

**Zeitschrift:** IABSE reports = Rapports AIPC = IVBH Berichte

**Band:** 65 (1992)

**Artikel:** Basis of design and actions on structures

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**DOI:** <https://doi.org/10.5169/seals-50030>

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## EC 1: Basis of Design and Actions on Structures

EC 1: Principes de dimensionnement et actions sur les structures porteuses

EC 1: Grundlagen für Entwurf, Bemessung und Konstruktion und Einwirkungen auf Tragwerke

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## SUMMARY

The Eurocode «Basis of Design and Actions on Structures» is to be a comprehensive code of practice providing information on basis of design and on all actions that it is necessary to consider in the design of structures. This paper briefly describes the background to the preparation of the Eurocode and outlines its proposed framework and contents. The progress achieved in its development is summarised and the plans for completing the work are described.

## RESUME

L'Eurocode «Basis of Design and Actions on Structures» sera une norme complète concernant les principes de dimensionnement et toutes les actions qui doivent être considérées lors de la conception d'une structure. Cet article décrit brièvement le cheminement du développement de l'Eurocode et présente le cadre général proposé ainsi que son contenu. Il résume également les progrès obtenus pendant son développement et la planification pour compléter le travail en cours.

## ZUSAMMENFASSUNG

Der Eurocode 1 «Grundlagen für Entwurf, Bemessung und Konstruktion und Einwirkungen auf Tragwerke» wird eine umfassende Norm für die Praxis mit Angaben zu den Grundlagen für die Tragwerksplanung sowie Informationen zu all denjenigen Einwirkungen, die beim Entwurf und der Bemessung von Tragwerken beachtet werden müssen. In kurzer Form werden die Ausgangslage und Vorbereitungen dargelegt, sowie der vorgeschlagene Rahmen und dessen Inhalt dargestellt. Der heute erreichte Stand in der Entwicklung wird zusammengefasst und das weitere Vorgehen bis zum Abschluss der Arbeiten wird beschrieben.



## 1. INTRODUCTION

### 1.1 Scope

1.1.1 When complete, this Eurocode, which is generally referred to as Eurocode 1, will serve two purposes. First it will provide details of the basis of design for building and civil engineering structures. Secondly it will contain information on all actions which it is necessary to consider in the design of such structures. It will be a comprehensive code relating to a wide range of structures including buildings, bridges, towers, masts, silos, tanks, and chimneys. It will not, however, specifically cover exceptional structures such as nuclear reactors and dams, although the rules given for particular actions may be applicable to the design of these structures.

1.1.2 Eurocode 1 is the first in the series of nine Eurocodes which will, in due course, present common rules for the design of structures made of the major materials. The design of any particular structure on the basis of the Eurocodes is made by the use of the relevant Parts of Eurocode 1 together with the appropriate other Eurocode which gives the design rules for the specific structural material. The Eurocodes are not concerned specifically with the appraisal of existing structures.

### 1.2 Background

1.2.1 The preparation of the Eurocodes for the design of structures was initiated by the Commission of the European Communities in 1976 who established a Steering Committee made up of national delegations from the Member States to oversee the work. The work which was undertaken by drafting groups of experts under contract to the Commission, did not initially include development of rules for actions. It did include the preparation of a draft code on common unified rules for all types of construction and common safety requirements. These rules were not operational but were provided as a basis for preparing the operational Eurocodes. The rules were published in 1984 [1].

1.2.2 In 1984 the Steering Committee agreed to a proposal that an enquiry on national codes and standards concerned with actions be undertaken by the Building Research Establishment (BRE) amongst Members States. The report of the enquiry concluded that the preparation of a Eurocode for Actions on Structures was feasible. With the agreement of the Steering Committee a small Task Group was established to advise on the steps necessary. The Task Group was supported by national bodies including the Building Research Establishment (BRE), Centre Scientifique et Technique du Bâtiment (CSTN), Institut für Bautechnik (IfBt), and the Danish Building Research Institute (SBI).

1.2.3 An outline for a comprehensive Eurocode for Actions was proposed, together with suggestions for the first stages of the work, based on preparatory studies by Task Group members. The proposal was accepted by the Steering Committee in 1985.

1.2.4 An inherent feature of the proposed Eurocode 1 was that it would be suitable for structural design based on the limit state concept using the partial safety factor format.

1.2.5 Priority was first given in developing Eurocode 1 to the most important actions related to the design of building structures. The aim was to have the Parts covering these actions - gravity loads, imposed loads, snow loads, wind loads and actions due to fire - available for use when, or as soon as possible after, publication for experimental use by the European Committee for Standardisation (CEN) of ENV Eurocode 2: Part 1: Concrete Structure and ENV Eurocode 3: Part 1: Steel Structures.

1.2.6 The scope of the work was extended to include traffic loads on bridges (road and rail) and loads in silos and tanks leading in 1990 to completion of draft Eurocode documents [2] covering;

- General rules (for buildings)
- Densities of building materials and stored materials
- Permanent actions due to gravity
- Imposed loads on floors and roofs
- Snow loads
- Wind loads: static actions
- Actions on structures exposed to fire
- Loads in silos and tanks
- Railway loads (in relation to bridges)

For traffic loads on road bridges reports were presented to the Commission of technical studies and giving proposals for drafting [3].

1.2.7 The transfer of the technical work of preparation of the Eurocodes from the Commission of the European Communities to the European Committee for Standardisation (CEN) took place in 1990 [4]. Whilst establishing the programme of mandates of the Commission for the continuation of the work, the opportunity was taken to reorganise the comprehensive framework of Eurocode 1 into Parts.

#### Part 1: Basis of design

Fundamental requirements, limit state concept, general definitions and classifications concerning actions, material properties, geometrical data, load arrangements and load cases, common design requirements, durability aspects.

#### Part 2: Gravity and imposed loads, snow, wind and fire loads

General basis for determining actions for use in the structural design of Buildings, Bridges and Civil Engineering Works and specific rules for actions on Buildings arising from gravity, imposed loads on floors and roofs, snow, wind and fire.

#### Part 2A: Thermal actions

Data and rules for the determination of temperatures in components and structures for use in the structural design of Buildings, Bridges and Civil Engineering Works.



**Part 2B: Construction loads and deformations imposed during execution**

General basis for determining actions arising in the execution of Buildings, Bridges and Civil Engineering Works and for taking them into account in structural design.

**Part 2C: Accidental Actions**

General basis for determining accidental actions arising from impact, explosions and seismic events and rules for taking them into account in the structural design of Buildings, Bridges and Civil Engineering Works. (This Part will refer for seismic events to Eurocode 8: Design of Structures in Seismic Regions.)

**Part 2D: Water and Wave loads**

Basis for determining actions arising from flow of water and waves for use in the structural design of Buildings, Bridges and Civil Engineering Works.

**Part 2E: Soil and water pressure**

General basis for determining actions from soil and water pressure for use in the structural design of Buildings and Civil Engineering Works

**Part 3: Traffic loads on bridges**

Basis for determining, for use in the structural design of road bridges and mainline railway bridges, the actions arising from traffic and pedestrian loads.

**Part 4: Loads in silos and tanks**

General basis for determining, for use in structural design, the actions in Silos and Tanks arising from the storage of bulk materials.

**Part 5: Actions induced by Cranes and Machinery**

General basis for determining, for use in structural design, the actions on Buildings, Bridges and Civil Engineering Works arising from the operation of cranes and machinery.

**Part 10: Actions on structures exposed to fire**

Mechanical actions and standard fire exposure. Supplement to Part 2 rules for the actions to be considered in fire exposure.

### 3. ORGANISATION AND THE PREPARATION WORK

#### 3.1 CEN Sub-Committee TC250\SC1

3.1.1 When the mandate to elaborate the Eurocodes was given to CEN in 1990, Technical Committee TC250 was established with Subcommittees, one responsible for each Eurocode [4]. Subcommittee TC250/SC1 undertook the task of preparation of the Eurocode 1: Basis of design and Actions on Structures. The Swiss Association for Standardisation (SNV) was appointed as the Secretariat for Subcommittee SC1. The work is being undertaken by the Swiss Society of Engineers and Architects (SIA) on behalf of SNV.

3.1.2 The scope of the work of Subcommittee TC250/SC1 was agreed by TC250 as follows:

'To prepare and maintain European Standards in the field of structural design rules for building and civil engineering works covering general rules for determining actions for use in design, and special and additional rules for actions arising from gravity, imposed loads, snow, ice, wind, thermal actions, currents and waves, soil and water pressure, and traffic and pedestrian loads on bridges; execution loads and deformations; actions from storage of bulk materials in silos and tanks, actions induced by cranes and machinery, accidental actions and actions on structures exposed to fire'.

3.1.3 The primary responsibility of Subcommittee TC250/SC1 is the elaboration of the rules for actions in Parts 2-5 and 10. Since basis of design concerns the specification of actions, the assessment of design resistance and design verification, the preparation of Part 1: Basis of design is being undertaken under the guidance of the Co-ordination Group thus allowing all Subcommittees the opportunity of comment during the formative stages of the draft.

3.1.4 At the inaugural meeting of Subcommittee TC250/SC1 in Zurich in December 1990, the programme of work in accordance with the mandates was agreed and Project Teams were established.

3.1.5 The Project Teams are made up of experts and are preparing drafts, with the assistance of the Subcommittee's technical secretaries and in consultation with the national technical contacts, for approval by Subcommittee SC1 following CEN procedures. This procedure, which is adopted by all the TC250 Subcommittees, should provide the most rapid progress to agreement on harmonisation of actions for use in the design of structures.

#### 3.2 Programme of Work

3.2.1 Essentially the first phase of work - the initial programme - is to advance the results achieved by the previous Task Group [3, 4] to produce European prestandards (ENV).



3.2.2 The initial programme of work under the aegis of CEN was established with target dates as follows:

Target Dates			
	Approval of draft by Project Team	Approval by SCI as ENV	Publication as ENV
Part 1	April 1993	October 1993	April 1994
Part 2	January 1993	July 1993	January 1994
Part 3	April 1993	October 1993	April 1994
Part 4	December 1992	June 1993	December 1993
Part 10	October 1992	April 1993	October 1993

3.2.3 The preparation of the remaining parts of the Eurocode for Actions - Parts 2A, 2B, 2C, 2D, 2E, and 5 - will not commence until 1993 at the earliest when specific mandates covering them are expected to be issued by the Commission. In the meantime preparatory work is in hand by the Secretariat.

3.2.3 The development of the Parts covered by the initial programme, the main technical aspects and the progress of preparation is described in the companion papers to this overview [5].

#### 4. CONCLUSIONS

##### 4.1 Scope

4.1.1 Eurocode 1 is a comprehensive code of practice providing information on basis of design and all actions which it is necessary to consider in the design of structures.

4.1.2 Eurocode 1 is being prepared specifically for use with Eurocodes 2 to 9. It anticipates design verification based on the limit state concept using the partial safety factor format.

##### 4.2 Preparation

4.2.1 The initial programme of work to prepare Eurocode 1 is well advanced. The publication of European Prestandards (ENV) covering Basis of design, Gravity, Imposed loads, Snow, Wind and Fire loads, Traffic loads on bridges, and Bulk materials' loads in silos and tanks is targeted for 1993 and 1994.

## 5. REFERENCES

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