SLOVENSKI PREDSTANDARD

SIST ENV 1991-3

prva izdaja
april 1999

Eurocode 1- Osnove projektiranja in vplivi na konstrukcije - 3. del: Prometne obtežbe mostov (prevzet ENV 1991-3:1995 z metodo platnice)

Eurocode 1 - Basis of design and actions on structures - Part 3: Traffic loads on bridges

Eurocode 1 - Bases du calcul et actions sur les structures - Partie 3: Charges sur les ponts dues au trafic

Eurocode 1 - Grundlagen der Tragwerksplanung und Einwirkungen auf Tragwerke - Teil 3: Verkehrslasten auf Brücken

Deskriptorji: mostovi, prometni pasovi, gradbene konstrukcije, projektiranje, gradbeni predpisi, račun konstrukcije, klasifikacije, specifikacije, obtežbe, napetosti, cestna vozila, nezgode, trki

ICS 93.040

Referenčna številka
SIST ENV 1991-3:1999 ((sl),en)

Nadaljevanje na straneh od II do III in od 1 do 130

NACIONALNI UVOD

Predstandard SIST ENV 1991-3 ((sl),en), Eurocode 1 - Osnove projektiranja in vplivi na konstrukcije - 3. del: Prometna obtežba mostov, prva izdaja, 1999, ima status slovenskega predstandarda in je z metodo platnice prevzet evropski predstandard ENV 1991-3, Eurocode 1 - Basis of design and actions on structures - Part 3: Traffic loads on bridges, 1995, v angleškem jeziku.

NACIONALNI PREDGOVOR

Evropski predstandard ENV 1991-3:1995 je pripravil tehnični odbor Evropskega komiteja za standardizacijo CEN/TC 250 Konstrukcije, pododbor SC 1 Osnove projektiranja in vplivi na konstrukcije.

Odločitev za prevzem tega predstandarda po metodi platnice je sprejela delovna skupina USM/TC KON/WG 1 Osnove projektiranja in vplivi na konstrukcije, ki je pripravila tudi nacionalne parametre za uporabo v Sloveniji, potrdil pa tehnični odbor USM/TC KON Konstrukcije.

Ta slovenski predstandard je dne 1999-01-28 odobril direktor USM.

Rok veljavnosti tega predstandarda je tri leta od njegove izdaje oziroma do izdaje slovenskega standarda SIST EN 1991-3.

ZVEZE S STANDARDI

S prevzemom tega evropskega predstandarda veljajo naslednje zveze:

SIST ENV 1991-1:1998	Eurocode 1 - Osnove projektiranja in vplivi na konstrukcije - 1. del: Osnove projektiranja
SIST ENV 1991-2-1:1998	Eurocode 1 - Osnove projektiranja in vplivi na konstrukcije - Del 2-1: Vplivi na konstrukcije - Gostote, lastna teža in koristne obtežbe
ENV 1991-2-2:1995*	Eurocode 1 - Osnove projektiranja in vplivi na konstrukcije - Del 2-2: Vplivi na konstrukcije - Vplivi požara na konstrukcije
SIST ENV 1991-2-3:1998	Eurocode 1 - Osnove projektiranja in vplivi na konstrukcije - Del 2-3: Vplivi na konstrukcije - Obtežbe snega
SIST ENV 1991-2-4:1998	Eurocode 1 - Osnove projektiranja in vplivi na konstrukcije - Del 2-4: Vplivi na konstrukcije - Vplivi vetra
ENV 1991-2-5:1997*	Eurocode 1 - Osnove projektiranja in vplivi na konstrukcije - Del 2-5: Vplivi na konstrukcije - Vplivi temperaturnih sprememb
ENV 1991-2-6:1997*	Eurocode 1 - Osnove projektiranja in vplivi na konstrukcije - Del 2-6: Vplivi na konstrukcije - Vplivi med gradnjo
ENV 1991-2-7**	Eurocode 1 - Osnove projektiranja in vplivi na konstrukcije - Del 2-7: Vplivi na konstrukcije - Nezgodni vplivi zaradi udarov in eksplozij
ENV 1991-4:1995*	Eurocode 1 - Osnove projektiranja in vplivi na konstrukcije - 4. del: Vplivi v silosih in rezervoarjih
ENV 1991-5**	Eurocode 1 - Osnove projektiranja in vplivi na konstrukcije - 5. del: Vplivi žerjavov in strojev

* Dokument bo predvidoma prevzet kot SIST.
** Dokument je v fazi izdelave in bo predvidoma prevzet kot SIST.

ENV 1992	Eurocode 2 - Projektiranje betonskih konstrukcij
ENV 1993	Eurocode 3 - Projektiranje jeklenih konstrukcij
ENV 1994	Eurocode 4 - Projektiranje sovprežnih konstrukcij
ENV 1995	Eurocode 5 - Projektiranje lesenih konstrukcij
ENV 1996	Eurocode 6 - Projektiranje zidanih konstrukcij
ENV 1997	Eurocode 7 - Geotehnično projektiranje
ENV 1998	Eurocode 8 - Projektiranje konstrukcij na potresnih področjih
ENV 1999	Eurocode 9 - Projektiranje konstrukcij iz aluminijevih zlitin

Navedeni so nekateri standardi, ki so že objavljeni kot ENV, večinoma pa so v pripravi in bodo kot ENV predvidoma objavljeni v času veljavnosti tega predstandarda.

PARAMETRI ZA UPORABO V SLOVENIJI

Za vse parametre, ki določajo stopnjo varnosti in zanesljivosti konstrukcij, se v SIST ENV 1991-3 uporabljajo priporočene vrednosti, ki so zapisane v ENV 1991-3 v oglatih oklepajih (uokvirjene vrednosti).

Za vrednosti prostega koeficienta α se uporablja:

- za avtoceste α =1,0
- za drugo cestno mrežo α = 1,0

OPOMBI

- Povsod, kjer se v besedilu predstandarda uporablja izraz “evropski predstandard”, v SIST ENV 1991-3:1999 to pomeni “slovenski predstandard”.
- Uvod in nacionalni predgovor nista sestavni del predstandarda.

EUROPEAN PRESTANDARD

PRÉNORME EUROPÉENNE

EUROPÄISCHE VORNORM

ENV 1991-3

March 1995

ICS 93.040

Descriptors: bridges, traffic lanes, structures, design, building codes, computation, classifications, specifications, loads, stresses, roads vehicles, accidents, collisions

English version

Eurocode 1 - Basis of design and actions on structures - Part 3: Traffic loads on bridges

Eurocode 1 - Bases de calcul et actions sur les structures - Partie 3: Charges sur les ponts dues au trafic

Eurocode 1: Grundlagen der Tragwerksplanung und Einwirkungen auf Tragwerke - Teil 3: Verkehrslasten auf Brücken

This European Prestandard (ENV) was approved by CEN on 1994-09-22 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

Ref. No. ENV 1991-3:1995 E

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 harmonised technical specifications for products and for methods of testing their performance is available, some of the Structural Eurocodes cover some of these aspects in informative annexes.

Background to 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 works 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/TC 250 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 of structures for earthquake resistance
EN 1999	Eurocode 9	Design of aluminium alloy structures

(8) A separate sub-committee has been formed by CEN/TC250 for each of Eurocodes listed above.

(9) This Part of ENV 1991, which has benefited from preliminary studies made by CEC and UIC (Union Internationale des Chemins de Fer), and has been finalised in accordance with a mandate issued by CEC, is being published as a European Prestandard with an initial life of three years.

(10) This Prestandard is intended for experimental application.

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

(12) Meanwhile feedback and comments on this Prestandard should be sent to the Secretariat of Sub-committee CEN/TC250/SC1 at the following address :

until end May 1995 :	from June 1995 :
SNV / SIA	SIS / BST
Selnaustrasse 16	Box 5630
CH - 8039 ZURICH	S - 11486 STOCKHOLM
SWITZERLAND	SWEDEN

or to your National Standards organisation.

National Application Documents

(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 ☐ or [ ] ("boxed values"). The authorities in each member country are expected to review the "boxed values" and may substitute alternative definitive values for these safety elements for use in national application.

(14) Bridges are essentially public works, for which :

- the European Directive 89/440/CEC on contracts for public works is particularly relevant, and

- public authorities have responsibilities as owners.

In addition, public authorities also have responsibilities for the issue of regulations on authorised traffic (especially on vehicle loads) and for delivery and control dispensations when relevant, eg. for special vehicles. In this respect, it is assumed that the authorities having these responsibilities will cooperate closely with those responsible for the design and reassessment of bridges (see the clauses and Notes dealing with the basis and conditions of numerical validity of this Prestandard).

Within this context this Prestandard has been established with two main objectives :

- to be sufficiently precise and comprehensive for contractual use,

- to be sufficiently flexible to allow the relevant authorities and their designers fully to exert their technical responsibilities.

(15) Because of the responsibilities of public authorities for bridges, it has been anticipated that, for the application of this Part, it will be supplemented by :

- general complementary rules and options to be provided by National Application Documents (NAD - see (16) below) and

- complementary and/or modifying specifications for particular projects.

Wherever this Prestandard mentions "unless otherwise specified", it is intended that the relevant authorities (to be identified, if relevant, in the particular NADs) will remain free to intervene at either of the two levels above. It is the same where this Prestandard refers to the "client", if the client is not the relevant authority itself.

Information supplementing the Notes given in this Prestandard is given below to assist the preparation of the NADs.

(16) Some of the necessary 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 any mandatory values to be substituted for "boxed" values, referencing compatible supporting Standards and providing guidance on the national application of this Prestandard, will be issued by each member country or its Standards Organization.

(17) It is intended that this Prestandard will be used in conjunction with the particular NAD valid in the country in which the bridges are located.

Matters specific to this Prestandard

(18) The scope of Eurocode 1 is defined in clause 1.1.1 and the scope of this Part of Eurocode 1 is defined in clause 1.1.2. Additional Parts of Eurocode 1 which are planned are indicated in clause 1.1.3.

(19) This Prestandard is divided into six sections :

- three general sections 1 to 3 of common clauses
- three sections 4 to 6 dealing with road traffic loads, pedestrian and cycle loads, and railway traffic loads, respectively, and also with other loads specifically for road bridges, footbridges and railway bridges, respectively.

The limits of validity of the contents of these sections are defined. Beyond these limits, rules shall be given by NAD or specifically for particular projects.

Boxed values for partial load factors and ψ factors are given in annexes C, D and G.

(20) The bases for combinations of traffic loads with non-traffic loads are introduced in section 3, and developed in annexes C, D and G. They are intended to be applied in conjunction with other Parts of ENV 1991 and with the Parts of ENV 1992 to 1995 which are relevant for bridges.

If necessary, the NADs may make complementary reference to other documents.

When traffic loads need to be considered which are not codified in this Prestandard (eg. site loads, military loads, tramway loads) and which are not sufficiently treated in the NADs, complementary rules may be specified for particular projects.

Complementary rules may also be specified for bridges intended for both road and rail traffic.

Complementary rules will also often be necessary for accidental actions to be considered in design, see the notes in 2.3.

(21) Actions due to road traffic are represented in section 4 by a series of load models which represent different traffic and different components (eg. horizontal forces) of traffic action. Specific models are given for verification relating to fatigue.

(a) Load Models 1 and 2, defined in 4.3, are considered (with adjustment factors α and β equal to 1) to represent the most severe traffic met or expected in practice 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 Prestandard and the associated design codes ENV 1992 to 1995.

It is therefore recommended to the national authorities that values of the adjustment factors α be chosen for bridge design corresponding possibly to several classes of routes on which the bridges are located. Information on the numerical bases of Load Models 1 and 2 has already been issued and it is intended that further information will be provided in background documents.

It is recommended that the adjustment factors chosen are as few and simple as possible based on consideration of the national traffic regulations and the efficiency of the associated control. For the minimum of α_{Q1}, it is also recommended that the boxed value $\boxed{0,8}$ specified in 4.3.2(7) is not reduced without a precise justification for the relevant country.

(b) Load Model 3 (special vehicles) is intended in this Prestandard to be taken into account only where and as far as specified by the relevant authority. These decisions shall be supplemented, when relevant, by also specifying the associated traffic conditions, as mentioned in notes, and the degree of supervision provided by the police. In order to reduce as much as possible the diversity of such models in Europe, it is suggested that, in cases in which the relevant authority is selecting special vehicles for particular bridge designs, priority be given to special vehicles 900/150, 1800/200 and 3000/240 defined in annex A to section 4.

(c) Load Model 4 (crowd loading on road bridges) is also intended in this Prestandard to be taken into account only where specified by the relevant authority, especially for some bridges located in dense urban areas. It has been developed from observations during special events, eg. at the inauguration of important bridges.

(d) For verifications regarding fatigue, a series of alternative models is provided to be used depending on the verification level selected from the relevant design codes. Except in the simplest case where reference is made to Fatigue Load Model 1, the relevant authorities may, depending on the case and the expected traffic, have to :

- confirm or amend some numerical values given in this Prestandard and/or

- specify or approve complementary data for the use of the models, including traffic records.

(22) Actions due to pedestrian and cycle traffic are defined in section 5. Other actions, variable or accidental, specifically for footbridges are also defined. For these other actions, complementary data are required from the relevant authorities and decisions are needed by them, for a part to be specified in the NAD, and, for the remainder, for the particular projects.

In the few cases in which a dynamic analysis should be performed, appropriate load models should be taken.

(23) Actions due to rail traffic are defined in section 6 by reference to two Load Models 71 and SW relating to the two main types of traffic. Associated actions including dynamic effects, braking and traction forces, centrifugal forces, nosing force, and certain specific requirements are covered by means of factors, equations, diagrams or tables. Load spectra are given for the purpose of carrying out fatigue checks.

(a) Load Model 71, defined in 6.3.2, represents the static effect of standard rail traffic operating over the standard-gauge or wide-gauge European mainline-network.

(b) Load Models SW, defined in 6.3.3, represent the static effect of heavy rail traffic. Two load classifications, SW/0 and SW/2, are considered. The relevant authority is required to specify the lines, or sections of lines, over which such loads shall be taken into account.

(c) 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, to be specified by the relevant authority, for lines carrying rail traffic which is heavier or lighter than the standard (see 6.3.2(3)P).

(d) 6.4 gives detailed rules for the assessment of dynamic effects on bridges created by rail traffic. Generally, such effects may be adequately covered by the use of a dynamic amplification factor. In some cases, however, where there is the possibility of resonance or excessive vibrations of the deck, a specific check will be required. This is more likely for very high speed traffic.

Note : For such specific check see annex H.

(e) For the consideration of centrifugal forces, it is necessary to make provision in the rules for the fact that heavy traffic does not operate at high speeds whereas high speed passenger trains have light axle loading. Centrifugal forces depend on the loaded length of the bridge and on the maximum permissible speed. These variables are taken into account by multiplying Load Model 71 by a factor *f*, for which values and specific application rules are given in 6.5.1.

(f) Fatigue Models for steel bridges are based on specified load spectra for which results are presented in terms of a reference loading (Load Model 71) which is multiplied by a factor λ to take into account the effect of the load spectra passing over influence lines of various lengths. This factor is defined in terms of the span length of the structural member being considered, the tonnage of traffic crossing the bridge and the specified life of the structure.

Two main traffic combinations, based on the twelve reference service trains identified, are specified in annex F. Values of the factor λ have been defined for a range of spans and will be included in ENVs 1992 to 1994.

(g) Unless the track over the bridge is separated at each end by means of an adjustment switch, the interaction between the track and the bridge will produce additional forces. Requirements for limiting these forces and taking them into account are given in 6.5.4.

(h) For railway bridges, the deformations and vibrations caused by the passage of rail traffic have to be limited for safety considerations and passenger comfort. Principles and application rules dealing with these requirements are given in annex G.

Note : See also annex H.

Section 1 General

1.1 Scope

1.1.1 Scope of ENV 1991 - Eurocode 1

(1)P ENV 1991 provides general principles and actions for the structural design of building and civil engineering works including some geotechnical aspects and shall be used in conjunction with ENV 1992-1999.

(2) It may also be used as a basis for the design of structures not covered in ENV 1992-1999 and where other materials or other structural design actions are involved.

(3) ENV 1991 also covers structural design for construction conditions and structural design for temporary structures. It relates to all circumstances in which a structure is required to give adequate performance.

(4) ENV 1991 is not directly intended for the structural appraisal of existing construction, in developing the design of repairs and alterations, or for assessing changes of use, but may be so used where applicable.

(5) ENV 1991 does not completely cover special design situations which require unusual reliability considerations such as nuclear structures for which other specified design procedures should be used.

1.1.2 Scope of ENV 1991-3 - Traffic loads on bridges

(1) Part 3 of ENV 1991 specifies imposed loads (models and representative values) associated with road traffic, pedestrian actions and rail traffic which include, when relevant, dynamic effects and centrifugal, braking, acceleration and accidental forces.

(2) Section 1 defines common definitions and notation.

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

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

(5) Section 4 specifies :

- Imposed loads (models and representative values) due to the 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.

(6) Section 5 specifies :

- Imposed loads (models and representative values) associated with pedestrian and cycle actions on road bridges, footbridges and railway bridges.

- Other actions specifically for the design of footbridges.

(7) Sections 4 and 5 also specify loads on parapets.

(8) Section 6 specifies :

- Imposed actions due to rail traffic on bridges ;

- Other specific actions which railway bridges shall be designed to sustain.

1.1.3 Further Parts of ENV 1991

(1) Further Parts of ENV 1991 which, at present, are being prepared or planned are given in 1.2.

1.2 Normative references

This European Prestandard incorporates by dated or undated reference, provisions from other standards. These normative references are cited at the appropriate places in the text and publications listed hereafter.

ISO 3898 1987	Basis of design for structures Notations. General symbols.

Note : The following European prestandards which are published or in preparation are cited at the appropriate places in the text and publications listed hereafter.

ENV 1991-1	Eurocode 1 : Basis of design and actions on structures Part 1 : Basis of Design
ENV 1991-2-1	Eurocode 1 : Basis of design and actions on structures Part 2.1 : Densities, self-weight and imposed loads
ENV 1991-2-2	Eurocode 1 : Basis of design and actions on structures Part 2.2 : Actions on structures exposed to fire
ENV 1991-2-3	Eurocode 1 : Basis of design and actions on structures Part 2.3 : Snow loads
ENV 1991-2-4	Eurocode 1 : Basis of design and actions on structures Part 2.4 : Wind loads
ENV 1991-2-5	Eurocode 1 : Basis of design and actions on structures Part 2.5 : Thermal actions
ENV 1991-2-6	Eurocode 1 : Basis of design and actions on structures Part 2.6 : Loads and deformations imposed during execution