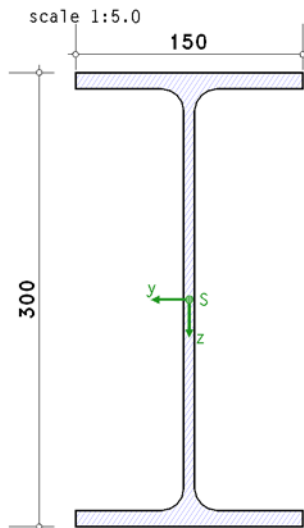


POS. 4: WAGENKNECHT 2.6.4

verification of cross-section EC 3-1-8 (12.10), NA: Deutschland

1. input report



steel

steel grade S235

material safety factor

resistance of cross-sections $\gamma_{M0} = 1.00$

geometry

section IPE300

resistance

plastic verification acc. to EC 3-1-1, 6.2

internal forces and moments referring to local axes of cross-section

σ -generating forces (N, M) work at centroid, τ -generating forces (V, T_t) work at shear center

Lk 1: $N_{Ed} = -469.00$ kN, $M_{y,Ed} = 95.00$ kNm, $V_{z,Ed} = 269.00$ kN

notes

buckling is not investigated.

2. Lk 1

2.1. verification of cross-section

internal forces and moments: $N = -469.00$ kN, $M_y = 95.00$ kNm, $V_z = 269.00$ kN

2.1.1. plastic verification

plastic verification for $N = -469.00$ kN, $M_y = 95.00$ kNm, $V_z = 269.00$ kN

plate buckling: section class of the section $1 \leq 2$ **ok**

shear buckling: $h_p/t_p = 39.24 \leq 72 \cdot \epsilon / \eta = 60.00$ **ok**

plastic values: $N_{pl,Rd} = A \cdot f_y / \gamma_{M0} = 1264.58$ kN, $M_{pl,y,Rd} = W_{pl,y} \cdot f_y / \gamma_{M0} = 147.65$ kNm

$V_{pl,z,Rd} = A_{vz} \cdot f_y / (3^{1/2} \cdot \gamma_{M0}) = 348.44$ kN

shear force

reduction factors:

web: $0.5 \cdot V_{pl,z,Rd} = 174.22$ kN < $|V_{z,Ed}| = 269.00$ kN: $\rho_z = (2 \cdot |V_{z,Ed}| / V_{pl,z,Rd} - 1)^2 = 0.296$

$|V_{y,Ed}| = 0$: $\rho_y = 0$ (no deduction)

axial force and shear force/torsion

web: $\Delta A_w = \rho_z \cdot A_w = 6.43$ cm², $A_w = 21.71$ cm²

$\Rightarrow N_{pl,v,Rd} = A_{red} \cdot f_y / \gamma_{M0} = 1113.58$ kN, $A_{red} = A - \Delta A_w = 47.39$ cm²

bending and shear force/torsion

web: $W_{v,y} = W_{pl,y} - \rho_z \cdot W_{pl,w} = 579.76$ cm³, $W_{pl,w} = W_{pl,y} - W_{pl,y,f} = 163.96$ cm³, $W_{pl,y,f} = 2 \cdot b_f \cdot t_f \cdot z_f = 464.33$ cm³

$\Rightarrow M_{pl,v,y,Rd} = W_{v,y} \cdot f_y / \gamma_{M0} = 136.24$ kNm

bending and axial force

deduction M_y : $N_{c,lim} = \min(0.25 \cdot N_{pl,v,Rd}, 0.5 \cdot A_w \cdot f_y / \gamma_{M0}) = 163.64$ kN, $A_w = h_w \cdot t_w \cdot (1 - \rho_z) = 1392.65$ cm²

$N_{Ed} > N_{c,lim}$: $f_{N,y} = (1 - n) / (1 - 0.5 \cdot a) = 0.690 < 1$, $n = |N_{Ed}| / N_{pl,v,Rd} = 0.421$, $a = (A_{red} - A_f) / A_{red} = 0.323 \leq 0.5$

$$A_f = 2 \cdot b_f \cdot t_f = 32.10 \text{ cm}^2, \quad A_{red} = 47.39 \text{ cm}^2 \Rightarrow M_{pl,V,N,y,Rd} = M_{pl,y,Rd} \cdot f_{N,y} = 94.03 \text{ kNm}$$

bending

verification: $M_{y,Ed}/M_{pl,V,N,y,Rd} = 1.010 > 1$ **fault !!**

3. final result

maximum utilization: resistance max U = 1.010 > 1 **fault !!**

resistance not ensured !!