POS. 11: SK'15, LENER, BSP.4A, S.279

detailed problems acc. to Eurocode 3

EC 3-1-5 (12.10), NA: Deutschland

steel grade

steel grade S 355

cross-section

beam: parameter (I-section):

$h = 1320.0$ mm, $t_w = 20.0$ mm, $b_f = 600.0$ mm, $t_f = 60.0$ mm

parameters

length of buckling field a = 240.0 cm

method of effective cross-sectional area

verification in beam field

calculation of buckling factors acc. to EC 3-1-5

effective cross-section values from resulting distribution of longitudinal stresses

loading

transverse loading on lower edge of cross-section:

design value of the vertical single load $F_{z,Ed} = 4000.0$ kN, loading length $s_s = 600.0$ mm

partial safety factors for material

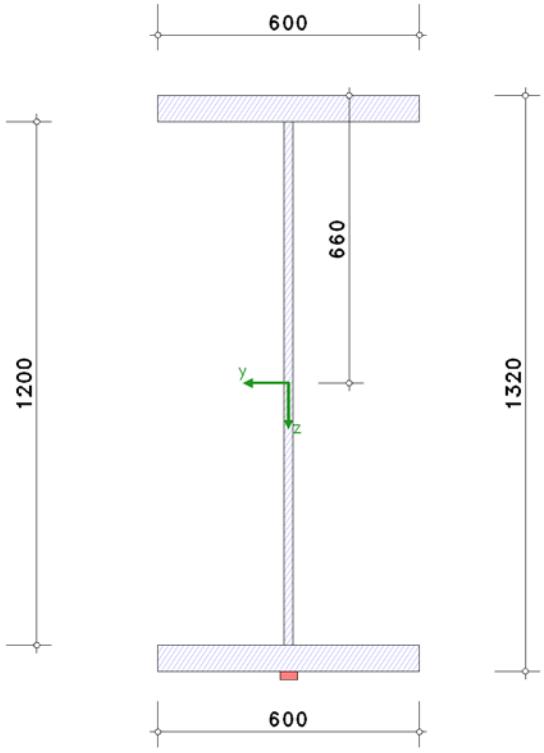
resistance of cross-sections $\gamma_{M0} = 1.00$

resistance of members in stability failure $\gamma_{M1} = 1.10$

verifications of buckling resistance

assumption: flange induced web buckling is excluded.

assumption: plate area is supported rigidly.



Lk 1:

method of effective cross-sectional area
EC 3-convention, compressive stresses positive
buckling of transverse loading: loading length > distance of two single loads, double load is not investigated !!
shear distortions are ignored.
cross-sectional properties: A = 960.00 cm², z_s = 660.0 mm, I_y = 3147840.00 cm⁴, y_s = 0.0 mm, I_z = 216080.00 cm⁴
maximum/minimum stresses: σ_z = 333.3 N/mm²

buckling of transverse loading
slenderness $\lambda_F = (F_y/F_{cr})^{1/2} = 1.090$, F_y = 9778.6 kN
reduction factor χ_F = 0.459
resistance of buckling $F_{z,Rd} = f_y \cdot L_{eff} \cdot t_w/\gamma_{M1}$ = 4076.38 kN, $L_{eff} = \chi_F \cdot l_y$ = 631.6 mm, l_y = 1377.3 mm
verification: $F_{z,Ed}/F_{z,Rd}$ = 0.981 < 1 **ok.**

total utilization: U = 0.981 < 1 **ok.**

Final Result

maximum utilization: max U = 0.981 < 1 **ok.**

verifications succeeded

Regulations

DIN EN 1990, Eurocode 0: Grundlagen der Tragwerksplanung;
Deutsche Fassung EN 1990:2002 + A1:2005 + A1:2005/AC:2010, Ausgabe Dezember 2010
DIN EN 1990/NA, Nationaler Anhang zur DIN EN 1990, Ausgabe Dezember 2010

DIN EN 1993-1-1, Eurocode 3: Bemessung und Konstruktion von Stahlbauten -
Teil 1-1: Allgemeine Bemessungsregeln und Regeln für den Hochbau;
Deutsche Fassung EN 1993-1-1:2005 + AC:2009, Ausgabe Dezember 2010
DIN EN 1993-1-1/NA, Nationaler Anhang zur DIN EN 1993-1-1, Ausgabe Dezember 2010

DIN EN 1993-1-5, Eurocode 3: Bemessung und Konstruktion von Stahlbauten -
Teil 1-5: Plattenförmige Bauteile;
Deutsche Fassung EN 1993-1-5:2006 + AC:2009, Ausgabe Dezember 2010
DIN EN 1993-1-5/NA, Nationaler Anhang zur DIN EN 1993-1-5, Ausgabe Dezember 2010