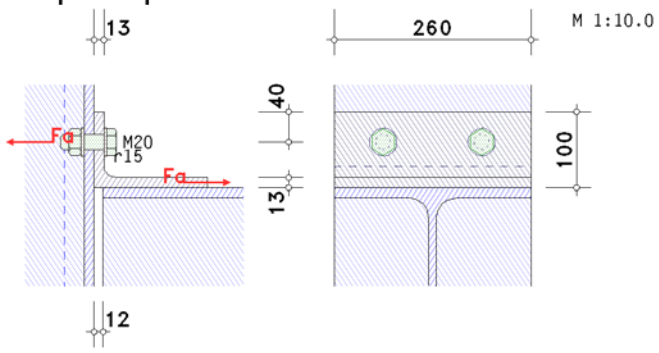
bc 6, flange cleat in bending

4H-EC3GK version: 10/2012-3j

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

1. input report



flange cleat:
leg 1 at column: leg thickness t_{1a} = 13.0 mm, leg length l_{1a} = 100.0 mm
leg 2 at beam: leg thickness t_{2a} = 13.0 mm
root radius r_a = 15.0 mm
width of flange cleat b_a = 260.0 mm
steel grade S275
distance of beam head from column flange g_a = 12.0 mm
connection device:
bolt class 8.8, bolt size M20
large wrench size (high strength bolt), preloaded (for info: preloading $F_{p,C}^* = 0.7 \cdot f_{yb} \cdot A_s$ = 109.8 kN)
distance of bolt-row (in leg 1) from edge e_1 = 40.0 mm
partial safety factors for material: γ_{M0} = 1.00, γ_{M2} = 1.25, γ_{M7} = 1.10 (standard)
stress:
lc 1 : $F_{a,Ed}$ = 50.0 kN per bolt

2. calculation

2.1. resistance

effective length of the T-stub flange (angle):
in mode 1+2: $\Sigma l_{eff} = 0.5 \cdot b_a$ = 130.0 mm
tension resistance of the T-stub flange:
in mode 1+2: $M_{pl,Rd} = (0.25 \cdot \Sigma l_{eff} \cdot t_f^2 \cdot f_y) / \gamma_{M0}$ = 1.51 kNm
$F_{t,Rd} = (k_2 \cdot f_{ub} \cdot A_s) / \gamma_{M2}$ = 141.12 kN, k_2 = 0.90
in mode 3: $\Sigma F_{t,Rd} = 2 \cdot n_b \cdot F_{t,Rd}$ = 282.24 kN
mode 1: complete yielding of the T-stub flange
$F_{T,1,Rd} = ((8 \cdot n - 2 \cdot e_w) \cdot M_{pl,1,Rd}) / (2 \cdot m \cdot n - e_w \cdot (m+n))$ = 133.35 kN
mode 2: bolt failure simultaneously with yielding of the T-stub flange
$F_{T,2,Rd} = (2 \cdot M_{pl,2,Rd} + n \cdot \Sigma F_{t,Rd}) / (m+n)$ = 153.05 kN
mode 3: bolt failure
$F_{T,3,Rd} = \Sigma F_{t,Rd}$ = 282.24 kN
tension resistance of the T-stub flange: $F_{T,Rd} = \min(F_{T,1,Rd}, F_{T,2,Rd}, F_{T,3,Rd})$ = 133.35 kN
resistance of flange cleat in bending
$F_{a,Rd}$ = 133.35 kN, ass. l_{eff} = 130.0 mm

2.2. verification

lc 1: bolt-row: $F_{Ed} = 2 \cdot F_{a,Ed}$ = 100.0 kN
F_{Ed} = 100.0 kN < F_{Rd} = 133.3 kN ⇒ U = 0.750 < 1 ok

verification succeeded