Tarmac®

TarmacDry® technical information and specifications.



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TARMACDRY
Drainage
Storage
Usage

Introduction and background to the problem.

The combined effect of climate change, population growth and increasing urbanisation means that major flooding events are likely to become more frequent in the UK.

The UK government is committed to building three million new homes by 2020 with a significant number of these houses likely to be built on land prone to flooding. The hospitals, retail parks and transport amenities required to support this growth will simply add to the problem. Increasing heavy rainfall patterns are of concern to water companies and local authorities as high volumes of stormwater run-off are placing an increased burden on existing drainage systems and urban watercourses. Pollutants settling on impervious surfaces are swept along and discharged into treatment plants or directly into rivers and streams. Balancing ponds are often used to collect and attenuate the rate of run-off from road and footpath surfaces, however whilst effective they often occupy land that could be built on. Developing sites with hard impervious paved areas and roofs prevents the natural dissipation of stormwater and increases both the rate and volume of run-off.

Current guidance

There is now a presumption in favour of using SuDS. The legislative and regulatory framework is changing to make it increasingly unacceptable to incorporate conventionally designed drainage systems.

Planning Policy Statement 25 (PPS25) sets out Government policy on development and flood risk. Its aims are to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding. PPS25 recommends the implementation of Sustainable Drainage Systems (SuDS) on all new development whilst the Environment Agency (EA) advises planning authorities on development and flood risk matters, to steer developments away from flood risk areas and to restrict development that would increase the risk of flooding. The EA actively encourages local authorities to include pervious pavements in supplementary planning guidance on SuDS. Housebuilders are also being encouraged by both the EA and the 'Code for Sustainable Homes' to adopt SuDS pervious pavements.

Pervious pavements

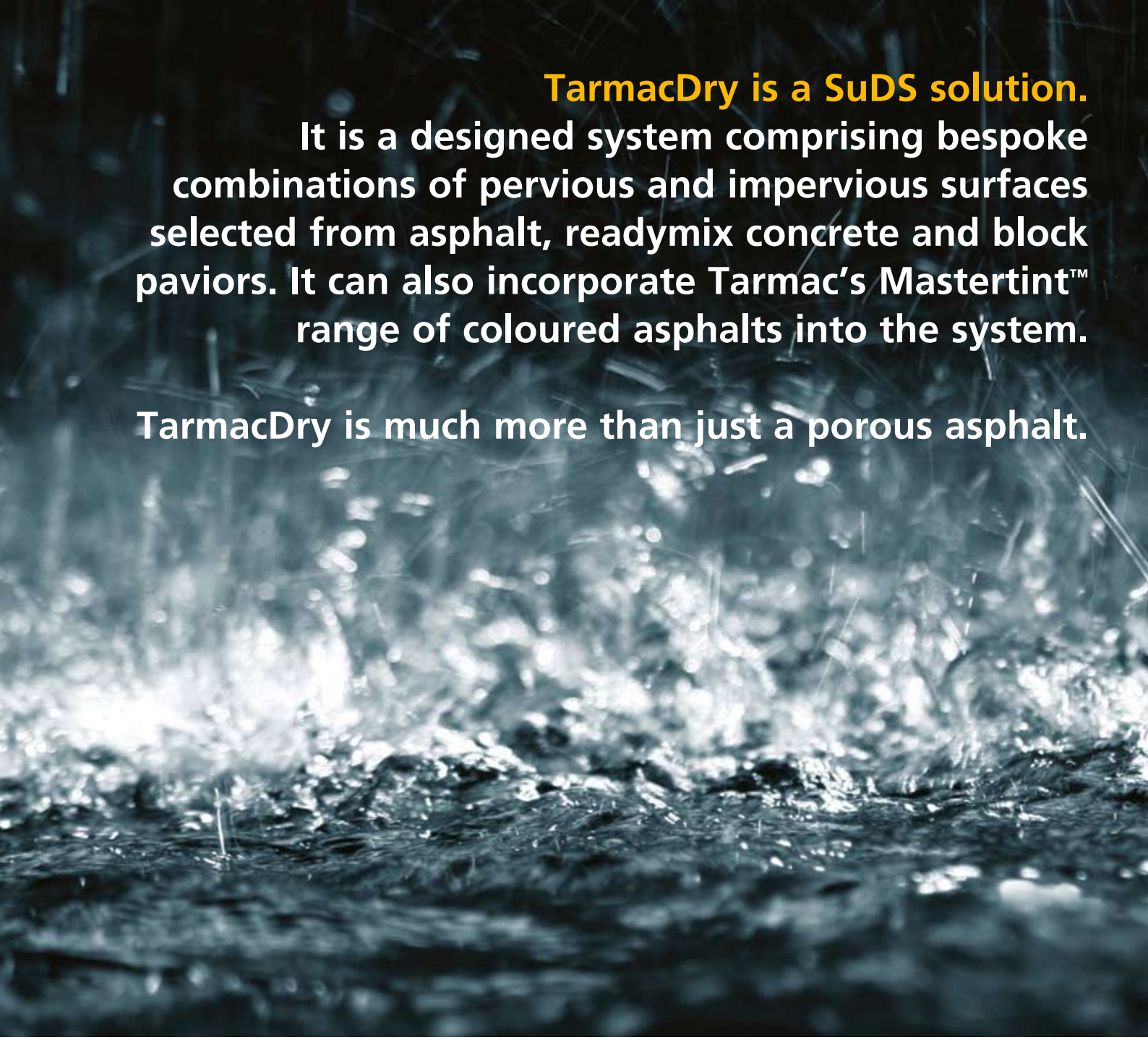
Historically roads have been designed to have dense surfaces and to be substantially impervious, so rain flowed off the road surface into the side drains. However conventional drainage systems are not always able to cope with the severe rainfall. Porous asphalt pavements provide a cost-effective solution with proven life spans in excess of 20 years whilst at the same time providing a stormwater management system that facilitates effective infiltration or attenuation, improving water quality and eliminating the need for balancing ponds. Porous asphalt pavements provide significant storage capacity for attenuating stormwater, enabling planners, designers and developers to be better placed to mitigate against flood damage through the provision of cost-effective drainage solutions for capturing and controlling the release of surface water.

Rainwater percolates rapidly through the asphalt surfacing into a porous granular reservoir layer which acts as a store before discharging at a controlled rate into the sub-soil or drained into the main stormwater drainage system.

This process helps to relieve stormwater surges and reduces the risk of flooding caused by our existing drainage network becoming overloaded.

Balancing ponds can be replaced by pervious pavements located in parking areas, lightly trafficked roads, sporting facilities, housing estates, school playgrounds, footpaths, driveways etc. They also help to reduce traffic noise and filter out pollutants in rainwater. TarmacDry asphalt layers are highly engineered to combine hydraulic conductivity and long term performance to improve toughness and resistance to the stresses caused by power steering. The basic concept of porous asphalt layers on top of an open-graded granular reservoir layer with a geotextile membrane is to form an engineered full depth pavement. The overall pavement thickness is designed to provide the necessary level of structural and hydraulic performance required on a project specific basis.





TarmacDry is a SuDS solution.

It is a designed system comprising bespoke combinations of pervious and impervious surfaces selected from asphalt, readymix concrete and block paviors. It can also incorporate Tarmac's Mastertint™ range of coloured asphalts into the system.

TarmacDry is much more than just a porous asphalt.

TarmacDry addresses all of the key SuDS performance criteria including:

- Quantity – meeting design requirements for rainwater management
- Quality – removing water borne pollutants
- Amenity – improving the local environment
- Economics – the most cost-effective solution



Tarmac's approach to SuDS

Tarmac is fully committed to source control which is generally accepted as the preferred design technique in any SuDS scheme. This technique is a fundamental part of the 'management train' approach to ensure that both quantity and quality stormwater run-off issues are addressed.

Infiltration should be the primary method used wherever possible, however if this is not achievable or appropriate then partial infiltration or attenuation solutions can be developed utilising the TarmacDry range of SuDS systems.

Tarmac can offer a unique fully integrated supply chain; all materials (aggregates + asphalt + concrete + blocks), full design support (including structural and hydraulic aspects) and installation service. We can also provide an after sales maintenance service backed by warranty.

A porous pavement design guide has been produced exclusively for Tarmac by TRL (Transport Research Laboratory) to underpin the structural design and performance of the TarmacDry porous asphalt pavement system.

In addition TarmacDry has the benefit of patent protection. We have 3 granted patents for (1) Porous asphalt system (2) Porous concrete system (3) Porous and impervious asphalt or concrete system.

Ongoing research at Coventry University demonstrates that TarmacDry is highly efficient at removing the majority of contaminants from storm water which facilitates the option of water harvesting/recycling.



The importance of the surface water management train. The surface water management train approach is fundamental to the creation of integrated SuDS designs compliant with best practice guidance.

The surface water management train starts with prevention, or good housekeeping measures, for individual premises; and progresses through local source controls to larger downstream site and regional controls. Run-off need not pass through all the stages of the management train. It could flow straight to a site control, but as a general principle it is better to deal with run-off locally, returning the water to the natural drainage system as near to the source as possible. Only if the water cannot be managed on site should it be conveyed elsewhere. This may be due to the water requiring additional treatment before disposal or the quantities of run-off generated being greater than the capacity of the natural drainage system at that point.

The design of SuDS requires active decisions between different options, often depending on the risks associated with each course of action. The risks of an area flooding have to be balanced with the costs of protecting the area from different levels of floods.

The management train concept promotes division of the area to be drained into sub-catchments with different drainage characteristics and land uses, each with its own drainage strategy. Dealing with the water locally not only reduces the quantity that has to be managed at any one point, but also reduces the need for conveying the water off the site.



Where does TarmacDry fit in to the surface water management train?

TarmacDry SuDS systems are generally based upon achieving source control as locally as possible with the aim of negating the requirement for additional treatment techniques.

Asphalt based porous pavements have been successfully installed and monitored for more than 40 years in the USA and throughout mainland Europe to demonstrate their performance in terms of effective water management. Here in the UK, Tarmac have been developing porous asphalt paving technology since 1997. Since then the technology has evolved considerably and has been thoroughly tested by independent bodies such as TRL Ltd and Coventry University and used in a number of commercial schemes (see case studies).

Research trials

Tarmac has over 100 years expertise in designing and building traditional impervious asphalt roads and the concept of TarmacDry represented a step change in pavement design. Which is why we have taken 10 years to develop and thoroughly validate TarmacDry before making it available to the UK SuDS market.

On-going trials at Coventry University are demonstrating that within a TarmacDry porous asphalt and in situ porous concrete system, microbes develop naturally in response to ongoing contamination. The microbes are able to treat and trap the contaminants and this capability is further enhanced by filtration and aeration within the construction. TarmacDry pervious pavements also limit the concentration of pollutants by immediate localised interception and long term research has demonstrated that the following are effectively removed from stormwater run-off:

- Heavy metals
- Hydrocarbons
- Phosphorus
- Nitrogen

Hence TarmacDry systems can minimise the need for costly traditional petrol/oil interceptors and can be used as a primary treatment facility in accordance with best practice guidance e.g. CIRIA C697 'The SuDS Manual', usually without the need for further treatment.

'As a result of testing work carried out by Coventry University on behalf of Tarmac throughout 2007, we conclude that in comparison with other surfaces tested and using a uniform approach, the TarmacDry Pervious Paving System, including asphalt and concrete surfaces, performed as well as any of the other surfaces tested. In particular its performance in terms of hydraulic conductivity (flow rates) and water cleansing was comparable with block paving with no discernible difference between the two'.

Dr Sue Charlesworth

SuDS Applied Research Group, Coventry University

The main conclusions from the testing undertaken at Coventry University are summarised below:

1. Water containing street dust was applied in measured amounts onto the surface of a number of different test rigs each having different layer types and thicknesses, the aim being to capture the outflow water at the base of each pavement structure and measure pollutant levels.

2. The heavy metals present in the outflow samples are at concentrations below the World Health Organisation (WHO) drinking water specifications.

3. Suspended sediment concentrations are all mainly below background levels suggesting that it is being trapped within the test rigs.

4. Used engine oil was applied every 4 weeks as a single dose to each test rig at a rate of 25 ml/m^2 until the effluent oil concentration reached 10mg/l. All of the concentrations measured in the outflows from each test rig were below 1 mg/l.

To date results from the Tarmac study at Coventry University indicate that the pollutants which have been applied to the rig surfaces are being held in the structure of the pavement. There is no evidence to indicate that any of the applied contaminants will reach breakthrough point.


2A

Key sustainability and cost benefits of TarmacDry pervious pavements.



There are several key cost benefits when compared to traditional drainage solutions including:

- A reduction in excavation volumes and depths - TarmacDry designed pavements typically achieve 100mm reduced thickness compared to alternative systems
- Minimises risk due to the shallow construction depth
- A reduction in material disposal costs
- The elimination of trench support and shoring requirements
- Faster construction time often shortening a project's build programme
- Negate the need for traditional petrol/oil interceptors
- A reduction in the need for permanent drainage, surface water sewers and balancing ponds.
- Easy to maintain because the silts are trapped exclusively in the surface course and can be rapidly removed using appropriate cleaning plant, without the need for any reconstruction or disturbance to the pavement

In addition there are many sustainability benefits through the use of TarmacDry pervious paving including:

- As well as reducing or eliminating stormwater run-off and flood risk, they help to recharge ground water levels
- Achieve natural water treatment
- Facilitation of rainwater re-use
- Optimisation of land-take
- They can be used as soakaways to deal with run-off from roofs and other paved areas
- Enhancement of biodiversity & amenity values
- They remove the need for working within confined spaces, compliant with Health & Safety and CDM Regulations
- They maximise user safety by providing a smooth, stable surface for pedestrians, free from trip hazards
- In addition to removing pollutants from run-off water, safety and user comfort is improved by the reduction in noise, spray, glare and standing water



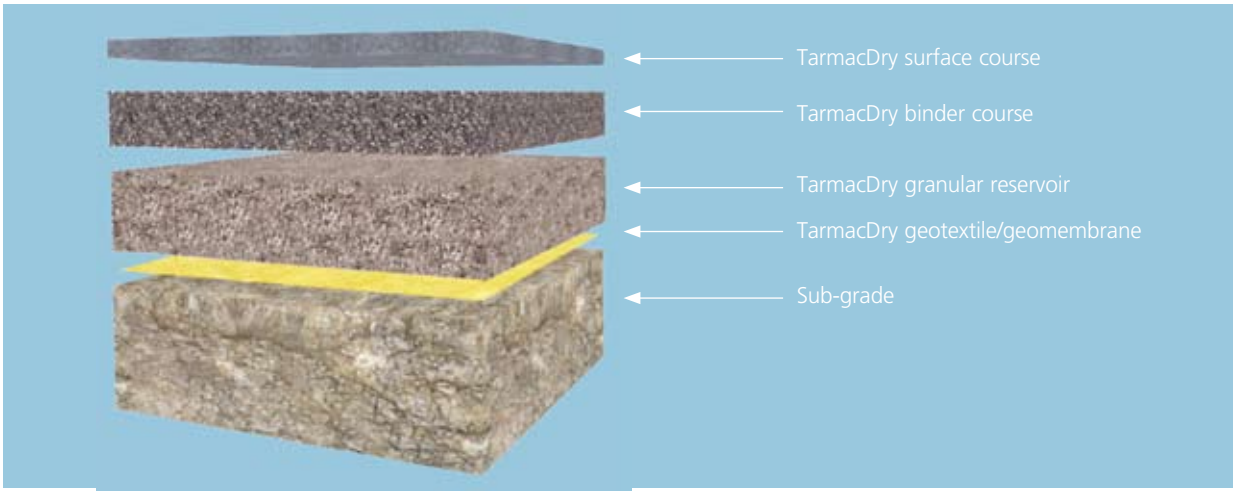
The TarmacDry range of pervious paving systems.

Tarmac can offer the following unique range of bespoke designed combinations of porous, permeable and impervious paving options:

- TarmacDry porous asphalt
- TarmacDry porous Mastertint (coloured asphalt)
- TarmacDry porous asphalt in combination with permeable block paving
- TarmacDry porous asphalt and/or permeable block paving in combination with impermeable asphalt

As an additional option, in situ concrete porous pavements, are currently under development for heavy duty applications.

The diagram below illustrates a typical TarmacDry asphalt pavement structure



The surface course is designed to give the required ride quality by providing a smooth finish with no trip hazards and to impart skid resistance as required. This layer can also serve to provide an aesthetic finish, available in the Mastertint range of colours.

Another important function of the TarmacDry asphalt surface course is to filter and treat surface water through the removal of contaminants such as silts/organics/heavy metals. Because most of the silt is contained within the surface course it is easier to maintain the hydraulic conductivity by cleaning it as necessary.

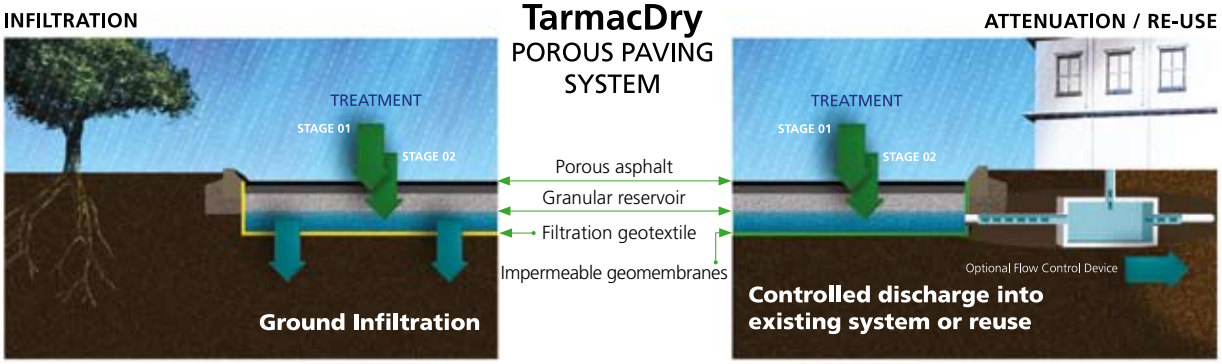
The binder and/or base layer(s) provide the main structural support and allow water to easily pass through to the unbound granular reservoir layer below. Base materials may not be required in certain applications (subject to individual design requirements).

The open granular layer serves as the reservoir for water storage within the pavement system. The thickness of this layer depends upon the structural and hydraulic requirements of the project.

For infiltration applications a geotextile is incorporated on top of the prepared sub-grade to provide additional filtration prior to discharge into the underlying layers. The geotextile also stops very fine material present in the sub-grade being pumped upwards into the granular layer, which could result in partial blocking and reduced storage capacity. Attenuation systems will require a geomembrane to prevent egress of water to the sub grade.

The sub-grade permeability will vary on each project and needs to be known and taken into account when the system is designed.

The diagram below shows how TarmacDry works as both an infiltration and an attenuation system



Stage 1: Settlement through the TarmacDry porous asphalt layer
Stage 2: Bacterial action through the granular reservoir layer

Design options

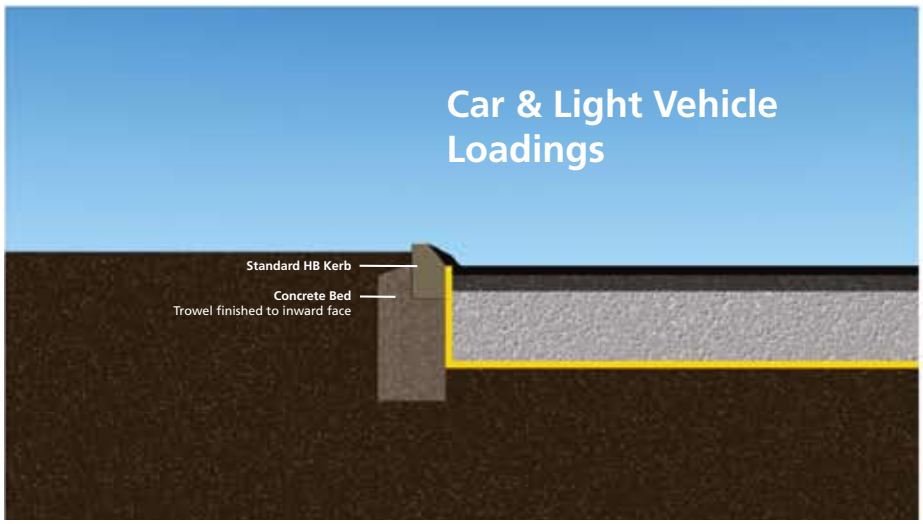
There are 3 primary forms of TarmacDry construction to meet specific requirements:

- Infiltration – it is recognised that total infiltration is generally the preferred design option and should be utilised as source control wherever possible
- Partial infiltration – this option is being increasingly used on low permeability sites where a proportion of the run-off is drained through infiltration and the remainder is discharged into an appropriate outfall
- Attenuation – this assumes no infiltration and utilises an impermeable geomembrane to achieve temporary storage prior to controlled discharge or re-use

In addition the following design considerations can be catered for:

- Rainwater re-use – TarmacDry systems can be utilised for harvesting rainwater with the granular reservoir creating a storage tank prior to re-use for a range of non-potable applications including toilet flushing and irrigation
- Sloping sites – TarmacDry systems can be successfully installed on sloping sites – although depending upon the gradients, it may be necessary to increase the depth of the granular reservoir and construct dams/baffles to control the flow of water
- SuDS and brownfield sites – a common misconception is that SuDS cannot be used on contaminated sites. In fact, appropriately designed TarmacDry paving systems can be successfully incorporated into any brownfield development and can offer many advantages over conventional drainage solutions. A primary benefit is that the shallow construction minimises the amount of contaminated spoil that needs to be disposed off-site
- SuDS retro-fit to existing development – SuDS can also be used very effectively to overcome drainage problems on existing developments. TarmacDry can provide a cost-effective solution without increasing land-take requirements. In certain circumstances use of a TarmacDry SuDS system could make land available for development which is currently sterilised by conventional drainage requirements
- Design capabilities – Tarmac offer a bespoke design service for the creation of innovative cost effective pervious pavement solutions in accordance with best practice guidance. This unique design service is based upon the completion of a TarmacDry enquiry form which provides the necessary project specific information to enable the optimum designed solution to be created in terms of performance, buildability and cost

Option 1: Full Infiltration



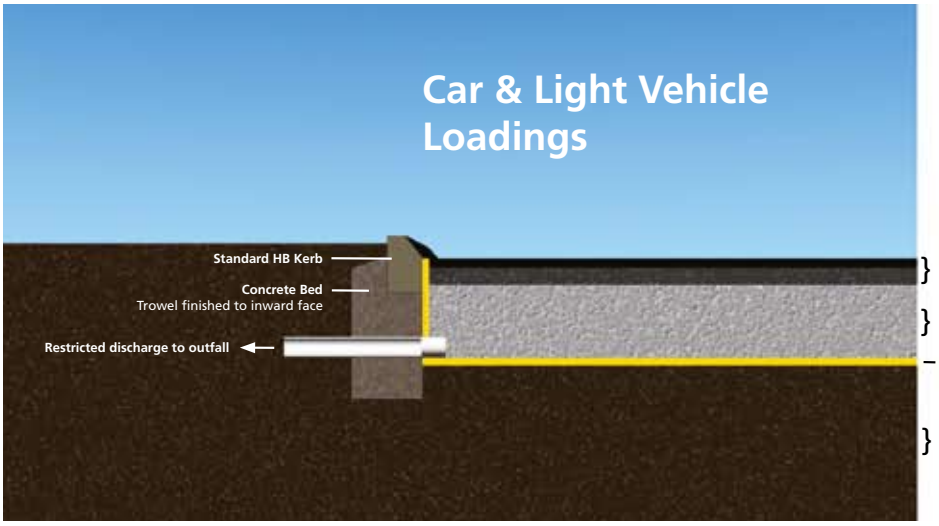
120 mm
TarmacDry porous asphalt layers

Minimum 200 mm
TarmacDry granular reservoir layer

TarmacDry Filtration Geotextile

Subgrade
To be a minimum CBR of 5% based on a saturated condition, hence capping may be required to engineers specification

Option 2: Partial Infiltration



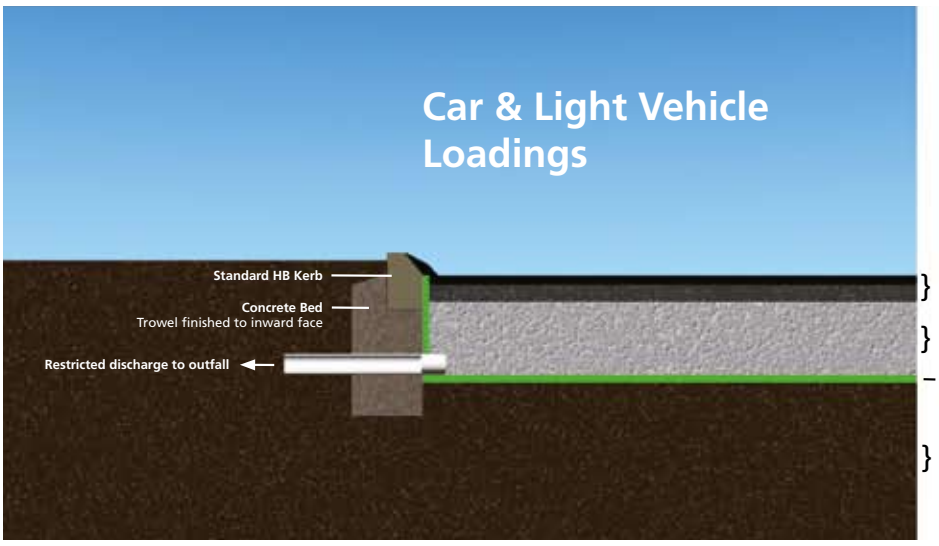
120 mm
TarmacDry porous asphalt layers

Minimum 200 mm
TarmacDry granular reservoir layer

TarmacDry Filtration Geotextile

Subgrade
To be a minimum CBR of 5% based on a saturated condition, hence capping may be required to engineers specification

Option 3: Full Attenuation



120 mm
TarmacDry porous asphalt layers

Minimum 200 mm
TarmacDry granular reservoir layer

Impermeable Geomembrane
TarmacDry membrane with welded joints.

Subgrade
To be a minimum CBR of 5% based on a saturated condition, hence capping may be required to engineers specification

TarmacDry geomembrane installation



TarmacDry granular reservoir



TarmacDry binder course



TarmacDry surface course

Design considerations.

Currently the main markets for pervious pavements are lightly trafficked areas such as car parks, retail parks, housing estate roads, pedestrian areas and service roads. However increasingly they are being utilised on more heavily trafficked urban roads, where loadings and traffic flows permit.

TarmacDry SuDS systems incorporate geotextiles where infiltration is required and geomembranes where attenuation is the main objective.

The purpose of these layers is to:

- Prevent pumping of finer soils into the open graded aggregate of the unbound layers
- Provide enhanced resistance to deformation of the subgrade under load by providing a tensile resistance

If an impermeable geomembrane is required to prevent water infiltration or create attenuation we will ensure it is able to withstand the loads imposed during construction and the service life of the pavement. The TarmacDry system incorporates robust materials such as polypropylene or HDPE liners that will have homogeneous welded joints and installed under a CQA system to ensure that water cannot penetrate into the subgrade. In addition Tarmac identify it is good practice to protect the geomembrane from damage with a geotextile fleece or fines layer.

Utilities

TarmacDry designs should be considered in conjunction with the location of underground utilities. If necessary, service corridors should be routed to ensure that they do not conflict with the scheme drainage. This is a particular consideration when incorporating impermeable geomembranes to achieve attenuation within the granular reservoir layer. One design option is to incorporate discrete sections of impermeable pavement construction into the project to facilitate this.

Maintenance.

TarmacDry porous asphalt pavement designs incorporate a high factor of safety and are based on the assumption that the top layer of construction will become clogged over time. This is taken into account at design stage to ensure that the TarmacDry system is still able to cope with a 1 in 100 year storm event even when 95% clogged.

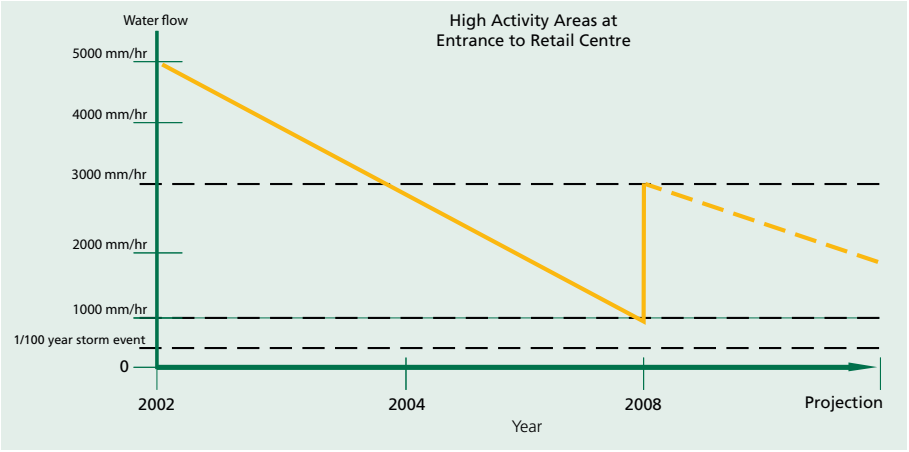
Long term experience demonstrates that TarmacDry pavements can perform satisfactorily for many years without any maintenance depending on the physical characteristics of the site. Tarmac offers a negotiable maintenance package from installation in which we guarantee a minimum level of performance for maintaining hydraulic conductivity of over 1000mm per hour. This is typically 10 times greater than required to cope with a 1 in 100 year storm event.

Maintenance in progress



Cleaning frequency – B&Q car park, Pompey Centre

TarmacDry was installed on the parking areas at the Pompey Centre retail park in 2002. This covered 20,000m², part of which was heavily trafficked at the entrance to a builders merchants and part lightly trafficked. The hydraulic conductivity on installation across the site was well in excess of 5,000mm/hr. By 2008 the conductivity in the heavily trafficked areas had fallen to below 1,000mm/hr and required cleaning whilst the lightly trafficked area was still delivering a conductivity above 5,000mm/hr. The conductivity of the heavily trafficked area was restored to above 3,000mm/hr after cleaning.



Before and after cleaning



Technical performance specifications of the various components.

CIRIA RP 697- updated guidance on technical design and construction

CIRIA RP 609 – hydraulic structural and water quality advice

CIRIA C582 – source control using constructed pervious surfaces

Geotextile specification – the relevant performance characteristics to consider are:

- Pore size – this should be designed and specified to assist in filtration and prevent migration of fine soil particles
- Permeability and break through head - the geotextile should not restrict outflow of water from the system. Therefore it should have a similar or greater permeability than the surrounding materials
- Puncture resistance – the geotextile must be able to resist the punching stresses caused by loading on sharp points of contact
- Tensile strength – the geotextile must have sufficient strength to resist the imposed forces from traffic or other loading

Geomembrane specification

- The geomembrane should be robust, weldable and be installed in accordance with a quality assurance regime that will demonstrate that the system is fully watertight. Dependent upon site specific design criteria it may be advisable to incorporate geotextile protection layers above/below the geomembrane
- It is important that the geomembrane can resist puncture and multi axial elongation stress and strains associated with settlement, resist environmental stress cracking and remain intact throughout the service life of the construction

Additional independent design guidance covering these aspects is available from CIRIA in the following documents:

- CIRIA RP 697- SuDS - updated guidance on technical design and construction

  This guidance provides best practice guidance on the planning, design, construction, operation and maintenance of Sustainable Drainage Systems (SuDS) to facilitate their effective implementation within developments. The guidance supersedes previous general guidance on SuDS and addresses landscaping, biodiversity issues, public perception and community integration as well as water quality treatment and sustainable flood risk management. A separate site handbook (C698 Site Handbook) for the construction of SuDS on the construction of SuDS has also been produced

- CIRIA RP 609 – SuDS - hydraulic structural and water quality advice

  This technical report summarises current knowledge on the best approaches to design and construction of sustainable drainage systems. This document focuses on the hydrological, hydraulic, structural, water quality and ecological aspects of the various SuDS features available in the UK

- CIRIA C582 – source control using constructed pervious surfaces

  This book discusses the critical issues that should be considered when designing and constructing pervious pavements that are to be used as a technique for stormwater source control. It details the types of surfaces available and provides examples of developments that have used these techniques. It explores the issues you need to consider relating to the hydraulic, structural and water quality performance of pervious surfaces. It also provides a design framework, which includes detailed recommendations for methods where necessary





Hydraulic conductivity testing of the TarmacDry system

Worldwide experience and case studies

The first scientific trials of porous pavements were carried out in Pennsylvania and Texas in 1977. This resulted in the production of a design guide which formed a basis for subsequent developments. Since then a growing number of porous pavements have been constructed in the USA resulting in the introduction of a design guide by NAPA in 2003.

Developments are more advanced in France where they are known as reservoir pavements by virtue of having a thick granular gap-graded sub-base to temporarily store water. In Bordeaux over 400 reservoir pavement schemes have been implemented since heavy rainfalls in 1982 threatened further development. The proven durability of these pavements in low traffic sites has led to their widespread adoption throughout France.

In the UK, the role of porous asphalt paving is referred to in the CIRIA SuDS guide. One of the earliest UK trials of an asphalt reservoir pavement took place on a car park in a Tarmac quarry near Bristol in 1999 and continues to perform well, both structurally and hydraulically. As a result of 10 years of testing, Tarmac have further improved technologies and gained 3 patents for the system. The age of this site tells us that maintenance may be required to ensure the pavement permeability remains functional, using water jetting 'suction' equipment to unblock the pores. The frequency of cleaning will be site specific, for example Tarmac's quarry car park has been cleaned once since installation using a mobile suction plant restoring much of the lost conductivity caused by clogging.





Pompey Retail Centre, Portsmouth, retail car park.

A 20,000m^2 retail car park was built by Tarmac in Portsmouth (2002) using asphalt porous pavement technology. The car park continues to perform well.

The car park was constructed on a flat site a few metres above sea level. This posed difficulties in the provision of an effective run-off gradient for the out flow drainage system. The designer did not want to use blocks due to the large area involved and was restricted in the volume of water run-off they were allowed to introduce into the existing storm drainage. The infiltration system used avoided difficulties in designing a full capacity out flow drainage system for a very flat, low lying area where water would have to flow a considerable distance before emptying into the sea. This resulted in reduced costs and also ensured the absence of standing water in the car park which is important for a retail outlet where customer safety and comfort are paramount.

The construction used a granular reservoir base and the hydraulic performance of each asphalt layer was tested to assess compliance before laying the next. The Transport Research Laboratory (TRL) assessed the pavement condition using a falling weight deflectograph (FWD) prior to the official opening. The results showed that there was consistency throughout the site in terms of both stiffness and deflection and the structure was considered suitable for the purpose that it was designed for. Because positive drainage was not necessary there was an overall significant cost saving to the main contractor.

The use of special polymer modified asphalts and other additives are key to delivering a long life porous pavement. Maintenance of hydraulic conductivity is another important aspect which Tarmac are well placed to advise on following extensive research. Tarmac's porous asphalt pavement technology has been tested extensively since 1998 in trials and the TRL have independently validated the systems structural performance. Porous pavements can be used on car parks, estate roads, basically anywhere that is lightly trafficked, although the technology is being continuously developed to enable it to be used on heavier trafficked sites.



Johnson & Johnson Headquarters, High Wycombe internal access roads.

Project brief

The project brief required no change to the site's natural system of drainage.

Johnson & Johnson required the construction of a short section of new access road within their facility whilst also providing a durable paved surface to an existing 500m long unbound chalk access track.

Conscious of the need not to affect the natural balance of how rainwater currently soaked away, Johnson & Johnson requested a system that would not simply channel water into the site's drainage system but continue to allow it to percolate naturally into the ground.

Tarmac provided design and technical input to meet the site constraints

GL Projects were the project managers for ongoing developments on the site and asked Tarmac for design advice that would meet these environmental requirements. They were aware of the concept of pervious pavements but required advice about the system and how it should be installed. After site visits by Tarmac's technical representatives the TarmacDry system was proposed and accepted.

Tarmac offered and provided a full technical assessment, proposing a structural design that would meet the individual loading requirements of Johnson & Johnson whilst also taking into consideration the existing differences in levels along the access track both longitudinally and transversely.

A visual inspection and site history was sufficient to prove the subgrade without the need for plate bearing tests to determine CBR values.

The client also wanted to incorporate new precast concrete edgings along both sides of the road that were sat on a conventional concrete bed and surround. Our design ensured this bed did not affect the hydraulic conductivity of the system.

The works were completed on programme without any site disruption

Following three months of liaison, discussions about the overall works programme and the agreement of an acceptable quote for the work, the granular reservoir layer was shaped and profiled onto the existing surface of the track.

The new concrete edgings were then installed, followed by machine laid porous binder and surface courses on dates previously agreed and fitting with the main contractor's own programme of works.

All materials were supplied from Tarmac's own Quality Assured production units

In total over 2,000m^2 of TarmacDry was installed with the works completed in July 2007.

Hydraulic conductivity testing proved the system's capabilities. An aspect of this contract was the need to undertake extensive hydraulic conductivity testing on all the lower asphalt layers prior to laying the surface course throughout the installation of system. This was done with the full approval of Johnson & Johnson and was undertaken by specialists from Tarmac's Technical Centre. The locations of each test were logged in a Technical Report and will be monitored to assess future performance.

Withywood Community Centre car park, Queens Road, Bristol.

Project brief

As a community project, the client's brief specified delivery of a scheme that was as sustainable as possible with minimal impact on the local environment.

Construction of the car park was a major element of a new purpose built community centre, a community led design and build project opened in November 2006. The design team comprised representatives from the South Bristol Church and Community Trust, the local Primary Care Trust, the Hartcliffe and Withywood Community Partnership and Bristol City Council. Funding for the project was secured from European grants, Bristol City Council and local charities.

Quattro Design, architectural specialists in residential, community, health and education projects, were contracted to design the centre.

Design collaboration between all stakeholders resulted in a number of environmentally focused design features for the centre

At the Withywood Centre, the TarmacDry system incorporates an in-built weir system, which forms part of the reservoir layer and provides an increased level of storage capacity. In addition, inlet pipes transfer rainwater from the 2,500m^2 roof of the community centre into the porous pavement.

The centre has the opportunity to draw from the collected and stored grey water supplies and, amongst other uses, water their landscaped areas.

Tarmac were involved during all phases of design and construction

At design stage, Tarmac proposed the exact depth of supporting porous subbase and the porous asphalt

This was based on knowledge of the subgrade, volume of anticipated traffic loading, surface area of the car park and the volume of water to be stored. Tarmac also gave advice regarding the type of impermeable geomembrane to be used and the number and size of weirs within the aggregate reservoir layer.

Prior to construction of the centre, Tarmac was involved in the programming and planning stage of the overall project. This early input successfully minimised the potential damage to the system caused by other construction activities. Tarmac was programmed to attend site during the closing three weeks of the build programme with the final surfacing not being laid until all other activities were complete. On commencement of the car park, Tarmac performed the following activities:

- Installation of the impermeable geomembrane
- Placement of the granular reservoir to the designed levels
- Construction of concrete weirs with integral overflow pipes
- Construction of drainage runs connected into the reservoir from the building's rainwater system
- Construction of a controlled discharge chamber and outfall into the existing main drainage system
- Machine laid porous asphalt layers by a combination of tracked and wheeled paving machines

All TarmacDry materials were sourced from local Tarmac quarries

In keeping with the sustainable theme of the project there was no need to haul specialist materials from other parts of the UK. Approximately 1000 tonnes of sub-base was supplied from Tarmac's Durnford Quarry in Long Ashton, Bristol and 600 tonnes of porous asphalt was supplied from Tarmac's Stancombe Quarry in Flax Bourton. Both locations are less than four miles from the Withywood Centre.

Aftercare and maintenance issues were also considered and addressed

Prior to leaving site Tarmac carried out a pressurised clean to a small area of the car park that had been overly silted by the adjacent construction work. Tarmac also issued an aftercare maintenance and repair guidance document to the client.

Comment

"It was a key part of our design brief to create a parking area that was not only environmentally friendly, but also capable of storing thousands of litres of rainwater as a sustainable solution for the new community centre. Working alongside Tarmac's National Contracting team, we were able to achieve this by using a Porous Pavement. In addition to the environmental benefits it delivered for the local community, there were also cost saving benefits when compared to permanent traditional drainage systems.

This innovative car park is working well and helping to protect the local community from the potential risk of localised flash-flooding."

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