1 TERMINOLOGY

1.1 Technical terms

In the present code the specific technical terms defined below are used. General technical terms used here are defined in SIA 260 and SIA 261.

Additive *Zusatzstoff* *ajout* *aggiunta*	Fine pozzuolanic or latent hydraulic substance for influencing concrete properties.
Admixture *Zusatzmittel* *adjuvant* *additivo*	Chemical substance which is added during the mixing process to influence the concrete or grout properties.
Aggregate *Gesteinskörnung* *granulat* *aggregati*	Mixture of grains of different sizes, obtained from natural sources or through the recycling of construction materials or artificially produced, for use in concrete or mortar.
Anchorage length *Verankerungslänge* *longueur d'ancrage* *lunghezza d'ancoraggio*	Transmission length required to transfer the reinforcing force to the concrete.
Anchorage zone *Ankerzone* *zone d'ancrage* *zona di ancoraggio*	Highly stressed zone in the immediate vicinity of a prestressing anchorage.
Bar bundle *Stabbündel* *groupement de barres* *fascio d'armature*	Two or three contacting reinforcing bars running in the same direction.
Bar spacing *Stababstand* *espacement des barres* *interasse dei ferri*	Distance between axes of parallel reinforcing bars.
Compression field *Druckfeld* *champ de compression* *campo di compressione*	Parallel stress field of uniaxial compression with uniform stress intensity.
Concrete *Beton* *béton* *calcestruzzo*	Construction material produced of cement, aggregate (maximum grain size greater than 4 mm) and water, possibly with the addition of additives and admixtures, which acquires its properties through the hydration of the cement.
Concrete overlay *Überbeton* *surbéton* *calcestruzzo di ricoprimento*	Layer of concrete applied to an existing structural member.
Cover concrete *Überdeckungsbeton* *béton d'enrobage* *calcestruzzo di copriferro*	Layer of concrete between reinforcement and concrete surface.

Cover of reinforcement
Bewehrungsüberdeckung
enrobage de l'armature
copriferro

Distance between the surface of the reinforcement and the surface of the concrete.

Cover reinforcement
Überdeckungsbewehrung
armature de peau
armatura del copriferro

Additional reinforcement within the cover concrete.

Creep
Kriechen
fluage
scorrimento viscoso

Strain increase due to persistent stress.

Designed concrete
Beton nach Eigenschaften
béton à performance spécifiée
calcestruzzo a prestazione garantita

Concrete whose required properties and additional requirements are the responsibility of the producer.

Deviator
Umlenkelement
élément de déviation
deviatore

Structural member for deviating prestressing tendons.

Duct
Hüllrohr
gaine
guaina

Metal or plastic tube for sheathing prestressing steel.

Edge distance of reinforcement
Randabstand der Bewehrung
distance au nu de l'armature
distanza armatura - superficie

Distance between the axis of the reinforcement and the surface of the concrete.

Edge element
Randelement
zone de bord
zona di borda

Strengthened edge zone of a shear wall.

Effective depth
statische Höhe
hauteur statique
altezza statica

Distance between the axis of gravity of the tensile reinforcement and the compressed edge of the cross-section.

Endurance limit
Dauerfestigkeit
limite de fatigue
limite di fatica

Fatigue strength corresponding to an unlimited number of stress reversals.

Equipment
Ausrüstung
equipement
infrastruttura

Parts of the construction works, such as carriageway joints, bearings, drains, railings etc., which are usually installed afterwards.

Exposure class
Expositionsklasse
classe d'exposition
classe d'esposizione

Classification category for structural members which describes the environmental influences and the resulting risks with respect to durability.

Fan
Fächer
éventail
ventaglio

Fan-shaped stress field of uniaxial compression with variable stress intensity.

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Fatigue strength curve
Betriebsfestigkeitskurve
courbe de résistance à la fatigue
curva della resistenza alla fatica

Double logarithmic representation of the fatigue strength as a function of the number of stress reversals.

Fibre reinforced concrete
Faserbeton
béton renforcé de fibres
calcestruzzo fibrorinforzato

Concrete with reinforcement in the form of admixed metallic, non-metallic, inorganic or organic fibres, which in comparison with the maximum grain size of the aggregate are of similar length and very thin.

Finite fatigue life
Zeitfestigkeit
résistance à la fatigue
resistenza alla fatica

Fatigue strength for a limited number of stress reversals.

Force spreading zone
Kraftausbreitungszone
zone de diffusion des forces
zona di diffusione della forza

Zone adjacent to an anchorage zone which serves to spread the prestressing force within the structural member.

Fresh concrete
Frischbeton
béton frais
calcestruzzo fresco

Concrete after mixing, as long as it can be worked, prior to achieving stability of form.

Grout
Füllgut
matériau d'injection
materiale d'iniezione

Construction material for filling ducts.

Hardened concrete
Festbeton
béton durci
calcestruzzo indurito

Concrete which has largely or completely hardened.

Heavyweight concrete
Schwerbeton
béton lourd
calcestruzzo pesante

Concrete with a density of over 2600 kg/m^3.

Lightweight concrete
Leichtbeton
béton léger
calcestruzzo leggero

Concrete with a density of 800 to 2000 kg/m^3.

Mortar
Mörtel
mortier
malta

Construction material produced of cement, aggregate (maximum grain size no greater than 4 mm) and water, possibly with the addition of additives and admixtures.

Node
Knoten
nœud
nodo

Highly bi- or triaxially stressed zone within a stress field.

Normalweight concrete
Normalbeton
béton normal
calcestruzzo normale

Concrete with a density of 2000 to 2600 kg/m^3.

Overstrength
Überfestigkeit
surrésistance
sovraresistenza

Difference between the characteristic strength value and the strength assumed under earthquake action.

Precast concrete element *Betonfertigteil* *élément préfabriqué* *elemento prefabbricato*	Reinforced or prestressed concrete member which is prefabricated at a factory or on site and is subsequently installed in its final position.
Prescribed concrete *Beton nach Zusammensetzung* *béton à composition prescrite* *calcestruzzo a composizione*	Concrete whose composition and constituent materials are prescribed to the producer.
Prestress *Vorspannung* *précontrainte* *precompressione*	Effect of the forces applied to a structure or structural member in a controlled manner through the tensioning of prestressing steel.
Prestressed concrete *Spannbeton* *béton précontraint* *calcestruzzo precompresso*	Concrete whose reinforcement consists partially of tensioned prestressing steel.
Prestressing anchorage *Spannverankerung* *ancrage de précontrainte* *testa d'ancoraggio*	Structural member for applying and anchoring a prestressing force.
Prestressing force *Spannkraft* *force de précontrainte* *forza di precompressione*	Tensile force which is applied to prestressing steel for the purpose of prestressing.
Prestressing steel *Spannstahl* *acier de précontrainte* *acciaio di precompressione*	Steel in the form of wires, strands and bars which is suitable for use in a prestressing tendon or for pretensioning.
Prestressing system *Spannsystem* *système de précontrainte* *sistema di precompressione*	Prestressing tendons and deviators together with associated equipment such as jacks and grouting equipment.
Prestressing tendon *Spannglied* *unité de précontrainte* *cavo di precompressione*	Reinforcing element consisting of tensioned prestressing steel, prestressing anchorages, duct and grout.
Pretensioning *Spannbettverfahren* *précontrainte par fils adhérents* *pre-tensione*	Prestressing method in which the prestressing steel is tensioned before concreting.
Reinforced concrete *Stahlbeton* *béton armé* *calcestruzzo armato*	Concrete whose reinforcement consists of reinforcing steel.
Reinforcement *Bewehrung* *armature* *armatura*	Insertions in concrete, usually of reinforcing steel and prestressing steel.
Reinforcing steel *Betonstahl* *acier d'armature passive* *acciaio d'armatura*	Steel which is suitable for use as non-prestressed reinforcement.

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Relative rib area
bezogene Rippenfläche
surface relative projetée des nervures
superficie relativa delle nervature

Ratio between the projected area of the ribs and the surface area of reinforcing steel bars.

Relaxation
Relaxation
relaxation
rilassamento

Stress decrease in prestressed steel whose length is kept constant.

Shotcrete
Spritzbeton
béton projeté
calcestruzzo spruzzato

Concrete produced by dry- or wet-mixing and placed and compacted by spraying.

Shrinkage
Schwinden
retrait
ritiro

Decrease in the volume of concrete caused by drying, and, at low water-cement ratios, due to hydration of the cement.

Steel fibre reinforced concrete
Stahlfaserbeton
béton renforcé de fibres métalliques
calcestruzzo con fibre d'acciaio

Fibre reinforced concrete with steel fibre reinforcement.

Stress field
Spannungsfeld
champ de contrainte
campo di tensione

Model of the force flow within the structural member or structure, represented by nodes, compression fields, struts, fans and ties.

Stress redistribution
Schnittgrössenumlagerung
redistribution des sollicitations
ridistribuzione degli sforzi

Change in the internal forces and moments of a statically indeterminate system determined on the assumption of linear elastic behaviour, characterised by superposition of a self-equilibrating stress state.

Strut
Druckstrebe
bielle de compression
biella in compressione

Narrow compression field with high stress intensity.

Verification section
Nachweisschnitt
section de contrôle
sezione di verifica

Section for which the punching resistance is determined.

1.2 Symbols

1.2.1 Latin upper-case letters

A	ductility class, stress limit for crack formation
A_c	cross-sectional area of the concrete
A_{cc}	cross-sectional area confined by stirrups
A_{c0}	loaded partial area
A_{c1}	total area with the same centre of gravity as A_{c0}
A_{eff}	effective cross-sectional area
A_k	effective cross-sectional area enclosed by longitudinal reinforcement
A_{nom}	nominal support area
A_p	cross-sectional area of the prestressing steel
A_{p1}	cross-sectional area of an individual prestressing tendon
A_s	cross-sectional area of the reinforcing steel
A_{sc}	cross-sectional area of the stirrups in the case of circular cross-sections (in relation to the area $d\,s_c$)
A_{sw}	cross-sectional area of the stirrups
A_{sy}, A_{sz}	cross-sectional area of the stirrups in y- and z-direction (in relation to the areas $a\,s_c$ and $b\,s_c$)
B	reinforcing steel, ductility class, stress limit for crack formation
C	concrete, consistency class (degree of compactability), ductility class, stress limit for crack formation, cold-drawn (prestressing steel)
Cl	class of chloride content
D	density class for lightweight concrete
D_{max}	maximum grain size of aggregate
E_{cd}	dimensioning value of the modulus of elasticity of concrete
E_{cm}	mean value of the modulus of elasticity of concrete
E_{lcm}	mean value of the modulus of elasticity of lightweight concrete
E_p	mean value of the modulus of elasticity of prestressing steel
E_s	mean value of the modulus of elasticity of reinforcing steel
F	consistency class (flow diameter)
F_c	force in the flexural compression zone
F_{cw}	concrete compressive force in the web
F_p	force in the prestressing steel
F_{pRd}	dimensioning value of the resistance of the prestressing steel
F_t	tensile force in the reinforcing steel
F_{tVd}	dimensioning value of the longitudinal tensile force due to shear force
H	hot-rolled (prestressing steel)
I	profiled (prestressing steel)
LC	lightweight concrete
M_d	dimensioning value of bending moment
M_r	bending moment at which the first crack appears

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M^+_{Rd}	maximum bending resistance
$M^+_{Rd,1}$	maximum bending resistance at head of column
$M^+_{Rd,2}$	maximum bending resistance at base of column
N_d	dimensioning value of normal force
N_D	$5 \cdot 10^6$ stress reversals
N_{fat}	$2 \cdot 10^6$ stress reversals
P	prestressing force
P_d	dimensioning value of prestressing force
P_k	characteristic value of prestressing force
P_{max}	maximum force in the prestressing steel during tensioning
P_∞	prestressing force at time $t = \infty$
Q_{fat}	fatigue action
R	fire resistance class, ribbed (prestressing steel)
R	ultimate resistance
R_d	dimensioning value of ultimate resistance
RH	relative humidity
S	consistency class (slump)
S7	seven-wire strand
T	temperature
T_d	dimensioning value of torsional moment
T1	profiling type (prestressing steel)
V_d	dimensioning value of shear force
$V_{d,i}$	dimensioning value of shear force in panel i
V^+_d	increased shear force
V_{Rd}	dimensioning value of the shear resistance
$V_{Rd,c}$	dimensioning value of the resistance of the concrete compression field
$V_{Rd,s}$	dimensioning value of the resistance of the stirrup reinforcement
X…	exposure class (X0, XC, XD, XS, XF, XA)
Y	prestressing steel

1.2.2 Latin lower-case letters

a	dimension
a_c	dimension of the confining stirrups
a_d	dimensioning value of a geometrical property
a_{min}	smallest cross-sectional dimension
a_1, a_2	width of the area A_{c0} or A_{c1}
b	dimension
b_c	dimension of the confining stirrups
b_{eff}	effective slab width
$b_{eff,i}$	part of the effective slab width

b_i half of distance between two adjacent webs

b_w web width, thickness of edge element

$b_{w,nom}$ nominal value of web width

b_{w0} thickness of shear wall

b_1, b_2 length of the area A_{c0} or A_{c1}

c integration factor

c_{nom} cover of reinforcement

d effective depth, mean effective depth in the case of several layers of reinforcement, diameter

d' distance of compression reinforcement from compression edge

d_c diameter of the spiral reinforcement

d_i mandrel diameter for bends

d_k maximum diameter which can be inscribed within the area A_k

d_x, d_y effective depth in relation to the reinforcement in x- or y-direction

e eccentricity

e_d dimensioning value of load eccentricity

e_{0d} eccentricity due to geometrical imperfections

e_{1d} eccentricity of action

e_{2d} eccentricity due to deformation

f_{bd} dimensioning value of bond stress

$f_{bd}(t)$ dimensioning value of bond stress at time t

f_{cd} dimensioning value of concrete compressive strength

f_{ck} characteristic value of cylinder compressive strength (5% fractile)

$f_{ck,cube}$ characteristic value of cube compressive strength

f_{cm} mean value of cylinder compressive strength

f_{ctd} dimensioning value of concrete tensile strength

$f_{ctk\ 0.05}$ 5% fractile value of concrete tensile strength

$f_{ctk\ 0.95}$ 95% fractile value of concrete tensile strength

f_{ctm} mean value of concrete tensile strength

f_{lctm} mean value of tensile strength of lightweight concrete

f_p tensile strength of prestressing steel

f_{pd} dimensioning value of yield strength of prestressing steel

f_{pk} characteristic value of tensile strength of prestressing steel

$f_{p0.1}$ 0.1% strain limit stress of prestressing steel

$f_{p0.1k}$ characteristic value of yield strength of prestressing steel

f_R relative rib area

f_s yield strength of reinforcing steel

f_{sd} dimensioning value of yield strength of reinforcing steel

f_{sk} characteristic value of yield strength of reinforcing steel

$f_{s0.2}$ 0.2% strain limit stress of reinforcing steel

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f_t	tensile strength of reinforcing steel
f_{tk}	characteristic value of tensile strength of reinforcing steel
$(f_t/f_s)_k$	characteristic value of ratio (f_t/f_s)
h	height, height of structural member
h_{pl}	height of plastic region
h_s	storey height
h_w	height of a shear wall
h_0	relative thickness of structural member = $2A_c/u$
k_c	factor for determining concrete strength
$k_{c\sigma}$	factor for reduction of normal stress
$k_{c\tau}$	factor for reduction of shear stress limit
k_d	factor for determining the shear resistance of slabs
k_E	factor for determining the modulus of elasticity of concrete
k_e	factor for reduction of the length of the verification section
k_f	reduction factor for reinforcing steel crossing joints
k_r	factor for determining the punching resistance of slabs
k_s	strain-hardening ratio of reinforcing steel
k_T	factor for taking into account temperature
k_t	factor for taking into account the dimensions of the structural member
k_v	factor for taking into account deformations
k_ρ	factor for taking into account the reinforcement ratio of slabs
k_σ	factor for calculating the stress-strain diagram of concrete
k_ξ	amplification factor for stresses in reinforcing steel
$k_Ø$	reduction factor for bent reinforcing bars
l	length, span
l_{bd}	anchorage length
$l_{bd,0}$	basic value of anchorage length of prestressing steel (pretensioning)
$l_{bd,net}$	basic value of anchorage length
l_c	length of edge element
l_{cr}	buckling length of compression member
l_i	span i
l_w	length of a shear wall
l_x, l_y	span in x-, y-direction
l_0	distance between points of zero moment
m	slope of the fatigue strength curve, number of compression members
m_d	dimensioning value of bending moment per unit length
m_{Dd}	dimensioning value of decompression moment
m_{Pd}	dimensioning value of bending moment in the column strip due to prestressing
m_{Rd}	dimensioning value of the bending resistance per unit length

m_{0d}	reference moment per unit length
n	number, number of storeys
q	response factor for structures subjected to earthquake action
r	radius
r_y	radius of plastic region
s	bar spacing
s_c	spacing of confining stirrups
t	time, duration, age, dimension
t_k	effective panel thickness
t_s	age of concrete at onset of shrinkage
t_0	age of concrete at initial loading
u	circumference, circumference of the verification section, deviation force
v_d	dimensioning value of shear force per unit length
$v_{d,max}$	maximum shear force per unit length due to permanent and fatigue actions
$v_{d,min}$	minimum shear force per unit length due to permanent and fatigue actions
v_{Rd}	dimensioning value of shear or punching resistance per unit length
w	deflection
$w_{c\varphi}$	deflection, calculated for the uncracked state, taking into account creep of concrete
w_R	greatest deflection assumed on reaching the ultimate resistance
x	depth of the flexural compression zone, coordinate
y	coordinate
z	lever arm of the internal forces, coordinate
z_i	lever arm of the longitudinal forces in the panel i

1.2.3 Greek letters

α	compression field inclination
α_f	compression field inclination in the flange
α_{fat}	compression field inclination in the case of fatigue action
α_i	base inclination of compression members
α_{im}	mean angle of inclination of groups of compression members
α_T	coefficient of thermal expansion
β	inclination of a stirrup reinforcement
$\beta(t_0)$	factor to account for the age of the concrete at initial loading
$\beta(t–t_0)$	factor to account for the duration of loading
$\beta(t–t_s)$	factor to account for the onset of shrinkage
β_{fc}	factor to account for the concrete strength
β_p	inclination of the prestressing tendons in relation to the reference axis
γ_c	resistance factor for concrete
γ_{cE}	partial factor for the modulus of elasticity of concrete
γ_P	load factor for an action due to prestressing

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γ_s	resistance factor for reinforcing steel and prestressing steel
$\Delta\sigma_{ed}$	equivalent stress difference (= $\lambda\Delta\sigma_{sd}$)
$\Delta\sigma_p$	stress increase in prestressing steel
$\Delta\sigma_{p,D}$	endurance limit of prestressing steel
$\Delta\sigma_{pd,D}$	dimensioning value of endurance limit of prestressing steel
$\Delta\sigma_{pd,fat}$	dimensioning value of fatigue resistance of prestressing steel
$\Delta\sigma_{p,fat}$	nominal fatigue resistance of prestressing steel
$\Delta\sigma_{pr}$	stress variation due to relaxation of the prestressing steel
$\Delta\sigma_{sd}$	absolute value of the stress difference between maximum and minimum stress under fatigue action
$\Delta\sigma_{s,D}$	endurance limit of reinforcing steel
$\Delta\sigma_{sd,D}$	dimensioning value of endurance limit of reinforcing steel
$\Delta\sigma_{sd,fat}$	dimensioning value of fatigue resistance of reinforcing steel
$\Delta\sigma_{sd,i}$	individual stress difference due to fatigue action
$\Delta\sigma_{s,fat}$	nominal fatigue resistance of reinforcing steel
$\Delta\varphi$	unintended deviations per unit length
$\Delta V_{Rd,p}$	vertical component of force in the inclined prestressing tendon
ε	amplification factor, axial strain
ε_c	concrete compressive strain
ε_{cc}	creep strain of concrete
$\varepsilon_{c,el}$	elastic strain of concrete
ε_{cs}	shrinkage strain
$\varepsilon_{cs,\infty}$	final value of shrinkage
ε_{c1d}	dimensioning value of concrete compressive strain on reaching f_{cd}
ε_{c2d}	dimensioning value of ultimate compressive strain of concrete
$\varepsilon_{c\infty}$	irreversible concrete compressive strain
ε_{sd}	dimensioning value of strain in the reinforcement
ε'_{sd}	dimensioning value of strain in the reinforcement in the compression zone
ε_{ud}	dimensioning value of ultimate strain of reinforcing steel or prestressing steel
ε_{uk}	characteristic value of ultimate strain of reinforcing steel or strain at maximum load for prestressing steel
ζ	ratio of concrete compressive strains
η_{fc}	conversion factor to account for the more brittle failure behaviour of higher-strength concrete
η_l	conversion factor for the tensile strength of lightweight concrete
η_{lE}	conversion factor for the modulus of elasticity of lightweight concrete
ϑ	angle between the main reinforcement and the principal direction of the shear force
κ	amplification factor to account for higher mode shapes
λ	operational load factor
μ	frictional coefficient
ν_c	Poisson's ratio

ξ	ratio of bond strengths
ρ	dry density, geometrical reinforcement ratio of the tension zone referred to the effective slab width
ρ'	geometrical reinforcement ratio of the compression zone
σ	normal stress
σ_c	normal stress in concrete
$\sigma_{cd,max}$	maximum compressive stress in concrete due to permanent and fatigue actions
$\sigma_{cd,min}$	minimum compressive stress in concrete due to permanent and fatigue actions
σ_d	dimensioning value of a normal stress
σ_p	stress in prestressing steel
σ_{pd}	dimensioning value of stress in prestressing steel to be anchored (pretensioning)
σ_{pi}	initial stress in prestressing steel
$\sigma_{p,max}$	maximum stress in prestressing steel
σ_{p0}	stress in prestressing steel at time $t = 0$
$\sigma_{p\infty}$	stress in prestressing steel after deduction of all losses
$\sigma_{s,adm}$	stress limit related to cracking
σ_1	pressure due to confining reinforcement
τ_{cd}	dimensioning value of shear stress limit
$\tau_{cd,red}$	dimensioning value of the shear strength of a joint
$\varphi(t,t_0)$	creep coefficient
φ_{RH}	factor to account for relative humidity
φ_x	sum of planned deviation angles up to point x
χ_d	dimensioning value of maximum curvature
$\chi_{d,irr}$	irreversible curvature
ω_c	mechanical reinforcement ratio of confinement
ω_y, ω_z	mechanical reinforcement ratio of confinement in y- or z-direction

1.2.4 Special symbols

Ø	diameter
$Ø_H$	external duct diameter
$Ø_{min}$	diameter of the thinnest reinforcing bar
$Ø_p$	equivalent diameter of a prestressing tendon
$Ø_s$	diameter of a reinforcing bar
$Ø_{sl}$	diameter of the reinforcing bars in longitudinal direction
$Ø_{sl,max}$	maximum diameter of the reinforcing bars in longitudinal direction
{…}	function of the dimensioning values within brackets; depending on the verification, individual or several of these values may not apply.

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