TOPMIX
PERMEABLE
The ideal concrete solution for surface and storm water management
The built environment has grown rapidly over the last 50 years, resulting in large areas of land being paved over with impermeable materials. Over the same period of time the number of occasions that the UK experiences three, or more, consecutive days of heavy rainfall has increased by 50%.

With climate change predicted to lead to increasingly warmer and wetter weather conditions, rainfall is likely to continue to rise. As a result, many experts believe the kind of wide-scale flooding seen in 2007 and the winter of 2013/14 will become ever more frequent, unless dramatic action is taken now.
In towns and cities where there is a lot of hard landscaping and limited green space, only around a tenth of rainwater is absorbed into the ground. This is compared with 80-90% in rural areas.
Tarmac’s TOPMIX PERMEABLE can play a fundamental role in the majority of Sustainable Urban Drainage Systems (SuDS) designs, providing a practical, long-term answer to surface water flooding that can be implemented quickly and cost effectively. A new, fast draining concrete pavement solution, it rapidly directs excess water away from streets, parking surfaces, driveways and walkways.

Unlike conventional concrete, it has a high void content of between 20-35%. This allows surface water to drain through into the sub-strata and dissipate naturally, reducing the risk of surface water flooding and watercourse contamination.
**HOW IT WORKS**

**TOPMIX PERMEABLE DESIGN OPTIONS**

There are three typical best practice applications that can be employed in the construction of a pervious paving solution using Tarmac’s TOPMIX PERMEABLE.

**SYSTEM A – FULL INFILTRATION**

This system allows all water falling onto the pavement to permeate through the TOPMIX PERMEABLE surface layer, pass through the lower pavement courses and into the sub-grade. Some water may be retained within the pavement reservoir before permeating into the sub-grade. Full infiltration systems do not discharge any additional water into traditional drainage systems. Geotextiles may be incorporated into the system depending on the nature of the sub-grade.

**SYSTEM B – PARTIAL INFILTRATION**

This system is viable for locations where the underlying ground offers some level of permeability and infiltration is acceptable. Within the sub-base layer outlet pipes are installed that allow any excess water that cannot penetrate into the existing ground to be drained into other drainage devices such as watercourses, swales or sewers. This system is typically used where the sub-grade is not capable of draining all of the water as a means of reducing the volume of run-off from the site. Geotextiles may be incorporated into the system depending on the nature of the project.

**SYSTEM C – FULL ATTENUATION**

Use of this system is typically adopted where water recycling is desired, in areas where water may be contaminated, or where the sub-grade is impermeable or becomes weak when saturated. The system includes the installation of an impermeable membrane above the sub-grade and the provision of outlet pipes within the sub-base layer. Full attenuation allows water to be captured and harvested for re-use in non-potable applications such as irrigation or flushing toilets. Geotextiles may be incorporated into the system depending on the nature of the project.
FACTORS TO CONSIDER WHEN USING PERMEABLE PAVEMENTS:
• Do not use permeable pavements where there will be very heavy silt loads from the proposed use (e.g. stockpiling sawdust or large recycling centres subject to heavy silt loads)
• It is possible to construct part of an area in impermeable materials that drain onto a permeable pavement. For example, car parking bays are often constructed using permeable paving and the access ways are impermeable construction
• Open graded permeable sub-base below the permeable pavement should not be used by construction traffic, as this will increase the likelihood of clogging
• The design of permeable pavements must take into account the overland flow routes of water when the design capacity is exceeded. Although exceedance will result in flooding of some areas of a site, the flows should be routed to prevent flooding of buildings for events that are well in exceedance of the capacity of the system. Further guidance is provided in CIRIA Report C 635 (CIRIA, 2006).

TYPICAL APPLICATIONS
These three designs can be used for a wide range of practical applications, including:
• Low volume residential roads and parking lots
• Pavements, bike and pedestrian pathways
• Patios
• Tennis courts
• Road shoulders
• Swimming pool decks
• Alleyways
• Driveways
• Greenhouse floors
• Pavement edge drains and gutters
• Hardstanding for sports facilities
• Underneath permeable blocks for ground stabilisation.
SURFACE DURABILITY

HEAVILY TRAFFICKED AREAS

Even though Tarmac’s TOPMIX PERMEABLE does not soften in hot weather and is resistant to scuffing when tested in accordance with TRL Report 176 Appendix G, we would still recommend that an impermeable surface is used in areas exposed to frequent tight turning circles and sections carrying very heavy traffic. Designs for these areas would typically incorporate a full SuDS foundation with an impermeable surfacing such as a traditional asphalt or concrete on the top. Run-off may be into the adjoining fully pervious pavement or another drainage channel depending on the site. The pervious foundation across the site acts as a reservoir and water can be dealt with in the same way as a fully pervious pavement.

FREEZE-THAW RESISTANCE

An effective permeable pavement system will be designed so that the underlying attenuation layer will store the water that passes through it. Because of this, no water should be left sitting within the surface structure. However, if water was ever left to settle within the system (due to changes in future climate etc.), Tarmac’s TOPMIX PERMEABLE offers excellent freeze-thaw resistance due to the ability for freezing water to expand in the voids. In addition, Tarmac’s TOPMIX PERMEABLE does not contain steel reinforcement so it is not prone to water or chloride attack.

SURFACE SKID RESISTANCE

Tarmac’s TOPMIX PERMEABLE has comparable skid resistance to low texture asphalt and concrete typically used in the construction of UK footpaths and car parks when tested in wet conditions in compliance with ENG1-961 and HD26/011. It is therefore recommended for low speed applications, typically less than 30 miles per hour. Additional care and consideration should be given for surface material selection in areas of higher slip risk, such as slopes or where heavy breaking may occur.

EXAMPLES OF APPLICATIONS

Where TOPMIX PERMEABLE is not appropriate
• HGV delivery routes for supermarkets and shops
• Access to car park ticket barriers
• Tight turning areas in industrial yards
• Bus routes.
SUMMARY OF THE SYSTEM
A typical system consists of a layer of TOPMIX PERMEABLE from Tarmac installed on top of an aggregate sub-base, which is in turn laid onto undisturbed soil or a capping layer. The structure and dimensions of each layer will depend on the application and the design of the system. Tarmac’s TOPMIX PERMEABLE allows rainwater to drain through the wearing surface. During periods of high rainfall the system performs as a reservoir, delaying the discharge of storm water into watercourses or drainage systems. Its ability to store water also acts as a cooling system during periods of rising temperatures when stored water evaporates creating a surface cooling cycle.

DISCHARGE CONSENTS
Where new or renovated paving systems are being installed it is necessary to determine if a discharge consent is required, this is dependent on the pavement usage and the likelihood of contaminants being present in the water to be discharged.

SUB-GRADE PERMEABILITY
The underlying permeability of the existing sub-grade plays an important role in dictating the viability of a pervious solution, the level of infiltration that can be achieved directly relates to the system that can be employed. Permeability testing should be carried out on-site at paving formation levels in order to enable accurate design to be created.
DESIGN CONSIDERATIONS
The design and implementation of pervious paving solutions are dictated by a number of key characteristics relating to the existing site conditions and post construction performance. A pervious paving solution is required to be tailored to each individual application based on the following design criteria.

TRAFFIC LOADING
In order for an accurate and cost-effective design to be created it is necessary to determine the general loadings that the pavement will be subjected to. Incorrect specification of loading can result in premature system failure or poor system performance.

PERFORMANCE CHARACTERISTICS
- Void content up to 35%
- Flow rate: Up to 1,000l/m²/min
- Compressive strength: 10-20N/mm²
- Flexural strength: 1.5-3N/mm²

WATER TABLE LEVEL
For an attenuation layer to be incorporated into a pervious paving solution it is imperative that the existing water table is established. A high underlying water table level can have detrimental effects on the available storage within an attenuation layer, as a small rise in table level will reduce the available storage. Increases in the water table level can also negate the pollutant filtering effect of the pavement as the distance to the watercourse is reduced.

MINIMIZE SITE DISTURBANCE
By integrating paving and drainage, less site area is needed to manage stormwater, allowing a more compact site development footprint.

WATER STORAGE CAPACITY
The capacity of the drainage system needs to be designed in tangent with the structural requirements of the paving solution, with care taken that the greatest substructure design is used to ensure water storage capacity and also structural performance. Storage capacity is required to be designed in line with rainfall return periods - the period of time where the depth of rainfall is only equalled or exceeded once.