Eurokoodeks 1: Ehituskonstruktsioonide koormused. Osa 2: Sildade liikluskoormused

Eurocode 1: Actions on structures - Part 2: Traffic loads on bridges

EESTI STANDARDIKESKUS
ESTONIAN CENTRE FOR STANDARDISATION

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 1991-2:2004 sisaldab Euroopa standardi EN 1991-2:2003+AC:2010 ingliskeelset teksti.	This Estonian standard EVS-EN 1991-2:2004 consists of the English text of the European standard EN 1991-2:2003+AC:2010.
Standard on kinnitatud Eesti Standardikeskuse 18.06.2004 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.	This standard is ratified with the order of Estonian Centre for Standardisation dated 18.06.2004 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.
Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on 10.09.2003.	Date of Availability of the European standard text 10.09.2003.
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ICS 91.080, 93.040

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NORME EUROPÉENNE

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English version

Eurocode 1: Actions on structures - Part 2: Traffic loads on bridges

Eurocode 1: Actions sur les structures - Partie 2: Actions sur les ponts, dues au trafic

Eurocode 1: Einwirkungen auf Tragwerke - Teil 2: Verkehrslasten auf Brücken

This European Standard was approved by CEN on 28 November 2002.

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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Contents

Foreword

This document (EN 1991-2:2003) 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 March 2004, and conflicting national standards shall be withdrawn at the latest by December 2009.

This document supersedes ENV 1991-3:1995.

CEN/TC 250 is responsible for all Structural Eurocodes.

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, Slovakia, 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 agreement[1] 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 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).

[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).

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[2] referred to in Article 12 of the CPD, although they are of a different nature from harmonised product standards[3]. 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 ~~a~~ full compatibility of these technical specifications with the Eurocodes.

[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.

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,
– 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 works[4]. 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 1991-2

EN 1991-2 defines models of traffic loads for the design of road bridges, footbridges and railway bridges. For the design of new bridges, EN 1991-2 is intended to be used, for direct application, together with Eurocodes EN 1990 to 1999.

The bases for combinations of traffic loads with non-traffic loads are given in EN 1990, A2.

[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 (Interpretative Document Nr. 1)**.**

Complementary rules may be specified for individual projects :
– when traffic loads need to be considered which are not defined in this Part of Eurocode 1 (*e.g.* site loads, military loads, tramway loads) ;
– for bridges intended for both road and rail traffic ;
– for actions to be considered in accidental design situations ;
– for masonry arch bridges.

For road bridges, Load Models 1 and 2, defined in 4.3.2 and 4.3.3, and taken into account with adjustment factors α and β equal to 1, are deemed to represent the most severe traffic met or expected in practice, other than that of special vehicles requiring permits to travel on the main routes of European countries. The traffic on other routes in these countries and in some other countries may be substantially lighter, or better controlled. However it should be noted that a great number of existing bridges do not meet the requirements of this EN 1991-2 and the associated Structural Eurocodes EN 1992 to EN 1999.

It is therefore recommended to the national authorities that values of the adjustment factors α and β be chosen for road bridge design corresponding possibly to several classes of routes on which the bridges are located, but remain as few and simple as possible, based on consideration of the national traffic regulations and the efficiency of the associated control.

For railway bridges, Load Model 71 (together with Load Model SW/0 for continuous bridges), defined in 6.3.2, represent the static effect of standard rail traffic operating over the standard-gauge or wide-gauge European mainline-network. Load Model SW/2, defined in 6.3.3, represents the static effect of heavy rail traffic. The lines, or sections of lines, over which such loads shall be taken into account are defined in the National Annex (see below) or for the individual project.

Provision is made for varying the specified loading to cater for variations in the type, volume and maximum weight of rail traffic on different railways, as well as for different qualities of track. The characteristic values given for Load Models 71 and SW/0 may be multiplied by a factor α for lines carrying rail traffic which is heavier or lighter than the standard.

In addition two other load models are given for railway bridges :
– load model "unloaded train" for checking the lateral stability of single track bridges and
– load model HSLM to represent the loading from passenger trains at speeds exceeding 200 km/h.

Guidance is also given on aerodynamic actions on structures adjacent to railway tracks as a result of passing trains and on other actions from railway infrastructure.

Bridges are essentially public works, for which :
– the European Directive 89/440/EEC on contracts for public works is particularly relevant, and
– public authorities have responsibilities as owners.

Public authorities may also have responsibilities for the issue of regulations on authorised traffic (especially on vehicle loads) and for delivery and control dispensations when relevant, *e.g.* for special vehicles.

EN 1991-2 is therefore intended for use by :
– committees drafting standards for structural design and related product, testing and execution standards ;
– clients (*e.g.* for the formulation of their specific requirements on traffic and associated loading requirements) ;
– designers and constructors ;
– relevant authorities.

Where a Table or a Figure are part of a NOTE, the Table or the Figure number is followed by (n) (*e.g.* Table 4.5(n)).

National Annex for EN 1991-2

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 1991-2 should have a National Annex containing all Nationally Determined Parameters to be used for the design of bridges to be constructed in the relevant country.

National choice is allowed in EN 1991-2 through the following clauses :

Section 1 : General	
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5.2.3(2)	Definition of load models for inspection gangways
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5.3.2.3(1)P NOTE 1	Definition of service vehicles for footbridges
5.4(2)	Characteristic value of the horizontal force on footbridges

5.6.1(1)	Definition of specific collision forces
5.6.2.1(1)	Collision forces on piers
5.6.2.2(1)	Collision forces on decks
5.6.3(2) NOTE 2	Definition of a load model for accidental presence of a vehicle on a footbridge
5.7(3)	Definition of dynamic models of pedestrian loads

Section 6 : Rail traffic actions and other actions specifically for railway bridges	
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6.8.1(11)P Table 6.10	Number of tracks loaded when checking drainage and structural clearances
6.8.2(2) Table 6.11	Assessment of groups of loads
6.8.3.1(1)	Frequent values of multi-component actions
6.8.3.2(1)	Quasi-permanent values of multi-component actions
6.9(6)	Fatigue load models, structural life
6.9(7)	Fatigue load models, special traffic
Annex C(3)P	Dynamic factor
Annex C(3)P	Method of dynamic analysis
Annex D2(2)	Partial safety factor for fatigue loading

Section 1 General

1.1 Scope

(1) EN 1991-2 defines imposed loads (models and representative values) associated with road traffic, pedestrian actions and rail traffic which include, when relevant, dynamic effects and centrifugal, braking and acceleration actions and actions for accidental design situations.

(2) Imposed loads defined in EN 1991-2 are intended to be used for the design of new bridges, including piers, abutments, upstand walls, wing walls and flank walls etc., and their foundations.

(3) The load models and values given in EN 1991-2 should be used for the design of retaining walls adjacent to roads and railway lines.

NOTE For some models only, applicability conditions are defined in EN 1991-2. For the design of buried structures, retaining walls and tunnels, provisions other than those in EN 1990 to EN 1999 may be necessary. Possible complementary conditions may be defined in the National Annex or for the individual project.

(4) EN 1991-2 is intended to be used in conjunction with EN 1990 (especially A2) and EN 1991 to EN 1999.

(5) Section 1 gives definitions and symbols.

(6) Section 2 defines loading principles for road bridges, footbridges (or cycle-track bridges) and railway bridges.

(7) Section 3 is concerned with design situations and gives guidance on simultaneity of traffic load models and on combinations with non-traffic actions.

(8) Section 4 defines :

– imposed loads (models and representative values) due to traffic actions on road bridges and their conditions of mutual combination and of combination with pedestrian and cycle traffic (see section 5) ;

– other actions specifically for the design of road bridges.

(9) Section 5 defines :

– imposed loads (models and representative values) on footways, cycle tracks and footbridges ;

– other actions specifically for the design of footbridges.

(10) Sections 4 and 5 also define loads transmitted to the structure by vehicle restraint systems and/or pedestrian parapets.

(11) Section 6 defines :

– imposed actions due to rail traffic on bridges ;

– other actions specifically for the design of railway bridges and structures adjacent to the railway.

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).

EN 1317	Road restraint systems Part 1 : Terminology and general criteria for test methods Part 2 : Performance classes, impact test acceptance criteria and test methods for safety barriers Part 6 : Pedestrian restraint systems, pedestrian parapetparpets

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

EN 1990	Eurocode : Basis of Structural Design
EN 1991-1-1	Eurocode 1 : Actions on structures : Part 1-1 : General actions - Densities, self-weight imposed loads for buildings
EN 1991-1-3	Eurocode 1 : Actions on structures : Part 1-3 : General actions - Snow loads
prEN 1991-1-4	Eurocode 1 : Actions on structures : Part 1-4 : General actions - Wind actions
prEN 1991-1-5	Eurocode 1 : Actions on structures : Part 1-5 : General actions - Thermal actions
prEN 1991-1-6	Eurocode 1 : Actions on structures : Part 1-6 : General actions - Actions during execution
prEN 1991-1-7	Eurocode 1 : Actions on structures : Part 1-7 : General actions - Accidental actions
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 1997	Eurocode 7 : Geotechnical design
EN 1998	Eurocode 8 : Design of structures for earthquake resistance
EN 1999	Eurocode 9 : Design of aluminium structures

1.3 Distinction between Principles and Application Rules

(1) Depending on the character of the individual clauses, distinction is made in EN 1991-2 between Principles and Application Rules.

(2) The Principles comprise :
– general statements and definitions for which there is no alternative, as well as ;
– requirements and analytical models for which no alternative is permitted unless specifically stated.

(3) The Principles are identified by the letter P following the paragraph number.

(4) The Application Rules are generally recognised rules which comply with the Principles and satisfy their requirements.

(5) It is permissible to use alternative design rules different from the Application Rules given in EN 1991-2 for works, provided that it is shown that the alternative rules accord with the relevant Principles and are at least equivalent with regard to the structural safety, serviceability and durability which would be expected when using the Eurocodes.

NOTE If an alternative design rule is substituted for an Application Rule, the resulting design cannot be claimed to be wholly in accordance with EN 1991-2 although the design will remain in accordance with the Principles of EN 1991-2. When EN 1991-2 is used in respect of a property listed in an annex Z of a product standard or an ETAG[5], the use of an alternative design rule may not be acceptable for CE marking.

(6) In EN 1991-2, the Application Rules are identified by a number in brackets *e.g.* as this clause.

1.4 Terms and definitions

NOTE 1 For the purposes of this European Standard, general definitions are provided in EN 1990 and additional definitions specific to this Part are given below.

NOTE 2 Terminology for road restraint systems is derived from EN 1317-1.

1.4.1 Harmonised terms and common definitions

1.4.1.1
deck
parts of a bridge which carry the traffic loading over piers, abutments and other walls, pylons being excluded

1.4.1.2
road restraint system
general name for vehicle restraint system and pedestrian restraint system used on the road

NOTE Road restraint systems may be, according to use :
– permanent (fixed) or temporary (demountable, *i.e.* they are removable and used during temporary road works, emergencies or similar situations),
– deformable or rigid,
– single-sided (they can be hit on one side only) or double-sided (they can be hit on either side).

5 ETAG : European Technical Approval Guideline