SLOVENSKI STANDARD
SIST EN 13230-1:2009

01-september-2009

Nadomeġļa:
SIST EN 13230-1:2004
SIST EN 13230-1:2004/AC:2006

Železniške naprave - Zgornji ustroj - Betonski pragi in kretniški betonski pragi - 1. del: Splošne zahteve

Railway applications - Track - Concrete sleepers and bearers - Part 1: General requirements

Bahnanwendungen - Oberbau - Gleis- und Weichenschwellen aus Beton - Teil 1: Allgemeine Anforderungen

Applications ferroviaires - Voie - Traverses et supports en béton - Partie 1 : Prescriptions générales

Ta slovenski standard je istoveten z: **EN 13230-1:2009**

ICS:

45.080	Traļnice in ġeleznigki deli	Rails and railway components
91.100.30	Beton in betonski izdelki	Concrete and concrete products

SIST EN 13230-1:2009 **en,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 13230-1

June 2009

ICS 91.100.30; 93.100

Supersedes EN 13230-1:2002

English Version

Railway applications - Track - Concrete sleepers and bearers - Part 1: General requirements

Applications ferroviaires - Voie - Traverses et supports en béton - Partie 1 : Prescriptions générales

Bahnanwendungen - Oberbau - Gleis- und Weichenschwellen aus Beton - Teil 1: Allgemeine Anforderungen

This European Standard was approved by CEN on 13 May 2009.

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 CEN 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 CEN Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

Foreword 4

Introduction 5

1 Scope 6

2 Normative references 6

3 Terms and definitions 7

4 Common characteristics 8
4.1 General 8
4.2 Loading 9
4.2.1 Loads 9
4.2.2 Load distribution 9
4.3 Design bending moments 9
4.3.1 General 9
4.3.2 Bending moments at rail seat 9
4.3.3 Bending moments at the centre part 10
4.4 Data to be supplied 10
4.4.1 General 10
4.4.2 Data to be supplied by the purchaser 10
4.4.3 Data to be supplied by the supplier 11

5 Materials 11
5.1 General requirements 11
5.2 Cement 12
5.3 Aggregates 12
5.4 Mixing water 13
5.5 Admixtures 13
5.6 Concrete 13
5.7 Steel 14
5.7.1 Prestressing tendons 14
5.7.2 Reinforcing steel 14
5.7.3 Steel connecting bar 14
5.8 Embedded components 14

6 General requirements 14
6.1 Design 14
6.1.1 Geometrical design 14
6.1.2 Concrete cover 17
6.1.3 Prestressing system design 17
6.1.4 Reinforcing steel design 17
6.2 Manufacturing process 17
6.2.1 General requirements 17
6.2.2 Natural curing 18
6.2.3 Accelerated curing 18
6.3 Surface finish 20
6.4 Marking 20

7 Product testing 20
7.1 General 20
7.2 Mechanical parameters 21
7.3 Tests on product 21
7.4 Tests on concrete 22
7.5 Tests in combination with the fastening system 22

7.6 Additional tests 22

8 Quality control 22
8.1 General 22
8.2 Quality control during design approval tests 23
8.3 Quality control during manufacturing 23

Annex A (informative) Test method to determine the Taber Wear index for a fine aggregate 24
A.1 General 24
A.2 Apparatus 24
A.3 Preparation of Mortar Tiles 24
A.3.1 Sampling 24
A.3.2 Mortar Tile preparation 24
A.3.3 Mortar Tile curing 25
A.3.4 Grinding of Mortar Tiles 25
A.4 Test procedure 25
A.5 Calculation of Taber Wear Index 25

Annex B (informative) Test method for freeze-thaw resistance 26

Annex C (informative) Test method for measuring the water absorption of concrete at atmospheric pressure 27
C.1 Introduction 27
C.2 Samples 27
C.3 Sequence of test 27
C.4 Requirements 28

Annex D (informative) Definition and recommendation for measurement of rail seat inclination and twist between rail seats 29

Annex E (informative) Bending moment calculation 30

Annex F (informative) Surface finish 31
F.1 General 31
F.2 General information for surface finish 31
F.3 Surface finish of the rail seat 31
F.4 Surface finish of all other surfaces 32
F.5 Detailed procedure for remedial work 32

Annex G (informative) Quality control during manufacturing – Routine tests and frequency of testing 33
G.1 General 33
G.2 Data of the sleeper to be checked 33
G.3 Examples for frequency of testing 34

Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2008/57/EC 35

Bibliography 39

Foreword

This document (EN 13230-1:2009) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

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 December 2009, and conflicting national standards shall be withdrawn at the latest by December 2009.

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

This document supersedes EN 13230-1:2002.

This European Standard is one of the series EN 13230 "Railway applications – Track – Concrete sleepers and bearers", which consist of the following parts:

— Part 1: General requirements

— Part 2: Prestressed monoblock sleepers

— Part 3: Twin-block reinforced sleepers

— Part 4: Prestressed bearers for switches and crossings

— Part 5: Special elements

This EN is used as the technical basis for transaction between corresponding parties (purchaser – supplier).

Annexes A to G are informative; they can be used as normative requirements by completion of a contract, if agreed by the contractors.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EC Directive 2008/57/EC.

For relationship with EC Directive 2008/57/EC, see informative Annex ZA, which is an integral part of this document.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This part of the standard covers the general requirements for concrete sleepers and bearers and is used in conjunction with the following parts:

— Part 2: Prestressed monoblock sleepers

— Part 3: Twin-block reinforced sleepers

— Part 4: Prestressed concrete bearers for switches and crossings

— Part 5: Special elements

Concrete sleepers and bearers are safety critical components for railway applications. They are not covered by any other standards.

As safety critical components, an agreement is needed between purchaser and supplier to operate a factory Quality System.

This position has always been highlighted by resolutions from CEN/TC 256/SC 1 "Railway applications / Track".

1 Scope

This part of EN 13230 defines technical criteria and control procedures which have to be satisfied by the constituent materials and the finished concrete sleepers and bearers, i.e.: precast concrete sleepers, bearers for switches and crossings, and special elements for railway tracks.

The main requirement of concrete sleepers and bearers is the transmission of vertical, lateral and longitudinal loads from the rails to the ballast or other support. In use they are also exposed to frost damage and to moisture, which can result in detrimental chemical reactions within the sleeper.

In this standard mechanical tests are defined which provide assurance of the capability of sleepers or bearers to resist repetitive loading and provide sufficient durability. In addition controls are placed on manufacturing processes and tests to ensure that the concrete will not suffer degradation in service through chemical reaction and frost damage.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 197-1, *Cement – Part 1: Composition, specifications and conformity criteria for common cements*

EN 206-1, *Concrete – Part 1: Specification, performance, production and conformity*

EN 934-2, *Admixtures for concrete, mortar and grout – Part 2: Concrete admixtures – Definitions, requirements, conformity, marking and labelling*

EN 1008, *Mixing water for concrete – Specification for sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete*

EN 10080, *Steel for the reinforcement of concrete – Weldable reinforcing steel – General*

prEN 10138 (all parts), *Prestressing steels*

EN 12620, *Aggregates for concrete*

EN 13146-5, *Railway applications – Track – Test methods for fastening systems – Part 5: Determination of electrical resistance*

EN 13230-2:2009, *Railway applications – Track – Concrete sleepers and bearers – Part 2: Prestressed monobloc sleepers*

EN 13230-3:2009, *Railway applications – Track – Concrete sleepers and bearers – Part 3: Twin-block reinforced sleepers*

EN 13230-4:2009, *Railway applications – Track – Concrete sleepers and bearers – Part 4: Prestressed bearers for switches and crossings*

EN 13481-2, *Railway applications –Track – Performance requirements for fastening systems – Part 2: Fastening systems for concrete sleepers*

3 Terms and definitions

For the purposes of this European standard, the following terms and definitions apply:

3.1
purchaser
body responsible for purchasing the product on the user's behalf

3.2
supplier
body responsible for the use of the EN in response to the purchaser's requirement. The supplier is also responsible for requirements, which apply to the producer or manufacturer

3.3
sleepers
transverse components of the track which control the gauge and transmits loads from the rail to the ballast or other sleeper support

3.4
concrete bearers for switches and crossings
transverse components of switches and crossings which control the relative geometry of two or more stretches of running rails and different pieces of special track work, and transmits loads from the rails to the ballast or other bearer support

3.5
bending moment
moment applied on the concrete sleeper or bearer which produces tension and compression in the element

3.6
positive bending moment
moment which produces tension or reduces compression at the bottom of the concrete sleeper or bearer

3.7
negative bending moment
moment which produces tension or reduces compression at the top of the concrete sleeper or bearer

3.8
rail seat
area on which a running rail rests

3.9
rail seat area
rail seat and the immediate area around the fastening system

3.10
rail seat bending moment
moment under the centre line of the rail

3.11
centre bending moment
moment at the centre part of a monoblock sleeper

3.12
prestressed monoblock sleeper
monoblock sleeper using pre-tensioned or post-tensioned tendons for prestressing the concrete

3.13
twin-block reinforced sleeper
sleeper in which two reinforced concrete blocks are connected by a steel connecting bar

3.14
prestressed concrete bearer
monoblock bearer using pre-tensioned or post-tensioned tendons for prestressing the concrete

3.15
test load
load applied during testing

3.16
crack
partial split in concrete due to an external bending moment

3.17
crack under loading
crack measured during a test with an external bending moment applied

3.18
residual crack
crack measured during a test after an external bending moment has been applied and remove

3.19
positive design bending moment for rail seat section (*Mdr*)
positive moment used to calculate test loads for rail seat section and used as design criteria for the concrete sleeper and bearer (unit: kNm)

3.20
negative design bending moment for rail seat section (Mdr_n)
negative moment used to calculate test loads for rail seat section and used as design criteria for the concrete sleeper and bearer (unit: kNm)

3.21
negative design bending moment for centre part (Mdc_n)
negative moment used to calculate test loads for centre part (when necessary) and used as design criteria for the concrete sleeper and bearer (unit: kNm)

3.22
positive design bending moment for centre part (*Mdc*)
positive moment used to calculate test loads for centre part (when necessary) and used as design criteria for the concrete sleeper and bearer (unit: kNm)

3.23
minimum cover
minimum cover given by the design nominal cover reduced by the tolerance; construction tolerances do not apply to the anchorage system of prestressed sleepers, in which case only apply the ordinary construction tolerances indicated by the manufacturer

4 Common characteristics

4.1 General

The track is an assembly of transverse concrete sleepers or bearers secured to the rails by means of a fastening system and supported by ballast or other support. It is characterised by the gauge of the track, the rail profile, the inclination of the rails and the spacing of the concrete sleepers and bearers.

4.2 Loading

4.2.1 Loads

The track is subjected to repeated loads in three different directions, generally applied simultaneously:

a) vertical loads depending on support conditions;

b) transverse loads from guiding forces, transverse resistance, etc.;

c) longitudinal loads from acceleration and braking, thermal stresses in continuous welded rail, etc.

Under all loading conditions the track has to retain its geometry including gauge, top, level and alignment.

The design load is calculated by applying a dynamic coefficient to the static wheel load.

The dynamic coefficient takes into account the normal dynamic effects of wheel and track irregularities.

The relationship between bending moments and loads is the responsibility of the purchaser

4.2.2 Load distribution

The assembled rail, fastening system and concrete sleepers and bearers on ballast or other support shall be considered as a beam on a continuous resilient support.

The moment of inertia of the rail profile, the spacing of the concrete sleepers and bearers and the elasticity of the whole assembly on its support have an influence on the longitudinal distribution of the vertical loads applied on the rail. As a result, the load applied on the concrete element is only a proportion of the design load.

4.3 Design bending moments

4.3.1 General

The design bending moments are defined in kNm by the concrete sleeper and bearer design criteria and are used to calculate test loads.

Information regarding the bending moment calculation is given in Annex E.

4.3.2 Bending moments at rail seat

4.3.2.1 Positive bending moment at rail seat (Mdr)

Wheel loads generate positive bending moments under the rail seat.

The required flexural strength under the rail seat is derived from the bending moment induced by the design load.

When subjected to the design bending moment, there shall be no first crack at the tensile face of the concrete sleeper or bearer which is stated in 7.2.

The second stage of the bending moment to be defined is the exceptional loading bending moment due to exceptional and random impact loads and is calculated by multiplying the design bending moment (Mdr) by coefficient (k_1). Any crack produced by this bending moment shall close upon removal of the bending moment. Exceptional bending moments occur only a few times in the lifetime of a concrete sleeper and bearer. The purchaser shall state the coefficient (k_1) to be applied to the design bending moment.

The third stage of the bending moment is the ultimate bending moment due to accidental impacts, calculated by multiplying the design bending moment (Mdr) by coefficient (k_2). The purchaser shall state the coefficient (k_2) to be applied to the design bending moment.

The values of k_1 and k_2 also depend on the characteristics of the fastening system.

Impact coefficients k_1 and k_2 are defined as k_{1d} and k_{2d} for dynamic tests, or k_{1s} and k_{2s} when used for static tests.

The purchaser shall specify the design bending moment at the rail seat section (Mdr).

4.3.2.2 Negative bending moment at rail seat (Mdr_n)

Negative bending moments under the rail seat can arise from vertical movement of the track, harmonic motion from rail corrugation and curving forces of the sleeper under dynamic loading and handling during trackworks.

If required, the purchaser shall specify the design negative bending moment at the rail seat.

4.3.3 Bending moments at the centre part

4.3.3.1 Positive bending moment at the centre part *(Mdc)*

The purchaser shall specify the design bending moment at the centre part (Mdc).

4.3.3.2 Negative bending moment at the centre part (Mdc_n)

Negative bending moments at the centre part can arise from ballast support close to the centre.

The purchaser shall specify the design bending moment at the centre part (Mdc_n).

4.4 Data to be supplied

4.4.1 General

The purchaser can require all the data from the supplier before the design approval tests

4.4.2 Data to be supplied by the purchaser

The purchaser shall specify the following data:

a) all design bending moments (Mdr, Mdc, Mdc_n) and when required (Mdr_n);

b) impact coefficients (k_{1d}) and (k_{2d}), and when required (k_{1s}) and (k_{2s});

c) required tests and choice of options (see for example Annexes A, B, C);

d) drawings and specifications necessary to define:

   1) critical dimensions (length – width – depth at rail seat – etc.);

   2) fastening system interface and geometric lay-out (see 6.1);

   3) particular tolerances (see 6.1, Table 1);

   4) conductor rail insulator supports;

5) scope of the test arrangements and procedures indicating whether the options are used.

e) absolute maximum and minimum weight of the concrete sleeper and bearer (kg/sleeper or kg/m);

f) any additional technical specification, e.g. electrical insulation;

g) rail profile definition;

h) minimum strength class of concrete (optional).

4.4.3 Data to be supplied by the supplier

4.4.3.1 Before the design approval tests

a) Detailed drawings of the concrete sleeper and bearer;

b) Characteristics of materials;

c) Description of manufacturing process.

d) Description of the prestress anchoring system (if any) for prestressed sleepers and bearers:

1) for bonded anchoring systems, the adherence specification of the tendons, for example indentation;

2) how prestress is applied to sleeper;

3) characteristics of chemical, dimensional and mechanical tolerances for anchor devices.

4.4.3.2 After the design approval tests

— Design approval test report.

4.4.3.3 Prior to start up of production

a) All data required in Clause 8 "Quality control";

b) Production file for manufacturing data as defined in the following:

1) EN 13230-2:2009, clause 5;

2) EN 13230-3:2009, sub-clause 7.1;

3) EN 13230-4:2009, sub-clause 5.1.

5 Materials

5.1 General requirements

All materials shall comply with European standards. If no European standards exist, the appropriate national standards shall be used. Materials other than those specified below shall only be used with the agreement of the purchaser.

Great care shall be exercised in the selection of materials to ensure the long term durability of the concrete. Consideration shall be given to the requirements for freeze-thaw resistance, porosity and abrasion resistance.