

BRITISH STANDARD

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

Part 1: Method of specifying and guidance for the specifier

ICS 91.100.30



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Foreword

Publishing information

This part of BS 8500 is published by BSI Standards Limited, under licence by 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BS 8500-1:2006+A1:2012 supersedes BS 8500-1:2006, which is withdrawn.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

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

- changes to reflect changed guidance in BRE Special Digest 1 [1];
- revised guidance on resisting chloride-induced corrosion;
- extended guidance on recommended concrete quality in long life structures;
- changes resulting from the withdrawal of British Standards;
- reducing the strength class of the FND designated concretes to C25/30;
- new guidance on the chloride class for post-tensioned prestressed concrete;
- changes resulting from new European standards published since 2003;
- simplification of the cement and combination designations;
- presentational changes to ease the use of this standard;
- corrections.

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

The start and finish of text introduced or altered by Corrigendum No. 1 is indicated in the text by tags **[C1]** and **[C1]**.

Amendment A1 introduces the following principal changes:

- updates to **3.1** and **A.8.1** have been carried out to account for BS 8500-2:2006+A1:2012, Annex D, regarding the updated application requirements for demonstrating that the risk of damaging alkali-silica reaction has been minimized. The updated requirements replace any earlier references to BRE Digest 330 [12] (wherein the historical basis for the rules can be found);
- subclauses **4.2** and **4.3**, and clauses **A.4**, **A.7** and **A.8** have been updated to reflect current guidance on pavement quality;
- all references have been updated; and
- the index has been updated.

Hazard warnings

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 British Standard 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 third-party certification has been approved by the Standards Policy Strategy Committee.

It is the constant aim of BSI to improve the quality of our standards and we welcome any comments or proposals for improvements.

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 specifier is offered five approaches to the specification of concrete.

a) *Designated concretes.*

For many common applications, the simplest approach is to specify a designated concrete. Designated concretes were developed to make the specification of designed concretes simpler, complete and more reliable. While they do not cover every application nor do they permit the use of every potential concreting material, they are suitable for a wide range of housing, structural and other construction applications.

An essential part of the designated concrete concept is the requirement for the producer to hold current $\overline{A_1}$ product conformity certification (see 3.1.17) $\overline{A_1}$ and therefore designated concretes are only applicable where third-party certification is selected as the option in specifying the concrete. Where the option selected is not to use a certified concrete, the method of designation/specification given in b), c) or d) below is used.

It is stressed that the reference to third-party certification does not make such a method of specification obligatory: it has been included with the support of industry bodies wishing to maintain the progress which has been achieved in quality levels as a result of such certification.

The environments to which the concrete is to be exposed are identified from A.2. Guidance on the selection of designated concrete is given in A.4 and the specification is drafted in accordance with 4.2.

$\overline{A_1}$ The inclusion of the requirement for third-party product conformity certification has been approved by the Standards Policy and Strategy Committee. $\overline{A_1}$

b) *Designed concretes.*

Designed concretes are suitable for almost all applications. They may be used as an alternative to designated concrete and should be used where the requirements are outside of those covered by designated concretes, e.g.:

- where special cements or combinations are required, e.g. low heat of hydration;
- where the concrete is to be exposed to one of the chloride (XD) or sea water (XS) exposure classes;
- where lightweight or heavyweight concrete is required;
- where a strength class is required other than those covered by designated concrete;
- where strength is a requirement for the concrete and $\overline{A_1}$ product conformity certification (3.1.17) $\overline{A_1}$ is not required.

$\overline{A_1}$ NOTE 1 Product conformity certification (see 3.1.17) is recommended for all concrete, including designed concrete, although it is not obligatory. $\overline{A_1}$

The environments to which the concrete is to be exposed are identified from **A.2**. Using the intended working life and the minimum cover to reinforcement, the limiting values of composition are determined for each of the identified exposure classes using the guidance in **A.4**. The requirements for the concrete are selected from this composite of limiting values plus structural and fire considerations, and the specification is then drafted in accordance with **4.3**.

c) *Prescribed concretes.*

This approach allows the specifier to prescribe the exact composition and constituents of the concrete. It is not permitted to include requirements on concrete strength, and so this option has only limited applicability.

Where a prescribed concrete is specified, the specifier is responsible for any initial testing to determine that the specified proportions will achieve the intended performance in the fresh and hardened states with an adequate margin (see BS EN 206-1:2000, **6.1**). According to BS EN 206-1, the specifier is also responsible for ensuring that the specified proportions do not result in damaging alkali-silica reaction (ASR), but see **A.8.1** for an alternative approach.

In general, it is better to specify using one of the performance options (designated or designed concrete), but there are a few situations where the prescribed concrete method of specification is appropriate. For example, with exposed aggregate finishes, uniformity of appearance is a key requirement. Having done trial mixes to confirm that the finished surface is as required and the mix satisfies the other required properties, e.g. strength, maximum w/c ratio, with an adequate margin, the concrete may then be specified as a prescribed concrete using the sources and proportions of constituent materials used in the approved trial mix.

The specification is drafted in accordance with **4.4**.

d) *Standardized prescribed concretes.*

Standardized prescribed concretes are applicable for housing and similar construction where concrete is site-batched on a small site or obtained from a ready-mixed concrete producer who does not have **EN** product conformity certification (**3.1.17**) **A1**. Guidance on the selection of standardized prescribed concrete is given in **A.4.5** and the specification is drafted in accordance with **4.5**.

Standardized prescribed concrete may be used as an alternative to the GEN series of designated concretes. As the concrete producer is unlikely to be known at the time of specification, the best approach in these situations is to specify a suitable designated concrete and the equivalent standardized prescribed concrete as alternatives.

e) *Proprietary concretes.*

This approach is appropriate where it is required that the concrete achieves a specific performance, using defined test methods. The proprietary concrete is selected in consultation with the concrete producer and the specification is drafted in accordance with 4.6.

NOTE 2 This method of specification might not be suitable for initial use in public procurement contracts if the specification, in effect, determines the concrete producer. BSI has not substantiated any claimed performance made for proprietary concrete by any producer.

The producer is not required to disclose full details of the mix constituents or composition to the specifier. Where the concrete is produced under [A1] product conformity certification (see 3.1.17) [A1], the producer is required to substantiate to their third-party certification body that their proprietary concrete satisfies any performance requirements and limiting values that are specified or declared. Where the concrete is not under [A1] product conformity certification (see 3.1.17) [A1], the producer is required to confirm that any performance requirements and limiting values that are specified or declared were satisfied and, on request, supply the relevant test data.

A performance approach to specifying self-compacting concrete is given in *The European Guidelines for self-compacting concrete – specification, production and use* [2]. This uses the proprietary method of specification and is written in a form that complements BS EN 206-1. In this case, the compressive strength class and limiting values are specified as if a designed concrete was being specified, but the properties of the fresh concrete are specified from the classes given in the *Guidelines*.

Within each approach to drafting the specification, there are a number of instances in which the specifier selects from the various options given in this part of BS 8500.

The Foreword to BS EN 206-1 sets out the context in which BS EN 206-1 operates in the context of European standards. As BS 8500 is the UK complementary standard to BS EN 206-1, the context in which BS 8500 operates is the same when BS 8500 is used within a suite of European standards. For a number of years, the European Standard design codes will co-exist with the current British Standard design codes. Using this standard with current British Standard design codes requires the designer to take account of:

- the different way of expressing strength, i.e. by strength class;
- the different ways of expressing workability, e.g. by consistence class;
- the different names for constituent materials;
- the different requirements or classes for constituent materials;
- the different format for specifying concrete;
- the new responsibilities of the concrete producer for conformity.

Guidance on using BS 8500 with BS 8110 is given in *How to use BS 8500 with BS 8110* [3].

An index is provided to aid the user of this standard.

1 Scope

This part of BS 8500 describes methods of specifying concrete and gives guidance for the specifier.

NOTE The guidance for the specifier is given in Annex A. This annex provides guidance on the concrete quality to specify for selected exposure classes, intended working life and nominal cover to normal reinforcement. It does not give guidance on stainless steel and non-metallic reinforcement. Guidance on nominal cover to reinforcement for structural and fire consideration is available in other publications, e.g. structural design codes of practice.

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 8500-2:2006+A1:2012, *Concrete – Complementary British Standard to BS EN 206-1 – Part 2: Specification for constituent materials and concrete*

BS EN 206-1:2000, including Amendment A1:September 2004 and Amendment A2:March 2006, *Concrete – Part 1: Specification, performance, production and conformity*

BS EN 12350-1, *Testing fresh concrete – Part 1: Sampling*

BS EN 12350-2, *Testing fresh concrete – Part 2: Slump test*

BS EN 12350-5, *Testing fresh concrete – Part 5: Flow table test*

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

BS EN 12350-7, *Testing fresh concrete – Part 7: Air content – Pressure methods*

BS EN 12390-7, *Testing hardened concrete – Part 7: Density of hardened concrete*

ASTM C173, *Standard test method for air content of freshly mixed concrete by the volumetric method* ¹⁾

¹⁾ Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA. Tel: +610 832 9585. Fax: +610 832 9555.
Website: <http://www.astm.org>.

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 and the following apply.

3.1.1 cement content

mass of cement contained in a cubic metre of fresh, fully compacted concrete, expressed in kilograms per cubic metre (kg/m^3)

NOTE Additions of Type II may be taken into account in respect of the cement content if the suitability is established (see BS EN 206-1:2000, 5.2.5.1 and BS 8500-2:2006+A1:2012, Table 1).

3.1.2 combination

restricted range of Portland cements and additions which, having been combined in the concrete 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 BS 8500-2:2006+A1:2012, Annex A.

3.1.3 compressive strength class

classification comprising the type of concrete (normal-weight or lightweight), the minimum characteristic 150 mm diameter by 300 mm cylinder strength and the minimum characteristic 150 mm cube strength

3.1.4 design chemical class (DC-class)

designation used to describe a concrete quality capable of resisting the selected aggressive chemical environment for the concrete, provided that any specified additional protective measures (APMs) are correctly applied to the structure

NOTE See A.4.4 and BRE Special Digest 1 [1].

3.1.5 Text removed

3.1.6 hydraulic gradient

difference in the hydrostatic head of water on opposite sides of a concrete element, in metres, divided by the section thickness, in metres

3.1.7 maximum aggregate size

largest aggregate size used in the concrete

NOTE The requirements for aggregate size in BS EN 12620 allow a small percentage to be retained on the upper sieve size.

3.1.8 minimum cover

depth of cover to reinforcement assumed for the purposes of durability design

3.1.9 nominal cover

depth of cover to reinforcement shown on the drawings comprising the minimum cover plus an allowance in design for deviation, Δc , to accommodate fixing precision

NOTE This allowance is typically in the range 5 mm to 15 mm for surfaces cast against formwork.

3.1.10 proprietary concrete

concrete for which the producer assures the performance subject to good practice in placing, compacting and curing and for which the producer is not required to declare the composition

3.1.11 recycled aggregate (RA)

aggregate resulting from the reprocessing of inorganic material previously used in construction

3.1.12 recycled concrete aggregate (RCA)

recycled aggregate principally comprising crushed concrete

☐_{A1} 3.1.13 alkali content of concrete

value calculated from the mix proportions and the determined alkali contents of each of the constituents and used for verifying that the alkali content of concrete does not exceed the specified limit ☐_{A1}

☐_{A1} 3.1.14 certified average alkali content

average of 25 consecutive determinations of alkali content carried out on spot samples and expressed as the sodium oxide equivalent (Na₂O eq.)

NOTE See BS 8500-2:2006+A1:2012, D.1. ☐_{A1}

☐_{A1} 3.1.15 declared mean alkali content

alkali content of cement or addition, expressed as the sodium oxide equivalent (Na₂O eq.), as declared by the cement or addition manufacturer

NOTE See BS 8500-2:2006+A1:2012, D.1. ☐_{A1}

☐_{A1} 3.1.16 guaranteed alkali limit

alkali limit, expressed as the sodium oxide equivalent (Na₂O eq.), which the constituent material supplier guarantees is not exceeded by any test result on any spot sample ☐_{A1}

☐_{A1} 3.1.17 product conformity certification

certification, based on product testing and surveillance, and approved 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. ☐_{A1}

☐_{A1} 3.1.18 sodium oxide equivalent (Na₂O eq)

alkali content, as a percentage, calculated as:

$$\%Na_2O \text{ eq} = \%Na_2O + 0.658\%K_2O \quad \text{☐}_{A1}$$

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 and the following apply.

NOTE 1 The abbreviations used to denote cement and combination types are given in Table A.6 and BS 8500-2:2006+A1:2012, Table 1.

ACEC	aggressive chemical environment for concrete (see Table A.2 for its determination)
APM	additional protective measure (see Table A.10 for the options)
BS EN	European Standard published by BSI containing a national foreword and, where appropriate, national annexes
BS EN ISO	International Standard that has been adopted as a European Standard published by BSI containing a national foreword and, where appropriate, national annexes
DC-(number)	design chemical class used to classify the resistance of concrete to chemical attack
DS-(number)	design sulfate class used to classify the sulfate or equivalent sulfate content of the site
FND(number of the DC-class)	designation used for a series of designated concretes that are used in foundation applications
GEN(number)	designation used for a series of designated concretes that are used for housing and similar applications
ggbs	ground granulated blastfurnace slag
PAV(number)	designation used for a series of designated concretes that are used in paving applications
RA	recycled aggregate
RCA	recycled concrete aggregate
RC(strength class)	designation used for a series of designated concretes that are used in reinforced and prestressed concrete applications
w/c	water/cement or combination
Δc	allowance in design for deviation of the cover to reinforcement
	<i>NOTE 2 This is the same as Δ_{cdev} used in BS EN 1992-1-1.</i>
$\Delta c_{dur, \gamma}$	additive safety element (for prestressing steel) given in the appropriate design code

4 Method of specifying

4.1 General

The specifier of the concrete shall ensure that all the relevant requirements for concrete properties are included in the specification given to the producer. The specification shall include any requirements for concrete properties that are needed for transportation after delivery, placing, compaction, curing or further treatment. The specification shall, if necessary, include any special requirements (e.g. for obtaining an architectural finish [4]).

The specifier shall take account of:

- the application of the fresh and hardened concrete;
- the method of placing;
- the method of compaction;
- the curing conditions;
- the dimensions of the element (the heat development);
- the environmental conditions to which the element is to be exposed;
- any requirements for exposed aggregate or tooled concrete finishes;
- any requirements related to the cover to reinforcement or minimum section width, e.g. maximum aggregate size;
- any further restrictions on the use of constituent materials with established suitability.

NOTE 1 Where types and classes of constituent materials and environmental conditions are not detailed in the specifications, the producer will select constituent materials for the specified requirements only (see BS 8500-2:2006+A1:2012, 4.1).

Concrete shall be specified either as:

- a) designated concrete conforming to BS 8500-2 (see 4.2); or
- b) designed concrete conforming to BS 8500-2 (see 4.3); or
- c) prescribed concrete conforming to BS 8500-2 (see 4.4); or
- d) standardized prescribed concrete conforming to BS 8500-2 (see 4.5); or
- e) proprietary concrete conforming to BS 8500-2 and a performance agreed between the specifier and the producer (see 4.6).

NOTE 2 Requirement for the concrete to conform to the appropriate clauses in BS 8500-2 invokes many general requirements for constituent materials, production and conformity and also requires the concrete to conform to the relevant requirements in BS EN 206-1 and the producer to comply with the relevant requirements in BS EN 206-1. Consequently conformity to BS 8500-2 includes conformity to BS EN 206-1.

When the specifier requires identity testing, this shall be carried out in accordance with:

- Annex B for slump, flow, air content and density of fresh concrete;
- Annex B for density of hardened concrete specimens;
- BS EN 206-1:2000, Annex B and **B.5** for compressive strength

4.2 Specification for designated concrete

4.2.1 General

The specification for designated concrete shall contain:

- a) the basic requirements given in 4.2.2;
- b) the additional requirements given in 4.2.3 where required.

NOTE 1 An appropriate designated concrete may be selected from the exposure class and intended working life given in Table A.3, Table A.8 and Table A.9. For housing and similar applications, an appropriate designated concrete may be selected by identifying from Table A.13 the application for which the concrete is to be used, or the application which most closely resembles it. Table A.14 may be used to check that the associated strength class is adequate for structural purposes.

For non-typical applications or to satisfy particular structural or other reasons, the designated concrete may be selected in accordance with the limiting values specified in BS 8500-2:2006+A1:2012, Clause 6.

NOTE 2 Identity testing by the specifier or user is not necessary for designated concrete, as the producer is required to hold current [A1] product conformity certification (3.1.17) [A1] and the certification body will audit the producer's conformity control. Nevertheless identity testing is not precluded.

NOTE 3 Where the producer is required to inform the specifier and user of a non-conformity (see BS EN 206-1:2000, 8.4), the [C1] product conformity certification (3.1.17) [C1] body will check that this action has been taken.

4.2.2 Basic requirements

The specification for designated concrete shall contain:

- a) a requirement to conform to BS 8500-2 (see Note 1);
- b) an appropriate concrete designation (see Note 2);
- c) the maximum aggregate size when other than 20 mm;
- [A1] d) the class of consistence when other than S3 for the GEN, FND and RC series, S3 for PAV2 or S2 for PAV1 [see Note 3 and Table A.13, footnote F)]. [A1]

NOTE 1 The specification of the designated concrete by its designation, e.g. GEN3, is an instruction to the producer to conform to BS 8500-2, as appropriate.

NOTE 2 GEN concrete with relatively low cement or combination content might not be suitable for obtaining satisfactory cast and direct finished surfaces, nor for methods of placing, such as pumping. The suitability of such concrete should be discussed with the producer.

NOTE 3 The consistence class should be selected by the user of the concrete and passed to the specifier.

4.2.3 Additional requirements

In addition to the basic requirements (4.2.2), the specification for designated concrete shall contain any of the following additional requirements and provisions that are deemed to be necessary:

- [A1] a) any restriction or relaxation on the permitted range of cement and combination types (see Note 1); [A1]
- b) any special requirements for the aggregates;

- c) where RC20/25 to RC40/50 is specified, permission to use RA or RCA at more than a mass fraction of 20% of coarse aggregate or the exclusion of these aggregates from the specification;
- d) accelerated or retarded set;
- e) colour;
- f) generic type and dosage of fibres where required;
- g) any requirement for a different chloride class, i.e. where the following classes are not appropriate:
 - Cl 1,0 for the GEN series of designated concrete;
 - Cl 0,40 for other designated concretes for all cements and combinations except SRPC;
 - Cl 0,20 for SRPC;
- h) any requirement for higher minimum air content, e.g. to allow for the effects of pumping (see Note 2).

NOTE 1 All the cement and combination types given in BS 8500-2:200+A1:2012, Table 5 have the potential to provide adequate durability if the appropriate designated concrete is specified and the concrete is transported, placed, compacted and cured correctly. However, in a few instances there might be an advantage in selecting a particular type of permitted cement or combination, e.g. in massive sections to control heat development; in hot or cold weather (see A.9). [A1] For some designated concretes, cement and combination types IVB-V, and IIIA with [C1] 56% [C1] to 65% ggbs, are subject to specific permission being given in the product specification. [A1]

NOTE 2 The minimum air content given in BS 8500-2:2006+A1:2012, Table 5 is based on the assumption that differences in the air content between the point of delivery and the point of placing are small. [A1] Where the distance between the point of discharge and the point of placing is large or if the concrete is being pumped, it might be necessary to undertake site trials to verify that the required minimum air content can be achieved at the point of placing and, where necessary, the minimum air content at the point of delivery should be specified accordingly. [A1]

4.3 Specification for designed concrete

4.3.1 General

NOTE 1 Guidance on the specification of designed concrete to resist identified exposure classes is given in A.4.

The specification for designed concrete shall contain:

- a) the basic requirements given in 4.3.2;
- b) the additional requirements given in 4.3.3 where required.

NOTE 2 For abbreviations to be used in specifications, see 3.2 and BS EN 206-1:2000, Clause 11.

4.3.2 Basic requirements

The specification for designed concrete shall contain (see Note 1 and Note 2):

- a) a requirement to conform to BS 8500-2;
- b) the compressive strength class;
- c) the limiting values of composition, e.g. maximum w/c ratio, minimum cement content or the DC-class where appropriate;

- d) where the DC-class has not been specified, the permitted cements and combinations (see Note 3);
- e) the maximum aggregate size where a value other than 20 mm is required;
- f) the chloride class where a class other than Cl 0,40 is required;
- g) for lightweight concrete, the density class or target density;
- h) for heavyweight concrete, the target density;
- i) the class of consistence or, in special cases, a target value for consistence.

NOTE 1 BS EN 206-1 requires the exposure class or classes to be specified as a description for a set of concrete requirements given in national provisions. This part of BS 8500 requires the specification of designed concrete to contain limiting values or the DC-class, for the following reasons.

- *Specification by exposure class is not appropriate where trade-off between cover to reinforcement and concrete quality is applied.*
- *Specification by exposure class is not suitable where the intended working life is other than “at least 50 years”, e.g. at least 100 years.*
- *Where there are multiple exposure classes, there can be a range of suitable concretes, e.g. one with air-entrainment and one without, and it is the specifier's responsibility to select from these options.*
- *In chemically aggressive environments, the determination of the exposure class (ACEC-class) is only the first step in determining the concrete specification.*

NOTE 2 Consideration should be given to specifying a requirement for the producer to  hold product conformity certification (3.1.17). 

NOTE 3 The specifier may choose one or more groups using the broad designations given in Table A.6, select specific cement and combination types from BS 8500-2:2006+A1:2012, Table 1 or choose other cement and combination types not listed in these tables, e.g. Portland-composite cements, composite cements, Portland cement with two or more additions, cement or combinations with low heat of hydration. With designed concrete it is not normally necessary to specify the cement strength class, but where this is needed, it may be specified. Where the specification for a designed concrete does not state the cement and combination types to be used, the producer is required to select from those listed in BS 8500-2:2006+A1:2012, Table 1.

4.3.3 Additional requirements

In addition to the basic requirements (4.3.2), the specification for designed concrete shall contain any of the following additional requirements and provisions that are deemed to be necessary, specifying performance requirements and test methods as appropriate:

- a) special types or classes of aggregate, e.g. for wear resistance or freeze-thaw resistance (see Note 1);
- b) where the use of coarse RA is deemed acceptable, a statement that coarse RA is permitted and a requirement for the RA to conform to BS 8500-2:2006+A1:2012, 4.3, and at least the following additional requirements specific to the type of RA:
 - 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, e.g. compressive strength classes, exposure classes;
- c) restrictions on the use of certain aggregates;
- d) generic type and dosage of fibres;
- e) characteristics required to resist freeze-thaw attack, e.g. air content (see Note 2);
- f) requirements for the temperature of the fresh concrete, where different from the lower limit in BS EN 206-1:2000, **5.2.8** or the upper limit in BS 8500-2:2006+A1:2012, **5.4**.
- g) strength development;
- h) heat development during hydration;
- i) retarded stiffening;
- j) resistance to water penetration;
- k) resistance to abrasion;
- l) tensile splitting strength;
- m) other technical requirements, e.g. requirements related to the achievement of a particular finish or special method of placing;
- n) any “concerning effects” (see BS EN 206-1:2000, Note to **A.4**), together with the tests to be applied and the acceptability criteria.

NOTE 1 In these cases, BS EN 206-1:2000, 6.2.3 suggests that concrete composition to minimize damaging alkali–silica reaction is the responsibility of the specifier. However, BS 8500-2:2006+A1:2012, 5.2 requires the producer to take appropriate action in these cases (see A.8.1 for explanation).

NOTE 2  The minimum air content given in Table A.8 is based on the assumption that differences in air content between the point of delivery and the point of placing are small. Where the distance between the point of discharge and the point of placing is large or if the concrete is being pumped, it might be necessary to undertake site trials to verify that the required minimum air content can be achieved at the point of placing and where necessary the minimum air content at the point of delivery should be specified accordingly. 

4.4 Specification for prescribed concrete

4.4.1 General

The specifier shall record the data linking the specified proportions to the intended performance.

Where necessary, these data shall be obtained by initial testing (see BS EN 206-1:2000, **6.1**).

The specification shall contain proportions such that the risk of damaging alkali–silica reaction is minimized or a requirement for the producer to minimize the risk of damaging alkali–silica reaction (see **A.8.1**).

The specification for prescribed concrete shall contain:

- a) the basic requirements given in **4.4.2**;
- b) the additional requirements given in **4.4.3** where required.

4.4.2 Basic requirements

The specification for prescribed concrete shall contain (see Note 1 and Note 2):

- a) a requirement to conform to BS 8500-2;
- b) the cement or combination type and standard strength class;
- c) the cement or combination content;
- d) the class of consistence or, in special cases, a target consistence;
- e) the type and categories of the aggregate;
- f) the maximum aggregate size and any limitations for grading;
- g) in the case of lightweight or heavyweight concrete, the target density of the concrete or the maximum or minimum density of aggregate as appropriate;
- h) the chloride class for the concrete or the maximum chloride content of the aggregate;
- i) the type and quantity of admixture or addition, if any;
- j) for characteristics that cannot be defined by other means, the sources of the constituents (see Note 3).

NOTE 1 Consideration should be given to specifying a requirement for the producer to $\langle A_1 \rangle$ hold product conformity certification (3.1.17). $\langle A_1 \rangle$

NOTE 2 The content of constituent materials should be given in terms of kilograms per cubic metre (kg/m^3). The use of nominal proportions, e.g. 1:2:4, is deprecated. Annex C gives guidance on the cement contents to expect where nominal proportions have been used.

NOTE 3 Generally only the generic types of constituent material need be specified.

4.4.3 Additional requirements

In addition to the basic requirements (4.4.2), the specification for prescribed concrete shall contain any of the following additional requirements and provisions that are deemed to be necessary:

- a) a requirement to conform to BS 8500-2:2006+A1:2012, 5.2.
- b) the sources of some, or all, concrete constituents;
- c) additional requirements for aggregates, e.g. proportion of fine aggregate;
- d) requirements for the temperature of the fresh concrete where different from the lower limit in BS EN 206-1:2000, 5.2.8 or the upper limit in BS 8500-2:2006+A1:2012, 5.4.
- e) the target w/c ratio (see Note);
- f) other technical requirements.

NOTE The specified value of the (target) w/c ratio should be 0.02 less than any required maximum value.

4.5 Specification for standardized prescribed concrete

4.5.1 General

The specification for standardized prescribed concrete shall contain:

- a) the basic requirements given in **4.5.2**;
- b) the additional requirements given in **4.5.3** where required.

*NOTE 1 The concrete may be selected using the guidance in **A.4.5**.*

The materials and the mix proportions given in BS 8500-2:2006+A1:2012, Clause **9** shall be examined to determine whether restriction of the specification is necessary.

NOTE 2 The assessment of the concrete proportions by the concrete producer forms an essential part of the conformity requirements.

NOTE 3 Equivalent designated concretes should be specified as an alternative or accepted if offered by the producer. Guidance on the specification of designated concretes equivalent to standardized prescribed concretes is given in Table A.13.

4.5.2 Basic requirements

The specification for standardized prescribed concrete shall contain:

- a) a requirement to conform to BS 8500-2;
- b) the description of the standardized prescribed concrete required, e.g. ST2;
- c) the maximum aggregate size;
- d) the slump class.

4.5.3 Additional requirements

In addition to the basic requirements (**4.5.2**), the specification for standardized prescribed concrete shall contain any of the following additional requirements and provisions that are deemed to be necessary:

- a) any restrictions on the types of cements or combinations permitted in BS 8500-2:2006+A1:2012, **9.2**;
- b) any restrictions on the types of aggregates permitted in BS 8500-2:2006+A1:2012, **9.2**.

4.6 Specification for proprietary concrete

4.6.1 General

The specification for proprietary concrete shall contain:

- a) the basic requirements given in **4.6.2**;
- b) the additional requirements given in **4.6.3** where required.

*NOTE For specifying self-compacting concrete, see **A.5**.*