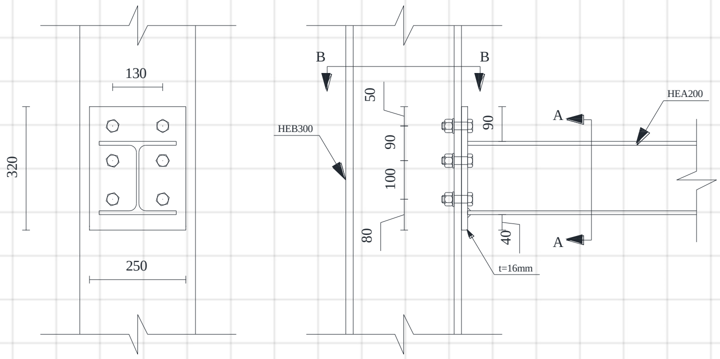
This [playlist](#) series focuses on the rigid connection calculation according to EN 1993-1-8. A comparison is made with Ansys at the end of the series after hand calculation. Finally, tips for applying the semi-rigid connection to RFEM are presented.

An Endplate welded to a beam, HEA200, is bolted to a HEB300 column with 6M20 class 8.8, as shown in the figures below. Steel material is S355 for all parties.

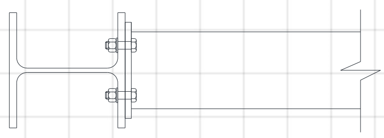
This [video](#) shows the resistance calculation of the Column Web in transverse compression according to EN 1993-1-8. The contents are as follows:

a) Table 6.1 Item 2 explanation.
b) Column Web in Transverse compression according to 6.2.6.2.
c) Column Web resistance in compression.

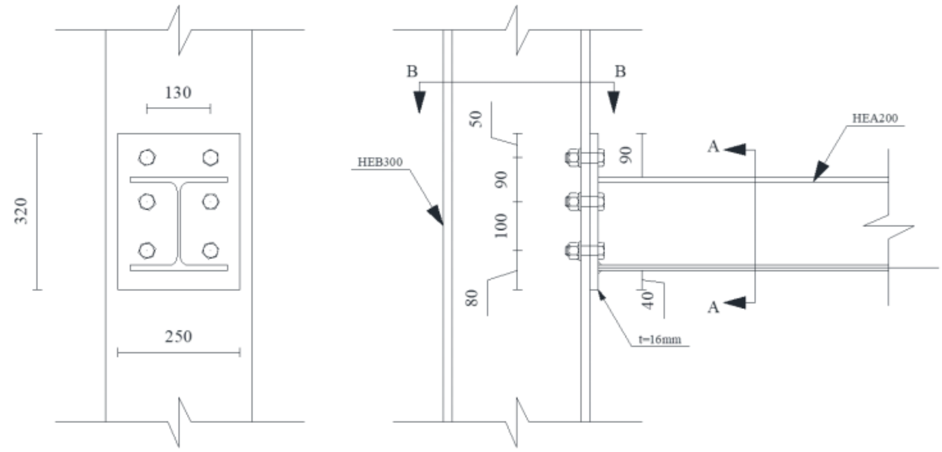
All dimensions are in mm unless otherwise specified.



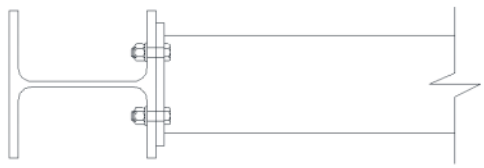
Sec A-A



Sec B-B

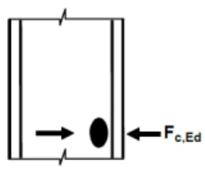


Sec A-A



Sec B-B

Table 6.1: Basic joint components

Component			Reference to application rules		
			Design Resistance	Stiffness coefficient	Rotation capacity
2	Column web In transverse compression		6.2.6.2	6.3.2	6.4.2 and 6.4.3

6.2.6.2 Column web in transverse compression

(1) The design resistance of an unstiffened column web subject to transverse compression should be determined from:

$$F_{c,wc,Rd} = \frac{\omega k_{wc} b_{eff,c,wc} t_{wc} f_{y,wc}}{\gamma_{M0}} \quad \text{but} \quad F_{c,wc,Rd} \leq \frac{\omega k_{wc} \rho\, b_{eff,c,wc} t_{wc} f_{y,wc}}{\gamma_{M1}} \qquad \text{... (6.9)}$$

where:

ω is a reduction factor to allow for the possible effects of interaction with shear in the column web panel according to Table 6.3;

$b_{eff,c,wc}$ is the effective width of column web in compression:

– for bolted end-plate connection:

$$b_{eff,c,wc} = t_{fb} + 2\sqrt{2}\,a_p + 5(t_{fc} + s) + s_p \qquad \text{... (6.11)}$$

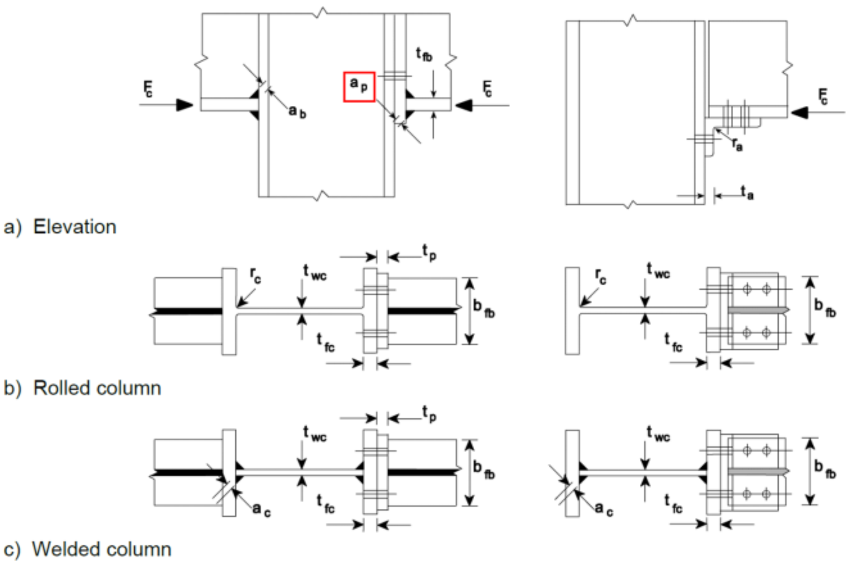
leg size of weld

s_p is the length obtained by dispersion at 45° through the end-plate (at least t_p and, provided that the length of end-plate below the flange is sufficient, up to $2t_p$).

– for a rolled I or H section column: $s = r_c$

– for a welded I or H section column: $s = \sqrt{2}a_c$

$s_p = t_p = 16$ mm
$\sqrt{2} \cdot a_p = 8$ mm
$s = r_c = 27$ mm
$t_{fb} = 10$ mm
$t_{fc} = 19$ mm
HEB 300
HEA 200
HEB 300



$b_{eff,c,wc} = 272$mm

Figure 6.6: Transverse compression on an unstiffened column

Table 6.3: Reduction factor ω for interaction with shear

Transformation parameter β	Reduction factor ω
$0 \leq \beta \leq 0{,}5$	$\omega = 1$
$0{,}5 < \beta < 1$	$\omega = \omega_1 + 2(1-\beta)(1-\omega_1)$
$\beta = 1$	$\omega = \omega_1$
$1 < \beta < 2$	$\omega = \omega_1 + (\beta - 1)(\omega_2 - \omega_1)$
$\beta = 2$	$\omega = \omega_2$
$\omega_1 = \dfrac{1}{\sqrt{1+1{,}3(b_{eff,c,wc}\, t_{wc} / A_{vc})^2}}$	$\omega_2 = \dfrac{1}{\sqrt{1+5{,}2(b_{eff,c,wc}\, t_{wc} / A_{vc})^2}}$
A_{vc} is the shear area of the column, see 6.2.6.1;	
β is the transformation parameter, see 5.3(7).	

$b_{eff,c,wc} = 272$mm
$t_{wc} = 11$ mm
$A_{vc} = 4743$ mm^2
$\omega = \omega_1 = 0.81$

ρ is the reduction factor for plate buckling:

- if $\bar{\lambda}_p \leq 0,72$: $\rho = 1,0$ ... (6.13a)
- if $\bar{\lambda}_p > 0,72$: $\rho = (\bar{\lambda}_p - 0,2)/\bar{\lambda}_p^{\,2}$ ... (6.13b)

$\bar{\lambda}_p$ is the plate slenderness:

$$\bar{\lambda}_p = 0,932\sqrt{\frac{b_{eff,c,wc}\,d_{wc}\,f_{y,wc}}{E t_{wc}^{\,2}}} \quad \text{... (6.13c)}$$

- for a rolled I or H section column: $d_{wc} = h_c - 2(t_{fc} + r_c)$
- for a welded I or H section column: $d_{wc} = h_c - 2(t_{fc} + \sqrt{2}a_c)$

k_{wc} is a reduction factor and is given in 6.2.6.2(2).

$h_c = 300\ mm$, $t_{fc} = 19\ mm$, $r_c = 27\ mm$ $\rightarrow$ $d_{wc} = 300\ mm - 2(19\ mm + 27\ mm) = 208\ mm$

$b_{eff,c,wc} = 272\ mm$

$f_y = 355\ MPa$

$E = 210\ GPa$, $t_{wc} = 11\ mm$

$\rightarrow \bar{\lambda}_p = 0.932\sqrt{\frac{272\ mm \times 208\ mm \times 355\ MPa}{210\ GPa \times (11\ mm)^2}}$

$\bar{\lambda}_p = 0.83 > 0.72 \rightarrow \rho = (0.83 - 0.2)/0.83^2 = 0.91$

6.2.6.2 Column web in transverse compression

(2) Where the maximum longitudinal compressive stress $\sigma_{com,Ed}$ due to axial force and bending moment in the column exceeds $0,7 f_{y,wc}$ in the web (adjacent to the root radius for a rolled section or the toe of the weld for a welded section), its effect on the design resistance of the column web in compression should be allowed for by multiplying the value of $F_{c,wc,Rd}$ given by expression (6.9) by a reduction factor k_{wc} as follows:

- when $\sigma_{com,Ed} \leq 0,7 f_{y,wc}$: $k_{wc} = 1$
- when $\sigma_{com,Ed} > 0,7 f_{y,wc}$: $k_{wc} = 1,7 - \sigma_{com,Ed}/f_{y,wc}$ ... (6.14)

NOTE: Generally the reduction factor k_{wc} is 1,0 and no reduction is necessary. It can therefore be omitted in preliminary calculations when the longitudinal stress is unknown and checked later.

$k_{wc} = 1$

$$F_{c,wc,Rd} = \frac{\omega k_{wc} b_{eff,c,wc} t_{wc} f_{y,wc}}{\gamma_{M0}} \quad \text{but} \quad F_{c,wc,Rd} \le \frac{\omega k_{wc} \rho b_{eff,c,wc} t_{wc} f_{y,wc}}{\gamma_{M1}}$$

$\omega = 0.81$, $k_{wc} = 1$, $b_{eff,c,wc} = 272$ mm, $t_{wc} = 11$ mm, $f_{y,wc} = 355$ MPa, $\gamma_{M0} = 1$

$\omega = 0.81$, $k_{wc} = 1$, $\rho = 0.91$, $b_{eff,c,wc} = 272$ mm, $t_{wc} = 11$ mm, $f_{y,wc} = 355$ MPa, $\gamma_{M1} = 1$

$F_{c,wc,Rd} = 860\ kN \nless 783\ kN$

$F_{c,wc,Rd} = 783\ kN$