RESIN BONDED SURFACING SYSTEMS FOR EXTERNAL APPLICATIONS

Supported by

FeRFA Guidance Note: No 13

CONTENTS

1. INTRODUCTION

This guide is based on the collective knowledge of FeRFA members having extensive experience in the requirements for successful applications of resin bonded surfacing. In separate sections, the guide gives recommendations for the selection, design, substrate preparation, application, maintenance and for the inspection and testing of surfacing. Its scope includes **resin bonded surfacing** applied to concrete, asphalt concrete conforming to EN 13108–1 and hot rolled asphalt conforming to EN 13108–4. Resin bound surfacing is often specified for similar applications and is the subject of FeRFA Guidance Note No 14.

2. DESIGN

2.1 Who is the Designer?

The designer is that person or organisation who:

- Takes control and responsibility for the design of the surfacing;
- Ensures that they are provided with all the information as set out in Section 2.2;
- Provides all the information set out in Section 3.1 to the Contractor.

A specified Surfacing Contractor may be deemed the designer if and only if they are provided with the information set out in Section 2.2.

The person or organisation which provides a contractor with a standard form of specification and which contains some or all of the information set out in Section 3.3 is ipso facto 'the designer'. The designer is responsible for all aspects of design and should not rely on the contractor to design those aspects which he has failed to include.

2.2 Information Required by the Designer

The following information should be provided to or sought by the designer.

a) Description, situation and address of site and means of access;

b) Those conditions of contract that might practically affect this particular work;

c) Location, intended usage and areas to be covered;

d) Age and nature of the base and its strength and finish;

e) The type and intensity of traffic to be expected;

f) Condition of the sub-grade and possible need for capping layer;

g) Composition of the subgrade and possible need for additional drainage (fully permeable resin bound surfacing only).

h) Location of manholes, surface drains, etc;

i) Drainage requirements;

j) Description of junctions with existing edgings/hard landscaping/buildings;

k) Location of trees;

l) Available depth from finished surfacing level to top of the base;

m) Any programming constraints.

2.3 Typical resin bonded surfacing applications

Typical applications include roads (materials used on public highways may require HAPAS approval), car parks (excluding decked car parks where a waterproof system is required), driveways, podium decks and terraces, public squares, courtyards and footpaths.

2.3.1 Resin bonded surfacing composition and design considerations

Composed of a layer of resin with kiln-dried aggregate embedded into the freshly applied resin layer, resin bonded surfacing is typically laid at a thickness of approximately 3 mm when 1 – 3 mm aggregate is used.

Resin bonded surfacing is typically laid on a solid base of concrete, asphalt concrete or hot rolled asphalt. Steel and timber substrates are also suitable but application to oily timber such as Cedar should be avoided. Manufacturers' instructions and recommendations should be strictly followed.

Resin bonded surfacing is not porous and must be applied to non-porous bases with adequate falls in place to allow free drainage. Resin loss into fissures or low spots in a textured surface may reduce the volume of resin available for bonding the aggregate and it is advisable when applying the resin to a fissured or textured surface to apply a scratch coat to regulate the surface before application of the resin layer. Resin bonded surfacing, although non-porous, should not be regarded as waterproof. It should be assumed that at least some aggregate will penetrate the full depth of the resin and leave a path for water penetration. When waterproofing is required this may be achieved by application of a waterproof layer followed by an embedment layer but only if the tensile strength of the resin is high enough and the resin is sufficiently elastic. The waterproof layer should typically be thicker than the embedment layer.

Resins used for bonded surfacing are typically based on two component polyurethane, polyurea, methyl methacrylate or bitumen extended epoxy technology; all having their own benefits. Suitable resins should be sufficiently flexible and elastic to accommodate movement in asphaltic substrates and to avoid undue stress within the substrate. The latter is particularly important when resin bonded surfacing is applied to older asphaltic bases which have lost much of their original tensile strength and older asphaltic bases approaching their maximum service life may not be suitable for application of resin bonded surfacing.

All resins require some delay before application to newly applied concrete, asphalt and asphalt concrete substrates. Concrete must be allowed to dry sufficiently to prevent blistering of the resin caused by moisture vapour pressure, a surface relative humidity ≤ 75% being an indication that the concrete is sufficiently dry. Similarly, the free volatiles in asphalt or asphalt concrete must be allowed to evaporate to avoid blistering. A waiting time of 3 weeks in warm or mild weather (longer in cold weather) is typically sufficient.

The choice of aggregate can be critical, particularly when the surfacing is to be subjected to vehicular traffic. 1 – 3 mm Bauxite aggregate should be used on highways and is generally the preferred aggregate for vehicular traffic. Granite, basalt and some flint and quartz aggregates may be suitable for lighter vehicular traffic. Aggregates < 7 on the Mohs scale of mineral hardness should not be used when surfacing is subject to vehicular traffic. Rounded aggregates such as pea shingle are more prone to pick-out and therefore not suitable for vehicle traffic.

2.4 Application Depth

- Footpaths using 0.9 – 1.4 mm aggregate: Approximately 1.5 mm thickness.
- Footpaths and vehicular trafficked areas using 1 – 3 mm aggregate: Approximately 3 mm thickness.

Two layer application for waterproofing using 1 – 3 mm aggregate: Approximately 5 mm thickness.

2.5 Cracking

Cracking is principally caused by movement or settlement in the base or sub-base.

2.5.1 Base Movement

Cracks caused by base movement in concrete slabs are rare but economic considerations and the increased construction thickness often required dictate that resin bonded surfacing is frequently applied to asphaltic bases. It is good practice only to apply resin bonded surfacing to asphaltic bases with a bitumen binder which has a 'pen' or penetration test value ≤ 90 when tested in accordance with BS EN 13108-1 but some flow of asphaltic materials in warm weather will occur irrespective of the hardness of the bitumen. When flow of the bitumen is sufficient to exceed the tensile strength of the surfacing, cracking will occur in the surfacing. In such cases there may or may not be cracking of the base. Old asphaltic bases may weaken to the point where resin bonded surfaces cause stresses to occur in the base which the weakened material cannot withstand and cracking will occur in the base which is then reflected in the surfacing. Given the expected life of a new resin bonded surfaces, the designer should consider replacement of old bases before resin bonded surfacing is applied. Resins with sufficient elasticity to reduce stresses on the base should be used.

2.5.2 Sub-base Settlement

Settlement of the sub-base caused by inadequate compaction or by movement of the sub-grade, typically in clay belts, may result in cracking of the surfacing.

2.6 Joints

Movement joints in the base must not be bridged. Application of the resin should be discontinued at movement joints. Open bay joints should be treated in the same way as movement joints. Consideration should be given to the risk of closed bay joints opening up at a later date.

Duct tape should be used to ensure that a straight edge is provided at day-work joints and the tape removed before the resin has gelled. Care should be taken by the contractor when planning the works to reduce the length of day-work joints where possible and to position joints where they will have the least possible visual impact.

2.7 Waterproofing

Resin bonded surfacing is not designed to provide waterproofing and should not be used for most car park deck waterproofing applications, particularly on composite structures where high levels of movement may be experienced. When the resin is sufficiently elastic and the structure is suitable, a waterproof layer of resin may be applied to a prepared deck before application of the binder layer and aggregate. The resin manufacturer must be consulted before proceeding with waterproofing applications.

2.8 Weather Protection and Curing

Adequate weather protection must be provided at the work station if works are to be carried out when rain is possible and kiln-dried aggregate must be covered. The contractor must not rely on packaging to prevent moisture ingress. Aggregates should not be stored under tarpaulins for long periods unless adequate ventilation can be provided to prevent moisture ingress from atmospheric humidity. Kiln-dried aggregate which has become damp must not be used. Substrates which have become wet must be allowed to thoroughly dry before application proceeds. Application of resin bonded surfacing should be avoided if rain is expected before the resin has achieved initial cure.

2.9 Testing

The designer should specify what, if any, tests are to be carried out during or after application of the surfacing. This should include the type of test, the number of test positions, whether these are on a random or grid basis and the acceptance limits. Tests may include:

2.9.1 Surfacing thickness

Periodic checks may be carried out during application to ensure that the specified minimum quantity of resin has been used. A wet film gauge may be used to determine resin thickness during application.

2.9.2 Slip resistance

Slip resistance tests may be carried out using either the Ramp/Trolley test aka SlipAlert, or using a Pendulum Slip Resistance test machine. Tests are normally carried out in both wet and dry conditions. The acceptance limit in wet and dry conditions is generally 40 PTV (Pendulum Test Value) or as specified by the designer. Please note that slip resistance is influenced by gradient and steep gradients may limit the choice of aggregate to minerals such as bauxite, which have higher PTVs.

3. APPLICATION

Application of resin bonded surfacing requires specialist skills in substrate preparation, mixing and application. The advice of the manufacturer should be sought when choosing a contractor or preparing a tender list.

3.1 Information Required by the Contractor

The following information is required by the Contractor. It is strongly recommended that this information is properly recorded.

- Location of the project.
- Areas concerned.
- Type(s) of surfacing to be laid.
- Programme constraints.
- Relevant details of the base.
- Preparation of the base surface to be carried out.
- Design thickness of the surfacing and minimum thickness to be achieved.
- Joint details and locations.

3.2 Application of Resin Bonded Surfacing

- Concrete should have a maximum relative humidity of 75% before resin bonded surfacing is applied.
- Prepare concrete by mechanical means to produce a clean, dry, lightly textured surface that is free from laitance and loose or friable materials.
- Asphalt or asphalt concrete should remain uncovered for 3 weeks in warm conditions, longer in cold weather, to prevent entrapment of volatiles.
- Resin bonded surfacing is not suitable for application to asphalt or asphalt concrete containing softer grades of bitumen. The bitumen binder must have a pen value no greater than 90 and preferably 40/60 when tested in accordance with EN 1426 Needle Penetration Test. Bituminous materials with a higher pen value will be too soft and may deform in warm weather, especially under loading from wheels etc. Base courses of asphalt/asphalt concrete are often open graded allowing moisture penetration. Moisture will normally vaporize and be vented to the atmosphere but when the asphalt/asphalt concrete is covered with an impermeable resin surface, moisture below may become trapped. When the moisture vaporizes in hot weather, there is a high risk of blistering. Older asphalt/asphalt concrete will be weaker and should be expected to crack when overlaid with a resin bonded surfacing.
- Protect all kerbs, ironwork etc. from spillage/overflow of resin, preferably using duct tape to seal and use duct tape at termination points.
- The manufacturer's technical data must be followed when mixing.
- Spread with a notched squeegee or roller at a typical rate of 1.5 kg/m^2 and when 1 – 3 mm aggregate is to be scattered or 1 kg/m^2 when 0.9 – 1.4 mm aggregate is to be scattered. The application rate will increase when larger aggregate is used. Maximum application temperature 30^{0}C for most products. Manufacturer's instructions may vary.
- Fully blind resin bonded surfacing with the chosen size of kiln-dried aggregate at a minimum rate of 8 kg/m^2 or in accordance with the manufacturer's instructions. This must be done immediately after application of the resin whilst it is still fluid.
- Remove all duct tape/protection before the resin gels.
- Allow the resin bonded surfacing to cure in accordance with the recommendations of the manufacturer. Excess aggregate may then be removed by sweeping and vacuuming. This aggregate may then be re-used if it is dry and clean. It may require several cycles of sweeping and vacuuming to fully remove loose aggregate.
- Do not apply resin bonded surfacing during periods of high humidity or if rain is expected within its cure time or if the resin or aggregate has become damp.

4. CARE AND MAINTENANCE

4.1 Use of Cleaning Products

Cleaning products should be pH neutral where possible and biodegradability should be considered when cleaning permeable pavement as chemicals will drain to natural water courses. When using acidic or alkaline cleaners, pH should be as close to neutral as possible and cleaners should be neutralised before flushing with clean water to reduce the risk of staining and degradation of the resin. A discrete test patch should be chosen for a trial before general use.

4.2 Regular Cleaning

Regular appropriate cleaning of surfacing materials will contribute to the durability of the surfacing. As with any surfacing material, resin bound surfacing should be cleaned regularly and as frequently as necessary to maintain its appearance. Sweep with a broom to remove leaves, paper etc. Use water as necessary to wash the surface and only use cleaning products when water and a sweeping brush are insufficient for cleaning the surface. The use of abrasive pads and wire brushes should be avoided.

4.3 Removing Moss, Algae and Lichen

After brushing off biological growth, remove remaining moss, algae, lichen or other biological growth from the surface with a proprietary fungicide. Flushing with clean water may not be necessary and may affect the long term effectiveness of the treatment. Follow the instructions of the manufacturer and abide by local regulations with regard to the use of chemicals. Periodic use of a fungicide should be considered as a preventative measure in areas where conditions are likely to promote biological growth.

4.4 Chewing Gum Removal

Chewing gum can be removed by scraping or chipping or using proprietary local “spot” removal solutions or by employing a commercial cleaning company. Take care not to dislodge aggregate.

4.5 Power Washing

If power washing the surface, use only sufficient water pressure to remove dirt or contamination. Use cold water only (maximum 40 ^{0}C) with a fan jet, maintaining at least 300 mm between the lance and the surface holding the lance at an angle of approximately 45^{0}. Avoid concentration of the jet on one area by using a sweeping action from side to side.

4.6 Removing Oil Stains

Use a proprietary degreasing material and scrub into the surface with a broom. Ingrained stains may require the degreaser to be left in place for some time to allow the product to penetrate the deposit before flushing. Several applications of degreaser may be required for full removal.

4.7 Removing Tyre Marks

Use a proprietary tyre mark remover.

4.8 Removing Cement Stains

Use a proprietary acid based concrete/mortar cleaner and neutralise immediately after removal of the stain using copious amounts of clean water. A discrete test patch should be chosen for a trial before general use. Manufacturer’s application instructions and health and safety guidance must be followed.

4.9 Using the Surface

Protect the surface from damage caused by equipment such as vehicle jacks, skips etc. and from abrasion by dragging of heavy objects. Protect the surface from liquids and other materials which may stain or affect the surface such as hydraulic fluids, petrol, oil, diesel, paints, chewing gum, cement etc.

4.10 Localised Repairs

Resin bonded surfacing can be repaired using the same combination of resin and aggregate as used during installation. Repairs should be carried out as soon as possible after they have been identified to avoid further degradation.

FeRFA

FeRFA, the Resin Flooring Association, represents the major product manufacturers, specialist contractors and surface preparation companies, raw material suppliers and specialist service providers within the UK Resin Flooring Industry. Established in 1969, FeRFA now represents over 90 UK based companies. The Association has established Codes of Practice for full members. It takes an active role in promoting resin flooring and in developing both national and international standards.

All FeRFA publications are freely downloadable from the website at www.ferfa.org.uk
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