

საქართველოს ეროვნული სტანდარტი

ეპროკოდი 4: მრავალფენიანი ფოლადის და ბეტონის კონსტრუქციების
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English Version

**Eurocode 4 - Design of composite steel and concrete structures
- Part 1-2: General rules - Structural fire design**

Eurocode 4 - Calcul des structures mixtes acier-béton -
Partie 1-2: Règles générales - Calcul du comportement au
feu

Eurocode 4 - Bemessung und Konstruktion von
Verbundtragwerken aus Stahl und Beton - Teil 1-2:
Allgemeine Regeln Tragwerksbemessung im Brandfall

This European Standard was approved by CEN on 4 November 2004.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

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



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Foreword

This European Standard EN 1994-1-2: 2005, Eurocode 4: Design of composite steel and concrete structures: Part 1-2 : General rules – Structural fire design, has been prepared by Technical Committee CEN/TC250 « Structural Eurocodes », the Secretariat of which is held by BSI.

CEN/TC250 is responsible for all Structural Eurocodes.

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of an identical text or by endorsement, at the latest by February 2006, and conflicting National Standards shall be withdrawn at latest by March 2010.

This Eurocode supersedes ENV 1994-1-2: 1994.

According to the CEN-CENELEC Internal Regulations, the National Standard Organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and 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 1980's.

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 the 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 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:

EN1990, Eurocode : Basis of structural design

EN1991, Eurocode 1: Actions on structures

EN1992, Eurocode 2: Design of concrete structures

EN1993, Eurocode 3: Design of steel structures

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).

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EN1994, Eurocode 4: Design of composite steel and concrete structures

EN1995, Eurocode 5: Design of timber structures

EN1996, Eurocode 6: Design of masonry structures

EN1997, Eurocode 7: Geotechnical design

EN1998, Eurocode 8: Design of structures for earthquake resistance

EN1999, 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 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.

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 hENs 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.

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, and
- 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 shall clearly mention which Nationally Determined Parameters have been taken into account.

Additional information specific for EN 1994-1-2

EN 1994-1-2 describes the Principles, requirements and rules for the structural design of buildings exposed to fire, including the following aspects:

Safety requirements

EN 1994-1-2 is intended for clients (e.g. for the formulation of their specific requirements), designers, contractors and public authorities.

The general objectives of fire protection are to limit risks with respect to the individual and society, neighbouring property, and where required, environment or directly exposed property, in the case of fire.

Construction Products Directive 89/106/EEC gives the following essential requirement for the limitation of fire risks:

"The construction works must be designed and built in such a way, that in the event of an outbreak of fire

- the load bearing resistance of the construction can be assumed for a specified period of time;
- the generation and spread of fire and smoke within the works are limited;
- the spread of fire to neighbouring construction works is limited;
- the occupants can leave the works or can be rescued by other means;
- the safety of rescue teams is taken into consideration".

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 N°1.

⁵ see clauses 2.2, 3.2(4) and 4.2.3.3 of ID N°2

EN 1994-1-2:2005 (E)

According to the Interpretative Document N°2 "Safety in Case of Fire"⁵ the essential requirement may be observed by following various possibilities for fire safety strategies prevailing in the Member States like conventional fire scenarios (nominal fires) or "natural" (parametric) fire scenarios, including passive and/or active fire protection measures.

The fire parts of Structural Eurocodes deal with specific aspects of passive fire protection in terms of designing structures and parts thereof for adequate load bearing resistance and for limiting fire spread as relevant.

Required functions and levels of performance can be specified either in terms of nominal (standard) fire resistance rating, generally given in national regulations or, where allowed by national fire regulations, by referring to fire safety engineering for assessing passive and active measures.

Supplementary requirements concerning, for example

- the possible installation and maintenance of sprinkler systems;
- conditions on occupancy of building or fire compartment;
- the use of approved insulation and coating materials, including their maintenance.

are not given in this document, because they are subject to specification by the competent authority.

Numerical values for partial factors and other reliability elements are given as recommended values that provide an acceptable level of reliability. They have been selected assuming that an appropriate level of workmanship and of quality management applies.

Design procedures

A full analytical procedure for structural fire design would take into account the behaviour of the structural system at elevated temperatures, the potential heat exposure and the beneficial effects of active fire protection systems, together with the uncertainties associated with these three features and the importance of the structure (consequences of failure).

At the present time it is possible to undertake a procedure for determining adequate performance which incorporates some, if not all, of these parameters and to demonstrate that the structure, or its components, will give adequate performance in a real building fire. However where the procedure is based on a nominal (standard) fire, the classification system, which calls for specific periods of fire resistance, takes into account (though not explicitly), the features and uncertainties described above.

Application of this Part 1-2 is illustrated below. The prescriptive approach and the performance-based approach are identified. The prescriptive approach uses nominal fires to generate thermal actions. The performance-based approach, using fire safety engineering, refers to thermal actions based on physical and chemical parameters.

For design according to this part, EN 1991-1-2 is required for the determination of thermal and mechanical actions to the structure.

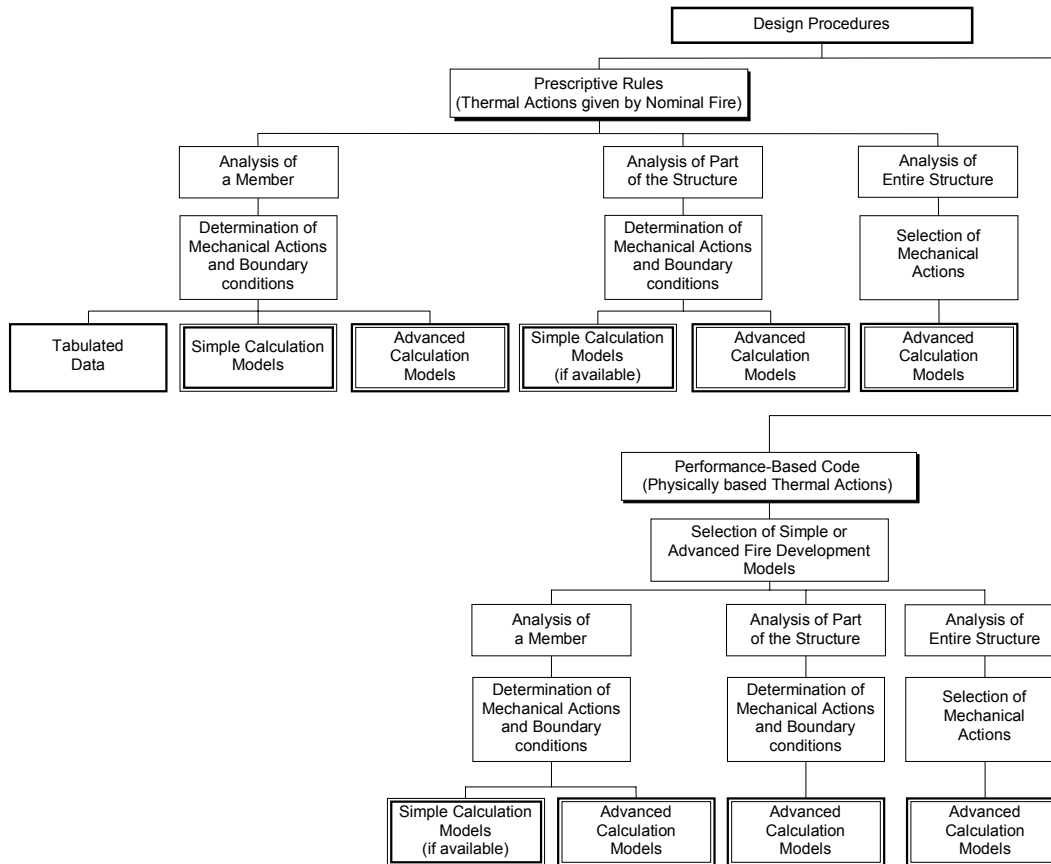


Figure 0.1: Alternative design procedures

Design aids

Apart from simple calculation models, EN 1994-1-2 gives design solutions in terms of tabulated data (based on tests or advanced calculation models) which may be used within the specified limits of validity.

It is expected, that design aids based on the calculation models given in EN 1994-1-2, will be prepared by interested external organizations.

The main text of EN 1994-1-2 together with informative Annexes A to I includes most of the principal concepts and rules necessary for structural fire design of composite steel and concrete structures.

EN 1994-1-2:2005 (E)

National annex for EN 1994-1-2

This standard gives alternative procedures, values and recommendations for classes with notes indicating where national choices may have to be made. Therefore the National Standard implementing EN 1994-1-2 should have a National annex containing all Nationally Determined Parameters to be used for the design of buildings to be constructed in the relevant country.

National choice is allowed in EN 1994-1-2 through clauses:

- 1.1(16)
- 2.1.3(2)
- 2.3(1)P
- 2.3(2)P
- 2.4.2(3)
- 3.3.2(9)
- 4.1(1)P
- 4.3.5.1(10)