

## BREEDON PERVIOUS PAVEMENT SYSTEM

### BREEDON POROUS

This HAPAS Certificate Product Sheet<sup>(1)</sup> is issued by the British Board of Agrément (BBA), supported by Highways England (HE) (acting on behalf of the Overseeing Organisations of the Department for Transport; Transport Scotland; the Welsh Assembly Government and the Department for Regional Development, Northern Ireland), the Association of Directors of Environment, Economy, Planning and Transport (ADEPT), the Local Government Technical Advisers Group and industry bodies. HAPAS Certificates are normally each subject to a review every three years.

(1) Hereinafter referred to as 'Certificate'.

This Certificate relates to Breedon Porous, a full-depth pavement system for use as part of a sustainable drainage system (SUDS) for surface water source control in lightly-trafficked areas such as car parks, residential roads and urban roads.

#### CERTIFICATION INCLUDES:

- factors relating to compliance with HAPAS requirements
- factors relating to compliance with Regulations where applicable
- independently verified technical specification
- assessment criteria and technical investigations
- design considerations
- installation guidance
- regular surveillance of production
- formal three-yearly review.



#### KEY FACTORS ASSESSED

**Mechanical resistance** — mix design data relating to rut rate and rut depth indicate that the asphalt layers have a satisfactory resistance to permanent deformation (see section 6).

**Water sensitivity** — the asphalt layers have a satisfactory retained stiffness after conditioning in water (see section 8).

**Surface characteristics** — the surface course of the system has a satisfactory texture depth and skid resistance (see section 9).

**Permeability** — the system is permeable and can eliminate surface ponding (see section 10).

**Durability** — the system has been used in the UK since 2005. Available evidence indicates that it will provide a durable pervious pavement (see section 12).



The BBA has awarded this Certificate to the company named above for the system described herein. This system has been assessed by the BBA as being fit for its intended use provided it is installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément



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Simon Wroe – Head of Approvals  
Engineering

Claire Curtis-Thomas  
Chief Executive

*Certificate amended on 3 May 2017 to update company name.*

*The BBA is a UKAS accredited certification body – Number 113.*

*The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at [www.bbacerts.co.uk](http://www.bbacerts.co.uk)  
Readers are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct.*

**British Board of Agrément**

Bucknalls Lane  
Watford  
Herts WD25 9BA

tel: 01923 665300

fax: 01923 665301

[clientservices@bba.star.co.uk](mailto:clientservices@bba.star.co.uk)

[www.bbacerts.co.uk](http://www.bbacerts.co.uk)

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## Requirements

In the opinion of the BBA, Breedon Porous, when manufactured and installed in accordance with the provisions of this Certificate, can be designed to provide a durable pervious pavement system for lightly trafficked applications such as car parks, residential and urban roads or similar.

## Regulations

### Construction (Design and Management) Regulations 2015 Construction (Design and Management) Regulations (Northern Ireland) 2007

Information in this Certificate may assist the client, Principal Designer/CDM co-ordinator, designer and contractors to address their obligations under these Regulations.

See section: 3 *Delivery and site handling* of this Certificate.

## Additional Information

### CE marking

The Certificate holder has taken the responsibility of CE marking the bituminous layers, in accordance with harmonised European Standard BS EN 13108-7 : 2006. An asterisk (\*) appearing in this Certificate indicates that data shown are given in the manufacturer's Declaration of Performance.

## Technical Specification

### 1 Description

1.1 Breedon Porous is a full-depth, pervious pavement system consisting of:

- bituminous-bound surface (6 mm, 10 mm or 14 mm), binder and/or base course layers, consisting of:
  - aggregate and fillers specified in accordance with BS EN 13043 : 2002
  - polymer-modified binders to BS EN 14023 : 2010 and/or
  - paving-grade bitumen specified in accordance with BS EN 12591 : 2009, with cellulose fibres and wax additives
- unbound sub-base and granular layers, consisting of aggregate complying with the physical property requirements in TRL Report PA-SCR243, the *Manual of Contract Documents for Highway Works (MCHW)*, *Specification for Highways Works (SHW)* Clause 505, Table 5/5, BS EN 13242 : 2013 and/or BS EN 13043 : 2002
- hot bitumen, hot elastomeric polymer modified binder, cold thixotropic bituminous compound or polymer-modified adhesive bitumen strip, for use on longitudinal and transverse joints
- geocells/geotextiles/geomembranes selected to meet the requirements of each site, taking into account the site geometry and the sub-grade permeability for infiltration systems, and the thickness and type of geomembrane for tanked systems.

1.2 The system is used in conjunction with a spray-applied bitumen emulsion tack or bond coat conforming to BS EN 13808 : 2013 or BS EN 14023 : 2010.

1.3 Bituminous-bound and unbound layer depths are determined in accordance with the design procedures identified in section 4.

1.4 Ancillary items used with the system, but outside the scope of this Certificate, include:

- joint preparation — hot-applied bitumen ( $\geq 40$  penetration) to BS EN 12591 : 2009, hot elastomeric polymer-modified bitumen ( $\geq 40$  penetration), cold-applied thixotropic bituminous compound, or polymer modified adhesive bitumen strip
- tack coat — C40 B 4 (K1-40) or C60 B 4 (K1-60) bitumen emulsion tack coat conforming to BS EN 13808 : 2013, for use on small areas not accessible by machine application
- pigments — used in the surface course for colour purposes. The colour retention of the surface has not been assessed by the BBA and is outside the scope of this Certificate.

## 2 Manufacture

2.1 As part of the assessment and ongoing surveillance of product quality, the BBA has:

- agreed with the manufacturer the quality control procedures and product testing to be undertaken
- assessed and agreed the quality control operated over batches of incoming materials
- monitored the production process and verified that it is in accordance with the documented process
- evaluated the process for management of nonconformities
- checked that equipment has been properly tested and calibrated
- undertaken to carry out the above measures on a regular basis through a surveillance process, to verify that the specifications and quality control being operated by the manufacturer are being maintained.

2.2 The management system of the Certificate holder has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2008 by BSI (Certificate FM 33936).

## 3 Delivery and site handling

3.1 The bound layers are delivered to site in bulk, in insulated vehicles. The unbound layers are delivered to site in bulk sheeted vehicles.

3.2 The system is not classified under the *Classification, Labelling and Packaging of Substances and Mixtures (CLP Regulation)* 2009.

## Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on Breedon Porous.

### Design Considerations

## 4 General

4.1 Breedon Porous is satisfactory for use as a full-depth pavement system as part of a sustainable drainage system (SUDS) for surface water source control, in lightly-trafficked areas such as car parks, residential and urban roads.

4.2 A Breedon Porous pavement design for a specific project must always be preceded by a detailed review of the proposed site to establish:

- use/type of application
- traffic loading (commercial vehicles per day)
- suitability of site conditions for an attenuation/infiltration or combination system
- requirements for water harvesting
- nature of the sub-grade/receiving course (porosity, hydraulic conductivity/water infiltration rate, stability)
- other sources of surface run-off.

4.3 The choice of aggregate type used in the surface course will depend on site specific details including location and contractual requirements for polished stone values. The polished stone value will be measured in accordance with BS EN 1097-8 : 2009.

4.4 Once the design criteria have been established, there are two main parts to the design procedure: pavement structural design and hydraulic design. This design must be completed in accordance with the Breedon Porous Pervious Pavement System Design, Delivery and Installation Procedures Manual.

4.5 The Certificate holder will liaise with the specifier or appointed hydraulic engineer for adequate hydraulic design.

## 5 Practicability of installation

The system must only be installed by installers who have been trained and approved by the Certificate holder.

## 6 Mechanical resistance

Test results for design and site void content\*, rut rate and depth\* were reviewed. The results indicate that a satisfactory resistance to permanent deformation\* can be obtained.

## 7 Bond to substrate

The torque bond strength of the system measured greater than 400 kPa. This is considered satisfactory and would meet the minimum requirement of the BBA HAPAS *Guideline Document for the Assessment and Certification of Thin Surfacing Systems for Highways*, Table B.5.

## 8 Water sensitivity

Sensitivity to water tests were conducted on the bitumen bound layers. The results indicate that the bound layers will not be significantly affected by the presence of water.

## 9 Surface characteristics

Results of texture depth and Slip Resistance Value (SRV) [or Pendulum Test Value (PTV)] of the surface course, measured in accordance with BS 598-105 : 2000 and BS EN 13036-4 : 2003, indicate that a satisfactory skid resistance can be achieved (see Table 2 in section 15 of this Certificate).

## 10 Permeability

A review of initial and retained in-situ surface infiltration, completed on various site trials, indicate that water will flow through each layer and the complete system at, or in excess of, the design rate of 5000 mm·h<sup>-1</sup> (see Tables 1 and 3 in section 15 of this Certificate).

## 11 Maintenance

The surface should be cleaned periodically using a sweeper fitted with water jetting and vacuuming equipment. Power washing or mechanical brushing must not be used to clean the laid asphalt as this will result in the detritus becoming ingrained in the surfacing.

## 12 Durability

The system has been used in the UK since 2005. Available evidence suggests that, provided adequate maintenance is carried out in accordance with the recommendations of section 11, the system will provide a durable pervious pavement for use as part of a sustainable drainage system (SUDS).

## Installation

### 13 General

13.1 Breedon Porous is installed by the Certificate holder's installers in accordance with procedures detailed in their Design, Delivery and Installation Procedures Manual and the relevant clauses of BS 594987 : 2015, which includes requirements for:

- site inspection and assessment
- surface preparation and cleanness
- acceptable weather conditions
- minimum paver and rolling temperatures (bitumen-bound layers only)
- site-specific toolbox talks
- equipment type and operation
- joint making
- compaction procedure
- precautions during installation

- record keeping
- installation method statement.

13.2 When geocells, geomembrane or geotextiles are used they must be installed in accordance with the manufacturer's recommendations.

### **Unbound layers**

13.3 For large areas it is recommended that a paver is used. The use of pneumatic tyred rollers (PTRs) is recommended for compaction, and vibration is not used. The use of geocells to provide support and stability to the unbound layers is recommended.

13.4 The use of geomembranes and geotextiles is dependent on the California bearing ratio of the sub-grade, the thickness of the sub-base, the anticipated traffic loading and whether infiltration or attenuation is required.

### **Bituminous bound layers**

13.5 Asphalt must be delivered and compacted within four hours of manufacture. Prior to compaction, the asphalt is visually inspected and the temperature checked to confirm that the required rolling temperature can still be achieved. The minimum rolling temperature is binder specific and will be either 90°C or 120°C. This must be identified by the Certificate holder prior to the commencement of installation.

13.6 The minimum surface temperature prior to laying must be -1°C on a rising thermometer, provided the surface is dry and free from ice. Laying must be suspended when the air temperature reaches 0°C on a falling thermometer.

13.7 Owing to the open-graded nature of the unbound layers, some disturbance of the sub-base surface will occur during the installation of the base course. To minimise this, a geocell top layer is used along with a 2/6.3 mm aggregate. The sub-base and geocell top layer should be continuously monitored for any major disturbance. If any occurs, the paver is stopped, the delivery vehicle is pulled off the paver and the sub-base is re-compacted, and aggregate added if necessary, before continuing with installation.

### **Joints**

13.8 All bituminous bound longitudinal joints should be prepared as follows:

- cold cut joints should be cut to a full depth vertical face and painted with a material selected from those listed in section 1.4 of this Certificate prior to the next run of material
- cold matched joints can be cold matched without cutting if the open edge presents a substantially vertical face and has no major lateral deviations or damage from site traffic. The joint must be painted as described for cold cut joints
- warm matched joints can be warm matched without cutting when the mat temperature is at, or above, 50°C. The joint must be painted as described for cold cut joints
- when paving in echelon, the joints are matched without previous painting, subject to the minimum rolling temperature specified in section 13.5 being strictly adhered to.

13.9 Transverse joints should be cut or sawn to a vertical face at least 300 mm from the day joint.

## **14 Repair**

### **Major repairs**

14.1 The damaged area is removed by planing to the full depth of the affected layer. The planed area is reinstated using material to the same specification, unless otherwise agreed with the purchaser, using the procedures identified in section 13.

### **Minor repairs**

14.2 Minor repairs can be carried out by cutting out the damaged section and replacing it with a material of suitable specification agreed between the Certificate holder and the purchaser.

### 15 Tests

Tests were carried out at, or on samples taken from, Breedon Porous trial sites incorporating a 6 mm, 10 mm and 14 mm surface course. Tables 1 to 3 provide typical results from a Breedon Porous site completed using a 10 mm surface course.

*Table 1 Results from tests carried out on the Breedon Porous system with a 10 mm Breedon Porous surface course material*

Test	Mean result	Method
Torque bond strength at 20 ± 2°C (kPa)	487 <sup>(1)</sup>	Guideline Document, Appendix A.3
Surface infiltration (mm·hr <sup>-1</sup> )	8127 <sup>(2)</sup>	BS EN 12616 : 2013, Method A

(1) Mode of failure not recorded. Age at time of test <56 days.

(2) Mean water infiltration rate for full pavement depth, 3 years after installation.

*Table 2 Surface characteristics results for Breedon Porous 10 mm surface course*

Test	Result <sup>(1)(2)</sup>	Method
Texture depth (mm) trafficked	2.2	BS 598-105 : 2000

(1) Mean result measured approximately 4 months after installation.

(2) Granite aggregate.

*Table 3 Results from tests carried out in-situ on Breedon Porous system with a 10 mm surface course*

Test	Mean result	Method
Surface infiltration (mm/hr)	12187 <sup>(1)</sup>	BS EN 12616 : 2013, Method A

(1) Mean result measured 2 months after installation.

### 16 Investigations

16.1 An installation of Breedon Porous was witnessed by the BBA to confirm the practicability of the installation and on-site quality control procedures.

16.2 A user/specifier survey relating to the performance of use was carried out to confirm the system's performance and durability in service for the typical applications stated in this Certificate.

16.3 The manufacturing process was evaluated, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used. The inspection confirmed that the plant operated in accordance with requirements and the Quality Plan and Quality System agreed with the BBA.

16.4 Visits to existing sites were conducted by the BBA to confirm the system's performance in use.

16.5 Evaluation of test data relating to the 6 mm, 10 mm and 14 mm surface course and the 20 mm binder course confirmed satisfactory properties relative to in-situ and laboratory design performance claims.

## Bibliography

- BS 598-105 : 2000 *Sampling and examination of bituminous mixtures for roads and other paved areas — Methods of test for the determination of texture depth*
- BS 594987 : 2015 *Asphalt for roads and other paved areas — Specification for transport, laying, compaction and product-type testing protocols*
- BS EN 1097-8 : 2009 *Tests for mechanical and physical properties of aggregates — Determination of the polished stone value*
- BS EN 12591 : 2009 *Bitumen and bituminous binders — Specifications for paving grade bitumen*
- BS EN 12616 : 2013 *Surfaces for sports areas — Determination of water infiltration rate*
- BS EN 13036-4 : 2003 *Road and airfield surface characteristics — Test methods — Method for measurement of slip/skid resistance of the surface: The pendulum test*
- BS EN 13043 : 2002 *Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas*
- BS EN 13108-7 : 2006 *Bituminous mixtures — Material specifications — Porous Asphalt*
- BS EN 13242 : 2013 *Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction*
- BS EN 13808 : 2013 *Bitumen and bituminous binders — Framework for specifying cationic bituminous emulsions*
- BS EN 14023 : 2010 *Bitumen and bituminous binders — Specification framework for polymer modified bitumens*
- BS EN ISO 9001 : 2008 *Quality management systems — Requirements*
- Guideline Document for the Assessment and Certification of Thin Surfacing Systems for Highways, July 2015*
- Manual of Contract Documents for Highway Works, Volume 1 Specification for Highway Works, Clause 801*

### 17 Conditions

#### 17.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is issued only to the company, firm, organisation or person named on the front page – no other company, firm, organisation or person may hold claim that this Certificate has been issued to them
- is valid only within the UK
- has to be read, considered and used as a whole document – it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English Law.

17.2 Publications, documents, specifications, legislation, regulations, standards and the like referenced in this Certificate are those that were current and/or deemed relevant by the BBA at the date of issue or reissue of this Certificate.

17.3 This Certificate will remain valid for an unlimited period provided that the product/system and its manufacture and/or fabrication, including all related and relevant parts and processes thereof:

- are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA
- continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine
- are reviewed by the BBA as and when it considers appropriate.

17.4 The BBA has used due skill, care and diligence in preparing this Certificate, but no warranty is provided.

17.5 In issuing this Certificate the BBA is not responsible and is excluded from any liability to any company, firm, organisation or person, for any matters arising directly or indirectly from:

- the presence or absence of any patent, intellectual property or similar rights subsisting in the product/system or any other product/system
- the right of the Certificate holder to manufacture, supply, install, maintain or market the product/system
- actual installations of the product/system, including their nature, design, methods, performance, workmanship and maintenance
- any works and constructions in which the product/system is installed, including their nature, design, methods, performance, workmanship and maintenance
- any loss or damage, including personal injury, howsoever caused by the product/system, including its manufacture, supply, installation, use, maintenance and removal
- any claims by the manufacturer relating to CE marking.

17.6 Any information relating to the manufacture, supply, installation, use, maintenance and removal of this product/system which is contained or referred to in this Certificate is the minimum required to be met when the product/system is manufactured, supplied, installed, used, maintained and removed. It does not purport in any way to restate the requirements of the Health and Safety at Work etc. Act 1974, or of any other statutory, common law or other duty which may exist at the date of issue or reissue of this Certificate; nor is conformity with such information to be taken as satisfying the requirements of the 1974 Act or of any statutory, common law or other duty of care.