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**INTERIM GUIDELINE DOCUMENT
FOR THE ASSESSMENT AND CERTIFICATION OF
THIN SURFACING SYSTEMS
FOR HIGHWAYS**

Date: June 2013

Note: This document has been updated to take account of Highways Agency interim arrangements for CE marking of Asphalt Concretes IAN 154/12. Readers are advised to contact the British Board of Agrément directly for current position.

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This document is published under the HAPAS scheme (Highway Authorities Product Approval Scheme). The document has been compiled by SG3 (Specialist Group 3) and ratified by HiTAC (the Highways Technical Advisory Committee).

Representation on Specialist Group 3

British Board of Agrément (BBA)

ADEPT (Association of Directors of Environment, Economy, Planning and Development)

Highways Agency (HA) - Also representing other Overseeing Organisations

Institute of Asphalt Technology (IAT)

Mineral Products Association (MPA)

Refined Bitumen Association Ltd (RBA)

Transport Research Laboratory (TRL)

Acland Investments Ltd (Independent experts)

Association of Consulting Engineers (ACE)

Chartered Institution of Highways and Transportation (CIHT)

Metropolitan Borough Councils (Technical Advisory Group) MBC (TAG)

Road Emulsion Association Ltd (REAL)

Road Surface Treatments Association (RSTA)

Representation on the Highways Technical Advisory Group (HiTAC)

British Board of Agrément (BBA)

ADEPT (Association of Directors of Environment, Economy, Planning and Development)

Highways Agency (HA) - Also representing other Overseeing Organisations

Mineral Products Association (MPA)

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* The following appendices are no longer contained in this guideline but can be obtained by contacting the BBA directly if required (e.g. as an optional test):

Appendix A.4 Ageing Characteristics

Appendix A.6 Changes in longitudinal irregularities

Appendix A.7 Initial changes in maximum transverse irregularities

Appendix A.12 Accelerated ageing

Appendix A.13 Fatigue characteristics of bituminous mixtures using indirect tensile fatigue

1. SCOPE

- 1.1 This guideline provides an assessment procedure which may lead to the issue of a BBA HAPAS Roads and Bridges Agrément Certificate for a product described as a thin surfacing. The issued Certificate will confirm a system's compliance with the requirements as defined by Specialist Group 3 and agreed by HiTAC.
- 1.2 The test methods and protocols contained in this document are for certification purposes only and are not intended for use on a contractual basis as a specification.
- 1.3 For the purpose of this scheme a thin surfacing system is defined as a system that:
- has satisfactorily completed Stages 1 to 6 of this Guideline.
 - can be installed at a nominal depth up to 50 mm. The actual depth range for the product will be defined by best practice based on the nominal size of the aggregate from the current version of BS 594987. If depths outside this are requested they will be confirmed via assessment.
 - Is a cold or hot bituminous based product.
- 1.4 A condition of Certification is that systems are only installed by contractors approved by the Certificate holder and who operate a quality system which satisfactorily addresses the appropriate details listed in Section 3 *Assessment*. The Certificate holder is required to audit the contractor and make the details of the audits available to the BBA when requested.

2. INTRODUCTION

2.1 The assessment procedure is undertaken in six stages:

Stage 1 – Submission for Product Approval

Stage 2 – Quality Assurance

Stage 3 – Laboratory Testing

Stage 4 – System Installation Trial

Stage 5 – System Performance Trial (if required)

Stage 6 – Certification

2.2 Each stage must be successfully completed and, where appropriate, a report issued prior to the commencement of the next stage. However, Stages 1 to 5 may be undertaken concurrently at the request of the Applicant. The applicant will have the option of withdrawing from the programme at any stage should the system submitted fail to comply with the requirements.

2.3 All systems must be able to demonstrate satisfactory performance on at least three sites of appropriate nominal installation depth classification over a period of at least two years. One of the sites will have been monitored during the two-year period by the BBA or their agent.

2.4 Where systems already have type approval, or part approval, from an overseeing organisation (as defined in the Design Manual for Roads and Bridges) then existing test data, if suitable, may be used for assessment purposes under Stages 3 to 5. The suitability of existing test data will be determined by the BBA.

2.5 In the event of an Applicant offering a system including a number of options with regard to system components and/or alternative application procedures. The BBA will define the number of Certificates required and the range of tests to be performed to allow the acceptance of the alternative materials and/or procedures.

2.6 The BBA in consultation with Specialist Group 3, reserves the right to amend or supplement the tests required for BBA Assessment and Certification at any time if required. The cost of all further tests will be borne by the applicant.

2.7 A Certificate will only be awarded on the system's successful completion of the appropriate Stages 1 to 6.

3. ASSESSMENT PROCEDURE

Stage 1: Submission for product approval

3.1 An application will include the details listed below for examination by the BBA. If they are found to be acceptable, they will form the basis of the subsequent assessment:

Application for BBA assessment:	applicant details and historical data for the system
Quality Plan:	<p>details of the system to be assessed, production procedures (including controls and tolerances), location of all production plants. For example:</p> <ul style="list-style-type: none">• binder (type, source, characteristics)• aggregate(s) (type, source, characteristics)• ancillary products (type, source, characteristics)• Mix design parameters• final product (nominal thickness as laid and claimed regulation, composition, storage, delivery to and storage on site)• quality system information.
Installation procedures:	<p>limitations in respect to weather and substrate conditions</p> <p>substrate preparation</p> <p>pre-installation survey details</p> <p>installation details</p> <p>details for maintenance and repair (including any special repair materials)</p> <p>on-site storage and handling of materials</p> <p>on site quality control / assurance procedures and associated documentation</p> <p>audit checks on the installer(s)</p>
CE Mark product information:	<p>Information confirming compliance to appropriate standard BS EN 13108 or other appropriate CE mark (e.g. BS EN 12271 or 12273)</p> <p>Data relating to type testing and factory production control in accordance with the appropriate standard BS EN 13108–20 and BS EN 13108–21</p> <p>Type test reports indicating mixture constituents, composition and claimed properties</p> <p>FPC certificate from a Notified Body.</p>

3.2 Should there be during the assessment, the need to modify the system defined by the Applicant (eg as a result of failure of the system to meet the requirements) the content of the assessment and additional work required will be reconsidered by the

BBA.

- 3.3 If the system includes hazardous substances (ie that require special precautions to be taken under the COSHH Regulations), the applicant must supply all the relevant data. In terms of the COSHH regulations, no formal assessment of the suitability of this data is undertaken by the BBA. However, this data is always required to ensure the safe use and testing of the system in their laboratories. The applicant's instructions for use must include all necessary data to allow the safe use of the product.

Stage 2: Quality assurance

- 3.4 The BBA will assess the applicant's quality controls, records etc to ensure that a consistent product is offered for sale. This includes audit visits to one or more locations to confirm the Quality Plan for the system. The assessment of quality control⁽¹⁾ forms the basis for subsequent surveillance visits.

(1) If evidence of a CE Marked product is provided by the applicant, this will be acceptable. No further information is required for Stage 2 of this assessment.

Stage 3: Laboratory testing

Identification / Characterisation

- 3.5 If the product is not CE marked the applicant must provide the results of tests, which show that the components of the system offered for assessment fall within the agreed specification for the system.
- 3.6 These checks also serve to ensure that the system offered for assessment is typical and to enable confirmation, at a later date, that other samples also fall within the agreed specification.

Performance testing

- 3.7 All samples submitted for testing are prepared by the applicant or their representative. Preparation of the samples may be witnessed by the BBA, or their agent. The applicant must provide evidence that the system submitted for this stage is within the declared manufacturing tolerances, eg certificate of conformity, including quality control data.

Note Where a product is CE Marked to BS EN 13108 the applicant will identify performance properties from PD 6691 and provide their Certificate of Conformity, CE mark and labeling to support any performance claims made. This should be compared to the mandatory and optional tests detailed in Tables 1 and 2 and any additional tests completed.

- 3.8 Testing is undertaken as defined in Appendix A and Tables 1 and 2.

Table 1 Mandatory tests

Test/Method	Method	Performance Levels	Applicability of test
Laboratory tests:			
Polished Stone Value (PSV) of the aggregate Aggregate Abrasion Value (AAV)	BS EN 1097-8 : 2009	HD36/06 ⁽²⁾	Data always required for aggregates used for installation / performance trial.
Resistance to permanent deformation (45°C or 60°C) ⁽³⁾ WTS _{AIR} (mm•1000 cycles)	BS EN 12697-22 : 2003 proc B small device in air	Table B.1	Required when the nominal laid thickness + claimed regulating depth ≥20 mm.
Torque bond test ⁽⁴⁾ Shear stress (kPa) Installation depth (mm)	Appendix A.3	≥400 Record	Paver laid hot materials only ⁽⁴⁾
Water sensitivity (ITSR) ⁽⁵⁾	BS EN 12697-12	Record	Not applicable for CE marked asphalt products
Road tests:			
Visual observations - Initial Visual assessment by BBA inspection panel. After 2 years trial period	Appendix A.10	- ≥ G ⁽⁶⁾	Required Required
Surface macrotexture depth ⁽⁵⁾ Initial surface macrotexture depth (mm)	BS EN 13036:2010	IAN 154 Sept 2012 Table 9/3	Always required
Retained surface macrotexture depth (mm)		IAN 154 Sept 2012 Table NG 9/32	

- (1) Performance levels are defined in Appendix B.
- (2) Guidance on the specification of PSV and AAV should be sought by reference to the Design Manual for Roads and Bridges, Volume 7 Pavement Design and Maintenance, Section 5 Surfacing and Surfacing Materials, HD36/06 Surfacing Materials for new and maintenance construction.
- (3) Performance will be measured in accordance with PD 6691 carried out on samples ≥20 mm thick on new assessments as from 1 April 2011.
- (4) Record value, mode of failure and age at time of test for microsurfacing, and multilayer thin surfacing
- (5) Post 1 July 2013 a declaration in accordance with CE mark (if applicable). Pre 1 July 2013 Appendix A.3.
- (6) In accordance with marking scheme in Appendix A.10
- (7) Retained surface macrotexture depth measurements are made in the nearside wheel tracks.

Table 2 Optional tests⁽¹⁾

Test	Method	Performance Levels
Road tests:		
Noise - Statistical Pass-by	Appendix A.8	IAN 154 Sept 2012 Table NG 9/30

- (1) When a manufacture claims other additional performance characteristics these may be included pending a completion of satisfactory assessment.

Stage 4: System installation trial

- 3.9 The applicant must arrange for the system installation trial during daylight hours, to demonstrate the installation and quality control to enable verification of installation procedures by the BBA.
- 3.10 The applicant's Installation procedures must be practicable and sufficiently detailed to cover all foreseen eventualities. This will include the application rates of the bond coat, binder, aggregate and/or mixed material, methods of verification to be used on site, maintenance and repair techniques, aftercare, and frequency of testing and acceptable variations within the specified limits. Current methods are documented in BS 594987 and SHW Clause 903.
- 3.11 After witnessing the system installation trial, the BBA will assess the visual condition of the completed system and may witness the site performance tests detailed in Table 1.
- 3.12 Alternatively, where a system already has type approval, or part approval, from an overseeing organisation, then existing data relating to the road trial carried out as part of the approval, may be used for assessment purposes under this stage. The suitability of this data will be determined by the BBA.

Stage 5: System performance trial

- 3.13 A system performance trial is required to assess the performance of the installed product and to monitor the systems performance over a two-year period.
- 3.14 The applicant will arrange for a laboratory with UKAS approval to take core samples for mandatory and optional laboratory testing from the installation.
- Note For CE marked products, existing type test data relating to the mandatory and optional laboratory tests, where acceptable to the BBA, may be used for assessment purposes under this stage.
- 3.15 The installation of the system is carried out and assessed as detailed in section 3.4.
- 3.16 The following is carried out to monitor the performance of the system over the two-year trial period:
- Visual observation (initial, 12 and 24 month)
 - Surface macrotexture depth (initial 12 and 24 month)
 - Optional road tests (where performance is claimed against a parameter)
 - The BBA inspection panel, at the end of the two-year trial period will conduct a visual assessment of the system in accordance with Appendix A.10

Stage 6: Certification

- 3.17 Any Certificate issued will be in BBA HAPAS Product Sheet format and will verify the product's compliance with the requirements given in this document. The Certificate will also define the products specification, intended application and summary of results of tests.
- 3.18 The assessment and any Certificate issued is subject to the terms and conditions of the relevant BBA contract which can be found on the BBA website:
www.bbacerts.co.uk/terms.html
- 3.19 During the validity of any Certificate, the Certificate holder will be responsible for the quality assurance/control of the production at the manufacturing locations declared to the BBA.
- 3.20 The BBA or its agents will carry out a minimum of two audit visits each year to check the Certificate holder's records and to ensure that the procedures and controls defined at the outset continue to apply. The number and frequency of the visits will be agreed between the BBA and the applicant.

Audit Checks on Installers

- 3.21 The applicant will conduct audit checks on the installer(s) approved by the applicant in accordance with the Agreed Quality Plan for the system and his installation procedures.

4 ACCEPTANCE OF DATA SUPPLIED BY THE APPLICANT

- 4.1 For none CE marked products the BBA will accept test data from laboratories with UKAS accreditation for the specific tests referred to in Table 1.
- 4.2 In the absence of a laboratory meeting the conditions of Section 4.1, the BBA may accept test data from other UKAS accredited testing laboratories, or laboratories approved by the BBA, that have demonstrated their competence and ability to perform the relevant tests to the satisfaction of the BBA.
- 4.3 Test data from overseas, external, independent testing laboratories that have the equivalent national accreditation for the specific tests may be accepted if there is a reciprocal agreement between UKAS and the national accreditation authority of the country in question, and the test methods used have been demonstrated as being equivalent to the satisfaction of the BBA.
- 4.4 Other data supplied in support of the assessment (eg. background information, test data relating to generic materials), where the above conditions are not met, will only be accepted after having been individually assessed and approved as being suitable by the BBA.

5 BIBLIOGRAPHY

BS 598-110 : 1998 *Sampling and examination of bituminous mixtures for roads and other paved areas — Methods of test for the determination of wheel-tracking rate and depth*

BS 594987 : 2010 *Asphalt for roads and other paved areas — Specification for transport, laying and compaction and type testing protocols*

BS EN 1097-8 : 2009 *Tests for mechanical and physical properties of aggregates — Determination of the polished stone value*

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 13108-20:2006: *Bituminous mixtures. Material specifications. Type testing*

BS EN 13108-21 : 2006 *Bituminous mixtures. Material specifications. Factory production control*

BS EN 12697-22 : 2003 *Bituminous mixtures — Test methods for hot mix asphalt — Wheel tracking*

BS EN 12697-12 : 2008 *Bituminous mixtures – Test methods for hot mix asphalt. Determination of the water sensitivity of bituminous specimens*

HD36/06 *Design Manual for Roads and Bridges, Volume 7: Pavement design and maintenance, Section 5 Surfacing and Surfacing Materials, HD36/06 Surfacing Materials for new and maintenance construction*

Manual of Contract Documents for Highway Works, Volume 1 Specification for Highway Works, Series 900 Road pavements — bituminous bound materials

PD 6691 : 2010 *Guidance on the use of BS EN 13108 Bituminous mixtures – Material Specifications*

1 Scope

- 1.1 This protocol describes the method for determining the susceptibility of thin surfacing systems to deformation.
- 1.2 The test is carried out on specimens cored from a completed installation up to and including 20 mm thick. This test procedure has been developed specifically for the assessment of thin surfacing systems under HAPAS Certification procedures.

2 References

Normative references

- 2.1 These normative references are cited at the appropriate points in the text and the publications are listed in section 10. Subsequent amendments to, or revisions of, any of these publications apply when incorporated in it by updating or revision.

Informative references

- 2.2 Other publications that provide information or guidance referred to in this test. Editions of these publications current at the time of issue of this standard are listed in section 10, but reference should be made to the latest edition.

3 Definitions

Test surface of a specimen — the surface of a cored specimen on which the road traffic would run.

In addition, the definitions given in BS EN 12697-27 : 2001 and BS EN 12697-22 : 2003 will also apply.

4 Apparatus

For the purpose of this test, the apparatus described in BS EN 12697-27 : 2001 and BS EN 12697-22 : 2003 will be used.

5 Sampling and test specimens⁽¹⁾

- 5.1 The samples to be tested will be cores taken in accordance with BS EN 12697-27 : 2001.
- 5.2 A minimum of six cores will be taken from a 100 m length of the installation at nominally even spacing along a diagonal line across the lane width.
- 5.3 The cores will be maintained at a temperature of $15 \pm 10^{\circ}\text{C}$ during transportation to the test laboratory and for up to 96 hours once delivered. If wheel tracking testing has not commenced within 96 hours of coring, the specimens are placed in storage and maintained at a temperature $5 \pm 2^{\circ}\text{C}$ until commencement of the testing procedure.

5.4 The cores are taken and tested within six weeks of the installation date.

- (1) Laboratory prepared samples prepared in accordance with Appendix A.11 may also be used. However, it should be noted that the mechanical properties of bituminous materials are significantly influenced by the method of specimen preparation, even when the volumetric proportions are similar. Therefore, laboratory prepared samples can only be accepted for comparative studies.

6 Test procedure

The procedure described in BS EN 12697-22 : 2003 is used.

7 Calculation and expression of results

Calculated and expressed in accordance with BS EN 12697-22 : 2003.

8 Test report

Reported in accordance with BS EN 12697-22 : 2003.

9 Precision

The precision data given in BS EN 12697-22 : 2003 applies.

10 List of references

BS EN 12697-27 : 2001 *Bituminous mixtures – Test methods for hot mix asphalt – Part 27: Sampling*

BS EN 12697-22 : 2003 *Bituminous mixtures – Test methods for hot mix asphalt – Part 22 : Wheel Tracking*

APPENDIX A.2 **SENSITIVITY TO WATER**(CERTIFICATES ISSUED BEFORE 1 JULY 2013)

1 Scope

- 1.1 This protocol describes a method for the determination of the water sensitivity of thin surfacing systems by measuring the retained stiffness after water conditioning. This method is applicable to laboratory-moulded specimens and core specimens obtained from existing roads.
- 1.2 This test procedure has been developed specifically for the assessment of thin surfacing systems under HAPAS Certification procedures. It is not suitable for micro-surfacing or multiple layer surface dressing.

2 References

Normative references

These normative references are cited at the appropriate points in the text and the publications are listed in section 10. Subsequent amendments to, or revisions of, any of these publications apply when incorporated in it by updating or revision.

3 Definitions

Water sensitivity — the quality or state of a thin surfacing system, prepared so as to be suitable for trafficking if it were part of a road pavement, following conditioning in water.

Unconditioned stiffness — the stiffness modulus of the mixture as determined in accordance with BS EN 12697-26 : 2004 ANNEX C prior to water and thermal conditioning.

Conditioned stiffness — the stiffness modulus of the mixture as determined in accordance with BS EN 12697-26: 2004 ANNEX C after the compacted mixture has been subjected to one or more cycles of water and thermal conditioning.

Stiffness ratio — the ratio of the conditioned stiffness to unconditioned stiffness.

In addition, the definitions given in BS EN 12697-26 : 2004 also apply.

4 Apparatus

Vacuum desiccator — capable of accommodating the samples to be tested and capable of withstanding a vacuum of 760 mm Hg (1 atmosphere) at sea level.

Vacuum pump — capable of evacuating air from the vacuum desiccator to a partial vacuum of at least 510 mm Hg at sea level.

Water baths — of suitable size to accommodate at least one specimen and thermostatically controlled such that temperatures of $5\pm 1^{\circ}\text{C}$, $20\pm 0.5^{\circ}\text{C}$ and $60\pm 1^{\circ}\text{C}$ can be maintained respectively.

Indirect tensile stiffness modulus equipment — as described in BS EN 12697-26 : 2004 ANNEX C.

Wire mesh basket — of sufficient rigidity to support the side and bottom of the compacted specimens, without bending or flexing appreciably and having an open area to total area ratio of at least 75 per cent.

Note: Stainless steel Expamet has been found to be suitable for this purpose.

5 Sampling and Test specimens

5.1 The specimens for test must be laboratory moulded specimens or cylindrical cores. The use of laboratory moulded specimens is strongly preferred and ensures that the more porous cut faces, with exposed aggregate, are not subjected to water conditioning.

Laboratory moulded specimens

- 5.2 Laboratory moulded specimens are compacted using a suitable device in accordance with the method described in Appendix A.11.
- 5.3 The test specimens are prepared in accordance with BS EN 12697-26 : 2004 ANNEX C
- 5.4 Specimens for testing must be maintained at a temperature of $15\pm 10^{\circ}\text{C}$ for a maximum period of 96 hours from the time of manufacture.
- 5.5 If water sensitivity testing has not commenced within 96 hours of manufacture of the specimens. The specimens are placed in storage and maintained at a temperature of $5\pm 2^{\circ}\text{C}$ until commencement of the testing procedure.

Cored specimens

- 5.6 Core specimens are obtained in accordance with BS EN 12697-27 : 2001 except the cores have a diameter of 100 ± 5 mm.
- 5.7 All cores will be taken at locations evenly distributed across the laid area, but not within 500 mm of any edge where possible, but in all cases within a laid area of 60 m^2 .
- 5.8 Cored specimens must be received at the testing laboratory within 24 hours of coring.
- 5.9 The storage of specimens for testing or preparation for testing will be in accordance with BS EN 12697-26: 2004 ANNEX C and for a maximum period of 4 days from receipt at the laboratory.
- 5.10 If water sensitivity testing has not commenced within 96 hours of coring, the cores are placed in storage and maintained at a temperature of $5 \pm 2^{\circ}\text{C}$ until commencement of the testing procedure.
- 5.11 Cored specimens are trimmed by wet sawing in preparation for testing and must be allowed to dry in air at a temperature $15\pm 10^{\circ}\text{C}$ for a minimum period of 16 hours prior to commencing the testing procedure.

5.12 Six specimens are tested and the specimens must not be stacked at any stage.

6 Test procedure

The unconditioned stiffness is determined in accordance with BS EN 12697-26 : 2004 ANNEX C and designated as $ITSM_U$. The procedure is:

- 1) The specimen is placed in the vacuum desiccators and covered with distilled water at a temperature of $20 \pm 1^\circ\text{C}$, the apparatus is sealed, and a partial vacuum of 510 ± 25 mm Hg for 30 ± 1 minutes applied.
- 2) The specimen is removed from the vacuum desiccator and placed in a hot water bath at a temperature of $60 \pm 1^\circ\text{C}$ for 6 ± 1 hours. The sample may be supported in a wire mesh basket if necessary to minimise distortion.
- 3) The specimen is removed from the hot water bath and immediately placed in a cold water bath at a temperature of $5 \pm 1^\circ\text{C}$ for 16 ± 1 hours.

Note: It is acknowledged that the water temperature will rise when the cores at 60°C are placed in the water bath.

- 4) The specimen is removed from the cold water bath and immediately placed in a water bath at a temperature of $20 \pm 0.5^\circ\text{C}$ for 2 hours.
- 5) The specimen is removed from the water bath, surface dried and the conditioned stiffness determine at a test temperature of $20 \pm 0.5^\circ\text{C}$ for the first conditioning cycle and designated as $ITSM_{c1}$.

Note: The temperature of the test specimen must be equal to a temperature of $20 \pm 0.5^\circ\text{C}$ prior to performing the stiffness test.

- 6) The procedure given in clauses 3 to 5 is repeated and the conditioned stiffness of the specimen determined for the second and third conditioning cycles. These are designated as $ITSM_{c2}$ and $ITSM_{c3}$ respectively.

7 Calculation and expression of results

The stiffness ratio ($ITSM_{Ratio,ci}$) is calculated for the specimens for each conditioning cycle as follows:

$$ITSM_{Ratio,ci} = ITSM_{Ci} / ITSM_U$$

where:

ci = Conditioning cycle $i=1, 2, 3$

$ITSM_{Ci}$ = Conditioned stiffness after conditioning cycle ci , and

$ITSM_U$ = Unconditioned stiffness.

8 Test report

8.1 The conditioned stiffness and the calculated stiffness ratio for each specimen at

each conditioning cycle are reported.

8.2 In addition, the following are reported:

- The unconditioned stiffness for each specimen
- Identification of the specimens
- Details of the preparation of the specimens
- The test temperature
- Any deviations from the test method
- Identifying characteristics of sample.

8.3 Where core specimens are tested; the location from where the cores were taken, the date they were taken and details of the individual(s) removing the cores are reported.

9 Precision

The precision for this test method has not been established.

10 List of References

BS EN 12697-26 : 2004 *Bituminous mixtures. Test methods for hot mix asphalt. Stiffness*

BS EN 12697-27 : 2001 *Bituminous mixtures – Test methods for hot mix asphalt – Part 27: Sampling*

Note: The mechanical properties of bituminous materials are significantly influenced by the method of specimen preparation, even when the volumetric proportions are similar. It cannot be inferred that the stiffness or retained stiffness of a laboratory moulded specimen can be replicated in a field core specimen. If cores are tested to this procedure, cut faces with exposed aggregate will be exposed to water conditioning, which may be unrepresentative of field conditions. In this case, testing of cores can be considered as a worst case scenario.

11 Acknowledgement

11.1 This test was developed by a team working under the DoT LINK programme on Transport Infrastructure and Operations led by the University of Nottingham.

11.2 It has been modified by Specialist Group 3 for use during the HAPAS Assessment and Certification of Thin Surfacing Systems for Highways

APPENDIX A.3 TORQUE BOND TEST

1 Scope

The following protocol describes methods for determining the Bond Strength between a thin surfacing system and its substrate, which may be bituminous or cementitious, by measuring the peak shearing torque at a known temperature.

Two methods of test are described for tests carried out on site and on cores taken from site and tested in the laboratory.

The test is only be carried out on thin surfacing systems which have been installed for a period of between 28 and 56 days⁽¹⁾.

This test procedure has been developed specifically for the assessment of thin surfacing systems under HAPAS Certification procedures. The method should not be used for specifying purposes.

2 Definitions

τ : inter-layer bond strength in kiloPascals (kPa),

M : peak value of applied shearing torque in Newton metres (N•m),

D : diameter of core in millimetres (mm)

3 Apparatus

Equipment

Core cutting apparatus — suitable for cutting 100 mm⁽¹⁾ diameter cores in bituminous and cementitious materials;

Torque meter — fitted with a fiducial reading gauge. The device is calibrated over a range of 0-350 N•m with a scale readable to at least 10 N•m. The device is fitted with a socket-fitting allowing steel plates to be fitted and removed.

Metal Plate — of mild steel having a diameter of 95±5 mm and a thickness of 14±2 mm. The plate incorporates a fitting enabling it to be coupled to the torque meter⁽²⁾.

Thermometer — readable to a temperature of 0.1°C and accurate to 0.5°C.

Steel Rule

Callipers — for measurement of core diameters;

Watch or Timer — readable and accurate to 1 second.

Mould — for confining laboratory test specimens, (eg 150 mm concrete cube mould).

Spirit Level — for checking laboratory test specimens;

Oven or refrigerated incubator (optional)

- (1) Cores may be cut prior to the 28 day post-installation period and stored at $5 \pm 2^{\circ}\text{C}$ prior to testing. Multiple layer and micro-surfacing thin surfacing can be cored after the 56 days.
- (2) Fittings of 12.7 mm and 19.05 mm have been found to be suitable.

Materials

Adhesive — a stiff adhesive, such as rapid setting epoxy resin, with sufficient strength to avoid failure within the adhesive or at the adhesive/thin surfacing interface.

Mounting material — for laboratory tests (eg. rapid hardening mortar, concrete or grout).

4 Test methods

Site test

- 4.1 The location to be tested is cored using a 100 ± 5 mm diameter core barrel to a depth of 20 mm below the thin surfacing layer to be tested. The method for sampling involves cutting six cores at nominally even spacing along a diagonal line across the lane width. Cores are taken from a 100 m length of the installation or the total installation where this is less than 100 m.
- 4.2 All debris must be removed from the rebate formed by the core barrel. The surface to be tested must be clean and dry.
- 4.3 The bonding agent is used to secure the metal plate to the surface of the core, taking care to ensure that the plate is parallel to the surface.
- 4.4 When the bonding agent has developed sufficient strength, (ie. failure should not occur within the adhesive), the torque meter is fitted to the metal plate, using adapters and extension rods as appropriate.
- 4.5 Torque is applied to the core at a steady rate so that the torque wrench sweeps an angle of 90° within 30 ± 15 seconds. Care must be taken to ensure that the torque is applied parallel to the core surface within $\pm 10^{\circ}$. Torque is applied to the plate until failure of the bond occurs or a torque of $300 \text{ N}\cdot\text{m}$ is exceeded.
- 4.6 The value of torque at failure is recorded, M , (in Newton metres). The bond interface temperature is measured and recorded immediately after failure.
- 4.7 The core and substrate are examined and the condition of the bond interface is recorded (eg. smooth, planer, rough or irregular). The substrate type is recorded (eg. bituminous or cementitious surface) and where known, details of the substrate condition prior to surfacing are recorded (ie. planed, untreated or regulated).
- 4.8 The core diameter is measured and recorded at two locations approximately 90° apart using calipers and the mean value, D , recorded to an accuracy of 1 mm.
- 4.9 The depth of the surfacing to the substrate interface is measured and recorded to an accuracy of 1 mm.

4.10 The bond strength is calculated in accordance with section 5.

Laboratory test

- 4.11 A 100 mm (or 150 mm) diameter core is cut to a minimum depth of 80 mm below the bottom of the surface layer. The core is extracted, taking care not to damage the surface layer of the core or the bond interface with the substrate. Six such cores are taken along a 100 m length of the installation at nominally even spacing along a diagonal line across the lane width.
- 4.12 The core is trimmed to a length suitable for mounting if appropriate.
- 4.13 The core is placed in the mould using mortar or grout as a bedding layer if appropriate, so that the upper layer and the bond interface to be tested is 20 ± 10 mm above the rim of the mould. The mould is filled with the mortar/grout and trimmed flush with the mould rim, ensuring that the core is perpendicular to, and the upper surface parallel with the mould surface. This is checked using the spirit level.
- 4.14 The metal plate is fixed to the core using the adhesive and allowed to set.
- 4.15 Unless otherwise specified⁽¹⁾, the mounted cores are conditioned by storing at a temperature of $20 \pm 2^\circ\text{C}$ for a minimum of 4 hours and for not more than 16 hours before testing. The duration and temperatures employed are recorded.
- 4.16 Unless otherwise specified, the core is tested at a temperature of $20 \pm 2^\circ\text{C}$. Where other temperatures are used, the test is completed within 5 minutes of removal from the conditioning environment.
- 4.17 The mould containing the mounted core is fixed or clamped to a suitably rigid surface. The test is carried out as described in section 4.5.
- 4.18 The core is examined and all the relevant information is recorded as described in clauses 4.6 to 4.9.

5 Calculation of and expression of results

The bond strength is calculated for each specimen using the following formula:

$$\tau = \frac{12M \times 10^6}{\pi D^3}$$

The arithmetic mean of the inter-layer bond strength, τ , for the six specimens is calculated.

6 Test report

The test report includes the following information:

- Name of organisation carrying out the test
- Method of test used

- Description of materials (system and substrate)
- Date of test
- Peak torque at failure (N•m)
- Inter-layer bond strength (kPa), (individual and mean values)
- Time to failure (seconds)
- Diameter of core (mm)
- Depth of Bond interface (mm)
- Temperature of the Bond interface at test (°C)
- Conditioning details (duration and temperature)
- Site or Laboratory test
- Identification of Site or Scheme
- Core location
- Age of the installation/specimen at the time of test
- Nature of the Bond interface
- Mode of Failure.

7 Precision

The precision for this test method has not been determined.

Note: Temperatures outside this range may be specified, for example, to compare data obtained from site tests carried out at temperatures other than $20\pm 2^{\circ}\text{C}$. In this case, additional laboratory apparatus (ie. ovens or refrigerated incubators) may be required. Conditioning of specimens in a soaked condition may also be undertaken. Details of the conditioning used prior to testing must be recorded.

APPENDIX A.5 SENSITIVITY TO DIESEL (OR OTHER FLUID)

In accordance with BS EN 12697-43

APPENDIX A.8 NOISE

1 Scope

- 1.1 This protocol describes the procedure to be followed for the determination of the influence of the road surface on traffic noise using the statistical pass-by method.
- 1.2 The test procedure that has been developed specifically for the assessment of thin surfacing systems under HAPAS Certification procedures.

2 References

Normative references

- 2.1 These normative references are cited at the appropriate points in the text and the publications are listed in section 10. Subsequent amendments to, or revisions of, any of these publications apply to this protocol only when incorporated in it by updating or revision.

Informative references

- 2.2 Other publications that provide information or guidance referred to in this test. Editions of these publications current at the time of issue of this standard are listed in section 10, but reference should be made to the latest edition.

3 Definitions

Category L vehicles — light vehicles including passenger cars and car derived vans, excluding vehicles towing trailers.

Category H1 vehicles — commercial trucks with 2 axles and greater than 3.5 tonnes.

Category H2 vehicles — commercial trucks with more than 2 axles and greater than 3.5 tonnes.

Surface macrotexture depth — the quantity of road surface macrotexture determined using a mobile device taking measurements of the Sensor Measured Texture Depth (SMTD), as defined in TRRL LR 639, or the of surface macrotexture as defined in BS EN 13036-1 : 2010.

In addition, the other definitions given in ISO 11819-1 : 2002 apply.

4 Apparatus

The apparatus described in ISO 11819-1 : 2002 Section 5 are used. The frequency range of between 100 and 5000 Hz (centre frequencies of the one-third octave bands) should be covered.

5 Test location

- 5.1 The test location road speed category is classified as either Medium or High as defined in ISO 11819-1: 2002, clause 3.3.

- 5.2 Not less than two test locations are selected for each road speed category, which may be on the same site provided the locations are at least 100 m apart or on different carriageways. Each test location will be representative in terms of road speed category and traffic level. For evaluation purposes, the road surface at the test location must have been open to traffic for a period of not less than 12 months. Each of the test sites selected must meet the requirements of ISO 11819-1 : 2002 Section 6 and ISO/CD 11819-2 : 2000. The road must be essentially straight, although sites located on slight bends may be considered as valid test sites. To minimise excessive side forces, which would exaggerate tyre/road noise, slight bends are defined as bends with a radius of curvature greater than 500 m for medium-speed, and 1000 m for high-speed road categories. The crossfall of the test lane at the test site must not exceed 4%.
- 5.3 The macrotexture of the road surface is measured. The measurements will be taken from the nearside wheel-track along the whole length of test material. The macrotexture depth of the nearside wheel-track in front of a test location must be within 10 per cent of the average macrotexture measured along the site. In the case of the high-speed road category, the macrotexture depth in the wheel-track at the test location will be greater than 1.0 mm measured in accordance with BS EN 13036-1 : 2001 or SMTD methods.
- 5.4 The microphone location at each measurement site is recorded accurately and marked with appropriate methods such that the position can be readily identified for a period of at least two years.

6 Test procedure

- 6.1 Acoustic measurements must only be carried out when the road surface is dry and the meteorological condition specified in ISO 11819-1 : 2002, Section 11 are met.
- 6.2 The air and surface temperatures are monitored in accordance with the procedure described in ISO 11819-1: 2002, Clause 8.5. The road surface temperature, T_{surface} , must be within 5°C to 50°C during acoustic measurements. The air temperature, T_{air} , must be within 5°C to 30°C.
- 6.3 Acoustic measurements are taken in accordance to ISO 11819-1: 2002, Sections 7 and 8.

7 Calculation and expression of results

- 7.1 When sufficient vehicle pass-bys' have been measured a linear regression analysis is performed in accordance with ISO 11819-1 : 2002, Clause 9.1. In the case of the high-speed road category, measurements must not be taken of vehicles travelling at speeds of less than 60 km·h⁻¹ in accordance with AFNOR Standard S31-119.
- 7.2 For each category of vehicle defined in section 3 *Definitions*, the Vehicle Sound Level, L_{veh} , is calculated as the ordinate sound level of the regression line at the reference speed for the category of road given in Table 1. All levels are calculated to two decimal places and rounded to one decimal place.

Table 1 Reference speeds (km·h⁻¹) for different road speed categories

Vehicle category	Road speed category (km·h ⁻¹)	
	Medium	High
L - light vehicles	80	110
H1- trucks with two axles	70	90
H2 - trucks with more than two axles	70	90

7.3 For the regression calculation and subsequent normalisation to the reference speed, the range of speeds covered by the measured vehicles is such that the reference speed will be within the range of plus-or-minus one standard deviation from the actually measured average speed of the vehicles measured.

7.4 The results for light vehicles is normalised for temperature according to the following formula:

$$\text{Corrected } L_{veh,L} = \text{Measured } L_{veh,L} + 0.03 \times [(0.7T_{\text{surface}} + T_{\text{air}})/2 - 20]$$

(This is a tentative correction based upon the on-going analysis)

7.5 The overall level of the surface influence on traffic noise at each test site is calculated for the road speed category assessed. The overall influence is defined as the Road Surface Influence (RSI_x) and is determined from the Vehicle Sound Levels, L_{veh} , and the weighting factors given in Table 1. This must be reported to one decimal place.

7.6 For the High Speed road category the Road Surface Influence, RSI_H is defined as;

$$RSI_H = 10 \log_{10} \left(7.8 \times 10^{\frac{L_{veh,L}}{10}} + 0.578 \times 10^{\frac{L_{veh,H1}}{10}} + 10^{\frac{L_{veh,H2}}{10}} \right) - 95.9$$

7.7 For the Medium Speed road category the Road Surface Influence, RSI_M is defined as;

$$RSI_m = 10 \log_{10} \left(11.8 \times 10^{\frac{L_{veh,L}}{10}} + 0.629 \times 10^{\frac{L_{veh,H1}}{10}} + 0.157 \times 10^{\frac{L_{veh,H2}}{10}} \right) - 92.3$$

8 Test report

The macrotexture of the road surface measured either by high-speed texture meter (or other method), taken from the nearside wheel-track along the whole length of test material.

The category of road assessed should be clearly stated together with the RSI.

In addition, all results are reported in accordance with ISO 11819-1 : 2002, Section 13.

Note that road surface temperature (item 21) is not optional in this protocol.

A graph is given for each vehicle type, which shows measured data together with the calculated regression and its 95 % confidence interval.

9 Precision

For the purposes of this protocol, the precision data given in ISO 11819-1 : 2002, Section 9.6 *Measurement uncertainty* will apply.

10 List of references

BS EN ISO 11819-1: 2001. *Acoustics - Measurement of the influence of road surfaces on traffic Noise - Part 1: Statistical Pass-by method..*

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

TRANSPORT AND ROAD RESEARCH LABORATORY. *Measurement of road surface texture by a contactless sensor. LR 639.*

APPENDIX A.9 SKID RESISTANCE

1 Scope

- 1.1 This protocol describes the procedure for the determination of the wet skid resistance of a thin surfacing system using the Sideway force Coefficient Routine Investigation Machine, (SCRIM).
- 1.2 The test procedure has been developed specifically for the assessment of thin surfacing systems under HAPAS Certification procedures. The method has yet to be proven and shown to be valid. Therefore, the method is unsuitable for use in specifications and should not be used for this purpose.

2 References

Informative documents

Other publications that provide information or guidance referred to in this test. Editions of these publications current at the time of issue of this standard are listed in section 10, but reference should be made to the latest edition.

3 Definitions

The definitions given in HD 28/04 apply.

4 Apparatus

- 4.1 Sideway force Coefficient Investigation Machine calibrated and operated in accordance with the manufacturers instructions and/or Annex 1 and Annex 2 respectively of HD 28/04.
- 4.2 If the measurements are to be made on a trial site which is a trunk road, then the SCRIM will have taken part in an annual group trial organised by the TRL within the previous twelve months.

5 Test site

- 5.1 Testing is confined to the nearside wheel track of the lane being investigated.
- 5.2 A minimum length of 100 m must be available for testing.

6 Test procedure

- 6.1 Measurements will be taken with the SCRIM at a speed of 50 km•h⁻¹.
- 6.2 An initial survey with the SCRIM is carried out within four weeks of the surfacing being laid.
- 6.3 Not less than three surveys with SCRIM are carried out during the second full summer after the surfacing was laid. These are performed at timely intervals between 1st May and 30th September and the Mean Summer SCRIM Coefficient (MSSC) calculated in accordance with HD28/04.

Note: If required, not less than three surveys with SCRIM can be carried out during the first full summer after the surfacing was laid at timely intervals between 1st May and 30th September and the MSSC calculated in accordance with HD28/04. If the initial survey was carried out towards the beginning of the period for making surveys with SCRIM, the initial survey can be used as one of the three surveys.

7 Calculations and expression of results

The results are calculated and expressed in accordance with HD28/04.

8 Test report

The test report for each SCRIM survey will contain the commercial vehicle flow per lane per day and the category of road at the trial site in accordance with Table 3.1 of HD 28/04. In addition, if the trial site is a multi-lane carriageway, each lane is separately identified, monitored and reported over the trial period.

9 Precision

The precision for this test has not been established.

10 List of references

HD28/04 Design Manual for Roads and Bridges: Volume 7: Pavement Design and maintenance: Part 1: Skidding Resistance. HMSO 1999

APPENDIX A.10 VISUAL ASSESSMENT OF TRIAL SITES

1 Scope

- 1.1 This protocol describes a general procedure for the visual assessment of trial sites by a BBA HAPAS Inspection Panel.
- 1.2 This procedure has been developed specifically for the assessment of thin surfacing systems under BBA HAPAS Certification procedures.

2 References

Normative references

- 2.1 This protocol incorporates, by reference, provisions from specific editions of other publications. These normative references are cited at the appropriate points in the text and the publications are listed in section 11. Subsequent amendments to, or revisions of, any of these publications apply to this protocol only when incorporated in it by updating or revision.

Informative references

- 2.2 This protocol refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are in section 11, but reference should be made to the latest editions.

3 Definitions

For the purposes of this Appendix, the definitions given in BS EN 12697-27 : 2001 apply together with the following:

A site — is a length of highway open to regular traffic on which one or more surfacing materials, component materials or construction techniques has been laid to assess their (comparative) performance in service.

A section — is a distinct length of a site on which one distinct surfacing material, component material or construction technique has been laid or employed.

4 Responsibilities

- 4.1 The BBA as Convenor is responsible for:
 - fixing the date of the inspection by liaison with the other members of the BBA HAPAS Inspection Panel and the Applicant.
 - briefing the Inspection Panel on the aims of the inspection and provide the following information:
 - A copy of this *procedure*
 - *Panel member's* Report Form (Appendix E)
 - for collating the panel mark using Tables A.10.1 and Table B.4

- 4.2 The Applicant is responsible for:
- for arranging access to the site for inspection, road closures and any other precautions necessary to ensure that the inspection can be carried out in a safe manner.
 - arranging any site testing required during the inspection by a BBA Approved Laboratory.
- 4.3 The Panel members will provide and wear the necessary safety clothing and protection during the inspection.

5 Inspection Panel

- 5.1 The Inspection Panel consists of the BBA Convener and two other members who have experience of road surfaces in particular thin surfacings. If due to unforeseen circumstances one member cannot attend on the day, a minimum of two (including the Convenor) will be acceptable.
- 5.2 After confirming the date for an inspection, the BBA Convener informs other members as soon as possible prior the inspection. A copy of this procedure for inspecting road trial sites is sent to panel members who have not participated to ensure familiarity.

6 Initial project briefing

The Inspection Panel are assembled, members are given a *Panel Member's Report Form*. The BBA Convenor will also have a BBA Convenor's Report Form (Appendix E.1). The BBA Convener will brief members on the particular aims of the trial and any implications on the emphasis of that inspection. A copy of the BBA Inspection report for the site installation trial will be available on the day.

7 Inspection

- 7.1 The Panel Members will agree on the weather conditions prevailing, and record these accordingly.
- 7.2 The Panel Members inspect the condition at each section as closely as practicable. By stopping and examining at intervals will ensure Members view the surface with the light in a different direction.
- 7.3 Any portion at one end of a machine-laid section which has a slightly different appearance from the rest of the section is ignored by the Panel. Similarly, localised areas subjected to accidental mechanical or chemical actions (eg. damage caused by a vehicle running on its wheel-rim damage or by major diesel spillage) will also be ignored. If variations are on a larger scale, such as between wagon loads when laid, the section will be assessed in sub-sections.

Note: The BBA Convenor should try to establish the reasons for any large differences by checking the laying records and, where appropriate, the compositional analysis at the appropriate time.

- 7.4 Members record the details on the *Panel Member's Report Form* with a mark for each section or sub-section after inspecting it. Whilst members can discuss points

of interest noted during the inspection, they will not confer their marking until all members have recorded their individual mark.

8 Marking

8.1 Each section or sub-section will be assessed on the basis of its current serviceability irrespective of the elapsed time since it was laid. In considering the serviceability of the surfacing, the aspects in Table A.10.1 for the specific type of surfacing will be considered, together with any project related aspects given in the initial briefing. If any of the aspects are evident to a significant degree on the section, the relevant suffix from Table 1 is applied to the basic marking. Suffix v will not be applied to a section marked as t, nor + to one marked -.

Table A.10.1 Fault Suffixes

Suffix	Description	Notes
v	Variable	Random variations from point to point within the section only (not 'traffic-laning' or of obvious variations from load to load).
t	Variability with traffic intensity	Marked transverse differences caused by variations in traffic intensity between lanes and wheel tracks.
+	Fatting up	
-	Loss of chippings Loss of aggregate Loose aggregate	
f	Fretting of mortar	
g	Growth of vegetation	
p	Ponding	
d	De-lamination from substrate	
s	Stripping	
c	cracking	

8.2 Once any appropriate fault suffixes have been assigned, the basic mark is allocated in Appendix B Table B.4

9 Confidentiality

Whilst the Panel marking can be reported, the individual marks allocated by members of the Panel will be treated in confidence. This is to allow members to make judgments as to the condition of the trial sections without consideration of the commercial interests of their organisation.

10 Reporting of results

The inspection report will include the following information:

- Date, time and location of the inspection
- Number of people in the Inspection Panel present
- Prevailing weather conditions
- Sufficient details of each section inspected to allow unique identification
- Basic Panel marking with any associated fault suffixes for each section inspected
- Any comments about the site(s) not otherwise covered.

11 References

BS EN 12697-27 ; 2001 *Bituminous mixtures – Test methods for hot mix asphalt – Part 27: Sampling*

TRANSPORT RESEARCH LABORATORY (1997). *Laboratory tests on high-friction surfaces for highways*. TRL Report 176, J C Nicholls.

APPENDIX A.11 LABORATORY PREPARATION OF SAMPLES(CERTIFICATES ISSUED
BEFORE 1 JULY 2013)

1 Scope

- 1.1 This protocol describes the procedure for preparing specimens of thin surfacing systems such that they are suitable for subsequent testing.
- 1.2 This procedure has been developed specifically for the assessment of thin surfacing systems under HAPAS Certification procedures. The method has yet to be proven and shown to be valid. Therefore, the method is unsuitable for use in specifications and should not be used for this purpose.

2 Normative References

This protocol incorporates, by reference, provisions from specific editions of other publications. These normative references are cited at the appropriate points in the text and the publications are listed in section 6. Subsequent amendments to, or revisions of, any of these publications apply to this protocol only when incorporated in it by updating or revision.

3 Apparatus

Mixing apparatus — any type of mechanical mixer which can be maintained at the required mixing temperature, provide a well coated homogenous mixture of the required amount of bituminous mixture in the specified time and allows all of the mixture to be recovered.

Compactor — any type of mechanical compactor which can compact the mixture to the desired density without causing damage to the aggregate. Suitable compactors include the Marshall Hammer, vibrating hammers, kneading compactors, rolling wheel compactors or gyratory compactors.

Forced-draught oven — thermostatically controlled and capable of being set to maintain any desired temperature from room temperature to 260°C to within $\pm 2^\circ\text{C}$.

Digital thermometer — capable of measuring temperatures from room temperature to 260 °C with an accuracy of ± 2 °C.

Metal oven trays — of sufficient size to heat the required amount of aggregate for each mixture.

Metal oven trays — of sufficient size to receive, as well as to heat the uncompacted bituminous mixture. The size of the tray should have an area and depth such that the mixture can be spread to a constant depth of up to 40 mm.

Metal spatula or spoon — of sufficient size to allow rapid and thorough mixing of the uncompacted mixture.

Oven gloves.

4 Thin Surfacing Systems Mixed Off-Site

4.1 For thin surfacing systems that are mixed at separate mixing plants, representative samples of a typical batch of material prepared at a mixing plant will be sampled from a wagon in accordance with BS EN 12697-27 : 2001.

4.2 The temperature of the mixture must be at the specified compaction temperature and the mixture compacted to the required voids content specified by the manufacturer.

Note: The minimum time necessary should be used to heat the mixture if heating is required.

4.3 After compaction, the compacted mixture specimen is allowed to cool to room temperature prior to removal from the compaction mould.

5 Thin Surfacing Systems Mixed In-Situ

5.1 For thin surfacing systems in which the component materials are mixed in-situ, the aggregates will be sampled in accordance with BS EN 932-1 : 1997 and the bitumen sampled in accordance with BS EN 58 : 2004.

5.2 The aggregate is graded in accordance with the mixture design provided by the manufacturer. The amount of aggregate is sufficient to obtain a mixture specimen(s) of the desired size.

5.3 A sufficient quantity of binder is obtained to achieve the specified binder content.

5.4 The desired mixing and compaction temperatures, with tolerances, must be specified by the manufacturer.

5.5 The aggregate is preheated for a minimum of two hours at the specified mixing temperature.

5.6 The bituminous binder is preheated to the specified mixing temperature.

Note: Binders held at the mixing temperature for more than two hours should be discarded.

5.7 The equipment used for mixing the component materials to form the surfacing system is preheated to the desired mixing temperature.

5.8 The thin surfacing system is manufactured in the trays from the binder and aggregate in a manner agreed with the Applicant as replicating the manufacture of the system on the road.

5.9 After completion of manufacture, including appropriate compaction, the compacted mixture specimen is allowed to cool to room temperature prior to removal from the compaction mould.

6 List of References

BS EN 12697-27 : 2001 *Bituminous mixtures – Test methods for hot mix asphalt – Part 27: Sampling*

BS EN 932-1 : 1997 *Tests for general properties of aggregates. Methods for sampling*

BS EN 58 : 2004 Bitumen and bituminous binders. Sampling bituminous binders

APPENDIX B PERFORMANCE LEVELS

Table B.1 Wheel tracking⁽¹⁾

Level ⁽²⁾	Test temperature (°C)	Maximum wheel tracking in layers ≥30 mm thick				Maximum wheel tracking in layers <30 mm thick			
		Rate (mm•h ⁻¹)		Rut depth (mm)		Rate (mm•h ⁻¹ per mm thickness)		Rut depth (mm of rut/mm thickness)	
		mean	max ⁽³⁾	mean	max ⁽³⁾	mean	max ⁽³⁾	mean	max ⁽³⁾
3	60	5.0	7.5	7.0	10.5	0.167	0.25	0.233	0.35
2	45	2.0	3.0	4.0	6.0	0.07	0.10	0.133	0.20
1	45	5.0	7.5	7.0	10.5	0.167	0.25	0.233	0.35
0	No requirement								

(1) Table B.1 is applicable if testing to BS 598-110. Performance level 2 and 3 is equivalent to classification 1 and 2 respectively of PD 6691 when testing to BS EN 12697-22 : 2003.

(2) For performance level relationship to site classification see PD 6691 : 2010

(3) Mean" is the mean result of 6 consecutive results and "max" is the maximum value measured on any single core.

Table B.2 Surface macrotexture depth levels⁽¹⁾

Level ⁽²⁾	Minimum initial surface macrotexture (mm) (Untrafficked)	Mean initial surface ⁽³⁾ macrotexture (Untrafficked)	Minimum surface macrotexture (mm) (After 2 years trafficking)
3	1.3	Record	0.9
2	1.0	Record	0.7
1	0.8	Record	0.6
0	No requirement		No requirement

(1) At least two sets of 10 measurements required. The minimum average for a set of 10 measurements must not be lower than the minimum initial requirement.

(2) For interim arrangements please refer to IAN 154/12

(3) This is a recorded value for Highway Authority information.

Table B.3 Hydraulic conductivity levels⁽¹⁾

Level	Mean of six results (s-1)	Individual result (s-1)
3	> 0.12	> 0.06
2	> 0.06	> 0.03
1	> 0.03	> 0.02
0	No requirement	No requirement

(1) Only applicable if a system is claimed as porous.

Table B.4 Two-year performance trial visual inspection requirement

Mark	Description	Two year performance trial Pass / Fail criteria
E	No discernible fault	Pass
G	No significant fault	Pass
M	Some faults	Fail
A	Several faults	Fail
S	Seriously faulted	Fail
P	Requires remedial treatment	Fail
B	Requires immediate remedial treatment	Fail

Table B.5 – Torque bond strength on asphalt and concrete substrates

Bond (kPa)⁽¹⁾	Failure mode
≥400	Interface failure / failure in the substrate / failure in the surface course
(1)	With the exception of multiple layer thin surfacings all thin surfacings must achieve this value within 56 days of the installation date. Multiple layer thin surfacings must complete the test, mode of failure, and identify the number of days to achieve the recorded value.

Table B.6 – Sensitivity to water (for Certificates issued prior to 1 July 2013. No longer relevant for Certificates issued after 1 July 2013)

Retained⁽¹⁾ stiffness(%)	Comments
≥80	For all binder / aggregate combinations
(1)	The test method and the requirement of >80% is not suitable for micro-surfacing or multiple layer thin surfacing. Alternative tests (if available) appropriate to the material will be considered.

APPENDIX C CMAX CALCULATION

The following procedure provides a method for calculating the number of cv/l/d that the surface could carry whilst maintaining the performance level achieved for surface macrotexture.

$$C_{\max} = f_{\text{site}} \times f_{\text{texture}} \times f_{\text{depth}} \times C_{\text{trial}}$$

where:

f_{site} , f_{texture} and f_{depth} are factors defined below; and C_{trial} is the traffic level (cv/l/d) on the trial site.

C_{\max} is rounded down to the nearest 500 cv/l/d if over 1000 cv/l/d or the nearest 100 cv/l/d if less than 1000 cv/l/d.

Values of C_{\max} (after rounding) in excess of 5000 cv/l/d for site stress levels 1 and 2 are quoted as up to 5,000 cv/l/d⁽¹⁾ and values of C_{\max} (after rounding) in excess of 2,500 cv/l/d for site stress levels 3 and 4 are quoted as up to 2500 cv/l/d⁽¹⁾.

(1) C_{\max} values of up to 5000 cv/l/d and up to 2500 cv/l/d imply that the applicability of that system is unrestricted with regard to traffic levels for the combination of site stress level and texture depth.

f_{site} is a factor to take account of any inherently different stresses imposed by the traffic on the trial site from those imposed by the traffic on a potential site on which the system is wanted to be used. Usually, separate values of C_{\max} will be calculated for each site stress level for potential sites on which the system may be wanted to be used.

$$f_{\text{site}} = \frac{S_{\text{trial}}}{S_{\text{design}}}$$

where S_{trial} and S_{design} are the site stress levels for the trial site and the potential site on which the system is to be used as determined from the site category in accordance with Table C.1.

S_{trial} and S_{design} can have values between 1 and 4, so that f_{site} can have a value between 0.25 and 4.

f_{texture} is a factor to take account of the extent that trafficking reduces the texture depth relative to the required level. Usually, separate values of C_{\max} will be calculated for each texture level for which the trial site has met the requirements.

$$f_{\text{texture}} = \text{Min} \left(\frac{(7 - 2age) \times t_0 \times T + age \times t_0 \times t_{age} - (7 - age) \times t_{age} \times T}{(7 - age) \times T \times (t_0 - t_{age})}, 2 \right)$$

where:

t_0 is the initial texture depth (mm) of the trial site before trafficking;

t_{age} is the in-service texture depth (mm) of the trial site at the end of the trial period;

T is the in-service texture depth required after two years (mm) according to Table B.2 for use on sites with that texture level; and

age is the period of the trial (years) before the final texture depth is measured, which is not less than two years.

$f_{texture}$ can have values between 1 and 2 for trial sites where the texture depth does not increase with time and which complied with the texture depth requirements in Table B.2 for the required texture level. $f_{texture}$ is designed to be unity if the texture depth only just meets in-service requirement at the end of the trial and to be equal to two if the texture depth would still comply with that requirement after seven years trafficking assuming that the decrease in texture depth is inversely proportional to the period in-service (see derivation at the end of this appendix).

Examples to show the values that can be produced by the above equation are:

t_0	T_{age}	T	age	$f_{texture}$
1.5	1.0	1.0	2	Min (1.0, 2) = 1.0
1.5	1.2	1.0	2	Min (1.4, 2) = 1.4
2.0	1.2	1.0	2	Min (1.2, 2) = 1.2
2.0	1.5	1.0	2	Min (1.8, 2) = 1.8
2.0	1.5	1.0	3	Min (2.5, 2) = 2.0
2.0	1.6	1.0	2	Min (2.2, 2) = 2.0
1.5	1.5	1.0	2	Min (∞ , 2) = 2.0

f_{depth} is a factor to take account of the additional inherent durability that tends to occur with thicker systems. However, it is appreciated that this tendency is not universally true.

$$f_{depth} = \text{Min} \left(6, \text{Max} \left[3, \frac{d}{10} + 2 \right] \right)$$

Where:

d is the nominal thickness of the system (mm) f_{depth} can have values between 3 and 6.

The following examples illustrate the principles discussed above:

Example 1

A trial of a system with a nominal thickness of 30 mm on a site with 500 cv/l/d, site stress level 1, 1.5 mm initial texture depth and 0.9 mm texture depth after 2 years will provide approval for use of the system on sites with:

	Site Stress(cv//d)			
	Level 1	Level 2	Level 3	Level 4
Texture level 1	3,000	1,500	1,000	800
Texture level 2	2,500	1,000	900	700
Texture level 3	n.a.	n.a.	n.a.	n.a.

Note: Values are not given for texture level 3 because the texture depth after 2 years is too low.

Example 2

A trial of a system with a nominal thickness of 20 mm on a site with 1,200 cv//d, site stress level 1, 2.6 mm initial texture depth and 1.5 mm texture depth after 2 years will provide approval for use of the system on sites with:

	Site Stress (cv//d)			
	Level 1	Level 2	Level 3	Level 4
Texture level 1	>5,000	4,500	>2,500	2,000
Texture level 2	>5,000	4,000	2,500	2,000
Texture level 3	>5,000	3,500	2,000	1,500

Table C.1 - Classification of Sites by Stress Condition

Site Category	Site Definition	Stress Level
A	Motorway (main line)	1
B	Dual carriageway (all purpose) - non-event sections	1
C	Single carriageway - non-event sections	1
D	Dual carriageway (all purpose) - minor junctions	1
E	Single carriageway - minor junctions	1
F	Approaches to and across major junctions (all limbs)	2
G1	Gradient >5% longer than 50 m: (Dual downhill; single uphill and downhill)	2
H1	Bend (not subject to 40 mph or lower speed limit) radius 100-250 m	2
H2	Bend (not subject to 40 mph or lower speed limit) radius <100 m	3
L	Roundabout	3
J	Approach to roundabout	4
K	Approach to traffic signals, pedestrian crossings, railway level crossings and similar	4

APPENDIX D DEFINITIONS AND ACRONYMS

BBA	British Board of Agrément
AAV	Aggregate Abrasion Value (as defined in BS EN 1097-8 : 2009).
BBA Approved Laboratory	A laboratory approved by the BBA to carry out test work on behalf of the BBA (ie sub-contracted by the BBA), which may lead to the approval of a product and the issue of a BBA Certificate. Before approval, the laboratory will have demonstrated to the BBA that it has the relevant expertise, equipment and quality systems in place to carry out the work required.
Certificate of Conformity	A Certificate providing evidence that a material has been tested and meets any required performance / specification requirements. A Certificate of Conformity will be traceable to a specific batch or delivery of the material and will normally be required to show the results of agreed performance / specification tests.
COSHH	Control of Substances Hazardous to Health.
HAPAS	Highway Authorities Product Approval Scheme
HiTAC	Highways Technical Advisory Committee. A committee, appointed by the Council of the BBA, consisting of representatives of parties responsible for overseeing and controlling the HAPAS scheme and the work of the BBA in this area
Multiple layer	A surface dressing that has completed the thin surfacing assessment
Overseeing organisation	Body responsible for a trunk road, as defined in the Design Manual for Roads and Bridges
PSV	Polished Stone Value (defined in BS EN 1097-8 : 2009).
Specialist Group	A Specialist Group formed under the auspices of HiTAC. The objectives of the Group are to develop guidelines and offer specialist advice for the assessment and Certification of products for highways.
TRL	Transport Research Laboratory
UKAS	The United Kingdom Accreditation Service
Visual Assessment	A procedure for assessing the visual condition of trial sites by Inspection Panel carried out in accordance with

APPENDIX E BBA HAPAS INSPECTION PANEL

Panel Member's Report Form

Panel Member:		Date of Inspection:				
BBA Panel Convener:		System:				
Location:		Job No:				
Weather and Road Conditions:						
See Table C1 Fault See Table C2 Suffix Mark Level		Site(s)				
		Practice (if necessary)	1.	2.	3.	4.

Table 1 Fault Suffixes

Suffix	Description
v	Variable Random variations from point to point within the section only, not 'traffic laning' or of obvious variations from load to load
t	Variability with traffic intensity Marked transverse difference caused by variations in traffic intensity between lanes and wheel tracks.
+	Fatting up
-	Loss of chippings, loss of aggregate or loose aggregate
f	Fretting of mortar
g	Growth of vegetation
p	Ponding
D	De-lamination from substrate
S	Stripping
C	Cracking

Table 2 Basic Mark

Mark	Description
E	No discernible fault
G	No significant fault
M	Some faults but insufficient for serious problems
A	Several faults but would usually be just acceptable
S	Seriously faulted but still serviceable in the short term
P	Requires remedial treatment
B	Requires immediate remedial treatment

BBA CONVENER'S REPORT FORM

System:	Location	
BBA Convener:	Date of inspection:	
Weather and Road Conditions		Job No:

Site(s)	Individual Markings (from Panel Member's Report Form)			Panel Mark	
	Assessor	Assessor	BBA Convener	Mark	Fault Suffix
Practice (if necessary)	Mark				
	Suffix				
1.	Mark				
	Suffix				
2.	Mark				
	Suffix				
3.	Mark				
	Suffix				

Signed.....

Date.....