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Full document details: 24/30457261 DC

Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

English Version

**Eurocode 4 - Design of composite steel and concrete
structures - Part 1-1: General rules and rules for buildings**

Eurocode 4: Calcul des structures mixtes acier-béton -
Partie 1-1: Règles générales et règles pour les bâtiments

Eurocode 4 - Bemessung und Konstruktion von
Verbundtragwerken aus Stahl und Beton - Teil 1-1:
Allgemeine Bemessungsregeln und Anwendungsregeln
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.

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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

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European foreword

This document (prEN 1994-1-1:2024) has been prepared by Technical Committee CEN/TC 250 “Structural Eurocodes”, the secretariat of which is held by BSI.

This document is currently submitted to CEN Enquiry.

This document will supersede EN 1994-1-1:2004.

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.

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 products, 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 1994 (all parts)

EN 1994 applies to the design of steel and concrete composite structures and those who undertake building and civil engineering works. It complies with the principles and requirements for the safety and serviceability of structures, the basis of their design and verification given in EN 1990, *Eurocode — Basis of structural and geotechnical design*.

EN 1994 is concerned only with requirements for resistance, serviceability, durability and fire resistance of steel and concrete composite structures. Other requirements, e.g. concerning thermal or sound insulation, are not considered.

EN 1994 is subdivided in various parts:

EN 1994-1-1, *Eurocode 4 — Design of composite steel and concrete structures — Part 1 1: General rules and rules for buildings*;

EN 1994-1-2, *Eurocode 4 — Design of composite steel and concrete structures — Part 1 2: Structural fire design*;

EN 1994-2, Eurocode 4 — Design of composite steel and concrete structures — Part 2: Bridges.

0.3 Introduction to EN 1994-1-1

EN 1994-1-1 gives basic rules for the design of steel and concrete composite structures and supplementary provisions specific for buildings.

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 1994-1-1

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 1994-1-1 can have a National Annex containing all national choices to be used for the design of buildings and civil engineering works relevant to each 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 1994-1-1 through notes to the following clauses:

4.4.1.2(2)	4.4.1.2(4)	4.4.1.2(5)	4.4.1.2(6)
5.1(3)	5.1(7)	5.4.2.1(5)	8.2.2.5(1)
8.6.8.1(1)	8.6.9.1(3)	8.8.2(9)	10.6(2)
10.7.5(7)	B.2.2.3(3)	D.4.1.3(5)	H.2(2)
H.2(3)	H.2(4)		

National choice is allowed in EN 1994-1-1 on the application of the following informative annexes:

Annex A	Annex C	Annex E	Annex G
Annex J			

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 EN 1994-1-1

(1) EN 1994-1-1 gives basic rules for the design of steel and concrete composite structures and supplementary provisions specific for buildings.

NOTE Specific rules for bridges are given in EN 1994-2.

1.2 Assumptions

(1) The assumptions of EN 1990 apply to EN 1994-1-1.

(2) In addition to the general assumptions of EN 1990, the assumptions given in EN 1992-1-1, EN 1992-1-2, and EN 1993-1-1 apply to this document.

(3) EN 1994-1-1 is intended to be used in conjunction with EN 1990, EN 1991 (all parts), EN 1992-1-1, EN 1993 (all parts), EN 1997 (all parts), EN 1998 (all parts when steel and concrete composite structures are built in seismic regions), EN 1090-1, EN 1090-2, EN 1090-4, EN 13670 and ENs for construction products relevant to steel and concrete composite structures.

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. in 'should' clauses), permissions ('may' clauses), possibilities ('can' clauses), and in notes.

EN 1990:2023¹, Eurocode — *Basis of structural and geotechnical design*

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

EN 1991-1-5, Eurocode 1 — *Actions on structures – Part 1-5: Thermal Actions*

EN 1992-1-1:2023, Eurocode 2 — *Design of concrete structures – Part 1-1: General rules and rules for buildings*

EN 1993-1-1:2022, Eurocode 3 — *Design of steel structures – Part 1-1: General rules and rules for buildings*

FprEN 1993-1-8:2023, Eurocode 3 — *Design of steel structures — Part 1-8: Joints*

prEN 1993-1-14:2023, Eurocode 3 — *Design of steel structures — Part 1-14: Design assisted by finite element analysis*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1990, EN 1992-1-1 and EN 1993-1-1 and the following apply.

¹ As impacted by EN 1990:2023/prA1:2024.

3.1.1**composite member**

structural member with components of concrete and of structural steel, interconnected by shear connection so as to limit the longitudinal slip between concrete and steel and the separation of one component from the other

3.1.2**shear connection**

interconnection between the concrete and steel components of a composite member that has sufficient strength and stiffness to enable the two components to be designed as parts of a single structural member

3.1.3**shear connector**

connector used in composite members to enable the combined action of the concrete and steel components

3.1.4**composite behaviour**

behaviour which occurs after the shear connection has become effective due to hardening of concrete

3.1.5**composite beam**

composite member subjected mainly to bending, composed of a structural steel section with one or two concrete flanges or a partially-encased structural steel section with or without concrete flanges

3.1.6**composite column**

composite member subjected mainly to compression or to compression and bending

3.1.7**composite slab**

slab in which a profiled steel sheet is used initially as permanent formwork and subsequently combines structurally with the hardened concrete to act as tensile reinforcement in the finished floor

3.1.8**solid slab**

slab with a constant depth of concrete

3.1.9**concrete slab**

either a composite slab or a solid slab

3.1.10**concrete flange**

concrete slab in combined action with the steel component, acting as compression or tension flange

3.1.11

locally stiff concrete slab

concrete flange of a composite beam at a web opening where the relative flexural stiffness of the concrete flange relative to the steel element significantly modifies the distribution of shear forces between the steel and concrete

3.1.12

composite frame

framed structure in which some or all of the elements are composite members and most of the remainder are structural steel members

3.1.13

composite joint

joint between a composite member and another composite, steel or reinforced concrete member, in which reinforcement bars in the concrete element are taken into account in the design for the resistance and the stiffness of the joint

3.1.14

propped structure or member

structure or member where the weight of concrete elements is applied to steel elements which are subject to temporary support in the span, or is carried independently through temporary supports until the concrete elements are able to resist stresses

3.1.15

un-propped structure or member

structure or member in which the weight of concrete elements is applied to steel elements which are unsupported in the span

3.1.16

un-cracked flexural stiffness

the stiffness $E_a I_1$ of a cross-section of a composite member where I_1 is the second moment of area of the transformed composite cross-section calculated assuming that any concrete in tension is un-cracked and that the total cross-section remains plane

3.1.17

cracked flexural stiffness

stiffness $E_a I_2$ of a cross-section of a composite member where I_2 is the second moment of area of the transformed composite cross-section calculated neglecting any concrete in tension but including reinforcement and assuming that the total cross-section remains plane

3.1.18

prestress

process of applying compressive stresses to the concrete part of a composite member, achieved by tendons or by controlled imposed deformations

3.1.19

braced members or systems

structural members or subsystems, which in analysis and design are assumed not to contribute to the overall horizontal stability of a structure

3.1.20**elastic resistance**

resistance of a cross-section based on linear elastic theory

3.1.21**plastic resistance**

resistance of a cross-section, based on rectangular stress blocks

3.1.22**non-linear resistance**

resistance at a cross-section level, which includes several types of non-linear cross-section analyses such as the determination of the moment resistance considering plastic resistance or based on strain limitation and the materials stress-strain curve

3.1.23**global analysis**

describes the analysis of the structure or system as a whole,

- elastic global analysis is based on the assumption that the stress-strain behaviour of the materials is linear, whatever the stress level, even if the resistance of a cross-section is based on its plastic or non-linear resistance.
- rigid plastic analysis neglects the effects of elastic deflections and assumes that all structural deformation takes place in discrete plastic hinge regions within the members or joints.
- non-linear plastic global analysis considers the spread of plasticity both through the cross-sections and along the members in plastic zones. This term also applies to a plastic analysis considering the impact of joints

Note 1 to entry: The purpose of global analysis is to determine deformations, internal forces and moments in beams, columns and framed structures.

3.1.24**member imperfection**

member imperfections include geometrical and structural imperfections

3.1.25**equivalent bow imperfection**

equivalent bow imperfections specified in this standard take into account the effects of:

- geometrical imperfections as limited by geometrical tolerances in product standards or the execution standard;
- structural imperfections due to fabrication and erection, e.g. residual stresses and variation of the yield strength

3.1.26**full shear connection**

span of a beam has full shear connection when an increase in the number of shear connectors would not increase the design bending resistance of the member. Otherwise, the shear connection is partial

3.1.27

partial shear connection

when the condition for full shear connection in accordance with 3.1.26 is not fulfilled

3.1.28

full interaction

when a composite element has full interaction, the slip in the composite connection between steel and concrete may be neglected. Thus only one neutral axis exists for the composite cross-section and the cross-section remains plane

3.1.29

double composite action

section where the steel member acts compositely with concrete flanges at both the top and bottom

3.1.30

transformed composite cross-section

composite cross-section with an effective (transformed) concrete area modified by the modular ratio n_L in accordance with 7.4.2.2(2), Formula (7.4) taking into account the effects from the type of loading and the time effects of creep and shrinkage for linear elastic analysis

3.1.31

composite hollow core slab

precast hollow core slab floor complemented by a cast in-situ topping

3.1.32

core

longitudinal void in precast hollow core slabs produced by specific industrial manufacturing techniques, located with a regular pattern and the shape of which is such that the vertical loading applied on the slab is transmitted to the webs

3.1.33

hollow core slab

prestressed or reinforced concrete element with a constant depth divided into an upper and a lower flange, linked by vertical webs, so constituting cores as longitudinal voids, the cross-section of which is constant and presents one vertical symmetric axis

3.1.34

hollow core slab floor

floor made of precast hollow core slabs after the grouting of the joints

3.1.35

open core

core with upper flange removed to receive transverse reinforcement bar and cast in-situ infill

3.1.36

precast floor plate

reinforced or prestressed concrete floor plate used as permanent formwork for cast-in-situ concrete, flat or with ribs, with or without lattice girders, but without void formers

3.1.37**precast product**

precast concrete element manufactured in compliance with a specific EN standard

3.1.38**solid composite slab**

slab comprising a precast concrete floor plate and bonded topping, which behave as a monolithic slab after hardening of the topping through the bond between the precast element and topping with or without connecting reinforcement

3.1.39**topping**

in-situ concrete layer cast over the entire precast floor surface, so that it acts monolithically by bond intended to increase its bearing capacity and so constituting a composite slab floor

3.1.40**European Technical Product Specification**

- a European Product Standard (EN),
- or a European Technical Assessment (ETA) based on a European Assessment Document (EAD),
- or a product documentation based on a transparent and reproducible assessment that complies with all requirements of the relevant EAD

3.2 Symbols

For the purposes of this document, the following symbols apply.

3.2.1 Latin upper case letters

A	Cross sectional area of the effective composite section neglecting concrete in tension
A_a	Cross sectional area of the structural steel section
A_b	Cross sectional area of the bottom transverse reinforcement
A_{bh}	Cross sectional area of the bottom transverse reinforcement in a haunch
A_c	Cross sectional area of concrete
$A_{c,eff}$	Effective cross sectional area of concrete considering the modular ratio
$A_{c,L}$	Area of concrete considering time dependent effects
A_{ct}	Cross sectional area of the tensile zone of the concrete
A_{fb}	Cross sectional area of the bottom flange of the steel section
A_{fc}	Effective cross-section area of the compression flange
A_{ft}	Cross sectional area of the top flange of the steel section
$A_{i,s}$	Area of the effective equivalent steel section for shrinkage actions
$A_{i,0}$	Area of the effective equivalent steel section for non-permanent actions

$A_{i,p}$	Area of the effective equivalent steel section for permanent actions
A_{pe}	Effective cross sectional area of profiled steel sheeting
A_s	Cross sectional area of reinforcement
A_{sf}	Cross sectional area of transverse reinforcement
A_t	Cross sectional area of the top transverse reinforcement
A_v	Shear area of a structural steel section
A_{vc}	Shear area of a column web panel
A_1	Loaded area under the gusset plate
E_a	Modulus of elasticity of structural steel
E_{cd}	Design value of modulus of elasticity of concrete
E_{cm}	Secant modulus of elasticity of concrete
$E_{c,eff}$	Effective modulus of elasticity of concrete accounting for creep deformations
E_d	Load vector
E_s	Design value of modulus of elasticity of ordinary reinforcing steel
$(EI)_{eff}$	Effective flexural stiffness for calculation of relative slenderness
$(EI)_{eff,II}$	Effective flexural stiffness for use in second-order analysis
$(EI)_2$	Cracked flexural stiffness per unit width of the concrete or composite slab
$F_{c,wc,c,Rd}$	Design value of the resistance to transverse compression of the concrete encasement to a column web
F_{Ed}	Design force, or Design concentrated load
$F_{\ell,Ed}$	Design longitudinal force per stud caused by composite action in the beam
$F_{ten,Ed}$	Design tensile force per stud
$F_{t,Ed}$	Design transverse force per stud caused by composite action in the slab
$F_{s,Ed}$	Design longitudinal shear force per stud
G_a	Shear modulus of structural steel
G_c	Shear modulus of concrete
G_f	Fracture energy of concrete
G_k	Characteristic value of the sum of all permanent actions
I	Second moment of area of the effective composite section neglecting concrete in tension
I_a	Second moment of area of the structural steel section
I_{at}	St. Venant torsion constant of the structural steel section

I_c	Second moment of area of the uncracked concrete section
$I_{c,L}$	Second moment of area of the concrete slab considering the modular ratio
I_{cross}	Second moment of area in cross-direction assuming an uncracked concrete
I_{ct}	St. Venant torsion constant of the uncracked concrete encasement
$I_{i,s}$	Second moment of area of the effective equivalent steel section for shrinkage actions
$I_{i,0}$	Second moment of area of the effective equivalent steel section for non-permanent actions
$I_{i,p}$	Second moment of area of the effective equivalent steel section for permanent actions
$I_{L,eff}$	Effective second moment of area of the composite cross-section
I_{long}	Second moment of area of the slab in the longitudinal direction assuming an uncracked concrete
I_s	Second moment of area of the reinforcement
I_1	Second moment of area of the effective equivalent steel section assuming that the concrete in tension is uncracked
I_2	Second moment of area of the effective equivalent steel section neglecting concrete in tension but including reinforcement
$K_e, K_{e,II}$	Correction factors to be used in the design of composite columns
K_0	Calibration factor to be used in the design of composite columns
L	Length
L_{A-B}	Distance between two cross-sections A and B
L_{bc}, L_{bs}	Bearing lengths
L_e	Equivalent span length
$L_1; L_2; L_3$	Span lengths
L_p	Distance from centre of a concentrated load to the nearest support
L_v	Length of shear connection
L_x	Distance from a cross section to the nearest support
M_a	Contribution of the structural steel section to the design plastic resistance moment of the composite section
$M_{a,Ed}$	Design bending moment, applied to the structural steel section before composite action is achieved
$M_{b,Rd}$	Design value of the buckling resistance moment of a composite beam
M_{cr}	Elastic critical moment for lateral torsional buckling of a composite beam

M_{Ed}	Design bending moment
$M_{Ed,Im}$	Maximum first-order moment within the length of the column, including the effect of imperfections and any lateral loading not included in the global analysis
$M_{Ed,Em}$	Maximum moment at the ends of the column from the global analysis including second-order effects where required by 7.2
$M_{Ed,max}$	Maximum design bending moment along the beam
$M_{el,Rd}$	Design value of the elastic resistance moment of the composite section
$M_{f,Rk}$	Characteristic plastic moment of resistance of the cross-section consisting of the effective area of the flanges only
$M_{i,Ed}$	Part of the design bending moment on the composite section
$M_{i,D,Ed}$	Design value of bending moment from prestressing by imposed deformation on the transformed composite cross-section
$M_{i,L,Ed}$	Design value of bending moment from actions on the time dependant transformed composite cross-section
$M_{i,P,Ed}$	Design value of bending moment from permanent actions on the transformed composite cross-section
$M_{i,PT,Ed}$	Design value of bending moment developing due to creep
$M_{i,sh,Ed}$	Design value of bending moment from shrinkage on the transformed composite cross-section
$M_{i,0,Ed}$	Design value of bending moment from non-permanent actions on the transformed composite cross-section
M_{pa}	Design value of the plastic resistance moment of the effective cross section of the profiled steel sheeting
$M_{pl,a,Rd}$	Design value of the plastic resistance moment of the structural steel section
$M_{pl,Rd}$	Design value of the plastic resistance moment of the composite section with full shear connection
$M_{pl,N,Rd}$	Design value of the plastic resistance moment of the composite section taking into account the compressive normal force
$M_{pl,y,Rd}$	Design value of the plastic resistance moment about the y-y axis of the composite section with full shear connection
$M_{pl,z,Rd}$	Design value of the plastic resistance moment about the z-z axis of the composite section with full shear connection
M_{pr}	Reduced plastic resistance moment of the profiled steel sheeting
M_{Rd}	Design value of the resistance moment of a composite section or joint
$M_{Rd}(\eta)$	Design value of the plastic resistance moment of a composite section considering the degree of shear connection
M_{Rk}	Characteristic value of the resistance moment of a composite section or joint

$M_{y,Ed}$	Design bending moment applied to the composite section about the y-y axis
$M_{z,Ed}$	Design bending moment applied to the composite section about the z-z axis
N_a	Design value of the normal force in the structural steel section of a composite beam
$N_{a,Ed}$	Design axial force, respectively applied to the structural steel section before composite action is achieved
N_c	Design value of the compressive axial force in the concrete flange, taking account of the degree of shear connection
N_{cd}	Axial force in concrete in the cross-section where the design bending moment is the maximum along the beam
$N_{c,el}$	Compressive axial force in the concrete flange corresponding to $M_{el,Rd}$
$N_{c,f}$	Design value of the compressive axial force in the concrete flange with full shear connection
N_{cr}	Elastic critical axial force
$N_{cr,eff}$	Elastic critical load of a composite column corresponding to an effective flexural stiffness
N_{c1}	Design value of the compressive axial force in the concrete outside the steel flanges of concrete encased composite column
N_{Ed}	Design value of the compressive axial force
$N_{G,Ed}$	Design value of the part of the compressive axial force that is permanent
$N_{i,D,Ed}$	Design value of axial force from prestressing by imposed deformation on the transformed composite cross-section
$N_{i,L,Ed}$	Design value of axial force from actions on the time dependant transformed composite cross section
$N_{i,P,Ed}$	Design value of axial force from permanent actions on the transformed composite cross-section
$N_{i,PT,Ed}$	Design value of axial force developing in time due to creep
$N_{i,sh,Ed}$	Design value of axial force from shrinkage on the transformed composite cross-section
$N_{i,0,Ed}$	Design value of axial force from non-permanent actions on the transformed composite cross-section
N_p	Design value of the plastic resistance of the profiled steel sheeting to axial force
$N_{p,l}$	Axial force in profiled steel sheeting anchored at the slab support
$N_{pl,a}$	Design value of the plastic resistance of the steel section
$N_{pl,Rd}$	Design value of the plastic resistance of the composite section to compressive axial force

$N_{pl,Rk}$	Characteristic value of the plastic resistance of the composite section to compressive axial force
N_s	Design value of the plastic resistance of the steel reinforcement to axial force
$N_{s,l}$	Axial force in reinforcement anchored at the slab support
P_e	Maximum value of the resistance per shear connector resulting from a standard push test
P_{Ed}	Design value of the shear force in a shear connector
P_{em}	Mean failure load per shear connector from a standard push test
$P_{pb,Rd}$	Design value of the bearing resistance of a stud
P_{Rd}	Design value of the shear resistance of a single connector
P_{Rk}	Characteristic value of the shear resistance of a single connector
$P_{\ell,Rd}$	Design shear resistance of a single headed stud in the longitudinal direction of the beam
$P_{t,Rd}$	Design shear resistance of a single headed stud in the transverse direction of the beam
$P_{ten,Rd}$	Design tension resistance of a headed stud
Q_k	Characteristic value of the sum of all variable actions
R_{Ed}	Design value of a support reaction
R_m	Mean value of resistance
$R_{pl,m}$	Resistance in combined bending and compression based on the full plastic interaction
$R_{pl,d}$	Resistance in combined bending and compression
$R_{w,Rd}$	Shear resistance of steel sheeting, in accordance with FprEN 1993-1-3:2023, 8.1.6
S_j	Rotational stiffness of a joint
$S_{j,ini}$	Initial rotational stiffness of a joint
$V_{a,Ed}$	Design value of the shear force acting on the structural steel section
$V_{a,Rd}$	Design value of the shear resistance of the structural steel section
$V_{b,Rd}$	Design value of the shear buckling resistance of a steel web, shear resistance of profiled steel sheeting, in accordance with FprEN 1993-1-3:2023, 8.1.5
$V_{b,e,Rd}$	Design value for vertical shear of the profiled steel sheeting, with a width
$V_{c,cs}$	Shear capacity of the compression strut at the support of a composite slab
$V_{c,ct}$	Shear capacity of concrete in a composite slab at crack propagation zone close to the crack tip

$V_{c,cz}$	Shear capacity of the uncracked compression zone in a composite slab
$V_{c,Ed}$	Design value of the shear force acting on the reinforced concrete web encasement
$V_{c,Rd}$	Shear resistance of the concrete ribs in accordance with EN 1992-1-1:2023, 8.2.2 for a slab width of 1,0 meter.
$V_{c,ks}$	Shear capacity of a composite slab inducing kinking of reinforcement and spalling of concrete
$V_{c,ks,1}$	Shear capacity of a composite slab inducing spalling of concrete
$V_{c,ks,2}$	Shear capacity of a composite slab inducing kinking of reinforcement
V_{Ed}	Design value of the shear force acting on the composite section
$V_{g,Ed}$	Design value of permanent vertical shear forces $V_{g,Ed}$ during construction stage
$V_{L,Ed}$	Longitudinal shear force
$V_{p,Rd}$	Design value of the resistance of a composite slab to punching shear
$V_{pl,a,Rd}$	Design value of the plastic resistance of the structural steel section to vertical shear
$V_{pl,a,T,Rd}$	Design value of the reduced plastic shear resistance of the structural steel section making allowance for the presence of a torsional moment
$V_{pp,Rd}$	Shear resistance of a composite slab for a surface parallel to the direction of the profiled steel sheeting
$V_{pt,Rd}$	Shear resistance of a composite slab for a surface transverse to the direction of the profiled steel sheeting
$V_{v,Rd}$	Design value of the resistance of a composite slab to vertical shear
$V_{wp,c,Rd}$	Design value of the shear resistance of the concrete encasement to a column web panel

3.2.2 Latin lower case letters

a	Spacing between parallel beams
a_{hs}	Diameter of a circular hollow section or width of a rectangular hollow section
a_{rp}	Distance of the stud axis to the reinforcement which avoids the splitting of concrete (effective edge distance)
a_{sc}	Distance from the centre of the stud to the end of the sheeting
a_q	Distance between concentrated forces pushing against each other
b	Width of the flange of a steel section
b_c	Width of the concrete encasement to a steel section; Width of a concrete flange

$b_{\text{eff,c,wc}}$	Effective width of the column web in compression
b_{eff}	Total effective width
$b_{\text{eff,0}}$	Effective width at an end support
$b_{\text{eff,1}}$	Effective width at mid-span for a span supported at both ends
$b_{\text{eff,2}}$	Effective width at an internal support
b_{ei}	Effective width of the concrete flange on each side of the web
b_{em}	Effective width of a composite slab
b_{ev}	Effective width of a composite slab for shear forces
b_{fp}	Horizontal distance between the web-to-flange junction and the corner of the re-entrant stiffener
b_{i}	Geometric width of the concrete flange on each side of the web
b_{bot}	Width of the bottom flange to the profiled steel sheeting
b_{m}	Width of a composite slab over which a load is distributed
b_{min}	Minimum width of concrete within the through of the steel sheeting
b_{p}	Dimension of concentrated point or line load
b_{r}	Width of the top flange to the profiled steel sheeting
b_{s}	Distance between centres of adjacent ribs of profiled steel sheeting
b_{sl}	Slab width
b_{top}	Width of the top of the concrete rib
b_0	Mean width of a concrete rib for open-through profiles or minimum width for re-entrant sheeting profiles; Width of a concrete haunch
b_{0i}	Distance between the centres of the outstand shear connectors;
c	Width of the outstand of a steel flange
c_{eff}	Effective perimeter of reinforcing bar
Δc_{dev}	Allowance in design for deviation of the concrete cover
$c_{\text{min,b}}$	Minimum concrete cover due to bond requirement
c_{s}	Stiffness of the shear connection
c_y, c_z	Thickness of concrete cover
$c_{z,\text{min}}$	Minimum concrete cover
d	Diameter of the shank of a stud connector Overall diameter of circular hollow steel section

d_{do}	Diameter of the weld collar to a stud connector
d_{ef}	Height of a top reintrant stiffener on the upper side of an open through profiled sheeting
d_p	Distance between the centroidal axis of the profiled steel sheeting and the extreme fibre of the composite slab in compression
d_q	Distance between centroidal axis of the sum of anchored tensile forces in profiled steel sheeting and reinforcement to the extreme fibre of composite slabs in compression
d_s	Distance between the steel reinforcement in tension to the extreme fibre of the composite slab in compression
$d_{s,c}$	Depth below the top of the slab to the reinforcement
$d_{s,0}$	Reference distance from the centroid of the tension forces to the extreme fibre of the concrete in compression of a composite slab
d_w	Clear depth of the web of the structural steel section
e	Distance from the bottom fibre of the profile sheeting to its center of gravity
e_D	Distance between the edge of a connector and the edge of the flange of the beam
$e_{d,F}$	Either $2e_{h,F}$ or $2e_{v,F}$
$e_{d,min}$	Additional eccentricity
e_g	Gap between the reinforcement and the end plate in a composite column
$e_{h,F}$	Lateral distance from the point of application of force F_{Ed} to the relevant steel web, if F_{Ed} is applied to the concrete slab
e_k	Distance from the edge of the concrete rib on the higher moment side to the centre-line of the nearest stud connector
e_p	Distance from the plastic neutral axis of profiled steel sheeting to the extreme fibre of the composite slab in tension
e_N	Eccentricity of loading
e_v	Nominal concrete cover from the side of the haunch to the connector
$e_{v,F}$	Vertical distance from the point of application of force F_{Ed} to the relevant steel web, if it is applied to the slab
f_{cd}	Design value of concrete compressive strength
f_{ck}	Characteristic compressive cylinder strength of concrete at age t_{ref}
f_{cm}	Mean concrete cylinder compressive strength at age t_{ref}
f_{ctm}	Mean value of the axial tensile strength of concrete
$f_{ct,eff}$	Mean value of the effective tensile strength of the concrete
$f_{ct,0}$	Reference strength for concrete in tension

f_{sd}	Design value of the yield strength of reinforcing steel
f_{sk}	Characteristic value of the yield strength of reinforcing steel
f_{sm}	Mean value of the yield strength of reinforcing steel
f_y	Nominal value of the yield strength of structural steel
f_{yd}	Design value of the yield strength of structural steel
f_{yk}	Characteristic value of the yield strength of steel
f_{ym}	Mean value of the yield strength of structural steel
$f_{yp,d}$	Design value of the yield strength of profiled steel sheeting
f_u	Ultimate tensile strength of the material of the stud
f_1, f_2	Reduction factors for bending moments at supports
h	Overall depth; thickness
h_a	Depth of the structural steel section
h_A	Embedment depth of a stud connector above the profiled steel sheeting
h_c	Thickness of the concrete flange; Depth of the concrete encasement to a steel section; Thickness of concrete above the top of the profiled sheeting: $h_c = h_{cs} - h_{pg}$ or the thickness of the in-situ concrete above a semi-prefabricated concrete element
h_{cs}	Total height of concrete slab including profiled sheeting
h_e	Thickness of the finishes
h_f	Length of a shear surface
h_p	Overall depth of the profiled steel sheeting excluding longitudinal stiffener
h_{pc}	Height of centroid of the lowest shear connection device above the lower chord, for re-entrant profiles midway between upper and lower chord
h_{pg}	Overall depth of the profiled steel sheeting including longitudinal stiffener if available, otherwise $h_{pg} = h_p$
h_s	Depth between the centroids of the flanges of the structural steel section, for symmetrical sections: $h_s = h_a - t_f$
h_{sc}	Overall nominal height of a stud connector in accordance with EN ISO 13918
k	Coefficient which allows for the effect of non-uniform self-equilibrating stresses
k_c	Coefficient which takes account of the stress distribution within the section immediately prior to cracking
k_{cc}	Reduction factor considering the effect of concrete relaxation and sustained loading
k_E	Factor in accordance with EN 1992-1-1:2023, 5.1.6(1)

k_{el}	Lowest factor applied to the part of design moment on composite section to reach an elastic stress limit
k_{is}	Coefficient which allows for the effect of the reduction of the normal force of the concrete slab due to initial cracking and local slip of the shear connection
k_{ℓ}	Reduction factor for resistance of a headed stud used with profiled steel sheeting parallel to the beam
k_s	Rotational stiffness
k_{sc}	Stiffness of a shear connector
k_t	Reduction factor for resistance of a headed stud used with profiled steel sheeting transverse to the beam
k_{tc}	Coefficient considering the effect of high sustained loads on concrete compressive strength, see EN 1992-1-1:2023, 5.1.6(1)
$k_{t,max}$	Maximum value of k_t
k_{up}	Factor taking account if the beam is propped during construction or not
$k_{wc,c}$	Factor for the effect of longitudinal compressive stress on transverse resistance of a column web
k_1	Flexural stiffness of the cracked concrete or composite slab
k_2	Flexural stiffness of the web
k_{Φ}	Coefficient considering the distance between a stud and the end of the profiled sheeting for the determination of design resistance for end anchoring
m_{Ed}	Design transverse bending moment per unit of length
n	Modular ratio
n_f	Number of connectors for full shear connection
n_L	Modular ratio depending on the type of loading
n_r	Number of shear stud connectors in one rib
n_{sc}	Number of shear connectors
n_0	Modular ratio for short-term loading
p_{Ed}	Design line load
q_{Ed}	Design distributed load
r	Ratio of end moments
s_f	Longitudinal spacing of transverse reinforcement
s_x	Longitudinal spacing center-to-center of the stud shear connectors
s_y	Transverse spacing center-to-center of the stud shear connectors
t	Age, wall thickness of a hollow section

t_e	Thickness of an end plate
$t_{\text{eff,c}}$	Effective length of concrete
t_f	Thickness of a flange of the structural steel section
t_p	Thickness of the steel profiled sheeting
t_{ref}	Reference time, see EN 1992-1-1:2023, 5.1.6(1)
t_w	Thickness of the web of the structural steel section
t_0	Age at loading
v	Anchoring length
$v_{L,Ed}$	Design longitudinal shear force per unit of length
$v_{L,Ed,max}$	Maximum design longitudinal shear force per unit of length
$v_{L,Rd}$	Longitudinal shear resistance per unit length at the interface between steel and concrete in a composite member
$w_{\text{lim,cal}}$	Limit for the calculated crack width
w_s	Width of a top reintrant stiffener on the upper side of an open through profiled sheeting
w_o	Geometrical imperfection
y-y	Cross section axis parallel to the flanges
z	Lever arm
z-z	Cross section axis perpendicular to the flanges
z_c	Depth of concrete in compression
z_{cl}	Distance between center lines of concrete slab and steel section
z_p	Distance between the compression force in the concrete and the tension force in the steel sheeting
z_{pl}	Distance between the plastic neutral axis and the extreme fibre of the concrete slab in compression
z_s	Distance between the compression force in the slab and the tension force in the rib reinforcement
z_0	Vertical distance

3.2.3 Greek upper case letters

$\Delta\sigma_s$	Increase of stress in steel reinforcement due to tension stiffening of concrete
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3.2.4 Greek lower case letters

α	Ratio of characteristic resistance of a shear connector from push test to the characteristic resistance used for design
α_{cr}	Minimum force amplifier to reach the elastic critical buckling load
α_M	Coefficient related to bending of a composite column
α_{My}, α_{Mz}	Coefficients related to bending of a composite column about the y-y axis and the z-z axis respectively
α_s	Coefficient considering the slab system for determination of the flexural stiffness of the slab for verification of lateral torsional buckling
α_{st}	Ratio of the product of the area and second moment of area of the composite cross-section to the product of area and second moment of area of the steel section
β	Reduction factor for plastic moment resistance
β_c	Coefficient increasing the design shear strength for composite columns
β_d	Reduction factor
β_l	Parameter for the effective width of concrete flange
β_L	Angle of spread for concentrated longitudinal force
β_M	Equivalent moment factor
β_s	Section parameter
γ_c	Partial factor for concrete
γ_G	Partial factor for permanent actions
γ_M	Partial factor for a material property, also accounting for model uncertainties and dimensional variations
γ_{M0}	Partial factor for structural steel applied to resistance of cross sections, see EN 1993-1-1:2022, 8.1(1)
γ_{M1}	Partial factor for structural steel applied to resistance of members to instability assessed by member checks, see EN 1993-1-1:2022, 8.1(1)
γ_p	Partial factor for prestressing action
γ_Q	Partial factor for variable actions
γ_s	Partial factor for reinforcing steel
γ_{Rd}	Partial factor for taking into account model uncertainties in the resistance model
γ_v	Partial factor for design shear resistance of a shear connector
γ_{vs}	Partial factor for longitudinal shear in composite slabs for buildings

γ_0	Overall partial factor
δ	Slip between the concrete and steel due to the deformation of the shear connection
δ_c	Steel contribution ratio
δ_u	Slip value of 2,0 mm for slip between the concrete for classification of shear connector resistance
δ_{ek}	Characteristic value of the elastic slip of connectors when reaching the characteristic resistance
δ_{max}	Sagging vertical deflection
δ_p	Deflection of steel sheeting under its own weight plus the weight of wet concrete
$\delta_{p,max}$	Limiting value for δ_p
δ_{sh}	Deflection of composite slab due to shrinkage
δ_{uk}	Characteristic value of the slip capacity of connectors at Ultimate Limit State
ε	Material parameter given by $\sqrt{235 / f_y}$ where is f_y in N/mm ²
ε_{sh}	Shrinkage strain of the concrete
η	Degree of shear connection
η_a, η_{a0}	Factors related to the confinement of concrete
η_c, η_{c0}	Factors related to the confinement of concrete
η_{cc}	Factor to account for the difference between the undisturbed compressive strength of a cylinder and the effective compressive strength that can be developed in the structural component
$\eta_{cc,up}$	Upper value of η_{cc} factor
η_{cL}	Factor related to the confinement of concrete
η_i	Stiffness modification factor
$\eta_{lw,fc}$	Coefficient related to f_{ck} in lightweight aggregate concrete
$\eta_{lw,fct}$	Influence factor of the increased brittleness of lightweight concrete axial tensile strength of concrete f_{ctm}
η_{min}	Minimum degree of shear connection in accordance with the Ductility Category of shear connector
η_s	Utilisation factor of reinforcement
η_v	Coefficient for interaction of shear and bending
η_0	Minimum degree of shear connection in accordance with composite beam geometry

θ_f	Angle
$\bar{\lambda}$	Relative slenderness
$\bar{\lambda}_{LT}$	Relative slenderness for lateral torsional buckling
μ_d	Factor related to design for compression and uniaxial bending
$\mu_{f,d}$	Design friction value
$\mu_{f,k}$	Characteristic friction value
μ_{dy}, μ_{dz}	Factor μ_d related to plane of bending
ν	Reduction factor to allow for the effect of longitudinal compression on resistance in shear
ν_a	Poisson's ratio for structural steel
ρ	Parameter related to reduced design bending resistance accounting for vertical shear
ρ_m	Factor
ρ_s	Reinforcement ratio
ρ_{up}	Ratio between moments
$\sigma_{com,c,Ed}$	Longitudinal compressive stress in the encasement due to the design normal force
σ_{ct}	Tensile stress in the extreme fibre of concrete
$\sigma_{c,Rd}$	Local design strength of concrete
σ_s	Stress in the tension reinforcement
$\sigma_{s,0}$	Stress in the tension reinforcement neglecting tension stiffening of concrete
σ_x	Stress in the tension reinforcement in the x direction
σ_y	Stress in the tension reinforcement in the y direction
τ_{Ed}	Longitudinal shear stress, at the junction between one side of a flange in accordance with EN 1992-1-1:2023, 8.2.5
τ_{Rd}	Design shear strength
$\tau_{u,Rd}$	Design value of longitudinal shear strength of a composite slab
$\tau_{u,Rk}$	Characteristic value of longitudinal shear strength of a composite slab
ϕ	Diameter (size) of a steel reinforcing bar
ϕ^*	Maximum diameter of a steel reinforcing bar
φ	Creep coefficient

$\varphi(t, t_0)$	Creep coefficient, defining creep between times t and t_0 , related to elastic deformation at 28 days
χ	Reduction factor for flexural buckling
χ_{LT}	Reduction factor for lateral torsional buckling
ψ	Coefficient
ψ_L	Creep multiplier

3.3 Additional symbols used in Annex A

3.3.1 Latin upper case letters

$A_{s,r}$	Cross-sectional area of the longitudinal reinforcement in row r
K_{sc}	Stiffness of a group of connectors
K_β	Coefficient
$M_{Ed,j}$	Design bending moment applied to a connection j

3.3.2 Latin lower case letters

d_{sb}	Distance between the longitudinal reinforcing bars in tension and the centroid of the beam's steel section
d_{wc}	Straight height of the column web
h_{st}	Distance between the longitudinal reinforcing bars in tension and the centre of compression
$k_{c,wc}$	Stiffness coefficient for an unstiffened web and a contact plate
$k_{c,wc,c}$	Additional stiffness coefficient for a column web encased in concrete
k_i	Stiffness coefficient
k_{slip}	Reduction factor taking account of the deformation of the shear connection
$k_{s,r}$	Stiffness coefficient for a reinforcement row in tension
k_{wp}	Stiffness coefficient for a steel column web given by FprEN 1993-1-8:2023, A.2.2(1)
$k_{wp,c}$	Additional stiffness coefficient for a steel column web encased by concrete
n_{LS}	Number of shear connectors distributed over the length L
t_{wc}	Thickness of the column web
ν	Factor

3.3.3 Greek lower case letters

β	Transformation parameter
ξ	Parameter related to deformation of the shear connection

3.4 Additional symbols used in Annex B

3.4.1 Latin upper case letters

L_o	Length of overhang
L_s	Shear span length
$M_{pa,m}$	Plastic resistance moment of profiled steel sheeting based on measure values
$M_{pr,m}$	Reduced plastic moment
$N_{c,fm}$	Compressive axial force in the concrete flange at moment $M_{pl,Rm}$
$N_{c,m}$	Compressive axial force in the concrete flange with partial shear connection
P	Load
P_e	Expected failure load
V_t	Support reaction under the ultimate test load
W_t	Measured failure load

3.4.2 Latin lower case letters

$f_{cm,t}$	Actual mean value of the concrete cylinder compressive strength in the test specimen
f_{ut}	Actual ultimate tensile strength of the material of the stud in the test specimen
f_{yp}	Nominal yield strength of profiled steel sheeting
$f_{ypm,t}$	Mean value of the measured yield strength of profiled steel sheeting
s_e	Experimental slip at a load of $0,7 P_{Rk}$
$z_{pl,m}$	Location of the neutral plastic axis

3.4.3 Greek lower case letters

δ_u	Maximum slip measured in a test at the characteristic load level
η_{test}	Degree of shear connection in the test
μ_m	Mean value of the friction coefficient
τ_u	Value of longitudinal shear strength of a composite slab determined from testing

3.5 Additional symbols used in Annexes D and E

3.5.1 Latin upper case letters

$A_{a,bT}$	Cross-sectional area of bottom Tee
$A_{a,tT}$	Cross-sectional area of top Tee
$A_{v,bT}$	Shear area of bottom Tee
$A_{v,tT}$	Shear area of top Tee
$F_{tr,Rd}$	Resistance of transverse reinforcement to local loads
I_{bT}	Second moment of area of bottom Tee
$I_{1, gross}$	Second moment of area of the composite section with solid web
$I_{1, net}$	Second moment of area of the composite section at the centre of the opening
I_{tT1}	Second moment of area of the transformed composite top Tee
$M_{A,Ed}$	Design bending moment in locally stiff slab at the low moment end of the opening
$M_{A,Rd}$	Bending resistance moment in locally stiff slab at the low moment end of the opening
$M_{B,Ed}$	Design bending moment in locally stiff slab at the high moment end of the opening
$M_{B,Rd}$	Bending resistance moment in locally stiff slab at the high moment end of the opening
$M_{c,Rd}$	Bending resistance of the slab for the Vierendeel effect
$M_{elN,bT}$	Moment required to cause yield in the bottom steel Tee at the low moment end of the opening taking into account the axial force
$M_{elN,tT}$	Moment required to cause yield in the top steel Tee at the high moment end of the opening taking into account any axial force
$M_{NV,bT,Rd}$	Reduced bending resistance of bottom Tee due to axial force and using the effective web yield strength or thickness for the effects of shear
$M_{NV,tT,Rd}$	Reduced bending resistance of top Tee due to axial force and using the effective web yield strength or thickness for the effects of shear
$M_{o,Ed}$	Design value of bending moment at the centre-line of an opening
$M_{vc,Rd}$	Local Vierendeel bending resistance due to composite action
$M_{wp,Ed}$	Design value of in plane moment at mid-height of the web post
$N_{bT,Ed}$	Design value of tensile force in bottom Tee
$N_{bT,Rd}$	Design value of tensile resistance of bottom Tee

$\Delta N_{cs,Ed}$	Increase in design value of compression force developed by the shear connectors placed between the centre-lines of adjacent openings
$N_{oc,Ed}$	Design value of compression force in slab developed from the nearer support to the centre of the opening
$N_{oc,Rd}$	Design value of compression resistance of concrete slab at the centre of an opening
$N_{sl,Rd}$	Cumulated shear resistance of the connectors placed between the nearer support and the center-line of the opening
$N_{tT,Ed}$	Design value of compression force in top Tee
$N_{tT,Rd}$	Design axial resistance of the top Tee
$N_{w,Ed}$	Compressive force in the web
$P_{comp,Ed}$	Vertical compression force at the lower moment side of an opening with locally stiff slab
$P_{s,Ed}$	Longitudinal shear force acting on a shear connector over the opening that is used to develop the Vierendeel bending resistance due to composite action
$P_{ten,Ed}$	Vertical tension force acting on the group of shear connectors at the higher moment side of the opening
$V_{av,Ed}$	Average value of the shear forces at the centre of adjacent openings
$V_{bT,Ed}$	Design value of the shear force acting on the bottom Tee
$V_{bT,Rd}$	Plastic shear resistance of the bottom Tee
$V_{c,Rd}$	Shear resistance of the concrete slab
$V_{iT,Ed}$	Design value of the shear force acting on a Tee, equal to either $V_{bT,Ed}$ or $V_{tT,Ed}$
$V_{iT,Rd}$	Design value of the plastic shear resistance of a Tee, equal to either $V_{bT,Ed}$ or $V_{tT,Ed}$
$V_{oa,Ed}$	Design value of the shear force acting on the steel profile at an opening
$V_{oc,Ed}$	Design value of the shear force acting on the concrete slab at an opening
$V_{oc,Rd}$	Design shear resistance of the concrete slab at the opening position
$V_{o,Ed}$	Design value of the shear force acting on the beam at the centre of the opening
$V_{o,ser,Ed}$	Design value of shear force at the opening at the serviceability limit state
V_{slab}	Maximum possible shear force in a stiff slab at the center of the opening
$V_{tT,Ed}$	Design value of the shear force acting on the top Tee
$V_{tT,Rd}$	Plastic shear resistance of the top Tee
$V_{Vier,Rd}$	Shear resistance to Vierendeel bending
$V_{wp,Ed}$	Design value of horizontal shear force in web post

3.5.2 Latin lower case letters

a_{eff}	Effective length of opening for buckling and deflection calculations
a_{eq}	Equivalent length of opening for Vierendeel bending
a_{eqA}	Distance from the lower moment end of the opening to the point where the local moment in the slab is equal to 0
a_{eqB}	Distance from the higher moment end of the opening to the point where the local moment in the slab is equal to 0
a_o	Length of opening
$b_{\text{eff},b}$	Effective width of slab due to local bending
$b_{\text{eff},V}$	Effective width of slab due to local shear
$b_{\text{hm},\text{eff}}$	Effective width of the slab determined at the high-moment end of the opening
d_c	Distance of the centroid of the compressed part of the slab from the upper face of the steel profile
$d_{s,c,b}$	Distance of the bottom reinforcement to the top of the slab
$d_{s,c,\text{ten}}$	Distance of the transverse reinforcement in the tension region to the upper edge of the slab
d_y	Width of load introduction perpendicular to the beam axis
e_o	Eccentricity of centre line of opening above centre line of beam
$f_{y,\text{red}}$	Reduced yield strength of the structural steel which takes account of MV interaction
n_{bo}	Number of openings along the beam
h_{bT}	Depth of bottom Tee
$h_{\text{ts},\text{lim}}$	Limit of slab depth for stiff slab
h_{tT}	Depth of top Tee
h_o	Depth of opening
k_a	Modification factor on composite resistance to Vierendeel bending for long openings
n_t	Number of shear connectors in the group acting in tension
r_{w1}, r_{w2}	Factors
s_o	Centre to centre spacing of adjacent openings
w_{add}	Additional mid-span deflection due to the openings
w_b	Mid-span deflection of the equivalent solid web composite beam
w_p	Edge-to-edge spacing of openings

$w_{v,add}$	Relative deflection due to Vierendeel bending
x_0	Position of centre of opening from nearer support
z_{bT}	Distance of centroid of bottom Tee from the bottom of the steel section
z_{tT}	Distance of centroid of top Tee from the top of the steel section

3.5.3 Greek lower case letters

ρ_{min}	Minimum reinforcement ratio
$\rho_{st,lim}$	Limit of reinforcement ratio for stiff slabs
ρ_t	Transverse reinforcement ratio
ϕ	Diameter of the transverse reinforcement in the tension region of the slab

3.6 Additional symbols used in Annex F

3.6.1 Latin upper case letters

$F_{L,Ed}$	Design longitudinal shear force
$F_{V,Ed}$	Design vertical shear force
N_{cyc}	Reference number of cycles
$N_{cyc,f}$	Number of force range cycles
$P_{L,Rd}$	Design longitudinal shear resistance
$P_{V,Rd}$	Design vertical shear resistance
T_{Ed}	Design splitting force

3.6.2 Latin lower case letters

a_r	Distance between the axis of the stud and the closest concrete surface
$a_{r,o}$	Distance between the axis of the stud and the slab surface where the concrete cone failure would appear
a_{rp}	Effective edge distance
$a_{rp,o}$	Relevant effective edge distance for the concrete cone failure
c_v	Nominal concrete cover
k_v	Coefficient
m	Slope of the fatigue strength
s	Spacing of the stirrup
s_v	Transverse spacing between studs

v Distance of the stirrup to the lower face of the connector's head

3.6.3 Greek upper case letters

$\Delta P_{L,c}$ Reference value of fatigue strength for the range of longitudinal shear forces per stud at $N_{cyc} = 2 \times 10^6$

$\Delta P_{L,R}$ Fatigue strength based on the range of longitudinal shear forces per stud

$\Delta P_{V,c}$ Reference value of fatigue strength for the range of vertical shear forces per stud at $N_{cyc} = 2 \times 10^6$

$\Delta P_{V,R}$ Fatigue strength based on the range of vertical shear forces per stud

ΔP_R Fatigue strength based on the difference of shear force per stud

ΔP_c Reference value of fatigue strength at 2 million cycles

3.6.4 Greek lower case letters

β_r Angle

$\gamma_{Mf,s}$ Partial factor for fatigue strength of shear connectors

γ_{ff} partial factor for fatigue actions

η_r Correction factor

ϕ_s Diameter of the stirrups

ϕ Diameter of the longitudinal reinforcement

3.7 Additional symbols used in Annex G

3.7.1 Latin upper case letters

C_2 Coefficient

$M_{pl,sc}$ Plastic moment of the connector

W_{sc} Modulus of flexion

3.7.2 Latin lower case letters

$f_{ctk,0,05}$ Characteristic value of tensile strength of concrete in accordance with EN 1992-1-1:2023, Table 5.1

k_u Correction factor

n_y Number of plastic yielding in the stud

3.8 Additional symbols used in Annex H

3.8.1 Latin upper case letters

$A_{c,N}/A_{c,N}^0$	Ratio taking into account the geometric effect of axial spacing and edge distance on the characteristic resistance $N_{c,Rk}$
$N_{c,Rd}$	Design resistance of the headed stud to concrete cone failure
$N_{c,Rk}$	Characteristic resistance of the headed stud to concrete cone failure
$N_{c,Rk}^0$	Characteristic resistance of a single headed stud placed in the slab and not influenced by adjacent studs or edges
$N_{p,Rd}$	Design resistance of the headed stud to concrete pull-out failure mode
$N_{p,Rk}$	Characteristic resistance of the headed stud to concrete pull-out failure mode
$N_{s,Rd}$	Design resistance of the steel stud to tension
$N_{s,Rk}$	Characteristic resistance of the steel stud to tension

3.8.2 Latin lower case letters

b_x	Distance
c	Distance of the headed stud to the closest edge
$c_{cr,N}$	Characteristic edge distance
h_{ef}	Effective embedment depth of the stud
k_1	Factor that takes into account the load transfer mechanism
n_s	Number of regularly spaced headed studs
$s_{rc,N}$	Characteristic spacing of studs to ensure the characteristic resistance of the stud in case of concrete cone failure under tension load
t_n	Thickness of the head

3.8.3 Greek lower case letters

γ_{Mc}	Partial factor for the concrete cone failure mode
γ_{Mp}	Partial factor for the pull-out failure mode
γ_{Ms}	Partial factor for the tension resistance of steel of the stud
$\psi_{ec,N}$	Factor taking into account the group effect when different tension loads are acting on the individual fasteners of a group in case of concrete cone failure
$\psi_{M,N}$	Factor
ψ_P	Increasing factor for the characteristic resistance of the headed stud to concrete pull-out failure mode

$\psi_{re,N}$	Shell spalling factor
$\psi_{s,N}$	Factor taking into account the disturbance of the distribution of stresses in the concrete due to the proximity of an edge of the slab

3.9 Additional symbols used in Annex I

η_m	Moment ratio
$m_{ybt,Ed}$	Design transverse bending moment per unit of length of the plate supporting the slab
$m_{ybt,Rd}$	Design transverse resistant bending moment per unit of length of the plate supporting the slab

3.10 Additional symbols used in Annex J

3.10.1 Latin upper case letters

A_s	Tensile stress area of the bolt
D_{upper}	Largest value of the upper sieve size D in an aggregate for the coarsest fraction of aggregates in the concrete permitted by EN 206.
F_{prC}	Preloading force in the bolt
L_{bc}	Nominal bearing length
L_f	Infill lengths
$P_{b,Rd}$	Design value of shear resistance based on bolt failure
$P_{c,Rd}$	Design value of shear resistance based on concrete failure

3.10.2 Latin lower case letters

a_b	Breadth of the chamfer
a_h	Height of the chamfer
b_e	Width of the hollow core slab
b_g	Gap between the slabs
d	Diameter of the bolt used as connector
f_{ub}	Ultimate tensile strength of the bolt
h_j	Depth of the slab where the transfer of compression is not possible
h_{pc}	Thickness of the precast floor plate
h_{sc}	Overall nominal height of the non-preloaded bolted shear connector above the flange
h_{core}	Diameter of openings in hollow core slabs

k Factor

3.10.3 Greek lower case letters

α_b, α_c Factors

β_h Coefficient

ε_h Coefficient

ϕ Diameter of the transverse rebars

4 Basis of design

4.1 General Rules

4.1.1 Requirements

(1) The design of composite structures shall be in accordance with the general rules given in EN 1990 and the specific provisions for steel-concrete composite structures given in this document.

(2) The basic requirements of EN 1990 are deemed to be satisfied for composite structures when the following are applied together:

- limit state design in conjunction with the partial factor method in accordance with EN 1990;
- actions in accordance with EN 1991 (all parts);
- combination of actions in accordance with EN 1990; and
- resistances, durability and serviceability in accordance with this document.

4.1.2 Robustness

(1) The provisions on robustness given in EN 1990, EN 1993-1-1 and EN 1992-1-1 should be followed.

(2) The general arrangement of the structure and the interaction and connection of its various parts should be such as to give appropriate robustness during construction and use.

4.1.3 Reliability

(1) The provisions on reliability given in EN 1990, EN 1993-1-1 and EN 1992-1-1 shall be followed.

4.2 Principles of limit states design

(1) The ultimate limit state and serviceability limit state shall be considered for all aspects of the composite structure.

(2) All relevant design situations shall be considered, including relevant phases in the erection stage.

NOTE For the selection of design situations, see EN 1990.

4.3 Basic variables

4.3.1 Actions and environmental influences

- (1) The characteristic values of actions for the design of composite structures, including any regional, climatic and accidental situations, shall be obtained from the relevant parts of EN 1991.
- (2) The actions to be considered during the erection stage may be obtained from EN 1991-1-6.
- (3) In verification for steel sheeting as formwork, the effects of ponding shall be considered.

4.3.2 Material and product properties

- (1) Unless otherwise stated in EN 1994-1-1, actions caused by time dependent behaviour of concrete should be obtained from EN 1992-1-1.

4.3.3 Classification of actions

- (1) The effects that occur in statically determinate structures, and in statically indeterminate structures when compatibility of the deformations is not considered, shall be classified as primary effects.

NOTE The effects of shrinkage and creep of concrete and non-uniform changes of temperature result in internal forces in cross-sections, curvatures and longitudinal strains in members.

- (2) In statically indeterminate structures, the primary effects of shrinkage, creep and temperature are associated with additional action effects, such that the total effects are compatible. These additional effects shall be classified as secondary effects and shall be considered as indirect actions.

4.4 Verification by the partial factor method

4.4.1 Design values

4.4.1.1 Design values of actions

- (1) For the design of composite structures, combination of actions and partial factors of actions shall be derived from EN 1990:2023, Annex A.
- (2) For pre-stress by controlled imposed deformations, e.g. by jacking at supports, the partial factor γ_p should be specified for ultimate limit states, taking into account favourable and unfavourable effects.

NOTE The value for γ_p for favourable effects is 1,0 and for unfavourable effects is 1,1 unless a different value is given in the National Annex.

4.4.1.2 Design values of material or product properties

- (1) Unless an upper estimate of strength is required, partial factors shall be applied to lower characteristic or nominal strengths.
- (2) For concrete, the design compressive strength f_{cd} shall be obtained by reference to EN 1992-1-1:2023, 5.1.3 and 5.1.6(1) for normal weight concrete and to EN 1992-1-1:2023, Annex M, Tables M.1 and M.2 for lightweight concrete.

NOTE 1 For confined concrete, see EN 1992-1-1:2023, 8.1.4.

NOTE 2 More details for compressive strength f_{cd} are given in 5.1.

NOTE 3 The value for γ_c is that used in EN 1992-1-1.

(3) For steel reinforcement, the design yield strength f_{sd} corresponds to the value f_{yd} as given in EN 1992-1-1:2023, 5.2.4(1). More details for steel reinforcement are given in 5.2.

NOTE The value for γ_s is that used in EN 1992-1-1.

(4) For structural steel, connecting devices in accordance with EN 1993-1-8 and profiled steel sheeting, partial factors γ_M shall be applied. Unless otherwise stated, the partial factor for structural steel shall be taken as γ_{M0} .

NOTE 1 Values for γ_M are those given in EN 1993-1-1 for structural steel

NOTE 2 Values for γ_M are those given in EN 1993-1-8 for connecting devices

NOTE 3 Values for γ_M are those given in EN 1993-1-3 for profiled steel sheeting. The recommended value for profiled steel sheeting in tension is 1,0 unless the National Annex specifies different values.

(5) For shear connection, a partial factor γ_V shall be applied.

NOTE The value for γ_V is 1,25 unless the National Annex gives a different value.

(6) For longitudinal shear in composite slabs for buildings, a partial factor γ_{VS} shall be applied.

NOTE The value for γ_{VS} is 1,25 unless the National Annex gives a different value.

4.4.1.3 Design values of geometrical data

(1) Geometrical data for cross-sections and systems may be taken from the relevant EN and EN-ISO product standards, EADs or ETAs or drawings for the execution and treated as nominal values. Reference is given to EN 1993-1-1:2022, 4.2.2 and EN 1992-1-1:2023, 4.2.2.

4.4.2 Design resistances

(1) For composite structures, design resistances shall be determined in accordance with EN 1990:2023, Formula (8.20), Formula (8.21) or Formula (8.23).

4.4.3 Combination of actions

(1) The combination of actions given in EN 1990:2023, Clause 8 and Annex A shall be used.

4.4.4 Verification of static equilibrium

(1) The reliability format for the verification of static equilibrium for buildings, as described in EN 1990:2023, Table A1.8, shall be applied to design situations equivalent to the static equilibrium limit state, e.g. for the design of holding down anchors or the verification of uplift of bearings of continuous beams.

5 Materials

5.1 Concrete

(1) Unless otherwise given in EN 1994-1-1, properties should be obtained by reference to EN 1992-1-1:2023, 5.1.3 and 5.1.6 for normal weight concrete and to EN 1992-1-1:2023, Annex M for lightweight concrete.

(2) Except where (3) applies, the design compressive strength of the concrete f_{cd} should be taken from EN 1992-1-1:2023, 5.1.6 or Annex M.

(3) The design compressive strength of the concrete f_{cd} should be taken from EN 1992-1-1:2023, 5.1.6 formula (5.3), where the value of η_{cc} in accordance with EN 1992-1-1:2023, formula (5.4) or formula (M.4) should not exceed the value of 0,85 for

- the bending resistance determined using plastic methods in accordance with 8.2.1.2, 8.2.1.3 or 8.3.2 (2); or
- the bending resistance determined using non-linear methods in accordance with 8.2.1.5 where the complete thickness of the concrete flange is subject to compression; or
- the resistance of the cross section of a column, determined using plastic methods in accordance with 8.8.3.2.

Notwithstanding the above, where the resistance of the cross section of a concrete filled section is determined using plastic methods in accordance with 8.8.3.2, the limit of 0,85 on the value of η_{cc} may be increased to 1,0.

NOTE The proposed value for k_{tc} in accordance with EN 1992-1-1 is 1,0 for the concrete compression strength at 28-days, unless other values are given by the National Annex to this standard. For concrete compression strength based on $t_{ref} > 28$ days reference is given to EN 1992-1-1:2023, 5.1.6(1).

(4) This part of EN 1994 does not cover the design of composite structures with concrete strength classes lower than C20/25 and LC20/22 and higher than C70/85 and LC60/66.

(5) Shrinkage of concrete should be determined taking account of the ambient humidity, the dimensions of the element and the composition of the concrete.

(6) Where composite action is taken into account in buildings, the effects of autogenous shrinkage may be neglected in the determination of stresses and deflections.

(7) For buildings, the values of shrinkage strain should be as given in EN 1992-1-1 or in Annex C.

NOTE The choice of values can be given in the National Annex.

(8) The secant modulus of elasticity of the concrete E_{cm} for short-term loading should be obtained by reference to EN 1992-1-1:2023, 5.1.4 for normal weight concrete and EN 1992-1-1:2023, Annex M for lightweight aggregate concrete.

(9) The application of fibre reinforced concrete in accordance with EN 1992-1-1:2023, Annex L requires advanced design methods based on the stress-strain curve of the fibre reinforced concrete and justification of the shear connector resistance by experimental tests in accordance with Annex B.

5.2 Reinforcing steel

(1) Properties should be obtained by reference to EN 1992-1-1:2023, 5.2, see also 4.4.1.2(3). All reinforcing steel used in composite structures where plastic resistance is taken into account, should meet the requirements of ductility Class B or Class C in accordance with EN 1992-1-1:2023, Table 5.5.

(2) For composite structures, the design value of the modulus of elasticity E_s may be taken as equal to the value for structural steel given in EN 1993-1-1:2022, 5.2.5.

(3) The rules for in this part of EN 1994 does not apply for reinforcement grades higher than B500 for the following cases:

- plastic global analysis of continuous composite beams;
- plastic resistance of partially-encased composite beams sections;
- plastic resistance of composite slabs; and

- plastic resistance of composite columns in accordance with 8.8.3.

5.3 Structural steel

- (1) Properties should be obtained by reference to EN 1993-1-1:2022, 5.1 and 5.2, see also 4.4.1.2(4).
- (2) The rules for application of plastic resistance in this Part of EN 1994 apply to structural steel of nominal yield strength not more than 460 N/mm².

5.4 Connecting devices

5.4.1 Fasteners

- (1) Reference should be made to EN 1993-1-8 for requirements for fasteners (bolts, rivets or pins) and welding consumables.

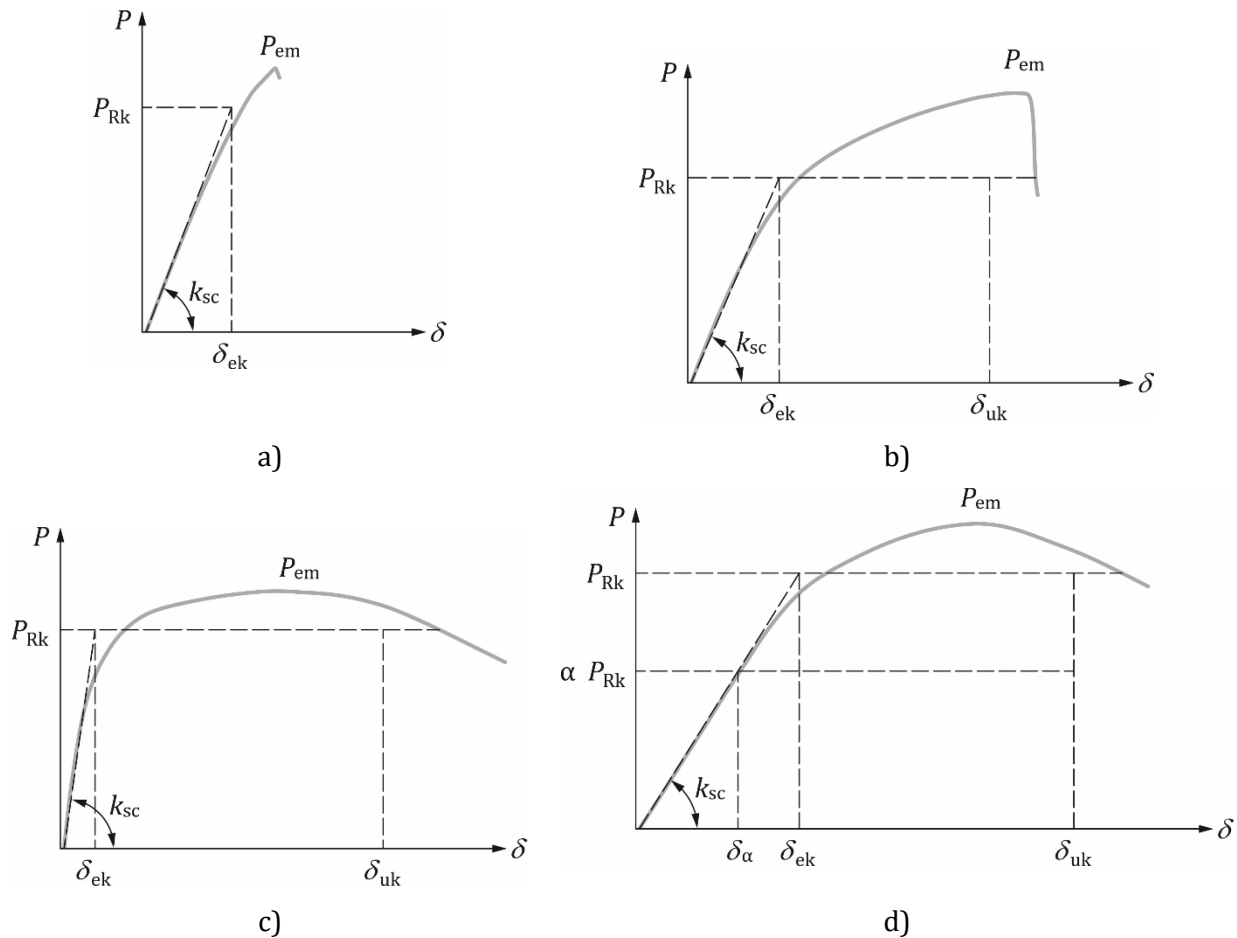
5.4.2 Shear connectors

5.4.2.1 Ductility

- (1) Shear connectors that are used in design according to this Eurocode should be classified according to the requirements given in Table 5.1. The associated load-slip relation P - δ for the Ductility Categories, together with the definition of δ_{ek} and δ_{uk} are given in Figure 5.1. The properties δ_{uk} , δ_{ek} , P_{Rk} and P_{em} are to be evaluated in accordance with Annex B.

Table 5.1 — Ductility Categories for shear connectors

Ductility Category	Characteristic elastic slip when characteristic resistance is reached δ_{ek}	Characteristic slip capacity in ULS δ_{uk}	Definition
D1	-	-	Brittle or flexible shear connector with linear or multilinear load slip curve, not fulfilling the requirements of the Ductility Categories D2 or D3 [see Figure 5.1(a) and(b)]
D2	$\delta_{ek} \leq 2,5 \text{ mm}$	$6,0 \text{ mm} \leq \delta_{uk} < 10 \text{ mm}$	Ductile shear connector in accordance with (2), (3) or (5) with sufficient deformation capacity in accordance with (4) to justify the assumption of ideal-plastic behaviour of the shear connection in the structure, where the characteristic resistance P_{Rk} intersects δ_{ek} and δ_{uk} in the load-slip curve [see Figure 5.1(c), (d)]
D3		$\delta_{uk} \geq 10 \text{ mm}$	



Key

- a) D1 Ductility Category D1 (brittle behaviour)
- b) D1 Ductility Category D1 (flexible behaviour with multilinear curve)
- c) D2 or D3 Ductility Category D2 and D3 (ductile behavior)
- d) D2 or D3 Ductility Category D2 and D3 where the design longitudinal shear stress is to be modified by the ratio α according to Clause (5)

Figure 5.1 — P-δ relation for Ductility Categories

(2) Headed studs in solid slabs may be deemed to be Ductility Category D2 when the rules for headed studs and shear connection in 8.6.8.1 apply and the concrete strength Class does not exceed C60/75.

NOTE For other types of shear connectors, the classification into the Ductility Category in accordance with Table 5.1 can be verified by push tests in accordance with Annex B or taken from an European Technical Specification (TS) or a transparent and reproducible assessment that complies with all the requirements of an European Assessment Document (EAD).

(3) Headed studs in profiled steel sheeting may be deemed to be at least Ductility Category D2 when the design resistance for shear is calculated in accordance with 8.6.9.1(1) or 8.6.9.2(1).

NOTE For Ductility Category D3 shear connectors, the classification can be provided by Push-Tests in accordance with Annex B or taken from an European Technical Specification (TS) or a transparent and reproducible assessment that complies with all the requirements of an European Assessment Document (EAD).

(4) The assumption of ideal plastic behavior is to be verified to classify shear connectors in Category D2 or D3. This may be deemed to be fulfilled when the assumption of a horizontal plateau of the load-slip curve between δ_{ek} and δ_{uk} can be proved.

NOTE A horizontal plateau of the load-slip curve between δ_{ek} and δ_{uk} can be assumed if the ratio of P_{em} / P_{Rk} does not exceed a value of 1,3.

(5) Shear connectors fulfilling the requirements of δ_{ek} for Category D2 or D3, exceeding the minimum ultimate slip capacity δ_{uk} given in Table 5.1 but not fulfilling the assumption of a horizontal plateau of the load-slip curve between δ_{ek} and δ_{uk} in accordance with (4) may be considered as Category D2 and D3 respectively, provided that design longitudinal shear stress on a shear failure for any potential surface of longitudinal shear failure in accordance with 8.6.11.2 is increased by the ratio of $P_{Rk} / (\alpha P_{Rk})$, [see Figure 5.1(d)]. Otherwise those connectors are to be classified in Category D1, Table 5.1.

NOTE 1 The values α may be taken from an European Technical Specification (TS) or a transparent and reproducible assessment that complies with all the requirements of an European Assessment Document (EAD) or the value for P_{em} and P_{Rk} can be determined by push tests in accordance with Annex B.1.

NOTE 2 For the classification, the shear connector resistance αP_{Rk} may be taken at a slip of δ_{α} . The design shear resistance is then taken as $P_{Rd} = \alpha P_{Rk} / \gamma_v$ where $0 < \alpha \leq 1,0$, [see Figure 5.1(d)]. The value δ_{α} is smaller than 2,0 mm unless the National Annex gives a different value for use within specific countries.

(6) The flexibility of the shear connector is to be considered:

- in ultimate limit states where significant impact on the rotation capacity of a member is expected;
- in serviceability limit states where significant impact on the deflection of a member is expected.

5.4.2.2 Headed stud shear connectors

(1) Reference should be made to EN ISO 13918. The headed stud shear connectors should be type SD1 or SD3.

(2) The rules for headed studs and shear connection in accordance with 8.6 apply.

5.4.2.3 Other types of shear connectors

(1) Other types of shear connectors may be used if their performance (in particular load-slip behaviour) has been adequately verified.

NOTE European Standard (EN), European Technical Specification (TS) or a transparent and reproducible assessment that complies with all the requirements of an European Assessment Document (EAD) or verification in accordance with Annex B.2 provide adequate verification.

5.5 Profiled steel sheeting for composite slabs in buildings

(1) Properties should be obtained by reference to FprEN 1993-1-3:2023, 5.1 and 5.2.

(2) For the design of composite slabs according to this standard, profiled steel sheets should be:

- profiled steel sheets manufactured from steel in accordance with EN 10025 (all parts) or;
- cold-formed steel sheets in accordance with EN 10149-2 or EN 10149-3 or;
- galvanized steel sheet in accordance with EN 10346 or;
- galvanized steel sheet with organic coatings in accordance with EN 10169.

6 Durability

6.1 General

(1) The relevant provisions given in EN 1990, EN 1992 and EN 1993 shall be followed.

(2) Detailing of the shear connection shall be in accordance with 8.6.10 for headed studs.

NOTE For other types of shear connector detailing is to be applied in accordance to CEN/TS 1994-1-102—¹, or an European Technical Product Specification.

6.2 Profiled steel sheeting for composite slabs in buildings

(1) The exposed surfaces of the steel sheeting shall be adequately protected to resist the particular atmospheric conditions. The relevant provisions given in EN 1993-1-3 should be followed.

(2) Zinc and other metallic coatings, if specified, shall be in accordance to EN 10346 or with relevant standards.

NOTE Hot-dipped zinc coated (Z275) profiled steel sheeting is sufficient for internal elements in a non-aggressive environment but the specification can be varied depending on service conditions.

(3) Organic coatings, if specified, should be in accordance with EN 10169 or with relevant standards in force.

7 Structural analysis

7.1 Structural modelling for analysis

7.1.1 Structural modelling and basic assumptions

(1) Clause 7 is applicable to composite structures in which most of the structural members and joints are either composite or of structural steel.

(2) The structural model and basic assumptions shall be chosen in accordance with EN 1990:2023, 7.1.1 and shall reflect the anticipated behaviour of the cross-sections, members, joints and bearings.

(3) Where the structural behaviour is essentially that of a reinforced or pre-stressed concrete structure, with only a few composite members, global analysis should be generally in accordance with EN 1992-1-1.

(3) Analysis of composite slabs with profiled steel sheeting in buildings should be in accordance with Clause 10.

(4) For the calculation of bending effects in composite beams resulting from shrinkage and non-uniform changes of temperature, the effective width of the concrete slab in accordance with 7.4.1.2 may be used.

7.1.2 Joint modelling

(1) The effects of the behaviour of the joints on the distribution of internal forces and moments within a structure, and on the overall deformations of the structure, may be neglected, but where such effects are significant (such as in the case of semi-continuous joints) they should be taken into account, see Clause 11 and EN 1993-1-8.

(2) To identify whether the effects of joint moment-rotation behaviour on the analysis need to be taken into account, a distinction should be made between three joint models as follows, see FprEN 1993-1-8:2023, 11.2 and 7.1.1.