

SUSTAINABLE DRAINAGE SYSTEMS



SuDS
Solutions





INTRODUCTION TO AGGREGATE INDUSTRIES

Aggregate Industries are at the frontline of the construction and infrastructure industries, producing and supplying an array of construction materials. With over 330 sites and more than 4,100 dedicated employees, we're home to everything from aggregates, asphalt, ready-mixed concrete and precast concrete products.

In addition to producing, importing, exporting and supplying construction materials we also offer national road surfacing and contracting services. Our complete range of products will help you work sustainably, safely, professionally and profitably. It's all of this that puts us at the heart of construction.

We are a proud member of LafargeHolcim, which is the leading global building materials and solutions company with around 80,000 employees in over 80 countries. It holds leading positions in all regions with a balanced portfolio of developing and mature markets.

Our Sustainable Drainage System (SuDS) solutions range offers a comprehensive choice of options to both reduce flood risk and to control and minimise pollution before it enters our watercourses, enabling us to use water in a more sustainable and environmentally beneficial way.

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SuDS WITH AGGREGATE INDUSTRIES

Ever-changing weather systems, increasing urbanisation and rapid run-off have put a tremendous strain on conventional storm water drainage systems. This has resulted in sewers and culverts becoming overloaded, causing floods and contaminating natural waterways.

Sustainable Drainage Systems (SuDS) provide an alternative approach to traditional drainage systems. They mitigate many of the adverse impacts of storm water run-off on the environment in terms of both volume and pollutants.

Aggregate Industries have been at the forefront of research work regarding materials for use in SuDS solutions. Initially as part of the research team contributing to PPR 482-A pilot scale trial of reservoir pavements for Drainage Attenuation published by the Transport Research Laboratory (TRL) investigating the use of SuDS solutions. This subsequently contributed to HD221/18 within the Design Manual for Roads and bridges. More recently we also contributed to CIRIA's C753 document – "The SuDS Manual" published in December of 2015.

Our SuDS solutions work by temporarily retaining and slowly releasing rainfall back into the waterways in a controlled manner. This helps prevent floods, while allowing natural processes to break down pollutants which would otherwise impact further downstream.

SuDS became a legal consideration for all new developments per the Flood & Water Management Act 2010 and was integrated into Building Regulations in 2015.

OUR SuDS SOLUTIONS WORK BY TEMPORARILY RETAINING AND SLOWLY RELEASING RAINFALL BACK INTO THE WATERWAYS IN A CONTROLLED MANNER



THE NEED FOR SUSTAINABLE DRAINAGE SOLUTIONS

Flood potential

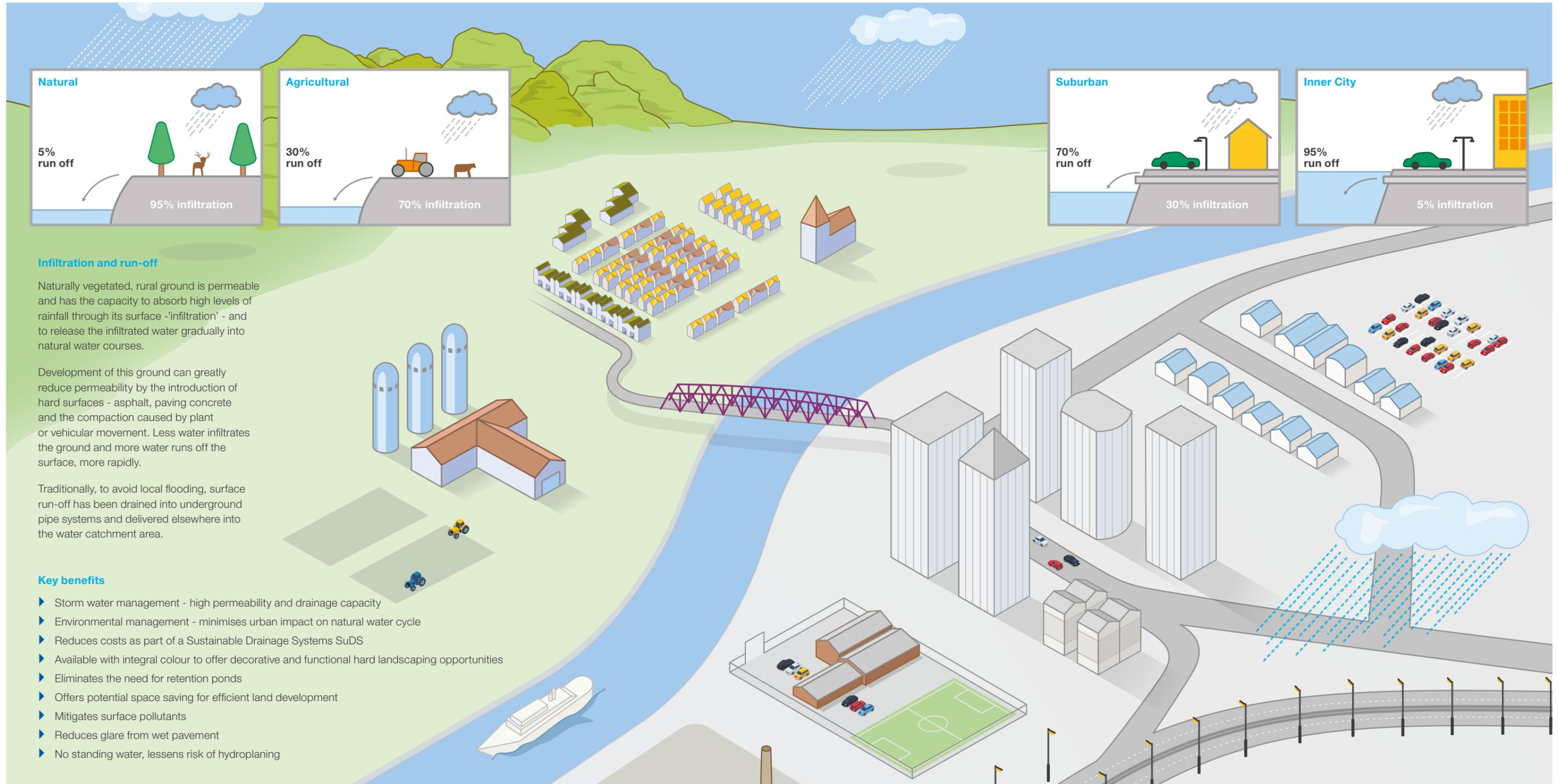
As development increases, so do run-off speeds and volumes. Their rapid delivery into the local water courses can cause flooding downstream, resulting in danger to life and damage to property, or erosion and destruction of natural habitats.

Pollution

Traffic, hard surfaces and increased run-off can increase the risk of pollutants, which are literally washed off the streets into the water catchment, contaminating the downstream water supply.

Climate changes

It is generally accepted that the UK's climate is changing and that our weather is becoming more extreme. Paradoxically, in the short term, it is not the overall levels of rainfall that influence the need for sustainable drainage, but the ferocity and frequency of the single rainfall events that may cause flooding. These, combined with on-going development, add to the necessity for SuDS solutions.



Infiltration and run-off

Naturally vegetated, rural ground is permeable and has the capacity to absorb high levels of rainfall through its surface - 'infiltration' - and to release the infiltrated water gradually into natural water courses.

Development of this ground can greatly reduce permeability by the introduction of hard surfaces - asphalt, paving concrete and the compaction caused by plant or vehicular movement. Less water infiltrates the ground and more water runs off the surface, more rapidly.

Traditionally, to avoid local flooding, surface run-off has been drained into underground pipe systems and delivered elsewhere into the water catchment area.

Key benefits

- ▶ Storm water management - high permeability and drainage capacity
- ▶ Environmental management - minimises urban impact on natural water cycle
- ▶ Reduces costs as part of a Sustainable Drainage Systems SuDS
- ▶ Available with integral colour to offer decorative and functional hard landscaping opportunities
- ▶ Eliminates the need for retention ponds
- ▶ Offers potential space saving for efficient land development
- ▶ Mitigates surface pollutants
- ▶ Reduces glare from wet pavement
- ▶ No standing water, lessens risk of hydroplaning

TYPES OF SuDS

ENGINEERED OR HARD LANDSCAPING

Engineered SuDS can be split into two different types:

- ▶ Permeable surfaces
- ▶ Impermeable surfaces with engineered source control drainage systems

THE KEY SuDS PRINCIPLES

1. SOURCE CONTROL

Sustainable drainage systems control surface water run-off as close to its origin as possible. This is termed 'source control'.

This minimises changes in the volume and rate of surface run-off from developed sites and thereby minimises flood risk and other environmental damage.

Additionally, SuDS may offer an element of pollution control as well as 'attenuation' – where infiltrated water is stored before its controlled release.

2. MANAGEMENT TRAIN

These levels of control and treatment result from a series of techniques ('management train') that integrate with one another to gradually reduce levels of pollution, volume and flow rate prior to discharge.

3. WATER QUALITY

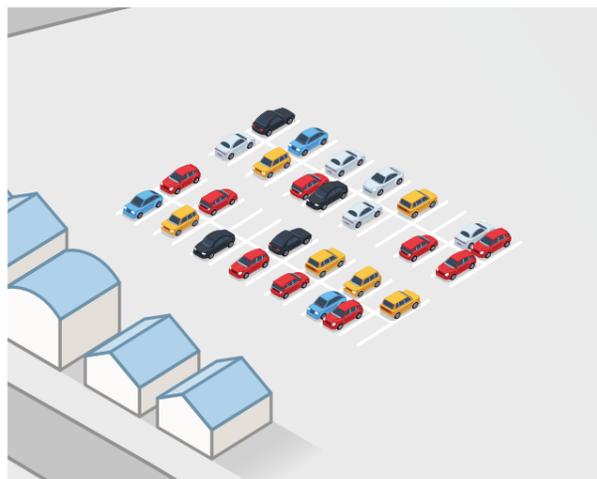
Removing pollution from run-off is an important part of SuDS design. The use of SuDS to control pollution and replace oil separators is highlighted in the most recent edition of Pollution Prevention Guideline PPG 3 published by the Environment Agency (2006).

4. AMENITY AND BIODIVERSITY

Trees are an important element in the biodiversity of urban areas and improve amenity by providing enhanced aesthetics, cooling and shading. Aggregate Industries' SuDS methods can be designed to protect and enhance the health of existing and new trees by protecting the roots systems and providing irrigation and aeration to the soil.

The key considerations can be summarised as follows:

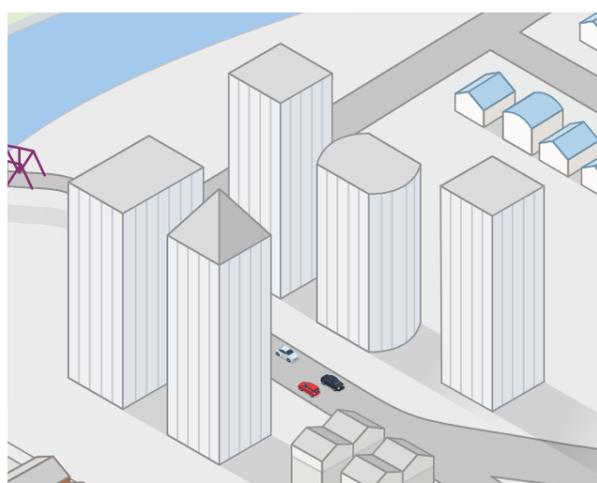
- ▶ Water quantity
- ▶ Water quality
- ▶ Amenity benefit



PERVIOUS SURFACES

Pervious surface systems include permeable or porous surfaces to car parks, roads, hardstandings and pedestrian areas. Any area covered by a hard surface can be turned into a permeable surface and incorporated into a sustainable drainage design.

Infiltra block (page 14) and SuperDrainasphalt (page 15) are products typical of these types of systems and when incorporated into an urban SuDS development, they enhance the urban landscape. A study by HR Wallingford determined that pervious surfaces are one of the most effective and space efficient methods of incorporating SuDS into developments designed to comply with Planning Policy Guidance 3, requiring a high density of housing to be provided on new developments.

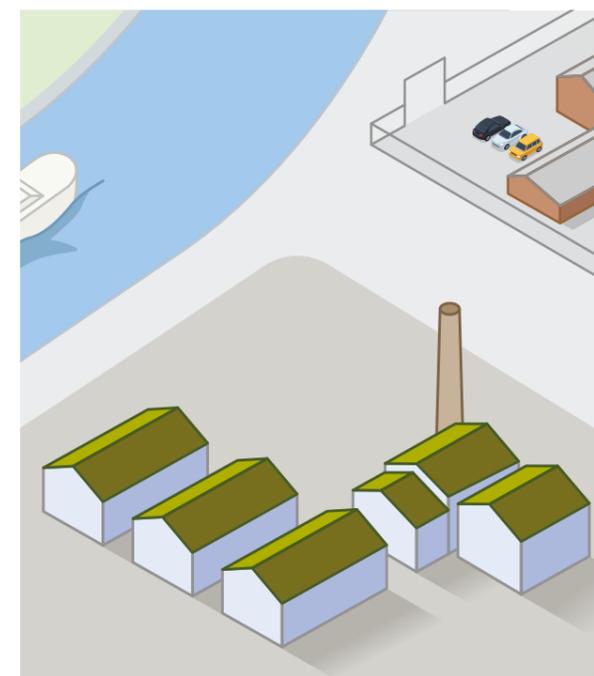


IMPERMEABLE SURFACES

Impermeable surfaces can accommodate SuDS solutions using a proprietary system available in the market.

SuDS ON BROWNFIELD SITES

The first consideration for using SuDS on brownfield sites is whether ground contamination is actually present, since not all brownfield sites are contaminated.



GREEN AND SOFT LANDSCAPING

Swales, ponds, wetlands and similar methods are classed as green/soft landscaping and many SuDS schemes involve their use. The Charcon systems provided by Aggregate Industries can be used as part of soft landscaping systems. It is bad SuDS practice to direct untreated run-off into ponds or wetlands as it will reduce their contribution to biodiversity and landscape value.

Aggregate Industries' systems can be used to provide pre-treatment to stormwater before it enters ponds or wetlands. The geocellular system can be used as an under-drain below swales to improve treatment performance and also increase storage capacity. Grassgrid can be used to provide erosion protection in swales, ponds, and other similar systems.

Even if there is contamination, the use of SuDS is still possible providing that care is taken in its design to avoid mobilising pollution into the surface or groundwater. The use of shallow SuDS such as the Aggregate Industries' systems should limit the need for the deep excavations that are commonly required with conventional drainage.

All contaminated sites are different and the level of contamination can vary from slight to high. Therefore, each site should be assessed on its own merits considering the following:

- ▶ Prevent mobilisation of contamination and its transportation to receiving waters. This means infiltration cannot be used if soils contain contaminants in a form that can be leached out. If such soils are present, then infiltration may still be used if it occurs below the base of the contaminated soils.
- ▶ Prevent the flow of contaminated groundwater into the SuDS solution. Such flow is unlikely with the shallow Aggregate Industries systems.
- ▶ Use features that minimise excavation and disposal to keep costs down. The excavation and disposal of contaminated soils is expensive, especially in the South East of England. Shallow SuDS features such as permeable pavements minimise excavations giving considerable cost savings.
- ▶ Many brownfield sites are only marginally contaminated and the contamination may be in a non-leachable form. Often, this does not pose a significant risk to groundwater when SuDS are used.

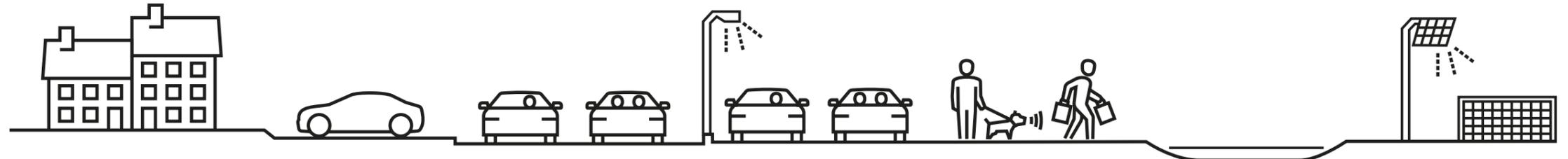


PRODUCT AND APPLICATIONS

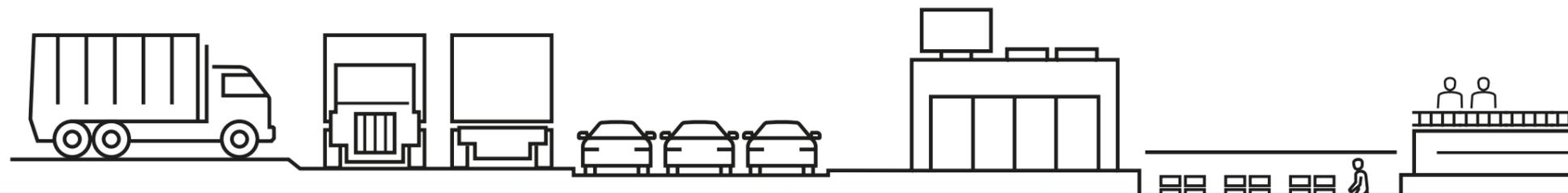
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PRODUCT AND APPLICATION SELECTION



LOCATION	SHARED SURFACE, MEWS COURTS, CUL-DE-SACS AND HOME ZONES	DRIVEWAYS	RESIDENTIAL ESTATE AND ACCESS ROADS (MAX. 20MPH)	RESIDENTIAL DISTRIBUTOR AND COLLECTOR ROADS, (MAX. 30MPH)	PEDESTRIAN AREAS, FOOTPATHS	SWALES	SPORT PITCHES
Water Transmission Layer	Grassgrid Infilta SuperDrainasphalt	Grassgrid Hydromedia Infilta SuperDrainasphalt	Grassgrid Hydromedia Infilta SuperDrainasphalt	Hydromedia Infilta SuperDrainasphalt	Grassgrid Hydromedia Infilta SuperDrainasphalt SuperSport	Grassgrid	Hydromedia Lytag SuperSport
Water Storage	SuperFlow	SuperFlow	SuperFlow	SuperFlow	SuperFlow	SuperFlow	SuperFlow



LOCATION	LORRY PARKS	INDUSTRIAL ESTATE ROADS	CAR PARKS	ROOFS	BASEMENTS	PODIUM DECKS
Water Transmission Layer	Infilta	Infilta SuperDrainasphalt	Grassgrid Hydromedia Infilta SuperDrainasphalt	Hydromedia Infilta	Hydromedia Infilta	Hydromedia Infilta
Water Storage	SuperFlow	SuperFlow	SuperFlow	Lytag	SuperFlow	Lytag

CHARCON

OVERVIEW OF CHARCON HARD LANDSCAPING

Charcon Infilta permeable paving is available in a range of sizes and finishes to suit all applications. The invisible nib profile creates joints that allow fast and efficient water entry into the sub-base SuDS solution below. The combination of hidden nibs, range of surface colours and finishes of the Infilta paving range creates an aesthetically pleasing surface finish for all applications.

PRODUCTS

- ▶ Andover Textured Infilta
- ▶ Stonemaster Infilta (Washed and Cast finish)
- ▶ Woburn Infilta (Rumbled and Original)
- ▶ EcoPave Textured Infilta
- ▶ Europa Infilta
- ▶ Infilta is available in a range of sizes, colours and finishes



ASPHALT

OVERVIEW OF ASPHALT

Aggregate Industries manufactures and supplies British and European standardised asphalts as well as a comprehensive range of Performance Asphalts to meet a wide range of applications.

Our porous asphalt range includes SuperDrainasphalt and SuperSport which offer highly durable and effective transition layers, allowing water to flow quickly to the storage area below. These products come in various aggregate sizes to suit a range of applications and can be combined with our wide range of other sustainable drainage products to offer the perfect Sustainable Drainage Systems solution. Designed to reduce the potential impact of surface water drainage in new and existing developments.

- ▶ SuperDrainasphalt is a product that has been developed for use within a SuDS system
- ▶ Low environmental impact surfacing
- ▶ Durability maximised by careful mix design and use of a carefully selected polymer modified binder
- ▶ SuperDrainasphalt and SuperSport offer high hydraulic conductivity levels
- ▶ For certain applications SuperDrainasphalt and SuperSport can be supplied in a range of colours

PRODUCTS

- | | |
|------------------------|---------------------|
| ▶ SuperDrainasphalt 32 | ▶ SuperSport 20 |
| ▶ SuperDrainasphalt 20 | ▶ SuperSport 14 |
| ▶ SuperDrainasphalt 14 | ▶ SuperSport 10 |
| ▶ SuperDrainasphalt 10 | ▶ SuperSport MUGA |
| ▶ SuperDrainasphalt 6 | ▶ SuperSport Tennis |



AGGREGATES

OVERVIEW OF AGGREGATES

The SuperFlow product range is Aggregate Industries' line of high performance aggregates specifically designed to provide controlled water management within SuDS.

PRODUCTS

SuperFlow SuDSAgg

- ▶ Aggregate Type: 0/40mm crushed rock
- ▶ Application: Sub-base reservoir layer
- ▶ Drainage Solution: SuperDrainasphalt and Hydromedia

SuperFlow SuDSAgg is a well graded, reduced fines, crushed aggregate with a maximum nominal size of 40mm. SuperFlow SuDSAgg is designed to meet the structural requirements of a Foundation Class 2 material as defined in the Design Manual for Roads & Bridges, with a void content of 30% or greater to ensure optimal water management. Its structural stability means it can be used independently or as a stabilisation layer over Aggregate Industries' SuperFlow 20 when used under paver laid SuperDrainasphalt.

Working in partnership with our in-house surfacing division, Aggregate Industries can offer the complete asphalt SuDS solutions.

SuperFlow 20

- ▶ Aggregate Type: 4/20mm crushed angular rock
- ▶ Application: Upper sub-base reservoir layer
- ▶ Drainage Solution: Hand laid SuperDrainasphalt, Infilta Block Paving and Hydromedia

SuperFlow 20 is a coarse graded aggregate produced to British European standard and works as a reservoir sub-base layer, offering controlled rain water retention within the SuDS pavement construction. SuperFlow 20's specific grading and low degradation value results in a durable material which is easy to place and compact, while ensuring water flow is slowed and released in a more sustainable and environmentally friendly manner. The excellent physical properties and drainage characteristics of SuperFlow 20 make it an integral component to many Sustainable Drainage Systems.

SuperFlow 63

- ▶ Aggregate Type: Coarse crushed angular rock
- ▶ Application: Lower sub-base reservoir / capping layer
- ▶ Drainage Solution: Infilta Block Paving

SuperFlow 63 is a robust starter aggregate which works as the initial lower reservoir or capping layer within the SuDS pavement construction. The product offers optimal voids due to its angular shape allowing for controlled water storage and flow, while its natural strength ensures the long term integrity of the SuDS solution is maintained.

SuperFlow 6

- ▶ Aggregate Type: 2/6 Crushed angular stone
- ▶ Application: Laying course / bedding aggregate
- ▶ Drainage Solution: Infilta block paving

Aggregate Industries SuperFlow 6 is a high performance laying course aggregate specifically designed to provide controlled water management within Sustainable Drainage Systems (SuDS).

SuperFlow 6 provides a stable flat laying surface, while retaining the optimal level of voids for consistent water flow. This carefully graded aggregate, with its natural strength and interlocking properties ensures both the long term integrity of the pavement and the excellent drainage characteristics are maintained.

SuperFlow JointAgg

- ▶ Aggregate Type: Crushed stone grit
- ▶ Application: Brushing in grit / Jointing sand
- ▶ Drainage Solution: Infilta block paving

Aggregate Industries SuperFlow JointAgg is a high performance finishing aggregate specifically designed for brushing into block pavement joints. This aesthetically pleasing product offers excellent free draining characteristics due to its low fines content, while its natural strength ensures the long term integrity of the SuDS is maintained for a refined, yet functional pavement finish.



READY-MIXED CONCRETE

OVERVIEW OF READY-MIXED CONCRETE

Hydromedia® is an ideal solution for surface and storm water management. It's a fast draining, engineered concrete pavement solution that rapidly directs storm water off streets, parking surfaces, driveways and walkways. It minimises costs and long-term maintenance for local authorities and developers of storm water management and there are a range of strengths available. Designed with a sub-base to contain typically 15-35% voids, water flows freely through Hydromedia® at rates in excess of 150 - 1000 litres/minute/m².

PRODUCTS

There are four prime versions of Hydromedia® in the product range:

- ▶ Hydromedia® pedestrian – No traffic applications
- ▶ Hydromedia® car park – Light traffic conditions
- ▶ Hydromedia® underlayer – Non traffic
- ▶ Hydromedia® underlayer – Light traffic

A range of strengths are available. Please speak to our technical specialists to find out which grade suits your project.



LYTAG

OVERVIEW OF LYTAG

Lytag has been supplying lightweight aggregate for over 60 years and has sold in excess of 16 million tonnes of material. Manufactured in accordance with EN 13055, the standard for lightweight aggregates, Lytag is widely available within the UK and Europe.

Made from pulverised fuel ash, a waste material produced from electricity production in coal-fired power stations, the aggregate is called 'sintered pulverised fuel ash lightweight aggregate', but more commonly known as Lytag.

Lytag products are classified as secondary aggregates. This means that the quantity of fly ash being tipped is reduced and virgin aggregate extraction is reduced. By considering the use of Lytag products at an early stage in the design process, you have the potential to reduce the quantities of construction material required in a project. This leads to overall cost savings. Due to the reduced weight of Lytag products, larger volumes can be transported, reducing vehicle movements both on the public highway and site.

PRODUCTS

Geofill

An 8/14mm lightweight aggregate used to raise levels or reduce pressure on retaining walls. Due to its shape and absorptive qualities, it will initially absorb up to 20% of the geofills weight in water, followed by letting water pass through without silting up.

Sportag

A 4/8mm material used extensively in sports pitches and golf courses, acting as localised water run-off channels.

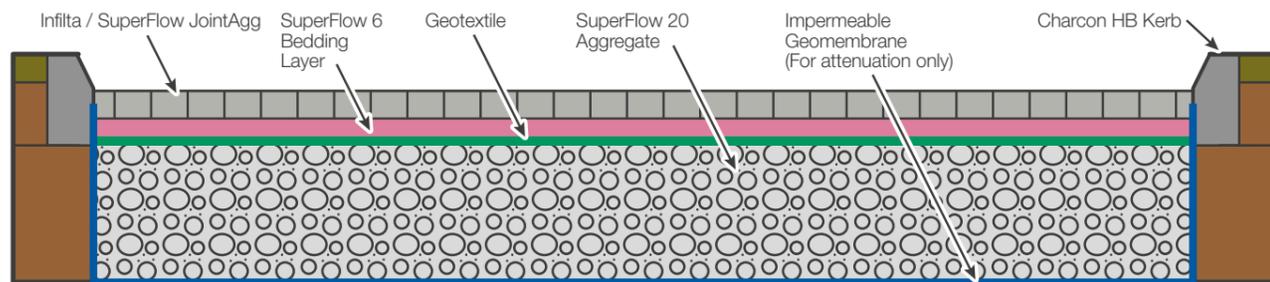
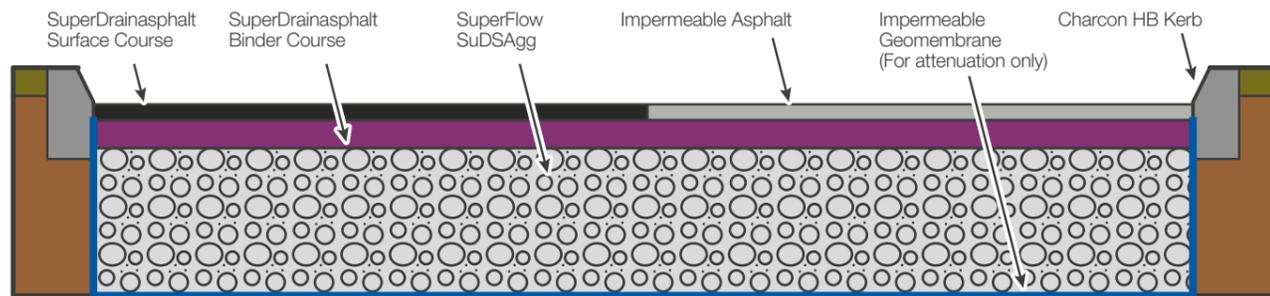
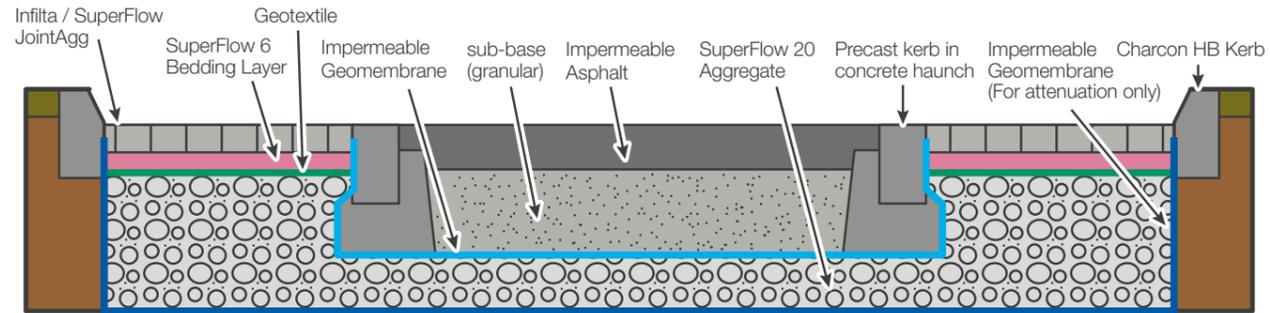
Hortag

A 4/8mm material used within the horticulture market, available in small bags for use in garden drainage as well as improving root growth.



EXAMPLE SOLUTIONS

For further advice and additional options contact your Aggregate Industries SuDS specialist.



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PRELIMINARY CONSIDERATIONS

Aggregate Industries offer five pervious pavement systems for use in areas that require a pervious hard surface (Infilta, SuperDrainasphalt, Grassgrid, Hydromedia, a combination of impermeable and permeable solutions).

The wide range of Aggregate Industries SuDS solutions means that a system can be designed to cover all situations and site constraints. Design considerations include:

LAND USE CHARACTERISTICS

- ▶ Which SuDS techniques are best suited for the proposed land use of the area draining to the system?
For example, is there an exceptionally high silt load?
- ▶ Is the site contaminated?
This will affect the level of treatment required
- ▶ What are the soil conditions and strength of sub-grade?
Ideally a site investigation report will identify the nature of the ground and the groundwater levels. The infiltration rate of the soils should be determined by testing. Normally, clay soils are not suitable for any significant infiltration

SITE CHARACTERISTICS

Not all components will be suitable for all sites and the criteria critical to the project should be identified at an early stage.

- ▶ Are there any site characteristics that may restrict or prevent the use of a particular SuDS technique?
- ▶ Is the site subject to heavy vehicular traffic?
- ▶ Does the site slope?
This will affect the ease of use of permeable surfaces
- ▶ What space is available for SuDS?
All Aggregate Industries Sustainable Drainage Systems are space efficient and do not require extra landtake

CATCHMENT CHARACTERISTICS

- ▶ Are there any regulatory requirements that restrict or prevent the use of a particular SuDS technique, or that may impose additional requirements on the performance?
- ▶ In particular, is the site in a groundwater source protection zone?
The Environment Agency will require a high level of treatment in the outer source protection zone and are likely to prevent the use of infiltration within inner source protection zones for more highly polluting uses
- ▶ Is the site near a SSSI (Site of Special Scientific Interest) or SAC (Special Area of Conservation)?
- ▶ Are receiving waters used for recreation?
If so, a higher level of treatment will be required

PERFORMANCE REQUIREMENTS

- ▶ Is there a particular pollutant of concern that requires treatment?
For example, in industrial sites there may be a particular chemical used that could pollute run-off and will require treatment (e.g. formaldehyde in chipboard factories)
- ▶ Will one technique meet all design requirements?

KEY CONSIDERATIONS

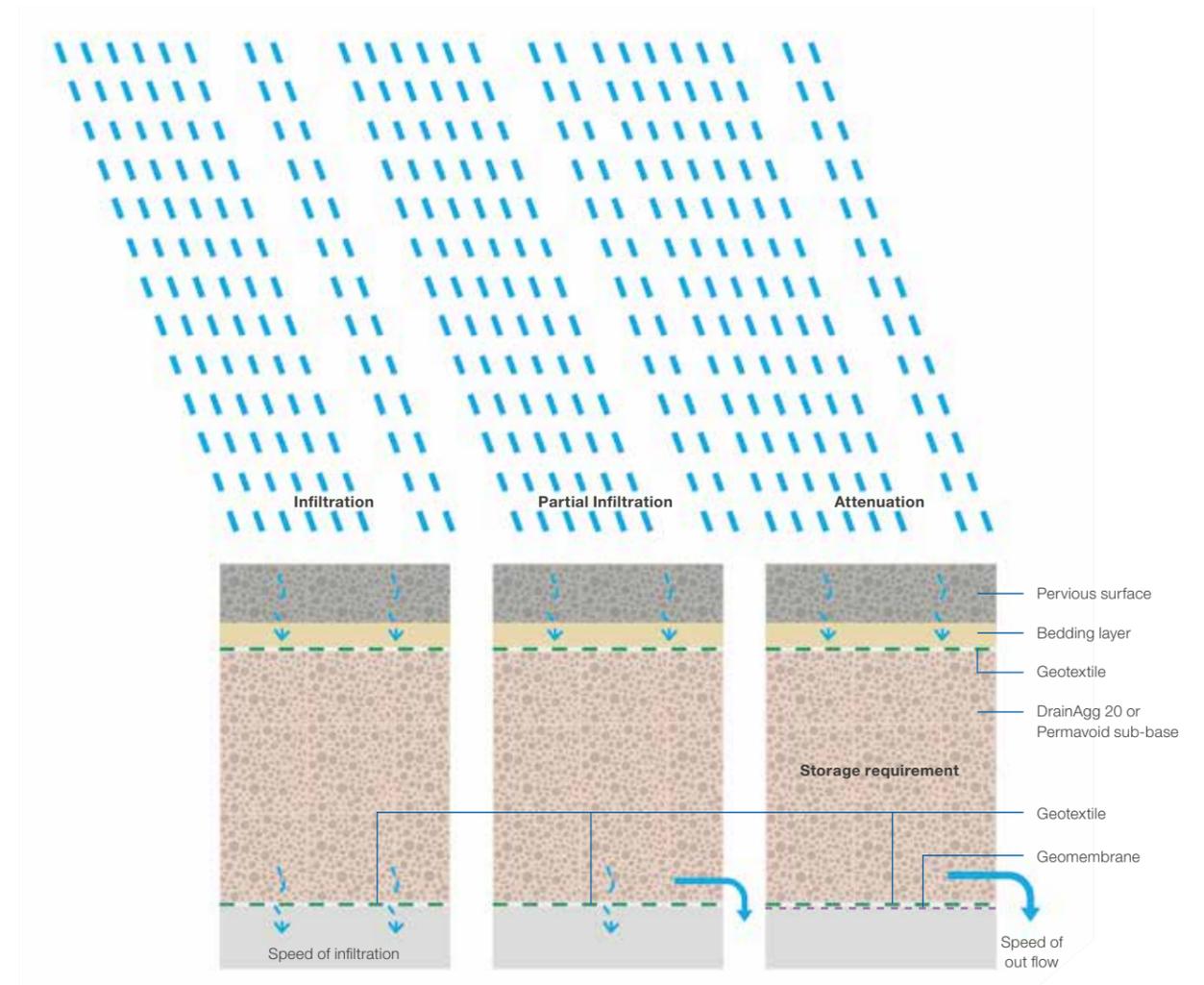
Typical SuDS pavement design has three key design considerations:

- ▶ Hydraulic design - to provide sufficient water storage capacity
- ▶ Structural design - to meet traffic loading requirements. Please consult suds@aggregate.com for advice and guidance
- ▶ Pollution control - specification of materials to treat pollutants and prevent their entry into the water course

HYDRAULIC DESIGN

There are four key criteria to consider:

- ▶ Water entry
- ▶ Infiltration or attenuation
- ▶ Rainfall (rainfall against catchment area)
- ▶ Outflow and drainage



HYDRAULIC DESIGN

Water entry, infiltration speed, rainfall intensity, duration and frequency will be relevant to the type of SuDS required. The first step in designing SuDS pavements is to establish the method of water entry so that an economic pavement structure can be designed.

PERVIOUS PAVEMENTS

The hydraulic design must consider the infiltration rate of the hard surfacing (i.e. the rate at which rainfall will be able to enter the aggregates – see Fig 1). This needs to be greater than the rate of rainfall that an area is designed to drain. It is also normal practice to allow a 90% reduction in the ‘as new’ infiltration rate to allow for clogging. Hydraulic conductivity is a measure of surface infiltration rate and this has been measured at a number of sites where Aggregate Industries’ permeable surfaces are installed. All the permeable surfacing systems supplied by Aggregate Industries have a hydraulic conductivity far greater than required in the UK, to allow storm water to pass directly into the underlying aggregates (all except Grassgrid have, as new, rates greater than 5000 mm/h).

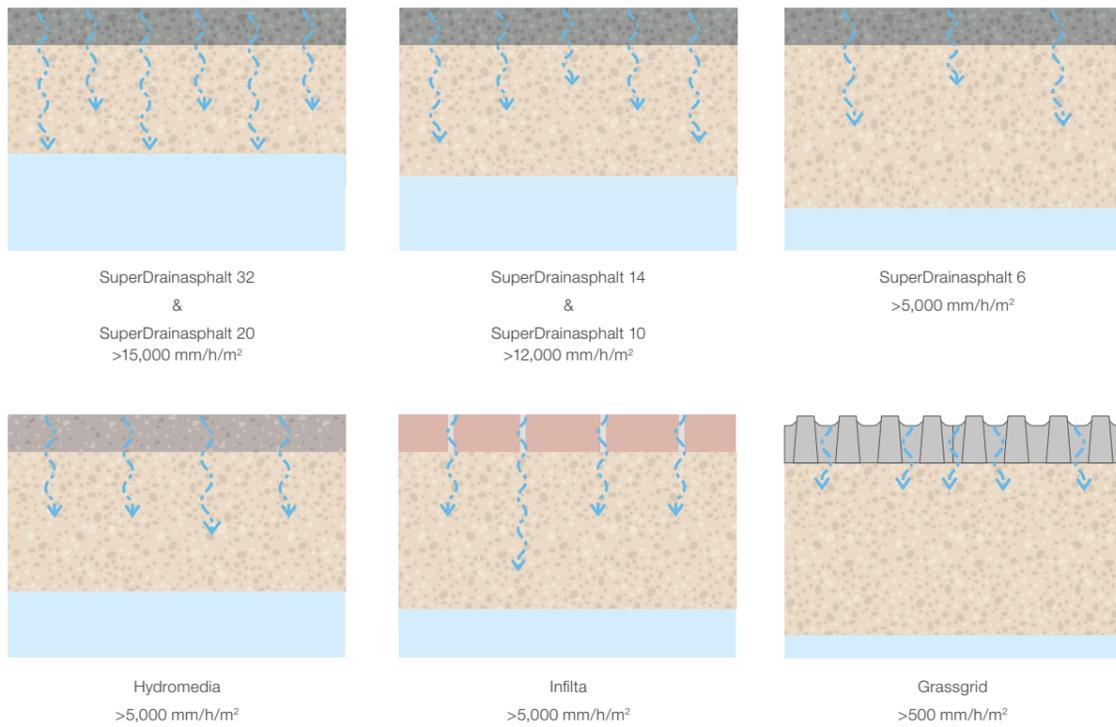


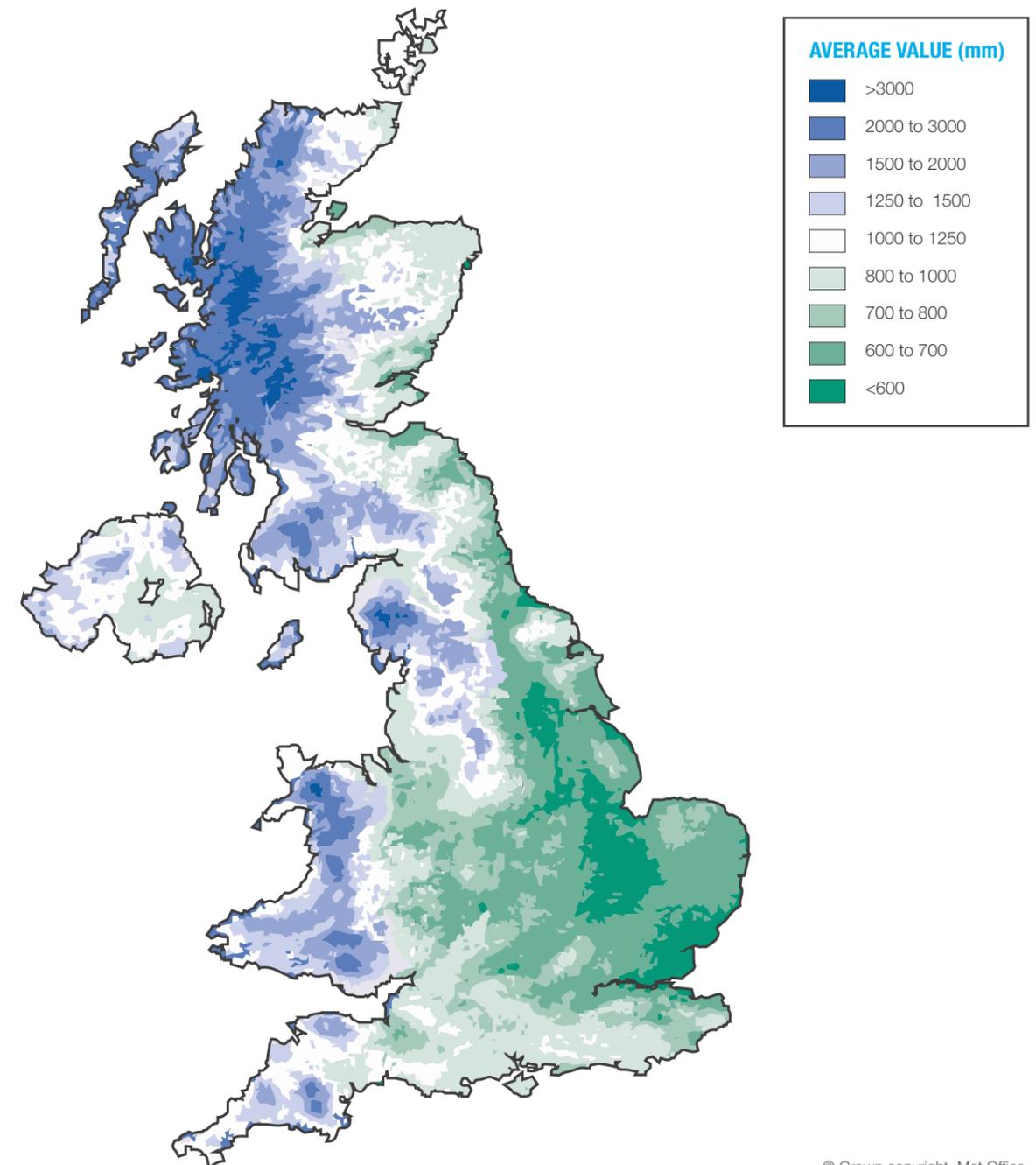
Fig 1. Water entry rate for Charcon and Bardon pervious surfaces hydraulic conductivity

HYDRAULIC CONSIDERATIONS

The proposed site location within the UK will be relevant to the type of rainfall that the SuDS will have to cope with. It's important to establish the recurrence of storms of different durations so that the optimum pavement solution can be designed.

RAINFALL AMOUNT

Annual Average, 1981 - 2010



POLLUTION CONTROL

DEALING WITH POLLUTION AT SOURCE

Permeable surfaces are an excellent means of removing pollution from urban run-off. The main reason for this is that the pollution is dealt with at source before it becomes concentrated, entrained and emulsified within the run-off, which can occur in conventional piped systems.

POLLUTION REMOVAL MECHANISMS

The systems are also robust because there are a number of different pollution removal mechanisms occurring within the pavement. These include, in order of significance:

1. Filtration of sediment particles either by geotextiles or by aggregate materials
2. Biodegradation of organic pollution such as oil
3. Adsorption of pollutants onto aggregates
4. Settlement of sediment within the aggregate

POLLUTION REMOVAL PERFORMANCE

The pollution removal performance of a wide range of pervious surfaces has been measured on installed pavements both in the UK and worldwide. The results show their effectiveness in removing metals and hydrocarbons as well as the beneficial effect on the concentrations of phosphorous and nitrogen in run-off.

Pervious pavements provide such efficient pollution removal because there are a number of mechanisms at work within the pavement:

- ▶ Filtration to remove silt or suspended solids (with associated pollutants)
- ▶ Biodegradation of hydrocarbons and other organic pollutants
- ▶ Adsorption
- ▶ Volatilisation
- ▶ Precipitation

The majority of pollution in rainfall run-off occurs in either frequently occurring storms or in the first part of the flows from less frequent but more intense events (known as the first flush). It has been recognised that if 90% of the average annual rainfall is captured and treated, then most pollution will be dealt with. This can easily be achieved by permeable pavements.



A GEOTEXTILE (I.E. PERMAFILTER)

A Geotextile (i.e. Permafilter) is a non-woven, dimpled, needle punched geotextile that has been specifically designed for hydrocarbon pollution treatment in civil engineering applications (such as filtration separation, drainage, protection and reinforcement). The entrapped hydrocarbons can be biodegraded by naturally occurring micro-organisms providing a self-cleansing mechanism.

CHARCON A GEOTEXTILE (I.E. PERMAFILTER)

A Geotextile (i.e. Permafilter) has been specifically designed to retain hydrocarbon pollutants. A Geotextile (i.e. Permafilter) comprises non-woven, needle punched geotextile made from a proprietary blend of modified polyester fibres. The textile has a weight of 300g/m².

The entrapped pollutants are either removed or reduced to levels suitable for discharge into controlled waters.

WORKING PRINCIPLE

The proprietary blend of fibres in a Geotextile (i.e. Permafilter) exhibit specific hydrophilic and hydrophobic properties and these, combined with the dimpled structure, work together to form multiple layers with inherent oil retention properties.

The hydrophobic (water repelling) material receives and retains the hydrocarbon pollutants, whilst the hydrophilic (water attracting) elements simultaneously facilitate water retention resulting in a long term stable biofilm, which subsequently degrades the entrapped pollutants.

APPLICATIONS

The range of applications for the a Geotextile (i.e. Permafilter) is virtually unlimited in traditional geotextile applications, where enhanced hydrocarbon treatment can be achieved. Furthermore, it is applicable in many 'new' applications where the superior hydrocarbon retention is an indispensable requirement.

Examples for applications using a Geotextile (i.e. Permafilter):

- ▶ Pollution barriers
- ▶ Permeable pavements
- ▶ Impervious pavements
- ▶ Infiltration systems
- ▶ Attenuation systems

EXPERIMENTAL RESULTS

A Geotextile (i.e. Permafilter) demonstrated retention of up to 6 litres of oil per 10m². The effluent monitoring showed a maximum discharge of 4.5ppm during the first flush and during consecutive rain events only an average concentration of 1.5ppm.

USE OF GEOTEXTILES AND GEOMEMBRANES

Due consideration should be given to Geotextiles and Geomembranes.

GEOTEXTILES

Geotextiles are used to serve two purposes in a SuDS pavement:

- ▶ The first is to prevent the migration of fine material between layers; for permeable paving this can mean that a geotextile is used at the base of the bedding layer in addition to the bottom of the SuDS structure; generally with porous asphalt and porous concrete a geotextile is only used at the base of the structure.
- ▶ The second is to provide a layer to protect a waterproof membrane from damage caused by sharp aggregate particles within either a sub-base or a sub-grade that can cut the membrane.

UPPER GEOTEXTILE

The upper geotextile is used to prevent migration of the finer laying course material into the coarser sub-base material.

Tests have shown that water quality will improve when it flows through a concrete block permeable pavement. There is evidence that the use of geotextile between the laying course and the sub-base may assist in enhancing pollution removal and biodegrading of pollutants.

The decision to use a geotextile between the laying course and the sub-base is a balance between durability and structural performance of the pavement and possible improvements in water quality.

For non-woven geotextiles in contact with open graded aggregate, durability has been shown to increase as the weight of the textile increases. Geotextiles such as those specified by Aggregate Industries are heavier weight materials (300g/m²) that are more durable than thin lightweight materials.

In applications where there will be frequent trafficking by HGV's, buses, etc., or the pavement is subjected to a large number of braking and accelerating forces, the upper geotextile should be omitted and the grading of the laying course and sub-base designed to avoid migration of materials.

LOWER GEOTEXTILE

Geotextiles are used in this location to act as a separator to prevent the sub-base punching into the sub-grade soils and causing clogging of the sub-base. Where water infiltrates to the ground, this geotextile will also act as a filter and support biodegradation. And where the geotextile is to be used to protect an impermeable membrane, the use of a reinforced geotextile is recommended by Aggregate Industries.

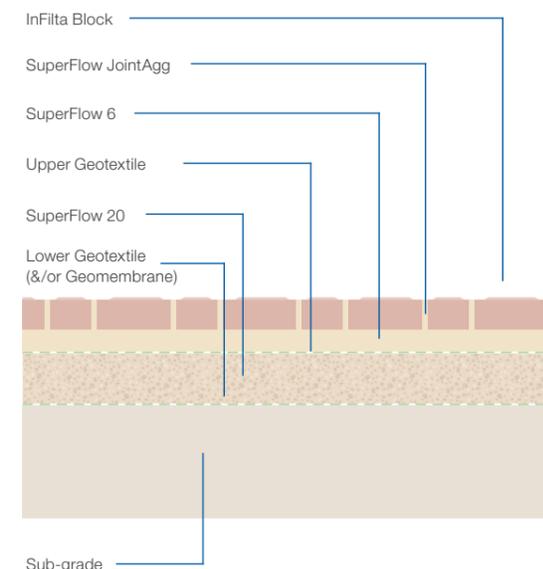
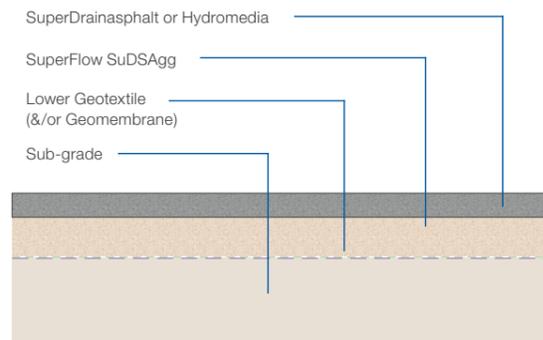
OTHER USES

A Geotextile (i.e. Permafilter) can also be used to protect against oil ingress below swales, infiltration basins and other similar SuDS components where additional protection is required.

GEOMEMBRANES

Geomembranes are impermeable liners used in Aggregate Industries' SuDS components to form water tight tanks. The membrane used depends on a risk assessment of the site and the ground and groundwater conditions.

The use of a polypropylene membrane that's robust and resistant to puncture is recommended. The membrane has welded joints and should be installed by a qualified sub contractor under a quality assurance scheme that includes testing of the joints.



PERMEABLE PAVEMENTS ON SLOPING SITES

If a pervious pavement is built on a sloping site, it must be designed to prevent all the water in the aggregates running to the bottom of the slope and exiting the surface. The slope also reduces the available storage in the aggregates.

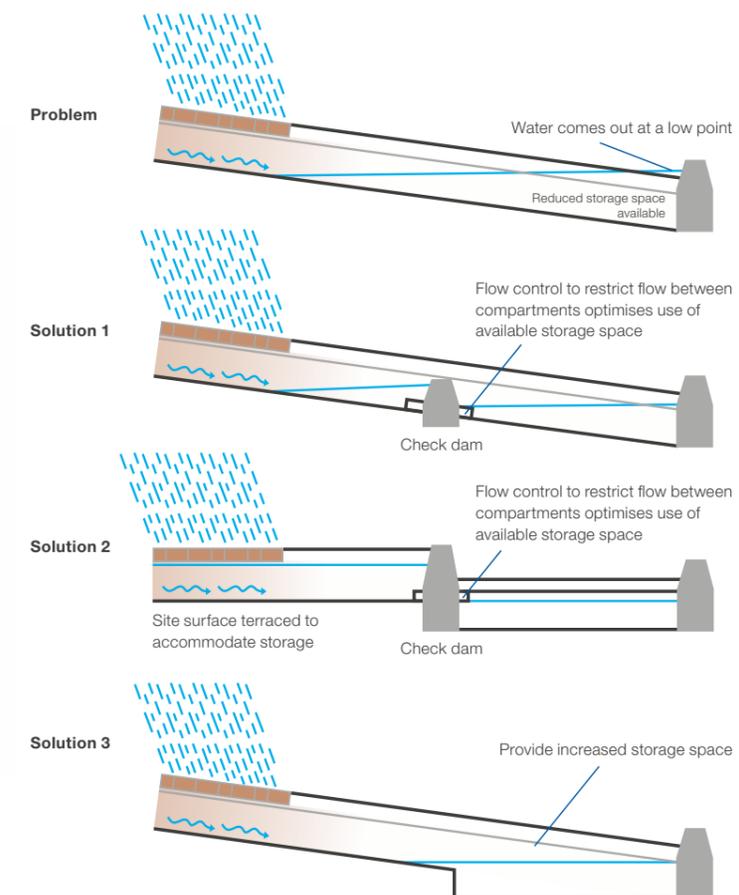
For sloping sites where the sub-grade gradient exceeds about 5%, terraced areas of permeable pavements that are separated below the surface by compartment walls, are particularly effective. Here, flow rates between compartments can be controlled, enabling optimal treatment of the water for maximum pollutant removal within the pavement. Terraces of interconnected permeable pavements can be used in isolation or with just a final SuDS stage, such as a pond, to effectively treat run-off from paving and roofs.

There are three potential solutions to this issue:

- ▶ Install dams within the aggregates with flow controls to ensure the water does not flow to the lowest level and come out of the surface. There are various ways of achieving this, including bunds formed in concrete, membrane or blockwork.
- ▶ Terrace the site to give flat areas of permeable paving that have separated aggregates, storage areas.
- ▶ The SuperFlow aggregates thickness at the base of the slope can be increased to allow for the reduced storage capacity at the top of the slope.

These precautions are required wherever the aggregate is used for water storage on sloping sites (including any infiltration systems). In all cases, careful analysis and detailing is required to ensure that the water flows within the pavement are as predicted and that unexpected 'spring lines' do not occur in the pavement. The exact design will depend on the site area, discharge limits, etc.

If the pavement area slopes towards a building then, as a precaution, a channel drain or surface channel should be provided to drain the water away to a suitable outfall and prevent it ponding up against the building.



CONSTRUCTION, INSTALLATION AND MAINTENANCE

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INSTALLATION OF CHARCON INFILTA

The laying of permeable paving should follow the guidance provided in the interpave manual and BS 7533 Part 3.

FORMATION

Any soft spots should be excavated first and back-filled with suitable well compacted material. The subgrade, or original ground formation, should be prepared by trimming to level and compacting, in accordance with the 'Specification for Highway Works', to a tolerance within +20mm to -30mm. If subgrade improvement is employed, testing will be needed to demonstrate that the design CBR values and design infiltration rate have been consistently achieved.

LOWER GEOTEXTILE

A Geotextile should be laid on the prepared formation; joints should be overlapped by 300mm.

SUB-BASE

The appropriate SuperFlow Aggregate sub-base should be laid in 100-150mm layers and compacted to ensure that the maximum density is achieved for the particular material type and grading, without crushing the individual particles, or reducing the void ratio below the design value. This is achieved with 4 passes of a smooth wheeled roller, max. weight 1,000kg/m width without vibration.

UPPER GEOTEXTILE

A Geotextile should be laid on the SuperFlow Aggregate; joints should be overlapped by 300mm.

TOLERANCE OF SURFACE LEVELS

	Maximum permissible deviation from design level			Surface regularity of the surface course	
	Normal block paving	Infilta block paving		Normal block paving	Infilta block paving
Sub-base	+5mm -10mm	+20mm -20mm	Pavement flatness	10mm under a 3m straight edge	n/a
Roadbase	+5mm -10mm	+20mm -20mm	Difference in level at the joint of adjacent paving units	2mm	2mm
Laying course	+5mm -10mm	+20mm -20mm			
Surface course	+6mm -6mm				

BEDDING LAYER

A 50mm depth of SuperFlow 6 bedding aggregate should be laid and loosely screeded to form the bedding layer for the Infilta Paving. The accuracy of the final level of the bedding layer, +/- 20mm tolerance, is of particular importance as the aggregate will not compact down to same the degree as a sand bedding layer would when the block surface layer is vibrated.

LAYING PAVING

The Infilta paving should be butted tightly together and laid in a suitable laying pattern to ensure maximum interlock / stability. If cutting is required the paving should be cut accurately to ensure a tight fit and should not be less than one third of the individual paver size.

JOINTS

Once the paving is laid they should be subjected to a first pass with a vibrating plate compactor. It may be prudent to consider a neoprene sole plate to the plate compactor to avoid surface damage to the block pavers. After the first pass with the vibrating plate, SuperFlow JointAgg should be brushed into the joints. Once the joints have been filled any remaining loose material should be cleared from the surface and a further pass with the vibrating plate should be undertaken, joints to be inspected and topped up as necessary.

INSTALLATION OF SUPERDRAINASPHALT

SUPERDRAINASPHALT

Aggregate Industries porous asphalt surfaces should be installed in accordance with the guidance provided in BS 594987 and the specification for Highway Works.

SuperDrainasphalt is normally paver laid but can also be hand laid for small areas. Coarse graded aggregate sub-base materials such as SuperFlow 20 do not provide a surface stable enough to bear the weight of the heavy equipment used in paver laid operations so, in these circumstances SuperFlow SuDSAgg is the preferred sub-base material.

Care should be taken during construction of both the SuDS pavement and any adjacent works that the surface is not subjected to any undue contamination or mechanical damage.

It has no particularly special installation requirements but, similar to other open graded asphalt mixes, it will have a tendency to chill more rapidly in cooler weather and care should be taken to ensure that the material is fully compacted across the whole width of the mat to minimise the risk of joints opening up under traffic.



INSTALLATION OF CHARCON GRASSGRID

Grassgrid should be laid in a half bond pattern and it should be provided with an edge restraint. Where Grassgrid is used on slopes without any edge restraint, it should have staggered vertical joints with every second row staked with 500mm long wood or metal pins.

The units should be infilled with 40/60 rootzone mix and an appropriate grass seed mix for the location.

GENERAL PRINCIPLES

Installation design for Grassgrid system varies according to the following factors:

- ▶ Application type
- ▶ Anticipated loadings (if trafficked)
- ▶ Nature of existing sub-grade
- ▶ Degree of gradient (if relevant to application type)

APPLICATION TYPES

- ▶ Vehicular traffic including pedestrians, private cars, light commercial vehicles (including light aircraft)
- ▶ Gradients including: cuttings/slopes, motorway embankments, spillways (for flood control works)
- ▶ Water courses including: river bed reinforcement, restraining bank construction, existing bank stabilisation

LAYING DESIGN

The recommended laying design of Grassgrid units is influenced by the specific application type and circumstances:

Vehicular traffic

Half-bonded, preferably in a restrained area.

Edge restraints

Edge restraints are recommended wherever possible, especially for heavier loading applications.

Sub-grade

Stability of sub-grade needs to be assessed as this will affect aggregate requirement.

Aggregates

If sub-grade is stable:

- ▶ No aggregates required (for lighter loadings only) (see below)

If sub-grade is not stable:

- ▶ Material: granular aggregates Type 1
- ▶ Compacted depth: for light traffic applications: 100mm minimum
- ▶ For heavier traffic applications: 150mm minimum



INSTALLATION OF HYDROMEDIA®

SITE PREPARATION

- ▶ Clean off any remaining soil
- ▶ Ensure soil bearing capacity of $\geq 50\text{MPa}$
- ▶ Use of geotextile membrane between soil and sub-base
- ▶ Cables and pipes must be buried inside sub-base
- ▶ To achieve a successful finish prepare pouring boxes; recommended compartments of 5m x 5m maximum to avoid cold joints

PLACEMENT

- ▶ You can place directly or through auxiliary means (bucket, dump trucks), Hydromedia is not pumpable. Discharge time should never exceed the maximum time from batching as per the delivery note - 90 minutes from loading
- ▶ Hydromedia workability verification. If during discharging, the concrete has difficulty coming down the chute, the paste has no shine or you observe balls (loss of fluidity of paste), it will be considered that the delivery is not suitable for use
- ▶ For each layer, the thickness should not exceed 140mm and always maintain the top layer thickness greater than 80mm
- ▶ Install leaving the level 5mm above that required to allow for compaction
- ▶ Do not place under rain
- ▶ Do pour between 5°C & 30°C

COMPACTING AND FINISHING

- ▶ Compact with a roller weighting 45kg per linear metre
- ▶ Perform this operation for a few minutes until you observe a clear compaction of the material
- ▶ Ensure that the roller is slightly moistened to prevent aggregate sticking to its surface
- ▶ After compaction, finishing is carried out with a power-trowel with pan attached and the surface is closed for a few minutes, until you observe the correct surface finish

CURING

- ▶ Once the concrete has been finished with the power-trowel, cover the entire surface with a curing membrane, e.g. plastic sheet to protect the product from drying out. The plastic sheet will be retained for seven days. If desired, you can water lightly always above the plastic, but it is not considered necessary
- ▶ The installation of the curing membrane must occur directly after finishing to prevent the evaporation of surface water from the product
- ▶ It is estimated that from the commencement of installation of each bay to the installation of the curing membrane, it should not exceed 15 minutes



MAINTENANCE

Generally speaking maintenance requirements for Aggregate Industries SuDS related products are quite minimal and intensive up-keep is not necessary.

The main cause of loss of permeability to the system is likely to be litter, excessive silt accumulation or physical/mechanical damage, so failure to carry out some minimal and timely intervention to keep the upper surface free of debris, accumulated detritus and growths such as, moss and weeds will have the effect of reducing the total drainage service life of the pavement surface.

With the exception of Grassgrid, which does not require any specific maintenance other than periodic visual inspection, the general principles for maintaining the different systems are the same, however there are important, subtle differences in procedures for the different surfaces that should be noted.

FOR SUPERDRAINASPALT & HYDROMEDIA:

A wide soft broom can be used to sweep the surface but this has a tendency to push smaller material into the surface. A rubber-tined rake is usually better, although slow and arduous. Best of all is a mechanical garden vacuum cleaner which will greatly speed up the operation and do it more efficiently. Any equipment used should be well maintained and carefully operated to avoid contamination of or physical damage to the surface.

Periodically, dependent on observed build-up, the surface will benefit from a vigorous wash using cold water pressure washers. These, however, must be used with care. During cleaning great attention must be paid to ensuring that the process does not damage the surface by dislodging any stone chippings and that any detritus is removed from the surface by sweeping before pressure washing. This is to ensure that such detritus is not forced into the surface by the force of the pressure washer making it more difficult to dislodge subsequently.

NOTE: Steam cleaners should not be used.

If the surface has become very badly sealed and does not respond satisfactorily to this treatment, suitable specialist equipment such as mobile pressure water suction cleaner is required. This water-suction method has been demonstrated to have the ability to remove accumulated surface detritus and restore hydraulic performance without damaging the pervious system when used correctly.

The use of conventional brush sweepers (such as traditional road sweeping equipment) and hand held high pressure water jet equipment is accepted if treated with extreme caution. The sweepers must be used in vacuum mode only; use of the brushes must be avoided as they force detritus, such as sand and silt, into the surface voids and reduce the effectiveness of the system, they can also dislodge aggregate particles from the surface.

High pressure washers at their highest setting will have a similar effect and should therefore only be used at low pressure settings.

If there is a minor oil spillage immediately flush the area through with either plain water or water lightly diluted with a detergent. This will get the oil through the asphalt layer thereby minimising any possible softening of the asphalt. Once through the asphalt and into the aggregate sub-base naturally occurring bacteria can digest the oil safely. For more significant spills the sites "Spillage Response Plan" should be adopted. With a significant oil spillage it is likely that the SuperDrainasphalt will be damaged and will probably require replacement. In these circumstances the principal priority must be to protect the environment.

SNOW AND ICE

Snow and ice should not prove harmful to the pavement material and can be allowed to melt through in due course. If this is not acceptable then de-icing salt may be applied but as with all asphalt materials de-icing salt should preferably be applied before snow or ice is expected to develop.

If snow has fallen it should be cleared before the application of the salt by using hand shovels or wooden scrapers; use of mechanical, steel shovels should be avoided or used with care, as it is likely that such devices may snag on the increased texture of the SuperDrainasphalt with the likelihood that aggregate particles will be plucked from the surface. Purpose build snowploughs with rubber lips can be used with discretion.

Only proper De-Icing salt, produced in accordance with BS 3247 should be used and applied at a rate of between 25 & 40g/m². This specification requires the salt to be at least 92.5% soluble and to have a sizing range that means that the risk of any pore blocking of the SuperDrainasphalt is minimal. If salt that does not comply with this standard is used there is a risk that it will be blended with aggregate dust or sand, thus significantly increasing the risk of the SuperDrainasphalt surface being blocked.

FOR INFILTA:

Infilta permeable paving is a low maintenance pavement system and is tolerant of maintenance not being carried.

Periodically the surface should be visually inspected and dependent on observed build-up the detritus should be removed, in many cases using a wide broom, shovel and non-metallic rake being standard practice.

Every six months the surface will benefit from a mechanical vacuum sweep (vacuum turned off). During cleaning inspect the grit in the joints of the paving and where necessary ensure that the grit is filled to surface level of the paving.

SNOW AND ICE

Snow and ice should not prove harmful to the pavement material and can be allowed to melt through in due course. If this is not acceptable then de-icing salt may be applied but as with all asphalt materials de-icing salt should preferably be applied before snow or ice is expected to develop.

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CASE STUDIES

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MOUNT VERNON HOSPITAL HILLINGDON

CLIENT: Hillingdon NHS Trust

SECTOR: Healthcare

CONTRACTOR: Jarvis Contracting

SUBCONTRACTOR: Toppesfield Ltd

ARCHITECT: Day & England, Stevenson Marsh

ENGINEER: Wilsham Consulting

- ▶ Flood mitigation surfacing solution
- ▶ High quality material meeting specific requirements
- ▶ 4050m² of porous SuperDrainasphalt car park material supplied
- ▶ SuperDrainasphalt supplied with Bardon Hill aggregates at a PSV of 60
- ▶ Asphalt mixed and delivered at between 160 and 180°C

THE BACKGROUND

Completed in 2009, SuperDrainasphalt surfacing solutions helped to prevent flood risk at the £13m Mount Vernon Hospital project.

THE PROBLEM

Extensive flooding was occurring prior to works downstream of Mount Vernon Hospital. So, the project in hand needed to reduce both total and peak flows. A multi-stage sustainable water treatment system was proposed, combining a number of techniques such as porous asphalt, swales, French drains and attenuation basins.

THE SOLUTION

The site's main boulevard for the hospital and terminal for the London Bus Company were combined with SMA, as well as porous asphalt for the large car park. The final pavement solution was specified as 35mm of 10mm SuperDrainasphalt laid on 80mm of 20mm Open Binder. The solution allowed for the effective drainage of surface water at source and was also suitable for worse case storm water scenarios.

Hillingdon NHS Managers were pleased with the project, having provided a leading example of sustainable low impact civil design in the UK. When commenting on the performance of the SuperDrainasphalt used, Hillingdon NHS said, "I don't know why this is not done everywhere". A huge benefit of using porous asphalt for the Trust was that it essentially eliminated ponding and therefore slipping hazards around cars.

CUSTOMER TESTIMONIAL

"We worked with Aggregate Industries to fine tune the specification so everyone was happy that the balance between cost and strength had been achieved."

Stephen Gibson, Wilsham Consulting (www.wilsham.co.uk)



THE ROYAL OLDHAM HOSPITAL MANCHESTER

Aggregate Industries has supplied an innovative drainage system for a new £1.8m, 13,000m² car park at The Royal Oldham Hospital in Manchester – part of the Pennine Acute Hospitals NHS Trust.

THE BACKGROUND

In 2014, Pennine Acute Hospitals NHS Trust, which runs The Royal Oldham Hospital announced plans to create a new purpose built car park at Westwood Park for hospital staff. The car park would provide 562 spaces located much closer to the hospital and would also feature improved security, including CCTV monitoring, a new controlled pedestrian entrance allowing access for staff 24 hours a day and improved lighting.

Manchester based national contractor, Bethell Construction, were successful in securing the £1.8m contract following a competitive tender process and they were employed on a 'design and construct' basis to develop the initial planning design for not just the new car park, but also footpaths, external works and an adoptable access road.

THE PROBLEM

As the site was within close proximity to the hospital, noise, dust and traffic movements needed careful consideration. The options for the surface water design were compounded by the fact that the local statutory water company, United Utilities, had specified a 5l/s flow rate for the outfall of surface water from the 13,000m² car park into the public sewer. An essential component for the successful delivery of this complex project was finding the right materials supplier to work with to produce a workable solution for the car park drainage. The ability to deliver both technical advice and an innovative solution was key.

THE SOLUTION

Aggregate Industries recommended an innovative system using SuperDrainasphalt, a permeable asphalt that allows water to pass freely through the underlying structure, specifically developed for use as an asphalt porous surface and binder course component in a Sustainable Drainage System (SuDS) pavement. This material also reduces surface water spray and headlight glare in wet weather, and its inverted texture allows for high capacity acoustic absorption.

Aggregate Industries' technical team worked alongside Manchester-based national contractor, Bethell Construction to install the system which comprised a 100mm layer of 63-10mm aggregate over an impervious membrane, with a 50mm layer of Type-3 sub-base on top. Water would drain into an attenuation tank with an underground soakaway, while a drainage channel running along the middle of the car park was also incorporated into the design. Finally, the surface of the car park was laid in layers of asphalt approximately 90mm of 20mm SuperDrainasphalt Binder Course and 40mm of 10mm SuperDrainasphalt Surface Course.



READING SCHOOL FOR GIRLS

CLIENT: Education Funding Agency

SECTOR: Education

CONTRACTOR: Interserve Kajima

SUBCONTRACTOR: WH Willis & Sons Ltd

- ▶ Surface flooding solution
- ▶ 2500tn of SuperFlow SuDSAgg supplied for main car park
- ▶ 4050m² of porous SuperDrainasphalt car park material supplied
- ▶ 400tn of SuperFlow 6 supplied for block paved pedestrian walkways

THE BACKGROUND

Working on behalf of principal contractor Interserve Projects, AH Willis & Sons delivered a new pervious 124 space car park as part of the £26m redevelopment of Reading Girls School.

THE PROBLEM

Historically, the site suffered from poor surface water run-off leading to surface water flooding. So, under guidance from the Environment Agency, the contractor adopted the Sustainable Drainage System principles into its car park design.

THE SOLUTION

Aggregate Industries was selected as the supplier of choice for the permeable aggregates and porous asphalt requirements. This was due to the high performing SuperDrainasphalt, which offered the desired level of flow for surface water run-off. The SuperFlow SuDSAgg, that works as a sub-level reservoir, provided the optimal level of water retention within the sub-base construction underneath, resulting in far greater rain water management.

To assist with the overall SuDS design, SuperFlow 6 was chosen thanks to its low fines and free flowing angular characteristics. It was used as a block paving laying coarse aggregate on the pedestrian walkways to offer further control of surface water run-off within these particular areas.



IKEA SPAIN

SECTOR: Commercial

- ▶ Achieve optimal flatness and uniform thickness for the comfort of IKEA customers trying to navigate a busy parking lot while pushing carts loaded with bulky items.
- ▶ Guarantee maximum drainage capacity (400 litres per square metre per minute) to avoid rainwater accumulation.
- ▶ Resist heavy foot and vehicular traffic despite the holes in its surface.
- ▶ Honor IKEA's high aesthetic standards, which go above and beyond what might be expected for a car park.
- ▶ Be easily installed in less than 30 days.
- ▶ While asphalt is normally the obvious material choice for most car parks, it fails to deliver on several of IKEA's key requirements. In order to meet every one of the customer's expectations, we knew we couldn't simply propose an "off the shelf" solution.

THE BACKGROUND

When IKEA was constructing a new retail store outside of Madrid, the customer experience was at the heart of the design, right down to the car park. Since the Swedish furniture company wanted a best-in-class surface that would be perfectly flat, puddle free and ultra-resistant, they knew to call upon the expertise of another world leader, LafargeHolcim, to find the perfect solution. Our Hydromedia™ draining concrete for water management delivered on all counts of this challenging project that took more than an illustrated user manual to pull off.

Key project figures: 10,000m² car park surface

1620m³

Hydromedia™ speciality concrete

22 Days

Delivery and technical assistance

IKEA and LafargeHolcim:

A beautifully designed partnership

As the world's largest furniture retailer with 328 stores in 28 countries, IKEA is synonymous with functional design and quality. So when it looked to optimise the construction of its newest store in the suburbs of Madrid, IKEA needed a partner equally committed

to high-performance design and quality. That's why they turned to LafargeHolcim to see how we could perfect design, reduce execution speed and minimise subsequent maintenance of the future complex.

THE PROBLEM

Constructing a new IKEA store requires a few more tools and loads more expertise than assembling one of the brand's intuitively-designed bookshelves or bedside tables. Our teams collaborated closely with IKEA in Spain to identify their needs, understand their unique brand experience and brainstorm solutions.

The store's 10,000m² car park quickly emerged as a key aspect of the project that could benefit from our products and technical expertise. Together with the client, we established a set of construction criteria which, when combined, represent a real challenge.

THE SOLUTION

Thanks to its very high permeability and drainage capacity, Hydromedia™ concrete absorbs rainwater and facilitates its natural runoff into the ground. Designed for urban environments, using Hydromedia™ means less flooding and safer roads, pathways and car parks. Its cutting-edge formula also gives guarantees better robustness and greater long-term resistance.



BARKING RIVERSIDE LONDON

CLIENT: Barking Riverside Limited

CONTRACTOR: Sheppard Robson

SUBCONTRACTOR: Mae with O'Keefe

SECTOR: Housing

ARCHITECT: LB Barking and Dagenham, Southern Housing Group and the London Thames Gateway Development Corporation

GROUNDWORKER: D. F. Cark Bionomique

- ▶ Built on the former Barking power station
- ▶ 40% of the development designed on green space
- ▶ Sustainable living at the heart of the project

THE BACKGROUND

At 185 hectares, Barking Riverside is one of the largest development sites in London. It is also one of the most ambitious and important developments in the UK. The vision was to provide a model for sustainable living in the 21st Century where best practice is used throughout.

THE PROBLEM

Barking Riverside has been built on the former Barking Power Station site. So, making it developable has required land remediation, site clearance and changes to land levels to plan for flood risk.

THE SOLUTION

With 40% of the development designed as green space, Aggregate Industries' Charcon Infilta block paving provided a permeable surface to the hard landscaped areas, allowing water filtration through the paving and mitigating flood risk across the site.

With sustainable living at the heart of this project, our Infilta block paving helped tackle the necessary drainage requirements. And our natural stone replica paving, StoneMaster, provided a wonderful landscape setting with up to 57% non-primary materials within its mix.

Furthermore, Andover Washed, characterised by its pale, understated colour, was also provided to enhance the contemporary backdrop of the project. This product also has a minimum of 53% recycled or reclaimed material.

To finish the site off, Eco Countryside Kerb, with its exceptional environmental credentials, maximised the use of renewable materials on site and optimised resource productivity.



ENDERBY PARK AND RIDE

CLIENT: Leicester City Council and Leicestershire County Council

SECTOR: Car Park

ENGINEER: Clear Environmental Consultants Ltd

GROUNDWORKER: Fitzgerald Civil Engineering Contractors Ltd

THE BACKGROUND

The Enderby Park and Ride scheme was planned to help cut congestion on city and county roads, having a positive impact on the reduction of noise and pollution. The facility significantly reduces the traffic volume from Junction 21 of the M1 and provides an alternative mode of transport to the city centre whilst contributing to the regeneration of Leicester.

THE SOLUTION

The main innovation on this scheme is the scale of the Sustainable Drainage System (SuDS) installed in the parking area. Rainwater is drained, treated for pollutants and attenuated in storage tanks that feed water run-off into balancing ponds to prevent flooding and create new opportunities for wildlife habitats.

With poor ground conditions and a high water table, Aggregate Industries, along with their engineering design consultants, helped identify the potential flooding issues as a result of the 6 hectare development. A shallow excavation solution was developed using a hybrid of Permavoid crates and aggregate sub-base attenuation systems. This allowed the cost to be kept to a minimum but meant that the attenuation levels were still sufficient.

We also supplied permeable paving to tackle surface water run-off from source as well as a non-permeable highly aesthetic Andover Textured block paving for the areas around the terminus building. Special painted blocks were also used to mark parking and disabled bays.

The flagship scheme has scooped a prestigious eco award at the regional Constructing Excellence Awards and coveted sustainability category in the CIHT Awards.



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APPENDIX 1 TECHNICAL SPECIFICATIONS

HYDROMEDIA® FAST DRAINING ENGINEERED CONCRETE



Hydromedia is an ideal solution for surface and stormwater management. A fast draining concrete pavement solution that rapidly directs stormwater off streets, parking surfaces, driveways and walkways. Minimises costs and long-term maintenance for local authorities and developers of stormwater management. A range of strengths is available.

Designed with a sub-base to contain typically 15 - 35% voids, water flows freely through Hydromedia at rates in excess of 150 - 1000 litres/minute/m².

PRODUCT RANGE

There are four prime versions of Hydromedia as below:

- ▶ Hydromedia pedestrian – No traffic applications
- ▶ Hydromedia car park – Very light traffic conditions
- ▶ Hydromedia underlayer – Non traffic
- ▶ Hydromedia underlayer – Light traffic.

A range of strengths is available. Please speak to our technical specialists to ascertain which grade suits your project.

APPLICATIONS

- ▶ Residential roads
- ▶ Car parks (light traffic - maximum load 3.5mt) and parking areas
- ▶ Leisure (e.g Tennis courts, swimming pool decks, cycleways)
- ▶ Driveways and alleyways
- ▶ Pavement edge drains and gutters
- ▶ Can be used as a structural underlayer.

KEY BENEFITS

- ▶ Stormwater management - high permeability and drainage capacity
- ▶ Environmental management - minimises urban impact on natural water cycle
- ▶ Reduces costs as part of a SuDS (Sustainable Drainage System)
- ▶ Available with integral colour to offer decorative and functional hard landscaping opportunities
- ▶ Eliminates the needs for retention ponds
- ▶ Offers potential space saving for efficient land development
- ▶ Mitigates surface pollutants
- ▶ Reduces glare from wet pavement
- ▶ No standing water, lessens risk of hydroplaning.

CHARACTERISTICS

- ▶ Compressive strength ~10-15N/mm²
- ▶ Voidage from 15-35% depending on type and placing technique
- ▶ Unit weight is typically 70% of conventional concrete
- ▶ Workable up to 90 minutes
- ▶ Flexural strength of 1.5 - 3N/mm².

TECHNICAL SUPPORT

Aggregate Industries Technical Services will provide advice, support and assistance in all aspects of the selection and use of Hydromedia concretes.

For further information, to place an order or to speak to one of our Hydromedia specialists, please contact the following sales offices:

Scotland - 01698 870947 **North** - 01283 712677 **Midlands and South East** - 01283 712677 **South West** - 01752 485201

GRASSGRID BLOCK PAVING

55%[†] non-primary materials



An interlocking cavity grid system, grassgrid offers natural looking hard standing for vehicles and strengthening of embankments.

- ▶ Unique in-built pyramid shapes provide unsurpassed strength
- ▶ Ideal for strengthening of embankments and water courses
- ▶ Suitable for use in permeable installations where specifications marry hard and soft landscaping
- ▶ Uses 55% recycled and reclaimed aggregates
- ▶ Excellent sustainability credentials.

APPLICATIONS

Grassgrid block paving is suitable for strengthening of embankments, all roadside verges, overspill car parks, recreational areas and emergency vehicle access roads. Refer to our technical department for further guidance on suitability for given applications.

MANUFACTURING STANDARD

Grassgrid block paving is manufactured using a semi-dry process and is manufactured in accordance with and complies with all relevant sections of BS EN 1338: Precast Concrete Block Paving – requirements and test methods.

Aggregate Industries fully operates an accredited Quality Assurance scheme, certified to BS EN 9001:2008 which is independently and regularly assessed by BSI (British Standards Institution).

All Aggregate Industries manufacturing sites are also certified to BS EN 14001 Environmental Management Systems.

PERFORMANCE WITH SLIP RESISTANCE

Not applicable.

COMPLEMENTARY PRODUCTS

All Aggregate Industries hard landscaping ranges, especially Andover Textured and Europa.



PRODUCT DATA	
Size (mm)	366x274
Thickness (mm)	100
Weight (kg)	15.8
Units/m ² (approx)	10
No. per pack	48
M ² /pack (approx)	4.80
Pack weight (T)	0.76
Colours	Grey
Chamfered	N/A

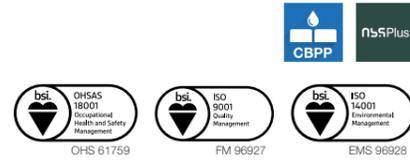


Q24. For NBS clauses, refer to Aggregate Industries technical services.

[†] Represents non-primary material within the complete mix design.

INFILTA

PERMEABLE BLOCK PAVING



A range of aesthetically pleasing permeable paving products used to form a hard wearing concrete block paving product. Used to form a permeable hard landscaped surface within a Sustainable Drainage Systems (SuDS). Each interlocking unit incorporates a specially designed 5mm spacer nib to allow the ingress of surface water through to the sub-base water storage system below.

FEATURES

- ▶ Permeable surfacing and source control SuDS technique
- ▶ Colour mix and texture options to provide high quality, aesthetic and functional schemes
- ▶ Can be easily lifted for access to services and reinstated without leaving the usual repair scars
- ▶ Offers high levels of durability and good grip

APPLICATIONS

Charcon Infilta is suitable for use in a range of applications including pedestrian areas, shopping precincts, access roads and car parking facilities. Refer to technical services for advice on specific applications Tel: 01335 372222.

MANUFACTURING STANDARD

Infilta permeable paving is compliant to European Standard BS EN 1338 and BS EN 1339.

All Aggregate Industries products are manufactured in accordance with ISO 9001 with factory compliance to ISO 14001.

PERFORMANCE WITH SLIP RESISTANCE

Strength: The products are manufactured to meet the strength requirements of BS EN 1338 and BS EN 1339.

Slip and skid resistance: Concrete block permeable paving has satisfactory slip/skid resistance in accordance with manufacturing standard BS EN 1338 and BS EN 1339.

COMPLEMENTARY PRODUCTS

Aggregate Industries SuDS range along with block paving, flag paving and kerb, aggregate, asphalt and ready-mixed concrete.



LYTAG

Test Description		Specification Reference	^0/4mmC	^4/8mmC	4/8mm	8/14mm	4/14mm	Date	
Bulk Density (Mg/m3)	Loose	BS EN 13055-1:2002/ BS EN 13055-2:2004/ BS EN 1097-3:1998	1.05	0.75	0.75	0.74	0.80	Sep-17	
	*Compacted								
Particle Density (Mg/m3)	Apparent	BS EN 1097-6:2000 ANNEX C	1.89	1.80	1.86	1.83	1.77	Sep-17	
	S.S.D		1.80	1.62	1.65	1.65	1.61	Sep-17	
	Oven Dry		1.17	1.41	1.41	1.44	1.41	Sep-17	
Water Absorption (%)	30 Min			12.5	13.6	11.9	11.6	Sep-17	
	24 Hr		5.7	16.5	16.7	14.8	14.6	Sep-17	
Uniformity Coefficient			>5	<3	<3	<3	<3	Sep-17	
Crushing Resistance (N/mm ²)		BS EN 13055-1:2002 ANN. A		9.2	9.1	8.7	11.0	Sep-17	
Disintegration Resistance (% loss)		BS EN 13055-1&2 ANN B							
Freeze/ Thaw Resistance (% loss)		BS EN 13055-1 ANNEX B							
Freeze/ Thaw Resistance (% loss)		BS EN 1367-1:2007		3.3		3.1		Jul-17	
Crushed Particles (%)		BS EN 933-5:1998		52.0				Sep-16	
Laboratory CBR (%)		BS 1377-4, Cl7:1990				13.0		Jul-17	
Laboratory CBR (%)**		BS 1377-4, Cl7:1990				31.0		Mar-16	
Immediate Bearing Index		BS EN 13286-47							
Angle of Internal Friction		BS 1377-7/ SHW cl.636			44.0	"39	42.0	Jan-16	
Effective Cohesion (kPa)					17.0	"36	29.0	Jan-16	
Frost Heave of unbound aggregate(mm)**		BS812-124:2009 Ann.B**				3.7		Apr-16	
Fragmentation Resistance (LA)		BS EN 1097-2:2010				33.0		Jul-17	
Wear Resistance (MicroDeval - wet)		BS EN 1097-1:2011				41.0		Jul-17	
Aggregate Abrasion Value (AAV)		BS EN 1097-8:2009 Ann.A				23.0		Jul-17	
Resistance to polishing (PSV)		BS EN 1097-8:2009							
Drying Shrinkage (%)		BS EN 1367-4:2008	0.021				0.041	Jan-16	
Petrographic Analysis		BS EN 923-3:1997	Main constituent = Fuel ash; Shape = Sub-rounded to well rounded sporadically subangular; Surface texture = Moderately rough to moderately smooth; Coating = Abundant iron oxide staining.						Jul-17
Potential Alkali Reactivity	Classification	Table 2 BRE Digest 330 pt2; Table B.2 BS 8500-2				Low		Jul-17	
	Expansion (%)	ASTM 1260 (Accelerated Mortar Bar Method)					0.025	Feb-16	
Magnesium sulfate soundness		BS EN 1367-2:2009							
Water Soluble Chloride Content (%)	C	BS EN 1744-1:2009+A1:2012, cl7				<0.001		Jul-17	
Water Soluble Sulfate Content (%)	SO ₃	BS EN 1744-1:2009+A1:2012, cl10.1				0.17		Jul-17	
Water Soluble Sulfate Content (%)	SO ₄	BS EN 1744-1:2009+A1:2012, cl10.1				0.21		Jul-17	
Water Soluble Sulphur Content (mg/l)	SO ₄	BS 1377-1990 ICP-AES method 2 (TRL report 447 method 1)				340		Jul-17	
Acid Soluble Sulfate Content (%)	SO ₃	BS EN 1744-1,Cl12:2009+A1:2012				0.10		Jul-17	
Acid Soluble Sulfur Content (%)	SO ₄	TRL 447 & BS 1377:1990: ICP-AES method 4 (test no.2)				0.18		Jul-17	
Total Sulfur Content (%) & Total Potential Sulfur (%)	SO ₄	BS 1377:1990: ICP-AES Method 17 (TRL report 447 test no.4)				0.10 0.29		Jul-17	
Total Sulfur Content (%)	S	BS EN 1744-1:2009+A1:2012, cl11				0.10		Jul-17	
Oxidisable Sulfides (%)	OS	TRL 447: Test no.2 & Test no.4				0.11		Jul-17	
	SiO ₂					50.6			
	TiO ₂					1.04			

FOR VISUAL ONLY

SUPERDRAIN ASPHALT™



A porous asphalt which allows water to pass through to the underlying structure. The product comes in various sizes to suit a range of applications and can be combined with our wide range of other sustainable drainage products to offer the perfect Sustainable Drainage Systems (SuDS) solution. Designed to reduce the potential impact of surface water drainage in new and existing developments.

FEATURES

- ▶ Porous material allows surface water to drain
- ▶ Developed for use as a porous asphalt surface and binder course component in a SuDS pavement
- ▶ Durability maximised by careful mix design and use of a carefully selected polymer modified binder

APPLICATIONS

- ▶ Commercial schemes
- ▶ New housing developments
- ▶ Retail parks
- ▶ Car parks



LAYER

Base, binder and surface courses

KEY PERFORMANCE PROPERTIES (TYPICAL PROPERTIES)

PROPERTY	UNITS	32MM SUPERDRAIN ASPHALT	20MM SUPERDRAIN ASPHALT	14MM SUPERDRAIN ASPHALT	10MM SUPERDRAIN ASPHALT	6MM SUPERDRAIN ASPHALT
Void Content	%	>18	>18	>18	NA	NA
Water Infiltration Rate <small>(Tested in accordance with EN 12616:2013, Method A)</small>	mm/hr	>15,000	>15,000	>12,000	>12,000	>5,000
	m/s	>4.1 x 10 ⁻³	>4.1 x 10 ⁻³	>3.3 x 10 ⁻³	>3.3 x 10 ⁻³	>1.4 x 10 ⁻³
Nominal Layer Thickness	mm	70-120	60-90	40-80	30-50	25-35

SUPERSPORT®



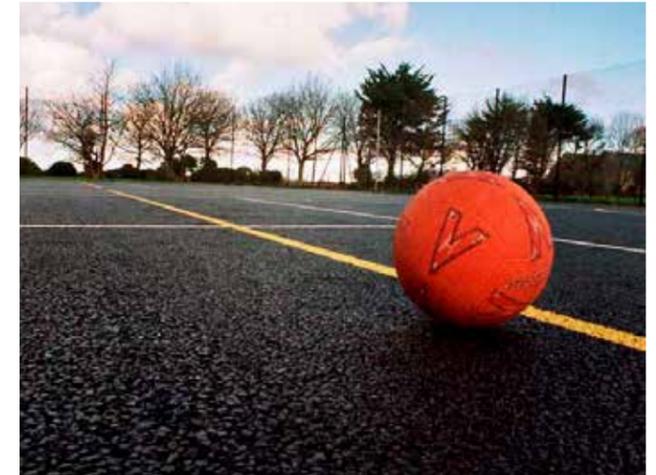
SuperSport is a range of asphalt products designed to meet job specific requirements and offer a range of benefits for tennis courts and Multi Use Games Areas (MUGAs). A selection of binders are used, these include normal penetration grades, polymer modified grades and our 'Plus' binder, to provide job specific requirements and benefits. SuperSport can also be produced as a red product.

SUPERSPORT RANGE

SuperSport Tennis: SuperSport Tennis is a fast draining material that is designed to meet the stringent demands of this sport. It is fully compliant with the requirements of the Lawn Tennis Association and SAPCA.

SuperSport MUGA: SuperSport MUGA is the ideal product for Multi Use Games Areas where a variety of activities including basketball, hockey, football and netball* are played. It is fully compliant with the requirements of SAPCA.

SuperSport binder course: SuperSport binder course materials are available in 10, 14 and 20mm aggregate sizes, enabling the contractor to select the material best suited to their application. These are the recommended binder course materials for our SuperSport surface course options.



APPLICATIONS

- ▶ Tennis courts
- ▶ Multi-use games areas
- ▶ School playgrounds

KEY PERFORMANCE PROPERTIES (TYPICAL PROPERTIES)

PROPERTY	UNITS	20MM SUPERSPORT	14MM SUPERSPORT	10MM SUPERSPORT	6MM SUPERSPORT MUGA	6MM SUPERSPORT TENNIS
Void Content	%	>18	>18	NA	NA	NA
Water Infiltration Rate <small>(Tested in accordance with EN 12616:2013, Method A)</small>	mm/hr	>15,000	>15,000	>12,000	>5,000	>5,000
	m/s	>4.1 x 10 ⁻³	>4.1 x 10 ⁻³	>3.3 x 10 ⁻³	>1.4 x 10 ⁻³	>1.4 x 10 ⁻³
Nominal Layer Thickness	mm	60-90	40-80	30-50	25-35	25-35

SUPERFLOW 6

AGGREGATE TYPE: 2/6 Crushed angular rock

SOLUTION: Permeable Block Paving

APPLICATION: Laying course / bedding aggregate

Aggregate Industries SuperFlow 6 is a high performance laying course aggregate specifically designed to provide controlled water management within Sustainable Drainage Systems (SuDS).

SuperFlow 6 provides a stable, flat laying surface, while retaining the optimal level of voids for consistent water flow. This carefully graded aggregate, with its natural strength and interlocking properties, ensures both the integrity of the pavement and the excellent drainage characteristics are maintained throughout.

FEATURES & BENEFITS:

- ▶ Super Sustainable: Working with the environment to prevent flooding and water pollution
- ▶ Super Production: Expert production techniques ensuring the highest levels of quality and consistency in line with British European standards BS EN13242 and BS EN12620
- ▶ Super Performance: Crushed angular stone offering long term durability and optimal void retention for controlled flow of water
- ▶ Super Support: Dedicated technical and specification teams to assist with your SuDS design

ASSOCIATED PRODUCTS & SOLUTIONS:

- ▶ Charcon Commercial Landscaping: Infilta™ product range offering high quality permeable paving blocks to suit all applications



KEY PERFORMANCE CRITERIA	
PROPERTY	STANDARD
Grading Characteristics	BS EN 13242
Resistance to fragmentation	BS EN 1097-2
Resistance to wear	BS EN 1097-1
Acid Soluble Sulphate (AS0.2)	BS EN 1774-1
Magnesium Sulfate Soundness	BS EN 1367-2

SuperFlow 6 complies with the requirements of BS7533-13 & the CIRIA document (C753)

SUPERFLOW 20

AGGREGATE TYPE: 4/20 Crushed angular rock

SOLUTION: Permeable block paving, hand laid porous asphalt & porous concrete

APPLICATION: Upper reservoir layer / free draining sub-base

Aggregate Industries SuperFlow 20 is a high performance open graded aggregate specifically designed to provide controlled water management within Sustainable Drainage Systems (SuDS)

SuperFlow 20 is a key component within the SuDS foundation design and forms an upper reservoir drainage layer offering controlled storage and flow of the rain water within the system. SuperFlow 20's specific grading, natural strength and interlocking properties ensures both the integrity of the pavement and excellent drainage characteristics are maintained throughout.

FEATURES & BENEFITS:

- ▶ Super Sustainable: Working with the environment to prevent flooding and water pollution
- ▶ Super Production: Expert production techniques ensuring the highest levels of quality and consistency in line with British European standards BS EN13242 and BS EN12620
- ▶ Super Performance: Crushed angular stone offering long term durability and optimal void retention for controlled flow of water
- ▶ Super Support: Dedicated technical and specification teams to assist with your SuDS design

ASSOCIATED PRODUCTS & SOLUTIONS:

- ▶ Charcon Commercial Landscaping: Infilta™ product range offering high quality permeable paving blocks to suit all applications
- ▶ SuperDrainasphalt™: A porous asphalt solution which offers an alternative to block paving systems
- ▶ Hydromedia® Concrete: A fast draining concrete pavement solution which rapidly directs stormwater off surfaces to the SuDS application beneath



KEY PERFORMANCE CRITERIA				
PROPERTY	STANDARD	CATEGORY	UNIT	VALUES
Grading Characteristics	BS EN 13242	N/A		N/A
Fines content	BS EN 933-1	f	%	≤ 4
Compacted Voids	Air Voids	N/A	%	≥ 30
Flakiness Index	BS EN 933-3	FI	%	≤ 20
Resistance to fragmentation	BS EN 1097-2	LA	%	≤ 30
Resistance to wear	BS EN 1097-1	MDE	%	≤ 20
Acid Soluble Sulphate (AS0.2)	BS EN 1774-1	(AS)	%	≤ 0.2
Magnesium Sulfate Soundness	BS EN 1367-2	MS	%	≤ 18
Horizontal Permeability	HA41/17	Coefficient of permeability, k	m/s	≥ 6 X 10 ⁻²
		Coefficient of permeability, k	m/h	≥ 20
		Coefficient of permeability, k	mm/h	≥ 20,000

SUPERFLOW 63

AGGREGATE TYPE: No fines crushed angular rock

SOLUTION: Permeable Block Paving

APPLICATION: Lower reservoir layer / free draining sub-base or capping

Aggregate Industries SuperFlow 63 is a high performance coarse aggregate specifically designed to provide controlled water management within Sustainable Drainage Systems (SuDS).

SuperFlow 63 is a robust, no fines aggregate typically used where the ground conditions are soft or where deep level make up is required where it forms a stable starter layer within the pavement construction. SuperFlow 63's large angular shape offers optimal voids for controlled flow of rain water, while it's natural strength ensures the long term integrity of the pavement is maintained.

FEATURES & BENEFITS:

- ▶ Super Sustainable: Working with the environment to prevent flooding and water pollution
- ▶ Super Production: Expert production techniques ensuring the highest levels of quality and consistency
- ▶ Super Performance: Crushed angular stone offering long term durability and optimal void retention for controlled flow of water
- ▶ Super Support: Dedicated technical and specification teams to assist with your SuDS design

ASSOCIATED PRODUCTS & SOLUTIONS:

- ▶ Charcon Commercial Landscaping: Infilta™ product range offering high quality permeable paving blocks to suit all applications
- ▶ SuperDrainasphalt™: A porous asphalt solution which offers an alternative to block paving systems
- ▶ Hydromedia® Concrete: A fast draining concrete pavement solution which rapidly directs stormwater off surfaces to the SuDS application beneath



KEY PERFORMANCE CRITERIA				
PROPERTY	STANDARD	CATEGORY	UNIT	VALUES
Grading Characteristics	BS EN 13242	N/A		N/A
Fines content	BS EN 933-1	f	%	≤ 4
Compacted Voids	Air Voids	N/A	%	≥ 30
Flakiness Index	BS EN 933-3	FI	%	≤ 20
Resistance to fragmentation	BS EN 1097-2	LA	%	≤ 30
Resistance to wear	BS EN 1097-1	MDE	%	≤ 20
Acid Soluble Sulphate (AS0.2)	BS EN 1774-1	(AS)	%	≤ 0.2
Magnesium Sulfate Soundness	BS EN 1367-2	MS	%	≤ 18
Horizontal Permeability	HA41/17	Coefficient of permeability, k	m/s	≥ 6 X 10 ⁻²
		Coefficient of permeability, k	m/h	≥ 20
		Coefficient of permeability, k	mm/h	≥ 20,000

SUPERFLOW SUDSAGG

AGGREGATE TYPE: 0/40mm Crushed angular rock

SOLUTION: Permeable block paving, porous concrete & porous asphalt

APPLICATION: Free draining sub-base / reservoir layer

Aggregate Industries SuperFlow SuDSAgg is a high performance sub-base aggregate specifically designed to provide controlled water management within Sustainable Drainage Systems (SuDS).

SuperFlow SuDSAgg is a well graded, reduced fines, crushed aggregate with a maximum nominal size of 40mm. This product has been designed with a void ratio of 30% or greater to ensure the optimal flow of water is achieved upon compaction. The excellent water management characteristics of SuperFlow SuDSAgg ensures a harmonious compatibility with the permeable asphalt or concrete surface being adopted within the pavement design.

SuperFlow SuDSAgg is designed to meet the structural requirements of a Foundation Class 2 material as defined in the Design Manual for Roads & Bridges. The products structural stability means it can be used independently or as a stabilisation layer over Aggregate Industries SuperFlow 20 when used under paver laid SuperDrainasphalt.

FEATURES & BENEFITS:

- ▶ Super Sustainable: Works with the environment to prevent flooding and water pollution
- ▶ Super Production: Expert production techniques ensuring the highest levels of quality and consistency

- ▶ Super Performance: Crushed angular shape and natural durability allows optimal compaction, void retention and long term performance
- ▶ Super Support: Dedicated technical and specification team to assist with your SuDS design

ASSOCIATED PRODUCTS & SOLUTIONS:

- ▶ Charcon Commercial Landscaping: Infilta™ product range offering high quality permeable paving blocks to suit all applications
- ▶ SuperDrainasphalt™: A porous asphalt solution which offers an alternative to block paving systems
- ▶ Hydromedia® Concrete: A fast draining concrete pavement solution which rapidly directs stormwater off surfaces to the SuDS application beneath
- ▶ SuperSport: A porous asphalt designed for use in sports surfacing applications



KEY PERFORMANCE CRITERIA				
PROPERTY	STANDARD	CATEGORY	UNIT	VALUES
Grading Characteristics	BS EN 13242	N/A		N/A
Fines content	BS EN 933-1	f	%	≤ 4
Compacted Voids	Air Voids	N/A	%	≥ 30
Flakiness Index	BS EN 933-3	FI	%	≤ 20
Resistance to fragmentation	BS EN 1097-2	LA	%	≤ 30
Resistance to wear	BS EN 1097-1	MDE	%	≤ 20
Acid Soluble Sulphate (AS0.2)	BS EN 1774-1	(AS)	%	≤ 0.2
Magnesium Sulfate Soundness	BS EN 1367-2	MS	%	≤ 18
Horizontal Permeability	HA41/17	Coefficient of permeability, k	m/s	≥ 6 X 10 ⁻²
		Coefficient of permeability, k	m/h	≥ 20
		Coefficient of permeability, k	mm/h	≥ 20,000

SUPERFLOW JOINTAGG

AGGREGATE TYPE: Washed crushed rock grit

SOLUTION: Permeable Block Paving

APPLICATION: Brushing into permeable block joints

Aggregate Industries SuperFlow JointAgg is a high performance finishing aggregate specifically designed for brushing into block pavement joints. This aesthetically pleasing product offers excellent free draining characteristics due to its low fines content, while its natural strength ensures the long term integrity of the SuDS system is maintained for a refined, yet functional pavement finish.

FEATURES & BENEFITS:

- ▶ Super Sustainable: Works with the environment to prevent flooding and water pollution
- ▶ Super Production: Expert production techniques ensuring the highest levels of quality and consistency
- ▶ Super Performance: Crushed angular shape and natural strength allows optimal void retention and long term durability
- ▶ Super Support: Dedicated technical and specification team to assist with your SuDS design

ASSOCIATED PRODUCTS & SOLUTIONS:

- ▶ Charcon Commercial Landscaping: Infilta™ product range offering high quality permeable paving blocks to suit all applications



KEY PERFORMANCE CRITERIA

PROPERTY	STANDARD
Resistance to fragmentation	BS EN 1097-2
Resistance to wear	BS EN 1097-1
Acid Soluble Sulphate (AS0.2)	BS EN 1774-1
Magnesium Sulfate Soundness	BS EN 1367-2

SuperFlow JointAgg complies with the requirements of BS7533-13 and the CIRIA document (C753)

APPENDIX 2 GUIDANCE AND LEGISLATION

Aggregate Industries works in accordance with guidance and legislation. This brochure is produced inline with up to date information at the time of production (2018).

Please note that Aggregate Industries does not maintain Professional Indemnity Insurance for any pavement advice that it provides, therefore the content in this brochure is provided in good faith for information only, it is not intended to amount to advice upon which you should solely rely.

You must obtain additional professional or specialist advice before taking, or refraining from taking, any action on the basis of the content of this brochure.

The documents below are the principle planning, legislative and design guidance for Sustainable Drainage Solutions:

- ▶ Planning Policy Statement PPS 25
- ▶ The Building Regulations
- ▶ CIRIA Report C753
- ▶ Pollution Prevention Guideline No.3
- ▶ Department of Transport
- ▶ Interpave, Guide to the Design Construction and Maintenance Pavements

For up to date, relevant documents, please refer to **www.susdrain.org**.

Created by CIRIA, it is the independent and authoritative platform for those involved in delivering sustainable drainage.

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