

## MILES MACADAM GROUTED MACADAM SURFACE COURSE SYSTEMS FOR HIGHWAYS

### HARDIPAVE

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 Government and the Department for Infrastructure, 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 Hardipave, a grouted macadam surface course for use as an alternative to conventional bituminous and concrete surface courses for new-build and road maintenance where high strength, rut resistance or fuel resistance are required.

#### 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

**Surface characteristics** — the initial and retained surface texture depth and skid resistance has been measured and is considered satisfactory (see section 6).

**Mechanical resistance** — the system has a satisfactory resistance to trafficking and loadings associated with its intended use (see section 7).

**Sensitivity to water and diesel** — the system has a satisfactory retained stiffness after conditioning in water and diesel (see section 8).

**Durability** — the system will provide a durable surface course with a working life equivalent to, or greater than, that expected of a conventional asphalt surface (see section 10).



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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Originally certificated on 13 January 2006



Hardy Giesler  
Chief Executive Officer

*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 MUST check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA directly.*

*Any photographs are for illustrative purposes only, do not constitute advice and should not be relied upon.*

## Requirements

In the opinion of the BBA, Hardipave, when manufactured and installed in accordance with the provisions of this Certificate, will provide an alternative to conventional bituminous or concrete surface courses.

Additional requirements of the overseeing organisations for surface course products on highways are given in the *Manual of Contract Documents for Highway Works (MCHW)*<sup>(1)</sup>, Volumes 1 and 2, Series 900 and 1000.

(1) The MCHW is operated by the Overseeing Organisations: Highways England (HE), Transport Scotland, the Welsh Government and the Department for Infrastructure (Northern Ireland).

## Regulations

### **Construction (Design and Management) Regulations 2015** **Construction (Design and Management) Regulations (Northern Ireland) 2016**

Information in this Certificate may assist the client, designer (including Principal Designer) and contractor (including Principal Contractor) to address their obligations under these Regulations.

See section: *3 Delivery and site handling* (3.2 and 3.3) of this Certificate.

## Technical Specification

### **1 Description**

1.1 Hardipave is a grouted macadam surface course, consisting of a proprietary 0/14 open-graded asphalt receiving course (incorporating a paving grade bitumen to BS EN 12591 : 2009 and aggregates to BS EN 13043 :2013), and a proprietary cementitious grout.

1.2 The grout comprises Portland cement, polymer, fine mineral aggregate and water. Optional plasticising and anti-foaming agents, rapid-curing additives and coloured pigments may also be included.

1.3 The system is used in conjunction with a bitumen emulsion tack coat or bond coat conforming to BS EN 13808 : 2013, to seal and enhance adhesion to the substrate.

### **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 Miles Macadam Ltd has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2015 by ISOQAR (Certificate 1140-Q15-001).

### **3 Delivery and site handling**

3.1 The receiving course is delivered to a site in accordance with BS 594987 : 2015, Section 4.

3.2 The cementitious powder for the grout is delivered in 750 kg pre-mixed bulk bags.

3.3 The Certificate holder has taken the responsibility of classifying and labelling the system under the *CLP Regulation (EC) No 1272/2008 on the classification, labelling and packaging of substances and mixtures*. Users must refer to the relevant Safety Data Sheet(s).

## Assessment and Technical Investigations

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

### Design Considerations

## 4 Use

4.1 Hardipave is satisfactory for use as a surface course in trafficked areas where low-speed traffic, heavy loads and fuel spillages occur. Low-speed traffic is defined for the purpose of this Certificate as roads with posted speed limits less than 40 mph.

4.2 The system can be applied to a bituminous or concrete substrate provided the underlying layers of the pavement are stable, and have sufficient load-spreading capabilities to support the imposed loading of the surface course during installation and expected service life.

4.3 The system can be used as part of new or maintenance pavement construction.

4.4 Construction joints are not required with the system. However, where it is laid over an existing concrete surface, any existing joints should be retained in the new surface to reduce the possibility of reflective cracking.

4.5 The choice of aggregate type will depend on site-specific details, including location and contractual requirements for polished stone value (PSV), texture depth and other properties.

## 5 Practicability of installation

### Receiving course

5.1 The receiving course is installed by contractors approved by the Certificate holder, using conventional paving equipment.

### Cementitious grout

5.2 The cementitious grout is applied by contractors trained and approved by the Certificate holder using proprietary grout mixing and application equipment.

## 6 Surface characteristics

### Initial texture depth

6.1 The system can achieve a mean initial (prior to trafficking) surface texture depth of between 1.0 and 1.5 mm when measured in accordance with BS EN 13036-1 : 2010.

### Initial skid resistance

6.2 The system can achieve a mean initial (prior to trafficking) skid resistance value (SRV) of  $\geq 40$  for the brush finish, and  $\geq 50$  for the brush finish and granite application (see section 11), when measured in accordance with BS EN 13036-4 : 2011.

### Erosion index

6.3 The system can maintain an erosion index of 0 when measured before and after surface immersion in diesel and freeze/thaw conditioning.

## 7 Mechanical resistance

### Resistance to permanent deformation

7.1 The system has a resistance to rut rate and rut depth that is classified as Type 2 in accordance with PD 6691 : 2015, Appendix D, Table D2, and is suitable for heavily stressed sites requiring very high rut resistance.

### Torque bond strength

7.2 The system, when installed in accordance with the provisions of this Certificate, has a torque bond strength of  $\geq 200$  kPa when measured in accordance with the BBA HAPAS *Guideline Document for the Assessment and Certification of Thin Surfacing Systems for Highways*, Appendix A.3.

## 8 Sensitivity to water and diesel

### Sensitivity to water

8.1 A retained stiffness of 94.6% was measured after conditioning in water. The results indicate that the system is not significantly affected after such exposure.

### Sensitivity to diesel

8.2 A retained stiffness of 60.9% was measured after conditioning in diesel. The core samples tested showed the surface was unaffected. The underside and cored faces showed some damage from diesel penetration. The results indicate that provided full penetration of the grout is achieved, the system is not significantly affected.

## 9 Maintenance

The system does not require routine maintenance. However, any damage must be repaired at the earliest opportunity (see section 12).

## 10 Durability

10.1 The system will provide a satisfactory alternative to conventional bituminous and concrete surface course materials that are exposed to low-speed traffic, heavy loads and fuel spillages.

10.2 Where satisfactory penetration of the grout is achieved, and substrates are structurally sound with load-spreading capabilities adequate to accommodate the imposed loading associated with the installation of the system and end use, available evidence indicates that the system will provide a durable surface course with a working life in excess of a conventional asphalt surfacing.

## Installation

## 11 General

### Receiving course

11.1 Hardipave 0/14 mm receiving course is installed in accordance with the Certificate holder's installation procedures, and a BBA Agreed Method Statement incorporating the following sections of BS 594987 : 2015:

- 5 *Preparatory works at the laying site* (except that bitumen emulsion tack coat to BS EN 13808 : 2013 will be applied to ensure a minimum residual bitumen of  $0.2 \text{ kg}\cdot\text{m}^{-2}$  and joints must not be painted to ensure satisfactory penetration of the grout)
- 6 *Laying* (the receiving course can be applied at a nominal layer thickness of between 35 and 50 mm)
- 9 *Compaction*
- 10 *Opening to traffic*.

## Cementitious grout

11.2 The grout is applied by the Certificate holder in accordance with the Certificate holder's installation procedures and a BBA Agreed Method Statement which includes recommendations for:

- spread rates of the grout
- limiting weather conditions
- compaction
- support coat requirements.

11.3 The grout can only be applied when the receiving course has been compacted and has cooled to a temperature below 40°C.

11.4 The grout is applied to the receiving course and spread with brooms and squeegees. Grout movement through the receiving course is by natural percolation, and a vibrating roller or plate. The grout should completely fill the receiving course. This is achieved by adding grout until asphalt is no longer visible and air bubbles have stopped rising to the surface.

11.5 Grout spread rate is calculated by measuring the square metre coverage versus the tonnage of grout used.

11.6 The grout should not be applied to the receiving course if free-standing water, ice or snow is present, during periods of heavy rain, or if exposure to frost is likely to occur during initial curing.

11.7 Full penetration of the grout must be achieved.

11.8 Following full penetration of the grout, a 0/2 mm granite can be applied to the surface at a nominal spread rate of 0.5 kg·m<sup>2</sup>.

## Curing

11.9 The curing time of the grout varies with ambient conditions. The Certificate holder recommends the following minimum durations, and should be consulted if doubt exists as to when the surface should be trafficked:

- pedestrian traffic — 12 hours
- vehicular traffic, eg commercial vehicles, cars — 24 hours
- exposure to high stress — 24 hours.

## 12 Repair

In the event of damage during installation or service, the system can be repaired by removing the damaged area and reinstalling the system in accordance with the procedures given in section 11.

## Technical Investigations

## 13 Tests

Tests were conducted on samples of Hardipave and the results assessed to determine:

- erosion index at 45°C after scuffing
  - control
  - after diesel immersion
  - after freeze/thaw
- sensitivity to water
- sensitivity to diesel
- torque bond strength at 20°C (kPa)
- wheel tracking at 60°C

- rate ( $\text{mm}\cdot\text{h}^{-1}$ )
- rut depth (mm)
- texture depth
- skid resistance.

## 14 Investigations

14.1 A trial was carried out to assess the practicability of the installation and on-site quality control procedures for the receiving course and the cementitious grout. A visual inspection of the site concluded that it was free from significant abnormalities.

14.2 A user/specifier survey relating to the performance in use was carried out which confirmed the system performance and durability in applications typical of those quoted within this Certificate.

14.3 The manufacturing process for the cementitious powder was evaluated by inspection of the factory and the methods adopted for quality control, and the quality and composition of the materials used. The inspection confirmed that the plant operated in accordance with requirements of the Quality Plan and Quality System agreed with the BBA.

14.4 The BBA carried out additional visual inspections at existing sites to confirm the performance of the system.

14.5 Test data relating to a comparison between Hardicrete (a heavy-duty, jointless surfacing/industrial paving, also produced by the Certificate holder) and Hardipave, carried out by Scott Wilson Pavement Engineering on behalf of the Certificate holder, have been used to support the Technical Investigations.

14.6 Additional data from Griptest surveys of Hardipave sites was supplied to support performance claims for surface characteristics after trafficking.

## Bibliography

BS 594987 : 2015 *Asphalt for roads and other paved areas — Specification for transport, laying and compaction and type testing protocols*

BS EN 12591 : 2009 *Bitumen and bituminous binders — Specifications for paving grade bitumens*

BS EN 13036-1 : 2010 *Road and airfield surface characteristics — Test methods — Measurement of pavement surface macrotexture depth using a volumetric patch technique*

BS EN 13036-4 : 2011 *Road and airfield surface characteristics — Test methods — Method for measurement of slip/skid resistance of a surface — The pendulum test*

BS EN 13043 : 2013 *Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas*

BS EN 13808 : 2013 *Bitumen and bituminous binders — Framework for specifying cationic bituminous emulsions*

BS EN ISO 9001 : 2015 *Quality management systems — Requirements*

Guideline Document for the Assessment and Certification of Thin Surfacing Systems for Highways, July 2004

Manual of Contract Documents for Highway Works, Volume 1 *Specification for Highway Works*

Manual of Contract Documents for Highway Works, Volume 2 *Notes for Guidance on the Specification for Highway Works*

PD 6691 : 2015 *Guidance on the use of BS EN 13108, Bituminous mixtures — Material specification*

### 15 Conditions

#### 15.1 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 or 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.

15.2 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.

15.3 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.

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

15.5 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.

15.6 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.