SLOVENSKI STANDARD
SIST ENV 1991-5:2004

01-september-2004

Eurocode 1: Osnove projektiranja in vplivi na konstrukcije – 5. del: Vpliv žerjavov in drugih strojev

Eurocode 1: Basis of design and actions on structures - Part 5: Actions induced by cranes and other machinery

Eurocode 1: Grundlagen der Tragwerksplannung und Einwirkungen auf Tragwerke - Teil 5: Einwirkungen aus Kränen und anderen Maschinen

Eurocode 1: Bases de calcul et actions sur les structures - Partie 5: Actions induites par les ponts roulants et autres machines

Ta slovenski standard je istoveten z: **ENV 1991-5:1998**

ICS:

91.010.30	Tehniļ ni vidiki	Technical aspects

SIST ENV 1991-5:2004 **en**

EUROPEAN PRESTANDARD
PRÉNORME EUROPÉENNE
EUROPÄISCHE VORNORM

ENV 1991-5

November 1998

ICS 91.010.30

Descriptors: civil engineering, structures, design, construction, building codes, computation, loads, cranes, machinery

English version

Eurocode 1: Basis of design and actions on structures - Part 5: Actions induced by cranes and other machinery

Eurocode 1: Bases de calcul et actions sur les structures - Partie 5: Actions induites par les ponts roulans et autres machines

Eurocode 1: Grundlagen der Tragwerksplannung und Einwirkungen auf Tragwerke - Teil 5: Einwirkungen aus Kränen und anderen Maschinen

This European Prestandard (ENV) was approved by CEN on 23 May 1997 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 a European Standard.

CEN members are required to announce the existence 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, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

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

Ref. No. ENV 1991-5:1998 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 harmonized technical specifications for products and for the methods of testing their performances are available, some of the Structural Eurocodes cover some of these aspects in informative annexes.

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 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/TC 250 for each of Eurocodes listed above.

(9) This Part of Eurocode 1, which has been finalised in accordance with a mandate issued by CEC, is being published as a European Prestandard (ENV) 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:

SIS / BST
Box 490 44
S-100 28 STOCKHOLM
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 ☐ ("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) 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.

(15) It is intended that this Prestandard will be used in conjunction with the particular NAD valid in the country in which buildings or civil engineering works are located.

Matters specific to this Prestandard

(16) 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.

(17) This Part of Eurocode 1 is divided into three sections:

– a general section 1 of common clauses;
– two sections 2 to 3 dealing with action induced by cranes on runways and actions induced by other machinery.

The three sections are complemented by seven annexes, A to G, some normative and some informative. The normative annexes have the same status as the sections to which they relate.

The limits of validity of the contents of the sections are defined. Where additional rules are needed they shall be given in the NAD or be specified for the particular project. Boxed values for partial load factors and ψ factors are given in annexes A, C and G.

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 procedure should be used.

1.1.2 Scope of ENV 1991-5 - Actions induced by cranes and other machinery

(1) Part 5 of ENV 1991 specifies imposed loads (models and representative values) associated with cranes on runway beams, stationary machines and transport vehicles which include, when relevant, dynamic effects and braking, acceleration and accidental forces.

(2) Section 1 defines common definitions and notations.

(3) Section 2 specifies actions induced by cranes on runways.

(4) Section 3 specifies actions induced by stationary machines.

(5) Annex G specifies imposed loads on floors from forklift trucks, road and rail vehicles, maintenance devices and helicopter.

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

(1) 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 3898:1997 Basis for design of 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 actions
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
ENV 1991-2-7	Eurocode 1: Basis of design and actions on structures Part 2.7: Accidental actions
ENV 1991-3	Eurocode 1: Basis of design and actions on structures Part 3: Traffic actions on bridges
ENV 1991-4	Eurocode 1: Basis of design and actions on structures Part 4: Actions in silos and tanks
ENV 1992	Eurocode 2: Design of concrete structures
ENV 1993	Eurocode 3: Design of steel structures
ENV 1994	Eurocode 4: Design of composite steel and concrete structures
ENV 1995	Eurocode 5: Design of timber structures
ENV 1996	Eurocode 6: Design of masonry structures
ENV 1997	Eurocode 7: Geotechnical design
ENV 1998	Eurocode 8: Design of structures for earthquake resistance
ENV 1999	Eurocode 9: Design of aluminium alloy structures
ENV 13001-1	Cranes-Safety-Design-General Part 1: General principles and requirements
ENV 13001-2	Cranes-Safety-Design-General Part 2: Load effects

1.3 Distinction between principles and application rules

(1) Depending on the character of the individual clauses, distinction is made in this Part 5 of ENV 1991 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 recognized rules which follow the principles and satisfy their requirements.

(5) It is permissable to use alternative rules different from the application rules given in this Eurocode, provided it is shown that the alternative rules accord with the relevant principles and have at least the same reliability.

(6) In this Part 5 of ENV 1991 the application rules are identified by a number in brackets, e.g. as this clause.

1.4 Definitions

(1) For the purposes of this Prestandard, a basic list of definitions is provided in ENV 1991-1, "Basis of design" and the additional definitions given below in 1.4.1 and 1.4.2 are specific to this Part of ENV 1991.

1.4.1 Terms and definitions specifically for hoists and cranes on runway beams

1.4.1.1 Dynamic factor: Factor that covers dynamic effects as from vibrational excitations, impact etc.

1.4.1.2 Selfweight Q_C of the crane: Selfweight of all fixed and movable elements including the mechanical and electrical equipment of a crane structure, however without the lifting attachment and a portion of the suspended hoist ropes or chains moved by the crane structure, see 1.4.1.3.

1.4.1.3 Hoistload Q_H: It includes the masses of the payload, the lifting attachment and a portion of the suspended hoist ropes or chains moved by the crane structure, see Figure 1.1.

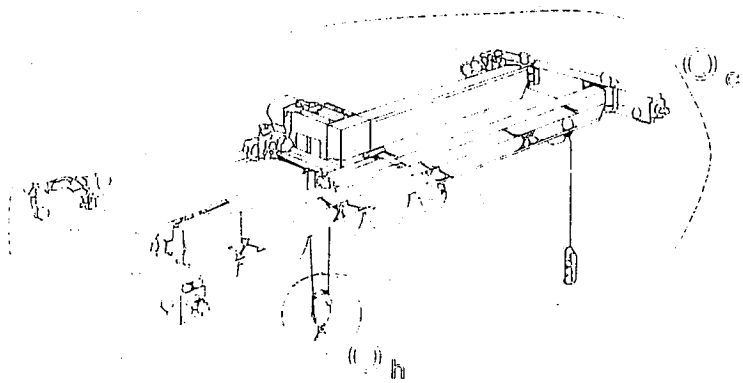

Figure 1.1: Definition of the hoistload and the selfweight of a crane

1.4.1.4 Crab: Part of an overhead travelling crane that incorporates a hoist and is able to travel on rails on the top of the crane bridge.

1.4.1.5 Crane bridge: Part of an overhead travelling crane that spans between the crane runway beams and supports the crab.

1.4.1.6 Guidance means: System used to keep a crane aligned on a runway, through horizontal reactions between the crane and the runway beams. The guidance means can consist of flanges on the crane wheels or a separate system of guide rollers operating on the side of the crane rails or the side of the runway beams.

1.4.1.7 Hoist: A machine for lifting loads.

1.4.1.8 Hoist block: An underslung trolley that incorporates a hoist and is able to travel on the bottom flange of a beam, either on a fixed runway (as shown in Figure 1.2) or under the bridge of an overhead travelling crane (as shown in Figures 1.3 and 1.4).

1.4.1.9 Overhead travelling crane: A machine for lifting and moving loads, that moves on wheels along overhead crane runway beams. It incorporates one or more hoists mounted on crabs or underslung trolleys.

1.4.1.10 Runway beam for hoist block: Crane runway beam provided to support a monorail hoist block that is able to travel on its bottom flange, see Figure 1.2.

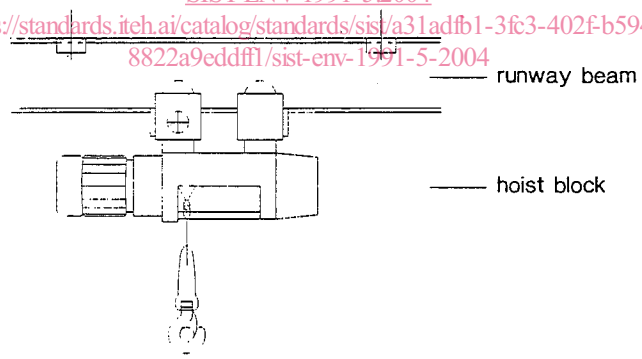

Figure 1.2: Runway beam with hoist block

1.4.1.11 Underslung crane: Overhead travelling crane that is supported on the bottom flanges of the crane runway beams, see Figure 1.3.

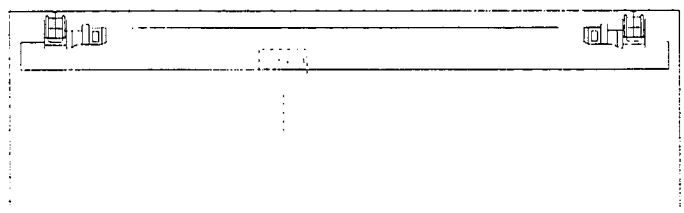

Figure 1.3: Underslung crane with hoist block

1.4.1.12 Top-mounted crane: Overhead travelling crane that is supported on the top of the crane runway beam. It usually travels on rails, but sometimes travels directly on the top of the beams, see Figure 1.4.

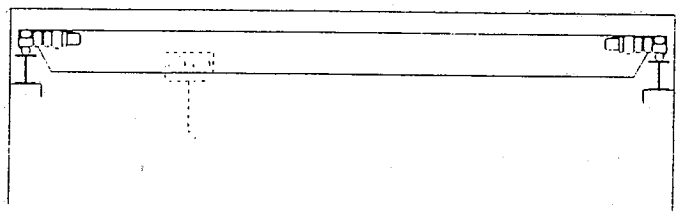

Figure 1.4: Top mounted crane with hoist block

1.4.2 Terms and definitions specifically for actions induced by machines

1.4.2.1 Natural frequency: The dynamic property of an elastic body or system by which it oscillates repeatedly from a fixed reference point when the external force is removed.

1.4.2.2 Free vibration: Vibration process of a system excited initially, which may be in the form of initial displacement or velocity, but no more time-varying force acting on it.

1.4.2.3 Forced vibration: Vibration process of a system which is caused by external time-varying loads acting on it.

1.4.2.4 Damping: Damping is dissipation of energy in a vibrating system.

1.4.2.5 Resonance: Resonance of a system in forced vibration is a condition when any change, however small, in the frequency of excitation causes a decrease in the response of the system.

1.4.2.6 Mode of vibration: In a system undergoing vibration, a mode of vibration is a characteristic pattern assumed by the system in which the motion of every particle is simple harmonic with the same frequency. Two or more modes may exist concurrently in a multi-degree freedom system.

1.5 Symbols

(1) For the purpose of this Prestandard, the following notation applies:

NOTE: The notation used is based on ISO 3898:1997

(2) A basic list of notations is provided in ENV 1991-1, "Basis of design" and the additional notations below are specific to this part.

Latin upper case letters

C	total number of working cycles during the design life of a crane
F	static component of a crane action
F_k	characteristic value of a crane action
F_w	Forces caused by in service wind
H_B	buffer force
H_L	longitudinal loads caused by acceleration and deceleration
H_S	horizontal loads caused by skewing
H_T	transverse loads caused by acceleration and deceleration
H_{TA}	tilting force
K	drive force
Qc	selfweight of the crane
Q_h	hoistload
Q_T	test load
S	guide force S caused by skewing
S_B	spring constant of the buffers

Latin lower case letters

h	distance between the instantaneous slide pole and means of guidance
kQ	load spectrum factor
m_c	mass of the crane
m_w	number of single wheel drives
n	number of wheel pair
n_r	number of runway beams

Greek lower case letters

α	skewing angle
λ	damage equivalent factor
μ	friction factor
φ_i	dynamic factor
φ_{fat}	damage equivalent dynamic impact factor

NOTE: Notations and Symbols which are not listed above are explained in the text where they first appear.