



SLOVENSKI STANDARD

oSIST prEN 1995-1-1:2023

01-december-2023

Nadomešča:

SIST EN 1995-1-1:2005

Evrokod 5: Projektiranje lesenih konstrukcij - 1-1. del: Splošna pravila in pravila za stavbe

Eurocode 5 - Design of timber structures - Part 1-1: General rules and rules for buildings

Eurocode 5 - Bemessung und Konstruktion von Holzbauten - Teil 1-1: Allgemeine Regeln und Regeln für den Hochbau

Eurocode 5 - Calcul des structures en bois - Part 1-1: Règles générales et règles pour les bâtiments

Ta slovenski standard je istoveten z: prEN 1995-1-1

<https://standards.iteh.ai/catalog/standards/sist/fda4f0fb-7a45-404c-b287-0035af00d6e0/osist-pren-1995-1-1-2023>

ICS:

91.010.30	Tehnični vidiki	Technical aspects
91.080.20	Lesene konstrukcije	Timber structures

oSIST prEN 1995-1-1:2023

en,fr,de

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

DRAFT
prEN 1995-1-1

September 2023

ICS 91.010.30; 91.080.20

Will supersede EN 1995-1-1:2004

English Version

Eurocode 5 - Design of timber structures - Part 1-1: General rules and rules for buildings

Eurocode 5 - Calcul des structures en bois - Part 1-1:
Règles générales et règles pour les bâtiments

Eurocode 5 - Bemessung und Konstruktion von
Holzbauten - Teil 1-1: Allgemeine Regeln und Regeln
für den Hochbau

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 250.

If this draft becomes a European Standard, 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.

This draft European Standard was established by CEN 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, Türkiye and United Kingdom.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.



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
1	Scope	11
1.1	Scope of EN 1995-1-1.....	11
1.2	Assumptions	11
2	Normative references.....	11
3	Terms, definitions and symbols	11
3.1	Symbols and abbreviations.....	20
4	Basis of design.....	53
4.1	General rules	53
4.2	Principles of limit state design	53
4.3	Basic variables	54
4.4	Stiffness values for structural analysis.....	58
4.5	Verification by the partial factor method	60
5	Materials	62
5.1	General	62
5.2	Strength graded structural timber (SL) with rectangular cross-section and structural finger jointed timber (FST)	70
5.3	Glued solid timber (GST).....	71
5.4	Glued laminated timber (GL).....	71
5.5	Cross laminated timber (CLT).....	72
5.6	Laminated veneer lumber (LVL).....	72
5.7	Glued laminated veneer lumber (GLVL).....	73
5.8	Softboards (SB).....	73
5.9	Adhesives.....	73
6	Durability.....	74
6.1	General	74
6.2	Measures to prevent a biological attack.....	74
6.3	Resistance to corrosion	78
7	Structural analysis	82
7.1	General	82
7.2	Structural modelling.....	83
7.3	Imperfections.....	87
7.4	Simplified method for the evaluation of effects of actions based on second order theory.....	92
8	Ultimate limit states	95
8.1	Member resistance verification.....	95
8.2	Stability of members: simplified verification.....	111
8.3	Additional rules for members with special geometries	116
8.4	System strength.....	144
9	Serviceability limit states	145
9.1	General	145
9.2	Deformations.....	145
9.3	Vibrations.....	148
9.4	Compressive deformation perpendicular to grain.....	158
10	Fatigue	159

10.1	General	159
10.2	Fatigue verification for equivalent constant amplitude fatigue loading.....	159
10.3	Fatigue verification for variable amplitude fatigue loading.....	161
11	Connections	161
11.1	General	161
11.2	Resistance of a single dowel-type fastener	163
11.3	Connection design with dowel-type fasteners.....	182
11.4	Spacings, edge distances and end distances	195
11.5	Brittle failure modes of connections with dowel-type fasteners laterally loaded parallel to grain.....	204
11.6	Brittle failure of connections loaded perpendicular to grain	213
11.7	Shear connectors	217
11.8	Punched metal plate fasteners	225
11.9	Expanded tube fasteners	225
11.10	Bonded-in rods.....	225
11.11	Carpentry connections	234
12	Mechanically jointed and glued webbed or flanged beams	243
12.1	Glued thin-webbed beams.....	243
12.2	Glued thin-flanged beams.....	245
12.3	Mechanically jointed beams	246
12.4	Mechanically jointed and glued columns.....	247
13	Diaphragms	247
13.1	General.....	247
13.2	Diaphragms built out of timber framed elements.....	248
13.3	Framed walls.....	255
13.4	Framed floors.....	263
13.5	Framed roofs.....	271
13.6	Diaphragms built out of CLT, LVL and GLVL	272
14	Timber foundation piles	274
Annex A	(informative) Additional guidance for increasing the robustness of timber structures	275
A.1	Use of this annex	275
A.2	Scope and field of application	275
A.3	Design for removal of structural elements	276
A.4	Design for segmentation using fuse elements	276
Annex B	(informative) Stability and bracing of members and structural systems	278
B.1	Use of this annex	278
B.2	Scope and field of application	278
B.3	Unbraced members: effective lengths and critical loads	278
B.4	Braced members and bracing systems.....	287
Annex C	(informative) Buckling of beam columns – non-linear method	307
C.1	Use of this annex	307
C.2	Scope and field of application	307
C.3	General.....	307

prEN 1995-1-1:2023 (E)

C.4	In-plane buckling.....	308
C.5	Buckling of members under major axis bending and axial force (compression or tension), subject to lateral torsional buckling.....	309
C.6	Buckling of members under biaxial bending and axial force (compression or tension), subject to lateral torsional buckling.....	312
C.7	Creep-buckling.....	314
Annex D (normative) Additional design provisions for cross laminated timber (CLT).....		316
D.1	Use of this annex	316
D.2	Scope and field of application	316
D.3	Concentrated loads perpendicular to plane without reinforcement.....	316
D.4	Concentrated loads perpendicular to the plane with reinforcement.....	316
D.5	Concentrated loads in-plane.....	319
D.6	Ribbed plates build up from ribs and CLT plates	322
Annex E (informative) Mechanically jointed members		325
E.1	Use of this annex	325
E.2	Scope and field of application	325
E.3	General	325
E.4	Effective bending stiffness.....	327
E.5	Stresses in the cross-section.....	327
E.6	Load on mechanical fasteners.....	328
Annex F (informative) Built-up columns.....		329
F.1	Use of this annex	329
F.2	Scope and field of application	329
F.3	General	329
F.4	Mechanically jointed columns.....	330
F.5	Spaced columns with packs or gussets	330
F.6	Lattice columns with glued or nailed joints.....	334
Annex G (informative) Alternative method for vibration analysis of floors		337
G.1	Use of this annex	337
G.2	Scope and field of application	337
G.3	General	337
G.4	Transient response	338
G.5	Resonant response.....	339
Annex H (normative) Connections with punched metal plate fasteners (PMPF).....		342
H.1	Use of this annex	342
H.2	Scope and field of application	342
H.3	Design resistances.....	342

H.4	Connection forces at an angle to the grain	343
H.5	Plate geometry	347
H.6	Plate strength and stiffness properties	349
H.7	Plate anchorage strengths.....	350
H.8	Connection strength verification in plane of timber assembly	351
H.9	Plate withdrawal strengths.....	355
H.10	Connection strength verification out of plane of timber assembly	356
H.11	Plate slip modulus.....	357
Annex I (informative)	Connections with three-dimensional connectors.....	358
I.1	Use of this annex	358
I.2	Scope and field of application	358
I.3	Connection slip modulus	358
I.4	Connection capacity.....	358
I.5	Angle bracket connection capacity	360
I.6	Joist hanger connection resistance	360
I.7	Post base connection resistance	362
Annex J (informative)	Connections with expanded tube fasteners.....	363
J.1	Use of this annex	363
J.2	Scope and application	363
J.3	Introduction	363
J.4	General requirements	363
J.5	Design requirements.....	364
J.6	Lateral load-carrying resistance and slip modulus	365
J.7	Splice connections.....	366
J.8	Connections exposed to bending moments, shear and normal forces.....	367
Annex K (normative)	Connections with interlayers	370
K.1	Use of this annex	370
K.2	Scope and field of application	370
K.3	Timber to timber connections	370
K.4	Steel to timber joints.....	375
Annex L (normative)	Laminated timber decks (LTD)	381
L.1	Use of this annex	381
L.2	Scope and field of application	381
L.3	Basis of design	382
L.4	Materials.....	382
L.5	Numerical analysis for laminated timber decks	382

prEN 1995-1-1:2023 (E)

L.6	System stiffness	382
L.7	System strength	384
L.8	Simplifications for system strength	385
L.9	Effective loaded area for concentrated vertical loads	386
L.10	System verification of glued laminated timber decks	386
Annex M (normative) Material and product properties for design		387
M.1	Use of this annex	387
M.2	Scope and field of application	387
M.3	Timber products	387
M.4	Gypsum and gypsum-based products	394
M.5	Fasteners and connectors	395
Annex N (informative) Classes and determination of some material properties		400
N.1	Use of this annex	400
N.2	Scope and field of application	400
N.3	Strength classes for cross laminated timber (CLT)	400
N.4	Strength classes for laminated veneer lumber (LVL)	401
N.5	Characteristic strength and stiffness values of gypsum plasterboards and fibreboards	403
N.6	Categories for screws and rods with wood screw thread	405
Annex O (informative) Numerical analysis for uni-directional timber elements		407
O.1	Use of this annex	407
O.2	Scope and field of application	407
O.3	Determination of stiffness values	407
Annex P (informative) Foundations with timber piles		409
P.1	Use of this annex	409
P.2	Scope and field of application	409
P.3	General	410
P.4	Materials and properties	411
P.5	Durability	411
P.6	Structural analysis	413
P.7	Ultimate limit states	413
P.8	Serviceability limit states	415
Annex Q (informative) Requirements for logs and pile extensions used as foundation piles		416
Q.1	Use of this annex	416
Q.2	Scope and field of application	416
Q.3	Wood species	416
Q.4	Geometrical properties	417

Q.5	Grading	418
Annex R (informative) Lateral displacement of multi storey monolithic shear walls and single-storey segmented shear walls		
R.1	Use of this annex	421
R.2	Scope and field of application	421
R.3	Method of calculation of lateral displacement	422
R.4	Displacement contributions for LTF, fully anchored- and monolithic CLT- and GLVL-C shear walls without openings	424
R.5	Displacement contributions for single-storey segmented CLT- and GLVL-C shear walls without opening	427
Annex S (informative) Framed walls with combined anchorage		
S.1	Use of this Annex	430
S.2	Scope and field of application	430
S.3	General	430
S.4	Ultimate Limit State	430
S.5	Serviceability limit state	437
Bibliography		438

iTeh Standards
(<https://standards.itih.ai>)
Document Preview

[oSIST prEN 1995-1-1:2023](https://standards.itih.ai/catalog/standards/sist/fda4f0fb-7a45-404c-b287-0035af00d6e0/osist-pren-1995-1-1-2023)

<https://standards.itih.ai/catalog/standards/sist/fda4f0fb-7a45-404c-b287-0035af00d6e0/osist-pren-1995-1-1-2023>

prEN 1995-1-1:2023 (E)

European foreword

This document (prEN 1995-1-1:2023) has been prepared by Technical Committee CEN/TC 250 “Structural Eurocodes”, the secretariat of which is held by BSI. CEN/TC 250 is responsible for all Structural Eurocodes and has been assigned responsibility for structural and geotechnical design matters by CEN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 1995-1-1:2004 and its amendments and corrigenda.

The first generation of EN Eurocodes was published between 2002 and 2007. This document forms part of the second generation of the Eurocodes, which have been prepared under Mandate M/515 issued to CEN by the European Commission and the European Free Trade Association.

The Eurocodes have been drafted to be used in conjunction with relevant execution, material, product and test standards, and to identify requirements for execution, materials, products and testing that are relied upon by the Eurocodes.

The Eurocodes recognize the responsibility of each Member State and have safeguarded their right to determine values related to regulatory safety matters at national level through the use of National Annexes.

The main changes compared to the previous edition are listed below:

- inclusions of main timber products, e.g. cross laminated timber (CLT);
- inclusion of product groups with similar material behaviour;
- inclusion of material parameters needed for the design according to this document;
- improved guidance on durability;
- inclusion of provisions on holes in beams;
- extension of compression perpendicular to grain verifications to serviceability limit state design;
- inclusion of provisions on reinforcements;
- improved guidance on vibration verification;
- inclusion on guidance on fatigue verification;
- inclusion of provisions on carpentry connections;
- inclusion of provisions on bonded-in rods;
- inclusion of provisions on foundations with timber piles;
- improved provisions on robustness.

0 Introduction

0.1 Introduction to the Eurocodes

The Structural Eurocodes comprise the following standards generally consisting of a number of Parts:

- EN 1990 Eurocode — Basis of structural and geotechnical design
- EN 1991 Eurocode 1 — 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 structures
- New parts are under development, e.g. Eurocode for design of structural glass

The Eurocodes are intended for use by designers, clients, manufacturers, constructors, relevant authorities (in exercising their duties in accordance with national or international regulations), educators, software developers, and committees drafting standards for related product, testing and execution standards.

NOTE Some aspects of design are most appropriately specified by relevant authorities or, where not specified, can be agreed on a project-specific basis between relevant parties such as designers and clients. The Eurocodes identify such aspects making explicit reference to relevant authorities and relevant parties.

0.2 Introduction to EN 1995 (all parts)

EN 1995 (all parts) applies to the design of timber structures and gives specific design rules for buildings and civil engineering timber works.

EN 1995 is subdivided in various parts:

EN 1995-2, *Eurocode 5 — Design of timber structures — Part 2: Bridges*

EN 1995-3, *Eurocode 5 — Design of timber structures — Part 3: Execution*

EN 1995-1 in itself does not exist as a physical document, but comprises the following three separate documents, the basic part being EN 1995-1-1:

EN 1995-1-1, *Eurocode 5 — Design of timber structures — Part 1-1: General rules and rules for buildings*

EN 1995-1-2, *Eurocode 5 — Design of timber structures — Part 1-2: Structural fire design*

CEN/TS 19103, *Design of timber structures — Structural design of timber-concrete composite structures – Common rules and rules for buildings*

prEN 1995-1-1:2023 (E)

EN 1995-2 “Bridges” refers to the common rules in EN 1995-1-1. The Clauses in EN 1995-2 supplement, modify or supersede them, where relevant.

EN 1995-3 “Execution” refers to the common rules in EN 1995-1-1. The Clauses in EN 1995-3 supplement the Clauses in EN 1995-1 and 1995-2.

0.3 Introduction to EN 1995-1-1

EN 1995-1-1 gives general design rules for timber structures and civil engineering timber works.

0.4 Verbal forms used in the Eurocodes

The verb “shall” expresses a requirement strictly to be followed and from which no deviation is permitted in order to comply with the Eurocodes.

The verb “should” expresses a highly recommended choice or course of action. Subject to national regulation and/or any relevant contractual provisions, alternative approaches could be used/adopted where technically justified.

The verb “may” expresses a course of action permissible within the limits of the Eurocodes.

The verb “can” expresses possibility and capability; it is used for statements of fact and clarification of concepts.

0.5 National Annex for EN 1995-1-1

National choice is allowed in this document where explicitly stated within notes. National choice includes the selection of values for Nationally Determined Parameters (NDPs).

The national standard implementing EN 1995-1-1 can have a National Annex containing all national choices to be used for the design of buildings and civil engineering works to be constructed in the relevant country.

When no national choice is given, the default choice given in this document is to be used.

When no national choice is made and no default is given in this document, the choice can be specified by a relevant authority or, where not specified, agreed for a specific project by appropriate parties.

National choice is allowed in EN 1995-1-1 through notes to the following clauses:

4.3.1.3(2)	4.3.1.4(1)	4.5.1(1)	4.5.2(1)
9.3.8(5)	10.1(2)	10.2(6)	H.3(1)
L.3(1)	L.3(2)		

National choice is allowed in EN 1995-1-1 on the application of the following informative annexes:

Annex A	Annex B	Annex C	Annex E
Annex F	Annex G	Annex I	Annex J
Annex N	Annex O	Annex P	Annex Q
Annex R	Annex S		

The National Annex can contain, directly or by reference, non-contradictory complementary information for ease of implementation, provided it does not alter any provisions of the Eurocodes.

1 Scope

1.1 Scope of prEN 1995-1-1

(1) prEN 1995-1-1 gives general design rules for timber structures.

(2) prEN 1995-1-1 also gives specific design rules for buildings and timber civil engineering works.

1.2 Assumptions

(1) The assumptions of EN 1990 apply to this document.

(2) prEN 1995-1-1 is intended to be used in conjunction with EN 1990, EN 1991 (all parts), EN 1998 (all parts) when timber structures are built in seismic regions.

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.

NOTE See the Bibliography for a list of other documents cited that are not normative references, including those referenced as recommendations (i.e. through 'should' clauses) and permissions (i.e. through 'may' clauses).

EN 1990:2023, *Eurocode - Basis of structural and geotechnical design*

EN 1991 (all parts), *Eurocode 1 - Actions on structures*

prEN 1991-1-1:2023, *Eurocode 1 - Actions on structures - Part 1-1: General actions - Specific weight of materials, self-weight of construction works and imposed loads for buildings*

prEN 1992-1-1, *Eurocode 2 - Design of concrete structures - Part 1-1: General rules and rules for buildings, bridges and civil engineering structures*

prEN 1993-1-9, *Eurocode 3 - Design of steel structures - Part 1-9: Fatigue*

prEN 1995-3, *Eurocode 5 - Design of timber structures - Part 3: Execution*

prEN 1997-3, *Eurocode 7 - Geotechnical design - Part 3: Geotechnical structures*

EN 1998 (all parts), *Eurocode 8 - Design of structures for earthquake resistance*

EN 1999-1-1, *Eurocode 9 - Design of aluminium structures - Part 1-1: General rules*

EN 10255:2004+A1:2007, *Non-alloy steel tubes suitable for welding and threading - Technical delivery conditions*

EN 14080:2013, *Timber structures - Glued laminated timber and glued solid timber - Requirements*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1990 and the following apply.

prEN 1995-1-1:2023 (E)**3D-connector**

folded or welded metal coupling device between *components* (3.1.9) and/or *members* (3.1.43) to be connected and kept in place with *dowel-type fasteners* (3.1.17)

EXAMPLE Angle brackets, joist hangers, hold downs.

3.1.2**adhesive**

non-metallic substance capable of joining materials by surface bonding (adhesion) with the *bond* (3.1.5) possessing adequate internal strength (cohesion)

[SOURCE: EN 923:2015, 2.1.1]

3.1.3**angle bracket**

L-shaped metal *3D-connector* (3.1.1), with or without stiffening corrugation used to fasten together two elements using *nails* (3.1.47), screws or bolts

3.1.4**assembly**

composition of elements

3.1.5**bond**

adhesion of one surface to another, with the use of an *adhesive* (3.1.2)

3.1.6**bonded-in rod**

fastener used in *connections* (3.1.10) or as reinforcement of wood-based elements established by interaction of *rod* (3.1.59), *adhesive* (3.1.2) and wood-based elements

3.1.7**bow imperfection**

distance of the centroid line from the perfect centroid line

3.1.8**carpentry connection**

connection (3.1.10), which relies on direct contact between the connected elements, the force transmission being ensured through compression and shear stresses in the contact areas, possibly complemented with transversal metallic parts to prevent disconnection

3.1.9**component**

part of an *assembly* (3.1.4)

3.1.10**connection**

area where two or more elements fastened together by mechanical means or bonded by *adhesives* (3.1.2)

3.1.11**connector**

coupling device interposed between or on elements to be connected and kept in place with *dowel-type fasteners* (3.1.17)