

Screeds, bases and in situ floorings —

Part 1: Concrete bases and [A₁] cementitious [A₁] levelling screeds to receive floorings — Code of practice

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Committees responsible for this British Standard

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Association of Concrete Industrial Flooring Contractors

Association of Lightweight Aggregate Manufacturers

British Cement Association

Concrete Society

Contract Flooring Association

Federation of Plastering and Drywall Contractors

Federation of Resin Flooring Formulators and Applicators

Mastic Asphalt Council

Mortar Producers Association Limited

National Federation of Terrazzo-Marble and Mosaic Specialists

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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	7
5 Materials	8
6 Design considerations	12
7 Work on site	23
8 Inspection and testing of bases and levelling screeds	29
Annex A (normative) Recommendations for the use of lightweight aggregates in concrete bases and levelling screeds	31
Annex B (informative) Guidance for specifying fine aggregates for cementitious levelling screeds: comparison of the grading and fines content of aggregates in BS EN 13139 with established UK practice	33
Annex C (normative) Methods for the assessment of levels and surface regularity	35
Annex D (normative) Method for the determination of in situ crushing resistance of bonded and unbonded levelling screeds	36
Annex E (normative) Determination of in situ crushing resistance of floating levelling screeds	38
Annex F (normative) Curing recommendations for different cement types	39
Bibliography	40
Figure 1 — Illustration of layers in a ground-supported concrete floor	5
Figure 2 — Illustration of layers in a suspended concrete floor	6
Figure C.1 — Stainless steel slip gauges for checking surface regularity	35
Figure D.1 — BRE screed tester	37
Table 0 — Cement and combination types based on BS 8500-1:2006 Table A.6	9
Table 1 — British Standards for admixtures	11
Table 2 — Concrete strength for base slabs	12
Table 3 — Choice of in situ crushing resistance category for levelling screeds	14
Table 4 — Acceptance limits for in situ crushing resistance test (after dropping the weight four times)	15
Table 5 — Classification of surface regularity of direct finished base slab or levelling screed	17
Table B.1 — Fine aggregate descriptions and recommended European designations	34
Table B.2 — Comparison of the grading and fines content limits of aggregates in BS EN 13139 with established UK practice (% passing by mass)	34

Foreword

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

BS 8204-1:2003+A1:2009 supersedes BS 8204-1:2003, 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**. Minor editorial changes are not tagged.

This part gives recommendations for the design and laying of concrete bases and cementitious levelling screeds to receive in situ floorings.

The main changes from the 2002 edition are the following.

- a) The specification for materials has been updated to include the European Standard specifications for aggregates and concrete.
- b) The length of the straightedge, used in the determination of surface regularity, is changed from 3 m to 2 m. In doing so, it brings BS 8204 in line with BS 5385.

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 2, *Concrete wearing surfaces — 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 40, an inside back cover 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 concrete bases that are to receive in situ wearing screeds of the following types:

- a) concrete (see BS 8204-2);
- b) polymer modified cement (see BS 8204-3);
- c) terrazzo (see BS 8204-4);
- d) mastic asphalt (see BS 8204-5);
- e) synthetic resin (see BS 8204-6);
- f) magnesium oxychloride;
- g) pumpable self-smoothing screeds (see BS 8204-7);

and for bases and levelling screeds that are to receive flexible floor coverings such as:

- h) textiles;
- i) linoleum;
- j) polyvinyl chloride;
- k) rubber;
- l) cork;

and rigid floorings such as:

- m) wood block and strip;
- n) laminate floor coverings;
- o) ceramic tiles;
- p) natural stone.

It applies to ground-supported and suspended concrete floor bases.

This part of BS 8204 includes the use of concrete and levelling screeds made with lightweight aggregates conforming to BS EN 13055-1. Where the recommendations differ from those for normal weight aggregates, these are given in Annex A.

Recommended methods for the assessment of levels and surface regularity and for the determination of in situ crushing resistance (soundness) are given in Annex C, Annex D and Annex E.

This part of BS 8204 is not intended to provide guidance on the structural design or related construction of concrete ground-supported floors or suspended slabs. Information on these aspects is given in BS 8110-1 and reference [4]. The specification of concrete for base slabs is given in BS 8500-2. The recommendations in this code of practice relate to those other aspects of design and construction of concrete slabs that affect the performance of the overlying levelling or wearing screed.

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

See Part 3 for polymer modified cementitious levelling screeds.

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*.

Text deleted

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

BS 4551:2005, *Mortar — Methods of test for mortar — Chemical analysis and physical testing*.

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

[A1] Text deleted **[A1]**

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 **[A1]**:2006 **[A1]**, *Concrete — Complementary British Standard to BS EN 206-1 — Part 1: Method of specifying and guidance for the specifier.*

BS 8500-2 **[A1]**:2006 **[A1]**, *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.*

[A1] BS EN 197-4:2004, *Cement — Part 4: Composition, specifications and conformity criteria for low early strength blastfurnace cements.* **[A1]**

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

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

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

[A1] BS EN 934-3, *Admixtures for concrete, mortar and grout — Part 3: Admixtures for masonry mortar — Definitions, requirements, conformity, marking and labelling.* **[A1]**

BS EN 10223-2, *Steel wire and wire products for fences — Part 2: Hexagonal steel wire netting for agricultural, insulation and fencing purposes.*

BS EN 12620 **[A1]**:2002 **[A1]**, *Aggregates for concrete.*

BS EN 13055-1, *Lightweight aggregates — Part 1: Lightweight aggregates for concrete, mortar and grout.*

BS EN 13139, *Aggregates for mortar.*

[A1] BS EN 13263-1, *Silica fume for concrete — Part 1: Definitions, requirements and conformity criteria.* **[A1]**

BS EN 13318, *Screed material and floor screeds — Definitions.*

BS EN 13813, *Screed material and floor screeds — Screed material — Properties and requirements.*

[A1] 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.* **[A1]**

CP 102:1973, *Code of practice for protection of buildings against water from the ground.*

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 ground-supported concrete 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 and/or additives

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**levelling screed**

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

3.7**wearing screed**

screed that serves as a flooring

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

3.8**bonded screed**

screed that is bonded to the base

3.9**unbonded screed**

screed laid either onto a separating layer or onto a base not prepared to achieve bonding

3.10**floating screed**

screed laid on an acoustic and/or thermal insulating layer and completely separated from other building elements, such as walls and pipes

3.11**fine concrete screed**

screed consisting of concrete in which the maximum aggregate size is 10 mm

3.12 **A_1 cementitious A_1 screed**

screed consisting of screed material containing A_1 fine aggregate A_1 up to a 4 mm maximum aggregate size

3.13**smoothing compound**

material applied to a base or screed to provide a smooth, even surface suitable for the installation of a floor covering

3.14**departure from datum**

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

3.15**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.

3.16**in situ crushing resistance (ISCR)**

resistance of levelling screeds to the crushing effect of imposed loads and traffic in service

NOTE ISCR was formerly known as soundness.

3.17

no-fines concrete basecoat (of a lightweight aggregate screed)

layer forming the lower section of the screed, which can be either bonded to the concrete base or separated by an intermediate layer

3.18

Ⓐ cementitious Ⓐ topping (of a lightweight aggregate screed)

bonded surface layer of the screed, commonly Ⓐ cementitious Ⓐ thickness approximately 15 mm, which provides a smoother finish suitable for the flooring

3.19

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.

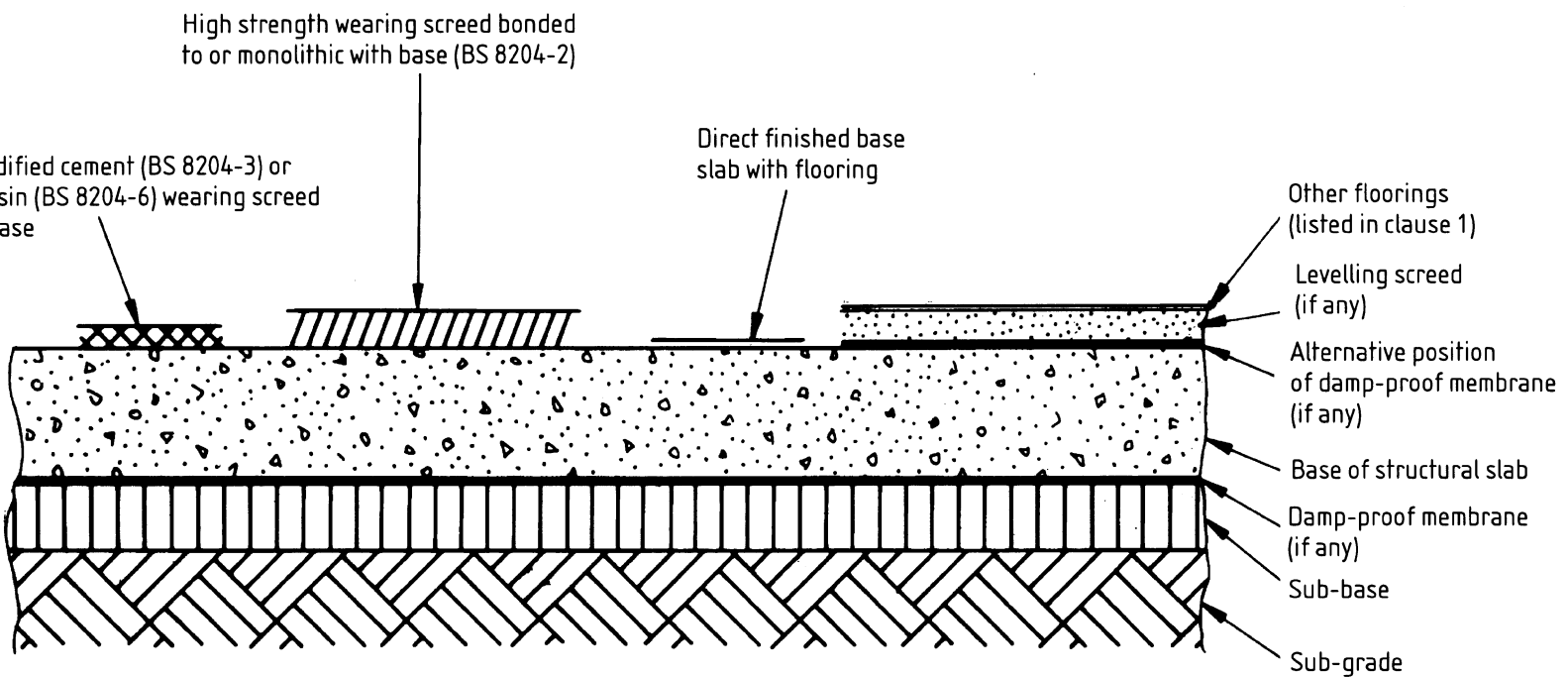


Figure 1 — Illustration of layers in a ground-supported concrete floor

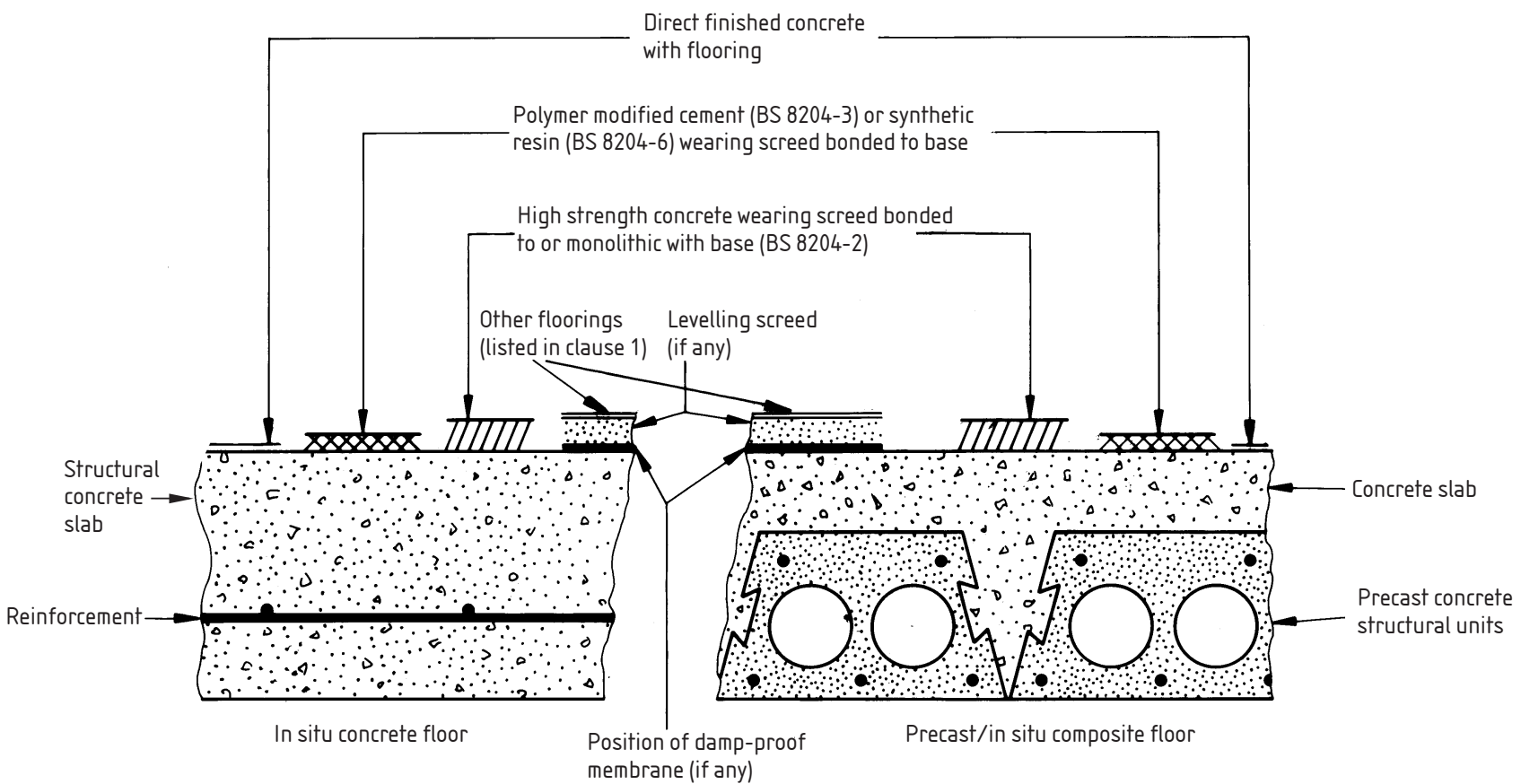


Figure 2 — Illustration of layers in a suspended concrete floor

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 base and/or **A₁** cementitious **A₁** levelling screed 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) type of flooring to be laid;
- g) specifications for the base and screed;
- h) class of concrete for proposed base;
- i) number of layers;
- j) thickness of floor and flooring;
- k) finished floor level and maximum permissible departure from datum;
- l) class of surface regularity (see Table 5) of base or levelling screed;
- m) type of damp-proofing and insulation;
- n) type and thickness of levelling screed;
- o) category of in situ crushing resistance (soundness) required;
- p) any work consequent upon services passing through the floor;
- q) treatment of joints;
- r) treatment of skirtings;
- s) treatment of junctions with adjacent floor and floorings;
- t) type of surface finish of base or levelling screed;
- u) any requirement for a smoothing compound;
- v) any special requirements related to underfloor heating;
- w) minimum time intervals between stages of work and the application of heat in the building;
- x) date for the completion of preliminary work;
- y) dates for the start and completion of various sections of the floor;
- z) details of any compliance testing required;
- aa) 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 levelling screed protected from rain, wind and sun;
- b) delays due to frost and cold weather;
- c) laying underfloor services; this should 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 and/or levelling screed before the flooring is laid, where appropriate (see 7.10);
- e) period of protection of the base or screed from damage by other trades, including the period of restriction of access, until the flooring is laid;
- f) 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. **[A1]** Lower strength classes **[A1]** *text deleted* **[A1]** 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. 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 F).

Concretes made with the cements and combinations listed in **[A1]** Table 0 **[A1]** 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.

There is limited experience of the use of some types of cement and combinations in cementitious levelling screeds, see 5.1.4.

CAUTION. Calcium aluminate (high alumina) cement 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 7.2).

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 concrete bases

[A1] *Text deleted* **[A1]**

[A1] 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 [2] 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, or 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	CIIA
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	CIIA+SR ^f
IIIB ^{e, g}	Portland cement with 66 % to 80 % ground granulated blastfurnace slag	CEM III/B	CIIB
IIIB+SR ^e	Portland cement with 66 % to 80 % ground granulated blastfurnace slag with additional requirements that enhance sulfate resistance	CEM III/B+SR ^f	CIIB+SR ^f
IVB-V	Portland cement with 36 % to 55 % fly ash	CEM IV/B(V)	CIVB

^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 [2] for the sulfate-resisting characteristics of other cements and combinations. See IP 17/05 [13] 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 IIA-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.

^g Where IIIB is specified, IIIB+SR may be used. **[A1]**

5.1.3 Cement for cementitious levelling screeds

The cement or combination for cementitious levelling screeds should be one of the following:

- Portland cement CEM I conforming to BS EN 197-1;
- sulfate-resisting Portland cement conforming to BS 4027;
- [A1]** Portland cement combined with ground granulated blastfurnace slag conforming to BS EN 15167-1, II/A or II/B-S;
- Portland cement combined with fly ash conforming to BS EN 450-1, II/A;
- Calcium aluminate cement (high alumina cement) conforming to BS EN 14647;
- proprietary cements, designed to provide rapid drying and hardening properties, for which no British Standard exists (reference should be made to the manufacturers for guidance on the use of the cement).

- g) air-entrained/enhanced Portland cement CEM I 32,5R conforming to BS EN 197-1;
- h) Portland-fly ash cement CEM II/B-V conforming to BS EN 197-1;
- i) Portland-limestone cement CEM II/A conforming to BS EN 197-1;
- j) Portland silica fume cement CEM II/A conforming to BS EN 197-1.

Cements or combinations with high replacement contents of ground granulated blastfurnace slag (III/B) or fly ash (IVB-V) should not be used. There is limited experience of the use of III/A (36 % to 65 % slag) in screed material for cementitious screeds and reference should be made to the manufacturers for guidance where this cement type is to be used. It might be advisable to limit the ggbs content to a maximum of 50 %.

For Portland-limestone cement [see item i)] and limestone fines, reference should be made to the BRE Special Digest 1, 2005 [2] for low temperature situations.

5.1.4 Other cements for cementitious levelling screeds

Text deleted

5.2 Additions

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.

5.3 Aggregates

NOTE See A.1 for the use of lightweight aggregates.

5.3.1 General

Guidance on the specification of fine aggregates conforming to BS EN 13139 is given in Annex B.

Aggregates should not contain any deleterious material in sufficient quantity to affect adversely the surface of a directly finished base or levelling screed. For example, lignite, coal and iron pyrites in the aggregate can cause “pop-outs”. 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.” 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 [3] and BS EN 1367-4).

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

5.3.2 Aggregates for concrete bases

Aggregates for concrete bases should conform to BS EN 12620.

5.3.3 Aggregates for fine concrete levelling screeds

Aggregates for fine concrete levelling screeds should be composed of 4/10 material conforming to BS EN 12620 and of fine aggregate in accordance with 5.3.4. See Annex B.

5.3.4 Fine aggregate for cementitious levelling screeds

Fine aggregate for cementitious levelling screeds should conform to BS EN 13139.

The preferred grading would be a 0/4 fine aggregate with a fines category 1 within the range MP, and ideally have a grading between 20 % to 66 % passing the 0.5 sieve. For further discussion see Annex B.

NOTE The above refers to site-mixed screeds up to approximately 40 mm. For thicker screeds a grading of 0/8 would be more appropriate.