

SINGAPORE STANDARD

Eurocode 1 : Actions on structures

– Part 1-1 : General actions – Densities, self-weight,
imposed loads for buildings

(This national standard is the identical implementation of EN 1991-1-1 : 2002 and is adopted with permission of CEN, Avenue Marnix 17, 1000 Brussels)

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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 SS EN is the identical implementation of EN 1991-1-1 : 2002 'Eurocode 1: Actions on structures – Part 1-1 : General actions – Densities, self-weight, imposed loads for buildings'.

Attention is drawn to the following:

- 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 Singapore Standards which implement international or European publications referred to in this document may be found in the SS Electronic Catalogue at:
<http://www.singaporestandardseshop.sg>

The EN gives values with notes indicating where national choices may be made. Where a normative part of the EN allows for national choice to be made, the range and possible choice will be given in the normative text, and a note will qualify it as a Nationally Determined Parameter (NDP). NDPs can be a specific value for a factor, a specific level or class, a particular method or a particular application rule if several are proposed in the EN.

The requirements of this SS EN 1991-1-1 : 2008 are to be read in conjunction with the Singapore National Annex (NA) to SS EN 1991-1-1 : 2008 which contains information on the Singapore Nationally Determined Parameters and is published separately.

National choice is allowed in EN 1991-1-1 through the following clauses:

- 2.2(3),
- 5.2.3(1) to 5.2.3(5),
- 6.3.1.1 (Table 6.1),
- 6.3.1.2(1)P (Table 6.2),
- 6.3.1.2(10) & (11),
- 6.3.2.2 (1)P (Table 6.4),
- 6.3.2.2 (3),
- 6.3.3.2(1) (Table 6.8),
- 6.3.4.2 (Table 6.10) and
- 6.4 (1)(P) (Table 6.12)

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

At the time of publication, this standard is expected to be used as a reference in the Building and Construction Authority's 'Approved Document – Acceptable Solutions'.

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

**Eurocode 1: Actions on structures - Part 1-1: General actions -
Densities, self-weight, imposed loads for buildings**

Eurocode 1: Actions sur les structures - Partie 1-1: Actions
générales - Poids volumiques, poids propres, charges
d'exploitation bâtiments

Eurocode 1: Einwirkungen auf Tragwerke - Teil 1-1:
Wichten, Eigengewicht und Nutzlasten im Hochbau

This European Standard was approved by CEN on 30 November 2001.

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 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 Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



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Foreword

This document (EN 1991-1-1:2002) has been prepared by Technical Committee CEN/TC 250 "Structural Eurocodes", the secretariat of which is held by BSI.

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 October 2002, and conflicting national standards shall be withdrawn at the latest by March 2010.

CEN/TC 250 is responsible for all Structural Eurocodes.

This document supersedes ENV 1991-2-1:1995.

The annexes A and B are informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Background of the Eurocode programme

In 1975, the Commission of the European Community decided on an action programme in the field of construction, based on article 95 of the Treaty. The objective of the programme was the elimination of technical obstacles to trade and the harmonisation of technical specifications.

Within this action programme, the Commission took the initiative to establish a set of harmonised technical rules for the design of construction works which, in a first stage, would serve as an alternative to the national rules in force in the Member States and, ultimately, would replace them.

For fifteen years, the Commission, with the help of a Steering Committee with Representatives of Member States, conducted the development of the Eurocodes programme, which led to the first generation of European codes in the 1980s.

In 1989, the Commission and the Member States of the EU and EFTA decided, on the basis of an agreement¹ between the Commission and CEN, to transfer the preparation and the publication of the Eurocodes to CEN through a series of Mandates, in order to provide them with a future status of European Standard (EN). This links *de facto* the Eurocodes with the provisions of all the Council's Directives and/or Commission's Decisions dealing with European standards (e.g. the Council Directive 89/106/EEC on

¹ Agreement between the Commission of the European Communities and the European Committee for Standardisation (CEN) concerning the work on EUROCODES for the design of building and civil engineering works (BC/CEN/03/89).

construction products - CPD - and Council Directives 93/37/EEC, 92/50/EEC and 89/440/EEC on public works and services and equivalent EFTA Directives initiated in pursuit of setting up the internal market).

The Structural Eurocode programme comprises the following standards generally consisting of a number of Parts:

EN 1990	Eurocode :	Basis of Structural Design
EN 1991	Eurocode 1:	Actions on structures
EN 1992	Eurocode 2:	Design of concrete structures
EN 1993	Eurocode 3:	Design of steel structures
EN 1994	Eurocode 4:	Design of composite steel and concrete structures
EN 1995	Eurocode 5:	Design of timber structures
EN 1996	Eurocode 6:	Design of masonry structures
EN 1997	Eurocode 7:	Geotechnical design
EN 1998	Eurocode 8:	Design of structures for earthquake resistance
EN 1999	Eurocode 9:	Design of aluminium structures

Eurocode standards recognise the responsibility of regulatory authorities in each Member State and have safeguarded their right to determine values related to regulatory safety matters at national level where these continue to vary from State to State.

Status and field of application of Eurocodes

The Member States of the EU and EFTA recognise that Eurocodes serve as reference documents for the following purposes:

- as a means to prove compliance of building and civil engineering works with the essential requirements of Council Directive 89/106/EEC, particularly Essential Requirement N°1 – Mechanical resistance and stability – and Essential Requirement N°2 – Safety in case of fire ;
- as a basis for specifying contracts for construction works and related engineering services ;
- as a framework for drawing up harmonised technical specifications for construction products (ENs and ETAs)

The Eurocodes, as far as they concern the construction works themselves, have a direct relationship with the Interpretative Documents² referred to in Article 12 of the CPD, although they are of a different nature from harmonised product standards³. Therefore, technical aspects arising from the Eurocodes work need to be adequately considered by

² According to Art. 3.3 of the CPD, the essential requirements (ERs) shall be given concrete form in interpretative documents for the creation of the necessary links between the essential requirements and the mandates for harmonised ENs and ETAGs/ETAs.

³ According to Art. 12 of the CPD the interpretative documents shall :

- a) give concrete form to the essential requirements by harmonising the terminology and the technical bases and indicating classes or levels for each requirement where necessary ;
- b) indicate methods of correlating these classes or levels of requirement with the technical specifications, e.g. methods of calculation and of proof, technical rules for project design, etc. ;
- c) serve as a reference for the establishment of harmonised standards and guidelines for European technical approvals.

The Eurocodes, *de facto*, play a similar role in the field of the ER 1 and a part of ER 2.

EN 1991-1-1:2002 (E)

CEN Technical Committees and/or EOTA Working Groups working on product standards with a view to achieving full compatibility of these technical specifications with the Eurocodes.

The Eurocode standards provide common structural design rules for everyday use for the design of whole structures and component products of both a traditional and an innovative nature. Unusual forms of construction or design conditions are not specifically covered and additional expert consideration will be required by the designer in such cases.

National Standards implementing Eurocodes

The National Standards implementing Eurocodes will comprise the full text of the Eurocode (including any annexes), as published by CEN, which may be preceded by a National title page and National foreword, and may be followed by a National annex.

The National annex may only contain information on those parameters which are left open in the Eurocode for national choice, known as Nationally Determined Parameters, to be used for the design of buildings and civil engineering works to be constructed in the country concerned, *i.e.* :

- values and/or classes where alternatives are given in the Eurocode,
- values to be used where a symbol only is given in the Eurocode,
- country specific data (geographical, climatic, etc.), e.g. snow map,
- the procedure to be used where alternative procedures are given in the Eurocode,–.

It may also contain

- decisions on the application of informative annexes,
- references to non-contradictory complementary information to assist the user to apply the Eurocode.

Links between Eurocodes and harmonised technical specifications (ENs and ETAs) for products

There is a need for consistency between the harmonised technical specifications for construction products and the technical rules for works⁴. Furthermore, all the information accompanying the CE Marking of the construction products which refer to Eurocodes should clearly mention which Nationally Determined Parameters have been taken into account.

Additional information specific for EN 1991-1-1

EN 1991-1-1 gives design guidance and actions for the structural design of buildings and civil engineering works, including the following aspects:

- densities of construction materials and stored materials ;
- self-weight of construction elements, and
- imposed loads for buildings.

⁴ see Art.3.3 and Art.12 of the CPD, as well as clauses 4.2, 4.3.1, 4.3.2 and 5.2 of ID 1.

EN 1991-1-1 is intended for clients, designers, contractors and public authorities.

EN 1991-1-1 is intended to be used with EN 1990, the other Parts of EN 1991 and EN 1992 to EN 1999 for the design of structures.

National annex for EN 1991-1-1

This standard gives alternative procedures, values and recommendations for classes with notes indicating where National choices have to be made, therefore the National Standard implementing EN 1991-1-1 should have a National Annex containing all Nationally Determined Parameters to be used for the design of buildings and civil engineering works to be constructed in the relevant country.

National choice is allowed in EN 1991-1-1 through:

- 2.2(3),
- 5.2.3(1) to 5.2.3(5),
- 6.3.1.1 (Table 6.1),
- 6.3.1.2(1)P (Table 6.2),
- 6.3.1.2(10) & (11),
- 6.3.2.2 (1)P (Table 6.4),
- 6.3.2.2 (3),
- 6.3.3.2(1) (Table 6.8),
- 6.3.4.2 (Table 6.10) and
- 6.4 (1)(P) (Table 6.12)

Section 1 General

1.1 Scope

(1) EN 1991-1-1 gives design guidance and actions for the structural design of buildings and civil engineering works including some geotechnical aspects for the following subjects:

- Densities of construction materials and stored materials;
- Self-weight of construction works;
- Imposed loads for buildings.

(2) Section 4 and Annex A give nominal values for densities of specific building materials, additional materials for bridges and stored materials. In addition for specific materials the angle of repose is provided.

(3) Section 5 provides methods for the assessment of the characteristic values of self-weight of construction works.

(4) Section 6 gives characteristic values of imposed loads for floors and roofs according to category of use in the following areas in buildings:

- residential, social, commercial and administration areas;
- garage and vehicle traffic areas;
- areas for storage and industrial activities;
- roofs;
- helicopter landing areas.

(5) The loads on traffic areas given in Section 6 refer to vehicles up to a gross vehicle weight of 160 kN. The design for traffic areas for heavy vehicles of more than 160 kN gross weight needs to be agreed with the relevant authority. Further information may be obtained from EN 1991-2.

(6) For barriers or walls having the function of barriers, horizontal forces are given in Section 6. Annex B gives additional guidance for vehicle barriers in car parks.

NOTE Forces due to vehicle impact are specified in EN 1991-1-7 and EN 1991-2.

(7) For the design situations and effects of actions in silos and tanks caused by water or other materials see EN 1991-3.

1.2 Normative References

This European Standard incorporates by dated or undated reference provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to, or revisions of, any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE 1 The Eurocodes were published as European Prestandards. The following European Standards which are published or in preparation are cited in normative clauses :

EN 1990	Eurocode : Basis of Structural Design
EN 1991-1-7	Eurocode 1: Actions on structures: Part 1-7: Accidental actions from impact and explosions
EN 1991-2	Eurocode 1: Actions on structures: Part 2: Traffic loads on bridges
EN 1991-3	Eurocode 1: Actions on structures: Part 3: Actions induced by cranes and machinery
EN 1991-4	Eurocode 1: Actions on structures: Part 4: Actions in silos and tanks

NOTE 2 The Eurocodes were published as European Prestandards. The following European Standards which are published or in preparation are cited in NOTES to normative clauses :

EN 1991-1-3	Eurocode 1: Actions on structures: Part 1-3: Snow loads
EN 1991-1-4	Eurocode 1: Actions on structures: Part 1-4: Wind actions
EN 1991-1-6	Eurocode 1: Actions on structures: Part 1-6: Actions during execution