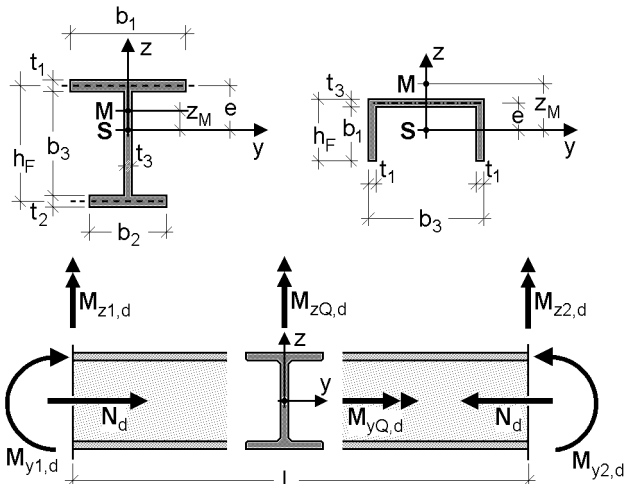
POS. 11: BDK MIT ND, MYD UND

Geometrie, Belastung und Materialkennwerte

BIEGEDRILLKNICKEN zweiachsige BIEGUNG mit/ohne NORMALKRAFT (4H-STAHL Version: 10/2005-2e) (Prinzipskizze)



Material-Sicherheitsbeiwert Stahl: γ_M = 1.10, λ_a = 92.9

Stablänge L = 5000 mm

Knicklängenbeiwert, Wölbeinspannungsgrad

β_y = 1.00 β_z = 1.00 β_0 = 1.00

Anzahl Zwischenstützungen

ny = 0 nz = 0 (keine Gabellagerung)

Querschnitt Profil: IPE300

Materialdaten Stahl: S235 (St37)

E = 210000.0 N/mm² G = 81000.0 N/mm²

$f_{y,k}$ = 240.0 N/mm² $f_{y,kt}$ = 215.0 N/mm²

Schnittgrößen Theorie I. / II. Ordnung

N_d = 100.0 / 100.0 kN

$M_{y1,d}$ = 0.0 / 0.0 , $M_{z1,d}$ = 0.0 kNm

$M_{yFeld,d}$ = 40.6 / 40.6 , $M_{zFeld,d}$ = 3.1 kNm

$M_{y2,d}$ = 0.0 / 0.0 , $M_{z2,d}$ = 0.0 kNm

Beiwerte

k_n = 1.00 n = 2.50 (Bild 14 / Tab. 9)

ζ_y = 1.12 (parabelförmige Momentenverteilung)

$M_{Ki,k}$ (wird errechnet)

Angriffspunkt der Querlast z_p = -150.0 mm

Nachweise nach Element 322, 323 (T.2)

Maßgebende Querschnittswerte

A	=	53.8 cm²							
$W_{el,y}$	=	557.0 cm³	$W_{pl,y}$	=	628.0 cm³	$\alpha_{pl0,y}$	= 1.13	$\alpha_{pl,y}$	= 1.13
$W_{el,z}$	=	80.5 cm³	$W_{pl,z}$	=	125.0 cm³	$\alpha_{pl0,z}$	= 1.55	$\alpha_{pl,z}$	= 1.25
I_y	=	8360.0 cm⁴	I_z	=	604.0 cm⁴	I_T	= 20.2 cm⁴	I_ω	= 125900.0 cm⁶
h_F	=	289.3 mm	e	=	144.6 mm	c	= 231.2 mm	z_M	= 0.0 mm
i_y	=	124.7 mm	i_z	=	33.5 mm	i_p	= 129.1 mm	i_M	= 129.1 mm

Bemessungsgrößen

$N_{pl,d}$ = 1173.8 kN

$M_{pl0,y,d}$ = 137.0 kNm $M_{pl,y,d}$ = 137.0 kNm $M_{pl0,z,d}$ = 27.3 kNm $M_{pl,z,d}$ = 22.0 kNm

Nachweis b/t- Verhältnis

vorh. (b/t) --0 = 5.28 < grenz (b/t) --0 = 17.23 (Flansch)

vorh. (b/t) 0-0 = 35.01 < grenz (b/t) 0-0 = 129.43 (Stegblech)

vorh. (b/t) --0 = 5.28 < grenz (b/t) --0 = 44.33 (Flansch,unten)

Biegeknicken: (EL. 322) $N_d/(\kappa*N_{pl,d}) + \beta_{m,y}*M_{y,d}*k_y/M_{pl,y,d} + \beta_{m,z}*M_{z,d}*k_z/M_{pl,z,d} + \Delta n \le 1$

$s_{K,y} = \beta_y*L$ = 5000 mm $\Rightarrow \lambda_{K,y}$ = 40.1 $\Rightarrow \bar{\lambda}_{K,y}$ = 0.432 ==> κ_y(a)= 0.944

$s_{K,z} = \beta_z*L$ = 5000 mm $\Rightarrow \lambda_{K,z}$ = 149.2 $\Rightarrow \bar{\lambda}_{K,z}$ = 1.606 ==> κ_z(b)= 0.306 ==> κ = min(κ_y,κ_z) = 0.306

$N_d/N_{pl,d}$ = 0.085 $M_{y,d}/M_{pl,y,d}$= 0.296 $M_{z,d}/M_{pl,z,d}$= 0.142

$\beta_{m,y}$ = 1.000 k_y = 0.793 $\beta_{m,z}$ = 1.000 k_z = 1.000 Δn = 0.049

Ausnutzung = 0.278 + 0.235 + 0.142 + 0.049 = 0.704 < 1

Biegedrillknicken: (EL. 323) $N_d/(\kappa_z*N_{pl,d}) + M_{y,d}*k_y/(\kappa_M*M_{pl,y,d}) + M_{z,d}*k_z/M_{pl0,z,d} \le 1$

$N_{Ki,z,d}$ = 455.2 kN $N_{Ki,\vartheta,d}$ = 658.8 kN $N_{Ki,\lambda vi,d}$ = 455.2 kN

$N_{Ki,d}$ = 455.2 kN (Biegeknicklast maßgebend)

λ_{Vi} = 149.2 $M_{Ki,d}$ = 85.7 kNm ==> $\bar{\lambda}_M$ = 1.265 ==> κ_M(n=2.50) = 0.561

$\beta_{M,y}$ = 1.300 a_y = 0.163 ==> k_y = 0.955 $\beta_{M,z}$ = 1.300 a_z = -1.695 ==> k_z = 1.472

Ausnutzung = 0.278 + 0.504 + 0.169 = 0.951 < 1

Maximale Ausnutzung 0.951 < 1 ⇒ Nachweis erfüllt.