British Board of Agrément
Bucknalls Lane
Watford
Herts
WD25 9BA

Tel: 01923 665300
Fax: 01923 665301
e-mail: mail@bba.star.co.uk
website: www.bbacerts.co.uk

GUIDELINES DOCUMENT

FOR THE ASSESSMENT AND CERTIFICATION OF

HIGH-FRICTION SURFACING

FOR HIGHWAYS

March 2017

Note: This document may be revised from time to time to take account of improvements and amendments to test and assessment methods and material innovations. Readers are advised to contact the British Board of Agrément directly for current position.

HAPAS GUIDELINES

Terms and Conditions of Use

REPRESENTATION ON SPECIALIST GROUP 1 – HIGH-FRICTION SURFACING

ADEPT (Association of Directors of Environment, Economy, Planning and Development)
British Board of Agrément (BBA)
Highways Agency (HA) – also representing other overseeing organisations
Road Safety Markings Association (RSMA)
Road Surface Treatments Association (RSTA)
Transport Research Laboratory (TRL)

LIST OF CONTENTS

1 SCOPE

1.1 The assessment is directed towards the issue of a BBA HAPAS Certificate confirming a High-Friction Surfacing System's compliance with the requirements as defined by Specialist Group 1, High-Friction Surfacing for Highways, and agreed by HiTAC.

1.2 For the purpose of this scheme a High-Friction Surfacing is defined as having a minimum skid resistance value (SRV) of 65 measured using the portable Skid-Resistance Pendulum Tester as defined in TRL Report 176 : Appendix E.

1.3 Systems approved under the scheme are deemed suitable for use on highways with an existing surface temperature depth of between 0.50 mm and 2.0 mm, measured using the Sand Patch Test as defined in (1)BS EN 13036-1:2010, and for installation on highways at road surface temperatures of 5°C to 35°C.

1.4 The suitability of a system for use on concrete and on bituminous surfaces with texture depth and road surface temperature during installation outside the ranges given in clause 1.3, or for use on 'negative textured' bituminous surfacing, e.g. thin surfacing and Stone Mastic Asphalt (SMA) pre-treated with a void filler, shall be assessed at the request of the applicant.

1.5 Colour durability may be assessed at the request of the applicant.

1.6 Systems receiving a Certificate shall be recognised under the Highway Authorities Product Approval Scheme (HAPAS) as referenced in MCHW 1, Specification for Highway Works, Series 900, Road Pavements – Bituminous Bound Materials

1.7 A condition of Certification shall be that systems are installed only by BBA approved installers. Details of the scheme can be found in the BBA document Assessment and Surveillance Scheme for Installers of High-Friction Surfacing for Highways.

1.8 A system shall be classified according to the results of the performance tests, as defined in Table 1. This classification shall determine the suitable areas of use for the system in terms of durability. The life expectancy of a system used in an appropriate location, as defined in Table 2, is 5 to 10 years.

(1) BS 598-105: 2000 and Appendix D to be used in case of dispute.

2 INTRODUCTION

2.1 The assessment and Certification procedure shall be undertaken in six stages, as follows:

Stage 1 **–** Assessment of applicant's data
Stage 2 **–** Assessment of factory production control
Stage 3 **–** Laboratory testing (and optional tests)
Stage 4 **–** System installation trial
Stage 5 **–** System performance trial (if applicable)
Stage 6 **–** Certification

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

2.3 A system performance trial shall be required where it cannot be demonstrated that the system has performed satisfactorily over a minimum period of two years on at least five sites of appropriate classification.

2.4 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 shall 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.

2.5 Specialist Group 1 reserves the right to amend or supplement the tests required for BBA Assessment and Certification at any time. The cost of all further tests shall be borne by the applicant.

2.6 A Certificate shall only be awarded on the system's successful completion of the appropriate stages 1 to 6.

3 ASSESSMENT AND CERTIFICATION PROCEDURE

3.1 Stage 1 : Assessment of applicant's data

3.1.1 Applicants shall submit at least the details listed below for examination by the BBA. If they are found to be acceptable they shall form the basis of the subsequent assessment

3.1.1.1	Application for BBA Assessment Including:	Applicant details and historical data for the system.
3.1.1.2	Quality Plan, including:	Details of the production procedures, controls and tolerances, for example: binder (type, source, characteristics, etc) aggregate (type, source, characteristics, etc) ancillary products (type, source, characteristics, etc) final product (thickness, composition, packaging, etc)
3.1.1.3	Installation method statement, including:	Limitation in respect of weather and substrate conditions. substrate preparation. installation procedures. details for maintenance and repair, on-site quality control / assurance procedures.

3.1.2 Should there be, during the assessment, the need to modify the system defined by the applicant (for example as a result of failure of the system to meet the requirements) the content of the assessment and additional work required shall be reconsidered by the BBA. The cost of additional testing shall be borne by the applicant.

3.1.3 If the system includes hazardous substances, i.e. that require special precautions to be taken under the COSHH Regulations, the applicant shall supply all the relevant data. No formal assessment of the suitability of this data, in terms of the COSHH Regulations, shall be undertaken by the BBA. However, this data shall always be required by the BBA, and its subcontractors, to ensure the safe use and testing of the system in their laboratories. The applicant's instructions for use shall include all necessary data to allow the safe use of the product.

3.2 Stage 2 : Assessment of factory production control

3.2.1 The BBA shall assess the applicant's production processes, material controls, records, etc to ensure that a consistent product is offered for sale. This shall (where relevant) include a visit to the factory. The assessment of factory production control shall form the basis for subsequent surveillance visits.

3.2.2 Where registration to ISO 9000 Series exists, this shall be taken into full account during the assessment.

3.3 Stage 3 : Laboratory testing

3.3.1 Identification / characterisation

3.3.1.1 The BBA shall undertake a series of tests to determine the characteristics of the system, and its various constituent parts. These checks also serve to ensure that the system offered for assessment is typical and to enable confirmation of other samples at a later date.

3.3.1.2 The properties to be measured will depend heavily on the nature of the materials offered for assessment. Typical tests are listed in Appendix A. The list is not exhaustive and the final test programme shall be agreed in consultation with the applicant.

3.3.1.3 The applicant shall provide evidence that the system submitted for this stage is within the declared manufacturing tolerances, e.g. certificate of conformity, including quality control data.

3.3.2 Performance testing

3.3.2.1 All samples submitted for testing shall be prepared by the applicant or his representative. Preparation of the samples shall be witnessed by the BBA, or their agent. The applicant shall provide evidence that the system submitted for this stage is within the declared manufacturing tolerances, e.g. certificate of conformity, including quality control data etc.

3.3.2.2 Testing shall be undertaken, on behalf of the BBA, by a laboratory approved by the BBA, in accordance with the test methods defined in Appendix D. The tests shall include:

(a) Simulative tests
(i) Scuffing
(ii) Wear
(iii) Tensile adhesion

(b) Conditioning tests
(i) Heat ageing
(ii) Freeze/thaw
(iii) Resistance to diesel

(c) Movement test

Thermal movement

(d) Optional tests when requested by the applicant

(i) Installation temperature test

This test is only carried out to verify specific claims, made by the applicant, that the system can be applied when the surface temperature of the substrate is outside the range 5°C to 35°C.

Claims that the system can be applied outside the temperature range 5°C to 35°C shall be verified by an additional scuffing test on laboratory prepared samples. The system shall be applied onto the substrate maintained at the claimed surface temperature(s) and the results compared against those obtained on laboratory samples prepared on substrates with the surface temperature maintained at (20 ±2)°C.

(ii) Texture depth of substrate

This test is only carried out to verify specific claims, made by the applicant, that the system can be applied when the surface texture depth of the substrate is outside the range 0.50 mm to 2.0 mm.

Claims that the system can be applied to a substrate with a surface texture depth outside the range 0.50 to 2.0 mm shall be verified by an additional scuffing test on laboratory prepared samples. The system shall be applied onto substrates manufactured with texture depths > 2.0 <3.0 mm and the results compared against those obtained on laboratory samples prepared on SMA substrates with a surface texture depth of (1.05 ±0.1) mm. The surface temperature of the substrate prior to the application of the system shall be maintained at (15 ±10)°C.

(iii) Concrete substrate test

This test is only carried out to verify specific claims, made by the applicant, that the system can be applied to concrete substrates.

Claims that the system can be applied to a concrete substrate shall be verified by additional laboratory tests. These tests shall include a scuffing test and tensile adhesion test on laboratory prepared samples on concrete substrates and the results compared against those obtained on laboratory prepared samples on SMA substrates. The surface temperature of the substrate prior to the application of the system shall be maintained at (15 ±10) °C.

(iv) Application to bituminous surfacing pre-treated with a void filler

This test is carried out to assess the effect of applying a pre-treatment system to a high textured, positively-textured bituminous surfacing, or a negatively textured asphalt e.g. thin surfacing and SMA. The type of material and method of application shall be specified by the applicant and details included in the Method Statement.

These tests include a scuffing test and tensile adhesion test on laboratory prepared samples or samples prepared on site on SMA substrates with a high texture depth of greater than 2.0 mm and the results compared with those obtained on samples on SMA substrates with a texture depth of (1.05 ±0.1) mm. The surface temperature of the substrate prior to the application of the system shall be maintained at (15 ±10)°C.

In addition, the applicant shall arrange for an installation trial to demonstrate the installation in accordance with the applicants Method Statement. The trial shall be witnessed by the BBA.

(v) Colour durability

This test is only carried out to verify specific claims, made by the applicant regarding colour durability.

Assessment of colour durability shall be carried out in accordance with the SG10 Guidelines Document for the Assessment and Certification of Coloured Surface Treatments for Highways.

3.3.2.3 A system shall be classified in accordance with the performance criteria for durability as defined in Table 1. Once classified, suitable locations where the system may be used can be identified by reference to Table 2. The life expectancy of a system used in an appropriate location, as defined by Table 2, is 5 to 10 years.

Table 1 Laboratory performance criteria

Test[1]		Parameter	Type 1	Type 2	Type 3
Scuffing[2]	Initially	Texture depth (mm)	≥ 1.4 ≥ 65	≥ 1.2 ≥ 65	≥ 1.0 ≥ 65
	After 500 wheel-passes	Texture depth (mm) Erosion index	≥ 1.2 ≤ 3	≥ 1.0 ≤ 15	≥ 0.8 ≤ 15
	After heat ageing for 112 days at (70 ±3)°C and 500 Wheel-passes	Texture depth (mm) Erosion index	≥ 1.2 ≤ 5	≥ 1.0 ≤ 15	≥ 0.8 ≤ 15
	After freeze/thaw conditioning and 500 Wheel-passes	Texture depth (mm) Erosion index	≥ 1.2 ≤ 5	≥ 1.0 ≤ 15	≥ 0.8 ≤ 15
	After diesel susceptibility conditioning and 500 Wheel-passes	Texture depth (mm) Erosion index	≥ 1.2 ≤ 5	≥ 1.0 ≤ 15	≥ 0.8 ≤ 15
	Thermal Movement	Record			
Wear	Initially	Texture depth (mm) SRV	≥ 1.4 ≥ 65	≥ 1.2 ≥ 65	≥ 1.0 ≥ 65
	After 100 000 wheel-passes	Texture depth (mm) Erosion index SRV	≥ 1.1 ≤ 3 ≥ 70	≥ 0.9 ≤ 15 ≥ 65	≥ 0.8 ≤ 20 ≥ 65
Tensile Adhesion		Stress at (-10 ±2)°C (Nmm^{-2})	≥ 1.0	≥ 1.0	≥ 1.0
		Stress at (20 ±2)°C (Nmm^{-2})	≥ 0.5	≥ 0.5	≥ 0.5

(1) Tests carried out on SMA substrates with a texture depth of (1.05 ±0.1) mm.
(2) The scuffing test for Type 1 and 2 is carried out at 45°C and for Type 3 at 35°C.

Table 2 Area of application by type classification

Suitable areas for use of systems classified in accordance with Table 1 to give an expected 5 to 10 years, service life. Serviceability in terms of durability is dependent upon the systems complying with the criteria in Table 4.

Site category (as defined in HD28/04)	**Site definition**	**Maximum traffic levels (commercial vehicle per lane per day)**		
		Type 1	**Type 2**	**Type 3**
Q	Approaches to and across major junctions, approaches to roundabouts.	3500	1000	250
G1	Gradient 5% to 10%, longer than 50 m.			
S1	Bend radius <500 m – dual carriageway.			
R	Roundabout.			
G2	Gradient >10%, longer than 50 m.	2500	750	175
S2	Bend radius <500 m – dual carriageway.			
K	Approach to pedestrian crossing and other high risk situations.	2500	500	100

Table 3 Minimum requirements for newly laid systems

Parameter	**Type 1**	**Type 2**	**Type 3**
Skid resistance value (1) (5) (SRV)	≥ 65	≥ 65	≥ 65
Tensile adhesion (2) (Nmm^{-2}) at (20 ±2)°C	≥ 0.5	≥ 0.5	≥ 0.5
Texture depth(1) (2) (mm) (initial)	≥ 1.4	≥ 1.2	≥ 1.0
Scuffing test(2)(3) Texture depth (5) (mm) Erosion index (4)	 ≥ 1.2 ≤ 3	 ≥ 1.0 ≤ 15	 ≥ 0.8 ≤ 15

(1) Measurements made on the installation during the installation trial.
(2) Measurements made in the laboratory on samples prepared during the installation trial.
(3) The scuffing test for Type 1 and 2 is carried out at 45°C and for Type 3 at 35°C.
(4) Interim requirement of ≤ 10 for installer pre-approval samples for a Type 1 system.
(5) For installer pre-approval samples, the initial and texture after scuffing and SRV are recorded for information only and are not pass/fail criteria.

Table 4 Minimum requirements for trafficked systems

Criteria used to assess the performance of a system during and at the end of the two-year performance trial carried out on the site of the appropriate classification in Table 2.

Parameter(1)	Type 1	Type 2	Type 3
Skid resistance value (SRV)	≥ 65	≥ 65	≥ 65
Erosion index	≤ 2	≤ 3	≤ 5
Estimated overall system loss (%)	≤ 15	≤ 15	≤ 15
Estimated fatting-up (%)	< 10	< 10	< 10
Texture depth (mm) Mean value Minimum individual value	 ≥ 1.0 ≥ 0.8	 ≥ 1.0 ≥ 0.8	 ≥ 1.0 ≥ 0.8
Cracking (mm)	≤ 0.5	≤ 0.5	≤ 0.5
Tensile adhesion (Nmm^{-2}) on core samples at (20 ±2)°C	≥ 0.5	≥ 0.5	≥ 0.5
Scuffing test(2) on core samples (after 2 years, trafficking) Texture depth (mm) (mean value) Erosion index	 ≥ 0.8 ≤ 5	 ≥ 0.8 ≤ 20	 ≥ 0.8 ≤ 20
Visual assessment by BBA Panel Inspection(3)	E or G	E or G	E or G

(1) Tests are carried out on the installation in the nearside wheel-track or on core samples taken from the installation in accordance with Appendix C.
(2) The scuffing test for Type 1 and 2 is carried out at 45°C and for Type 3 at 35°C.
(3) In accordance with marking scheme in Appendix F.

3.4 Stage 4 : System installation trial

3.4.1 The applicant shall arrange for the system installation trial, during daylight hours, to demonstrate the installation and quality control / assurance procedures.

3.4.2 The trial shall be witnessed and assessed by the BBA to cover the installation procedures defined in the applicant's Method Statement. If the installation trial is to be used as a performance trial then the Inspection Panel, if required, shall also be invited to witness the installation.

3.4.3 The Installation Method Statement shall be practicable and sufficiently detailed to cover all foreseen eventualities. It shall include the coverage rates of the resin and/or aggregate, methods of verification to be used on site, maintenance and repair techniques, aftercare and on-site quality control.

3.4.4 The BBA shall witness the site tests detailed in clause 3.4.5.

3.4.5 The applicant shall arrange for a laboratory approved by the BBA to carry out the following tests on the installation system during the system installation trial in accordance with the test methods defined in Appendix C.

(a) Visual observation
(b) Skid resistance value (SRV)
(c) Texture depth

3.4.6 In addition, the following tests shall be carried out on samples prepared, on SMA slabs manufactured in accordance with Appendix E, or on core samples taken in accordance with Appendix C, during the system installation trial.

(d) Tensile adhesion at (20±2ºC
(e) Scuffing test

3.4.7 The tests (d) and (e) shall be carried out by a laboratory approved by the BBA in accordance with the test methods as defined in Appendix D.

3.4.8 The test report shall be made available to the BBA within six weeks of the date of the trial.

3.4.9 The minimum requirements for newly laid systems are given in Table 3.

3.5 Stage 5 : System performance trial (if applicable)

3.5.1 A system performance trial shall be required where it cannot be demonstrated that the system has performed satisfactorily over a minimum period of two years on at least five sites of appropriate classification. The trial shall be used to assess the installation of the system and to monitor the system's performance over a two year period. In disputed cases the requirement for a system performance trial shall be decided by the BBA in consultation with Specialist Group 1. This may result in a site visit by the Inspection Panel, the cost of which shall be borne by the applicant.

3.5.2 The installation of the system shall be carried out and assessed as detailed in clause 3.4

3.5.3 In addition the applicant shall arrange with a laboratory approved by the BBA to monitor the site and carry out the tests detailed in clause 3.5.4 at 12 and 24 month interval over the two-year period. The test report shall be made available to the BBA within one month of the due date. The Inspection Panel may be required to inspect the site, during the trial period, if the results of the monitoring suggest the need for such an inspection.

3.5.4 The applicant shall arrange for a laboratory approved by the BBA to carry out the following tests on the installed system to monitor its performance over the two year trial period in accordance with the test methods defined in Appendix C.

(a) Visual observation
(b) Skid resistance value (SRV)
(c) Texture depth
(d) Erosion index

3.5.5 In addition, at the end of the two-year trial period the following tests shall be carried out on core samples taken from the trial site in the nearside wheel-track:

(e) Tensile adhesion at (20±2ºC
(f) Scuffing test

3.5.6 The tests (e) and (f) shall be carried out by a laboratory approved by the BBA in accordance with the test methods as defined in Appendix D.

3.5.7 The minimum requirements for trafficked systems are given in Table 4.

3.5.8 The BBA Inspection Panel, at the end of the two-year trial period, shall witness (if appropriate) the site tests detailed in 3.5.4 and conduct a visual assessment of the system in accordance with the method defined in Appendix F.

3.6 Stage 6 : Certification

3.6.1 Any Certificate issued shall be in the BBA HAPAS Certificate Product Sheet format and shall verify the system's compliance with the requirements given in this document. The Certificate shall also define the system assessed, the conditions of use and the resulting classification based on the results of the performance tests and assessed durability.

3.6.2 The assessment and any Certificate issued shall be 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

3.6.3 During the validity of any Certificate issued the BBA shall carry out up to two visits each year to each production location and/or the Certificate holder's offices (where appropriate), to ensure that the procedures and controls defined at the outset continue to apply.

3.6.4 Any Certificate issued shall remain valid provided there is a BBA HAPAS approved HFS installer linked to the Certificate. If subsequent to issue it is identified that a Certificate holder does not have an approved installer then the following action will be taken:

3.6.4.1 Notice period. The manufacturer will be informed that they have one season[1] to obtain an approved installer. During this time the BBA will continue to audit the manufacturer to ensure the capability to produce remains as described in the Agreed Quality Plan. If the manufacturer obtains an approved installer then the notice period will cease from the date the approved installer application is complete.

3.6.4.2 Suspension. If following the notice period no approved installer is identified then the manufacturers BBA HAPAS Certificate will be suspended for a period of one season. During this time the BBA will continue to audit the manufacturer to ensure the capability to manufacture remains as described in the Agreed Quality Plan. If during this period an installer application is received then the suspension will be lifted when the approved installer application is completed.

3.6.4.3 Withdrawal. If an approved installer application is not completed during the suspension period then the BBA will withdraw the Certificate. An alternative approval may be offered. The alternative approval will not include use as a high friction, anti-skid surfacing and will be issued under a new Certificate number.

If post-withdrawal an approved installer is identified then the BBA will determine the work required. Depending on the conclusions from the re-Certification assessment and of any changes to the material a new Certificate will be issued which will have a different number to the original issued.

1. One season is a time period which includes or is equal to 1 April to 31 March.

3.7 BBA Approved Installer surveillance visits

Details of the frequency of the BBA inspection and test requirements can be found in the BBA document Assessment and Surveillance Scheme for Installers of High-Friction Surfacing for Highways.

4 ACCEPTANCE OF DATA SUPPLIED BY THE APPLICANT

4.1 The BBA shall accept test data from laboratories with UKAS accreditation for the specific tests referred to in TRL Report 176 which are performed on samples approved by the BBA. The BBA would require the test laboratory to submit a copy of their UKAS testing schedule.

4.2 In the absence of a laboratory meeting the conditions of clause 4.1, the BBA may accept test data from other UKAS accredited testing laboratories, or a laboratory approved by the BBA, that have demonstrated their competence and ability to perform the relevant tests to the satisfaction of the BBA Quality Manager.

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 (e.g. background information, test data relating to generic materials, etc), where the above conditions are not met, shall only be accepted after having been individually assessed and approved as being suitable by the BBA.

APPENDIX A

Typical characterisation tests

1. Thermoplastic hot-melt systems

1.1 Currently this category includes only the rosin ester systems (binder/aggregate pre-blended).

1.2 The tests for these systems may include:

1.2.1 Infra-red [IR Spectroscopy]
1.2.2 Softening Point (R & B [BS 2000-58 : 2007 or BS EN 1238 : 2011]
1.2.3 Density [[BS EN ISO 1183-1:2012 or BS EN ISO 1183-2:2004
1.2.4 Ash content [BS EN ISO 3451-5 : 1997]
1.2.5 Flow resistance [BS 2499-3 : 1993]
1.2.6 Tensile strength/elongation (briquette) [BS 6319-7 : 1985]
1.2.7 Effect of prolonged heating/overheating
(a) Tensile strength/elongation (briquette)
(b) Softening point
(c) Flow resistance

1.3 These tests shall be carried out on the binder component supplied by the manufacturer without the aggregate and any filler.

2 Chemically curing systems

2.1 These systems include two or more components which are mixed prior to installation and cured by chemical reaction. The aggregate is scattered over the surface of the applied resin before it has set. Currently this category includes epoxy, polyurethane and acrylic systems. The tests for these systems may include:

2.2 Tests on the individual uncured resin components may include:

2.2.1 Infra-red [IR Spectroscopy}
2.2.2 Density [BS EN ISO 1183-1:2012 or BS EN ISO 1183-2:2004
2.2.3 Viscosity [BS EN 12092:2001)]
2.2.4 Ash content [BS EN ISO 3451-5 : 1997]

2.3 Cure tests (to cover the claimed application temperature range) may include:

2.3.1 Pot life (hand mixed grades only)
2.3.2 Set time (time after application at which the aggregate can not be applied)
2.3.3 Trafficking time

2.4 Tests on cured resin (free film) may include:

2.4.1 Tensile strength/elongation [BS EN ISO 527-1&3 : 1996]
(a) Un-aged
(b) Heat aged at 70^{o}C for 28 days

3 Tests on the aggregate

3.1 The following tests shall be carried out to characterise the aggregate. The applicant shall be required to supply evidence that the tests have been carried out. This shall include a Certificate of conformity and quality control data.

3.1.1 Particle size distribution [BS EN 933-1 : 2012]
3.1.2 Polished stone value (PSV) [BS EN 1097-8 : 2009 (except that the PSV shall be determined on the size of aggregate as supplied for use)].
3.1.3 Aggregate abrasion value (AAV) [BS EN 1097-8 : 2009 (except that the AAV shall be determined on the size of aggregate as supplied for use)]

APPENDIX B

Definitions and acronyms

AAV	Aggregate abrasion value, (as defined in BS EN 1097-8 : 2009 except that the tests shall be carried out on aggregate of size as defined by the Applicant).
ADEPT	Association of Directors of Environment, Economy, Planning and Development.
Approved Installer	The firm or organisation applying for assessment, or approved by the BBA, for the installation of the High-Friction Surfacing System.
BBA	British Board of Agrément
BBA approved laboratory	A laboratory approved by the BBA to carry out specific test work. Before approval, the laboratory shall 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 shall 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.
Erosion index	An index quantifying the degree of erosion of a specimen or area on site (as defined in Appendix D).
Fatting-up	The migration of binder from the system or substrate through and appearing on the surface of the High-Friction Surfacing System.
HA	Highways Agency, also representing other overseeing organisations including the Department for Transport; the Scottish Executive Development Department; the Welsh Assembly; the Department Regional Development, Northern Ireland.
HAPAS	Highway Authorities Product Approval Scheme.
HD28/04	Design Manual for Roads and Bridges, Volume 7: Pavement design and maintenance: Skidding Resistance
HFS	High-Friction Surface. For the purpose of this scheme, a High-Friction Surface is defined as having a minimum SRV of 65 measured using the portable Skid-Resistance Tester as defined in Road Note 27.
HiTAC	Highways Technical Advisory Committee. A committee, appointed by the Council of the BBA, consisting of representatives of Highway Regulatory and Industry Organisations responsible for providing advice to the BBA in the development of the HAPAS scheme.
Inspection panel	A team representative of the constitution of Specialist Group 1 who are convened, when required, to assess the installation and or performance of a High-Friction Surfacing System installed on site.
Pot life	The maximum time after mixing, at a given temperature and relative humidity, whereby a product may be satisfactorily applied

PSV	Polished stone value, (as defined in BS EN 1097-8 : 2009 except that the test shall be carried out on aggregate of size as defined by the applicant).
Set time	The time after application (at a given temperature and relative humidity) of a chemically curing system after which the aggregate can no longer be applied and adequately incorporated into the resin component. Set time will not be applicable to thermoplastic systems whereby the aggregate is included with the resin prior to melting.
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.
SMA	As defined in Appendix E.
SRV	Skid resistance value (as defined in Appendix D).
System loss	The loss of aggregate from, wearing away of, delamination of a system either individually or in any combination.
Texture depth	Sand Patch Method for the determination of texture depth (as defined in Appendix D).
Trafficking time	The time after application, (at a given temperature and relative humidity), whereby the system will accept normal trafficking.
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 in accordance with the method defined in TRL Report 176 Appendix R.
Visual observation	A procedure for assessing the visual condition of sites as defined in Appendix C.

APPENDIX C

Site test methods and procedures

1. Visual observations

A visual check, including photographic evidence, shall be carried out on the installation, during daylight hours, for uniform surface texture and any discernable faults.

2. Erosion index (degree of erosion)

2.1 The erosion index shall be determined in accordance with the method defined in Appendix D except that the specimen shall be the system under inspection.

2.2 Ten measurements shall be made, at equally spaced intervals, along the length of road being assessed. The assessment shall be carried out in the nearside wheel-track of the lane being assessed.

3 Skid resistance value (SRV)

The side resistance value shall be determined in accordance with the method defined in Road Research Laboratory Road Note 27, *Instructions for Using the Portable Skid Resistance Tester* and TRL Report 176 : Appendix E, except that the measurements shall be taken in the nearside wheel-track equally spaced along the length being assessed.

4. Texture depth

4.1 Texture depth shall be measured using the Sand-Patch Method as defined in BS EN 13036:1:2010 except that ten measurements shall be made, at equally spaced intervals, along the length of road being assessed as follows:

4.1.1 For newly laid systems, measurements shall be made diagonally across the width of the road to represent the area of the site being assessed.

4.1.2 For trafficked systems, measurements shall be made along the nearside wheel-track to represent the length of the site being assessed.

5. Tests on core samples

5.1 Three cores (220 ±5) mm, prepared in accordance with BS 598-110 : 1996, shall be taken along the near-side wheel track, at equally spaced intervals, to represent the length of the site being assessed.

5.2 The cores shall be subjected to the required test(s) in accordance with the methods defined in Appendix D.

6. Estimated overall system loss

6.1 System loss may be due to loss of aggregate from the surface, wearing away or delamination of the system from the substrate.

6.2 The overall system loss shall be estimated visually, with the aid of photographs to demonstrate the loss, and be representative of the area of the site being assessed.

7 Estimated fatting-up

The degree of fatting-up shall be estimated visually, with the aid of photographs to demonstrate the degree of fatting-up, and be representative of the area of the site being assessed.

8. Cracking

The maximum width of crack(s) in the system shall be confirmed to be ≤ 0.5 mm using a pin gauge on the length of the site being assessed.

APPENDIX D

Laboratory test methods and procedures

For the purpose of the assessment of High-Friction Surfacing the following test methods and procedures have been agreed by the Specialist Group 1 – High-Friction Surfacing.

1. Requirements for SMA slabs are given in Appendix E

2. Requirements for concrete slabs are given in TRL Report 176 (1977): Appendix B with the following amendments:

Clause B.4.3 Delete '*either'* and '*or (150 ±2) mm' by'(150 ±2) mm'*

3. Procedure for applying High-Friction surfaces and the measurement of the surface thickness are given in TRL Report 176 (1977) : Appendix C with the following amendments:

Clause C.4.1 Delete *'±0.1mm'* and replace with *'±0.25 mm'*

Clause C.4.1 Delete *'discs of (10 ±1) mm diameter'* and replace with '*discs of between 10 mm and 20 mm diameter'*

Clause C.4.7 Delete '±*1.0C* and replace with '*±2.0ºC'*

Clause C.5 The 20 mm perimeter of the test slab surface shall not form part of the test area.

Clause C.5.2.2 Delete '±*1.0ºC'* and replace with '*±2.0ºC'*

Clause C.5.3.2 Delete '±*0.2 mm'* and replace with '*±0.5 mm'*

Clause C.5.4 The clause shall be amended to read:

Cure the coated samples at a temperature of (20 +/-5)ºC for 7 days prior to testing. If the samples are not ready for testing after the 7 days, cure period they shall be stored flat so that the whole of the bottom surface is supported at a temperature of (5 +/-2)ºC.

4 Procedure for determination of texture depth is given below

The apparatus shall be in accordance with Clause 4 of BS EN 13036-1: 2010. The measuring cylinder shall be of 25mL ± 1mL total capacity.

Carry out texture depth measurements under laboratory conditions (on the asphalt slabs) in accordance with BS EN 13036-1: 2010.

Calculate the texture depth of the asphalt slab and HFS specimen in accordance with Clause of BS EN 13036-1: 2010.

The texture depth shall be reported to the nearest 0.1mm.

5. Procedure for the determination of skid resistance value is given in TRL Report 1796 (1977) : Appendix E.

6. Test procedure for determination of the degree of erosion and visual observations are given in TRL Report 176 (1977) : Appendix F with the following amendments:

Clause F.7.1 Visual observations to be carried out under daylight only.

Table F.1 Delete '*Area of Coating Remaining'* and replace with '*Area of coating (including aggregate) remaining'.*

Clause F.6.2 '*For thermoplastic systems only any area of melting or displacement shall be regarded as being erosion'.*

'*The loss of binder and/or aggregate shall constitute erosion'*

7. Test procedure for scuffing is given Appendix H

8. Test procedure for wear is given in TRL Report 176 (1977) : Appendix H with the following amendments:

Clause H.4.7 Delete '*±1.0ºC'* and replace with '*±2.0ºC'.*

Clause H.5.1 Delete '*(2.0 ±0.1) bar'* and replace with '*(2.0 ±0.2) bar'*.

Clause H.5.3 Delete '*(10 ±2)ºC'* and replace with '*(20 ±2)ºC'*.

Clause H.5.4 Add the following text at the beginning of the clause:

'*Condition the samples in an environment maintained at (10 ±2)ºC for a period of greater than 4 hours'.*

Clause H.5.5 Delete '*When the surface temperature is in the range (10 ±2)ºC,'* and replace with '*Condition the samples in an environment maintained at (20 ±2)ºC and when the surface temperature is in the range of (20 ±2)ºC.'*

9. Test procedure for tensile adhesion is given in TRL Report 176 (1977) : Appendix J with the following amendments:

Clause J.4.1 Load cell to be Grade 2 accuracy to BS 1610 and of a suitable capacity.

Clause J4.4 Note: An angle grinder fitted with a diamond blade has been found suitable for cutting through the high-friction surfacing.

10. Procedure for heat-ageing conditioning is given in TRL Report 176 (1977) : Appendix K with the following amendments:

Clause K.4.1 Delete *'complying with BS 2648.'*. Oven must be capable of maintaining the sample temperature at (70 ±3)ºC.

Clause K.5.3 Sample edges must be supported during heat ageing.
A minimum conditioning period of 24 hrs at (5 ±2)ºC shall be allowed prior to scuffing.

11. Procedure for freeze/thaw conditioning is given in TRL Report 176 (1977) : Appendix L with the following amendments:

Clause L.3 Note: The temperatures relate to the conditioning chamber

Clause L.5.3 A metal frame (sealed using a suitable sealant) is to be used to retain the brine solution instead of road tape.

Brine solution to be made using sodium chloride (GP grade).

Clause L.5.7 Delete *'a single specimen'* and replace with *'two samples'*

12. Procedure for diesel susceptibility conditioning is given in TRL Report 176 (1977) : Appendix M with the following amendments:

Clause M.5.3 Metal frame (sealed using a suitable sealant) to be used to retain the diesel oil instead of road tape.

Clause M.5.5 Samples to be stored in a temperature controlled environment at (5 ±2)ºC prior to testing.

Clause M.5.7 Delete *'a single specimen'* and replace with '*two samples.'*

13. Test procedure for determination of thermal movement is given in TRL Report 176 (1977) : Appendix N with the following amendments:

Clause N.5.6 Note: Temperature measurements to be surface temperatures.

Clause N.5.7 Note: Temperature measurements to be surface temperatures.

Clause N.5.8 Three samples to be tested, once each.

14. Test procedures for optional tests are given in TRL Report 175 (1977) : Appendix P with the following amendments:

Table P.1 Delete *'Extreme claimed ±2ºC* and add the following:
Minimum claimed installation temperature +0ºC & -2ºC
Maximum claimed installation temperature -0ºC & +2ºC

Clause P3 and Table P1

Test samples for the substrate texture depth and concrete substrate optional tests may be prepared in accordance with Appendix C of TRL Report 176 during the preparation of the test samples for the mandatory tests.

APPENDIX E

Requirements for SMA slabs

1. Scope

This Appendix describes the requirements for SMA slabs for subsequent testing after a high-friction surfacing has been applied.

2. Definitions

For the purpose of this Appendix, the definitions given in BS 598-Part 100 : 1987 applies.

3. Composition

3.1 The slabs shall be of SMA composition as below:

3.2 Constituents for SMA slabs:

Binder Grade	40/60
Binder Content	6.3 – 7.3%
Cellulose Fibre	0.30%

BS Sieve Size (mm)	% Passing
14	100
10	85 – 100
6.3	22 – 38
2.0	18 – 32
0.063	8 – 12

3.3 The material shall be mixed hot in a commercial asphalt plant to produce a homogeneous mixture. Laboratory mixing is also permitted.

3.4 For asphalt manufactured in the laboratory an ageing protocol is necessary to simulate a period of ageing. The slabs in their moulds shall be aged in a ventilated oven at 85ºC for a period of 48 hours ± 1 hour.

3.5 For asphalt manufactured in an asphalt plant and re-heated prior to slab manufacture the ageing protocol is not required. The volatiles are substantially removed during asphalt plant manufacture and some oxidation of the binder occurs. Oven ageing of laboratory mixed asphalt is used to replicate these changes in order to ensure consistency of adhesion of the HFS binder.

4. Compaction, dimensions and texture

4.1 Each slab shall receive sufficient compaction to ensure that it is adequately robust not to be damaged by subsequent handling. Once fully compacted the slabs shall be (305 ±2) mm by (305 ±2) mm in plan by (50 ±10) mm deep. The upper surface, after compaction shall have a texture (1.05 ±0.1) mm when measured in accordance with Appendix D except that the volume of the measuring cylinder shall be 50 ml.

4.2 The slabs, when tested in accordance with BS EN 12697-22: 2003 small device in air and shall have a WTSair1.0 of 60ºC. Slabs tested in accordance with BS 598-110 : 1998, shall have a wheel tracking rate of no more than 2.0 mm/hr at 45ºC.

5. Storage and transportation

The slabs shall be stored slabs flat, at a temperature of (15 ±10)ºC, so that the whole of the bottom surface is supported. During transportation, the slabs shall be similarly supported, but the temperature may be outside the range (15 ±10)ºC, for a total period of not more than 7 days provided the temperature does not exceed 30ºC.

For asphalt manufactured in the laboratory an ageing protocol is necessary to simulate a period of ageing. The slabs in their moulds shall be aged in a ventilated oven at 85ºC for a period of 48 hours ± 1 hour.

For asphalt manufactured in an asphalt plant and re-heated prior to slab manufacture the ageing protocol is not required.

Note 3: The volatiles are substantially removed during asphalt plant manufacture and some oxidation of the binder occurs. Oven ageing of laboratory mixed asphalt is used to replicate these changes in order to ensure consistency of adhesion of the HFS binder.

APPENDIX F

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 The protocol describes a procedure that has been developed specifically for the assessment of high-friction surfacing under BBA HAPAS Certification procedures. The method has yet to be proven and shown to be valid. The method is therefore unsuitable for use in specifications and should not be used for this purpose.

2. References

2.1 Normative references.

2.1.1 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 clause 12. Subsequent amendments to, or revisions of, any of these publications apply to this protocol only when incorporated in it by updating or revision.

2.2 Informative references

2.2.1 The protocol refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed in clause 12, but reference should be made to the latest edition.

3. Definitions

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

3.1.1 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 in order to assess their (comparative) performance in service.

3.1.2 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 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 G)

- Collating the panel mark using Table G2 .

4.2 The Applicant is responsible 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 shall consist of the BBA Convenor and two other members who have experience of road surfaces, in particular high-friction surfacing. 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 Convenor informs other members as soon as possible prior to the inspection. A copy of this procedure for inspecting road trial sites shall be sent to panel members who have not participated for familiarity.

6 Initial project briefing

The Inspection Panel are assembled, members are given a Inspection Panel Member's Report Form. The BBA Convenor will also have a BBA Convenor's Report Form (Appendix G1) BBA Convenor 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 will 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 localised areas that have been subject to untypical mechanical or chemical actions (e.g. damage caused by a vehicle running on its wheel-rim or by a major diesel spillage) will be ignored.

7.4 Members will record on their Panel Member's Report Form a mark for each section or sub-section soon after inspecting it. Whilst members can discuss points of interest noted during the inspection, they will not reveal their marking until all members have recorded their individual mark.

8 Marking

8.1 Each section or sub-section shall be assessed on the basis of its current serviceability irrespective of the elapsed time since it was laid. If any of the aspects are evident to a significant degree on the section, the relevant suffix from Table G1 is applied to the basic marking. Suffix v will not be applied to a section marked as *t,* nor + to one marked -.

8.2 Once any appropriate fault suffixes have been assigned, the basic mark is allocated from Table G2.

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 judgements as to the condition of the trial sections without consideration of the commercial interests of their organisation.

10 Reporting of results

The inspection report shall 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

BRITISH STANDARDS INSTITUTION **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 G

BBA HAPAS INSPECTION PANEL

Panel Member's Report Form

Panel Member:	Date of Inspection:
BBA Panel Convenor:	System:
Location:	Job No:
Weather and Road Conditions:	

	Site(s)			
	Practice (if necessary)	**1.**	**2.**	**3.**
See Table G1 Fault Suffix				
See Table G2 Mark				

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	

BBA HAPAS INSPECTION PANEL

Panel Member's Report Form

Mark	Description
E	No discernable 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

APPENDIX G.1

BBA HAPAS INSPECTION PANEL
BBA Convenor's Report Form

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

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

Signed……..

Date……

Appendix H

1. Summary of test method

1.1 A loaded pneumatic-tyre wheel with its axle set at an angle to the direction of motion is repeatedly passed over the surfacing of a specimen at the selected test temperature: (45°C ± 1°C) for Type 1 and Type 2 and (35°C ± 1°C) for Type 3.

Note 1: Types 1, 2 & 3 are specified for different intended uses considering maximum traffic levels (commercial vehicles per lane per day) and site severity. Table NG9/24 of MCHW, Volume 2, 2008 provides such a specification.

1.2 The Erosion Index determined after a set number of passes is used as a measure of the resistance of the HFS to scuffing.

2 Apparatus

2.1.1 *Scuffing-wheel apparatus,* consists of a loaded wheel which bears on a specimen held in a moving table. The table moves to and from beneath the wheel with the axle of the wheel held at an angle of 20° ± 1° to the vertical plane perpendicular to the direction of travel. Vertical play in both the loaded wheel bearings and the lever arm pivot point shall be less than 0.25mm.

2.1.2 *Pneumatic tyre,* of outside diameter of 215mm ± 2.5mm when inflated to the test pressure, fitted to the wheel. The tyre shall be inflated to 3.1bar ± 0.2bar (45psi) and have a ribbed tread of not less than 1.0mm

Note: Occasionally tyres when inflated to the test pressure may slightly exceed the specified diameter, when this occurs they should be rejected. The diameter has a direct effect on the scuffing action.

The tyre shall be visually inspected prior to each use. If the tyre tread that is to be utilised during the test appears filled with debris, the tyre shall be cleaned to restore the tread depth or replaced by a new clean tyre. The tyre may be rotated to enable the remaining tread satisfying the requirement to be used.

Note: The tyre tread is worn on less than a third of the circumference

2.1.3 *Weighted cantilever arm,* to apply a load to the wheel under standard test conditions of 520N ± 5N, measured at the level of the top of the specimen and normal to the plane of the sample table.

Note: The higher load used in BS EN 12697-22 of 700N is thought to be too great for the test and could damage the equipment and would need extensive correlation work.

2.1.4 *Sample table,* constructed so as to enable a 305mm x 305mm x 50mm laboratory prepared specimen to be held firmly in place with its upper surface horizontal, in the required tracking plane and with its centre positioned to ensure symmetrical tracking motion.

2.1.5 *Wheel-tracking machine,* constructed so as to enable the specimen to be moved backwards and forwards under the loaded wheel in a fixed horizontal plane. The centre of contact area of the tyre shall describe simple harmonic motion with respect to the centre of the top surface of the specimen with a frequency of 21 ± 0.2 load cycles (42 passes) per 60 seconds and a total distance of travel of 230mm ± 5mm.

Note: The frequency used in BS EN 12697-22 is 26 load cycles per 60 seconds. This was the frequency of the apparatus specified in BS 598.

2.1.6 *Carriage and frame* carrying marks to ensure the specimen is at the mid-point of its traverse*.* Vertical movement at opposite corners of the carriage shall be less than 0.25mm.

2.1.7 *Means for temperature control,* such that the temperature of the sample during testing is uniform and maintained constant at the selected test temperature 45°C ± 1°C or 35°C ± 1°C.

2.2 *Tyre pressure gauge* (accuracy to ± 0.1bar).

2.3 *A means of inflating tyres.*

2.4 *Tyre tread gauge* (accuracy to ± 0.1mm).

2.5 Talc, French chalk or limestone filler.

2.6 Rubber squeegee / wiper.

2.7 Thermometer and/or thermocouples, of appropriate range, which are capable of measuring to an accuracy of ± 0.5°C, for determining the temperature of the test specimen during conditioning and testing.

2.8 Sealing compound, mastic or heat-transfer silicone.

2.9 Drill, with a masonry bit suitable for drilling small holes in asphalt specimens.

3 Procedure

3.1 *Testing before scuffing*

3.2 *Take photographs* of the surface of the specimen before and after scuffing.

3.3 *Mark the centre* of two opposite vertical sides of the slab to indicate the centre of the scuffing track and to allow alignment of the erosion index grid after scuffing

3.4 *Measure the surface macrotexture* of the specimen with the HFS prior to tracking in accordance with 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 and Procedure C. The texture depth of the specimen before tracking shall be as declared for the product.

3.5 *Temperature monitoring hole*
Through the test surface of the slab, drill one hole of diameter adequate to hold a thermometer or thermocouple*,* at 30 mm to 40 mm from the edge of the slab, to a depth of half the thickness.

3.6 *Conditioning the specimens*

Condition the specimens at the specified test temperature for a period of 4 to 6 hours prior to testing.

***Note** :* The temperature can be monitored using a dummy specimen or the required temperature conditioning time can be evaluated during pre-calibration tests.

3.7 *Performing scuffing test*

3.7.1 *Check the tyre* inflation and the tyre tread depth and inspect the tyre for wear or damage.

3.7.2 Insert a thermometer or thermocouple into the temperature monitoring hole so that the tip is at mid depth of the slab, and seal the hole using a suitable mastic compound or a silicone heat-transfer compound

3.7.3 In order to reduce stickiness, it is recommended that an excess talcum powder is applied on the top surface of the specimen. Using a rubber squeegee / wiper, strike off the talcum powder excess, revealing the peaks of the specimen's macrotexture. The talc shall be dry and at the test temperature.

3.7.4 Place one specimen in the scuffing machine and maintain the specified test temperature throughout the testing regime. Secure the specimen rigidly to the table of the machine. Set the centre of the specimen within 10mm of the centre point of the loaded area at the mid-point of transverse. Ensure that the centreline of the slab as marked on the slab coincides with the centreline of the wheel contact patch and that the loaded cantilever arm is horizontal. Set the machine in motion for 500 wheel-passes (250 cycles taking approximately 12 minutes).

3.7.5 Throughout the test, maintain the test specimen at the specified test temperature ± 1.0°C, as measured by the thermometer or thermocouple.

Note: It is recommended that the temperature be monitored at intervals of 1 min or less during the test alternatively the temperature may be measured continuously and the maximum and minimum temperatures recorded.

3.7.6 Repeat the steps above for the other two replicate specimens.

3.7.7 Thoroughly wash the specimens to remove residual talc and deposited rubber. Dry the specimens thoroughly at a temperature not exceeding 30ºC.

3.7.8 Determine Erosion Index in accordance with Appendix D, and carry out a visual observation of the specimens after the scuffing test,

4 Reporting of results

The test report shall include the following information:

4.1 *Date, time and place of test*
4.2 *Details of the asphalt slab manufacture*, including:
4.2.1 Date and place of manufacture
4.2.2 Material type and specification
4.2.3 Mixing and compaction temperature

4.3 *Details of the high friction surfacing,* including:

4.3.1 Date and place of installation
4.3.2 HFS name
4.3.3 Binder and aggregate type
4.3.4 Any installation details (rate of spread of binder, scratch coat, primer, etc.
4.3.5 Ambient temperature during installation
4.3.6 Mean thickness of the coating of each sample

4.4 *Test data, including*:

4.4.1 The mean test temperature of each specimen
4.4.2 Initial and final tyre pressures and tread depths
4.4.3 Macrotexture of the asphalt slab and initial HFS macrotexture
4.4.4 Erosion Index and visual observations, including individual square gradings.
4.4.5 Photographs
4.4.6 Any anomalies

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