate structure to provide a strong, durable material
- Polymer-modified bitumens are the key to the performance of DrainAsphalt when compared to standard porous mixtures.
- Liquid polymer additives make the binder more viscous allowing it to adhere to the aggregate particles more effectively so that:
  - The pores remain open ensuring that the asphalt remains porous.
  - It allows the binder to adhere in a thicker, more stable film so it is more resistant to oxidation and less likely to become brittle.

Benefits of Pervious Pavements

- **Pollution control**
  - trapped in layers
  - broken down by bacteria
- **Silt control**
  - silt trapped at surface
- **Shallow construction**
- **Simple flow controls**
  - orifice plates



Barriers to use of Pervious Pavements

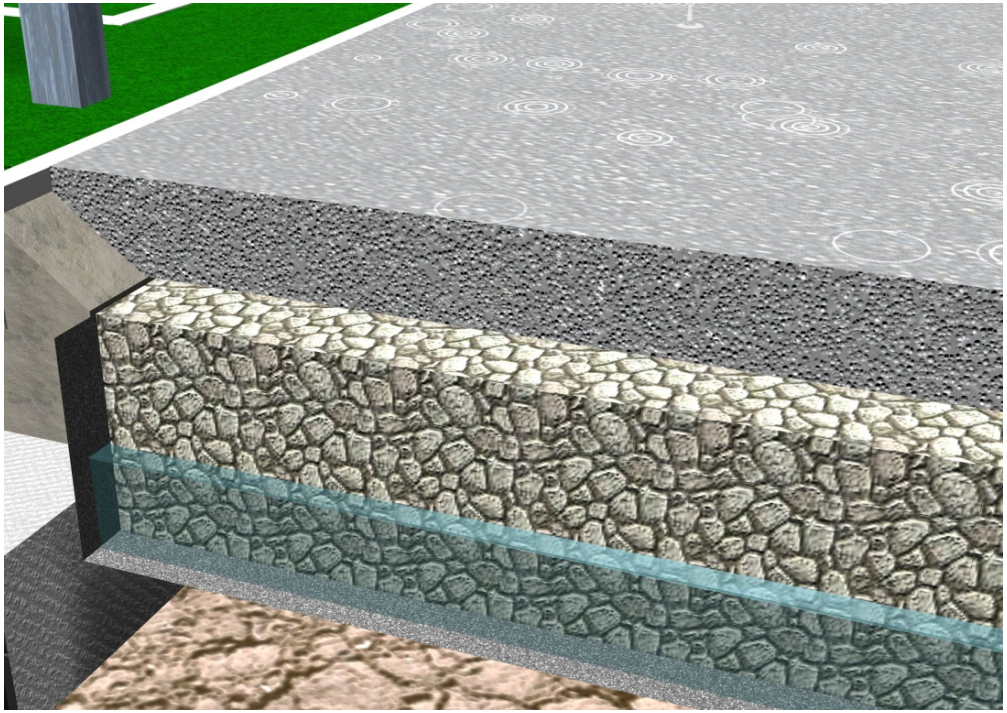
- Risk of pollution to groundwater
- Clogging
- Maintenance
- Trafficking ability
- Concern over water in pavement

*These **perceived** problems can be addressed by careful **design** and **construction***

Water Storage

Granular subbase

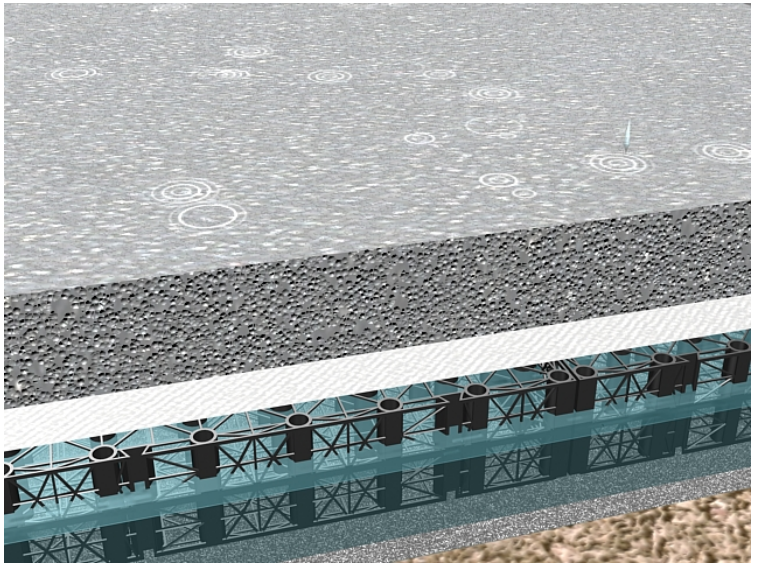
- Traditional approach
- Open graded aggregate
- 30% Void Ratio



Water Storage

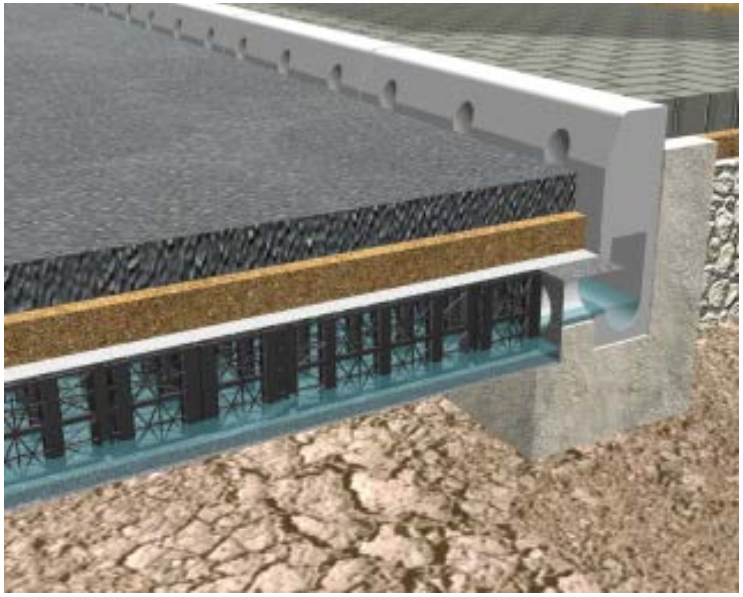
Geo Cellular subbase

- Plastic sub base replacement
- Modular system
- Interlocking structural raft
- High void ratio – 95%
- Low levels of soil removal
- Suited to sites with abnormal ground conditions (contamination, high water table, rock etc.)



Flexibility to use conventional, Impervious surfaces

- **Run-off collection, silt/effluent interception & treatment channel system**
- **Unique** method of SUDS drainage incorporating integral oil water separation mechanism
- Wider choice of surface finishes
- Suitable for heavily trafficked areas
- Speed of installation
- Closest to traditional drainage thinking



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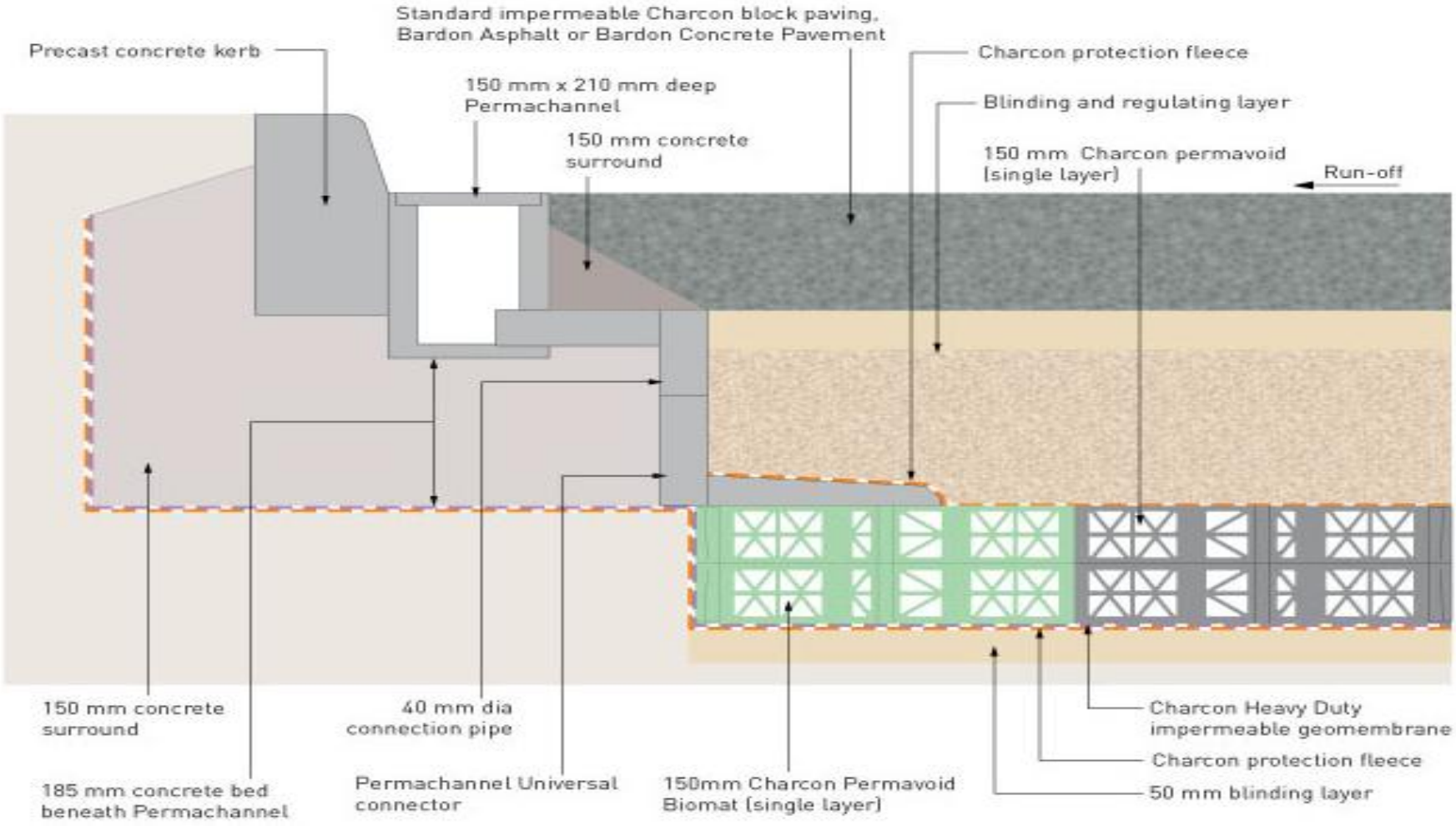
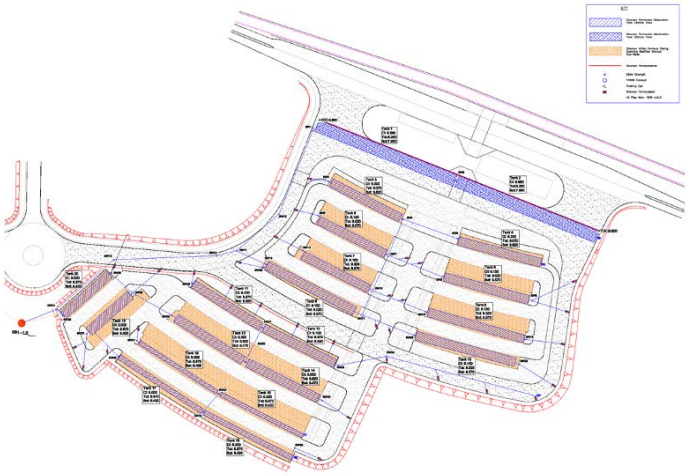


Design Considerations

- **Hydraulic**
  - Discharge design requirement
  - Green field run off rate
  - Rainfall data (Storm RP), Climate change
  - Acceptable frequency of ponding

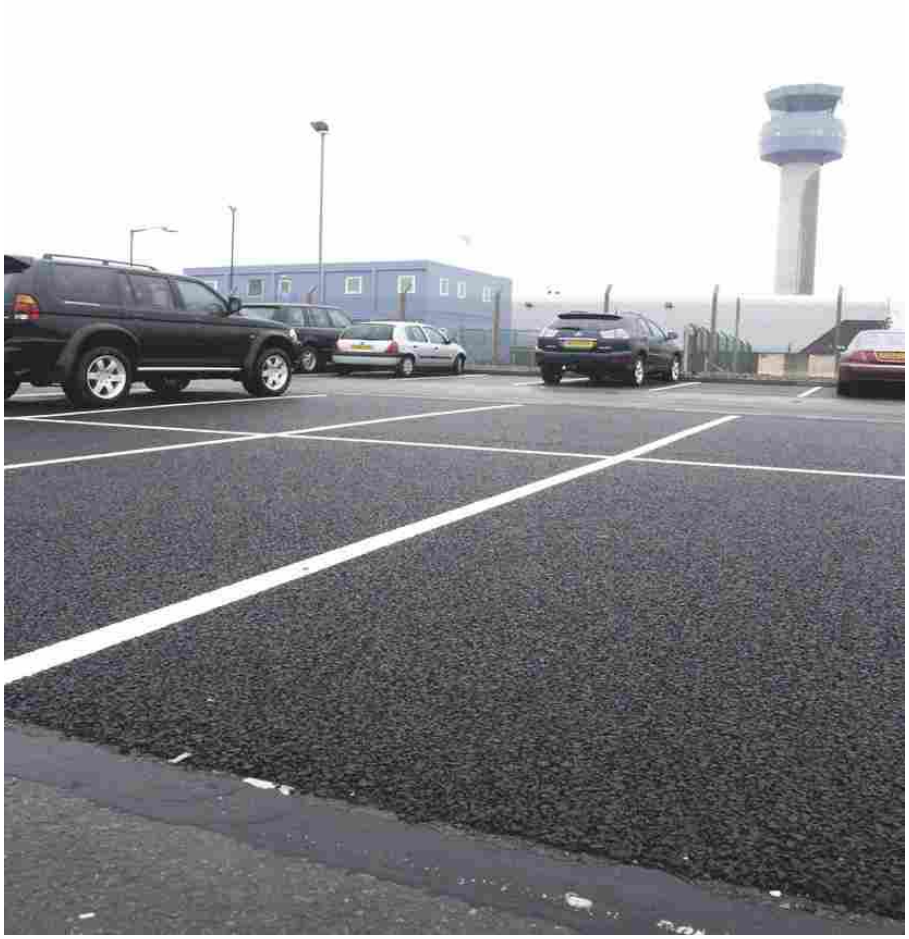


- **Structural**
  - Traffic loading
  - Soil types
  - Infiltration potential
- **Environmental** – Contamination, receiving water course/ aquifer, Trees/ Plants
- **Site Description** – Topography, Area of catchment, Layout, Services

Source Control SuDS in Action

Case Study 1 – Nottingham East Midlands Airport

- SuDS for an extension to an existing staff car park and two public long stay car parks
- Car park 1 – Bardon DrainAsphalt
- Car park 2 – Collection and treatment channels with modular sub base replacement
- Requirement to limit surface water runoff to on-site balancing ponds
- Runoff area of 4000 m2
- Located over clay soils
- Partial infiltration



Case Study 2 – St Peters Park, Little Eaton, Derbyshire

- SuDS for an extension to a village recreation ground car park
- Runoff area of 1,300 m2
- Bardon DrainAsphalt
  - 30mm thick 14mm Surface Course
  - 60mm thick 20mm Binder Course
  - 300mm thick open graded aggregate subbase
- Full infiltration

Case Study 3 – Derry Hill, Calne

- **Compact, High Density Housing Development**
- **Design Parameters**
  - Catchment:
    - Roofs and Garages 3347m2
    - Main Car Park 1622m2
    - Driveways 2220m2
  - Return Period:
    - External areas 10 years stored below ground with 100 year event contained within overland features
    - Roofs and garages 100 years below ground
  - Infiltration: SI rate 3 x 10-6 m/s (0.0108 m/hr)

Case Study 3 – Derry Hill, Calne

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Other combinations...

Sports Facilities and SuDS

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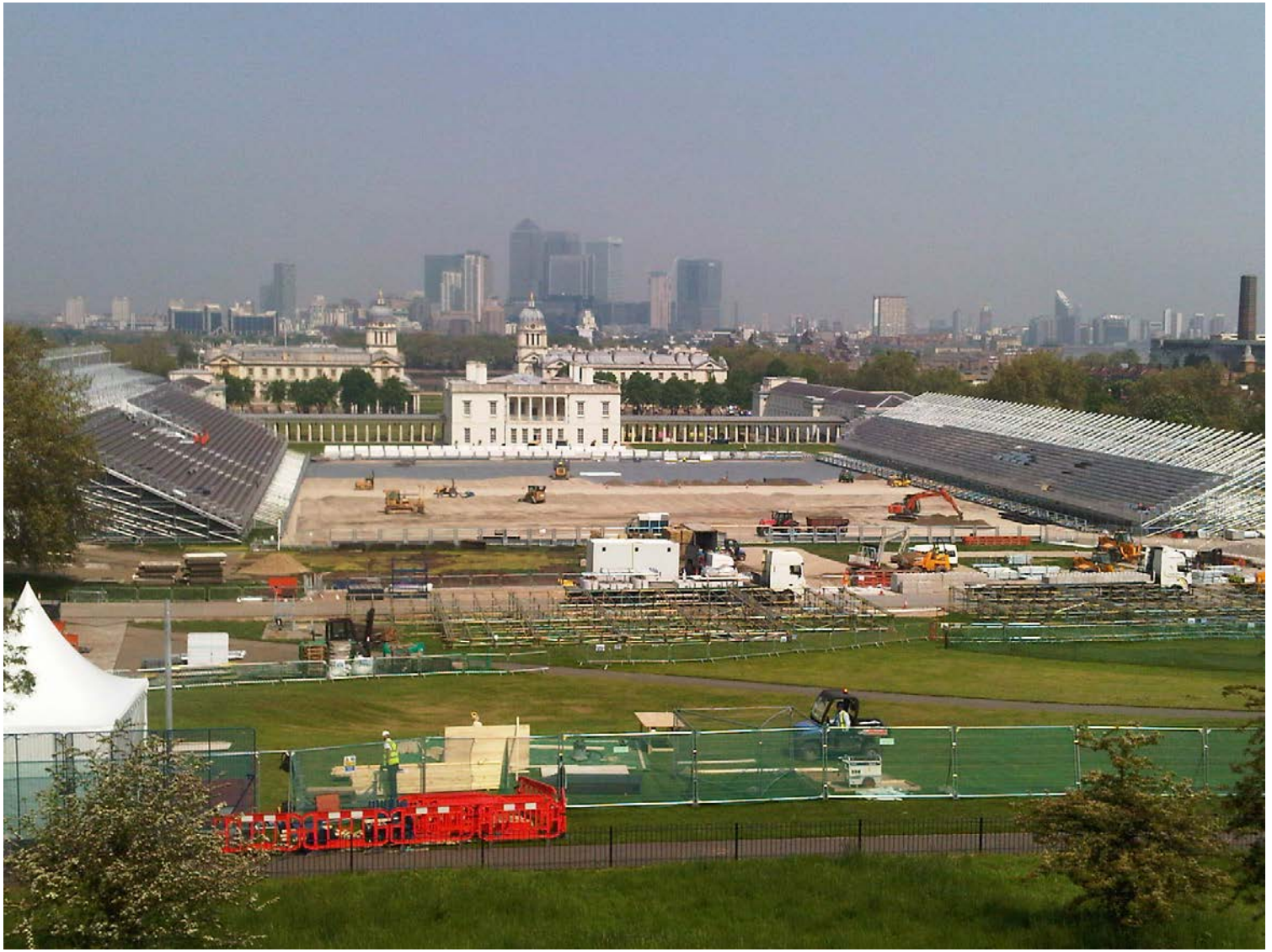

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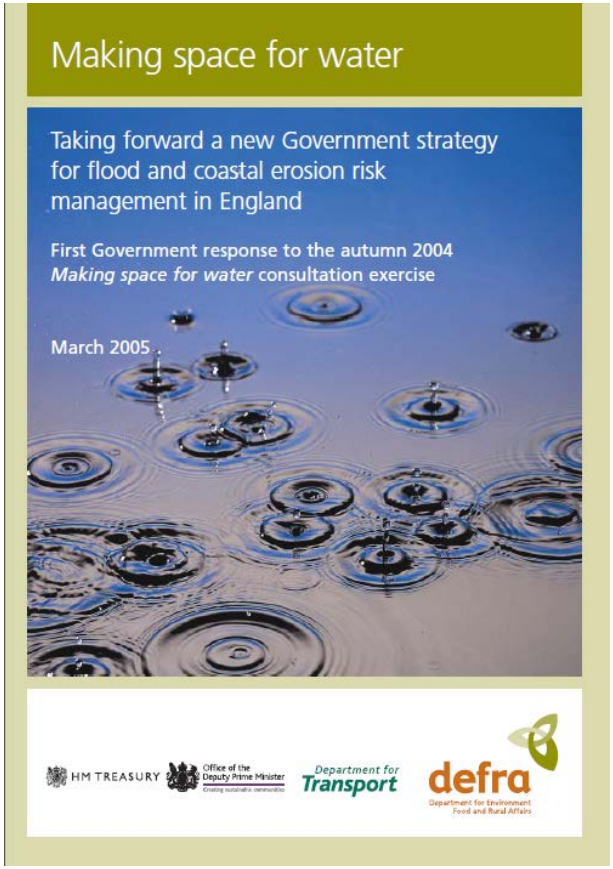
Highway applications

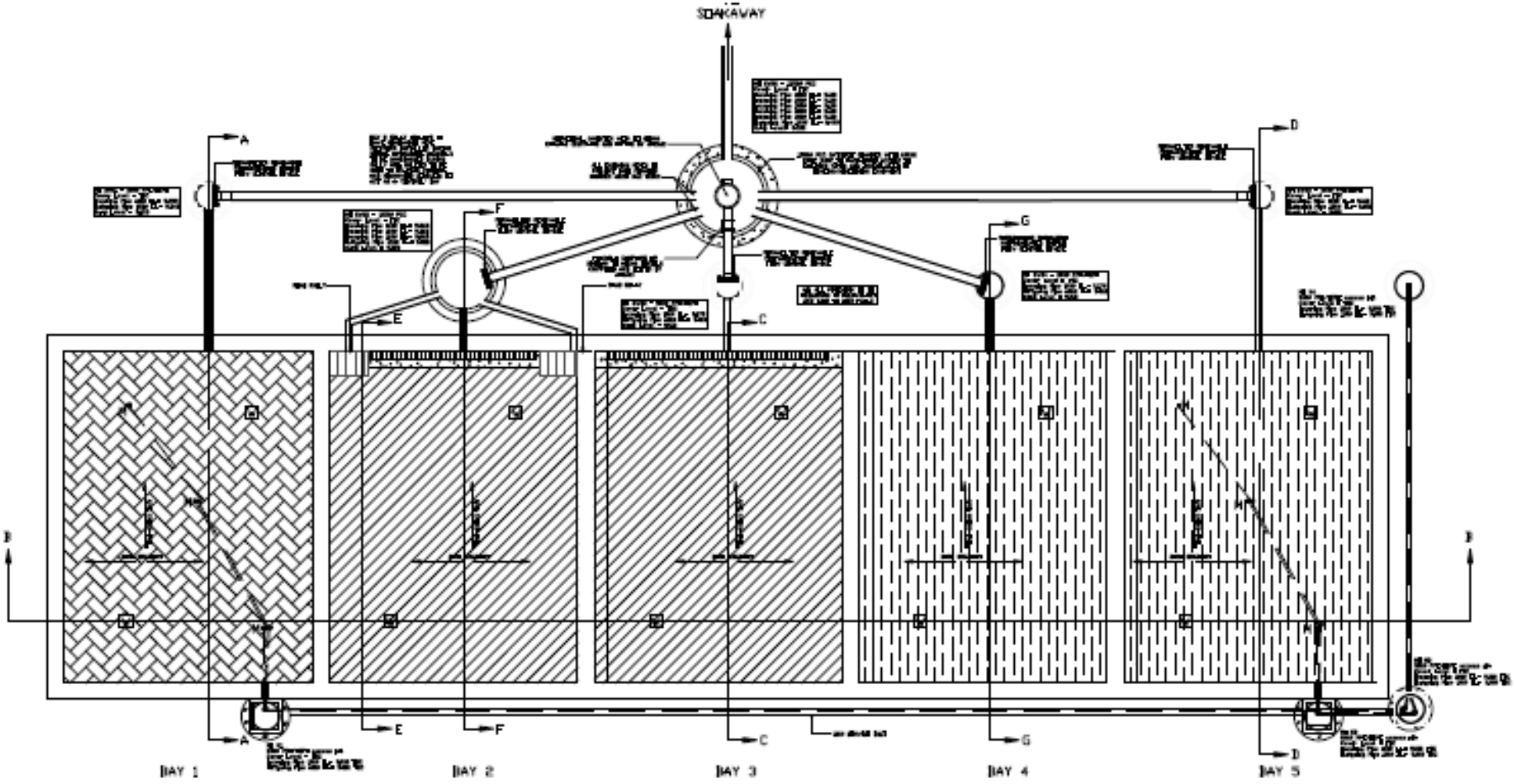
So source control SuDS including porous asphalt systems can be used for driveways, car parks and sports facilities but what about roads?

Making Space for Water – Reservoir Pavements

- HA sponsored trial as part of ‘Making Space for Water’
- Pavement Test Facility constructed at Aggregate Industries Hulland Ward site and used for assessment of heavy duty reservoir roads.
- Project managed by TRL
- TRL - structural and hydraulic monitoring



Reservoir Pavements Trial



Reservoir Pavements Trial

<table>
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<tr><th>Bay 1</th><th>Bay 2</th><th>Bay 3</th><th>Bay 4</th><th>Bay 5</th></tr>
<tr><td>Concrete Block paving
80mm</td><td>Traditional asphalt
180 mm</td><td>Traditional asphalt
180 mm</td><td>Porous asphalt
180 mm</td><td>Porous asphalt
180 mm</td></tr>
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290 mm</td><td>Porous concrete
290 mm</td><td>Porous concrete
290 mm</td><td>Porous concrete
290 mm</td></tr>
<tr><td>Permavoid
150 mm</td><td>Permavoid
150 mm</td><td>Granular reservoir layer
350 mm</td><td>Granular reservoir layer
350 mm</td><td>Granular reservoir layer
350 mm</td></tr>
<tr><td colspan="2"></td><td colspan="3">Sandy gravel subgrade</td></tr>
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Reservoir Pavements

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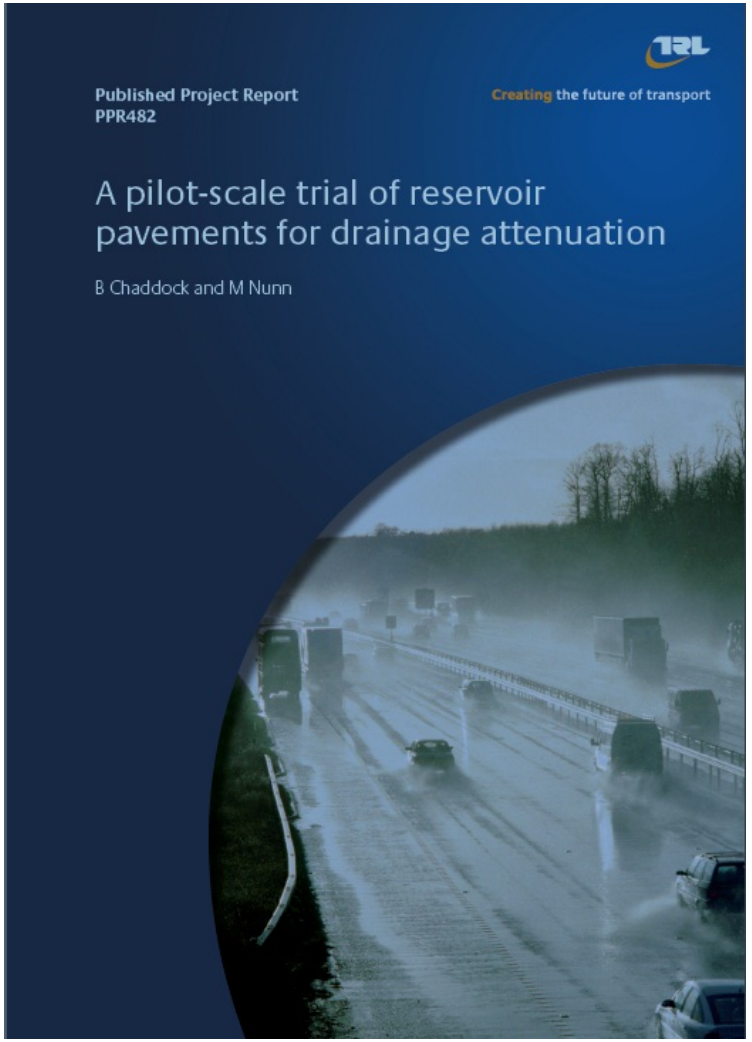
- TRL Report PPR482

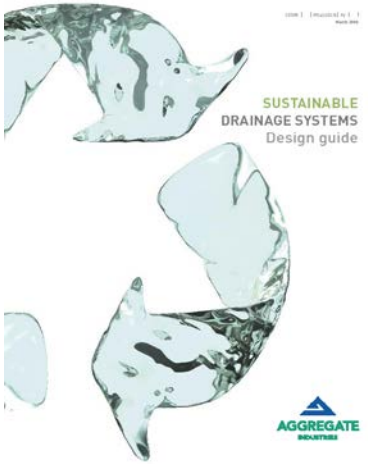
  Published in 2011

- Authors: Barry Chaddock (TRL) & Mike Nunn (Lane One Ltd)
- Highways Agency: Santi Santhalingham



Additional Design Guidance

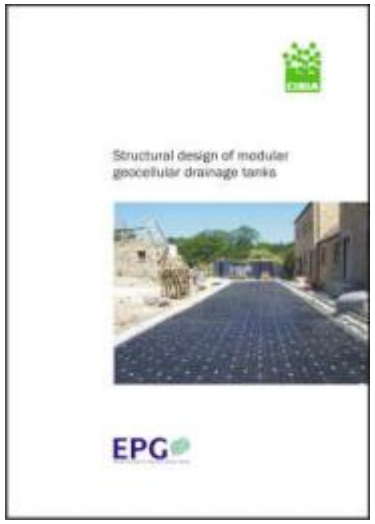
- Manufacturers
- CIRIA
- Environment Agency & SEPA
- Local Authorities



Communities and Local Government

Environment Agency

Guidance on the permeable surfacing of front gardens



In Summary

- Source control is a primary SuDS technique
- Pervious surfacing materials such as Porous Asphalt are an example of source control in action
- There is flexibility to use conventional surfacing materials in conjunction with run off collection & treatment channels
- Careful design and construction is key
- Source control SuDS pavements are now installed and working successfully on many sites
- Reservoir pavements research shows how SuDS can be used in highways
- New applications, combinations and retro fitting of SuDS in the future

The Many and Varied uses of Asphalt

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