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HAPAS

Roads and Bridges
Agrément Certificate
No 01/H048

Second issue*

Designated by Government
to issue
European Technical
Approvals

AGGREGATE INDUSTRIES THIN SURFACING SYSTEMS FOR HIGHWAYS

This Certificate is issued under the Highway Authorities Product Approval Scheme (HAPAS) by the BBA in conjunction with the Highways Agency (acting on behalf of the overseeing organisations of the Department for Transport; the Scottish Executive Development Department; the Welsh Assembly Government; the Department for Regional Development, Northern Ireland), the County Surveyors' Society, the Local Government Technical Advisers Group, and industry bodies. HAPAS Agrément Certificates are normally each subject to a review every five years.

Product



• THIS CERTIFICATE RELATES TO AGGREGATE INDUSTRIES THIN SURFACING SYSTEMS FOR HIGHWAYS, COMPRISING EITHER A POLYMER-MODIFIED BINDER OR PENETRATION GRADE BITUMEN WITH CELLULOSE FIBRES, LIMESTONE FILLER AND GRADED FINE AND COARSE AGGREGATES.

- The systems are used in conjunction with either a bitumen emulsion or a polymer-modified bond coat.
- The systems are installed only by contractors approved by Aggregate Industries UK Ltd using conventional paving equipment.

These Front Sheets must be read in conjunction with the accompanying Detail Sheets, which provide information to particular systems.

HAPAS Requirements — Detail Sheet 1

1 Requirements

The Highways Technical Advisory Committee (HiTAC) and HAPAS Specialist Group 3 (Thin Surfacing) have agreed with the British Board of Agrément the aspects of performance to be used by the BBA in assessing the compliance of Thin Surfacing Systems with the *Guidelines Document for the Assessment and Certification of Thin Surfacing Systems for Highways*. In the opinion of the BBA, the Aggregate Industries Thin Surfacing Systems for Highways, when manufactured and laid in accordance with the provisions of this Certificate, can be designed to meet the relevant requirements and can achieve the levels of performance given in Table 1 of the relevant Detail Sheet.

Regulations

2 Construction (Design and Management) Regulations 1994 (as amended)

Construction (Design and Management) Regulations (Northern Ireland) 1995 (as amended)

Information in this Certificate may assist the client, planning supervisor, designer and contractors to address their obligations under these Regulations.

See section: 4 Manufacture, quality control, delivery and site handling (4.2 and 4.3) of these Front Sheets.

Technical Specification

3 Description

3.1 Aggregate Industries Thin Surfacing Systems for Highways comprise a series of mixtures principally consisting of either a blend of a polymer-modified binder or penetration grade bitumen with cellulose fibres, limestone filler and graded fine and coarse aggregates. The systems are used in conjunction with either a bitumen emulsion or a polymer-modified bond coat.

3.2 The choice of aggregates, types and size used will depend on site specific details, including location, and contractual requirements for Polished Stone Value (PSV), texture depth and/or other properties. Reference should be made to the appropriate Detail Sheet for information on a particular system.

3.3 The petrological types of aggregates approved for use in the Aggregate Industries Systems include gritstones, granites, limestones and basalts.

4 Manufacture, quality control, delivery and site handling

4.1 The systems are manufactured, controlled and delivered in accordance with a BBA agreed Quality Plan which includes requirements for:

- binder
- aggregate selection
- plant suitability
- method of production and process control
- inspection and testing of finished product
- delivery vehicles.

4.2 Bond coats may be delivered to site either in bulk by tanker or in 200 kg drums.

4.3 The systems are not classified under the Chemicals (Hazard Information and Packaging for Supply) Regulations 2002 (CHIP3). Standard material safety data sheets for hot asphalts apply.

Installation

5 General

The systems are installed by approved contractors in accordance with the Certificate holder's installation procedures which include requirements for:

- limitations in respect of weather
- equipment
- substrate preparation
- joints
- installation procedures
- maintenance and repairs
- storage, handling and delivery
- on-site quality control and records
- technical requirements.

6 Maintenance and repair

Motorways, trunk roads and other major repairs

6.1 The damaged area is removed by planing, to provide a length of at least 15 m for resurfacing. The planed area is resurfaced using material to the same specification in accordance with the Certificate holder's installation procedures.

Minor repairs

6.2 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.

6.3 Where possible a diamond patch reinstatement shall be used. A minimum of 0.25 m in excess of the damaged area shall be replaced.

6.4 Joints must be saw cut, cleaned and painted with a thick uniform coating of hot bitumen.

Additional information

The management systems of Aggregate Industries UK Ltd have been assessed by the British Standards Institution as meeting the requirements of BS EN ISO 9001 : 2000, and also Sector Scheme No 14 *For the Quality Assurance of the Production of Asphalt Mixes*, Certificate No FM 25542.

Bibliography

BS EN ISO 9001 : 2000 *Quality management systems — Requirements*

Guidelines Document for the Assessment and Certification of Thin Surfacing Systems for Highways (Working Draft, Draft 4, 10th January 2000)

Conditions of Certification

7 Conditions

7.1 This Certificate:

- (a) relates only to the product that is described, installed, used and maintained as set out in this Certificate;
- (b) is granted only to the company, firm or person identified on the front cover — no other company, firm or person may hold or claim any entitlement to this Certificate;
- (c) is valid only within the UK;
- (d) has to be read, considered and used as a whole document — it may be misleading and will be incomplete to be selective;
- (e) is copyright of the BBA;
- (f) is subject to English law.

7.2 References in this Certificate to any Act of Parliament, Regulation made thereunder, Directive or Regulation of the European Union, Statutory Instrument, Code of Practice, British Standard, manufacturers' instructions or similar publication, are references to such publication in the form in which it was current at the date of this Certificate.

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

- (a) are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA;

(b) continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine;

(c) are reviewed by the BBA as and when it considers appropriate; and

(d) remain in accordance with the requirements of the Highway Authorities Product Approval Scheme.

7.4 In granting this Certificate, the BBA is not responsible for:

- (a) the presence or absence of any patent, intellectual property or similar rights subsisting in the product or any other product;
- (b) the right of the Certificate holder to market, supply, install or maintain the product; and
- (c) the actual works in which the product is installed, used and maintained, including the nature, design, methods and workmanship of such works.

7.5 Any recommendations relating to the use or installation of this product which are contained or referred to in this Certificate are the minimum standards required to be met when the product is used. They do not purport in any way to restate the requirements of the Health & Safety at Work etc Act 1974, or of any other statutory, common law or other duty which may exist at the date of this Certificate or in the future; nor is conformity with such recommendations to be taken as satisfying the requirements of the 1974 Act or of any present or future statutory, common law or other duty of care. In granting this Certificate, the BBA does not accept responsibility to any person or body for any loss or damage, including personal injury, arising as a direct or indirect result of the installation and use of this product.



In the opinion of the British Board of Agrément, Aggregate Industries Thin Surfacing Systems for Highways are fit for their intended use provided they are installed, used and maintained as set out in this Certificate. Certificate No 01/H048 is accordingly awarded to Aggregate Industries UK Ltd.

On behalf of the British Board of Agrément

A handwritten signature in black ink, appearing to read 'P. C. Hewitt', is written over a light grey background.

Date of Second issue: 27th August 2004

Chief Executive

**Original Certificate issued 22nd March 2001. This amended version includes revised HAPAS and CHIP3 statements, a new Quality Assurance Standard and updated Conditions of Certification.*

Electronic Copy

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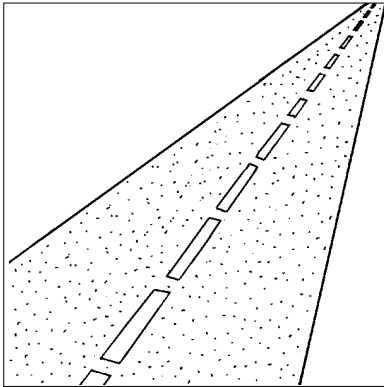
For technical or additional information,
contact the Certificate holder (see
front page).
For information about the Agrément
Certificate, including validity and
scope, tel: Hotline 01923 665400,
or check the BBA website.



Aggregate Industries UK Ltd

BARDON HITEX 14 mm THIN SURFACING SYSTEM FOR HIGHWAYS

Product



• THIS DETAIL SHEET RELATES TO THE BARDON HITEX 14 mm THIN SURFACING SYSTEM FOR HIGHWAYS.

• The system is for use as a thin road surfacing laid at nominal thicknesses between 25 mm and 50 mm, covering the Classification Type C as defined in Table 1 of the Guidelines Document for the Assessment and Certification of Thin Surfacing Systems for Highways.

This Detail Sheet must be read in conjunction with the Front Sheets which give additional information on the HAPAS Requirements, Regulations and Conditions of Certification.

Technical Specification

1 Description

1.1 Bardon Hitex 14 mm Thin Surfacing System for Highways comprises a mixture consisting of a blend of a polymer-modified binder (Hyplas 2, Styrelf, Cariphalte TS, Nypol or Olexobit 100) with limestone filler and graded fine and coarse aggregates (gritstone, granite or dolerite).

1.2 The system is used in conjunction with either K1-40 tack coat or Colbond 50 bond coat.

Design Data

2 General

2.1 Bardon Hitex 14 mm Thin Surfacing System for Highways is satisfactory for use as a thin surfacing system on highways.

2.2 The system is suitable for use on existing bituminous or concrete surfaces at a minimum temperature of 0°C, measured on a rising thermometer, provided the substrate is free from standing water or ice and that the minimum specified rolling temperature can be maintained in accordance with the Certificate holder's installation instructions.

2.3 The system, when manufactured and laid in accordance with the provisions of this Detail Sheet, can be designed to achieve the Performance Levels given in Table 1.

Table 1 Performance Levels achieved on trial installation⁽¹⁾

Test parameter	Performance Level achieved ⁽²⁾	Requirement
Texture depth untrafficked (mm)	3	≥ 1.5
after two year trafficking (mm)		≥ 1.0
Wheel tracking rate (mean/max individual) (mm h ⁻¹)	3	≤ 5.0/≤ 7.5
rut depth (mean/max individual) (mm)		≤ 7.0/≤ 10.5

(1) Mixture using Hyplas 2 binder and gritstone aggregate.

(2) Performance Levels are defined in Appendix B of the Guidelines Document.

3 Durability

3.1 The system has been used in the United Kingdom since 1994 and available evidence suggests that it will provide a durable surface course, suitable for use on all classes of road.

3.2 A monitored installation leading to HA Type Approval showed that, when laid at a nominal thickness of 30 mm on a road of Stress Level 1⁽¹⁾ and estimated Traffic Level of 1000 cv/l/d⁽²⁾, the system will meet the Performance Level 3⁽³⁾ requirement for initial and retained texture.

(1) Site Stress Levels are defined in Appendix C of the Guidelines Document.

(2) Traffic Levels (cv/l/d) are defined as commercial vehicles/lane/day.

(3) Performance Levels are defined in Appendix B of the Guidelines Document.

3.3 The results of the trial when assessed in accordance with Appendix C of the Guidelines Document, indicate that the system is suitable for use to achieve Performance Level 3 for texture depths on sites with Traffic Levels of C_{max} :

Site Stress Level 1	4500 cv/l/d
Site Stress Level 2	2000 cv/l/d
Site Stress Level 3	1500 cv/l/d
Site Stress Level 4	1000 cv/l/d.

Technical Investigations

The following is a summary of the technical investigations carried out on the Bardon Hitex 14 mm Thin Surfacing System for Highways.

4 Tests

Mandatory laboratory and road tests

4.1 A series of tests was carried out on a mixture based on gritstone aggregate, Olexobit 100 binder and Colbond 50 bond coat laid on the A303 road. The results of the tests are given in Tables 2 and 3.

Table 2 Mandatory tests carried out on the coarse aggregate, cores taken from the A303 road installation trial or on laboratory-prepared samples of the same mixture recipe

Test	Method	Mean result	Performance Level
Coarse aggregate properties:			
PSV	BS 812-114	66	n/a
AAV	BS 812-113	4.5	n/a
Wheel tracking at 60°C ⁽²⁾	Appendix A.1 Guidelines Document		
rate (mm h ⁻¹)		0.3	3
rut depth (mm)		1.6	
Sensitivity to water: retained stiffness (ITSM _{c3}) ⁽³⁾ (%)	Appendix A.2 Guidelines Document	107	n/a
Torque bond strength at 20±2°C on 95 mm diameter cores (kPa)	Appendix A.3 Guidelines Document	598	n/a

(1) Mixture using Olexobit 100 binder, gritstone aggregate and Colbond 50 bond coat.

(2) Mean core thickness = 27 mm.

(3) Retained indirect stiffness modulus at 20±0.5°C after three water conditioning cycles carried out on laboratory-prepared samples.

n/a = not applicable.

Table 3 Mandatory checks and tests carried out on the A303 road installation

Test	Method	Mean result	Requirement
Initial texture depth sand patch (mm)	BS 598-105	1.6	≥1.50
Visual observations		Good uniform surface with no significant faults or abnormalities noted	

Additional tests

4.2 A series of tests was carried out to confirm the performance of the system for wheel tracking. The results of the tests are given in Tables 4 to 8.

Table 4 Test on Hitex 14 mm using Olexobit 100 binder with a mean core thickness of 37 mm. Cores taken from M5 motorway, junctions 25–26

Test	Method	Mean result
Wheel tracking at 60°C:	Appendix A.1 Guidelines Document	
rate (mm h ⁻¹)		0.9
rut depth (mm)		2.5

Table 5 Test on Hitex 14 mm using Nypol binder with a mean core thickness of 33 mm. Cores taken from A39 Welcome Cross site

Test	Method	Mean result
Wheel tracking at 60°C:	Appendix A.1 Guidelines Document	
rate (mm h ⁻¹)		0.3
rut depth (mm)		1.4

Table 6 Test on laboratory-prepared samples of Hitex 14 mm using Olexobit 100 binder with a mean thickness of 50 mm

Test	Method	Mean result
Wheel tracking at 60°C:	Appendix A.1 Guidelines Document	
rate (mm h ⁻¹)		1.1
rut depth (mm)		2.6

Table 7 Test on laboratory-prepared samples of Hitex 14 mm using Styrelf binder with a mean thickness of 40 mm

Test	Method	Mean result
Wheel tracking at 60°C:	Appendix A.1 Guidelines Document	
rate (mm h ⁻¹)		0.3
rut depth (mm)		2.1

Table 8 Test on laboratory-prepared samples of Hitex 14 mm using Cariphalte TS binder with a mean thickness of 51 mm

Test	Method	Mean result
Wheel tracking at 60°C:	Appendix A.1 Guidelines Document	
rate (mm h ⁻¹)		0.4
rut depth (mm)		0.8

4.3 Supporting test data for wheel tracking at 60°C on a mixture using Hyplas 2, indicate satisfactory performance.

4.4 A series of tests was carried out to confirm the performance of the system for sensitivity to water. The results of the tests are given in Tables 9 to 11.

Table 9 Test on Hitex 14 mm using Hyplas 2 binder and granite aggregate

Test	Method	Mean result
Sensitivity to water: retained stiffness (ITSM _{c3}) ⁽¹⁾ (%)	Appendix A.2 Guidelines Document	89

(1) Retained indirect stiffness modulus at 20°C±0.5°C after three water conditioning cycles carried out on laboratory-prepared samples.

Table 10 Test on Hitex 14 mm using Nypol binder and gritstone aggregate

Test	Method	Mean result
Sensitivity to water: retained stiffness (ITSM _{c3}) ⁽¹⁾ (%)	Appendix A.2, draft Guidelines Document	91

(1) Retained indirect stiffness modulus at 20°C±0.5°C after three water conditioning cycles carried out on laboratory-prepared samples.

Table 11 Test on Hitex 14 mm using Styrelf binder and gritstone aggregate

Test	Method	Mean result
Sensitivity to water: retained stiffness (ITSM _{c3}) ⁽¹⁾ (%)	Appendix A.2 Guidelines Document	113

(1) Retained indirect stiffness modulus at 20°C±0.5°C after three water conditioning cycles carried out on laboratory-prepared samples.

4.5 Supporting test data for sensitivity to water on a mixture using Hyplas 2 binder and dolerite aggregate, indicate satisfactory performance.

4.6 A series of tests was carried out to confirm the performance of the system for torque bond strength. The results of the tests are given in Tables 12 to 15.

Table 12 Test on Hitex 14 mm using Olexobit 100 binder and no bond coat. Cores taken from M6 motorway

Test	Method	Mean result
Torque bond strength at 20±2°C on 100 mm diameter cores (kPa)	Appendix A.3 Guidelines Document	1044

Table 13 Test on Hitex 14 mm using Olexobit 100 binder and K1-40 bond coat. Cores taken from M5 motorway

Test	Method	Mean result
Torque bond strength at 20±2°C on 95 mm diameter cores (kPa)	Appendix A.3 Guidelines Document	1017

Table 14 Test on Hitex 14 mm using Hyplas 2 binder and K1-40 bond coat. Cores taken from trial installation at Bardon Hill Quarry

Test	Method	Mean result
Torque bond strength at 20±2°C on 100 mm diameter cores (kPa)	Appendix A.3 Guidelines Document	490

Table 15 Test on Hitex 14 mm using Nypol binder and K1-40 bond coat. Cores taken from A39 Clovelly to Bude

Test	Method	Mean result
Torque bond strength at 20±2°C on 99 mm diameter cores (kPa)	Appendix A.3 Guidelines Document	1371

4.7 Details of a test for noise on Hitex 14 mm were submitted and the result of the test is given in Table 16.

4.8 Noise levels will be affected by site specific conditions, including location and the condition of the existing road, and therefore the RSI_H values determined for the A38 road installation may not be reproduced on other installations.

Table 16 Test on Hitex 14 mm at A38 Devon Expressway at Dart Bridge, Devon

Test	Method	Mean result ⁽¹⁾
Noise: RSI _H [dB(A)] ⁽²⁾	Statistical pass-by method Guidelines Document Appendix A.8	-3.6 ⁽³⁾
age of site when tested (years)		3

(1) Mixture using Olexobit 100 binder and gritstone aggregate.

(2) The minimum speed Road Surface Influence (RSI_H) is a measure of the difference in noise, that could be expected if compared against a theoretical hot-rolled asphalt surface with 2 mm texture depth. A negative result indicates a reduction in noise level. Noise levels will vary according to specific site conditions and system characteristics including texture, age of installation and voids content.

(3) Mean result of two measurements, -4.0 and -3.2.

5 Investigations

5.1 An installation trial was carried out to assess the practicability of the installation and on-site quality control procedures. A visual inspection of the site concluded that it was free from significant abnormalities. Results from the installation confirmed that it complied with the contractual requirements.

5.2 A user/specifier survey relating to existing sites that were at least two years old was carried out to confirm the system's performance in use.

5.3 The manufacturing process was examined by inspection of a typical coating plant, including the methods adopted for quality control, and details were confirmed of the quality and composition of materials used. The inspection confirmed that the plant operated in accordance with the requirements of the Quality Plan and Quality System agreed with the BBA.

6 Additional information

6.1 Details of a test for scuffing on Hitex 14 mm using Olexobit 100 binder and Cwm Nant Lleici aggregate were submitted and the result of the test is given in Table 17.

Table 17 Test on laboratory-prepared samples of Hitex 14 mm with a mean thickness of 60 mm

Test	Parameter	Method in TRL Report 176 ⁽¹⁾	Mean result
Scuffing at 45°C	Initially	Texture depth (mm)	1.6
	After 500 wheel-passes	Texture depth (mm)	1.3
		Erosion index	0.0
Scuffing at 45°C	Initially	Texture depth (mm)	1.7
	After heat ageing ⁽²⁾ and 500 wheel passes	Texture depth (mm)	1.4
		Erosion index	0.3

(1) Including any agreed amendments detailed in Appendix D of the *Guidelines Document for the Assessment and Certification of High-Friction Surfaces for Highways* (16 November 1998).

(2) Heat ageing for 112 days at 70°C±3°C.

6.2 This test does not constitute any compliance to a High-Friction Surfacing System.

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 812-113 : 1990 *Testing aggregates — Method for determination of aggregate abrasion (AAV)*

BS 812-114 : 1989 *Testing aggregates — Method for determination of the polished-stone value*

Guidelines Document for the Assessment and Certification of Thin Surfacing Systems for Highways (Working Draft 4, 10 January 2000)

TRL Report 176 : 1997 *Laboratory tests on high-friction surfaces for highways*



On behalf of the British Board of Agrément

A handwritten signature in black ink, appearing to read 'P. C. Newman'.

Date of Second issue: 22nd September 2003

Chief Executive

*Original Detail Sheet issued 22nd March 2001. This revised version includes the addition of Performance Level indicators, increased nominal thickness and more test results (Tables 6, 7, 16 and 17).



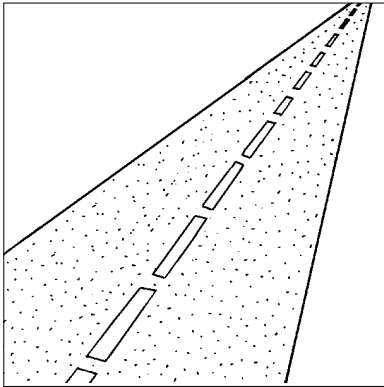
Aggregate Industries UK Ltd

BARDON THINPAVE 10 mm THIN SURFACING SYSTEM FOR HIGHWAYS

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HAPAS
Roads and Bridges
Certificate No 01/H048
DETAIL SHEET 3
Second issue*

Product



- THIS DETAIL SHEET RELATES TO THE BARDON THINPAVE 10 mm THIN SURFACING SYSTEM FOR HIGHWAYS.
- The system is for use as a thin road surfacing laid at nominal thicknesses between 18 mm and 40 mm, covering the Classification Types B and C as defined in Table 1 of the Guidelines Document for the Assessment and Certification of Thin Surfacing Systems for Highways.

This Detail Sheet must be read in conjunction with the Front Sheets which give additional information on the HAPAS Requirements, Regulations and Conditions of Certification.

Technical Specification

1 Description

1.1 Bardon Thinpave 10 mm Thin Surfacing System for Highways comprises a mixture consisting of a blend of a polymer-modified binder (Olexobit 100, Nypol, Cariphalte TS or latex/100/150 grade bitumen), with limestone filler and graded fine and coarse aggregates (gritstone, granite or dolerite).

1.2 The system is used in conjunction with either K1-40 tack coat or Colbond 50 bond coat.

Design Data

2 General

2.1 Bardon Thinpave 10 mm Thin Surfacing System for Highways is satisfactory for use as a thin surfacing system on highways.

2.2 The system is suitable for use on existing bituminous or concrete surfaces at a minimum temperature of 0°C, measured on a rising thermometer, provided the substrate is free from standing water or ice and that the minimum specified rolling temperature can be maintained in accordance with the Certificate holder's installation instructions.

2.3 The system, when manufactured and laid in accordance with the provisions of this Detail Sheet,

can be designed to achieve the Performance Levels given in Table 1.

Table 1 Performance Levels achieved on trial installation⁽¹⁾

Test parameter	Performance Level achieved ⁽²⁾	Requirement
Texture depth untrafficked (mm)	3	≥ 1.5
after two year trafficking (mm)		≥ 1.0
Wheel tracking rate (mean/max individual) (mm h ⁻¹)	3	≤ 5.0/≤ 7.5
rut depth (mean/max individual) (mm)		≤ 7.0/≤ 10.5

(1) Mixture using latex/100/150 grade bitumen and granite aggregate.

(2) Performance Levels are defined in Appendix B of the Guidelines Document.

3 Durability

3.1 The system has been used in the United Kingdom since 1996 and available evidence suggests that it will provide a durable surface course, suitable for use on all classes of road.

3.2 A monitored installation leading to HA Type Approval showed that, when laid at a nominal thickness of 27 mm on a road of Stress Level 1⁽¹⁾ and estimated Traffic Level of 1000 cv/l/d⁽²⁾, the system will meet the Performance Level 3⁽³⁾ requirement for initial and retained texture.

(1) Site Stress Levels are defined in Appendix C of the Guidelines Document.

(2) Traffic Levels (cv/l/d) are defined as commercial vehicles/lane/day.

(3) Performance Levels are defined in Appendix B of the Guidelines Document.

3.3 The results of the trial when assessed in accordance with Appendix C of the Guidelines Document, indicate that the system is suitable for use to achieve Performance Level 3 for texture depths on sites with Traffic Levels of C_{max} :

Site Stress Level 1	>5000 cv/l/d
Site Stress Level 2	4500 cv/l/d
Site Stress Level 3	>2500 cv/l/d
Site Stress Level 4	1000 cv/l/d.

Technical Investigations

The following is a summary of the technical investigations carried out on the Bardon Thinpave 10 mm Thin Surfacing System for Highways.

4 Tests

4.1 A series of tests was carried out to confirm the performance of the system for wheel tracking. The results of the tests are given in Tables 2 to 5.

Table 2 Test on Thinpave 10 mm using Olexobit 100 binder with a mean core thickness of 23 mm. Cores taken from A35 Hunter's Lodge

Test	Method	Mean result
Wheel tracking at 60°C:	Appendix A.1 Guidelines Document	
rate (mm h ⁻¹)		2.1
rut depth (mm)		4.4

Table 3 Test on Thinpave 10 mm using Nypol binder with a mean core thickness of 29 mm. Cores taken from A38 Heatherfield to Goodstone Cross

Test	Method	Mean result
Wheel tracking at 60°C:	Appendix A.1 Guidelines Document	
rate (mm h ⁻¹)		0.7
rut depth (mm)		2.3

Table 4 Test on Thinpave 10 mm using latex/100/150 grade bitumen with a mean core thickness of 45 mm. Cores taken from a trial installation at Bardon Hill Quarry

Test	Method	Mean result
Wheel tracking at 60°C:	Appendix A.1 Guidelines Document	
rate (mm h ⁻¹)		2.5
rut depth (mm)		4.8

Table 5 Test on laboratory-prepared samples of Thinpave 10 mm using Cariphalte TS binder with a mean thickness of 40 mm

Test	Method	Mean result
Wheel tracking at 60°C:	Appendix A.1 Guidelines Document	
rate (mm h ⁻¹)		0.8
rut depth (mm)		2.1

4.2 A series of tests was carried out to confirm the performance of the system for sensitivity to water. The results of the tests are given in Tables 6 to 8.

Table 6 Test on Thinpave 10 mm using latex/100/150 grade bitumen and gritstone aggregate

Test	Method	Mean result
Sensitivity to water: retained stiffness (ITSM _{c3}) ⁽¹⁾ (%)	Appendix A.2 Guidelines Document	115

(1) Retained indirect stiffness modulus at 20°C±0.5°C after three water conditioning cycles carried out on laboratory-prepared samples.

Table 7 Test on the mixture using Olexobit 100 binder and gritstone aggregate

Test	Method	Mean result
Sensitivity to water: retained stiffness (ITSM _{c3}) ⁽¹⁾ (%)	Appendix A.2 Guidelines Document	101

(1) Retained indirect stiffness modulus at 20°C±0.5°C after three water conditioning cycles carried out on laboratory-prepared samples.

Table 8 Test on Thinpave 10 mm using Cariphalte TS binder and gritstone aggregate

Test	Method	Mean result
Sensitivity to water: retained stiffness (ITSM _{c3}) ⁽¹⁾ (%)	Appendix A.2 Guidelines Document	112

(1) Retained indirect stiffness modulus at 20°C±0.5°C after three water conditioning cycles carried out on laboratory-prepared samples.

4.3 Supporting test data for sensitivity to water on a mixture using Olexobit 100 binder and dolerite aggregate, indicate satisfactory performance.

4.4 A series of tests was carried out to confirm the performance of the system for torque bond strength. The results of the tests are given in Tables 9 and 10.

Table 9 Test on Thinpave 10 mm using Olexobit 100 binder and Colbond 50 bond coat. Cores taken from the A35 site

Test	Method	Mean result
Torque bond strength at 20°C±2°C on 100 mm diameter cores (kPa)	Appendix A.3 Guidelines Document	944

Table 10 Test on Thinpave 10 mm using latex/100/150 grade bitumen and K1-40 bond coat. Cores taken from a trial installation at Bardon Hill Quarry

Test	Method	Mean result
Torque bond strength at 20°C±2°C on 95 mm diameter cores (kPa)	Appendix A.3 Guidelines Document	589

Additional tests

4.5 Noise measurements made on an installation on the A38 indicate that Thinpave 10 mm can reduce noise levels generated by vehicle tyres acting on the road surface. The results are given in Table 11.

4.6 Noise levels will be affected by site specific conditions, including location and the condition of

the existing road, and therefore the RSI_H values determined for the A38 road installation may not be reproduced on other installations.

Table 11 Test on Thinpave 10 mm at A38 Devon Expressway at Heathfield, Devon

Test	Method	Mean result ⁽¹⁾
Noise: RSI_H [dB(A)] ⁽²⁾	Statistical pass-by method Guidelines Document Appendix A.8	-7.8 ⁽³⁾
age of site when tested (months)		30

(1) Mixture using Olexobit 100 binder and gritstone aggregate.

(2) The minimum speed Road Surface Influence (RSI_H) is a measure of the difference in noise, that could be expected if compared against a theoretical hot-rolled asphalt surface with 2 mm texture depth. A negative result indicates a reduction in noise level. Noise levels will vary according to specific site conditions and system characteristics including texture, age of installation and voids content.

(3) Mean result of two measurements, -8.0 and -7.7.

5 Investigations

5.1 A user/specifier survey relating to existing sites that were at least two years old was carried out to confirm the system's performance in use.

5.2 The manufacturing process was examined by inspection of a typical coating plant, including the methods adopted for quality control, and details were confirmed of the quality and composition of materials used. The inspection confirmed that the plant operated in accordance with the requirements of the Quality Plan and Quality System agreed with the BBA.

Bibliography

Guidelines Document for the Assessment and Certification of Thin Surfacing Systems for Highways (Working Draft 4, 10 January 2000)



On behalf of the British Board of Agrément

Date of Second issue: 22nd September 2003

A handwritten signature in black ink, appearing to read 'P. C. Hewitt'.

Chief Executive

**Original Detail Sheet issued 22nd March 2001. This revised version includes the addition of Performance Level indicators, increased nominal thickness and more test results (Tables 5, 8 and 11).*

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Aggregate Industries UK Ltd

BARDON SMATEX 14 mm THIN SURFACING SYSTEM FOR HIGHWAYS

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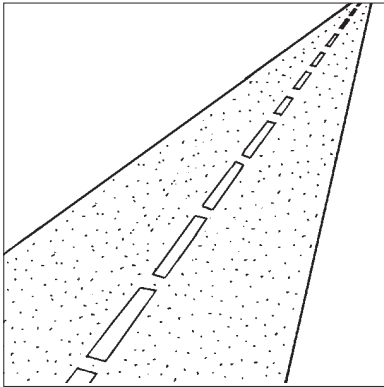
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DETAIL SHEET 4

Second issue*

Product



• THIS DETAIL SHEET RELATES TO THE BARDON SMATEX 14 mm THIN SURFACING SYSTEM FOR HIGHWAYS.

• The system is for use as a thin road surfacing laid at nominal thicknesses between 25 mm and 50 mm, covering the Classification Type C as defined in Table 1 of the Guidelines Document for the Assessment and Certification of Thin Surfacing Systems for Highways.

This Detail Sheet must be read in conjunction with the Front Sheets which give additional information on the HAPAS Requirements, Regulations and Conditions of Certification.

Technical Specification

1 Description

1.1 Bardon Smatex 14 mm Thin Surfacing System for Highways comprises a mixture consisting of a blend of polymer-modified binder (Cariphalte TS) or 40/60 grade bitumen and cellulose fibres with limestone filler and graded fine and coarse aggregates (gritstone, granite, dolerite or limestone).

1.2 The system is used in conjunction with either K1-40 tack coat or Colbond 50 bond coat.

Design Data

2 General

2.1 Bardon Smatex 14 mm Thin Surfacing System for Highways is satisfactory for use as a thin surfacing system on highways.

2.2 The system is suitable for use on existing bituminous or concrete surfaces at a minimum temperature of 0°C, measured on a rising thermometer, provided the substrate is free from standing water or ice and that the minimum specified rolling temperature can be maintained in accordance with the Certificate holder's installation instructions.

2.3 The system, when manufactured and laid in accordance with the provisions of this Detail Sheet,

can be designed to achieve the Performance Levels given in Table 1.

Table 1 Performance Levels achieved on trial installation⁽¹⁾

Test parameter	Performance Level achieved ⁽²⁾	Requirement
Texture depth untrafficked (mm)	3	≥1.5
after two year trafficking (mm)		≥1.0
Wheel tracking rate (mean/max individual) (mm h ⁻¹)	3	≤5.0/≤7.5
rut depth (mean/max individual) (mm)		≤7.0/≤10.5

(1) Mixture using 40/60 grade bitumen, cellulose fibre and gritstone aggregate.

(2) Performance Levels are defined in Appendix B of the Guidelines Document.

3 Durability

3.1 The system has been used in the United Kingdom since 1995 and available evidence suggests that it will provide a durable surface course, suitable for use on all classes of road.

3.2 A monitored installation leading to HA Type Approval showed that, when laid at a nominal thickness of 30 mm on a road of Stress Level 1⁽¹⁾ and estimated Traffic Level of 1770 cv/l/d⁽²⁾, the system will meet the Performance Level 3⁽³⁾ requirement for initial and retained texture.

(1) Site Stress Levels are defined in Appendix C of the Guidelines Document.

(2) Traffic Levels (cv/l/d) are defined as commercial vehicles/lane/day.

(3) Performance Levels are defined in Appendix B of the Guidelines Document.

3.3 The results of the trial when assessed in accordance with Appendix C of the Guidelines Document, indicate that the system is suitable for use to achieve Performance Level 3 for texture depths on sites with Traffic Levels of C_{max} :

Site Stress Level 1 and 2 >5000 cv/l/d
 Site Stress Level 3 and 4 >2500 cv/l/d

Technical Investigations

The following is a summary of the technical investigations carried out on the Bardon Smatex 14 mm Thin Surfacing System for Highways.

4 Tests

4.1 A series of tests was carried out to confirm the performance of the system for wheel tracking. The results of the tests are given in Tables 2 to 4.

Table 2 Test on Smatex 14 mm using 40/60 grade bitumen and cellulose fibres with a mean core thickness of 41 mm. Cores taken from North Road, Plymouth

Test	Method	Mean result
Wheel tracking at 60°C:	Appendix A.1 Guidelines Document	
rate (mm h ⁻¹)		0.6
rut depth (mm)		1.9

Table 3 Test on the laboratory-prepared samples of Smatex 14 mm using Cariphalte TS binder with a mean thickness of 32 mm

Test	Method	Mean result
Wheel tracking at 60°C:	Appendix A.1 Guidelines Document	
rate (mm h ⁻¹)		1.1
rut depth (mm)		3.0

Table 4 Test on the laboratory-prepared samples of Smatex 14 mm using 40/60 grade bitumen with a mean thickness of 50 mm

Test	Method	Mean result
Wheel tracking at 60°C:	Appendix A.1 Guidelines Document	
rate (mm h ⁻¹)		0.7
rut depth (mm)		1.2

4.2 A series of tests was carried out to confirm the performance of the system for sensitivity to water. The results of the tests are given in Tables 5 to 7.

Table 5 Test on Smatex 14 mm using 40/60 grade bitumen, cellulose fibres and gritstone aggregate

Test	Method	Mean result
Sensitivity to water: retained stiffness (ITSM _{c3}) ⁽¹⁾ (%)	Appendix A.2 Guidelines Document	91

(1) Retained indirect stiffness modulus at 20°C±0.5°C after three water conditioning cycles carried out on laboratory-prepared samples.

Table 6 Test on Smatex 14 mm using 40/60 grade bitumen, cellulose fibres and granite aggregate

Test	Method	Mean result
Sensitivity to water: retained stiffness (ITSM _{c3}) ⁽¹⁾ (%)	Appendix A.2 Guidelines Document	120

(1) Retained indirect stiffness modulus at 20°C±0.5°C after three water conditioning cycles carried out on laboratory-prepared samples.

Table 7 Test on Smatex 14 mm using 40/60 grade bitumen, cellulose fibres and limestone aggregate

Test	Method	Mean result
Sensitivity to water: retained stiffness (ITSM _{c3}) ⁽¹⁾ (%)	Appendix A.2 Guidelines Document	76

(1) Retained indirect stiffness modulus at 20°C±0.5°C after three water conditioning cycles carried out on laboratory-prepared samples.

4.3 Supporting test data for sensitivity to water on a mixture using dolerite aggregate, indicate satisfactory performance.

4.4 A series of tests was carried out to confirm the performance of the system for torque bond strength. The results of the tests are given in Table 8.

Table 8 Test on Smatex 14 mm using 40/60 grade bitumen, cellulose fibres and K1-40 bond coat. Cores taken from the M5

Test	Method	Mean result
Torque bond strength at 20°C±2°C on 100 mm diameter cores (kPa)	Appendix A.3 Guidelines Document	1258

5 Investigations

5.1 A user/specifier survey relating to existing sites that were at least two years old was carried out to confirm the system's performance in use.

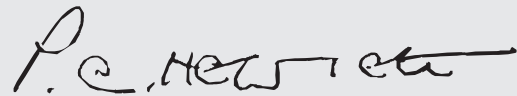
5.2 The manufacturing process was examined by inspection of a typical coating plant, including the methods adopted for quality control, and details were confirmed of the quality and composition of materials used. The inspection confirmed that the plant operated in accordance with the requirements of the Quality Plan and Quality System agreed with the BBA.

Guidelines Document for the Assessment and Certification of Thin Surfacing Systems for Highways (Working Draft 4, 10 January 2000)



On behalf of the British Board of Agrément

Date of Second issue: 22nd September 2003



Chief Executive

**Original Detail Sheet issued 22nd March 2001. This revised version includes the addition of Performance Level indicators, increased nominal thickness and more test results (Tables 3, 4 and 7).*

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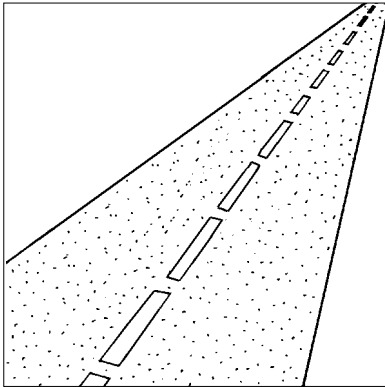
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Aggregate Industries UK Ltd

BARDON SMATEX 10 MM THIN SURFACING SYSTEM FOR HIGHWAYS

Product



• THIS DETAIL SHEET RELATES TO THE BARDON SMATEX 10 mm THIN SURFACING SYSTEM FOR HIGHWAYS.

• The system is for use as a thin road surfacing laid at nominal thicknesses between 18 mm and 50 mm, covering the Classification Type B and C as defined in Table 1 of the Guidelines Document for the Assessment and Certification of Thin Surfacing Systems for Highways.

This Detail Sheet must be read in conjunction with the Front Sheets which give additional information on the HAPAS Requirements, Regulations and Conditions of Certification.

Technical Specification

1 Description

1.1 The Bardon Smatex 10 mm Thin Surfacing System for Highways comprises a mixture consisting of a blend of polymer-modified binder (Cariphalte TS) or 40/60 grade bitumen with cellulose fibres, limestone filler and graded fine and coarse aggregates (gritstone, granite, basalt or quartzite).

1.2 The system is used in conjunction with either K1-40 tack coat or Colbond 50 bond coat.

Design Data

2 General

2.1 The Bardon Smatex 10 mm Thin Surfacing System for Highways is satisfactory for use as a thin surfacing system on highways.

2.2 The system is suitable for use on existing bituminous or concrete surfaces at a minimum temperature of 0°C, measured on a rising thermometer, provided the substrate is free from standing water or ice and that the minimum specified rolling temperature can be maintained in accordance with the Certificate holder's installation procedures.

2.3 The system, when manufactured and laid in accordance with the provisions of this Detail Sheet, can be designed to achieve the Performance Levels given in Table 1.

Table 1 Performance Levels

Test parameter	Performance Level ⁽¹⁾	Requirement
Texture depth untrafficked (mm)	2	≥1.2
after two years of trafficking (mm)		≥0.8
Wheel tracking rate (mean/max individual) (mm h ⁻¹)	3	≤5.0/≤7.5
rut depth (mean/max individual) (mm)		≤7.0/≤10.5

(1) Performance Levels are defined in Appendix B of the Guidelines Document.

3 Durability

The system has been used in the United Kingdom since 1994 and shares common elements with Bardon Smatex 14 mm, including the same binder, aggregate sources and bond coat. The available evidence suggests that it will provide a durable surface course, suitable for use on all classes of road where the two-year retained texture depth of >0.8 mm is required.

Technical Investigations

The following is a summary of the technical investigations carried out on the Bardon Smatex 10 mm Thin Surfacing System for Highways.

4 Tests

4.1 A series of tests was carried out to confirm the performance of the system. The results of the tests are given in Tables 2 to 9.

Table 2 Test on the laboratory-prepared samples of Smatex 10 mm using 40/60 grade bitumen with a mean thickness of 42 mm

Test	Method	Mean result
Wheel tracking at 60°C	Appendix A.1 Guidelines Document	
rate (mm h ⁻¹)		0.7
rut depth (mm)		1.6

Table 3 Test on the laboratory-prepared samples of Smatex 10 mm using Cariphalte TS binder with a mean thickness of 50 mm

Test	Method	Mean result
Wheel tracking at 60°C	Appendix A.1 Guidelines Document	
rate (mm h ⁻¹)		0.6
rut depth (mm)		0.7

Table 4 Test on Smatex 10 mm using 40/60 grade bitumen and gritstone aggregate

Test	Method	Mean result
Sensitivity to water retained stiffness (ITSM _{c3}) ⁽¹⁾ (%)	Appendix A.2 Guidelines Document	94

(1) Retained indirect stiffness modulus at 20±0.5°C after three water conditioning cycles carried out on laboratory-prepared samples

Table 5 Test on Smatex 10 mm using 40/60 grade bitumen and basalt aggregate

Test	Method	Mean result
Sensitivity to water retained stiffness (ITSM _{c3}) ⁽¹⁾ (%)	Appendix A.2 Guidelines Document	135

(1) Retained indirect stiffness modulus at 20±0.5°C after three water conditioning cycles carried out on laboratory-prepared samples

Table 6 Test on Smatex 10 mm using 40/60 grade bitumen and granite aggregate

Test	Method	Mean result
Sensitivity to water retained stiffness (ITSM _{c3}) ⁽¹⁾ (%)	Appendix A.2 Guidelines Document	103

(1) Retained indirect stiffness modulus at 20±0.5°C after three water conditioning cycles carried out on laboratory-prepared samples

Table 7 Test on Smatex 10 mm using 40/60 grade bitumen and quartzite aggregate

Test	Method	Mean result
Sensitivity to water retained stiffness (ITSM _{c3}) ⁽¹⁾ (%)	Appendix A.2 Guidelines Document	102

(1) Retained indirect stiffness modulus at 20±0.5°C after three water conditioning cycles carried out on laboratory-prepared samples

Table 8 Test on Smatex 10 mm using 40/60 grade bitumen and K1-40 bond coat

Test	Method	Mean result
Torque bond strength at 20±2°C on 98 mm diameter cores (kPa)	Appendix A.3 Guidelines Document	1393 ⁽¹⁾

(1) Mainly interface shear between the system and substrate.

Table 9 Performance Level achieved on the Cape Road, Warwick installation using Smatex 10 mm

Test parameter	Performance Level achieved ⁽¹⁾	Requirement
Texture depth untrafficked (mm)	2	≥1.2
after two years of trafficking (mm)		≥0.8

(1) Performance Levels are defined in Appendix B of the Guidelines Document.

4.2 The installation on the Cape Road, Warwick was laid at a nominal thickness of 30 mm on a road of Stress Level 1 and at an estimated Traffic Level of 456 cv/l/d, the system will meet the Performance Level 2 requirement for initial and retained texture.

4.3 The results of the installation when assessed in accordance with Appendix C of the Guidelines Document, indicate that the system is suitable for use to achieve Performance Level 2 for texture depths on sites with Traffic Levels of C_{max}:

Site Stress Level 1	3500 cv/l/d
Site Stress Level 2	1500 cv/l/d
Site Stress Level 3	1000 cv/l/d
Site Stress Level 4	900 cv/l/d

5 Investigations

5.1 A user/specifier survey relating to existing sites that were at least two years old was carried out to confirm the system's performance in use.

5.2 The manufacturing process was examined by inspection of a typical coating plant, including the methods adopted for quality control, and details were confirmed of the quality and composition of materials used. The inspection confirmed that the plant operated in accordance with the requirements of the Quality Plan and Quality System agreed with the BBA.

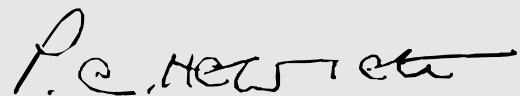
Bibliography

Guidelines Document for the Assessment and Certification of Thin Surfacing Systems for Highways (Working Draft, Draft 4, 10th January 2000)



On behalf of the British Board of Agrément

Date of issue: 27th August 2004



Chief Executive

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