

November 2022 - A review of this Code of Practice will take place, following the publication in early 2023 of BS 8870 - High friction surfacing – Specification.



CODE OF PRACTICE FOR HIGH FRICTION SURFACING



RSTA ADEPT Code of Practice for High Friction Surfacing

Foreword

This second edition of the Code of Practice has been produced by the Road Surface Treatments Association (RSTA) High Friction Surfacing Committee to embrace industry best practice and to reference current specification guidance contained within the HAPAS Product Certification Scheme.

This document has been peer reviewed by ADEPT Soils, Materials, Design and Specifications Committee.

The information contained herein is intended to represent industry best practice. No liability is accepted by RSTA or ADEPT for any damages caused to property or personal injury resulting from using the guidance contained within this document.

RSTA is the Road Surface Treatments Association www.rsta-uk.org

ADEPT is the Association of Directors of Environment, Economy, Planning and Transport
www.adeptnet.org.UK

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DOCUMENT CONTROL

Issue Statement

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1. Introduction

This Code of Practice has been written by the Road Surface Treatments Association High Friction Surfacing (HFS) Sector and ADEPT to assist procurers and installers to obtain a high quality durable surface treatment. HD36, Table 3.1 in the Design Manual for Roads and Bridges recommends the use of HFS on road sites which have been identified as being in the highest risk category requiring the highest level of surface friction.

It represents best practice for the selection and application of High Friction Surfacing Systems to maximise their performance and durability.

High Friction Surfacing is essential in many locations on the network to keep the road surface adequately safe for road users.

To obtain the best results it is necessary to give careful consideration to a wide range of details and to plan and design the work carefully and to use only HAPAS Approved installers. HAPAS categorises systems as Type-1, 2 and 3 systems, where Type-1 has attained the highest performance level. All comply with Clause 924 of the Specification for Highways Works, part of the Manual of Contract Documents for Highway Works.

The type of application in which these products are used and the prevailing ambient conditions at the time of installation are also important to ensure long term durability of the product.

The purpose of this Code is to identify the important aspects of the process, and to refer to other documents relating to good applications of high friction surfacing and so give practical guidance on achieving high quality.

This document is to be reviewed annually jointly by RSTA and ADEPT.

The Road Safety Marking Association (RSMA) and the Road Safety Surfacing Association (RSSA) endorse this document and encourage their members to support the use of the guidance contained herein.

2. Suitable sites for HFS

Each Local Authority should have a Skid Resistance Policy that defines the way that the Investigatory Level is determined for a site using the guidance contained within HD28.

To the highway engineer, high friction surfacing offers a surface application that provides a high level of skid resistance and so enhances safety and reduces accidents for high risk sites. High risk sites are generally defined as those requiring an Investigatory Level (IL) of 0.50 and above for friction as defined in the Design Manual for Roads and Bridges (DMRB) Volume 7 HD36 Table 3.1 (measured by SCRIM). These include:

- approaches to major junctions
- approaches to pedestrian crossings when pedestrians or other vulnerable road users may misjudge the speed of the traffic, for example near schools or where children cross, near public houses or where the approach speed is high
- sites with gradients steeper than 10% if other hazards are present
- bends with a radius of tighter than 500m on single carriageways, if there are risk factors present or a particular potential for loss of control such as an adverse camber or the geometry of the bend is potentially hazardous for the traffic speed

Guidance on the selection of sites requiring HFS is also provided in ADEPT (CSS) Guidance - Use of High Friction Surfacing available from <http://www.adeptnet.org.uk>.

The site categories described in general above, together with the traffic levels at which HFS becomes necessary are detailed in the DMRB Volume 7 HD 36 available from www.dft.gov.uk/ha/standards/dmrbs/.

A useful way of comparing the effectiveness of a High Friction Surfacing is through correlation between accident black spots prior to high friction surfacing systems being applied and the results after the application of the systems.

Between 1991 and 2001 MOLASSES (MONitoring Local Authority Safety SchemES) monitored a total of 2,309 Road Safety Schemes in the UK and calculated the Average Annual Accident Saved per year, by deducting the average number of accidents per year, after implementing each scheme from the average number of accidents prior to implementation.

High Friction Surfacing achieved an accident reduction rate of 35.1% based on a site balance of 10% rural and 90% urban roads.

3. Types of High Friction Surfacing

There are two main categories of HFS – Cold Applied and Hot Applied.

Cold Applied

These systems comprise a resin adhesive that bonds the prescribed aggregate typically graded 1-3mm to the prepared substrate. The aggregate is very hard with a low Aggregate Abrasion Value (AAV) and with a high Polished Stone Value (PSV) that provides the necessary friction with the tyre.

Cold applied resins include epoxy, polyurethane [PU], polyurea, methyl methacrylate [MMA] and polyurethane modified MMA.

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Cold applied resins are installed as a continuous film of adhesive. These are blended mechanically and then manually applied by squeegee onto which the aggregate is broadcast. Once the resin has cured, excess aggregate is removed by sweeping. Further details are provided in Section 12 below.

Hot Applied

For hot applied materials, the pre-mixed resin and aggregate is heated in a boiler at high temperature ensuring the material is mixed and workable. The hot thermoplastic material is screeded out in adjoining strips to cover the whole surface.

Further details are provided in Section 12 below.

4. Asset Management

Local authorities will have a skid policy which will determine where and when HFS is used. These products are normally used on road sections on approaches to junctions, roundabouts and pelican crossings where a reduced braking distance is deemed essential for road safety and the Investigatory Level (IL) for SCRIM is 0.5 or above. In terms of service life a two year study conducted by the BBA in 2013-14 concluded that the vast majority of HFS sites investigated gave a minimum service life of 5 years and on average hot applied systems demonstrated 8 years life and cold applied systems 12 years life. A SCRIM survey conducted on London roads in 2015 concluded that on sites requiring an IL of 0.55 or above calcined bauxite out performed other aggregate types over time.

5. Specification for High Friction Surfacing

High Friction Surfacing must comply with Specification for Highway Works (SHW) **Clause 924** which requires such systems to be HAPAS certificated. Successful certification under the HAPAS scheme involves meeting demanding performance criteria which are given in each system's certificate and meeting stringent Quality Assurance and Quality Control requirements on an ongoing basis.

The three key paragraphs are repeated as follows:

- 1 High friction surfacing systems shall have current HAPAS Roads and Bridges Certificates.
- 2 A high friction surfacing system with a current HAPAS certificate shall only be installed by a contractor approved by the HAPAS scheme provider and the certificate holder as an approved installer for that system.
- 3 The installation and quality control procedures shall be in accordance with the HAPAS certificate for each system and the current method statement agreed by the scheme provider. The results of all quality control checks carried out on site by the contractor and quality assurance information compiled in accordance with the requirements of the certificate, including results from surveillance visits, shall be made available to the overseeing organisation on request.

Clause 924 is an end performance specification. This transfers the responsibility for the design of the high friction system to the selected installer who is responsible for the

execution of the surface treatment and generally guarantees the treatment for a specified period of time. Clause 924 provides a limited guarantee of a minimum of 2 years, subject to the following rider:

This guarantee shall exclude defects arising from damage caused by settlement, subsidence or failure of the carriageway on which the surfacing has been applied, but shall cover failure to meet the minimum requirements set out in Table 4 of the HAPAS 'Guidelines Document for the Assessment and Certification of High Friction Surfaces for Highways'.

If the client specifies that high friction surfacing is installed in full compliance with this Code of Practice then the installer should be able to provide a 5 year guarantee for the appropriate class of system (refer to Appendix B).

There are three classes of HFS; Type 1, Type 2 and Type 3 depending upon the volume of commercial vehicles using the lane. Details are contained in the Guidelines Document for the Assessment and Certification of High Friction Surfacing obtainable from www.bbacerts.co.uk.

For each site category designers have discretion in how to use the guidance given in the local authority skid policy document and for Highways England HD28/15. Refer to the HAPAS Guidelines Document for the Assessment and Certification of High Friction Surfacing for Highways – Table 2 Area of Application by Type Classification.

This guidance and the guarantee of durability that it provides, only applies to systems manufactured and installed in accordance with Clause 924. The www.bbacerts.co.uk website provides a full list of approved systems and installers for each product should the client wish to verify any information.

Further information on the requirement of the HAPAS Scheme is given in Section 14 Performance Criteria.

6. Information to be provided by the client

The contract documents should state;

- a) The product and its installation shall comply with MCHW Clause 924 i.e. be manufactured and installed by companies with a HAPAS Certificate for the relevant system
- b) The type of system (see Section 3)
- c) A clear site drawing indicating the area to be treated
- d) The length and average width of each section, ideally by means of a schedule
- e) The surface type and age on which the system is to be installed
- f) The period during which the HFS may be applied (seasonality / site restrictions)
- g) The material specification to be applied (if necessary)
- h) The colour requirement for the system e.g. buff or grey
- i) Specific traffic management required. e.g. access period
- j) Other site specific requirements e.g. noise
- k) Road Markings (e.g. mark existing / remove)

1) Manhole covers (e.g. mask or treatment)

The documents shall be in sufficient detail for the scope of the works to be clearly identified and all the necessary Health and Safety issues identified.

Prior to commencement the client must give the chosen installer the opportunity to inspect all old surfaces included in the program and then it is the installer's responsibility to report details of any repairs needed to make the surface suitable for the application of the system they intend to install. If the client decides not to carry out those repairs then the installer may choose to remove that site from the programme (See Section 2 above) or both parties may agree a reduced guarantee to be stated in writing. The exclusion in Clause 924 relating to unforeseen defects still applies.

It may be that where there is a framework contract in place the installer can assist the client in the preparation of the detailed information to ensure the installed system will meet client expectations.

7. Planning and Co-ordination

Careful and detailed planning before work commences is an essential element of successful High Friction Surfacing. It is in the interests of both installers and clients that the site/programme of works flows smoothly.

Due to the nature of the majority of the sites there must be close co-ordination between installers and their clients at every stage, commencing with a pre-works meeting, the purpose of which is to ensure total understanding of the way that the site works programme will proceed.

Working under a road closure offers significant advantages in terms of speed of installation and safety and technically by potentially reducing the number of construction joints in the installation. Road closures need a significant notice period to organize.

The client must be aware that a significant reduction in the size of the indicated site programme will increase the installer's overhead costs per square metre of work undertaken. Significant changes can lead to a compensation event and contracts should make provision for compensating installers under these circumstances.

8. Safety, Health and Environment (SHE)

All those involved in preparing and executing high friction surfacing operations have a legal duty of care for the health and safety of both the operatives carrying out the works, and those who come into contact with the operation including the public, whilst works are in progress and during aftercare.

The planning and organising for safety, health and environmental issues commences as soon as a high friction site / programme is envisaged.

The Construction Design and Management (CDM) Regulations generally do not apply to the application of the process on single sites, however on larger schemes and on larger programmes clients are urged to follow closely the advice in the relevant Approved Code of Practice as they have the responsibility under the new version of the Regulations for initiating the framework for safe working practices.

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This will enable the CDM Co-ordinator and Principal Contractor to plan and prepare the information and documentation necessary to ensure that the specific hazards are identified on the various sites and the level of risk that is envisaged.

This must take into account the nature of the site, the materials to be used, the traffic management requirements and any special safety, health and environment issues that have become evident during the pre-tender stage. At tender stage the client must detail any traffic management requirements such as diversions, no parking notices and any other requirements which are addition to the scope of the Traffic Signs Manual Chapter 8 so that these costs can be accounted for.

On the appointment of the Principal Contractor to carry out the high friction operations, it is his duty to prepare a detailed Health and Safety Plan for that particular contract or works from the pre-construction information supplied by the Client, Designers and CDM-Coordinator. This must itemise the methods to be employed to overcome the specifically identified hazards and risk reduction measures that will be in force on this contract. They must also ensure adequate welfare is provided from the start of the contract.

The noise levels of all plant should be ascertained from manufacturers or suppliers so that due provisions can be made. If they are not available, the user must take measurements themselves and, ensure that all operators are provided with the correct hearing protection, where necessary.

Once the works commence the Principal Contractor has the control of safety, health and environment matters but liaison with the client, police and the general public on issues of congestion, diversions or closures must be ongoing throughout the contract.

The Principal Contractor has additional duties under other legislation to look after the health and safety not only of his own employees but of other persons who work alongside them and also of the passing public.

Written full specific risk assessments must be prepared which can be used to identify control measures for both physical and chemical hazards. The measures must form the Contractor's safe systems of work which enhance the safe behaviour of the workforce as well as protect the general public during the various stages of the works.

This Risk Assessment and the measures contained within it must be communicated to all involved in the project during the Induction procedure.

Account must also be taken of environmental factors with pollution from fumes, noise and dust being the main concern during the work phase. Disposal of waste and protection from spillage and contamination are other considerations when looking at the overall high friction activity.

9. Planning the Execution of the Work

On narrow roads, to ensure that a uniform application is applied across the entire site it is best practice to undertake these works within a road closure. This allows an improved quality of application and provides safety for the operatives, pedestrians and road users.

Where wider roads are being treated, there are also distinct advantages, in respect of the speed of application and overall finish of the application, lane or complete road closures will be necessary until the treatment is ready for trafficking. This should be applied to cause minimum inconvenience to road users but segregate traffic and the high friction surfacing operation.

Poor planning can result in low daily output, increased costs and public criticism. The risk assessments undertaken in advance of the works enable supervisory staff to give proper consideration to the layout of the application process. This is particularly critical on complex junctions, lane closures and busy urban areas to ensure that maximum output is achieved with minimal disruption.

In addition to compiling the site information, the high friction surfacing installer responsible for the application must decide on the methodology of how the application of the material is applied to the site in accordance with the relevant method statement.

Considerations need to be taken into account when planning the operations in relation to: the area to be surfaced, existing site conditions, traffic flows, application period and time of year the works are planned to take place.

The overall completed site should have minimal joints and an acceptable finish e.g. uniform surface texture free of surface blemishes and any discernible faults.

The information detailed in Section 13 for machine applied cold, hand applied cold and hot provides the relevant details on the appropriate application method.

10. Traffic Management Requirements

Traffic management must be managed by suitably qualified contractors in accordance with Chapter 8 Traffic Signs manual. Contractors will be able to provide evidence of appropriate training and qualifications in accordance with Sector Scheme 12 for Traffic Management.

11. Surface Preparation

In all cases due consideration should be paid to the applicable system installation method statement. It is essential that the substrate to be treated is in sound condition to maximise the service life of the HFS.

Prior to any HFS application being planned a detailed joint inspection should be undertaken between the client and installer to identify any defects requiring repair within the road surface e.g. cracks, rutting. The RSTA website contains information on pavement repair treatments www.rsta-uk.org.

From a HFS viewpoint, cracks are particularly undesirable as the HFS will crack in sympathy and the thermal and traffic stresses will increase crack width letting in water and may lead to potholing.

Where this defect is present, at least the surface course needs to be replaced in total or locally, prior to the installation of the HFS. HAPAS approved crack and joint repair materials that seal the existing joint are also suitable; flexible inlay systems may provide inadequate support for the HFS.

A rutted surface suggests that the movement is taking place in the surface course or binder course below. HFS is often applied where traffic is channelized and slowing, activities that easily rut the surface. In this instance the rutted areas should be replaced prior to the installation of the HFS.

On fatted road surfaces it is not advisable to apply any form of High Friction Surfacing treatment. In these areas it is advised that the existing surfacing is removed by milling and a new surface course is applied prior to the application of a High Friction surfacing.

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Prior to works commencing, it is a condition of the contract review stage within the quality assurance process that the installer informs the customer in writing whether or not the surface is acceptable for HFS installation, in accordance with this document.

Where the installer believes a good quality HFS installation cannot be achieved in accordance with this document, so that a guarantee can be provided, the client may agree to a derogation in writing, thus accepting a lesser life, or carry out remedial measures prior to works commencing. If the existing guarantee on the system is extended to 5 years then ensuring a sound substrate prior to application is critical to the delivery of the guarantee.

If HFS is to be applied onto a freshly laid asphalt surface course the client and installer must agree the time period (days) that the new surfacing must be left to cure prior to treating with HFS.

The different HFS systems that are available can influence how quickly freshly laid asphalt can be treated. The time delay between laying new asphalt and installing high friction surfacing is also influenced by the porosity of the surface course as this influences the rate of volatile loss from the newly installed asphalt layer. It may be possible to lay some systems onto new asphalt without significant delay if recommended by the manufacturer.

The time between completion of the asphalt surfacing and application of HFS can vary between less than 24 hours and 28 days. Hot applied systems and some cold applied systems can be laid within 24 hours, whereas some cold applied systems require a delay of up to 28 days before installation onto new asphalt. Minimum time intervals are stated on manufacturers data sheets and these should be strictly followed. It should be noted that stated values are minimum time intervals; HFS systems can be laid on recently installed asphalt surfaces that are older than 28 days

Surface dressings and micro-surfacing's (micro-asphalts) may not be suitable to receive high friction surfacing. If HFS is deemed necessary at any location where these surface treatments are installed, a detailed inspection should be carried out by the installer to ascertain their suitability to receive the prescribed HFS system.

The client and the installer shall agree any appropriate measures necessary to maintain adequate traffic safety during the time interval between asphalt installation and application of HFS.

The cleanliness of the existing road surface is critical to the adhesion of the HFS. The installer must ensure that the road surface is clean and dry, free from ice, frost, loose aggregate, embedded topsoil, vegetation, oil, grease, road salt and any other loose material likely to impair the adhesion of the system to the whole area of the road surface to be treated.

Preparation shall be carried out by hand work and by machine vacuum sweeping with drying if necessary. Surface contamination including any salt film, shall be removed by appropriate means in accordance with the manufacturer's instructions to ensure suitability of the substrate as determined by the installer. To optimise the service life of the new HFS, any old HFS shall be removed by fine cold milling, high pressure water jetting or similar removal process prior to re-treatment with HFS. The removal method must be agreed with the client, with an understanding that the resulting exposed substrate may not then be suitable for treatment and may require further remediation prior to treating with HFS.

The ambient and road surface temperatures should be measured. The installation of the systems should not be carried out if the road surface temperature is outside of the range given in the method statement for the system.

12. Constituents

a. Binder

The resin binders listed below have been assessed and approved for use in HFS:

- 1) Cold Epoxy Resin
- 2) Cold Bitumen Extended Epoxy Resin
- 3) Cold Polyurethane/ Polyurea
- 4) Cold Methyl Methacrylate
- 5) Cold Polyurethane modified MMA
- 6) Hot Rosin Ester (Thermoplastic)
- 7) Hot Hydrocarbon Resin (Thermoplastic)

b. Aggregate

The aggregate to be used in Type 1 applications shall meet the requirements in Table 1 below. Calcined bauxite of nominal 1-3mm grading is the only type of aggregate with a proven track record in high friction surfacing and suppliers of this material should provide evidence as required that their materials comply with the specification in Table 1.

It is a requirement of the HAPAS scheme that suppliers of calcined bauxite undertake six monthly testing by a UKAS accredited test house for physical properties contained within Table 1. Mineralogy and chemical properties may also be tested.

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Table 1: The Recommended UK Specification for the properties of Calcined Bauxite

Physical Property	Limits	Test Method
PSV 10/6	70+	BS EN 1097-8:2009
Abrasion Value 10/14	≤ 4	BS EN 1097-8:2009 Annex A
Particle Density	≥ 2.8	BS EN 1097-6:2000
Moisture Content	≤ 0.5%	EN 1097-6:2000
Particle Angularity	Blocked shape (not flakes)	Visual Assessment
Grading % passing		EN933-1:1997
4.00 mm	100%	
3.35 mm	≥ 95%	
1.18 mm	≤ 5.0%	
0.60 mm	≤ 0.5%	
Mineralogy		XRD
Diasporic or Gibbsite Corundum	60-85%	
Chemical Composition		XRF Spectrometry
Al ₂ O ₃	≥ 82.0%	
Fe ₂ O ₃	≤ 4.5%	
SiO ₂	≤ 12.5%	
K ₂ O+Na ₂ O	≤ 0.5%	
TiO ₂	≤ 4.5%	

13. Detailed Requirements for Each System

13.1 General

It is the responsibility of the manufacturer and installer of the system to ensure that the application of the materials is in accordance with the method statement and Certificate.

A copy of the method statement shall be available on every site for use by operatives and customers.

A full Risk Assessment of the site must be completed in advance of the works and a copy of this must be retained on site at all times. The supervisor overseeing the works must ensure that he has undertaken an induction of the works on site with the operatives prior to work commencing.

All Health and Safety Data Sheets and the Control of Substances Hazardous to Health Regulations (COSHH) risk assessments for the works shall be maintained on site.

The special requirements for each application are given as follows:

13.2 COLD LAY - HAND APPLICATION

13.2.1. Pre-works calibrations

The installer shall have all necessary calibrated measuring equipment on site for correct batching of the constituents and relevant certificates.

13.2.2 Preparation

The certificate holder (manufacturer) will be able to confirm if the selected HFS system can be laid on top of old HFS or whether this needs to be removed prior to treatment.

The minimum and maximum air and substrate temperature for a successful durable HFS is given in each system's method statement. This must be checked prior to work commencing. It is imperative that the Installer takes this into consideration when applying systems at either end of the ambient temperature range.

13.2.3 Application of Resin

The constituent components are mixed together in their prescribed ratio in accordance with the method statement prior to application to the substrate with a serrated squeegee and/or roller at the prescribed coverage rate.

13.2.4 Application of Calcined Bauxite

Once the resin has been applied to the surface and allowed to self-level, an excess of aggregate is broadcast over the resin. After the binder is sufficiently cured, the excess aggregate is removed by vacuum sweeper or by hand sweeping, depending on site conditions. Rolling of the aggregate is not permitted.

13.2.5 After-care (post sweeping)

This covers additional work post-installation and usually involves post sweeping i.e. removal of surplus aggregate. This is carried out within the first 48-72 hours following installation.

All advisory signs are to be removed once this final sweep is completed. No further aftercare is normally necessary.

13.2.6 Maintenance & Repair

Should the system be damaged localised repairs can be undertaken. The installer will be able to advise on how to remedy the damage.

It is the responsibility of both the installer and the client to agree areas of rectification works in advance of any works being undertaken on site.

13.3 HOT APPLIED - HAND APPLICATION

13.3.1. Pre-works calibrations

The installer shall ensure that the thermometer(s) on the mixing pot are working correctly and calibrated and relevant certificates are available. It is advised that installers monitor the temperature of the material by taking periodic readings using either a long handled or digital probe accurate to $\pm 2^{\circ}\text{C}$ to control and maintain the application and safe heating temperature range.

13.3.2. Surface Preparation

Refer to section 11.

13.3.3 Material Preparation

The material arrives on site in bags, with the resins, aggregate and fillers already mixed together. The material is heated and mixed in a suitable pre-heater in accordance with the method statement.

The material temperature should be periodically checked during the mixing and application process by the attached thermometers and by a long handled or digital probe accurate to $\pm 2^{\circ}\text{C}$, to ensure the maximum and minimum application temperatures are maintained and the safe heating temperature is not exceeded..

13.3.4 Application

The mixed thermoplastic HFS material is discharged from the boiler into buckets and transferred by hand to the screed box.

The HFS is applied to the prepared substrate using the screed box to give a finished thickness as prescribed in the certificate holder's method statement combing the material

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across the road surface allowing the encapsulated aggregate to be evenly distributed, providing a well textured finish, free from lumps and similar blemishes.

The screed box is passed sequentially across the road surface with a minimum of 10mm overlap to ensure 100% coverage.

The number of bags used should be reconciled with the surface area treated to confirm the correct rate of spread.

The Installers method statement will determine how segregation and overheating of the materials is avoided.

Materials that are overheated have the potential for premature failure.

13.3.5 After-care

On completion and prior to opening to un-restricted traffic the checklist in Appendix A must be followed by the installer:

13.3.6 Maintenance & Repair

Should the system be damaged localised repairs can be undertaken. The installer will be able to advise on how to remedy the damage.

It is the responsibility of both the installer and the client to agree areas of rectification works in advance of any works being undertaken on site.

14 Performance Criteria

Listed below in Table 2 is the performance criteria that each system providing a 5 year guarantee must achieve during serviceable life and at the end of the 5 year period in line with the site test methods and procedures set out in the Guidelines Document for the Assessment and Certification of High Friction Surfacing for Highways Appendix C Sections 3, 4 and 6.

Table 2: Required Performance Criteria for a 5 year Guarantee

Parameter	Type 1	Type 2	Type 3
Skid resistance value (SRV)	≥ 65	≥ 65	≥ 65
Estimated overall system loss in the wheel tracks (%)	≤ 25	≤ 25	≤ 25
Texture Depth (mm) Mean Value	≥ 1.0	≥ 1.0	≥ 1.0

In all cases of dispute the protocol for the visual assessment of HFS Sites by a HAPAS inspection panel as defined in the Guideline Document for the Assessment and Certification of High Friction Surfacing for Highways shall be used.

15 Quality Assurance

All HFS systems shall have HAPAS certification (Highway Authorities Product Approval Scheme) or equivalent. This covers all product manufacturers and installers.

The systems are based upon a set of performance parameters agreed by an expert Specialist Group (SG1) set up by and comprising all of the key industry stakeholder groups including trade associations such as the RSTA.

The specialist group has produced the Guidelines used by assessors to audit the manufacturers and the installers of the systems against the parameters. The Guidelines are available on the website www.bbacerts.co.uk and are kept up to date for new products and respond to feedback on the operation of the system.

In the first instance all the products go through a 'Type Approval' process where the companies quality assurance documentation is scrutinised and independent laboratory tests are carried out on the system, checking for compliance with the guideline parameters. In addition the product manufacturer and the installer have their own in-house procedures within a method statement showing how they monitor quality on an ongoing basis to control and deliver a quality system.

The scheme provider and product manufacturer carry out surveillance visits to installation sites on a regular basis. System samples are taken at manufacturers premises on a regular basis (usually twice a year) for independent laboratory testing.

A Certificate is valid for 3 years, unless withdrawn for any reason.

In order to demonstrate best practice client organisations, including Local Authorities and Highways England, directly or through their maintenance contractor, are committed to only use approved High Friction Surfacing Installers.

The use of approved installers transfers the responsibility for the performance of an installation on a site to the installer and reduces the need for site testing and supervision by the client. This transfers some supervision costs from the client to the installer.

A key part of the systems is the use of trained and competent staff as described below.

16 Training

Achieving the required service life of HFS systems is dependent on a wide range of factors and close attention to detail. Many engineers and technicians have had some experience of high friction surfacing, however only a limited number have had any formal training in the specification and execution of the work. It is important that everyone involved in the specification and installation of HFS systems has undergone appropriate training.

The Installer's Scheme addresses a number of training and qualification requirements for operatives on site. This generally constitutes training leading to NVQ for all types of application.

- Operatives should hold NVQ level 2 and CSCS cards.

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- Supervisors acting as a charge hand supervising one crew should hold NVQ level 3 and a CSCS card.
- Supervisors who are responsible for supervising more than one crew should hold NVQ level 4 and a CSCS card.

In addition Supervisors should maintain competency by attending an appropriate training course on High Friction Surfacing every 5 years. The RSTA run a CPD training course on high friction surfacing and offer a Silver certificate as evidence of maintaining competency.

It is the Association's view that a full understanding of all processes throughout the industry and the workforce makes a fundamental contribution to achieving high quality durable high friction surfacing applications.

In addition to the Installer's Scheme the RSTA provide a training course that defines the minimum standard required for all personnel involved in the installation of high friction surfacing. It is an ADEPT requirement that all personnel involved within high friction surfacing must attend this course every 5 years.

Details of all courses and content can be obtained from the RSTA website www.rsta-uk.org/calendar .

17 Road Surface Treatments Association

Membership of the Road Surface Treatments Association is available to manufacturers, contractors and suppliers of calcined bauxite, binders, client bodies and specialist consultants. The unanimous decision of the Association is to contribute to and adopt this Code of Practice as an example of its commitment to quality in all its undertakings.

It is a condition of membership of the Road Surface Treatments Association that manufacturers and installers have HAPAS certification or equivalent for their HFS systems.

APPENDIX A - Check lists

Pre-Contract Checklist for the Client

1. Has the need for HFS been determined based upon the Local Authority's Skid Policy?
2. Has the Commercial Vehicles traffic figure been obtained?
3. Has the existing road surface been inspected and found to be free from cracks, ruts or fatted areas? If these are present has resurfacing been organised? Does any old HFS need to be removed?
4. Does the tender document contain only HAPAS approved installers?
5. Has the main contractor stipulated the installer must have HAPAS approval? Has the Type (1, 2 or 3) of HFS been specified and is this suitable for the Road Type on which it is to be installed?
6. Have anticipated weather conditions been taken into consideration for the programmed installation for the chosen system?
7. Are the traffic management arrangements fixed, including traffic orders if necessary?
8. Has all the information required of Section 6 (client information) been supplied?
9. Has the Contract Review meeting (ECI) been held on site with the contractor?
10. Has a start-up meeting addressed all the necessary details as given in this document?
11. Have the training records for the staff and operatives to be employed on site been inspected?
12. Is the staffing for the supervision in place?

Pre-Contract Checklist for the Contractor

1. Has the site been visited and assessed for suitability?
2. Has the contractor got all relevant site information i.e. location of schools, bus route, market days, events etc?
3. What type of traffic control is to be operated and is there enough labour to carry out the works in a safe and proper manner?
4. Do all operatives hold appropriate training Certificates and CSCS cards?
5. Has adequate plant been allocated to carry out the works in the time available?
6. Is the calcined bauxite available when required?
7. Is the binder specified available when required?
8. Are calibration certificates available for thermometers, balances, measuring wheels or other measuring equipment?

Contractor Checklist

1. Is the existing surface acceptable for the treatment and agreed with the client? Have there been any recent changes to road surface condition?
2. If the site is unacceptable, has the client been informed?

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3. Has the site induction been carried out covering Health and Safety and technical issues for the site?
4. Does everybody understand the method of operation for the site?
5. Has the road surface been cleaned and swept to an acceptable standard?
6. Is the road clear of parked vehicles or any other obstructions?
7. Is the correct traffic management in place?
8. Has the area to be treated been marked out?
9. Have advisory 'Loose Chipping' signs with supplementary plates stating '20mph' and 'Skid Risk' been erected in locations in advance of the site to advise motorists of the potential hazard over the next 48 hours?
10. Are the correct traffic management signs and diversion routes in place?
11. Has all necessary masking of cat eyes and street furniture (ironwork) been carried out?
12. Are the operatives all present and correct and wearing the relevant Personal Protective Equipment?
13. Is all the plant present and in safe working order?
14. Are the weather conditions appropriate to commence work as per the manufacturer's guidelines?
15. Is the method statement and risk assessment available?
16. Is the planned method of operation safe, both to the operatives and the public?
17. Has the method of application been approved?
18. Has all the excess calcined bauxite aggregate been swept up prior to being opened to traffic?
19. Have all on site tests and checks been carried out and recorded?

Post Contract Check List

1. Check that the binder has fully cured and is hard.
2. Has there been a full visual check on the site to ensure that a uniform surface texture has been achieved?
3. Have any surface blemishes and discernible faults been rectified where practicable?
4. Has all loose and excess aggregate been swept from the surface?
5. Is a second and final sweep of the surface to be undertaken within 48/72 hours of the application?
6. Have all advisory signs been removed following the final sweep?
7. Has the required contract information being collected and documented?
8. Have arrangements been made for road marking replacement?
9. Are re-inspection arrangements clear and agreed?

APPENDIX B – Key Points for 5 year Guarantee

- Early Contractor Involvement (ECI)
- Site selection – ensure the site is suitable for treatment with HFS
- Site design – planning e.g. preparation work, crack sealing
- Product Selection – is the system suitable for site traffic levels
- Substrate in sound condition free from defects
- Dry clean surface free from contaminants such as salt
- Suitable substrate to maximise life e.g. Hot Rolled Asphalt (HRA) and has any old HFS been removed satisfactorily. Also if old HFS is removed ensure the underlying surface is sound and suitable for treatment.
- Only use HAPAS approved product
- Installed by a HAPAS approved installer
- Installed by trained operatives (NVQ)
- Installed within the specified parameters in the manufacturers Certificate i.e.
 - Correct air and surface temperatures
 - Correct material temperatures
 - Road surface texture within limits
- The Calcined Bauxite must meet the requirements in Table 1

APPENDIX C – Glossary of Terms

ADEPT	The Association of Directors of Environment, Economy, Planning and Transport previously known as the CSS (County Surveyors Society)
ADHESION	The property by which a binder sticks to the surface of a solid body e.g. the road or aggregate.
BBA	British Board of Agreement – a certification body which operates the HAPAS scheme for HFS.
BINDER	A liquid, comprised of resins mixed together
BOND	The adhesion between the binder and either the road surface or the applied Calcined Bauxite
CALCINED BAUXITE	A manufactured aggregate derived from calcining bauxite clay in a kiln at high temperatures to produce a very hard aggregate with exceptional skid resistance properties
CDM	Construction (Design and Management) Regulations providing legal advice on health and safety matters applying to construction sites
COSHH	Control of Substances Hazardous to Health
CURE	The chemical reaction between liquid constituents that results in a solid binder being formed
HAPAS	Highway Authorities Product Approval Scheme for certifying the performance in-situ of HFS systems
POLISHED STONE VALUE (PSV)	A measure of an aggregates resistance to polishing under traffic
QUALITY ASSURANCE (QA)	<p>Systematic monitoring and evaluation of the various aspects of a High Friction Surfacing operation to ensure that minimum standards of quality are being attained by the production process.</p> <p>Registration to BSEN ISO 9001 issued to a contractor by a certification body indicates minimum standards are being attained.</p>
RESIN	A solid or liquid synthetic organic polymer used as the basis of adhesives for bonding calcined bauxite to the road surface
SCRIM	A measure of the skid resistance of a road surfacing under wet conditions using a Sideways Force Coefficient Routine Investigation Machine

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SCREEDED	A term used to describe the application or distribution of hot applied HFS onto a road surface in narrow strips transversely across the carriageway.
SECTOR SCHEME 12	A national scheme endorsed by the major highway authorities to which contractors can become registered to demonstrate competency with regard to traffic management
SKIDDING RESISTANCE	The frictional forces between tyre and road which are available to oppose a vehicle skidding
TEXTURE DEPTH	A term used to denote the measure of projection of aggregates in a surface course
THERMOPLASTIC	The property of material by which their viscosity changes in relation to temperature change
THERMOSETTING	A material formed by an irreversible chemical reaction of two or more components which renders it resistant to temperature variations
TRAFFIC SIGNS MANUAL	Otherwise known as Chapter 8 published by the DfT providing advice on traffic management during road works, in particular how to set out signage on a site based on a risk assessment.

APPENDIX D – References

Design Manual for Roads and Bridges. Her Majesty's Stationery Office, London.

- HD 24/06 Traffic assessment (DMRB 7.2.1).
- HD 28/15 Skidding resistance (DMRB 7.3.1).
- HD 36/06 Surfacing material for new and maintenance construction (DMRB 7.5.1).
- HD 37/99 Bituminous surfacing materials and techniques (DMRB 7.5.2). IAN 156/16 Revision of permitted surface course options and aggregate specification for pavement surfacing Manual of Contract Documents for Highway Works. Her Majesty's Stationery Office, London.
- Volume 1: Specification for Highway Works (MCHW 1) www.dft.gov.uk/ha/standards/mchw/vol1/
- Volume 2: Notes for Guidance on the Specification for Highway Works (MCHW 2) www.dft.gov.uk/ha/standards/mchw/vol2/

DEPARTMENT FOR TRANSPORT Traffic Signs Manual, Chapter 8; Traffic safety measures & signs for roadworks and temporary situations. Her Majesty's Stationery Office, London.

HOUSE OF COMMONS Health and Safety at Work, etc., Act 1974. Her Majesty's Stationery Office, London.

HOUSE OF COMMONS Control of Substances Hazardous to Health (COSHH) Regulations 1988. Her Majesty's Stationery Office, London.

ISO9001 Quality Management Standard published by ISO.

Safety at Street Works and Road Works – A Code of Practice (the red book) published by DfT.

The latest published version of each standard must be used.