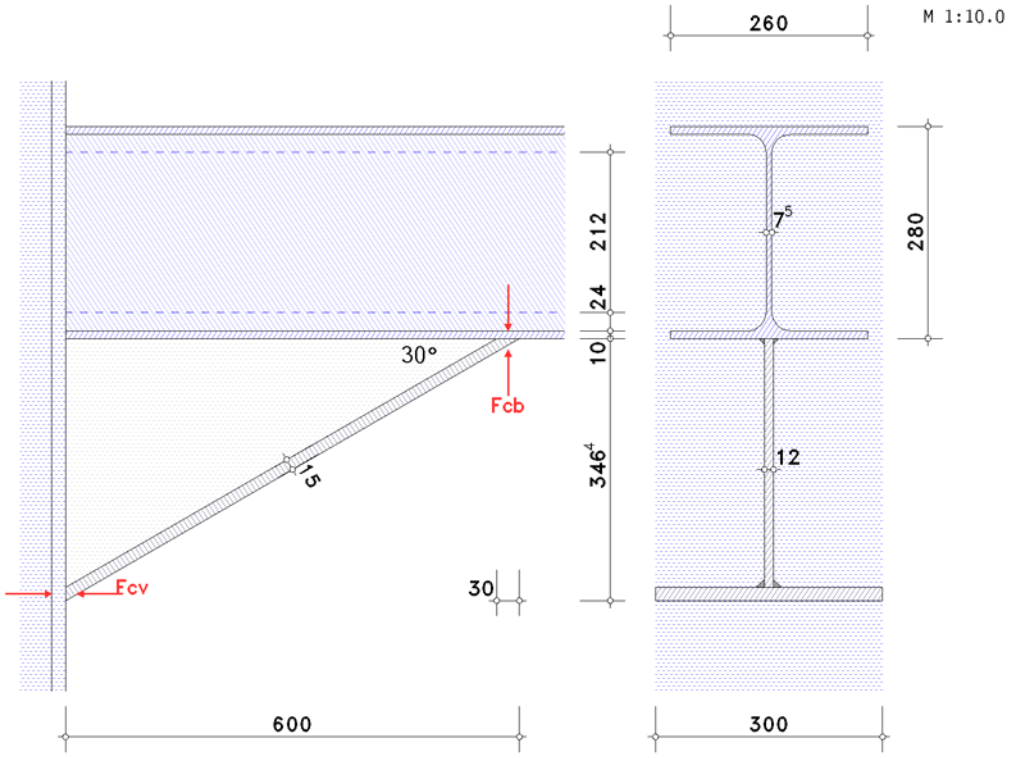
POS. 37: HAUNCH

4H-EC3GK version: 1/2012-1k

haunched beam in compression

Basic component 20

EC 3-1-8 (12.10), NA: Germany



beam:
- height h_b = 280.0 mm, web thickness $t_{w,b}$ = 7.5 mm, flange thickness $t_{f,b}$ = 10.0 mm, flange width $b_{f,b}$ = 260.0 mm
- root resp. leg length of the web weld s_b = 24.0 mm
- clear depth of the web $d_b = h_b - 2\cdot(t_{f,b}+s_b)$ = 212.0 mm

haunch:
- web thickness $t_{w,v}$ = 12.0 mm, flange thickness $t_{f,v}$ = 15.0 mm, flange width $b_{f,v}$ = 300.0 mm
- length L_v = 600.0 mm, angle of inclination α_v = 30.0° $\Rightarrow$ height $h_v = L_v\cdot\tan(\alpha_v)$ = 346.41 mm
- cutting length of the haunch flange parallel to the beam flange $s_s = t_{f,v}/\sin(\alpha_v)$ = 30.00 mm

periphery haunch-column:
- section class 2 (design plastic moment resistance, limited rotation capacity)
- plastic section modulus $W_{pl,v}$ = 216.750 cm³
- elastic section modulus referring to cross-section fibre with max. normal stress $W_{el,min,v}$ = 144.500 cm³

periphery haunch-beam:
- shear area $A_{v,b}$ = 3174.00 mm²

steel grade S 275

safety factors: γ_{M0} = 1.00, γ_{M1} = 1.10

stress:
- Lk 1 : $F_{c,f,v,Ed}$ = 15.0 kN $F_{c,f,b,Ed}$ = 150.0 kN

design resistance

thickness of haunch web plate t_{wv} = 12.0 mm > beam web thickness t_{wb} = 7.5 mm **ok.**
haunch flange thickness t_{fv} = 15.0 mm > beam flange thickness t_{fb} = 10.0 mm **ok.**
haunch flange width b_{fv} = 300.0 mm > beam flange width b_{fb} = 260.0 mm **ok.**
angle between haunch flange and beam flange α_v = 30.0° < 45° **ok.**

connection haunch-column: (Basic component 7: flange and web in compression)
- design moment resistance $M_{c,Rd} = M_{pl,Rd} = (W_{pl}\cdot f_y) / \gamma_{M0}$ = 59.61 kNm
- design resistance of beam/column flange and web in compression
  $F_{c,f,Rd} = M_{c,Rd} / (h - t_f)$ = 97.49 kN
- design resistance of haunch flange and web in compression
  $F_{c,f,v,Rd} = F_{c,f,Rd}$ = 97.49 kN

$h = h_b + h_v = 626.4 \text{ mm} > 600 \text{ mm} \Rightarrow F_{c,f,v,Rd} = 20\% \cdot F_{c,f,v,Rd} = 19.50 \text{ kN}$

connection haunch-beam: (Basic component 2: web in transverse compression)

effective width of web in transverse compression $b_{eff,c} = s_s + 5 \cdot (t_{f,b} + s_b) = 200.0$ mm

plate slenderness $\lambda_p = 0.932 \cdot [(b_{eff,c} \cdot d_w \cdot f_y) / (E \cdot t_w^2)]^{1/2} = 0.926$

reduction factor for web buckling $\rho = (\lambda_p - 0.2) / \lambda_p^2 = 0.85 < 1.0 \Rightarrow \rho = 0.85$

reduction factor for interaction with shear stress: $\beta = 1 \Rightarrow \omega = 0.88$

design resistance of column/beam web in transverse compression:

$F_{c,w,Rd} = \omega \cdot (k_w \cdot b_{eff,c} \cdot t_w \cdot f_{y,w}) / \gamma_{M0} = 363.1 \text{ kN}, \quad k_w = 1.00$

$F_{c,w,Rd,max} = \omega \cdot (k_w \cdot \rho \cdot b_{eff,c} \cdot t_w \cdot f_{y,w}) / \gamma_{M1} = 279.5 \text{ kN}$

$F_{c,w,Rd} > F_{c,w,Rd,max} \Rightarrow F_{c,w,Rd} = 279.5 \text{ kN}$

design resistance of a beam web in transverse compression

$F_{c,w,b,Rd} = F_{c,w,Rd} = 279.52 \text{ kN}$

verification

Lk 1: periphery haunch-column: $F_{Ed} = 15.0 \text{ kN} < F_{Rd} = 19.5 \text{ kN} \Rightarrow$ utilization $= 0.769 < 1$ **ok.**

periphery haunch-beam: $F_{Ed} = 150.0 \text{ kN} < F_{Rd} = 279.5 \text{ kN} \Rightarrow$ utilization $= 0.537 < 1$ **ok.**