

Screeds, bases and in situ floorings —

Part 2: Concrete wearing surfaces — Code of practice

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 British Cement Association
 Concrete Society
 Contract Flooring Association
 Federation of Plastering and Drywall Contractors
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Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Exchange of information and time schedule	6
5 Materials	7
6 Design considerations: performance requirements	11
7 Design considerations: general	17
8 Design considerations: direct finished slabs	19
9 Design considerations: wearing screeds	22
10 Work on site: general	25
11 Work on site: wearing screeds	28
12 Inspection and testing of wearing surfaces	29
13 Maintenance	31
Annex A (normative) Methods for assessing levels and surface regularity	32
Annex B (normative) Curing recommendations for different cement types	33
Annex C (normative) Determination of slip resistance of pedestrian surfaces by the ramp/trolley method, alternatively known as the roller coaster method	33
Bibliography	39
Figure 1 — Illustration of layers in a ground-supported concrete floor	4
Figure 2 — Illustration of layers in a suspended concrete floor	5
Figure A.1 — Stainless steel slip gauges for checking surface regularity	32
Figure C.1 — Trolley and ramp	35
Figure C.2 — Calculation to determine the coefficient of friction or the equivalent slip resistance	37
Table 0 — Cement and combination types based on BS 8500-1:2006 Table A.6	8
Table 1 — Admixtures	10
Table 2 — Classification of surface regularity for finished wearing surfaces	12
Table 3 — Classification of abrasion resistance and limiting depths of wear for the abrasion test: Recommendations for concrete bases, directly finished (DF) only, as wearing surfaces	13
Table 4 — Classification of abrasion resistance and limiting depths of wear for the abrasion test: Recommendations for concrete bases upgraded by dry shake/sprinkle finishes and for applied wearing screeds (WS)	14
Table C.1 — Reproducibility	37

Foreword

This part of BS 8204 has been prepared by Subcommittee B/507/6.

BS 8204-2:2003+A2:2011 supersedes BS 8204-2:2003+A1:2009, which is withdrawn.

The start and finish of text introduced or altered by Amendment No. 1 is indicated in the text by tags **A1** **A1**. The start and finish of text introduced or altered by Amendment No.2 is indicated in the text by tags **A2** **A2**. Minor editorial changes are not tagged.

The main changes from the 2002 edition are the following.

- a) The specifications for materials have been updated to include the European Standard specifications for aggregates and concrete.
- b) The method for determination of abrasion resistance previously contained in Annex B has now been replaced by the method contained in BS EN 13892-4. The designations for abrasion resistance have been changed to conform to BS EN 13813.

A1 The term “fine aggregate” is used throughout this document in accordance with European Standards, although common usage within the United Kingdom is to use the term “sand”. In most cases these terms are interchangeable. **A1**

The other parts of BS 8204 are as follows.

- Part 1, *Concrete bases and cementitious levelling screeds to receive floorings — Code of practice.*
- Part 3, *Code of practice for polymer modified cementitious wearing surfaces.*
- Part 4, *Code of practice for terrazzo wearing surfaces.*
- Part 5, *Code of practice for mastic asphalt underlays and wearing surfaces.*
- Part 6, *Synthetic resin floorings — Code of practice.*
- Part 7, *Pumpable self-smoothing screeds — Code of practice.*

As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 39, and a back cover.

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1 Scope

This part of BS 8204 gives recommendations for constituent materials, design, work on site, inspection and testing of in situ concrete direct finished base slabs, with concrete as the wearing surface, and wearing screeds (formerly known as high strength concrete toppings and granolithic toppings). It applies to both ground-supported floors and suspended floors.

BS 8204 does not provide guidance on the structural design of ground-supported or suspended floors. Information on this aspect is given in references [3] and [5] and in BS 8110-1.

NOTE BS 8110-1 is obsolescent and will be superseded by BS EN 1992-1-1:2004 in March 2010.

The recommendations in this code of practice relate to those other aspects of the design of concrete floors that affect the performance of their wearing surfaces.

2 Normative references

The following referenced documents are indispensable for 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.

Text deleted

BS 1370, *Specification for low heat Portland cement*.

Text deleted

BS 4027, *Specification for sulfate-resisting Portland cement*.

BS 4483:2005, *Steel fabric for the reinforcement of concrete — Specification*.

BS 6100-9, *Building and civil engineering — Vocabulary — Part 9: Work with concrete and plaster*.

Text deleted

BS 7976-2, *Pendulum testers — Part 2: Method of operation*.

BS 7979, *Specification for limestone fines for use with Portland cement*.

BS 8102, *Code of practice for protection of structures against water from the ground*.

BS 8110-1:1997, *Structural use of concrete — Part 1: Code of practice for design and construction*.

BS 8500-1:2006, *Concrete — Complementary British Standard to BS EN 206-1 — Part 1: Method of specifying and guidance for the specifier*.

BS 8500-2, *Concrete — Complementary British Standard to BS EN 206-1 — Part 2: Specification for constituent materials and concrete*.

BS EN 197-1:2000, *Cement — Part 1: Composition, specifications and conformity criteria for common cements*.

BS EN 197-4:2004, *Cement — Part 4: Composition, specifications and conformity criteria for low early strength blastfurnace cements*.

BS EN 206-1:2000, *Concrete — Part 1: Specification, performance, production and conformity*.

BS EN 450-1:2005+A1:2007, *Fly ash for concrete — Part 1: Definition, specifications and conformity criteria*.

BS EN 934-2, *Admixtures for concrete, mortar and grout — Part 2: Concrete admixtures — Definitions, requirements, conformity, marking and labelling*.

BS EN 934-3, *Admixtures for concrete, mortar and grout — Part 3: Admixtures for masonry mortar — Definitions, requirements, conformity, marking and labelling*.

BS EN 1008, *Mixing water for concrete — Specification for sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete*.

BS EN 12620:2002, *Aggregates for concrete*.

BS EN 12878, *Pigments for the colouring of building materials based on cement and/or lime — Specifications and methods of test*.

- BS EN 13263-1, *Silica fume for concrete — Part 1: Definitions, requirements and conformity criteria*.
BS EN 13318, *Screed material and floor screeds — Definitions*.
BS EN 13139, *Aggregates for mortar*.
BS EN 13892-4, *Methods of test for screed materials — Part 4: Determination of wear resistance-BCA*.
- BS EN 14647:2005, *Calcium aluminate cement — Composition, specifications and conformity criteria*.
BS EN 15167-1, *Ground granulated blast furnace slag for use in concrete, mortar and grout — Part 1: Definitions, specifications and conformity criteria*.
BS ISO 6707-1, *Building and civil engineering — Vocabulary — Part 1: General terms*.
PD 6682-1, *Aggregates — Part 1: Aggregates for concrete — Guidance on the use of BS EN 12620*.
PD 6682-3, *Aggregates — Part 3: Aggregates for mortar — Guidance on the use of BS EN 13139*.

3 Terms and definitions

For the purposes of this part of BS 8204 the terms and definitions given in BS 6100-1, BS 6100-6 and BS EN 13318 and the following apply.

3.1

base

building element that provides the support for a screed and floor finishes

3.2

flooring

uppermost fixed layer of a floor that is designed to provide a wearing surface

NOTE Layers in a concrete ground floor and a suspended concrete floor are illustrated in Figure 1 and Figure 2 respectively.

3.3

direct finished base slab

concrete flooring element that is suitably finished to provide a wearing surface or to receive directly the flooring to be applied without the need for a levelling screed

3.4

screed material

mixture comprising cement, aggregates, water and, in some cases, admixtures

3.5

screed

layer of material laid in situ, directly onto a base, bonded or unbonded, or onto an intermediate layer or insulation layer, for one or more of the following purposes:

- to obtain a defined level;
- to carry the final flooring;
- to provide a wearing surface

3.6

wearing screed

screed that serves as a flooring

NOTE This term was formerly known as high strength concrete topping or granolithic topping.

3.7

levelling screed

screed suitably finished to obtain a defined level and to receive the final flooring

3.8**overslab**

concrete layer (usually 100 mm or more thick) constructed on and commonly debonded from a hardened concrete base slab to provide a wearing surface or to receive flooring

3.9**departure from datum**

deviation in height of the surface of a flooring layer from a fixed datum plane

3.10**surface regularity**

deviation in height of the surface of a flooring layer over short distances in a local area

NOTE Surface regularity is also known as flatness.

3.11**addition**

finely divided material used in concrete in order to improve certain properties or to achieve special properties

NOTE There are two types of addition:

- nearly inert (Type 1);
- pozzolanic or latent hydraulic (Type 2).

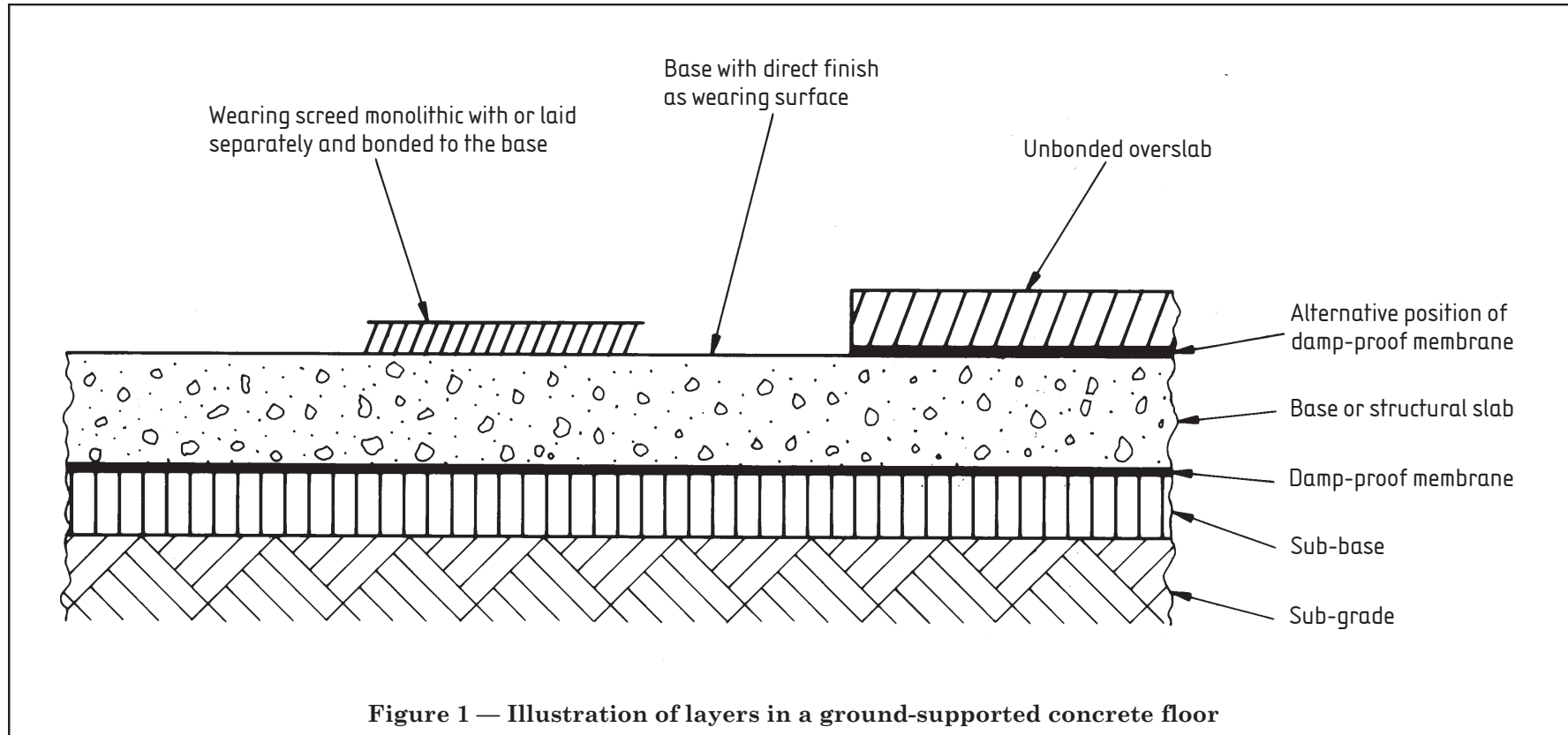
3.12**dry shake finish**

mixture of cement and fine hard aggregate, and sometimes admixture and pigment, applied dry as a thin layer and trowelled into the fresh concrete

3.13**combinations**

restricted range of Portland cements and additions which, having been combined in the mixer, count fully towards the cement content and water/cement ratio in concrete

NOTE A procedure for establishing the suitability of combinations is specified in Annex A of BS 8500-2:2002.



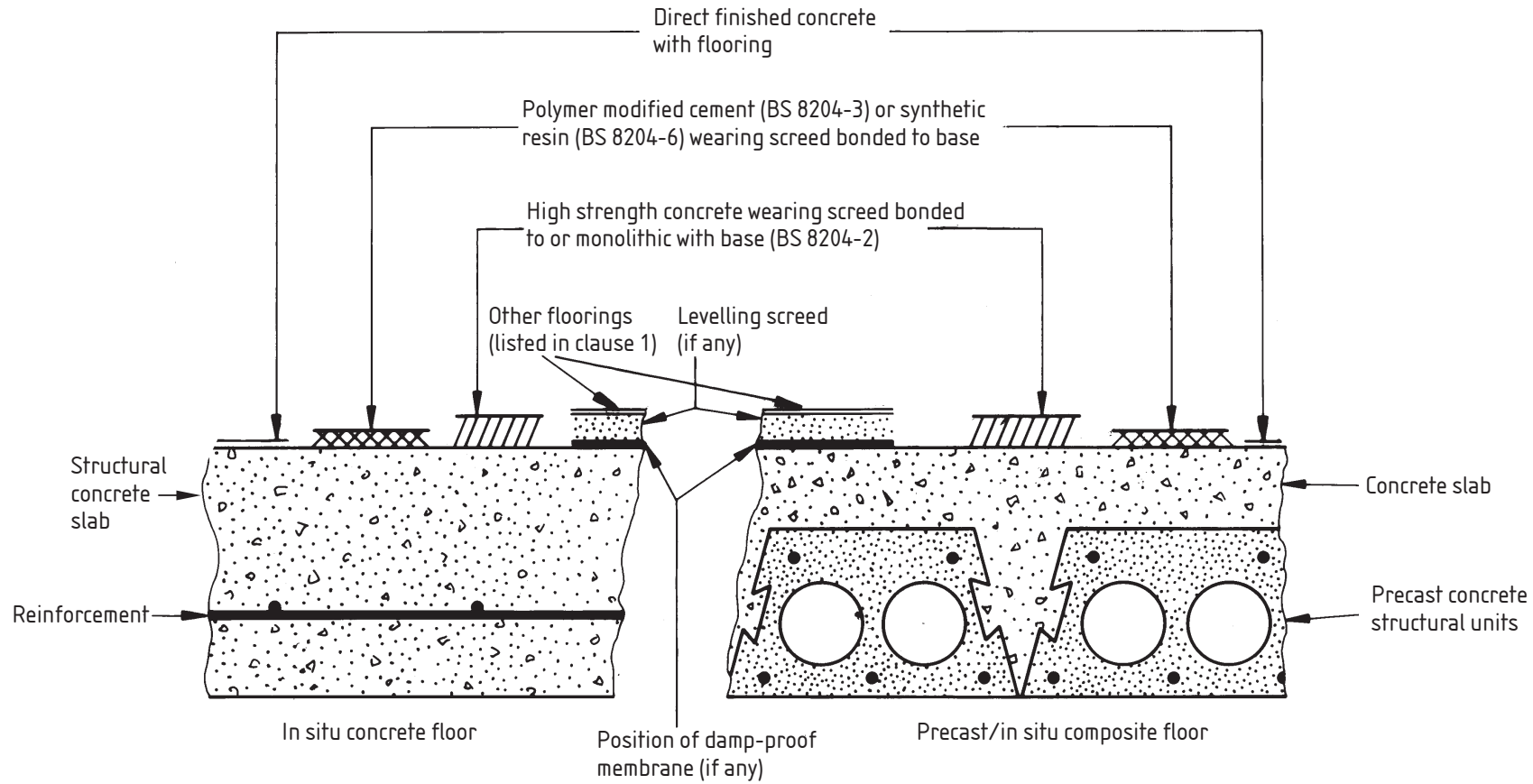


Figure 2 — Illustration of layers in a suspended concrete floor

4 Exchange of information and time schedule

4.1 General

It is essential that consultations and exchange of information between all parties concerned with the building operations are arranged at an early date. This will enable each party to have full knowledge of the particulars of the work so that they can cooperate in producing the conditions required to complete a satisfactory job.

4.2 Exchange of information

It is essential that the designer provides in good time all relevant information to those responsible for laying the concrete wearing surface and to others whose work might be affected, including whichever of the following are applicable:

- a) description, situation and address of site and means of access;
- b) those conditions of contract that might practically affect this particular work;
- c) degree of weather protection afforded by the structure;
- d) location and areas of floors to be covered;
- e) age and nature of the base and any preparatory treatment required;
- f) the cement type;
- g) finished floor level and maximum permissible departure from datum;
- h) class (see Table 2) of surface regularity;
- i) class of abrasion resistance;
- j) slip resistance;
- k) type of damp-proofing and insulation;
- l) type and thickness of wearing screed;
- m) any work consequent upon services passing through the flooring;
- n) treatment of joints;
- o) treatment of skirtings;
- p) treatment of junctions with adjacent floors and floorings;
- q) type of surface finish;
- r) any surface sealing or chemical surface hardening required;
- s) any requirements related to underfloor heating;
- t) minimum time interval between stages of work and the application of heat in the building;
- u) date for the completion of preliminary work;
- v) dates for the start and completion of various sections of the floor;
- w) details of any compliance testing required;
- x) any other requirements for materials, design or work on site.

4.3 Time schedule

In considering the time schedule, in addition to the usual intervals between commencement and completion of work by the various trades involved, allowances should be made for the following:

- a) completion of the building envelope to allow construction of a floor or wearing screed protected from rain, wind and sun;
- b) delays due to frost and cold weather;
- c) laying underfloor services; this should preferably be completed before the base is formed as there is a risk of subsequent cracking if services are embodied in the flooring;
- d) curing and drying of the base concrete before the flooring is laid, where appropriate;
- e) curing of the flooring;
- f) period of protection of the completed floor from damage by other trades, including the period of restriction of access;
- g) the risk of restrained drying shrinkage cracking in ground-supported floor slabs increasing if the floors are loaded soon after completion.

5 Materials

5.1 Cement

5.1.1 General

A1 In recent years an increasing number of cements have become widely available. The user should establish that the type of cement is appropriate for the intended use.

Cements (Portland cement or a composite Portland cement conforming to BS EN 197-1) and combinations (Portland cement combined at the batching plant with an addition, conforming to BS 8500-2:2006, Annex A), are treated as being technically equivalent by BS 8500-2. For most applications a cement or combination of strength class 42,5 N is applicable. Lower strength classes used either in concrete bases or in cementitious levelling screeds might need an increase in cement or combination content to obtain similar properties and performance. **A1** For example, a cement of strength class 32,5 N would probably require an increase in cement content of about 10 %. An additional period of curing might also be necessary (see Annex B).

A1 Concretes made with the cements and combinations listed in Table 0 have different characteristics, e.g. strength development, susceptibility to poor curing, and therefore the choice of cement or combination type should depend upon the particular placing conditions. **A1**

There is limited experience of the use of some types of cement and combinations in base slabs and in cementitious wearing screeds, see 5.1.2 and 5.1.3 respectively.

CAUTION. Calcium aluminate cement (high alumina) should be used with care. Guidance on the correct use of calcium aluminate cement should be sought from the manufacturers and current specialized publications (see 10.4).

WARNING 1. When Portland cement is mixed with water, or even becomes damp, alkalis are released that can be harmful to the skin. The effect depends on the length of contact, any abrasion, the individual and the part of the body involved. Suitable protective clothing should be worn. If eyes are affected, they should be washed out without delay and medical advice sought.

WARNING 2. Cement mortar and concrete might until set cause both irritant and allergic contact dermatitis.

— Irritant contact dermatitis is due to a combination of the wetness, alkalinity and abrasiveness of the constituent material.

— Allergic contact dermatitis is caused mainly by the sensitivity of an individual's skin to hexavalent chromium salts. **A1** Cement should be used within the period declared on the packaging or on the delivery note for bulk cement. **A1**

5.1.2 Cement for directly finished base slabs

 Text deleted 

 The cement or combination for concrete bases should be selected from Table 0.

For Portland-limestone cement and limestone fines, reference should be made to BRE Special Digest 1:2005 [1] for low temperature situations.

Table 0 — Cement and combination types^a based on BS 8500-1:2006 Table A.6

Broad designation ^b	Composition	Cement notation	Combination notation
CEM I	Portland cement	CEM I	—
SRPC	Sulfate-resisting Portland cement (BS 4027)	SRPC	—
IIA	Portland cement with either; 6 % to 20 % limestone, 6 % to 20 % ground granulated blastfurnace slag, 6 % to 20 % fly ash, 6 % to 10 % silica fume ^c	CEM II/A-L, CEM II/A-LL CEM II/A-S CEM II/A-V CEM II/A-D	CIIA-L, CIIA-LL CIIA-S CIIA-V —
IIB-S	Portland cement with 21 % to 35 % ground granulated blastfurnace slag	CEM II/B-S	CIIB-S
IIB-V	Portland cement with 21 % to 35 % fly ash	CEM II/B-V	CIIB-V
IIB+SR	Portland cement with 25 % to 35 % fly ash	CEM II/B-V+SR	CIIB-V+SR
IIIA ^{d, e}	Portland cement with 36 % to 65 % ground granulated blastfurnace slag	CEM III/A	CIIIA
IIIA+SR ^e	Portland cement with 36 % to 65 % ground granulated blastfurnace slag with additional requirements that enhance sulfate resistance	CEM III/A+SR ^f	CIIIA+SR ^f

^a There are a number of cements and combinations not listed in this table that may be specified for certain specialist applications. See BRE Special Digest 1 [1] for the sulfate-resisting characteristics of other cements and combinations. See IP 17/05 [14] for the use of high ggbs content cements and combinations in secant piling applications.

^b The use of these broad designations is sufficient for most applications. Where a more limited range of cement or combinations types is required, select from the notations given in BS 8500-2:2006, Table 1.

^c When IIA or CEM II/A-D is specified, CEM I and silica fume may be combined in the concrete mixer using the *k*-value concept; see BS EN 206-1:2000, 5.2.5.2.3.

^d Where IIIA is specified, IIIA+SR may be used.

^e Inclusive of low early strength option (see BS EN 197-4 and the “L” classes in BS 8500-2:2006, Table A.1).

^f “+SR” indicates additional restrictions related to sulfate resistance. See BS 8500-2:2006, Table 1, footnote D. 

5.1.3 Cement for cementitious wearing screeds

The cement for cementitious wearing screeds should be one of the following.

- a) Portland cement CEM I conforming to BS EN 197-1.
- b) Sulfate resisting cement conforming to BS 4027.
- c) Portland-slag cement CEM II/A-S or CEM II/B-S conforming to BS EN 197-1.
- d) Calcium aluminate cement (high alumina cement) conforming to BS 915-2.
- e) Proprietary cements designed to provide rapid drying and hardening for which there is no current British Standard. Reference should be made to the manufacturer for guidance on their use.
- f) $\overline{A_1}$ Portland cement combined with ground granulated blastfurnace slag conforming to BS EN 15167-1, II/A-S or II/B-S. $\overline{A_1}$

NOTE There is limited experience of the use and the abrasion resistance of air-entrained/enhanced Portland cement CEM I 32,5 R for cementitious wearing screeds.

5.2 Additions

$\overline{A_1}$ Additions should conform to:

- BS EN 450-1 category A or B for fly ash;
- BS EN 15167-1 for granulated blastfurnace slag;
- BS 7979 for limestone fines;
- BS EN 13263-1 for silica fume;
- Metakaolin with an appropriate Agrément certificate.

There are no British Standards for other additions and their suitability should be ascertained from experience of their use in similar products. $\overline{A_1}$

5.3 Aggregates

5.3.1 General

$\overline{A_1}$ Guidance on the specification of fine aggregates conforming to BS EN 13139 is given in Annex B. $\overline{A_1}$

NOTE The gradings for aggregates and $\overline{A_1}$ fine aggregates $\overline{A_1}$ in these standards are very different to those in the previous, superseded British Standards.

Guidance on aggregates and $\overline{A_1}$ fine aggregates $\overline{A_1}$ conforming to BS EN 12620 can be found in PD 6682-1 and guidance on $\overline{A_1}$ fine aggregates $\overline{A_1}$ conforming to BS EN 13139 can be found in PD 6682-3.

Aggregates should not contain any deleterious material in sufficient quantity to affect adversely the surface finish. For example, lignite, coal and iron pyrites can cause “pop-outs”. $\overline{A_1}$ BS EN 12620:2002, G.4, gives the limits for the lignite content in aggregates for concrete which should not normally be exceeded and states: “Where appearance is an essential feature of the concrete, aggregates should not contain materials in proportions that adversely affect surface quality or durability. $\overline{A_1}$ Some aggregates exhibit higher than average drying shrinkage and should not be used as they can give rise to a greater risk of cracking (see BRE Digest 357 [2] and BS EN 1367-4).

All-in aggregates should not be used in bases or wearing screeds.

All the requirements of 5.3 should be passed to the aggregate, concrete and screed materials suppliers.

5.3.2 Aggregates for direct finished concrete surfaces

Aggregates for direct finished concrete surfaces should be either:

- a) aggregates conforming to BS EN 12620 with a Los Angeles coefficient of less than LA₄₀ with mechanical properties conforming to the requirement in Table 2 of that standard for heavy duty concrete floor finishes; or
- b) any other type for which there is no British Standard, provided it has established suitability with regard to strength, density, shrinkage, durability and the abrasion resistance of the concrete.

5.3.3 **Fine aggregate for direct finished concrete wearing surfaces**

Fine aggregate for direct finished concrete wearing surfaces should be a natural fine aggregate, resulting from the disintegration of rock, conforming to the grading limits 0/4 (CP) or 0/4 (MP) or 0/2 (MP) of BS EN 12620.

NOTE 1 Fine aggregates produced from crushed rock are not recommended unless their grading is in accordance with that specified in BS EN 12620.

NOTE 2 The coarser limits of grading 0/4 (CP) fine aggregate can produce a harsher mix that can be difficult to finish with a “closed” surface. The finer limits of grading 0/2 (MP) fine aggregate can increase the water requirement and subsequent shrinkage as well as reducing the final strength of a wearing surface.

NOTE 3 Limestone fine aggregate might increase the risk that the floor surface could become polished under traffic and give a poor slip resistance.

5.3.4 **Aggregates for wearing screeds**

Aggregates for wearing screeds should conform to BS EN 12620 and have a Los Angeles coefficient of less than LA₄₀. Alternatively, aggregates with an established suitability for use as a wearing screed may be used.

5.3.5 **Fine aggregate for wearing screeds**

Fine aggregate for wearing screeds should conform to BS EN 13139.

Other fine aggregates may be used provided there are satisfactory data on the properties of similar wearing screeds made with them, e.g. bonded or unbonded.

NOTE Limestone fine aggregate can increase the risk of the floor surface becoming polished under traffic and giving a poor slip resistance.

5.4 **Pigments**

Pigments should conform to BS EN 12878.

5.5 **Admixtures**

Generally, admixtures should conform to the British Standards listed in Table 1. Other admixtures may be used provided there are satisfactory data on the properties of the wearing screed or concrete made with them.

Table 1 — Admixtures

Type	Standard
Accelerating	BS EN 934-2
Retarding	BS EN 934-2
Water-reducing	BS EN 934-2
Air-entraining	BS EN 934-2
Superplasticizing	BS EN 934-2

Admixtures should not impair the durability of the wearing screed or the concrete wearing surface, nor combine with the constituents to form harmful components, nor increase the risk of corrosion of any embedded metal.

If two or more admixtures are to be used together in the same wearing screed material or concrete data should be obtained to assess their interaction and ensure their compatibility (see 7.6 for use of admixtures).

5.6 **Dry shake/sprinkle finish and special aggregates**

NOTE There are no British Standards for these materials.

Dry shake materials should not contain any unsound particles that could adversely affect the surface finish. For example, impurities in some slags can cause “pop-out”. Recommendations on the use of proprietary materials are given in 6.2b) and 7.7.