



# SLOVENSKI STANDARD

## SIST EN 13230-1:2004

01-marec-2004

---

**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

<https://standards.iteh.ai/catalog/standards/sist/1eb95b57-6d52-4808-a1f1-90e5726614c6/sist-en-13230-1-2004>

**Ta slovenski standard je istoveten z: EN 13230-1:2002**

---

**ICS:**

45.080	Tračnice in železniški deli	Rails and railway components
91.100.30	Beton in betonski izdelki	Concrete and concrete products

**SIST EN 13230-1:2004**

**en**

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

SIST EN 13230-1:2004

<https://standards.iteh.ai/catalog/standards/sist/1eb95b57-6d52-4808-a1f1-90e5726614c6/sist-en-13230-1-2004>

EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 13230-1**

December 2002

ICS 45.080

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

[SIST EN 13230-1:2004](https://standards.iteh.ai/catalog/standards/sist/1eb95b57-6d52-4808-a1f1-90e5726614c6/sist-en-13230-1-2004)

<https://standards.iteh.ai/catalog/standards/sist/1eb95b57-6d52-4808-a1f1-90e5726614c6/sist-en-13230-1-2004>



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

Management Centre: rue de Stassart, 36 B-1050 Brussels

## Contents

Page

Foreword.....	4
Introduction.....	5
1 Scope.....	5
2 Normative references.....	5
3 Definitions.....	6
4 Common characteristics.....	7
4.1 General.....	7
4.2 Loading.....	7
4.2.1 Loads.....	7
4.2.2 Load distribution.....	8
4.3 Design bending moments.....	8
4.3.1 Bending moments at rail seat.....	8
4.3.2 Bending moments at the centre part.....	9
4.4 Data to be supplied.....	9
4.4.1 Data supplied by the purchaser.....	9
4.4.2 Data supplied by the supplier.....	10
5 Materials.....	10
5.1 General requirements.....	10
5.2 Cement.....	11
5.3 Aggregates.....	11
5.4 Mixing water.....	11
5.5 Admixtures.....	12
5.6 Concrete.....	12
5.7 Steel.....	12
5.7.1 Prestressing tendons.....	12
5.7.2 Reinforcing steel.....	12
5.7.3 Steel connecting bar.....	13
5.8 Cast-in components.....	13
6 General requirements.....	14
6.1 Design.....	14
6.2 Manufacturing process.....	17
6.2.1 General requirements.....	17
6.2.2 Natural curing.....	17
6.2.3 Accelerated curing.....	17
6.3 Surface finish.....	19
6.4 Electrical insulation.....	19
6.5 Marking.....	19
7 Product testing.....	20
7.1 General.....	20
7.2 Mechanical parameters.....	20
7.3 Tests on product.....	20
7.4 Tests on concrete.....	21
7.5 Tests in combination with the fastening system.....	21
7.6 Additional tests.....	21
8 Quality control.....	21
Annex A (informative) Test method to determine the Taber wear index.....	22
A.1 General.....	22

ITEH STANDARD PREVIEW

(standards.iteh.ai)

SIST EN 13230-1:2004

[https://standards.iteh.ai/catalog/standards/sist/1eb95b57-6d52-4808-a111-](https://standards.iteh.ai/catalog/standards/sist/1eb95b57-6d52-4808-a111-90e5726614c6/sist-en-13230-1-2004)

[90e5726614c6/sist-en-13230-1-2004](https://standards.iteh.ai/catalog/standards/sist/1eb95b57-6d52-4808-a111-90e5726614c6/sist-en-13230-1-2004)

A.2	Principle .....	22
A.3	Apparatus.....	22
A.4	Preparation of mortar tiles .....	22
A.4.1	Sampling .....	22
A.4.2	Mortar tile preparation.....	22
A.4.3	Mortar tile curing .....	23
A.4.4	Grinding of mortar tiles .....	23
A.5	Test procedure.....	23
A.6	Calculation of Taber wear index .....	23
Annex B (informative) Test method for freeze-thaw resistance.....		24
Annex C (informative) Test method for measuring the water absorption of concrete at atmospheric pressure .....		25
C.1	Introduction .....	25
C.2	Samples .....	25
C.3	Test sequence.....	25
C.4	Results .....	25
C.5	Requirements.....	26
Annex D (informative) Gauge used to measure the relative twist between rail seats.....		27
Annex E (informative) Bending moment calculation .....		28
E.1	Design bending moment calculation .....	28
E.2	Impact coefficients .....	29
Annex ZA (informative) Clauses of this European Standard addressing essential requirements or other provisions of EU Directives.....		30
Bibliography .....		32

iTeH STANDARD PREVIEW  
(standards.iteh.ai)

[SIST EN 13230-1:2004](https://standards.iteh.ai/catalog/standards/sist/1eb95b57-6d52-4808-a1f1-90e5726614c6/sist-en-13230-1-2004)

<https://standards.iteh.ai/catalog/standards/sist/1eb95b57-6d52-4808-a1f1-90e5726614c6/sist-en-13230-1-2004>

**EN 13230-1:2002 (E)****Foreword**

This document EN 13230-1:2002 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 June 2003, and conflicting national standards shall be withdrawn at the latest by June 2003

This document has been prepared under two mandates given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of EU Directive(s)

For relationship with EU Directive(s), see informative annex ZA which is an integral part of this document.

This European Standard is one of the series EN 13230 "Railway applications -Track — Concrete sleepers and bearers" which consists of the following parts:

— Part 1: *General requirements*;

— Part 2: *Prestressed monobloc sleepers*;

— Part 3: *Twin-block reinforced sleepers*;

— Part 4: *Prestressed bearers for switches and crossings*;

— Part 5: *Special elements*.

**iTeh STANDARD PREVIEW**  
(standards.iteh.ai)  
SIST EN 13230-1:2004  
<https://standards.iteh.ai/catalog/standards/sist/1eb95b57-6d52-4808-a1fl-90e5726614c6/sist-en-13230-1-2004>

The following terms are used in the standard to define the parties involved in using the EN as the technical bases for a transaction:

- purchaser: the operator or user of the equipment or the purchaser of the equipment on the user's behalf;
- supplier: the 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.

Annexes A, B, C, D and E are informative.

This document contains bibliographical references.

No other European Standard is superseded or replaced by this European Standard.

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, 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 monobloc sleepers*;
- Part 3: *Twin-block reinforced sleepers*;
- Part 4: *Prestressed 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, they need an agreement between purchaser and supplier to operate a factory quality system.

## 1 Scope

This part of prEN 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 moisture which can result in detrimental chemical reactions within the sleeper and to frost damage.

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 introduced in the manufacturing process and tests set out which will ensure that the concrete will not suffer degradation in service through chemical reaction and frost damage.

## 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).

ENV 10080, *Steel for reinforcement of concrete - Weldable ribbed reinforcing steel B 500.-Technical delivery conditions for bars, coils and welded fabric.*

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

prEN 10138, *Prestressing steels.*

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

EN 13230-2:2002, *Railway applications - Track - Concrete sleepers and bearers - Part 2: Prestressed monobloc sleepers.*

**EN 13230-1:2002 (E)**

EN 13230-3:2002, *Railway applications - Track – Concrete sleepers and bearers – Part 3: Twin-block reinforced sleepers.*

EN 13230-4:2002, *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 Definitions**

For the purpose of this standard, the following definitions apply:

**3.1 sleepers**  
transverse components of the track which control the gauge and transmit loads from the rail to the ballast or other sleeper support

**3.2 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 transmit loads from the rails to the ballast or other bearer support

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

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

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

**3.6 rail seat**  
area on which a running rail rests

**3.7 rail seat area**  
rail seat and the immediate area around the fastening system

**3.8 rail seat bending moment**  
moment under the centre line of the rail

**3.9 centre bending moment**  
moment at the centre part of a monobloc sleeper

**3.10 prestressed monobloc sleeper**  
monobloc sleeper using pre-tensioned or post-tensioned tendons for prestressing the concrete



**3.11****twin-block reinforced sleeper**

sleeper in which two reinforced concrete blocks are connected by a steel connecting bar

**3.12****prestressed concrete bearer**

monobloc bearer using pre-tensioned or post-tensioned tendons for prestressing the concrete

**3.13****test loads**

loads applied during testing

**3.14****crack**

partial split in concrete due to an external bending moment

**3.15****crack under loading**

crack measured during a test with an external bending moment applied

**3.16****residual crack**

crack measured during a test after an external bending moment has been applied and removed

**3.17****positive design bending moment for rail seat section ( $M_{dr}$ )**

moment used to calculate test loads and defined in kNm by the concrete sleeper and bearer design criteria

**3.18****negative design bending moment for centre part ( $M_{dc_n}$ )**

moment used to calculate test loads (when necessary) and defined in kNm by the concrete sleeper and bearer design criteria

**3.19****positive design bending moment for centre part ( $M_{dc}$ )**

moment used to calculate test loads (when necessary) and defined in kNm by the concrete sleeper and bearer design criteria.

**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 the ballast or other support. It is characterized 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:

- vertical loads depending on support conditions,
- transverse loads from guiding forces, transverse resistance, etc.
- longitudinal loads from acceleration and braking, thermal stresses in continuous welded rail, etc.

**EN 13230-1:2002 (E)**

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 design load value is the responsibility of the purchaser.

**4.2.2 Load distribution**

The assembled rail, fastening system and concrete sleepers and bearers on the 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.

The coefficient for longitudinal distribution of the design load is evaluated for each case according to the Zimmermann or other appropriate formula.

There should be no longitudinal distribution of impact loads with a frequency higher than the natural frequency of the track. An example of the bending moment calculation is given in informative annex E.

**4.3 Design bending moments**

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

iTeh STANDARD PREVIEW  
(standards.iteh.ai)

**4.3.1 Bending moments at rail seat**

SIST EN 13230-1:2004

**4.3.1.1 Positive bending moment at rail seat ( $M_{dr}$ )**

<https://standards.iteh.ai/catalog/standards/sist/1eb95b57-6d52-4808-a1f1-90c572661400/sist-en-13230-1-2004>

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.

Assessment of the positive bending moment at the rail seat ( $M_{dr}$ ) shall take into account an uneven bearing of the concrete sleeper and bearer and shall also use the load distribution coefficient of the design load (see 4.2.2).

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

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 ( $M_{dr}$ ) by the 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 exceptional accidental impacts, calculated by multiplying the design bending moment ( $M_{dr}$ ) by the coefficient ( $k_2$ ). The ultimate strength of the concrete element shall withstand this bending moment. 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.

#### 4.3.1.2 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.

#### 4.3.2 Bending moments at the centre part

##### 4.3.2.1 Positive bending moment at the centre part ( $Mdc$ )

If required, the purchaser shall specify the design bending moment at the centre part ( $Mdc$ ).

##### 4.3.2.2 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 Data supplied by the purchaser

The purchaser shall specify the following data:

- all design bending moments ( $Mdr$ ,  $Mdc_n$ ) and if necessary ( $Md_m$ ,  $Mdc$ );
- impact coefficients ( $k_{1d}$ ) and ( $k_{2d}$ ), and when required ( $k_{1s}$ ) and ( $k_{2s}$ );
- required tests and choice of options (see for example informative annexes A, B, C);
- drawings and specifications necessary to define:
  - critical dimensions (length - width - depth at rail seat – etc.);
  - fastening system interface and geometric lay-out;
  - particular tolerances (see 6.1 - Table 1);
  - conductor rail insulator supports;
  - scope of the test arrangements and procedures indicating whether the options are used.
- absolute maximum and minimum weight of the concrete sleeper and bearer (kg/sleeper or kg/m);
- any additional technical specification;
- rail profile definition;
- minimum strength class of concrete (optional).

**EN 13230-1:2002 (E)****4.4.2 Data supplied by the supplier****4.4.2.1 For the design approval tests**

- detailed drawings of the concrete sleeper and bearer;
- characteristics of materials;
- description of manufacturing process.

**4.4.2.2 After the design approval tests**

- design approval test report.

**4.4.2.3 Prior to start-up of production**

- all data required in clause 8 "Quality control";
- production file for manufacturing data as defined in the following:
  - 5.1 of EN 13230-2:2002;
  - 7.1 of EN 13230-3:2002;
  - 5.1 of EN 13230-4:2002.

**STANDARD PREVIEW**  
(standards.iteh.ai)

**5 Materials**

[SIST EN 13230-1:2004](https://standards.iteh.ai/catalog/standards/sist/1eb95b57-6d52-4808-a1fl-90e5726614c6/sist-en-13230-1-2004)

**5.1 General requirements**

<https://standards.iteh.ai/catalog/standards/sist/1eb95b57-6d52-4808-a1fl-90e5726614c6/sist-en-13230-1-2004>

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

Where aggregates contain varieties of silica susceptible to attack by alkalis ( $\text{Na}_2\text{O}$  and  $\text{K}_2\text{O}$  originating from cement or other sources) and as the concrete is exposed to humid conditions, precautions in the choice of constituents shall be taken. Typical precautions are 1, 2, 3, 4 below. Other precautions may be included in the provisions which are valid in the place of use of the concrete taking into account previous long-term experience using the particular combination of cement and aggregate and agreed by the purchaser.

Typical precautions:

- 1) use of low-alkali cement with total alkali content equivalent less than 0,60 %;
- 2) where national recommendations exist, use of pozzolanic materials as partial cement replacement;
- 3) use of only non-reactive aggregates, regularly confirmed by ex-quarry petrographic analysis (see 5.3);
- 4) the total mass of reactive alkalis in the concrete not exceeding  $3,5 \text{ kg/m}^3$  or being in accordance with national recommendations where available.