

BRITISH STANDARD

Concrete – Complementary British Standard to BS EN 206-1 –

Part 2: Specification for constituent materials and concrete

ICS 91.100.30



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Foreword

Publishing information

This part of BS 8500 is published by BSI Standards Limited, under licence from the British Standards Institution and came into effect on 30 November 2006. It was prepared by Working Group B/517/1/WG20, *Specification drafting*, under the authority of Subcommittee B/517/1, *Concrete production and testing*, and Technical Committee B/517, *Concrete and related products*. A list of organizations represented on these committees can be obtained on request to their secretary.

Supersession

BS 8500-2:2006+A1:2012 supersedes BS 8500-2:2006, which is withdrawn.

Relationship with other publications

BS 8500 contains additional United Kingdom provisions to be used in conjunction with BS EN 206-1. Together they form a complete package for the specification, production and conformity of fresh concrete.

BS 8500 is published in the following parts:

- BS 8500-1, *Method of specifying and guidance for the specifier*;
- BS 8500-2, *Specification for constituent materials and concrete*.

Information about this document

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 Corrigendum No.1 is indicated in the text by tags **C1** **C1**. Minor editorial changes are not tagged.

This is a full revision of BS 8500-2, and introduces the following principal changes:

- changes to reflect changed guidance in BRE Special Digest 1 (BRE SD 1);
- changes resulting from the withdrawal of British Standards;
- changes to the permitted cement types;
- reducing the strength class of the FND designated concretes to C25/30;
- changes resulting from new European Standards published since 2003;
- citing specialist publications for the detailed provisions for resisting damaging alkali-silica reaction;
- changes to the test method for composition of RCA and RA;
- corrections.

Amendment 1 introduces the following principal changes:

- **4.5** and Table 5 have been updated to reflect current guidance on pavement quality.
- Clauses **5.2** and **9.3** have been updated to reflect current guidance on minimizing the risk of alkali-silica reaction.
- A new Annex D that gives rules of application for demonstrating that the risk of damaging alkali-silica reaction has been minimized has been added. This replaces any earlier references to BRE Digest 330 [4] wherein the historical basis for the rules can be found.
- The index has been updated.

Hazard warnings

Where skin is in contact with fresh concrete, skin irritations are likely to occur owing to the alkaline nature of cement. The abrasive effects of sand and aggregate in the concrete can aggravate the condition. Potential effects range from dry skin, irritant contact dermatitis, to – in cases of prolonged exposure – severe burns. Take precautions to avoid dry cement entering the eyes, mouth and nose when mixing mortar or concrete by wearing suitable protective clothing. Take care to prevent fresh concrete from entering boots and use working methods that do not require personnel to kneel in fresh concrete. Unlike heat burns, cement burns might not be felt until some time after contact with fresh concrete, so there might be no warning of damage occurring. If cement or concrete enters the eye, immediately wash it out thoroughly with clean water and seek medical treatment without delay. Wash wet concrete off the skin immediately. Barrier creams may be used to supplement protective clothing but are not an alternative means of protection.

Use of this document

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this standard 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.

Contractual and legal considerations

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.

Introduction

The requirements in this part of BS 8500 are given for defined materials with an established or accepted adequate performance in United Kingdom conditions. These requirements might not be appropriate for use in exposure conditions different from the United Kingdom, particularly in hot climates. The use of constituents not listed in this standard should be by agreement between the producer and specifier on a case-by-case basis. Some guidance on the performance of these materials can be obtained by relative performance testing, as discussed in Concrete Society publication CS 109 [1].

BS 8500 and BS EN 206-1 take account of the distinct and different technical responsibilities of the specifier, producer and user. Where a body is responsible for more than one of these roles, internal procedures within that body should allocate responsibilities for the various actions.

1 Scope

This part of BS 8500 specifies constituent materials and concrete.

This part of BS 8500 complements BS EN 206-1. It provides United Kingdom national provisions where required or permitted by BS EN 206-1. It also covers materials, methods of testing and procedures that are outside the scope of BS EN 206-1, but within national experience.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of BS 8500. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

BS 812-104:1994, *Testing aggregates – Part 104: Method for qualitative and quantitative petrographic examination of aggregates*

BS 812-123, *Testing aggregates – Part 123: Method for determination of alkali-silica reactivity – Concrete prism method* ^{A1}

BS 1704, *Specification for solid-stem general purpose thermometers*

BS 1881-124, *Testing concrete – Part 124: Method for analysis of hardened concrete*

BS 1881-129, *Testing concrete – Part 129: Method for determination of density of partially compacted semi-dry fresh concrete*

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

BS 6068-2.37, *Water quality – Part 2: Physical, chemical and biochemical methods – Section 2.37: Method for the determination of chloride via a silver nitrate titration with chromate indicator (Mohr's method)*

BS 6068-2.42, *Water quality – Part 2: Physical, chemical and biochemical methods – Section 2.42: Determination of sodium and potassium: determination of sodium by atomic absorption spectrometry*

BS 6068-2.43, *Water quality – Part 2: Physical, chemical and biochemical methods – Section 2.43: Determination of sodium and potassium – Determination of potassium by atomic absorption spectrometry*

BS 6068-2.44, *Water quality – Part 2: Physical, chemical and biochemical methods – Section 2.44: Determination of sodium and potassium – Determination of sodium and potassium by flame emission spectrometry*

BS 6699, *Specification for ground granulated blastfurnace slag for use with Portland cement*

BS 7943, *Guide to the interpretation of petrographical examinations for alkali-silica reactivity*

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

BS 8000-2.1, *Workmanship on building sites – Part 2: Code of practice for concrete work – Section 2.1: Mixing and transporting concrete*

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

BS EN 196-1, *Methods of testing cement – Part 1: Determination of strength*

BS EN 196-2, *Methods of testing cement – Part 2: Chemical analysis of cement*

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

BS EN 206-1:2000, including Amendments A1, A2 and A3, *Concrete – Part 1: Specification, performance, production and conformity*

BS EN 450-1:2005, *Fly ash for concrete – Part 1: Definition, specifications and conformity criteria*

BS EN 480-1:1998, *Admixtures for concrete, mortar and grout – Test methods – Part 1: Reference concrete and reference mortar for testing*

BS EN 480-10, *Admixtures for concrete, mortar and grout – Test methods – Part 10: Determination of water soluble chloride content*

BS EN 480-11, *Admixtures for concrete, mortar and grout – Test methods – Part 11: Determination of air void characteristics in hardened concrete*

BS EN 480-12, *Admixtures for concrete, mortar and grout – Test methods – Part 12: Determination of the alkali content of admixtures*

BS EN 932-1:1997, *Tests for general properties of aggregates – Part 1: Methods for sampling*

BS EN 932-5, *Tests for general properties of aggregates – Part 5: Common equipment and calibration*

BS EN 933-2, *Tests for geometrical properties of aggregates – Part 2: Determination of particle size distribution – Test sieves, nominal size of apertures*

BS EN 934-2, *Admixtures for concrete, mortar and grout – Part 2: Concrete admixtures – 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 concrete industry, as mixing water for concrete*

BS EN 1097-3, *Tests for mechanical and physical properties of aggregates – Part 3: Determination of loose bulk density and voids*

BS EN 1367-4, *Tests for thermal and weathering properties of aggregates – Part 4: Determination of drying shrinkage*

BS EN 1744-1:1998, *Tests for chemical properties of aggregates – Part 1: Chemical analysis*

BS EN 12350-6, *Testing fresh concrete – Part 6: Density*

BS EN 12390-2, *Testing hardened concrete – Part 2: Making and curing specimens for strength testing*

BS EN 12390-7, *Testing hardened concrete – Part 7: Density of hardened 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 13055-1, *Lightweight aggregates – Part 1: Lightweight aggregates for concrete, mortar and grout*

BS EN 13263-1, *Silica fume for concrete – Part 1: Definitions, requirements and conformity criteria*

BS EN 14216, *Cement – Composition, specifications and conformity criteria for very low heat special cements*

BS EN 15167-1, *Ground granulated blastfurnace slag for use in concrete, mortar and grout – Part 1: Definitions, specifications and conformity criteria*

BS EN ISO 9001, *Quality management systems – Requirements*

Ⓐ¹ British Cement Association *Alkali-silica reaction – Testing protocol for greywacke aggregates – Protocol of the BSI B/517/1/20 ad hoc group on ASR*. Crowthorne, Berkshire. 1999. ¹ Ⓐ¹

Concrete in aggressive ground. Special Digest 1. Third edition. Watford: Building Research Establishment, 2005.¹⁾

Concretes with high ggbs contents for use in hard/firm secant piling. Quillin K, Nixon P J, Matthews J D, and Longworth T I. Information paper IP 17/05. Watford: Building Research Establishment, 2005.²⁾

Ⓐ¹ ¹⁾ Available from The Concrete Bookshop, 4 Meadows Business Park, Blackwater, Camberley, Surrey GU17 9AB. Website: <http://www.concretebookshop.com>. Ⓐ¹

²⁾ Available from BRE Bookshop, 151 Rosebery Avenue, London EC1R 4QX. Website: <http://www.brebookshop.com>.

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

For the purposes of this part of BS 8500, the terms and definitions given in BS EN 206-1:2000, **3.1** and BS 8500-1:2006, **3.1** and the following apply.

*NOTE The definition of the term “site (construction site)” given in BS EN 206-1:2000, **3.1.35** may be taken to include any land immediately adjacent to the contract specifically used for the purpose of setting up a batching plant.*

3.1.1 density of fresh concrete

mass of a quantity of compacted fresh concrete divided by its volume, expressed in kilograms per cubic metre (kg/m^3)

NOTE For the method of determining density of fresh concrete, see BS EN 12350-6. Compaction by the method described in BS EN 12350-6 is not appropriate for semi-dry concretes. The method for determining the density of partially compacted semi-dry concrete is described in BS 1881-129.

3.1.2 lot

quantity of a material produced under conditions presumed uniform

NOTE After specified tests this quantity, as a whole, is regarded as conforming or not conforming to the specified requirements.

3.1.3 production day

<for strength testing> day on which 20 m^3 or more of concrete from a family or a designed or designated concrete outside of a family has been produced

NOTE 1 The day on which a cumulative 20 m^3 has been produced since the last production day or since commencing production is also defined as one production day.

<for air content testing> day on which 50 m^3 or more of concrete with a specified air content has been produced

NOTE 2 The day on which a cumulative 50 m^3 has been produced since the last production day or since commencing production is also defined as one production day.

3.1.4 production week

period of 7 consecutive days comprising at least 5 production days or the period taken to complete 5 production days, whichever is longer

3.1.5 time of loading

time of first contact between cement and aggregates or, where the latter are surface dry, between cement and added water

3.1.6 product conformity certification

certification, based on product testing and surveillance, and issued by an accredited third-party certification body in accordance with a documented quality system

NOTE 1 Users of this part of BS 8500 are advised to consider the desirability of quality system assessment and registration against BS EN ISO 9001 by an accredited third-party certification body. Many certification bodies have this as a requirement of their product conformity certification.

Further information on the provisions for assessment, surveillance and certification of production control can be found in BS EN 206-1:2000, Annex C.

NOTE 2 Users seeking assistance in identifying appropriate conformity assessment bodies or schemes may ask BSI to forward their enquiries to the relevant association.

NOTE 3 Attention is drawn to the Department for Business, Innovation and Skills policy document, Conformity assessment accreditation policy. 

3.2 Symbols and abbreviations

For the purposes of this part of BS 8500, the symbols and abbreviations given in BS EN 206-1:2000, **3.2** and BS 8500-1:2006+A1:2012, **3.2** apply.

4 Complementary requirements for constituent materials

4.1 General

Constituent materials that conform to the relevant European Standards cited in BS EN 206-1 or the relevant British Standards cited in this part of BS 8500 shall be deemed to meet the requirement that they do not contain harmful ingredients in such quantities as might be detrimental to the durability of the concrete or cause corrosion of the reinforcement, provided that the concrete conforms to any specified limits placed on it, e.g. chloride class.

Where types and classes of constituent materials are not detailed in the specification, the producer shall select constituent materials for the specified requirements.

4.2 Cement and combinations

Where cements and combinations have been specified using a broad designation, the producer shall select one of the cements or combinations from Table 1 for the specified designation. Where neither a DC-class nor a specific cement or combination type is specified, the producer shall use one of the cements or combinations from Table 1.

Other cements and combinations, e.g. Portland-composite cements (CEM II-M), composite cements (CEM V), combinations of blended cements with an addition or Portland cement with two or more additions, shall be used when specified or agreed with the specifier.

Table 1 General purpose cements and combinations

Type	Notation	Standard	Broad designation	Grouping used in BRE SD1: 2005
Portland cement	CEM I	BS EN 197-1	CEM I	A
Portland silica fume cement ^{A)}	CEM II/A-D	BS EN 197-1	IIA	A
Portland limestone cement	CEM II/A-L	BS EN 197-1	IIA	B ^{B)} or C ^{B)}
	CEM II/A-LL	BS EN 197-1	IIA	B ^{B)} or C ^{B)}
Portland slag cements	CEM II/A-S	BS EN 197-1	IIA	A
	CEM II/B-S	BS EN 197-1	IIB-S	A
Portland fly ash cements	CEM II/A-V	BS EN 197-1	IIA	A
	CEM II/B-V	BS EN 197-1	IIB-V	A
	CEM II/B-V+SR ^{C)}	BS EN 197-1	IIB+SR	D
Blastfurnace cements	CEM III/A	BS EN 197-1 or BS EN 197-4	IIIA	A
	CEM III/A+SR ^{D)}	BS EN 197-4	IIIA+SR	D
	CEM III/B	BS EN 197-1 or BS EN 197-4	IIIB	A
	CEM III/B+SR ^{D)}	BS EN 197-4	IIIB+SR	F
Pozzolanic cement	CEM IV/B(V)	BS EN 197-1 or BS EN 14216	IVB-V	E
Sulfate-resisting Portland cement	SRPC	BS 4027	SRPC	G
<i>Combinations conforming to Annex A manufactured in the concrete mixer from Portland cement and fly ash, ggbs or limestone fines:</i>				
CEM I cement conforming to BS EN 197-1 with a mass fraction of 6% to 20% of combination of fly ash conforming to BS EN 450-1	CIIA-V	BS 8500-2, Annex A	IIA	A
CEM I cement conforming to BS EN 197-1 with a mass fraction of 21% to 35% of combination of fly ash conforming to BS EN 450-1	CIIB-V	BS 8500-2, Annex A	IIB-V	A
	CIIB-V+SR ^{C)}		IIB+SR	D
CEM I cement conforming to BS EN 197-1 with a mass fraction of 36% to 55% of combination of fly ash conforming to BS EN 450-1	CIVB-V	BS 8500-2, Annex A	IVB-V	E
CEM I cement conforming to BS EN 197-1 with a mass fraction of 6% to 20% of combination of ggbs conforming to BS 6699 or BS EN 15167-1	CIIA-S	BS 8500-2, Annex A	IIA	A
CEM I cement conforming to BS EN 197-1 with a mass fraction of 21% to 35% of combination of ggbs conforming to BS 6699 or BS EN 15167-1	CIIB-S	BS 8500-2, Annex A	IIB-S	A
CEM I cement conforming to BS EN 197-1 with a mass fraction of 36% to 65% of combination of ggbs conforming to BS 6699 or BS EN 15167-1	CIIA	BS 8500-2, Annex A	IIIA	A
	CIIA+SR ^{D)}		IIIA+SR	D
CEM I cement conforming to BS EN 197-1 with a mass fraction of 66% to 80% of combination of ggbs conforming to BS 6699 or BS EN 15167-1	CIIB	BS 8500-2, Annex A	IIIB	A
	CIIB+SR ^{D)}		IIIB+SR	F
CEM I cement conforming to BS EN 197-1 with a mass fraction of 6% to 20% of combination of limestone fines conforming to BS 7979	CIIA-L	BS 8500-2, Annex A	IIA	B ^{B)} or C ^{B)}
	CIIA-LL		IIA	B ^{B)} or C ^{B)}

^{A)} When IIA or 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.

^{B)} The classification is B if the cement or combination strength is class 42,5 or higher and C if it is class 32,5.

^{C)} With a minimum proportion of fly ash of 25%.

^{D)} Where the alumina content of the slag exceeds 14%, the tricalcium aluminate content of the Portland cement fraction shall not exceed 10%.

4.3 Aggregates

General suitability is established for the following:

- normal and heavyweight aggregates conforming to BS EN 12620;
- lightweight aggregates conforming to BS EN 13055-1;
- coarse recycled concrete aggregate (RCA) conforming to this part of BS 8500.

NOTE 1 When using the European Standards:

- a) *the use of normal-weight and heavyweight aggregates should follow the recommendations given in PD 6682-1;*
- b) *for lightweight aggregates specified in accordance with BS EN 13055-1, the producer should specify to the aggregate supplier the requirements for lightweight aggregates given in this clause, together with the following:*
 - *maximum aggregate size;*
 - *grading including tolerances;*
 - *target loose bulk density.*

Lightweight aggregates shall conform to the following requirements:

- a) the acid soluble sulfate content shall be not more than 1% when measured in accordance with BS EN 1744-1;
- b) for furnace bottom ash or clinker, the loss-on-ignition shall be not more than 10% when measured in accordance with BS EN 1744-1.

Where freeze-thaw resisting lightweight aggregates are specified, the producer shall hold data demonstrating that the chosen lightweight aggregates produce concrete with adequate freeze-thaw resistance.

NOTE 2 Freeze-thaw resistance is deemed to be adequate if the aggregates have a successful track record of use for at least 10 years in similar or worse environments with concrete of the quality specified or lower than the quality specified.

Where fine lightweight aggregate is to be used, the method of determination of the water absorption shall be selected by the producer and documented. The producer shall supply details of the test method to the specifier, if requested.

NOTE 3 There is no standard test method; the most appropriate technique will depend on the type of lightweight aggregate used. The specifier may require a different method to be used.

NOTE 4 The method given in BS EN 1097-6:2000, Annex C is not applicable to aggregates with particle sizes less than 4 mm.

Air-cooled blastfurnace slag aggregate shall meet the requirements in BS EN 12620:2002 for acid-soluble sulfate category AS_{1,0}.

Where freeze-thaw resisting normal-weight or heavyweight aggregates are specified, the aggregate shall meet the requirements in BS EN 12620:2002 for magnesium sulfate soundness category MS₂₅ for use in XF3 exposures and magnesium sulfate soundness category MS₁₈ for use in XF4 exposures except for porous flint aggregates. Porous flint aggregates shall be deemed to be suitable for use if they have been used successfully in concrete that has been exposed to freeze-thaw conditions for at least 10 years.

The aggregate drying shrinkage shall be not more than 0.075% when determined in accordance with BS EN 1367-4, unless otherwise specified.

The Los Angeles coefficient category, as classified in BS EN 12620:2002, of the combined coarse aggregate, excluding lightweight aggregates, shall be the category specified in the project specification; or where a category has not been specified, it shall meet the requirements for LA₄₀.

NOTE 5 Aggregates having Los Angeles coefficient values above 40 might also perform satisfactorily in normal concrete, but their compressive strength performance and, if reinforced, shear strength performance should be established in concrete trials before use.

Coarse RCA and coarse recycled aggregate (RA) shall conform to the requirements specified in Table 2. Composites of coarse RCA or coarse RA and natural aggregates shall conform to the general requirements for aggregate specified in BS EN 12620 as appropriate and to the general requirements for normal-weight aggregates specified in this subclause.

COMMENTARY ON FINE RCA AND FINE RA

Clean fine RCA is suitable for use in concrete. However, it is known that some concrete elements have been coated with gypsum plaster, and on crushing most of this gypsum plaster will finish in the fine RCA. Excess gypsum plaster can lead to delayed ettringite formation [2] and it is the judgement of BSI that there is no practical sampling system that would detect localized high volumes of sulfate. In addition there was no information on possible stockpile segregation. For these reasons, the use of fine RCA is left to the project specification, which can take account of the particular source of RCA.

Some fine RA might also be suitable for use in concrete, but because of the wide range of composition and lack of detailed information, generic requirements cannot be given at present. The comment above on gypsum in fine RCA also applies to some sources of fine RA.

NOTE 6 Provisions for the use of fine RCA and fine RA are not given in BS 8500 but this does not preclude their use where it is demonstrated that, due to the source of material, significant quantities of deleterious materials are not present and their use has been agreed. While some requirements for coarse RA are specified, they are insufficient to form an adequate specification. As the potential composition of RA is so wide, the additional specification requirements should be assessed on a case-by-case basis taking into account the specific composition of the RA. In particular the project specification for RA should include:

- *maximum acid-soluble sulfate;*
- *method for determination of the chloride content;*
- *classification with respect to alkali-aggregate reactivity;*
- *method for determination of the alkali content;*
- *any limitations on use in concrete.*

When the composition of coarse RCA and coarse RA is tested in accordance with Annex B, the test result obtained for each type of particle shall not exceed the maximum value specified in Table 2.

When determined in accordance with BS EN 1744-1, the acid-soluble sulfate content of coarse RCA shall not exceed the maximum value specified in Table 2.

Table 2 **Requirements for coarse RCA and coarse RA**
Requirements given as mass fraction (%)

Type of aggregate	Requirement ^{A)}					
	Maximum masonry content	Maximum fines	Maximum lightweight material ^{B)}	Maximum asphalt	Maximum other foreign material e.g. glass, plastics, metals	Maximum acid-soluble sulfate (SO ₃)
RCA ^{A), C)}	5	5	0.5	5.0	1.0	1.0
RA	100	3	1.0	10.0	1.0	— ^{D)}

A) Where the material to be used is obtained by crushing hardened concrete of known composition that has not been in use, e.g. surplus precast units or returned fresh concrete, and not contaminated during storage and processing, the only requirements are those for grading and maximum fines.

B) Material with a density less than 1 000 kg/m³.

C) The provisions for coarse RCA may be applied to mixtures of natural coarse aggregates blended with the listed constituents.

D) The appropriate limit and test method needs to be determined on a case-by-case basis (see Note 6 to 4.3).

When determining that the maximum chloride content of concrete specified in BS EN 206-1:2000, 5.2.7 has not been exceeded, the chloride content of coarse RCA and coarse RA and its variability shall be established and taken into account.

Except where permitted by the footnotes, coarse RCA shall not be used in concrete with a strength class greater than the maximum specified in Table 3, and shall be used only in the exposure classes specified in Table 3.

Table 3 **Limitations on the use of coarse RCA**

Type of aggregate	Limitations on use	
	Maximum strength class ^{A)}	Exposure classes ^{B)}
RCA	C40/50	X0, XC1, XC2, XC3, XC4, XF1, DC-1

A) Material obtained by crushing hardened concrete of known composition that has not been in use and not contaminated during storage and processing may be used in any strength class.

B) These aggregates may be used in other exposure classes provided it has been demonstrated that the resulting concrete is suitable for the intended environment, e.g. freeze-thaw resisting, sulfate-resisting.

4.4 Additions

General suitability as a Type II addition is established for the following:

- fly ash conforming to BS EN 450-1;
- silica fume conforming to BS EN 13263-1;
- ggbs conforming to BS 6699 or BS EN 15167-1;
- metakaolin with an appropriate Agrément Certificate. ³⁾

³⁾ Available from the British Board of Agrément.

General suitability as a Type I addition is established for the following:

- filler aggregate conforming to BS EN 12620 or BS EN 13055-1;
- pigments conforming to BS EN 12878.

General suitability of limestone fines conforming to BS 7979 is established for use in combinations conforming to Annex A.

Provided the additions are within the limits established in accordance with Annex A, the following additions shall be taken fully into account in the concrete composition in respect of the cement content and the w/c ratio:

- category A or B fly ash conforming to BS EN 450-1:2005;
- ggbs conforming to BS 6699 or BS EN 15167-1;
- limestone fines conforming to BS 7979.

The equivalent concrete performance concept (see BS EN 206-1:2000, **5.2.5.3**) shall not be used unless the producer's proposals for demonstrating equivalence and ensuring conformity have been approved by the specifier.

Where the *k*-value concept is used (see BS EN 206-1:2000, **5.2.5.2**), the starting point for limiting values shall be those specified in the specification for a CEM I cement concrete.

4.5 Admixtures

COMMENTARY ON 4.5

There is no requirement to use the concrete producer's constituent materials, other than the admixtures, as any adverse interactions between admixtures are shown by the test in BS EN 480-11 using standard materials.

Where the concrete contains one or more admixtures in addition to an air-entraining agent for freeze-thaw resistance, the air void characteristics of the combination of admixtures shall be tested in accordance with BS EN 480-11 using the admixture supplier's standard materials. The air void spacing factor, measured on specimens of hardened concrete made with reference concrete III in accordance with BS EN 480-1:1998 and an air content within $\pm 1\%$ of the target, shall be not greater than 0.20 mm.

[A1] Initial testing shall confirm that the entrained air content is within the permitted tolerance at the limits of the specified consistence class. **[A1]**

NOTE Initial tests as required by BS EN 206-1:2000, 5.2.6 for air-entrained concretes containing more than one admixture need only determine the air content to assess the performance of the air void system.

4.6 Fibres

General suitability for use in concrete conforming to BS EN 206-1 and this part of BS 8500 is established for fibres for concrete conforming to a European Technical Approval.