List of symbols

a throat thickness of fillet weld

a_1 effective length of the foundation, length of the base plate

a_c height of the column cross-section

a_h size of the anchor head

b width of angle leg, width of the base plate

b_0, b_1, b_w width, effective width of the foundation

b_b width of beam flange

b_c width of the column cross-section, of column flange

b_{eff} effective width

b_{haz} width of heat affected zone

b_p width of end plate

c effective width of the flexible base plate

$c_\varnothing$ required concrete cover for reinforcement

d nominal diameter of the bolt

d_0 diameter of the bolt hole

d_0, d_1, d_2 diameter

d_h diameter of anchor head

e eccentricity, distance from bolt to edge of T-stub, from edge of the angle

e, e_x, e_a, e_b bolt distances

e_0 eccentricity of the joint

e_1, e_2 bolt end distance, in force direction, perpendicular to force direction

e_x distance from bolt to edge of end plate

f_a characteristic strength for local capacity in tension and compression

$f_{a,haz}$ characteristic strength of heat affected zone

f_{cd} design value of compressive cylinder strength of concrete $f_{cd} = f_{ck} / \gamma_c$

$f_{cd,g}$ design value of compressive cylinder strength of grout

f_{ck} characteristic value of concrete compressive cylinder strength

f_j concrete bearing strength

f_o characteristic strength for bending and yielding in tension and compression

f_u ultimate strength

f_{ub} ultimate strength of the bolt

f_v characteristic shear strength

$f_{v,haz}$ characteristic shear strength of heat affected zone

$f_{vw,d}$ design shear resistance of the fillet weld per unit length

f_w characteristic strength of the weld metal

f_y yield stress of steel

f_{ya} average yield strength

f_{yb} yield stress of the bolt

f_{yc} yield stress of column

g length of the gap

g_1 leg length of fillet weld

h, h_0, h_1 height, height of concrete foundation

h_c height of column cross section

h_{ef} length of anchor embedded in the concrete

k stiffness coefficient

k_c total stiffness coefficient of the compression zone

k_{eff} total stiffness coefficient of one bolt row in tension

k_{eq} total stiffness coefficient the tension zone

k_i stiffness of component i

k_j stress concentration factor

k_θ reduction factor based on material temperature

m, m_x	distance from the bolt centre to the plate
m_1, m_2	distances from bolt to web of T-stub
$m_{pl,Rd}$	plastic bending moment resistance of the base plate per unit length
m_x	distance from bolt to beam flange
n	distance from bolt centre to contact with the foundation
p	bolt pitch
p_1, p_2	bolt pitch; in force direction, perpendicular to force direction
r	lever arm
r_c	fillet radius of column
r_e	theoretical resistance obtained from the design model
r_t	experimentally found resistance
t	thickness
t_0, t_1, t_2, t_w	thickness
t_e	effective thickness of partial penetration butt weld
t_f	thickness of flange
t_{fb}	thickness of beam flange
t_{fc}	thickness of column flange
t_g	thickness of grout
t_h	thickness of anchor head
t_p	thickness of plate thickness, of end plate
t_{tc}	thickness of column flange
t_w	thickness of the column web
t_{wa}	thickness of the washer
t_{wc}	thickness of column web
w_1, w_2	distance between bolts
x, y, z	axes
z	lever arm
z_c	lever arm of compression zone
$z_{c,b}$	lever arm of compression zone at bottom of the joint
$z_{c,t}$	lever arm of compression zone at top of the joint
z_{eq}	equivalent lever arm
z_t	lever arm of tension zone

A	area, surface area of the member per unit length
A_0	area
A_b	total area of bolt, unthreaded part
A_c	area of the column
A_{eff}	effective area; of the flexible base plate, of the cross-section
A_g	area of the gross section
A_h	bearing area of the bolt head
A_{net}	net area
A_s	net area of the bolt, in thread
A_v	shear area
B_e	effective length
$B_{t,Rd}$	design resistance of bolt in tension
C_0, C_1	constant values
C_e, C_T, C_X, C_K	efficiency parameter
$C_{f,d}$	friction coefficient

E	Young's modulus of steel
F	force
$F_{b,Rd}$	design bearing resistance
$F_{c,b,Rd}$	design resistance in compression in bottom zone of the joint
$F_{c,fb,Rd}$	design resistance of beam flange in compression
$F_{c,Rd}$	design resistance in compression
$F_{c,t,Rd}$	design resistance in compression in top zone of the joint
$F_{c,wc,Rd}$	design resistance of column web in compression
F_{el}	elastic limit
$F_{exp,fy/fum}$	resistance for the structural members obtained from the tests to failure
$F_{o,Rd}$	pull-out resistance
$F_{p,Cd}$	design preloading force
$F_{p,Rd}$	pull-through resistance
F_{Rd}	design resistance
F_{Sd}	applied force
$F_{t,Rd}$	design tension resistance
$F_{t,Sd}$	tensile force
$F_{t,ep,Rd}$	design resistance of end plate in bending
$F_{t,fc,Rd}$	design resistance of column flange in bending
$F_{t,wb,Rd}$	design resistance of beam web in tension
$F_{t,wc,Rd}$	design resistance of column web in tension
$F_{t,i,Rd}$	resistance of the *i-th* bolt row in tension
$F_{v,max}$	maximum shear force obtained in a test
$F_{v,Rd}$	design shear resistance
$F_{v,Sd}$	shear force
$F_{w,Rd}$	resistance of the weld per unit length
HAZ	Heat Affected Zone
I	second moment of inertia
I_b	second moment of inertia of beam
I_c	second moment of inertia of column
$\overline{S}_{j,ini}$	relative initial stiffness
$K_{i,e,20°C}$, $K_{i,pl,20°C}$	elastic and plastic stiffness of the component, at ambient temperature
L, L_1	length, beam span
L_b	length of beam
L_b	free length of the anchor bolt
$L_{b,lim}$	maximal bolt length, when anchor bolt my be exposed to prying
L_{be}	embedded length of the anchor bolt
L_{bf}	length of anchor bolt above the concrete foundation
L_c	length of column
L_{eff}	effective length of a T-stub
L_{eq}	equivalent length of the anchor bolt
L_w	length of fillet weld

$L_{w,eff}$	effective length of fillet weld
M	bending moment
M'	bending moment per unit length
$M_{j,Rd}$	moment resistance of joint
$M_{j,ult,d}$	predicted ultimate bending moment of joint
$M_{j,ult,ecp}$	experimental ultimate bending moment resistance of joint
$M_{pl,Rd}$	plastic bending moment resistance of member
M_{Sd}	applied bending moment
M_w	bending moment carried by the weld
N	normal force
N_0, N_1, N_2	axial force
N_{1y}	axial force of the chord corresponding to the plastification
$N_{pl,Rd}$	resistance of cross section
N_{Sd}	applied axial force
$N_{u,Rd}$	design ultimate resistance of the cross-section
Q	prying force
R_d	resistance of the connection
R_{fy}	plastic resistance of the connected dissipative member
S_j	stiffness of joint
$S_{j,sec}$	joint secant stiffness
$S_{j,ini}$	initial stiffness of joint
$S_{j,ini}$	initial stiffness of the joint
V	volume of the member per unit length
$V_{G,Ed}$	shear force due to the non seismic actions
$V_{M,Ed}$	shear force due to the resisting moments at the end sections of the beam
$V_{pl,Rd}$	plastic resistance to the shear force
V_{Sd}	design shear effort
$V_{wp,Rd}$	design resistance of column web panel in shear
W_{ext}	external energy
W_{int}	internal energy

α	reduction factor of bearing resistance
α_b	factor for bearing resistance
α_d	factor of end distance and pitch for bearing resistance
β	transformation parameter for shear loading
β, β_2, β_3	reduction factors
β_j	joint coefficient
β_{Lw}	reduction factor for long welds
β_w	correlation factor
δ	deformation, beam deflection at midspan, component deformation
δ_c	deformation of components in compression zone
$\delta_{b,c}$	deformation of components in compression zone at bottom of the joint

$\delta_{t,c}$	deformation of components in compression zone at top of the joint
δ_{Cd}	deformation capacity
δ_t	deformation of components in tension zone
$\Delta\theta$	temperature interval
Δt	time interval
ε	strain
ϕ	joint rotation
ϕ_{pl}	plastic rotation capacity
ϕ_p	available plastic rotation
γ	*partial safety factor
γ_M	*partial safety factor for the resistance
$\gamma_{M,fi}$	*partial safety factor for fire
γ_{M0}	*partial safety factor for steel
γ_{Mb}	*partial safety factor of bolted connections
γ_{Mw}	*partial safety factor for weld
γ_{Ms}	*partial safety factor of slip resistance
$\gamma_{Ms,ser}$	*partial safety factor of slip resistance at serviceability
γ_{M2}	*partial safety factor of net section at bolt holes
θ	temperature
θ_0	temperature of the lower beam flange at mid span
$\theta_1, \theta_2, \theta_i$	angle between diagonal and the chord
σ	normal stress
$\sigma_{//}$	normal stress parallel to the axis of the weld
$\sigma_\perp$	normal stress perpendicular to the axis of the weld
τ	shear stress
$\tau_{//}$	shear stress (in the critical plane of the throat) parallel to the weld axis
$\tau_\perp$	shear stress (in the critical plane of the weld) perpendicular to the weld axis
η	stiffness modification coefficient
λ_1, λ_2	dimensions of the T-stub
$\overline{\lambda}$	relative slenderness
$\mu_0,$	degree of utilization
μ	stiffness ratio
ρ_{haz}	heat affected zone (HAZ) softening factor
ψ	shape factor

* in prEN 1993-1-8: 2003 are the partial safety factors for prediction of the resistance simplified:

γ_{M0}	partial safety factor of steel
γ_{M1}	partial safety factor of stability
γ_{M2}	partial safety factor of connectors (bolts, rivers, pins, welds, weld, plates in bearing)
γ_{M3}	partial safety factor of hybrid connections, or under fatigue loading
γ_{M4}	partial safety factor of an injection bolt
γ_{M5}	partial safety factor of joints in hollow section lattice girder
$\gamma_{M6,ser}$	partial safety factor of pins at serviceability limit state
γ_{M7}	partial safety factor of high strength bolts

Indexes

$20°C$	ambient temperature
a	structural steel
b	bearing; bolt
c	calculation
cr	critical
d	design value
e	elastic
E	Young's modulus
f	failure, furnace
fi	fire design
HAZ	Heat Affected Zone
i	component
j	joint
m	member
max	maximum
min	minimum
pl	plastic
Rd	design resistance
Sd	design loading
t	time, duration on fire exposure
ten, t	tension
v	shear
w	weld
y	yield