



NSAI
Standards

Irish Standard
I.S. EN 13230-6:2020

Railway applications - Track - Concrete sleepers and bearers - Part 6: Design

I.S. EN 13230-6:2020

Incorporating amendments/corrigenda/National Annexes issued since publication:

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard — national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation — recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

This document replaces/revises/consolidates the NSAI adoption of the document(s) indicated on the CEN/CENELEC cover/Foreword and the following National document(s):

NOTE: The date of any NSAI previous adoption may not match the date of its original CEN/CENELEC document.

This document is based on:

EN 13230-6:2020

Published:

2020-04-29

This document was published under the authority of the NSAI and comes into effect on:

2020-05-18

ICS number:

91.100.30

93.100

NOTE: If blank see CEN/CENELEC cover page

NSAI
1 Swift Square,
Northwood, Santry
Dublin 9

T +353 1 807 3800
F +353 1 807 3838
E standards@nsai.ie
W NSAI.ie

Sales:
T +353 1 857 6730
F +353 1 857 6729
W standards.ie

Údarás um Chaighdeáin Náisiúnta na hÉireann

National Foreword

I.S. EN 13230-6:2020 is the adopted Irish version of the European Document EN 13230-6:2020, Railway applications - Track - Concrete sleepers and bearers - Part 6: Design

This document does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

For relationships with other publications refer to the NSAI web store.

Compliance with this document does not of itself confer immunity from legal obligations.

In line with international standards practice the decimal point is shown as a comma (,) throughout this document.

This page is intentionally left blank

EUROPEAN STANDARD

EN 13230-6

NORME EUROPÉENNE

EUROPÄISCHE NORM

April 2020

ICS 91.100.30; 93.100

English Version

Railway applications - Track - Concrete sleepers and bearers - Part 6: Design

Applications ferroviaires - Voie - Traverses et supports en béton - Partie 6 : Conception

Bahnwendungen - Oberbau - Gleis- und Weichenschwellen aus Beton - Teil 6: Bemessung

This European Standard was approved by CEN on 8 April 2019.

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-CENELEC 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-CENELEC Management Centre has the same status as the official versions.

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



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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Contents		Page
European foreword.....		4
Introduction		5
1	Scope.....	6
2	Normative references.....	6
3	Terms, definitions and symbols.....	6
4	General requirements	9
4.1	General process for determination of bending moments	9
4.1.1	General.....	9
4.1.2	Empirical method.....	9
4.1.3	Theoretical method.....	10
4.1.4	Combined method.....	11
4.2	Crack formation in concrete sleepers or bearers.....	11
4.2.1	Cracks under rail seat.....	11
4.2.2	Cracks at centre part (prestressed monoblock sleepers or bearers)	12
4.2.3	Cracks for tests for negative bending under rail seat or positive bending at centre part.....	12
4.3	Section design of sleeper	12
4.4	Durability of sleeper	12
5	Design parameters.....	12
5.1	Maintenance.....	12
5.1.1	Track and rolling stock quality	12
5.1.2	Distribution of the vertical load in the longitudinal direction	13
5.1.3	Distribution of ballast reaction along the length of the sleeper	13
5.2	Track laying conditions	13
5.2.1	Mass of sleeper	13
5.2.2	Length of sleeper	13
5.2.3	Depth of sleeper.....	13
5.2.4	Track installation methods	13
5.3	Track components design	14
5.3.1	Rail profile and sleeper spacing	14
5.3.2	Fastening system.....	14
5.3.3	Track stability	14
5.4	Impact of traffic characteristics and track alignment	15
5.4.1	Axle load	15
5.4.2	Maximum speed.....	15
5.4.3	Curving load	15
6	Design method	15
6.1	Specific aspects for design and testing.....	15
6.1.1	Railway experience for exceptional or accidental impact loads.....	15
6.1.2	Flexural tensile strength of concrete	15
6.1.3	Losses of prestressing	16
6.1.4	Experience for track work	16
6.2	Design calculation.....	16
6.2.1	General.....	16

6.2.2	Calculation of dynamic rail seat load P_k under normal service conditions.....	16
6.2.3	Calculation of the characteristic bending moments for rail seat of sleepers	16
6.2.4	Calculation of the characteristic bending moments for centre part of sleepers	17
6.2.5	Calculation of the characteristic bending moments for bearers.....	18
6.2.6	Checking of stresses in concrete	18
6.2.7	Determination of test bending moments for first crack formation.....	18
Annex A	(informative) Design methods and factors for sleepers	20
A.1	General	20
A.1.1	Introduction	20
A.1.2	Determination of characteristic bending moments.....	20
A.1.3	Load levels and corresponding bending moments	21
A.2	Rail seat load	22
A.2.1	Normal service increment for the dynamic wheel load.....	22
A.2.2	Distribution of vertical loads in longitudinal direction.....	22
A.2.3	Effects of elastic rail pads	25
A.2.4	Calculation of dynamic rail seat load	25
A.3	Characteristic bending moments.....	25
A.3.1	General	25
A.3.2	Rail seat section.....	26
A.3.3	Sleeper centre section.....	27
A.4	Factors for test loads and acceptance criteria	33
A.4.1	General	33
A.4.2	Factor for first crack formation.....	33
A.4.3	Factors for exceptional loads	34
A.4.4	Factors for accidental loads	35
A.4.5	Factor for fatigue test.....	35
A.5	Checking of stresses for Serviceability Limit State (for prestressed sleepers only).....	35
A.6	Design examples	36
A.6.1	General	36
A.6.2	Example 1: 1 435 mm gauge waisted sleeper with elastic beam on elastic foundation calculation.....	38
A.6.3	Example 2: 1 435 mm gauge rectangular sleeper using simplified method	46
A.6.4	Example 3: 1 668 mm gauge waisted sleeper.....	52
Annex B	(informative) Design methods and factors for turnout bearers	56
Annex ZA	(informative) Relationship between this European standard and the Essential Requirements of EU Directive 2008/57/EC aimed to be covered	59
Bibliography	61

EN 13230-6:2020 (E)

European foreword

This document (EN 13230-6:2020) 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 October 2020, and conflicting national standards shall be withdrawn at the latest by October 2020.

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

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 EU Directive 2008/57/EC.

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

This European Standard is one of the EN 13230 series, *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;*
- *Part 6: Design.*

This European Standard can be used as a technical basis between contracting parties (purchaser – supplier).

Annexes A and B are informative; they can be used as normative requirements by completion of a contract, if agreed by the contracting parties.

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, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This document covers the design of concrete sleepers and bearers and is used in conjunction with 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.*

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

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

EN 13230-6:2020 (E)

1 Scope

This document provides particular design guidance in the following areas:

- derivation of characteristic loads and test loads;
- calculation of characteristic and test bending moments.

The aim of this document is to give guidance for the preparation of all data to be given by the purchaser to the supplier in accordance with Parts 1 to 5 of EN 13230. It applies to gauges 1 000 mm, 1 435 mm, 1 668 mm as well as to all lengths of sleepers and bearers.

This document gives special criteria for the design of concrete sleepers and bearers as track components. The design methods in the Eurocode do not apply to these concrete elements.

All track parameters to be taken into account for the design of sleepers and bearers are detailed in this document. Information is given on these parameters so that they can be used as inputs for the design calculation process. It is the responsibility of the purchaser to calculate or determine all track parameters used in this document.

This document gives guidance for the design calculation process. It explains how experience and calculation can be combined to use design parameters.

This document gives examples of numerical data that can be used when applying Clauses 4 to 6 according to the state of the art.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 13146-3, *Railway applications – Track – Test methods for fastening systems – Part 3: Determination of attenuation of impact loads*

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

EN 13146-10, *Railway applications – Track – Test methods for fastening systems – Part 10: Proof load test for pull-out resistance*

EN 13230-1:2016, *Railway applications – Track – Concrete sleepers and bearers – Part 1: General requirements*

3 Terms, definitions and symbols

For the purposes of this document, the terms and definitions given in EN 13230-1:2016 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

-
- [Looking for additional Standards? Visit Intertek Inform Infostore](#)
 - [Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation](#)
-