SLOVENSKI STANDARD
SIST ENV 1992-1-3:2004

01-september-2004

Eurocode 2: Projektiranje betonskih konstrukcij - 1-3. del: Splošna pravila za montažne betonske elemente in konstrukcije

Eurocode 2: Design of concrete structures - Part 1-3: General rules - Precast concrete elements and structures

Eurocode 2: Planung von Stahlbeton- und Spannbetontragwerken - Teil 1-3: Allgemeine Regeln - Bauteile und Tragwerke aus Fertigteilen

Eurocode 2: Calcul des structures en béton - Partie 1-3: Règles générales - Eléments et structures en béton préfabriqués

Ta slovenski standard je istoveten z: **ENV 1992-1-3:1994**

ICS:

91.010.30	Tehniļ ni vidiki	Technical aspects
91.080.40	Betonske konstrukcije	Concrete structures

SIST ENV 1992-1-3:2004 **en**

EUROPEAN PRESTANDARD

PRÉNORME EUROPÉENNE

EUROPÄISCHE VORNORM

ENV 1992-1-3

October 1994

ICS 91.040.00; 91.080.40

Descriptors: buildings, concrete structure, computation, building codes, rules of calculation

English version

Eurocode 2: Design of concrete structures - Part 1-3: General rules - Precast concrete elements and structures

Eurocode 2: Calcul des structures en béton - Partie 1-3: Règles générales - Eléments et structures en béton préfabriqués

Eurocode 2: Planung von Stahlbeton- und Spannbetontragwerken - Teil 1-3: Allgemeine Regeln - Bauteile und Tragwerke aus Fertigteilen

This European Prestandard (ENV) was approved by CEN on 1993-06-25 as a prospective standard for provisional application. The period of validity of this ENV is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the ENV can be converted into an European Standard (EN).

CEN members are required to announce the existance of this ENV in the same way as for an EN and to make the ENV available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the ENV) until the final decision about the possible conversion of the ENV into an EN is reached.

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

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart,36 B-1050 Brussels

Contents

Foreword

OBJECTIVES OF THE EUROCODES

(1) The "Structural Eurocodes" comprise a group of standards for the structural and geotechnical design of buildings and civil engineering works.

(2) They cover execution and control only to the extent that is necessary to indicate the quality of the construction products, and the standard of the workmanship needed to comply with the assumptions of the design rules.

(3) Until the necessary set of harmonized technical specifications for products and for the methods of testing their performance are available, some of the Structural Eurocodes cover some of these aspects in informative Appendices.

BACKGROUND OF THE EUROCODE PROGRAMME

(4) The Commission of the European Communities (CEC) initiated the work of establishing a set of harmonized technical rules for the design of building and civil engineering works which would initially serve as an alternative to the different rules in force in the various Member States and would ultimately replace them. These technical rules became known as the "Structural Eurocodes".

(5) In 1990, after consulting their respective Member States, the CEC transferred the work of further development, issue and updating of the Structural Eurocodes to CEN, and the EFTA Secretariat agreed to support the CEN work.

(6) CEN Technical Committee CEN/TC250 is responsible for all Structural Eurocodes.

EUROCODE PROGRAMME

(7) Work is in hand on the following Structural Eurocodes, each generally consisting of a number of parts:

EN 1991 Eurocode 1 Basis of design and 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 provisions for earthquake resistance of structures
EN 1999 Eurocode 9 Design of aluminium alloy structures

(8) Separate sub-committees have been formed by CEN/TC250 for the

(9) This Part 1-3 of Eurocode 2 is being published as a European Prestandard (ENV) with an initial life of three years.

(10) This Prestandard is intended for experimental application and for the submission of comments.

(11) After approximately two years CEN members will be invited to submit formal comments to be taken into account in determining future actions.

(12) Meanwhile feedback and comments on this Prestandard should be sent to the Secretariat of CEN/TC250/SC2 at the following address:

Deutsches Institute für Normung e.V. (DIN)
Burggrafenstrasse 6
D-10787 Berlin
phone:(+49) 30 - 26 01 - 25 01
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or to your national standards organization.

NATIONAL APPLICATION DOCUMENTS (NAD's)

(13) In view of the responsibilities of authorities in member countries for safety, health and other matters covered by the essential requirements of the Construction Products Directive (CPD), certain safety elements in this ENV have been assigned indicative values which are identified by [ ] ("boxed values"). The authorities in each member country are expected to assign definitive values to these safety elements.

(14) Some of the supporting European or International standards may not be available by the time this Prestandard is issued. It is therefore, anticipated that a National Application Document (NAD) giving definitive values for safety elements, referencing compatible supporting standards and providing national guidance on the application of this Prestandard, will be issued by each member country or its Standards Organization.

(15) It is intended that this Prestandard is used in conjunction with the NAD valid in the country where the building or civil engineering works is located.

MATTERS SPECIFIC TO THIS PRESTANDARD

(16) The scope of Eurocode 2 is defined in 1.1.1 of ENV 1992-1-1 and the scope of this Part of Eurocode 2 is defined 1.1.2. Additional Parts of Eurocode 2 which are planned are indicated in 1.1.3 of ENV 1992-1-1; these will cover additional technologies or applications, and will complement and supplement this Part.

(17) In using this Prestandard in practice, particular regard should be paid to the underlying assumptions and conditions given in 1.3 of ENV 1992-1-1.

(18) The seven chapters of this Prestandard ...

four Appendices which have the same normative status as the chapters to which they relate. These Appendices have been introduced by moving some of the more detailed Principles/Application Rules, which are needed in particular cases, out of the main part of the text to aid its clarity.

(19) As indicated in paragraph (14) of this Foreword, reference should be made to National Application Documents which will give details of compatible supporting standards to be used. For this Part of Eurocode 2, particular attention is drawn to the approved Prestandard ENV 206 (Concrete - performance, production, placing and compliance criteria), and the durability requirements given in 4.1 of this Prestandard.

(20) The provisions of this Prestandard are based substantially on the 1978 edition of the CEB Model Code and other more recent CEB and FIP documents.

(21) In developing this Prestandard, background documents have been prepared, which give commentaries on and justifications for some of the provisions in this Prestandard.

For ENV 1992-1-3, the following additional sub-clause apply:

(22) This Part 1-3 of Eurocode 2 complements ENV 1992-1-1 for the particular aspects of precast concrete elements and structures.

(23) The framework and structure of this Part 1-3 correspond to ENV 1992-1-1. However, Part 1-3 contains Principles and Application Rules which are specific to precast concrete elements and structures.

(24) This Part 1-3 of Eurocode 2 includes one Informative Appendix, Appendix 105.

(25) Where a particular sub-clause of ENV 1992-1-1 is not mentioned in this ENV 1992-1-3, that sub-clause of ENV 1992-1-1 applies as far as deemed appropriate in each case.

Some Principles and Application Rules of ENV 1992-1-1 are modified or replaced in this Part, in which case they are superseded.

Where a Principle or Application Rule in ENV 1992-1-1 is modified or replaced, the new number is identified by the addition of 100 to the original number. Where a new Principle or Application Rule is added, it is identified by a number which follows the last number of ENV 1992-1-1 with 100 added to it.

A subject not covered by ENV 1992-1-1 is introduced in this Part by a new sub-clause. The sub-clause number for this follows the most appropriate clause number in ENV 1992-1-1.

(26) The numbering of equations, figures, footnotes and tables in this Part follow the same principles as the clause numbering in (25) above.

(27) In this Part 1-3 of Eurocode 2, reference is also made to relevant CEN Standards for precast products.

1 INTRODUCTION

This clause of ENV 1992-1-1 applies except as follows:

1.1 SCOPE

1.1.2 SCOPE OF PART 1-3 OF EUROCODE 2

Addition after Principle P(5):

P(106) Part 1-3 gives a general basis for the design and detailing of concrete structures in buildings made partly or entirely of precast elements.

P(107) Precast structures are characterised by the presence of joints which provide connections between elements.

(108) This Part 1-3 provides Principles and Application Rules which complement those given in ENV 1992-1-1. Matters related to the production and assembly of structures are covered by other CEN standards.

(109) In precast concrete structures special consideration should be given to:

- detailing of bearings
- detailing of joints/connections
- structural safety and stability during multi stage construction
- pre-tensioning.

1.4 DEFINITIONS

1.4.2 SPECIAL TERMS USED IN PART 1-3 OF EUROCODE 2

Addition after Principle P(2):

P(103) The following terms are used in this Part 1-3 with the following definitions:

- A precast element is one that is manufactured in a factory or place other than the final position in the structure, protected from adverse weather conditions.

- A composite element comprises insitu and precast concrete with or without reinforcement connectors.

- Rib and block floors consist of precast ribs (or beams) with an infill between them made of blocks, hollow clay pots or other forms of permanent shuttering, with or without an insitu topping.

- A sandwich panel normally consists of two layers of concrete with a thermal insulation sandwiched between them.

- Diaphragms are plane members which are subjected to in-plane forces. A diaphragm may consist of several precast units connected together.

- Ties are tensile members, effectively continuous, in floors, walls or columns.

- Isolated precast members are those for which, in the case of failure, no secondary means of load transfer, e.g. due to redistribution of internal forces and moments, is available.

(104) The following types of reinforced or prestressed precast elements are commonly used:

- Linear elements (e.g. beams, joists, columns)
- Slab elements (e.g. solid slabs fully or partially precast, ribbed slabs, ribs and blocks, hollow core units)
- Wall elements (e.g. solid, ribbed or sandwich)
- Other elements (e.g. foundations, stairs)

(105) Transient situations: In precast concrete construction transient situations include the following:

- Demoulding
- Transport to the storage yard;
- Support and load conditions during storage;
- Transport to site;
- Erection (hoisting) and construction.

2 BASIS OF DESIGN

This clause of ENV 1992-1-1 applies except as follows:

2.1 FUNDAMENTAL REQUIREMENTS

Addition after Principle P(4):

P(105) The layout of the structure and the interaction between the structural members shall be such as to ensure a robust and stable behaviour.

(106) The necessary interaction between elements is obtained by tying the structure together using a) peripheral ties, b) internal ties, c) horizontal ties to columns and walls and d) where required, vertical ties.

Where a building is divided by joints into structurally independent parts, each part should have an appropriate tying system.

(107) Ease of assembly and maintenance should be considered in design.

(108) Where required appropriate mechanical devices should be detailed to allow ease of inspection and replacement.

2.2 DEFINITIONS AND CLASSIFICATIONS

2.2.3 MATERIAL PROPERTIES

2.2.3.1 Characteristic values

Addition after Application Rule (4):

(105) In precast construction it is necessary to check the concrete compressive strength, f_c, at a number of stages of construction (e.g. demoulding, transfer of prestress, see Clause 3.1.2.2 of ENV 1992-1-1).

2.3 DESIGN REQUIREMENTS

2.3.1 GENERAL

Addition after Priciple P(4):

(105) Where relevant, consideration should be given in design to the effects of dynamic actions (e.g. impulse) during transient situations. In the absence of a more rigorous analysis this may be allowed for by multiplying the relevant static effects by an appropriate factor.

2.3.3 **PARTIAL SAFETY FACTORS FOR ULTIMATE LIMIT STATES**

2.3.3.1 **Partial safety factors for actions on building structures**

Replacement of Application Rule (1) by:

(101) Partial safety factors for the persistent and transient design situations are those given in Table 2.2 of ENV 1992-1-1. However for precast elements, in transient situations, a lower factor may be acceptable provided:

a) the behaviour of the completed structure in the permanent condition is not adversely affected; and

b) it is permitted by relevant documents.

2.3.3.2 **Partial safety factors for materials**

Replacement of Application Rule (4) by:

(104) Higher or lower values of γ_c and γ_s may be used for precast elements if these are justified by adequate control procedures and relevant documents.[1]

2.5 **ANALYSIS**

2.5.1 **GENERAL PROVISIONS**

2.5.1.1 **General**

Addition after Appication Rule (6):

P(107) In addition to satisfying the requirements of ENV 1992-1-1 the analysis of precast concrete structures shall take into account the behaviour of the joints between elements.

An analysis shall be made for each relevant stage of construction using the appropriate geometry and properties for that stage.

(108) The analysis of precast concrete structures should account for:

- the behaviour of the structural units at all stages of construction and their interaction with other elements (e.g. composite actions with insitu concrete, other precast units);

- the behaviour of the structural system, with particular regard to actual deformations and strength of connections;

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[1] see ENV 1991-1 "Basis of Design" and Informative Appendix 105

- the uncertainties influencing restraints and force transmission between elements arising from deviations in geometry and in the positioning of units and bearings.

(109) Horizontal restraint caused by friction due to the weight of any supported element may only be considered for non seismic zones (using $\gamma_{G,inf}$). In addition it may only be considered where

- the friction is not solely relied upon for overall stability of the structure; and

- the bearing arrangement precludes the possibility of accumulation of irreversible sliding of the elements, such as caused by uneven behaviour under alternate actions (cyclic thermal effects on the contact edges of simply supported elements).

(110) The effects of horizontal movements should be considered in design with respect to the resistance of the structure and the integrity of the joints. Proper bearing devices should be provided where necessary.

2.5.2 IDEALISATION OF THE STRUCTURE

2.5.2.1 Structural models for overall analysis

Addition after Application Rule (6):

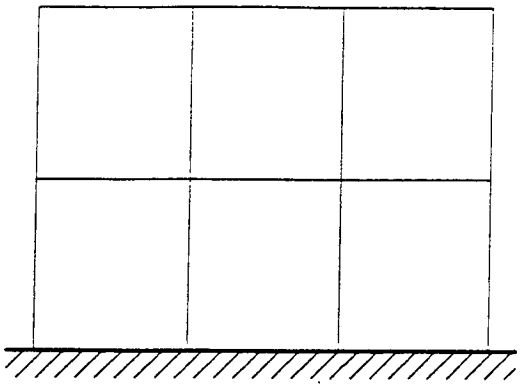
(107) In prefabrication the following structural systems are commonly used to ensure the overall stability. These and other systems may act alone or in combination:

a) Frame structures (Figure 2.106a), composed of linear precast elements (beams and columns). They may be designed either as cantilevering continuous columns (mainly for low rise buildings), or partly or wholly as a continuous framework.

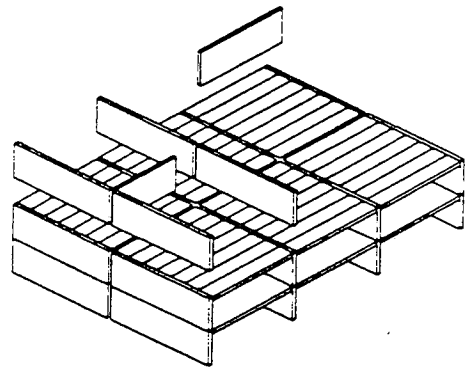
b) Cross wall structures or panel structures (Figure 2.106b) characterised by stiff in plane behaviour (shear walls) and hinged connections perpendicular to the plane direction (cross slabs). Longitudinal stability is obtained by walls or frames perpendicular to the cross walls.

c) Braced structures (Figure 2.106c) in which the beams and columns may have hinged joints. The horizontal stability is provided by bracing elements.

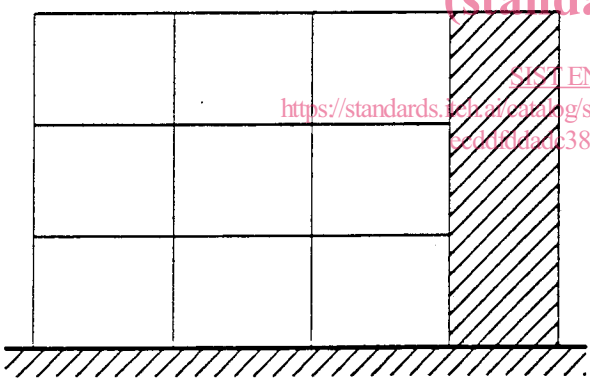
d) Floor or roof diaphragms (Figure 2.106d). Floors and roofs used to transfer horizontal forces to the bracing elements.



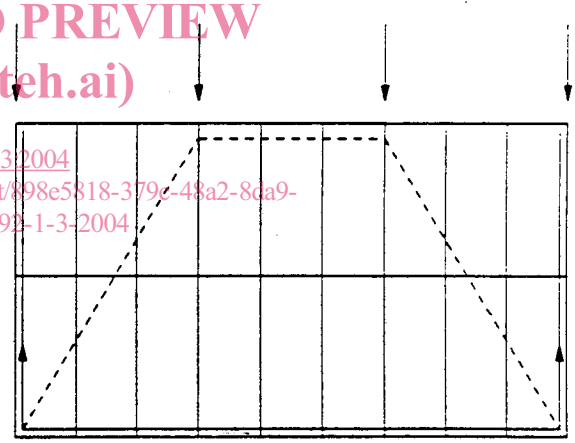
a) Frame Structure



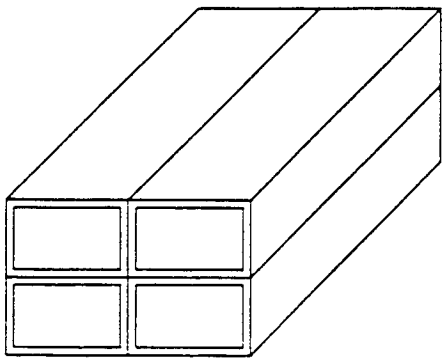
b) Cross Wall Structure (Panel Structures)

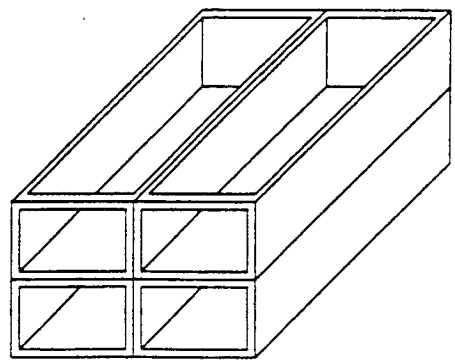


c) Braced Structure



d) Floor or Roof Diaphragm Plan





e) Cell Structure

Figure 2.106: Different Types of Structure