



**NSAI**  
Standards

Irish Standard

I.S. EN 1992-1-2:2004&AC:2008&A1:2019

# Eurocode 2: Design of concrete structures - Part 1-2: General rules - Structural fire design

# **I.S. EN 1992-1-2:2004&AC:2008&A1:2019**

*Incorporating amendments/corrigenda/National Annexes issued since publication:*

EN 1992-1-2:2004/A1:2019

EN 1992-1-2:2004/AC:2008

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S.R. xxx: Standard Recommendation — recommendation based on the consensus of an expert panel and subject to public consultation.

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*This document replaces/revises/consolidates the NSAI adoption of the document(s) indicated on the CEN/CENELEC cover/Foreword and the following National document(s):*

*NOTE: The date of any NSAI previous adoption may not match the date of its original CEN/CENELEC document.*

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NSAI  
1 Swift Square,  
Northwood, Santry  
Dublin 9

T +353 1 807 3800  
F +353 1 807 3838  
E standards@nsai.ie  
W NSAI.ie

Sales:  
T +353 1 857 6730  
F +353 1 857 6729  
W standards.ie

Údarás um Chaighdeáin Náisiúnta na hÉireann

## National Foreword

I.S. EN 1992-1-2:2004&AC:2008&A1:2019 is the adopted Irish version of the European Document EN 1992-1-2:2004, Eurocode 2: Design of concrete structures - Part 1-2: General rules - Structural fire design. NSAI adopts all Eurocodes as Irish Standards.

Eurocodes permit certain design parameters to be selected nationally. In Ireland, the selection of National Design parameters (NDP's) is the responsibility of the Eurocodes Consultative Committee (NSAI TC 015). National Annexes are developed in accordance with CEN and NSAI procedures and include a public consultation process.

Where NSAI TC 015 considers it appropriate, NDP's are agreed and listed in Irish National Annexes to Eurocodes.

Eurocodes must always be used in conjunction with the accompanying National Annex (NA), where available. For example, I.S. EN 1991-1-4, Eurocode 1: Actions on structures – Part 1-4: General actions – Wind actions is to be used in conjunction with NA to I.S. EN 1991-1-4.

National annexes are reviewed as necessary e.g. when a new edition, an amendment or a corrigendum to a Eurocode is issued. The national annex identifies what amendments/corrigenda are addressed. The user should check that the National Annex addresses the latest changes to the Eurocode. Previews of all documents are available on [www.standards.ie](http://www.standards.ie). Any questions should be directed to NSAI.

Where an Irish National Annex to a Eurocode has not been prepared, the user must make sure that the general requirements of I.S. EN 1990 and the accompanying Irish National Annex are complied with.

Where a Eurocode has been changed (revised/amended/corrected) and the National Annex has yet to be revised to account for the change(s), the National Annex for the previous version is available. Engineering judgement must be applied if using guidance contained therein. Where no National Annex exists, and NSAI TC 015 considers it appropriate to develop one, NDP's will be agreed and listed in new Irish National Annexes to Eurocodes. In the interim, Engineering Judgement must be applied e.g. when selecting appropriate parameters for NDP's.

Information on Eurocodes and the related national annexes is available from [www.nsal.ie](http://www.nsal.ie).

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

For relationships with other publications refer to the NSAI web store.

**Compliance with this document does not of itself confer immunity from legal obligations.**

*In line with international standards practice the decimal point is shown as a comma (,) throughout this document.*

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**EUROPEAN STANDARD**  
**NORME EUROPÉENNE**  
**EUROPÄISCHE NORM**

**EN 1992-1-2:2004/A1**

May 2019

ICS 91.010.30; 91.080.40

English Version

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

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

Eurocode 2: Bemessung und Konstruktion von  
Stahlbeton- und Spannbetontragwerken - Teil 1-2:  
Allgemeine Regeln - Tragwerksbemessung für den  
Brandfall

This amendment A1 modifies the European Standard EN 1992-1-2:2004; it was approved by CEN on 8 March 2019.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for inclusion of this amendment into the relevant 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 amendment 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.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

**EN 1992-1-2:2004/A1:2019 (E)**

<b>Contents</b>	<b>Page</b>
<b>European foreword.....</b>	<b>3</b>
<b>1      Modification of 4.2.1(1) .....</b>	<b>4</b>
<b>2      Modification of 5.3.3(1) .....</b>	<b>4</b>
<b>3      New Annex C.....</b>	<b>4</b>
<b>Annex C (informative) Buckling of columns under fire conditions.....</b>	<b>5</b>

## **European foreword**

This document (EN 1992-1-2:2004/A1:2019) 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 November 2019, and conflicting national standards shall be withdrawn at the latest by November 2019.

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

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## **EN 1992-1-2:2004/A1:2019 (E)**

### **1 Modification of 4.2.1(1)**

*Replace existing NOTE 2 in paragraph (1) of 4.2.1 with the following new NOTE 2:*

"NOTE 2 Tabulated data for the fire design of slender reinforced columns in braced and unbraced systems is given in Annex C."

### **2 Modification of 5.3.3(1)**

*Delete the following sentence in paragraph (1) of 5.3.3:*

"Further information is given in Annex C."

### **3 New Annex C**

*Replace the existing Annex C with the following:*

"



EUROPEAN STANDARD

**EN 1992-1-2:2004/AC**

NORME EUROPÉENNE

July 2008

EUROPÄISCHE NORM

Juillet 2008

Juli 2008

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ICS 91.010.30; 91.080.10

English version  
Version Française  
Deutsche Fassung

Eurocode 2: Design of concrete structures - Part 1-2: General rules -  
Structural fire design

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

Eurocode 2: Bemessung und Konstruktion  
von Stahlbeton- und  
Spannbetontragwerken - Teil 1-2:  
Allgemeine Regeln - Tragwerksbemessung  
für den Brandfall

This corrigendum becomes effective on 30 July 2008 for incorporation in the three official language versions of the EN.

Ce corrigendum prendra effet le 30 juillet 2008 pour incorporation dans les trois versions linguistiques officielles de la EN.

Die Berichtigung tritt am 30. Juli 2008 zur Einarbeitung in die drei offiziellen Sprachfassungen der EN in Kraft.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 1992-1-2**

December 2004

ICS 13.220.50; 91.010.30; 91.080.40

Supersedes ENV 1992-1-2:1995

English version

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

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

Eurocode 2: Planung von Stahlbeton- und  
Spannbetontragwerken - Teil 1-2: Allgemeine Regeln -  
Tragwerksbemessung für den Brandfall

This European Standard was approved by CEN on 8 July 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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EUROPÄISCHES KOMITEE FÜR NORMUNG

**Management Centre: rue de Stassart, 36 B-1050 Brussels**

## **EN 1992-1-2:2004 (E)**

### **Contents List**

- 1 General
  - 1.1 Scope
    - 1.1.1 Scope of Eurocode 2
    - 1.1.2 Scope of Part 1-2 of Eurocode 2
  - 1.2 Normative references
  - 1.3 Assumptions
  - 1.4 Distinctions between principles and application rules
  - 1.5 Definitions
  - 1.6 Symbols
    - 1.6.1 Supplementary symbols to EN 1992-1-1
    - 1.6.2 Supplementary subscripts to EN 1992-1-1
- 2 Basis of design
  - 2.1 Requirements
    - 2.1.1 General
    - 2.1.2 Nominal fire exposure
    - 2.1.3 Parametric fire exposure
  - 2.2 Actions
  - 2.3 Design values of material properties
  - 2.4 Verification methods
    - 2.4.1 General
    - 2.4.2 Member analysis
    - 2.4.3 Analysis of part of the structure
    - 2.4.4 Global structural analysis
- 3 Material properties
  - 3.1 General
  - 3.2 Strength and deformation properties at elevated temperatures
    - 3.2.1 General
    - 3.2.2 Concrete
      - 3.2.2.1 Concrete under compression
      - 3.2.2.2 Tensile strength
    - 3.2.3 Reinforcing steel
    - 3.2.4 Prestressing steel
  - 3.3 Thermal and physical properties of concrete with siliceous and calcareous aggregates
    - 3.3.1 Thermal elongation
    - 3.3.2 Specific heat
    - 3.3.3 Thermal conductivity
  - 3.4 Thermal elongation of reinforcing and prestressing steel
- 4 Design procedures
  - 4.1 General
  - 4.2 Simplified calculation method
    - 4.2.1 General
      - 4.2.2 Temperature profiles
      - 4.2.3 Reduced cross-section
      - 4.2.4 Strength reduction
        - 4.2.4.1 General

- 4.2.4.2 Concrete
    - 4.2.4.3 Steel
- 4.3 Advanced calculation methods
  - 4.3.1 General
  - 4.3.2 Thermal response
  - 4.3.3 Mechanical response
  - 4.3.4 Validation of advanced calculation models
- 4.4 Shear, torsion and anchorage
- 4.5 Spalling
  - 4.5.1 Explosive spalling
  - 4.5.2 Falling off of concrete
- 4.6 Joints
- 4.7 Protective layers
- 5 Tabulated data
  - 5.1 Scope
  - 5.2 General design rules
  - 5.3 Columns
    - 5.3.1 General
    - 5.3.2 Method A for assessing fire resistance of columns
    - 5.3.3 Method B for assessing fire resistance of columns
  - 5.4 Walls
    - 5.4.1 Non load-bearing walls (partitions)
    - 5.4.2 Load-bearing solid walls
    - 5.4.3 Fire walls
  - 5.5 Tensile members
  - 5.6 Beams
    - 5.6.1 General
    - 5.6.2 Simply supported beams
    - 5.6.3 Continuous beams
    - 5.6.4 Beams exposed on all sides
  - 5.7 Slabs
    - 5.7.1 General
    - 5.7.2 Simply supported solid slabs
    - 5.7.3 Continuous solid slabs
    - 5.7.4 Flat slabs
    - 5.7.5 Ribbed slabs
- 6 High strength concrete (HSC)
  - 6.1 General
  - 6.2 Spalling
  - 6.3 Thermal properties
  - 6.4 Structural design
    - 6.4.1 Calculation of load-carrying capacity
    - 6.4.2 Simplified calculation method
      - 6.4.2.1 Columns and walls
      - 6.4.2.2 Beams and slabs
    - 6.4.3 Tabulated data

## **EN 1992-1-2:2004 (E)**

### **Informative annexes**

- A Temperature profiles
- B Simplified calculation methods
- C Buckling of columns under fire conditions
- D Calculation methods for shear, torsion and anchorage
- E Simplified calculation method for beams and slabs

### **Foreword**

This European Standard EN 1992-1-2, "Design of 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 June 2005, and conflicting National Standards shall be withdrawn at latest by March 2010.

This European standard supersedes ENV 1992-1-2: 1995.

According to the CEN-CENELEC Internal Regulations, the National Standard Organisations of the following countries are bound to implement these 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 1980s.

In 1989, the Commission and the Member States of the EU and EFTA decided, on the basis of an agreement<sup>1</sup> between the Commission and CEN, to transfer the preparation and the

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<sup>1</sup> 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).

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:

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 Documents<sup>2</sup> referred to in Article 12 of the CPD, although they are of a different nature from harmonised product standards<sup>3</sup>. Therefore, technical aspects arising from the Eurocodes work need to be adequately considered by CEN Technical

<sup>2</sup> 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.

<sup>3</sup> According to Art. 12 of the CPD the interpretative documents shall :

- 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 ;
  - 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. ;
  - 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 1992-1-2:2004 (E)**

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,
- 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 products harmonised technical specifications (ENs and ETAs)**

There is a need for consistency between the harmonised technical specifications for construction products and the technical rules for works<sup>4</sup>. 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 to EN 1992-1-2**

EN 1992- 1-2 describes the Principles, requirements and rules for the structural design of buildings exposed to fire, including the following aspects.

#### *Safety requirements*

EN 1992-1-2 is intended for clients (*e.g.* for the formulation of their specific requirements), designers, contractors and relevant 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.

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<sup>4</sup> 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.

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

"The construction works must be designed and build 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".

According to the Interpretative Document N° 2 "Safety in case of fire" 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 fire regulations or by referring to fire safety engineering for assessing passive and active measures, see EN 1991-1-2.

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 and passive 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 call for specific periods of fire resistance, takes into account (though not explicitly), the features and uncertainties described above.



## EN 1992-1-2:2004 (E)

Application of design procedures is illustrated in Figure 0.1. 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. Additional information for alternative methods in this standard is given in Table 0.1.

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

### *Design aids*

Where simple calculation models are not available, the Eurocode fire parts give 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 1992-1-2, will be prepared by interested external organisations.

The main text of EN 1992-1-2, together with informative Annexes A, B, C, D and E, includes most of the principal concepts and rules necessary for structural fire design of concrete structures.

## National Annex for EN 1992-1-2

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 1992-1-2 should have a National Annex containing the Eurocode all Nationally Determined Parameters to be used for the design of buildings, and where required and applicable, for civil engineering works to be constructed in the relevant country.

National choice is allowed in EN 1992-1-2 through clauses:

- |             |               |
|-------------|---------------|
| - 2.1.3 (2) | - 5.3.2 (2)   |
| - 2.3 (2)P  | - 5.6.1 (1)   |
| - 3.2.3 (5) | - 5.7.3 (2)   |
| - 3.2.4 (2) | - 6.1 (5)     |
| - 3.3.3 (1) | - 6.2 (2)     |
| - 4.1 (1)P  | - 6.3.1 (1)   |
| - 4.5.1 (2) | - 6.4.2.1 (3) |
| - 5.2 (3)   | - 6.4.2.2 (2) |

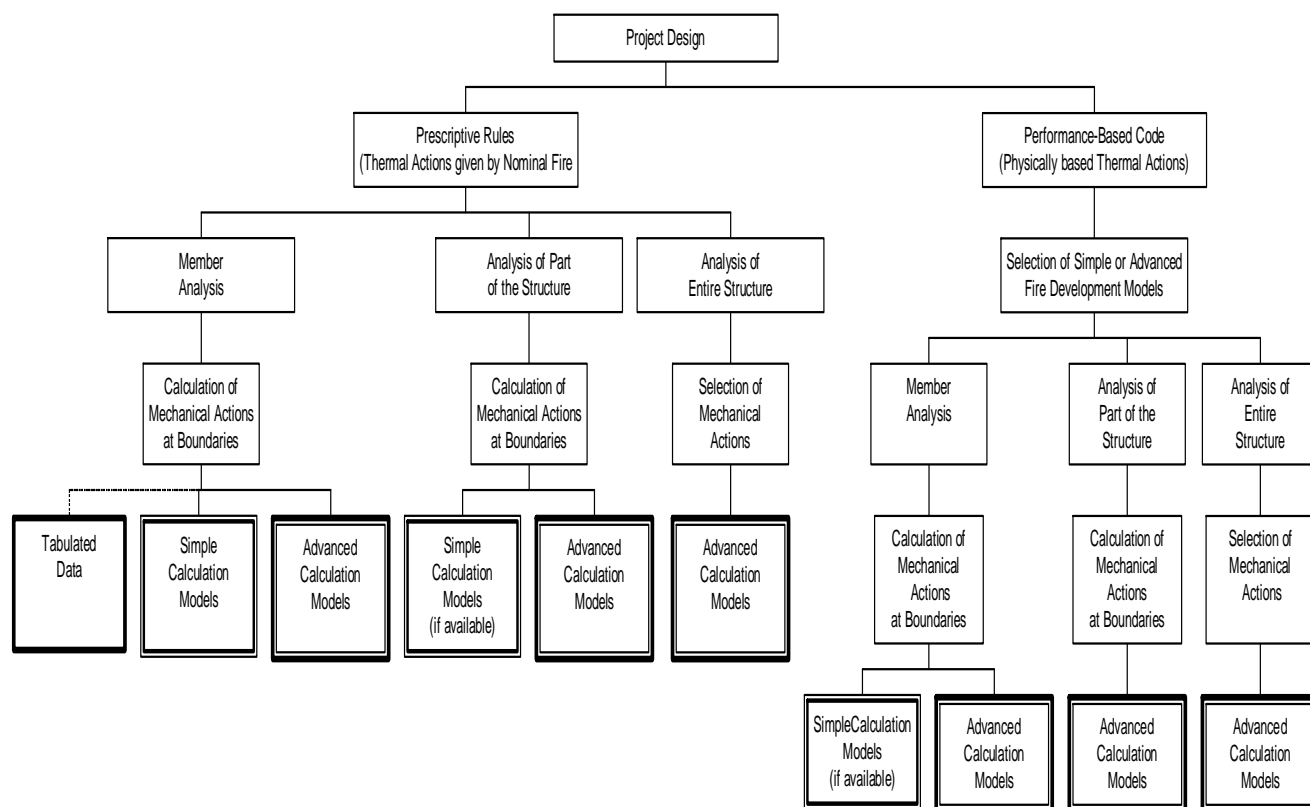


Figure 1 : Alternative design procedures

Table 0.1 Summary table showing alternative methods of verification for fire resistance

	Tabulated data	Simplified calculation methods	Advanced calculation models
<b>Member analysis</b> The member is considered as isolated. Indirect fire actions are not considered, except those resulting from thermal gradients	<b>YES</b> - Data given for standard fire only, 5.1(1) - In principle data could be developed for other fire curves	<b>YES</b> - standard fire and parametric fire, 4.2.1(1) - temperature profiles given for standard fire only, 4.2.2(1) - material models apply only to heating rates similar to standard fire, 4.2.4.1(2)	<b>YES</b> , 4.3.1(1)P Only the principles are given
<b>Analysis of parts of the structure</b> Analysis of parts of the structure. Indirect fire actions within the sub-assembly are considered, but no time-dependent interaction with other parts of the structure.	<b>NO</b>	<b>YES</b> - standard fire and parametric fire, 4.2.1(1) - temperature profiles given for standard fire only, 4.2.2(1) - material models apply only to heating rates similar to standard fire, 4.2.4.1(2)	<b>YES</b> 4.3.1(1)P Only the principles are given
<b>Global structural analysis</b> Analysis of the entire structure. Indirect fire actions are considered throughout the structure	<b>NO</b>	<b>NO</b>	<b>YES</b> 4.3.1(1)P Only the principles are given

## **EN 1992-1-2:2004 (E)**

### **SECTION 1 GENERAL**

#### **1.1 Scope**

##### **1.1.1 Scope of Eurocode 2**

(1)P Eurocode 2 applies to the design of buildings and civil engineering works in concrete. It complies with the principles and requirements for the safety and serviceability of structures, the basis of their design and verification that are given in EN 1990 – Basis of structural design.

(2)P Eurocode 2 is only concerned with requirements for resistance, serviceability, durability and fire resistance concrete structures. Other requirements, e.g. concerning thermal or sound insulation, are not considered.

(3)P Eurocode 2 is intended to be used in conjunction with:

- EN 1990 “Basis of structural design”
- EN 1991 “Actions on structures”
- hEN’s for construction products relevant for concrete structures
- ENV 13670-1 “Execution of concrete structures . Part 1: Common rules”
- EN 1998 “Design of structures for earthquake resistance”, when concrete structures are built in seismic regions

(4)P Eurocode 2 is subdivided in various parts:

- Part 1-1: General rules and rules for buildings
- Part 1-2: General rules – Structural fire design
- Part 2: Concrete bridges
- Part 3: Liquid retaining and containment structures

##### **1.1.2 Scope of Part 1-2 of Eurocode 2**

(1)P This Part 1-2 of EN 1992 deals with the design of concrete structures for the accidental situation of fire exposure and is intended to be used in conjunction with EN 1992-1-1 and EN 1991-1-2. This part 1-2 only identifies differences from, or supplements to, normal temperature design.

(2)P This Part 1-2 of EN 1992 deals only with passive methods of fire protection. Active methods are not covered.

(3)P This Part 1-2 of EN 1992 applies to concrete structures that are required to fulfil certain functions when exposed to fire, in terms of:

- avoiding premature collapse of the structure (load bearing function)
- limiting fire spread (flame, hot gases, excessive heat) beyond designated areas (separating function)

(4)P This Part 1-2 of EN 1992 gives principles and application rules (see EN 1991-1-2) for designing structures for specified requirements in respect of the aforementioned functions and the levels of performance.

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