

BS 8500-2:2023



BSI Standards Publication

Concrete – Complementary British Standard to BS EN 206

Part 2: Specification for constituent materials and concrete

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Summary of pages

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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 2023. 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 this committee can be obtained on request to the committee manager.

Supersession

This part of [BS 8500](#) supersedes BS 8500-2:2015+A2:2019, which is withdrawn.

Relationship with other publications

[BS 8500](#) contains additional United Kingdom provisions to be used in conjunction with [BS EN 206:2013+A2:2021](#). Together they form a complete package for the specification, production and conformity of concrete.

[BS 8500](#) is published in two parts:

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

Information about this document

This new edition of BS 8500-2 incorporates technical changes only. It does not represent a full review or revision of the document, which will be undertaken in due course. The principal changes are:

- the inclusion of [BS EN 197-5](#) cements and their equivalent combinations as general purpose cements;
- the redefinition of a production day for air content testing;
- clauses for production, delivery and conformity requirements moved to a new normative annex;
- amendment of the combination conformity procedures for the new equivalent combinations;
- corrections and minor clarifications; and
- all references have been updated.

The changes are predominantly concerned with the increased range of cementitious materials covered. [BS EN 197-5](#) introduced CEM II/C-M and CEM IV multi-component cements with a lower proportion of clinker than allowable by [BS EN 197-1](#). The conformity procedure for combinations, and examples, have been expanded for the equivalent combinations of Portland composite and composite cements.

This publication can be withdrawn, revised, partially superseded or superseded.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 bsigroup.com/standards, 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.

Hazard warning

WARNING. 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 part of [BS 8500](#) that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

The requirement for a producer to hold third-party certification to supply designated concrete has been approved by the Standards Policy and Strategy Committee. This exception has been permitted as an option for those who wish to specify a range of concretes defined as suitable for their designated application covered by third-party certification with specified minimum requirements.

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

The requirements in this part of [BS 8500](#) are given for defined materials with an established or accepted adequate performance in the conditions found in the United Kingdom. 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 part of [BS 8500](#) should be by agreement between the producer and specifier on a case-by-case basis.

1 Scope

This part of [BS 8500](#) specifies constituent materials and concrete. This part of [BS 8500](#) complements [BS EN 206](#). It provides United Kingdom national provisions where required or permitted by [BS EN 206](#). It also covers materials, methods of testing and procedures that are outside the scope of [BS EN 206](#), but within national experience.

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 document¹⁾. 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 812-104](#), *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*

[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 6068-2.37](#), (ISO 9297), *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 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*

¹⁾ Documents that are referred to solely in an informative manner are listed in the Bibliography.

BS 8500-1:2023, Concrete – Complementary British Standard to BS EN 206 – Part 1: Method of specifying and guidance for the specifier

[BS 8615-1](#), *Specification for pozzolanic materials for use with Portland cement – Part 1: Natural pozzolana and natural calcined pozzolana*

[BS 8615-2](#), *Specification for pozzolanic materials for use with Portland cement – Part 2: High reactivity natural calcined pozzolana*

[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 197-1:2011](#), *Cement – Part 1: Composition, specifications and conformity criteria for common cements*

[BS EN 197-5](#), *Cement – Part 5: Portland-composite cement CEM II/C-M and Composite cement CEM VI*

[BS EN 206:2013+A2:2021](#), *Concrete – Specification, performance, production and conformity*

[BS EN 450-1:2012](#), *Fly ash for concrete – Part 1: Definitions, specifications and conformity criteria*

[BS EN 480-1](#), *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 933-11](#), *Tests for geometrical properties of aggregates – Part 11: Classification test for the constituents of coarse recycled aggregates*

[BS EN 934-1](#), *Admixtures for concrete, mortar and grout – Part 1: Common requirements*

[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 1744-1:2009+A1:2012](#), *Tests for chemical properties of aggregates – Part 1: Chemical analysis*

[BS EN 12350-1](#), *Testing fresh concrete – Part 1: Sampling and common apparatus*

[BS EN 12350-5](#), *Testing fresh concrete – Part 5: Flow table test*

[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 12390-3](#), *Testing hardened concrete – Part 3: Compressive strength of test specimens*

[BS EN 12390-7](#), *Testing hardened concrete – Part 7: Density of hardened concrete*

[BS EN 12620](#), *Aggregates for concrete*

[BS EN 12878:2014](#), *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 13286-51](#), *Unbound and hydraulically bound mixtures – Part 51: Method for the manufacture of test specimens of hydraulically bound mixtures using vibrating hammer compaction*

[BS EN 14216:2015](#), *Cement – Composition, specifications and conformity criteria for very low heat special cements*

[BS EN 15167-1](#), *Ground granulated blast furnace slag for use in concrete, mortar and grout – Part 1: Definitions, specifications and conformity criteria*

[BS EN ISO 9001](#), *Quality management systems – Requirements*

[BS EN ISO/IEC 17021-1](#), *Conformity assessment – Requirements for bodies providing audit and certification of management systems – Part 1: Requirements*

[BS EN ISO/IEC 17065](#), *Conformity assessment – Requirements for bodies certifying products, processes and services*

Other publications

[N1] BRITISH CEMENT ASSOCIATION (BCA). *Alkali-silica reaction – Testing protocol for greywacke aggregates – Protocol of the BSI B/517/1/20 ad hoc group on ASR*. BCA: Crowthorne, Berkshire, 1999.

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 206:2013+A2:2021](#) and BS 8500-1:2023 and the following apply.

NOTE The definition of the term “site (construction site)” given in [BS EN 206:2013+A2:2021](#), 3.1.1.16 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 certified average alkali content

average of 25 consecutive determinations of alkali content carried out on spot samples and expressed as the sodium oxide equivalent (Na_2O eq.)

3.1.2 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 the 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](#).

3.1.3 general suitability

suitability of each constituent for its use in concrete

NOTE 1 This term is used in [BS EN 206:2013+A2:2021](#).

NOTE 2 Where general suitability is established for a constituent, this does not indicate suitability in every intended use of the concrete and for every concrete composition.

3.1.4 guaranteed alkali limit

alkali limit, expressed as the sodium oxide equivalent (Na_2O eq.), which the constituent material supplier guarantees is not exceeded by any test result on any spot sample

3.1.5 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.

3.1.6 production day

3.1.6.1 production day (for strength testing)

day on which 20 m³ or more of concrete from a family or a designed or designated concrete outside of a family has been produced or day on which a cumulative 20 m³ has been produced since the last production day or since commencing production

3.1.6.2 production day (for air content testing; continuous production)

day on which 150 m³ or more of concrete with a specified air content has been produced or day on which a cumulative 150 m³ has been produced since the last production day

3.1.6.3 production day (for air content testing; initial production or after non-conformity)

day on which 50 m³ or more of concrete with a specified air content has been produced or the day on which a cumulative 50 m³ has been produced since the last production day until three consecutive conforming samples are taken over three production days

3.1.7 production week

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

3.2 Symbols and abbreviations

For the purposes of this part of [BS 8500](#), the symbols and abbreviations given in [BS EN 206:2013+A2:2021](#) and BS 8500-1:2023 apply.

4 Complementary requirements for constituent materials

4.1 General

Constituent materials that conform to the relevant European Standards cited in [BS EN 206:2013+A2:2021](#) 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.

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

4.2 Cement, additions and combinations

COMMENTARY ON 4.2

[Table 1](#) is a list of cements, and where appropriate, their equivalent combinations of cement and additions. Their inclusion in this list is on the basis of some UK understanding or evidence of their

performance in concrete. Factory-made cements in accordance with [BS EN 197-1:2011](#) or [BS EN 197-5](#) are denoted “CEM”, whereas combinations of cement and additions are denoted “C”.

Cements and combinations of the same type are technically equivalent and this means a simplified broad designation may be used where “CEM” or “C” are omitted, as shown in the last column. As a single “I” is liable to be overlooked and as there is no combination equivalent to CEM I, then its designation is shown in full as listed in [Table 1](#).

Equivalent combinations to [BS EN 197-1:2011](#), “low heat common cements” and [BS EN 14216:2015](#), “very low heat special cements” (see [4.2.3.2](#)) have “LH” and “VLH” appended to their equivalent combination notation, e.g. an equivalent combination to a low heat blast furnace cement, CEM III/B-LH, would have the notation CIIIB-LH and the equivalent combination to a very low heat special blast furnace cement, VLH III/B, would have the notation CIIIB-VLH.

Guidance on resistance to sulfate attack and resistance to corrosion through chloride ingress is given in [BS 8500-1:2023](#).

The nomenclature used for the additions in combinations are defined in [BS EN 197-1:2011](#); e.g. S – ggbs, P – natural pozzolana, Q – natural calcined pozzolana, V – siliceous fly ash, L – limestone fines, D – silica fume.

[BS EN 197-1:2011](#) categorizes limestone fines as L or LL defined by limits on total organic carbon (TOC) by mass. As LL conforms to the requirements of L, only L is used by this part of [BS 8500](#) as the nomenclature for limestone fines.

4.2.1 General

Where cements or combinations are specified using a broad designation, one of the cements or equivalent combinations from [Table 1](#) shall be declared. Where a specific cement, combination type or DC-class is not specified, one of the cements or combinations from [Table 1](#) shall be used.

NOTE The specifier might want to use cements and combinations that are demonstrably equivalent to those listed in [Table 1](#) by application of the equivalent concrete performance concept (ECPC) as given in [4.2.3.3](#).

4.2.2 Cement

General suitability shall be established for cement conforming to either [BS EN 197-1:2011](#) or [BS EN 197-5](#).

NOTE Very low heat special cement conforming to [BS EN 14216:2015](#), and some low heat cements conforming to [BS EN 197-1:2011](#) and [BS EN 197-5](#), are suitable for concrete in massive structures and other applications to minimize the risk of thermal cracking.

4.2.3 Additions as part of cement

4.2.3.1 Additions for combinations

Suitability shall be established for the following additions to be used when combined with cement as a combination:

- fly ash conforming to [BS EN 450-1:2012](#);
- silica fume conforming to [BS EN 13263-1](#);
- ground granulated blastfurnace slag conforming to [BS EN 15167-1](#);
- limestone fines conforming to [BS 7979](#); and
- natural pozzolana or natural calcined pozzolana conforming to [BS 8615-1](#), or high reactivity natural calcined pozzolana conforming to [BS 8615-2](#).

NOTE A combination is equivalent to an [BS EN 197-1:2011](#), [BS EN 197-5](#) or [BS EN 14216:2015](#) cement where the requirements of [4.2.3.2](#) are fulfilled.

4.2.3.2 Cement by equivalent performance of combinations concept (EPCC)

Combinations shall be equivalent to a cement conforming to [BS EN 197-1:2011](#), [BS EN 197-5](#) or [BS EN 14216:2015](#) where the combination conforms to the same:

- a) nominal proportions for composition as a cement conforming to [BS EN 197-1:2011](#), [BS EN 197-5](#) or [BS EN 14216:2015](#) where, for the purpose of calculating composition proportions, the calcium sulfate content is not included in the proportion calculations; and
- b) the strength class; and
- c) where specified, low heat or very low heat properties confirmed in accordance with [BS EN 197-1:2011](#), [7.2.3](#) or [BS EN 14216:2015](#), [7.2.3](#).

NOTE The conformity procedure for combinations set out in [Annex B](#) meets all the requirements of [BS EN 206:2013+A2:2021](#) for the equivalent performance of combinations concept (EPCC).

4.2.3.3 Use of additions by equivalent concrete performance concept (ECPC)

The equivalent concrete performance concept (ECPC) may be used for cements conforming to [BS EN 197-1:2011](#) plus one or more additions and shall be in accordance with the principles given in [BS EN 206:2013+A2:2021](#).

NOTE PD CEN/TR 16639 provides more detailed information on this topic.

4.2.3.4 Use of additions by k-value concept

COMMENTARY ON 4.2.3.4

“k-value” is a prescriptive concept based on the comparison of a reference concrete with a cement “A” against a test concrete in which part of the cement “A” is replaced by an addition as a function of the water/cement ratio and the addition content.

Where the k-value concept is used, it shall be as given in [BS EN 206:2013+A2:2021](#) where the total amount of cement is calculated as:

- cement content + (k × addition);

and the water/cement ratio is calculated as:

- water/[cement content + (k × addition)];

and shall be as specified for the reference concrete. The units of measurement used for water, cement and addition shall be kg/m³.

NOTE This part of [BS 8500](#) does not contain any provisions for the use of the k-value concept with ggbs.

4.2.4 Other additions for concrete

Suitability shall be established for the following additions to be used in concrete:

- a) filler aggregate conforming to [BS EN 12620](#) or [BS EN 13055-1](#); and
- b) pigments conforming to [BS EN 12878:2014](#), Category B.

NOTE Pigments conforming to [BS EN 12878:2014](#) and containing chloride may be used for unreinforced concrete.

Table 1 — General purpose cements and combinations

Cement ^{A)} or equivalent combination ^{B)}	BS EN 197-1:2011 or BS EN 197-5 cement type notation	Additional requirement for composition	Equivalent combination notation	Broad notation
Portland cement	CEM I		—	CEM I
Sulfate-resisting Portland cement	CEM-I SR 0		—	CEM-I SR 0
	CEM-I SR 3		—	CEM-I SR 3
Portland silica-fume cement ^{C)}	CEM II/A-D		CIIA-D	IIA
Portland limestone cement	CEM II/A-L		CHIA-L	IIA
Portland-slag cement	CEM II/A-S		CIIA-S	IIA
	CEM II/B-S		CIIB-S	IIB-S
Portland natural pozzolana cement	CEM II/A-P		CHIA-P	IIA
	CEM II/B-P		CIIB-P	IIB-P
	CEM II/B-P+SR ^{D)}	P ≥ 25%	CIIB-P+SR	IIB-P+SR
Portland natural calcined pozzolana cement	CEM II/A-Q		CIIA-Q	IIA
	CEM II/B-Q		CIIB-Q	IIB-Q
	CEM II/B-Q+SR ^{D)}	Q ≥ 25%	CIIB-Q+SR	IIB-Q+SR
Portland fly ash cement	CEM II/A-V		CHIA-V	IIA
	CEM II/B-V		CIIB-V	IIB-V
	CEM II/B-V+SR ^{D)}	V ≥ 25%	CIIB-V+SR	IIB-V+SR
Portland composite cement to BS EN 197-5 ^{E)}	CEM II/C-M (V-L)		CIIC-VL	IIC-M
	CEM II/C-M (V-L)+SR ^{D)}	V ≥ 25%	CIIC-VL+SR	IIC-M+SR
	CEM II/C-M (S-L)		CIIC-SL	IIC-M
	CEM II/C-M (S-L)+SR ^{D)}	S ≥ 36%	CIIC-SL+SR	IIC-M+SR
	CEM II/C-M (S-V)		CIIC-SV	IIC-M
	CEM II/C-M (V-S)		CIIC-VS	IIC-M
Portland composite cement ^{E)}	CEM II/A-M (S-L)		CHIA-SL	IIA
	CEM II/A-M (L-S)		CHIA-LS	IIA
	CEM II/A-M (P-L)		CHIA-PL	IIA
	CEM II/A-M (L-P)		CHIA-LP	IIA
	CEM II/A-M (Q-L)		CHIA-QL	IIA
	CEM II/A-M (L-Q)		CHIA-LQ	IIA
	CEM II/A-M (V-L)		CHIA-VL	IIA
	CEM II/A-M (L-V)		CHIA-LV	IIA
	CEM II/A-M (S-V)		CHIA-SV	IIA
	CEM II/A-M (V-S)		CHIA-VS	IIA
	CEM II/B-M (L-S)		CIIB-LS	IIB-M
	CEM II/B-M (S-L)		CIIB-SL	IIB-M
	CEM II/B-M (P-L)		CIIB-PL	IIB-M
	CEM II/B-M (L-P)		CIIB-LP	IIB-M
	CEM II/B-M (Q-L)		CIIB-QL	IIB-M
	CEM II/B-M (L-Q)		CIIB-LQ	IIB-M
	CEM II/B-M (V-L)		CIIB-VL	IIB-M
	CEM II/B-M (L-V)		CIIB-LV	IIB-M
	CEM II/B-M (S-V)		CIIB-SV	IIB-M
	CEM II/B-M (V-S)		CIIB-VS	IIB-M

Table 1 — General purpose cements and combinations (continued)

Cement ^{A)} or equivalent combination ^{B)}	BS EN 197-1:2011 or BS EN 197-5 cement type notation	Additional requirement for composition	Equivalent combination notation	Broad notation
Blast furnace cement	CEM III/A	S ≥ 36%	CIIIA	IIIA
	CEM III/A+SR ^{D)}		CIIIA+SR	IIIA+SR
	CEM III/B		CIIBB	IIIB
	CEM III/B+SR ^{D)}		CIIBB+SR	IIIB+SR
	CEM III/C		CIIBC	IIIC
	CEM III/C+SR ^{D)}		CIIBC+SR	IIIC+SR
Pozzolanic cement ^{F), G)}	CEM IV/B-P		CIVB-P	IVB-P
	CEM IV/B-Q		CIVB-Q	IVB-Q
	CEM IV/B-V		CIVB-V	IVB-V
Composite cement to BS EN 197-5 ^{E)}	CEM VI (S-L)	S ≥ 36%	CVI-SL	VI
	CEM VI (S-L)+SR ^{D)}		CVI-SL+SR	VI+SR
	CEM VI (S-V)		CVI-SV	VI

^{A)} Cement type to [BS EN 197-1:2011](#) unless otherwise stated.

^{B)} Combinations conforming to [4.2.3.2](#) and with equivalent combination notation.

^{C)} 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 206:2013+A2:2021](#)).

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

^{E)} The constituents of composite cements or combinations are listed in order of greatest proportion, e.g. (L-S) or -LS is where the proportion of limestone fines is greater than the proportion of ggbs and (V-L) or -VL is where the proportion of siliceous fly ash is greater than the proportion of limestone fines.

^{F)} CEM IV/A cement with natural pozzolana should be classified as either CEM II/A-P (6%–20% natural pozzolana) or CEM II/B-P (21%–35% natural pozzolana).

^{G)} CEM IV/A cement with natural calcined pozzolana or high reactivity natural calcined pozzolana should be classified as either CEM II/A-Q (6%–20% pozzolana) or CEM II/B-Q (21%–35% pozzolana).

4.3 Aggregates

4.3.1 General suitability

General suitability shall be established for the following:

- normal-weight and heavy-weight aggregates conforming to [BS EN 12620](#) and the requirements specified in [4.3.2](#), [4.3.3](#), [4.3.4](#) and, where concrete resistance to XF3 and XF4 is required, [4.3.5](#);
- coarse crushed concrete aggregate (CCA) conforming to [BS EN 12620](#) and the requirements specified in [4.3.2](#), [4.3.3](#), [4.3.4](#) and [4.3.7](#);
- granulated, including pelletized, blast furnace slag and air-cooled blast furnace slag conforming to [BS EN 12620](#). Air-cooled blast furnace slag aggregate shall meet the requirements for acid-soluble sulfate category $AS_{1,0}$ and the requirements specified in [4.3.2](#), [4.3.3](#), [4.3.4](#) and, where concrete resistance to XF3 and XF4 is required, [4.3.5](#);
- lightweight aggregates conforming to [BS EN 13055-1](#) and the requirements specified in [4.3.2](#), [4.3.3](#), [4.3.6.1](#) and, where concrete resistance to freeze-thaw exposure is required, [4.3.6.2](#); and
- reclaimed aggregate conforming to [BS EN 206:2013+A2:2021](#).

NOTE Suitability is not established for coarse recycled aggregate (RA), fine RA or fine crushed concrete aggregate (CCA). There are some requirements for coarse RA set out in 4.3.8 but these are not sufficient to form an adequate specification.

4.3.2 Coarse aggregate, upper and lower size

Where D_{upper} is specified, the concrete shall not have a D_{max} greater than D_{upper} .

Where D_{max} is specified then it shall be assumed D_{max} equals D_{upper} and that a D_{lower} has not been specified.

NOTE In practical terms this means that specifying D_{max} in accordance with a previous edition of this part of BS 8500 is the same as specifying D_{max} to this edition.

Where D_{lower} is specified, the concrete shall not have a D_{max} less than D_{lower} .

4.3.3 Drying shrinkage

The aggregate drying shrinkage shall be not more than 0.075% when determined in accordance with BS EN 12620, unless otherwise specified.

4.3.4 Resistance to fragmentation

Unless otherwise specified, the Los Angeles coefficient category, as classified in BS EN 12620, of the combined coarse aggregate and excluding lightweight aggregates shall be LA_{40} .

4.3.5 Freeze-thaw resisting normal-weight and heavy-weight aggregates

Where freeze-thaw resisting normal-weight or heavy-weight aggregates are specified for use in XF3 or XF4 exposure classes, the aggregate shall meet the requirements in BS EN 12620 for the magnesium sulfate soundness category in Table 2.

Porous flint aggregates shall be deemed to be suitable for use in concrete for XF3 and XF4 exposure classes if there is evidence that they have been used successfully in concrete that has been exposed to freeze-thaw conditions for at least 10 years.

Table 2 — Magnesium sulfate soundness category for freeze-thaw resisting normal-weight and heavy-weight aggregates

Exposure resistance class	BS EN 12620 magnesium sulfate soundness category
XF3	MS_{25}
XF4	MS_{18}

4.3.6 Lightweight aggregates

4.3.6.1 General

Lightweight aggregates specified in accordance with BS EN 13055-1 shall have the following information available:

- maximum aggregate size (D_{max});
- grading including tolerances; and
- target loose bulk density.

The acid-soluble sulfate content shall meet the requirements specified in BS EN 12620 for acid-soluble sulfate category $AS_{0,8}$.

For furnace bottom ash or clinker, the loss-on-ignition shall be not more than 10% when measured in accordance with BS EN 1744-1:2009+A1:2012.

For fine lightweight aggregate, the method of determining the water absorption shall be declared unless otherwise specified.

NOTE 1 There is no standard test method for the determination of the water absorption of fine lightweight aggregate. The [BS EN 1097-6](#) method is for particles sizes of not less than 4 mm. The technique adopted depends on the type of lightweight aggregate.

NOTE 2 Fly ash and furnace bottom ash (FBA) produced from coal-fired power generation are covered by the WRAP/EA Quality Protocol: Pulverised Fuel Ash (PFA) [1], which describes bound and grout applications in construction and manufacturing.

4.3.6.2 Freeze-thaw resisting lightweight aggregates

The suitability of freeze-thaw resisting lightweight aggregate concrete shall be established by a record of successful use of the lightweight aggregate. Records shall be retained for at least 10 years, in similar or worse environments, with concrete of the quality specified or lower than the quality required.

4.3.7 Coarse crushed concrete aggregate

Coarse CCA 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](#), except where permitted by footnotes.

Coarse crushed concrete aggregates (CCA) shall meet the requirements set out in [Table 4](#). These provisions shall apply to mixtures of crushed concrete and natural coarse aggregates.

When determining that the maximum chloride content of concrete containing CCA, the chloride content of coarse CCA and its variability shall be established and taken into account.

NOTE 1 There is no limit on the proportion of coarse CCA that may be used in the concrete specified in [Table 3](#). A maximum percentage by mass of coarse natural normal-weight aggregate that is replaced by coarse CCA may be specified. Further guidance can be found in [BS EN 206:2013+A2:2021](#), Table E.2 and National Highways, CD 374 [2].

NOTE 2 Clean fine CCA 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 finishes in the fine CCA. This gypsum plaster is known to increase the sulfate content, which in turn can increase the risk of delayed ettringite formation (see BRE Information Paper IP 11/01 [3]) and there are great difficulties in detecting localized high volumes of sulfate. In addition, there is no information on possible stockpile segregation. For these reasons, the use of fine CCA is left to the project specification, which can take account of the particular source of CCA.

Table 3 — Limitations on the use of coarse CCA

Type of aggregate	Limitations on use: Maximum strength class ^{A)}	Limitations on use: Exposure class ^{B)}
CCA	C40/50	X0, XC1, XC2, XC3, XC4, XD1, 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.