

**SINGAPORE STANDARD****Concrete – Specification, performance,  
production and conformity**

(This national standard is the identical implementation of EN 206 : 2013 and is adopted with permission of CEN, Avenue Marnix 17, 1000 Brussels)



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SINGAPORE STANDARD

**Concrete – Specification, performance, production  
and conformity**

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## National Foreword

This Singapore Standard was prepared by the Technical Committee on Building Structure and Sub-structure under the direction of the Building and Construction Standards Committee.

This standard is a revision of SS EN 206-1:2009. It is an identical adoption of EN 206:2013 'Concrete – Specification, performance, production and conformity' and is adopted with the permission of CEN, Avenue Marnix 17, 1000 Brussels.

Attention is drawn to the following:

1. Where appropriate, the words 'European Standard' should be read as 'Singapore Standard'
2. The reference to the following European Standards shall be replaced by Singapore Standards as follows:

European Standard	Corresponding Singapore Standard
EN 197-1	SS EN 197-1
EN 934-1	SS EN 934-1
EN 934-2	SS EN 934-2
EN 1992-1-1	SS EN 1992-1-1
EN 12620	SS EN 12620
EN 13670	SS EN 13670
EN 15167-1	SS EN 15167-1

3. The comma has been used throughout as a decimal marker whereas in Singapore Standards it is a practice to use a full point on the baseline as the decimal marker.

The main changes in the revision of this standard are:

- (a) Adding application rules for fibre concrete and concrete with recycled aggregates;
- (b) Revising k-value concept for fly ash and silica fume and adding new rules for ground granulated blast furnace slag;
- (c) Introducing principles for the performance concepts for the use of additions, e.g. equivalent concrete performance concept and equivalent performance of combinations concept;
- (d) Revising and adding new concepts for the conformity assessment;
- (e) Including EN 206-9 "Additional rules for self-compacting concrete (SCC);
- (f) Including additional requirements for concrete for special geotechnical works (Annex D).

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Attention is drawn to the possibility that some of the elements of this Singapore Standard may be the subject of patent rights. Enterprise Singapore shall not be held responsible for identifying any or all of such patent rights.

### NOTE

1. *Singapore Standards (SSs) and Technical References (TRs) are reviewed periodically to keep abreast of technical changes, technological developments and industry practices. The changes are documented through the issue of either amendments or revisions.*
2. *An SS or TR is voluntary in nature except when it is made mandatory by a regulatory authority. It can also be cited in contracts making its application a business necessity. Users are advised to assess and determine whether the SS or TR is suitable for their intended use or purpose. If required, they should refer to the relevant professionals or experts for advice on the use of the document. Enterprise Singapore shall not be liable for any damages whether directly or indirectly suffered by anyone or any organisation as a result of the use of any SS or TR.*
3. *Compliance with a SS or TR does not exempt users from any legal obligations.*

English Version

## Concrete - Specification, performance, production and conformity

Béton - Spécification, performances, production et conformité

Beton - Festlegung, Eigenschaften, Herstellung und Konformität

This European Standard was approved by CEN on 28 September 2013.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



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EUROPÄISCHES KOMITEE FÜR NORMUNG

**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

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## Foreword

This document (EN 206:2013) has been prepared by Technical Committee CEN/TC 104 “Concrete and related products”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2014 and conflicting national standards shall be withdrawn at the latest by June 2014.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

Based on a CEN/BT Decision (DECISION BT 42/2013) EN 12620:2013 was withdrawn. Therefore, this document has been aligned with the specifications given in EN 12620:2002+A1:2008. As soon as CEN/TC 154 publishes a new version of EN 12620, CEN/TC 104 intends to amend EN 206.

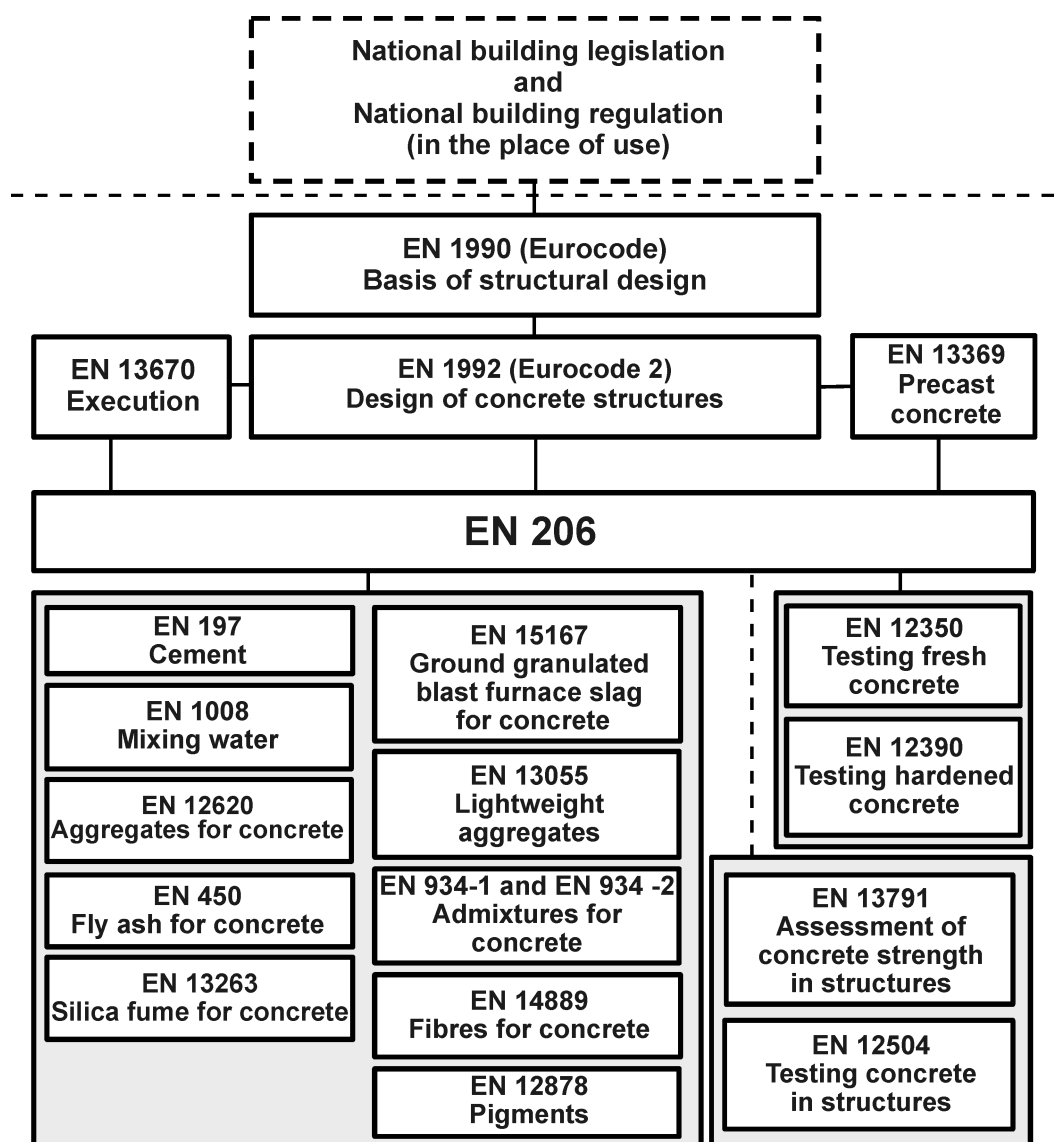
This document supersedes EN 206-1:2000 and EN 206-9:2010.

In particular, the following main items were subject to revision when preparing this European Standard:

- a) adding application rules for fibre concrete and concrete with recycled aggregates;
- b) revising  $k$ -value concept for fly ash and silica fume and adding new rules for ground granulated blast furnace slag;
- c) introduction of principles for the performance concepts for the use of additions, e.g. equivalent concrete performance concept and equivalent performance of combinations concept;
- d) revising and adding new concepts for the conformity assessment;
- e) including EN 206-9 “Additional rules for self-compacting concrete (SCC)”;
- f) including additional requirements for concrete for special geotechnical works (Annex D).

NOTE Annex D was jointly prepared by CEN/TC 104 and CEN/TC 288.

Figure 1 illustrates the relationships between EN 206 and standards for design and execution, standards for constituents and test standards.



**Figure 1 — Relationships between EN 206 and standards for design and execution, standards for constituents and test standards**

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## Introduction

This European Standard will be applied under different climatic and geographical conditions, different levels of protection and under different, well established, regional traditions and experience. Classes for concrete properties have been introduced to cover these situations. Where such general solutions were not possible, the relevant clauses contain permission for the application of provisions valid in the place of use of the concrete.

This European Standard incorporates rules for the use of constituents that are covered by European Standards. Constituents not covered by European Standards may be used in accordance with provisions valid in the place of use of the concrete.

If the concrete is in conformity with the limiting values, the concrete in the structure is deemed to satisfy the durability requirements for the intended use in the specific environmental condition, provided:

- the appropriate exposure classes were selected;
- the concrete has the minimum cover to reinforcement in accordance with the relevant design standard required for the specific environmental condition, e.g. EN 1992-1-1;
- the concrete is properly placed, compacted and cured, e.g. in accordance with EN 13670 or other relevant standards;
- the appropriate maintenance is applied during the working life.

Performance based concepts as alternatives to the concept of limiting values are under development.

Concrete conforming to this European Standard may be assumed to satisfy the basic requirements for materials to be used in all three Execution Classes as defined in EN 13670.

This European Standard defines tasks for the specifier, producer and user. For example, the specifier is responsible for the specification of concrete, Clause 6, and the producer is responsible for conformity and production control, Clauses 8 and 9. The user is responsible for placing the concrete in the structure. In practice there may be several different parties specifying requirements at various stages of the design and construction process, e.g. the client, the designer, the contractor, the concreting sub-contractor. Each is responsible for passing the specified requirements, together with any additional requirements, to the next party in the chain until they reach the producer. In the terms of this European Standard, this final compilation is known as the “specification of concrete”. Conversely, the specifier, producer and user may be the same party (e.g. a precast concrete manufacturer or a contractor doing design and build). In the case of ready-mixed concrete, the purchaser of the fresh concrete is the specifier who gives the specification of concrete to the producer.

This European Standard also covers the necessary exchange of information between the different parties. Contractual matters are not addressed. Where responsibilities are given for parties involved, these are technical responsibilities.

Notes and footnotes in tables of this standard are normative unless stated otherwise; other notes and footnotes are informative.

Further explanations and guidance on the application of this standard are given in other documents, such as CEN Technical Reports.

## 1 Scope

(1) This European Standard applies to concrete for structures cast in situ, precast structures, and structural precast products for buildings and civil engineering structures.

(2) The concrete under this European Standard can be:

- normal-weight, heavy-weight and light-weight;
- mixed on site, ready-mixed or produced in a plant for precast concrete products;
- compacted or self-compacting to retain no appreciable amount of entrapped air other than entrained air.

(3) This standard specifies requirements for:

- the constituents of concrete;
- the properties of fresh and hardened concrete and their verification;
- the limitations for concrete composition;
- the specification of concrete;
- the delivery of fresh concrete;
- the production control procedures;
- the conformity criteria and evaluation of conformity.

(4) Other European Standards for specific products e.g. precast products or for processes within the field of the scope of this standard may require or permit deviations.

(5) Additional or different requirements may be given for specific applications in other European Standards, for example:

- concrete to be used in roads and other trafficked areas (e.g. concrete pavements according to EN 13877-1);
- special technologies (e.g. sprayed concrete according to EN 14487).

(6) Supplementing requirements or different testing procedures may be specified for specific types of concrete and applications, for example:

- concrete for massive structures (e.g. dams);
- dry mixed concrete;
- concrete with a  $D_{\max}$  of 4 mm or less (mortar);
- self-compacting concretes (SCC) containing lightweight or heavy-weight aggregates or fibres;
- concrete with open structure (e. g. pervious concrete for drainage).

(7) This standard does not apply to:

- aerated concrete;
- foamed concrete;
- concrete with density less than 800 kg/m<sup>3</sup>;
- refractory concrete.

(8) This standard does not cover health and safety requirements for the protection of workers during production and delivery of concrete.

## **2 Normative references**

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

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

EN 934-1:2008, *Admixtures for concrete, mortar and grout — Part 1: Common requirements*

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

EN 1008, *Mixing water for concrete — Specification for sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete*

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

EN 1097-6:2013, *Tests for mechanical and physical properties of aggregates — Part 6: Determination of particle density and water absorption*

EN 1536, *Execution of special geotechnical work — Bored piles*

EN 1538, *Execution of special geotechnical work — Diaphragm walls*

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

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

EN 12350-4, *Testing fresh concrete — Part 4: Degree of compactability*

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

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

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

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

EN 12350-9, *Testing fresh concrete — Part 9: Self-compacting concrete — V-funnel test*

- EN 12350-10, *Testing fresh concrete — Part 10: Self-compacting concrete — L box test*
- EN 12350-11, *Testing fresh concrete — Part 11: Self-compacting concrete — Sieve segregation test*
- EN 12350-12, *Testing fresh concrete — Part 12: Self-compacting concrete — J-ring test*
- EN 12390-1, *Testing hardened concrete — Part 1: Shape, dimensions and other requirements for specimens and moulds*
- EN 12390-2, *Testing hardened concrete — Part 2: Making and curing specimens for strength tests*
- EN 12390-3, *Testing hardened concrete — Part 3: Compressive strength of test specimens*
- EN 12390-6, *Testing hardened concrete — Part 6: Tensile splitting strength of test specimens*
- EN 12390-7, *Testing hardened concrete — Part 7: Density of hardened concrete*
- EN 12620:2002+A1:2008, *Aggregates for concrete*
- EN 12699, *Execution of special geotechnical work — Displacement piles*
- EN 12878, *Pigments for the colouring of building materials based on cement and/or lime — Specifications and methods of test*
- prEN 13055, *Lightweight aggregates for concrete, mortar, grout, bituminous mixtures, surface treatments and for unbound and bound applications*
- EN 13263-1, *Silica fume for concrete — Part 1: Definitions, requirements and conformity criteria*
- EN 13577, *Chemical attack on concrete — Determination of aggressive carbon dioxide content in water*
- EN 14199, *Execution of special geotechnical works — Micropiles*
- EN 14216, *Cement — Composition, specifications and conformity criteria for very low heat special cements*
- EN 14488-7, *Testing sprayed concrete — Part 7: Fibre content of fibre reinforced concrete*
- EN 14721, *Test method for metallic fibre concrete — Measuring the fibre content in fresh and hardened concrete*
- EN 14889-1:2006, *Fibres for concrete — Part 1: Steel fibres – Definitions, specifications and conformity*
- EN 14889-2:2006, *Fibres for concrete — Part 2: Polymer fibres – Definitions, specifications and conformity*
- EN 15167-1, *Ground granulated blast furnace slag for use in concrete, mortar and grout — Part 1: Definitions, specifications and conformity criteria*
- prEN 16502, *Test method for the determination of the degree of soil acidity according to Baumann-Gully*
- EN ISO 7980, *Water quality — Determination of calcium and magnesium — Atomic absorption spectrometric method (ISO 7980)*
- ISO 4316, *Surface active agents — Determination of pH of aqueous solutions — Potentiometric method*
- ISO 7150-1, *Water quality — Determination of ammonium — Part 1: Manual spectrometric method*