BS 8500-1:2023

BSI Standards Publication

Concrete – Complementary British Standard to BS EN 206

Part 1: Method of specifying and guidance for the specifier

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Summary of pages
This document comprises a front cover, an inside front cover, pages I to VI, pages 1 to 69, an inside back cover and a back cover.

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This part of BS 8500 supersedes BS 8500-1:2015+A2:2019, which is withdrawn.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 the following 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 8500-1 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 introduction of the combined performance category for cements and combinations, which categorizes these by their resistance to sulfate attack and chloride ingress;
- the removal of minimum cement content and water/cement ratio as limiting values for resistance to corrosion of reinforcement due to carbonation;
- the removal of strength as a limiting value for resistance to corrosion of reinforcement due to chloride ingress;
- a revision of Table A.6 to allow easier specification of the increased number of cements and combinations for durability;
- improved guidance on identity testing;
- the identity testing strength criteria for lower strength concrete to align with BS EN 13791;
- improved guidance on consistence retention;
- guidance on digital monitoring and measurement;
- indicative strengths from cements and combinations;
- corrections and minor clarifications; and
- all references have been updated.

The changes are predominantly concerned with the increased range of cementitious materials, their durability and categorization. The 2021 edition of BS EN 197-5 introduced multi-component cements

with a lower proportion of clinker than that allowable by BS EN 197-1. Concretes containing varying proportions of Portland cement clinker, ggbs and limestone fines; and Portland cement clinker, pfa and limestone fines were tested for carbonation, chloride ingress, resistance to sulfate attack, ASR, dimensional stability and freeze/thaw. The results were compared to reference CEM I, CEM II/B-V and CEM III/A concretes and the performance of the cements or combinations associated with the tested proportions categorized accordingly.

The introduction of combined performance categories which group cements and their equivalent combinations by resistance to sulfate attack and by chloride migration coefficient allows easier comparison between familiar cements and those introduced in this part of BS 8500 when specifying concrete. This concept also gives a route for the acceptance of new cements and combinations that are not currently included and means that their introduction can be through a relatively simple amendment to the standard and not a full revision.

It has been accepted that the compressive strength of concrete is not a limiting factor for the durability of reinforced concrete when exposed to chlorides, and so the recommended strength class has been removed for concrete in XD and XS exposure conditions. As these strength classes were being used by specifiers as a guide to the strength that might be expected from a minimum cement content or water/cement ratio, new guidance has been provided.

It is acknowledged that for a particular cement or combination, the factor that controls the rate of carbonation is water/cement ratio. This is problematic when trying to set limiting values for a wide range of cements and combinations. It was noted and agreed that compressive strength is a good proxy for resistance to carbonation and so strength for all cements and combinations is the only limiting value for resistance to corrosion through carbonation so simplifying specification.

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 can 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 third-party certification has been approved by the Standards Policy and Strategy Committee.

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

There are five approaches to the specification of concrete. 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 sets out the context in which BS EN 206 operates in the context of European Standards. As BS 8500 is the UK complementary Standard to BS EN 206, the context in which BS 8500 operates is the same when BS 8500 is used within a suite of European Standards.

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 an appropriate level of product conformity certification. Although it is not usual practice for a British Standard to state that a legitimate claim of compliance is dependent on third-party conformity assessment, it is recognized that there is an identified market need for third-party conformity assessment of concrete. This is particularly true for construction works such as housing and building, where the user might not have any expertise in concrete specification and prefers to order on the basis of its application rather than specifying limiting values or prescribing composition. Where designated concrete is specified, it is on an elected basis, and having elected to specify a designated concrete then all its requirements, including those for third-party product conformity certification, are expected to be met. The inclusion of the requirement for third-party product conformity certification in this manner has been approved by the BSI Standards Policy and Strategy Committee.

Where designated concrete is not the approach selected, the method of specification given in b), c), d) or e) 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** onwards. Guidance on the selection of designated concrete is given in **A.4** and the specification is drafted in accordance with **4.2**.

b) *Designed concretes*

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

- 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 heavy-weight concrete is required;
- where a strength class is required other than those covered by designated concrete; and

- where strength is a requirement for the concrete and product conformity certification is not required.

NOTE Product conformity certification is recommended for all concrete, including designed concrete, although it is not obligatory.

The environments to which the concrete is to be exposed are identified in 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 approach has only limited applicability.

Where a prescribed concrete is specified, the specifier is responsible for any initial testing to determine that the proportions achieve the intended performance in the fresh and hardened states with an adequate margin. According to BS EN 206:2013+A2:2021, the specifier is also responsible for ensuring that the 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 approaches (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 completed 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 can 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 concrete*

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 product conformity certification. Guidance on the selection of standardized prescribed concrete is given in A.4.7 and the specification is drafted in accordance with 4.5.

Standardized prescribed concrete can 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 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 product conformity certification, 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 product conformity certification, 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.

1 Scope

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

Annex A of this part of BS 8500 provides guidance on the concrete quality to be specified for selected exposure classes, intended working life and nominal cover to reinforcing steel. It does not give guidance on the use of 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.

NOTE To avoid any confusion between "steel" and "stainless steel" with respect to concrete cover and the risk of corrosion to reinforcement, the term "carbon reinforcing steel" is used in this document.

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 document[1]. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ASTM C173, *Standard test method for air content of freshly mixed concrete by the volumetric method*[2]

BS 8500-2:2023, *Concrete – Complementary British Standard to BS EN 206 – Part 2: Specification for constituent materials and concrete*

BS EN 206:2013+A2:2021, *Concrete – Specification, performance, production and conformity*

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

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 12350-8, *Testing fresh concrete – Part 8: Self-compacting concrete – Slump-flow test*

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

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 the following apply.

[1] Documents that are referred to solely in an informative manner are listed in the Bibliography.
[2] Available from ASTM, www.astm.org.