

BS 594987:2024



BSI Standards Publication

Asphalt for roads and other trafficked areas – Transport, laying, compaction and product type testing protocols – Specification

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Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 December 2024. It was prepared by Subcommittee B/510/1, *Asphalt products*, and under the authority of Technical Committee B/510, *Road materials*. A list of organizations represented on these committees can be obtained on request to the committee manager.

Supersession

BS 594987:2024 supersedes [BS 594987:2015+A1:2017](#) and [BS 598-1:2011](#), which are withdrawn.

Relationship with other publications

BS 594987:2024 is intended to be read in conjunction with [PD 6691:2022](#) as the two documents cross reference each other.

Information about this document

This is a full revision of the document, and introduces the following principal changes:

- addition of warm mix asphalts;
- guidance on materials for bridge decks; and
- new annex covering the transport and laying of mastic asphalt;

The two following annexes have been transferred from [BS 598-1](#) to allow that document to be withdrawn:

- annex describing the method for the measurement of the rate of spread of coated chippings; and
- annex describing how to undertake an assessment of the compaction performance of a roller.

This publication can be withdrawn, revised, partially superseded or superseded. Information regarding the status of this publication can be found in the Standards Catalogue on the BSI website at knowledge.bsigroup.com, or by contacting the Customer Services team.

Where websites and webpages have been cited, they are provided for ease of reference and are correct at the time of publication. The location of a webpage or website, or its contents, cannot be guaranteed.

Presentational conventions

The provisions of this document are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is “shall”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Where words have alternative spellings, the preferred spelling of the *Shorter Oxford English Dictionary* is used (e.g. “organization” rather than “organisation”).

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Introduction

This British Standard specifies requirements for transporting asphalt mixtures, for preparatory site work and for laying and compacting asphalt mixtures.

Some of the annexes contain protocols to be used for initial product type testing of bituminous mixtures in accordance with the [BS EN 13108](#) series.

- [Annex A](#) specifies requirements for discharge and compaction temperatures for warm and hot mix asphalts: recipe AC, HRA and SMA produced in accordance with the [BS EN 13108](#) series.
- [Annex B](#) provides approximate rates of spread of asphalt.
- [Annex C](#), [Annex D](#), [Annex E](#), [Annex F](#) and [Annex G](#) provide recommended protocols for the product-type testing of asphalt mixtures in accordance with [BS EN 13108-20](#); in particular, guidance is given on sampling by coring, assessing for target composition, voids, compaction and deformation resistance.
- [Annex H](#) provides a recommended protocol for determining the design binder content of hot rolled asphalt (HRA) surface course mixtures.
- [Annex I](#) provides a required protocol on the correlation procedure for indirect density gauges.
- [Annex J](#) provides advice on the use of tack coats.
- [Annex K](#) specifies the method for the measurement of the rate of spread of coated chippings.
- [Annex L](#) provides guidance on the design of BBA mixtures for airfield pavements.
- [Annex M](#) specifies requirements for the transport, laying and compaction of mastic asphalt (MA).
- [Annex N](#) specifies the method for undertaking an assessment of the compaction performance of a roller.

1 Scope

This document specifies requirements for the transport, laying and compaction of asphalt mixtures for roads and other trafficked areas conforming to [BS EN 13108-1](#), [BS EN 13108-4](#), [BS EN 13108-5](#), [BS EN 13108-6](#), and as described in [PD 6691](#). It addresses the requirements from the time the mixtures leave the mixing plant until they are installed ready to receive a superimposed layer or traffic. It includes requirements for preliminary work at the laying site to verify the substrate is fit to receive the asphalt and the application of bond coats.

NOTE 1 The term “asphalt” used in this standard is the generic term used to describe the wide range of mixtures of aggregate and bituminous binders. Asphalt is referred to as bituminous mixtures in the [BS EN 13108](#) series.

This document does not contain explicit requirements for asphalt mixtures covered in other parts of [BS EN 13108](#) or proprietary asphalt mixtures. However, the general principles of this standard can be applied to those mixtures in addition to any special requirements specified in individual quality plans and/or method statements.

This document does not specify requirements for asphalt incorporating bituminous emulsion binders.

NOTE 2 [BS EN 13108-20](#) specifies tests for determining the conformity of a mix to any of the other parts of [BS EN 13108](#). This is similar to a mix design validation or job mix trial. [BS EN 13108-20](#) offers some choice in the way specimens are to be prepared for the purposes of product-type testing. Guidance for sample preparation for the demonstration of product-type test properties are given in [PD 6691:2022](#), 7.2 and are linked to the relevant protocols/annexes in this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions, or limits the application, of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards publications

[BS 1707](#), *Road surface dressing, bond coats, seals, preservatives and other sprays – Specification for the method of test for binder sprayers for accuracy of spread of binder (spray bar bench test)*

[BS EN 12272-1](#), *Surface dressing – Test methods – Part 1: Rate of spread and accuracy of spread of binder and chippings*

[BS EN 12697-6:2020](#), *Bituminous mixtures – Test methods – Part 6: Determination of bulk density of bituminous specimens*

[BS EN 12697-8](#), *Bituminous mixtures – Test methods – Part 8: Determination of void characteristics of bituminous specimens*

[BS EN 12697-13](#), *Bituminous mixtures – Test methods – Part 13: Temperature measurement*

[BS EN 12697-27:2017](#), *Bituminous mixtures – Test methods – Part 27: Sampling*

[BS EN 13036-1](#), *Road and airfield surface characteristics – Test methods – Part 1: Measurement of pavement surface macrotexture depth using a volumetric patch technique*

[BS EN 13036-7](#), *Road and airfield surface characteristics – Test methods – Part 7: Irregularity measurement of pavement courses – The straightedge test*

[BS EN 13108](#) (all parts)¹⁾, *Bituminous mixtures – Material specifications*

[BS EN 13588](#), *Bitumen and bituminous binders – Determination of cohesion of bituminous binders with pendulum test*

[BS EN 13808:2013](#), *Bitumen and bituminous binders – Framework for specifying cationic bituminous emulsions*

[BS EN 14023](#), *Bitumen and bituminous binders – Specification framework for polymer modified bitumens*

[BS EN 15322](#), *Bitumen and bituminous binders – Framework for specifying cut-back and fluxed bituminous binders*

[PD 6691:2022](#), *Guidance on the use of BS EN 13108, Bituminous mixtures*

¹⁾ Dated references are made to [BS EN 13108-21:2016](#), *Bituminous mixtures – Material specifications – Part 21: Factory*.

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in the [BS EN 13108](#) series and the following apply.

3.1.1 bond coat

proprietary polymer modified bituminous binder used to promote adhesion between and/or sealing of layers in the construction and maintenance of roads and paved areas

3.1.2 coated grit

aggregate with a maximum size of 4 mm to which a light application of paving grade bitumen is applied

3.1.3 joint

interface or proposed interface between two adjacent strips of freshly paved mixture or the interface between a strip of freshly paved mixture and an existing paved area

NOTE 1 Joints refer to vertical or near vertical interfaces. Longitudinal joints are formed parallel to the direction of laying and transverse joints are formed at right angles to the direction of laying.

NOTE 2 A free edge is not a joint. A free edge is the vertical or angled face of a pavement layer that is intentionally permanently exposed.

3.1.4 maximum compacted layer thickness

thickness that the layer does not exceed on completion of compaction, to which construction tolerances may be applied

3.1.5 layer

a thickness of material that is installed in a single pass of a paving operation

NOTE Several layers can be required to make up a pavement course.

3.1.6 milling

process of controlled removal of part of the surface of a road pavement or paved area using specialist machinery

NOTE 1 Milling removes a range of thicknesses, ranging from a small amount to level and smooth the surface, to full depth removal. Milling is typically used to remove a predetermined thickness prior to installation of inlay surfacing.

NOTE 2 Planing, cold planing or profiling are alternative terms for pavement milling/asphalt milling.

3.1.7 minimum thickness at any point

thickness that the layer may be at any point in the installation on completion of compaction, with no construction tolerances applied

NOTE The minimum thickness at any point is not a thickness that the layer may be intentionally reduced to for installation purposes.

3.1.8 nominal layer thickness

thickness of a single compacted layer as specified in the work specific requirements around which a construction tolerance is applied

3.1.9 permitted installed layer thickness

range from which a nominal layer thickness can be selected

3.1.10 tack coat

unmodified bituminous emulsion used to facilitate adhesion between layers in the construction and maintenance of roads and paved areas

3.1.11 shoulder-to-shoulder cover

maximum possible packing arrangement of a single layer thickness of randomly selected chippings, determined by placing the chippings such that all individual particles are positioned as closely as possible to one another and are touching one another (or the side of the tray) with at least one contact point

3.1.12 warm mix asphalt

asphalt mixture manufactured at lower temperatures than traditional hot mix asphalt that still achieves adequate coating of the aggregate with the binder during mixing and the required compaction at installation

3.2 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

AC	asphalt concrete
BBA	béton bitumineux pour chaussées aéronautiques
EME2	enrobé à module élevé class 2
HBM	hydraulically bound mixture
HDM	heavy-duty macadam
HMB	high-modulus base
HRA	hot rolled asphalt
IT-CY	indirect tension to cylindrical specimens
MA	mastic asphalt
PSV	polished stone value
PCSM	permanent cold-lay surfacing material
SHW	specification for highways works
SMA	stone mastic asphalt
SuDS	sustainable drainage systems

4 Transport and delivery

4.1 Transport

Loading of asphalt shall be carried out such that segregation is minimized, as verified by visual examination.

To minimize temperature loss during transport to the laying site, asphalt shall be transported in vehicles with insulated bodies or thermostatically controlled hot boxes. Further protection against heat loss shall be provided by sheeting systems, tarpaulins or other suitable insulating blankets.

Asphalt tipped to form a site stockpile shall be protected against adverse weather conditions and excessive heat loss to maintain a temperature such that the material is suitable for installation in accordance with [Annex A](#).

NOTE 1 Suitable methods include the use of a tarpaulin or an insulating blanket.

When used to facilitate discharge of the asphalt, application of release agents shall not cause softening or damage to the asphalt. The amount used shall be kept to a minimum. Diesel and/or kerosene shall not be used.

NOTE 2 Sealing grit, sand, soap solution, water or a proprietary release agent may be used on the floor and/or other surfaces of the vehicle to facilitate discharge of the asphalt.

When transporting more than one material in the same vehicle, measures shall be taken to avoid cross-contamination.

Mastic asphalt shall be transported in accordance with [Annex M](#).

4.2 Delivery to the site

Deliveries of asphalt to the site shall be planned to achieve a continuous laying process.

Asphalt shall be delivered at a temperature that allows it to be installed in accordance with [Clause 6](#) and [Clause 9](#).

NOTE For discharge temperatures, see [Annex A](#) for further guidance. Discharge temperatures, taken within 30 minutes after arrival on site, should allow adequate time to check that minimum temperatures prior to compaction will be achieved. However, other temperatures might be specified to suit specific site conditions and mixtures. Temperatures should be measured in accordance with [BS EN 12697-13](#).

5 Preparatory works at the laying site

5.1 General

Where asphalt is to be laid, the surfaces shall be free from loose materials, standing/running water and foreign matter, e.g. mud, slurry or other deleterious material. Prior to commencement of laying, the underlying course shall provide a stable surface of appropriate profile on which the asphalt can be placed.

Any defects visible in the underlying course not covered by the treatment design (for example cracked, debonded or crazed areas) shall be discussed with the client, and removed unless otherwise agreed.

NOTE 1 The surface on which the asphalt is to be laid should be of adequate strength to bear the equipment and compactive effort to be used in the laying of the asphalt.

NOTE 2 Lateral support, including the use of roller mounted edge restraints, can be used to minimize the risk of damage at unconfined edges and also to optimize their compaction.

NOTE 3 To minimize the risk of contamination, trafficking prior to the installation of the surface course should, as far as possible, be restricted to plant and equipment used for laying and compaction of the asphalt.

Preparatory works for mastic asphalt shall be carried out in accordance with [Annex M](#).

5.2 Chamber covers and interfaces with other assets

All assets (e.g. chamber covers, gully frames, kerbs, channels etc.) shall be set to the level required by the design.

Where asphalt abuts vertical faces of chamber covers, gully frames, kerbs, channels and similar assets, these vertical faces shall be cleaned and painted with a uniform coating of:

- a) hot applied 40/60 or 70/100 paving grade bitumen;
- b) cold applied thixotropic bituminous emulsion of similar grade; or
- c) polymer modified bituminous emulsion bond coat.

Asphalt shall be compacted around and against chamber covers and gully frames by means of tampers.

Excluding kerbs, the finished surface shall be either left flush with the top of, or not more than 3 mm above such features.

5.3 Resurfacing

5.3.1 Inlaying asphalt

Existing asphalt to be replaced with new asphalt shall be removed by milling.

The existing material shall be assessed to determine the presence of tar.

NOTE 1 Guidance on the assessment process is given in the ADEPT guide to “Managing Reclaimed Asphalt” [1] and Technical Guidance WM3 [2].

NOTE 2 SEPA’s “Guidance on the Production of Fully Recovered Asphalt Road Planings” [3] applies in Scotland.

The milling process shall produce a regular surface with a uniform texture and groove depth. Any discontinuity between adjacent milling machine passes shall be rectified by further milling.

Carriageways shall be milled to a level tolerance appropriate to the thickness of the new surfacing and its end application. If these tolerances are exceeded, the full extent of the area that does not conform shall be rectified by further milling or by regulating with materials in accordance with 5.4.

NOTE 3 Where only one layer is being removed and replaced on a carriageway, particular attention should be paid to the uniformity and level tolerance of the milled surface as poor control can adversely affect the ride quality of the finished pavement.

Existing ironwork shall not be disturbed by the milling process. Where necessary, asphalt in the vicinity of ironwork and in irregular or small areas shall be cut out with pneumatic tools or other suitable methods.

The milled surface shall be mechanically swept to remove all dust and loose debris. Lenses of partially delaminated existing asphalt shall be removed. All areas of cracking or deterioration shall be discussed with the client and shall be repaired by localized patching or deeper repair unless otherwise agreed.

Where a longitudinal milled edge forms a joint at surface course level, the cut edge shall be left neat, vertical and in straight lines. All transverse joints shall be sawcut. All exposed faces shall be treated in accordance with 6.9.2.

Carriageways closed to traffic to enable milling works shall be resurfaced after milling and prior to reopening to traffic unless otherwise agreed by the specifier. Where appropriate, temporary ramping shall be provided.

5.3.2 Overlaying asphalt

An existing surface shall only be used for receiving overlaid asphalt where the maximum depression under a 3 m straight edge placed longitudinally or under a template placed transversely does not exceed:

- a) 25 mm when the resurfacing is to consist of two-course work; or
- b) 13 mm when the resurfacing is to be a single surface course.

Where the existing surface does not meet these requirements, it shall be improved by milling and/or by the addition of a regulating course.

NOTE Prior to the laying of the new asphalt, all weak areas to be surfaced should be strengthened, major inequalities of profile remedied, and depressions filled and compacted (refer to 5.1).

If the existing surface exhibits excess free binder, the excess shall be removed by milling or other suitable methods, as agreed with the specifier.

5.3.3 Overlaying existing concrete pavements

Where asphalt is to be laid on existing concrete pavements, the concrete and joints shall be in a suitable condition to accept the asphalt overlay and achieve the required design.

NOTE 1 Further information on materials and treatments that may be used to delay the appearance of reflective cracking when overlaying concrete with asphalt is given in the “Concrete Pavement Maintenance Manual” [4].

NOTE 2 A bespoke design should be used to delay the appearance of reflective cracking when overlaying concrete with asphalt. The details of this are outside the scope of this standard.

NOTE 3 Further information on identification of defects in concrete pavements and suitable repairs can be found in the CPMM [4].

5.3.4 Overlaying existing sett paving

When overlaying existing sett paving, additional measures shall be taken to develop an appropriate solution.

NOTE These measures are outside the scope of this standard.

5.4 Adjustment or regulation of levels

When regulating the levels of the receiving surface, whether to provide super-elevation or for any other purpose, mixtures of appropriate nominal aggregate size conforming to [BS EN 13108-1](#), [BS EN 13108-4](#), [BS EN 13108-5](#) or [BS EN 13108-6](#) shall be used.

The design thicknesses of the layers to be installed shall conform to [Table 1](#) to [Table 3](#). These shall be designed in such a way that the need for regulating is minimized.

Where installation of regulating layers cannot be avoided, regulating materials conforming to [Table 4](#) shall be selected. Layer thicknesses shall also conform to [Table 4](#).

Table 1 — Thicknesses for AC mixtures conforming to BS EN 13108-1 (see [PD 6691:2022](#), Annex B)

Material description	PD 6691 reference	Size	Permitted installed layer thickness ^{A)}	Minimum thickness at any point
		mm	mm	mm
Fine graded surface course	AC 4 fine surf	4	15 – 25	10
Medium graded surface course	AC 6 med surf	6	20 – 25	15
Dense surface course	AC 6 dense surf	6	20 – 30	15
Open graded surface course	AC 10 open surf	10	30 – 35	25
Close graded surface course	AC 10 close surf	10	30 – 40	25
Open graded surface course	AC 14 open surf	14	35 – 55	30
Close graded surface course	AC 14 close surf	14	40 – 55	35
Dense binder course	AC 14 dense bin	14	40 – 55	35
Open graded binder course	AC 20 open bin	20	45 – 75	40
Dense, heavy-duty and high-modulus binder course	AC 20 dense/HDM/HMB bin	20	50 – 100	40
Dense, heavy-duty and high-modulus binder course	AC 32 dense/HDM/HMB bin	32	70 – 150	55
Dense, heavy-duty and high-modulus base	AC 32 dense/HDM/HMB base	32	70 – 150	55
EME2 base or binder course	AC 10 EME2 base/bin	10	60 – 100	50
EME2 base or binder course	AC 14 EME2 base/bin	14	70 – 130	60
EME2 base or binder course	AC 20 EME2 base/bin	20	90 – 150	80

NOTE Nominal installed thickness and minimum compacted layer thicknesses for BBA materials for airfields are not included in [Table 1](#).

^{A)} In the previous version of BS 594987, this column heading was ‘Nominal target layer thickness’.

Table 2 — Thicknesses for HRA mixtures conforming to BS EN 13108-4 (see PD 6691:2022, Annex C)

Material description	PD 6691 reference	Size	Permitted installed layer thickness ^{A)}	Minimum thickness at any point
		mm	mm	mm
HRA 50/10 binder course	HRA 50/10 bin	10	25 – 50	20
HRA 50/14 binder course	HRA 50/14 bin	14	35 – 65	30
HRA 50/20 binder course or base	HRA 50/20 bin/base	20	45 – 80	40
HRA 60/20 binder course or base	HRA 60/20 bin/base	20	45 – 80	40
HRA 60/32 binder course or base	HRA 60/32 bin/base	32	60 – 150	55
HRA 30/10 Type F binder course ^{B)}	HRA 30/10 F bin	10	35	30
HRA 35/14 Type F binder course ^{B)}	HRA 35/14 F bin	14	45 – 60	40
HRA 0/2 Type F surface course	HRA 0/2 F surf	2	25	20
HRA 0/2 Type F binder course ^{B)}	HRA 0/2 F bin	2	25	20
HRA 15/10 Type F surface course	HRA 15/10 F surf	10	30	25
HRA 30/10 Type F surface course	HRA 30/10 F surf	10	35	30
HRA 55/10 Type F surface course	HRA 55/10 F surf	10	40	35
HRA 30/14 Type F surface course	HRA 30/14 F surf	14	40	35
HRA 35/14 Type F surface course	HRA 35/14 F surf	14	45 – 50	40
HRA 55/14 Type F surface course	HRA 55/14 F surf	14	45	40
HRA 0/2 Type C surface course	HRA 0/2 C surf	2	25	20
HRA 55/10 Type C surface course	HRA 55/10 C surf	10	40	35
HRA 30/14 Type C surface course	HRA 30/14 C surf	14	40	35
HRA 35/14 Type C surface course	HRA 35/14 C surf	14	50	45
HRA 55/14 Type C surface course	HRA 55/14 C surf	14	45	40

^{A)} In the previous version of BS 594987, this column heading was 'Nominal target layer thickness'.

^{B)} See 5.6 for further information on the use of these mixtures on bridge decks.

Table 3 — Thicknesses for SMA mixtures conforming to BS EN 13108-5 (see PD 6691:2022, Annex D)

Material description	PD 6691 reference	Size	Permitted installed layer thickness ^{A)}	Minimum thickness at any point
		mm	mm	mm
SMA 6 surface course	SMA 6 surf	6	20 – 40	15
SMA 10 binder course	SMA 10 bin	10	25 – 50	20
SMA 10 surface course	SMA 10 surf	10	25 – 50	20
SMA 14 surface course	SMA 14 surf	14	35 – 50	30
SMA 14 binder course	SMA 14 bin	14	30 – 60	25
SMA 20 binder course or base	SMA 20 bin/base	20	50 – 100	40

^{A)} In the previous version of BS 594987, this column heading was 'Nominal target layer thickness'.

Table 4 — Thicknesses for AC, HRA and SMA regulating mixtures conforming to BS EN 13108-1, BS EN 13108-4 and BS EN 13108-5 (see PD 6691:2022, Annex B to Annex D)

Material description	PD 6691 reference	Size	Maximum compacted layer thickness ^{A)}	Minimum thickness at any point
		mm	mm	mm
AC6	AC 6 dense surf/reg	6	30	12
AC10	AC10 close surf/reg	10	40	20
AC14	AC14 dense bin/reg	14	60	30
HRA 50/10	HRA 50/10 reg	10	50	20
HRA 50/14	HRA 50/14 reg	14	60	30
SMA 6	SMA 6 reg	6	40	12
SMA 10	SMA 10 reg	10	50	20
SMA 14	SMA 14 reg	14	60	30
SMA 20	SMA 20 reg	20	80	40

NOTE Guidance on the selection of the binder grade is outside the scope of this specification. This note applies to Table 1 to Table 4.

^{A)} In the previous version of BS 594987, this column heading was 'Nominal target layer thickness'.

5.5 Application of bond coats

COMMENTARY ON 5.5

The requirements of this subclause relate to most surfacing applications. However, there are some for which the use of bond coats is unnecessary and might even be detrimental to in-situ performance. This is particularly the case for porous asphalt mixtures which are designed to be free draining through the full asphalt depth of the pavement. These are commonly used in all-weather sports surfacings and sustainable drainage systems (SuDS) applications. These mixtures are generally binder rich, and any applied bond coat would at least partially be lost into the open texture of the porous receiving course. Many porous mixtures are proprietary, in which case the guidance from the producer should be followed. For generic mixtures, produced to PD 6691 for example, guidance should be sought from the installer. However, where porous asphalt is to be placed on an impermeable substrate, a bond coat should be applied to protect the dense material below from long term water ingress.

5.5.1 General

A bond coat shall be applied uniformly and consistently to the receiving layer, prior to the laying of asphalt on any bound substrate in accordance with this clause and 5.5.2. Bond coats shall conform to either BS EN 13808, BS EN 15322 or BS EN 14023 and have a minimum peak cohesion value of 1.0 J/cm² determined by pendulum test in accordance with BS EN 13588.

The existing surface shall be free from all loose material and standing water before application of the bond coat commences.

For application to milled asphalt substrates, the minimum target rate of spread for bond coats shall provide not less than 0.35 kg/m² of residual binder.

NOTE 1 Milled surfaces produce excess fine material which might, if not removed, affect the adhesion of the bond coat.

NOTE 2 The enhanced adhesive and cohesive properties of bond coats are designed to provide greater confidence in the adhesion between layers, or to allow heavier rates of application to reduce the permeability of the surface of the lower layer, when compared with conventional bituminous emulsion tack coats. Although tack coats have traditionally been used, they are no longer regarded as best practice. However, there might be some situations where they are preferred. For specifiers who wish to use tack coats, information and guidance is given in Annex J.

NOTE 3 Hot applied polymer modified bituminous binders conforming to [BS EN 15322](#) or [BS EN 14023](#) with equivalent performance may also be used.

NOTE 4 Higher levels of cohesion for bond coats might be beneficial depending on the surface course thickness, the traffic stress and substrate type. Bond coats with a peak cohesion value of at least 1.0 J/cm² are suitable for most applications, including on substrates that are highly variable or porous. Bond coats with a peak cohesion value of at least 1.2 J/cm² can be used for applications such as under porous asphalt and in highly stressed areas, particularly those with a surface course thickness of less than 40 mm. Peak cohesion values should be agreed with the specifier.

For application to newly laid asphalt or overlaying existing (un-milled) asphalt, the minimum target rate of spread for bond coats shall provide not less than 0.20 kg/m² of residual binder.

NOTE 5 Example application rates are given in [Table 5](#) to achieve the desired residual binder.

For application to pavement quality concrete and Hydraulically Bound Mixtures (HBM) the target rate of spread for bond coats shall provide not less than 0.2 kg/m² of residual binder.

NOTE 6 The above rates are minimum values and a higher rate may be specified as appropriate, depending on the site conditions, substrate type and condition, e.g. after temporary trafficking.

NOTE 7 Bridge deck installation is covered in [5.6.2](#).

Table 5 — An example of bond coat minimum target rate of spread in litres per square metre of emulsion

Class of polymer modified bituminous emulsion ^{A)}	Newly laid and existing asphalt substrate	Milled substrates
	To achieve residual binder 0.20 kg/m ²	To achieve residual binder 0.35 kg/m ²
C50BP(2 to 5)	0.40 L/m ²	0.70 L/m ²
C60BP(2 to 5)	0.33 L/m ²	0.58 L/m ²
C65BP(2 to 5)	0.31 L/m ²	0.54 L/m ²

^{A)} The breaking class 2 to class 5 from [BS EN 13808:2013](#) is shown in parenthesis and does not affect binder content but can be agreed between supplier/producer and user of the emulsion.

5.5.2 Application by machine

Bond coats shall be machine applied at a uniform rate by calibrated metered mechanical spraying equipment, spray tanker, spraying device integral with the paving machine or hand spraying device.

For roads, the installer shall implement a quality management scheme, and document and record the findings. The scope of the quality management scheme shall include the application of bond coats, with documented procedures included for carrying out rate of spread and accuracy of spread tests in accordance with [BS EN 12272-1](#).

NOTE 1 The quality plan should have methods detailed to check the spraying equipment and to reconcile volume or mass used with areas treated and to visually assess accuracy of spread.

NOTE 2 Guidance on workforce competency is given in *National Highways Sector Scheme 13* [5].

The permitted deviation on the specified rate of spread shall not exceed ±20% and the accuracy of the spread shall not exceed 15%.

The installer of the bond coat shall repeat the test for rate of spread of binder at a minimum frequency of one test per month or whenever there is a change in bond coat.

The accuracy of spread of binder shall be tested in accordance with [BS EN 12272-1](#) every six months or whenever there is a change in bond coat or the spraying system is altered.

Alternatively, the accuracy of spread of the sprayer shall be calibrated using the depot tray test in accordance with [BS 1707](#) every six months or whenever the spraying system has been altered.

NOTE 3 [BS 1707](#) is expected to be replaced by a future Part 4 to [BS EN 12272](#).

Documentation shall be retained and made available on request.

Where application is approved by the specifier to be carried out by hand, the rate of spread shall be measured by calculating the volume or mass applied per m². The maximum area sprayed by hand shall be no greater than 100 m² unless otherwise agreed by the specifier.

There shall be no bare strips or areas having less than the minimum specified rate of spread. Transverse joints shall have an overlap not wider than 300 mm. Longitudinal joints shall have an overlap not wider than 300 mm to provide the minimum permitted rate of spread across the joint.

Where a paver with an integrated sprayer is used, the edge of the applied bond coat shall extend beyond the edge of the asphalt mixture when an adjacent width of asphalt is to be laid.

Where the longitudinal spray overlap causes the effective rate of spread to be increased by more than 50% of the specified rate, then the width of overlap shall be not greater than 100 mm and shall be outside the location of the wheel tracks for the lane.

The installation shall be undertaken to allow sufficient time for the bituminous emulsion to break (i.e. turn from brown to black) and bond to the substrate before the asphalt is laid, unless it is applied by a paver integrated sprayer, where the heat of the asphalt aids the break.

Any bituminous emulsion accumulating in hollows shall be dispersed by brushing and allowed to break before it is overlaid.

NOTE 4 Hot applied bitumen conforming to BS EN 14023 or BS EN 15322 used as bond coat may be overlaid immediately. Adhesion can be adversely impacted by substrate moisture.

NOTE 5 In certain cold or humid weather conditions, breaking of the emulsion could be delayed; for example, where temperatures are below 5 °C or humidity is above 70%. Breaking can be accelerated by the use of chemicals and/or heat.

NOTE 6 The pick-up of binder on the tyres of delivery vehicles and paver can be a problem, especially at the higher rates of spread and in hot weather. Avoidance measures include using a paver integrated sprayer, minimizing construction plant trafficking and plant waiting on sprayed sections, special non-tacky bond coats, the sparing use of 6 mm or smaller single-sized chippings, or the use of breaking agents.

NOTE 7 Adjacent to pedestrian refuges, crossings, street furniture, kerbs, road markings etc., hand application (canning and brushing) is acceptable. However, the specifier generally limits this to a width not exceeding 100 mm to be overlapped by machine spraying.

5.6 Asphalt for concrete bridge decks

COMMENTARY ON 5.6

The requirements in this subclause relate only to concrete bridge decks and not to steel bridge decks.

The “Design Manual for Roads and Bridges” (DMRB) [6] and the “Manual of Contract Documents for Highway Works” (MCHW) [7] have requirements for asphalt for concrete bridge decks.

5.6.1 General

COMMENTARY ON 5.6.1

The preferred asphalt mixtures for concrete bridge decks have been selected to minimize the potential for water ingress. The guidance in this clause cannot cover all variations in total surfacing thickness (which can be significant, particularly in old bridge decks).

Unless the works specific requirements state otherwise, the mixture to be laid directly on to the waterproofing layer on concrete bridge decks shall be one of the following:

- a) HRA 35/14 F bin;

NOTE 1 HRA 35/14 F is designated as a surface course mixture and not a binder course mixture as indicated. However, for the specific application on bridge decks, it may be designated as a binder course mixture (bin).

b) HRA 30/10 F bin;

NOTE 2 HRA 30/10 F bin is designated as a surface course mixture and not as a binder course mixture as indicated. However, for specific application on bridge decks, it may be designated as a binder course mixture (bin). HRA 30/10 F bin is not a performance-related design mixture and should not be specified as such. This mixture should only be used on legacy structures where layer thickness is an issue.

c) HRA 0/2 F surf (only if permitted by the waterproofing system manufacturer); or

NOTE 3 HRA 0/2 F surf is also referred to as an additional protective layer or sand asphalt.

d) Mastic asphalt.

HRA 35/14 F bin directly overlaying the waterproofing system shall have class 2 resistance to permanent deformation in accordance with PD 6691.

NOTE 4 This is typically achieved by the use of a polymer modified binder.

The mean void content for a set of six cores of the mixture at target composition determined in accordance with the trial strip protocol in [Annex F](#) shall be $V_{\max 4}$.

Coring for test samples shall not be undertaken from asphalt laid over the waterproofing membrane on bridge decks.

The material directly overlaying the waterproofing shall be compatible with the selected waterproofing system and capable of achieving the appropriate shear bond and tensile bond.

NOTE 5 Guidance on waterproofing to asphalt bond strength properties is given in CD 358 [8].

Any subsequent asphalt base and binder course layers shall be mixtures suitable for very heavily stressed sites requiring very high rut resistance in accordance with [PD 6691:2022](#) Table B.4, Table C.4 Class 2 or Table D.2 Class 2.

NOTE 6 Tapered areas should be trimmed to remove asphalt too thin to be sufficiently well compacted.

5.6.2 Installation

COMMENTARY ON 5.6.2

A site trial may be carried out to demonstrate that the following installation criteria can be achieved.

Bond coats shall only be applied directly to the waterproofing when recommended by the waterproofing system manufacturer. When applied, bond coats shall comply with the requirements in [5.5](#).

The installer of the asphalt shall avoid damaging the waterproofing system after it has been applied and when overlaying with asphalt.

The asphalt shall be applied at a temperature compatible with the installation instructions of the waterproofing system manufacturer.

The asphalt directly overlaying the waterproofing system shall be laid and compacted at temperatures that are sufficiently high to:

- a) form a dense layer; and
- b) activate the bond coat (when applied) so the asphalt is uniformly and well bonded to the system.

The installer of the asphalt shall give details of:

- 1) the minimum temperature at which the surfacing is to be laid, and at which compaction is to be essentially completed; and
- 2) how damage to the bond coat by the paver and other vehicles is to be minimized and repaired before and during surfacing.

6 Laying

6.1 General

Asphalt shall be either machine-laid by a self-propelled paver (see 6.4) or hand-laid (see 6.5).

The laying operation shall be controlled and carried out by operatives trained in asphalt laying.

NOTE Guidance on demonstrating competencies of asphalt paving operatives for highways is given in the National Highways Sector Scheme 16 [9].

When laying the asphalt, application of release and cleaning agents to tools and equipment shall not cause softening or damage to the asphalt. The amount used shall be kept to a minimum. Diesel and/or kerosene shall not be used.

Mastic asphalt shall be laid in accordance with Annex M.

Laying shall be carried out with due regard to ambient weather conditions so that materials are properly compacted.

6.2 Laying in adverse conditions

COMMENTARY ON 6.2

The following factors, which affect the rate of cooling of asphalt layers and hence the time available for compaction, should also be declared and put into a quality plan, and working practices adjusted accordingly.

- *Thicker layers cool more slowly, and binder course and base layers of 60 mm or more thickness provide adequate time for compaction under most weather conditions. Thinner layers need more attention and the installer should make a clearly declared provision for this in the quality plan (see National Highways Sector Scheme 16 [9] for further guidance).*
- *Wind speed has a greater effect on the rate of cooling than ambient temperature.*
- *The time available for compaction is also dependent on the type of binder, including additives in the mixture and the temperature of the mixture as it is laid.*
- *Providing insulation in paver hoppers reduces localized cooling.*
- *Materials laid in adverse conditions without appropriate compensating measures are unlikely to provide the same serviceability and durability as those laid in ideal conditions. All reasonable steps to avoid or prevent the effects of adverse conditions should be taken and declared by the installer as part of the quality plan.*
- *When the ambient temperature is high, asphalt layers take longer to cool. Trafficking of hot material might result in permanent deformation. Use of warm mix asphalt might mitigate some of these risks; otherwise, opening to traffic should be delayed.*

6.2.1 Wet weather

Laying shall not be carried out if standing water or running water is present on the surface to be covered.

NOTE Laying should be avoided during heavy rain. If wet weather is likely to be prolonged, laying should be suspended.

6.2.2 Low temperatures

The asphalt shall not be laid on any surface which is frozen or covered with ice or snow.

Laying shall cease when the air temperature reaches 0 °C on a falling thermometer, except in calm dry conditions, when laying shall cease if the air temperature reaches –3 °C on a falling thermometer.

NOTE Laying may proceed at air temperatures at or above –1 °C on a rising thermometer when the surface on which the asphalt is to be laid is dry and free from ice.