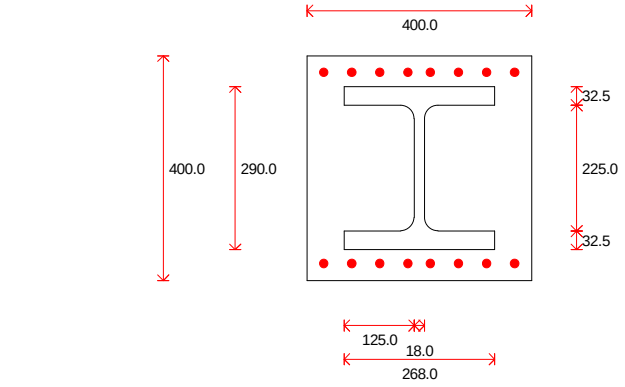


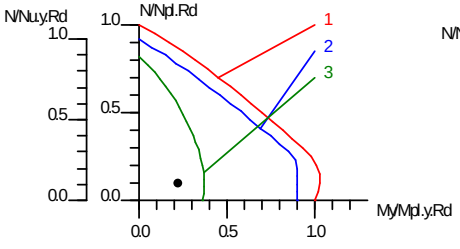
Steel-Profile: HE 260 M
Rebars 16 x d=16.0 mm

Npl.Rd = 10579.46 kN

Nu.y.Rd = 9727.96 kN Mpl.y.Rd = 1102.26 kNm

Nu.z.Rd = 8624.00 kN Mpl.z.Rd = 626.57 kNm

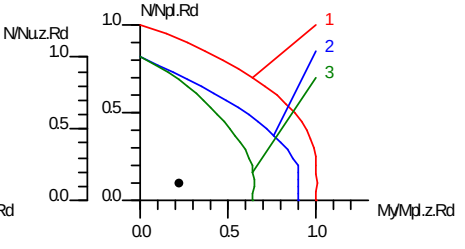
imperfection favouring buckling about z-axis with lbuck = 4.00 m



1: cross-section interaction curve My

2: load bearing interaction curve for bending about y-axis

3: load bearing interaction curves for biaxial bending My



1: cross-section interaction curve Mz

2: load bearing interaction curve for bending about z-axis

3: load bearing interaction curves for biaxial bending Mz

Project

Project-Name:	RP-ACO
Project-Number:	1573
Position-Name:	
Position-Number:	P02.1.40
User:	rf
Comment:	
created:	3/07/2011
modified last:	3/07/2011

Section definition

Type of section: completely encased I-profile

Steel-Profile: HE 260 M

h:	290 mm
b:	268 mm
t.w:	18 mm
t.f:	32.5 mm
r:	24 mm
b/tf	8.246

Concrete

h.c	400 mm
b.c	400 mm

Reinforcement

---

n	= 16
ds	= 16.0 mm
As	= 32.17 cm2
	= 2.33 %

fsk = 500.0 kN/mm2

distances from edge (cy,cz) and from centre (ey,ez) of section :

cy =	-36.0 mm	cz =	-25.0 mm	ey =	170.0 mm	ez =	170.0 mm	(1)
cy =	14.0 mm	cz =	-25.0 mm	ey =	120.0 mm	ez =	170.0 mm	(2)
cy =	64.0 mm	cz =	-25.0 mm	ey =	70.0 mm	ez =	170.0 mm	(3)
cy =	114.0 mm	cz =	-25.0 mm	ey =	20.0 mm	ez =	170.0 mm	(4)
cy =	-36.0 mm	cz =	-25.0 mm	ey =	170.0 mm	ez =	-170.0 mm	(5)
cy =	14.0 mm	cz =	-25.0 mm	ey =	120.0 mm	ez =	-170.0 mm	(6)
cy =	64.0 mm	cz =	-25.0 mm	ey =	70.0 mm	ez =	-170.0 mm	(7)
cy =	114.0 mm	cz =	-25.0 mm	ey =	20.0 mm	ez =	-170.0 mm	(8)
cy =	-36.0 mm	cz =	-25.0 mm	ey =	-170.0 mm	ez =	170.0 mm	(9)
cy =	14.0 mm	cz =	-25.0 mm	ey =	-120.0 mm	ez =	170.0 mm	(10)
cy =	64.0 mm	cz =	-25.0 mm	ey =	-70.0 mm	ez =	170.0 mm	(11)
cy =	114.0 mm	cz =	-25.0 mm	ey =	-20.0 mm	ez =	170.0 mm	(12)
cy =	-36.0 mm	cz =	-25.0 mm	ey =	-170.0 mm	ez =	-170.0 mm	(13)
cy =	14.0 mm	cz =	-25.0 mm	ey =	-120.0 mm	ez =	-170.0 mm	(14)
cy =	64.0 mm	cz =	-25.0 mm	ey =	-70.0 mm	ez =	-170.0 mm	(15)
cy =	114.0 mm	cz =	-25.0 mm	ey =	-20.0 mm	ez =	-170.0 mm	(16)

Materials

Yield point of the steel-profile	: 355 N/mm2
Reduced yield point of the steel profile	: 345 N/mm2
Yield point of re-bars	: 500 N/mm2
Characteristic concrete cylinder strength	: 30 N/mm2

Steel		Concrete		Reinforcement	
fy =	345.0 N/mm2	fck =	30.0 N/mm2	fsk =	500.0 N/mm2
ga =	1.100	gc =	1.500	gs =	1.150
fyd =	313.64 N/mm2	fcd =	17.00 N/mm2	fsd =	434.78 N/mm2
Ea =	21000.0 kN/cm2	Ecm =	3200.0 kN/cm2	Es =	21000.0 kN/cm2

System lengths and buckling values (1.0;0.7;0.5) :

---

ly = 4.00 m ky = 1.00

lz = 4.00 m kz = 1.00

Loading

NSd = 1000.00 kN
F-perm/F-tot = 0.7000
moment My1 (top) = 250.00 kNm
moment My2 (bottom) = 0.00 kNm

moment Mz1 (top) = 250.00 kNm
moment Mz2 (bottom) = 0.00 kNm

Moments for calculation (eventually with changed sign}
My1 = 250.00 kNm My2 = 0.00 kNm r = 0.00
Mz1 = 250.00 kNm Mz2 = 0.00 kNm r = 0.00

biaxial bending

Cross section parameter, relative slendernesses and chi-values

cross-section parameter delta = 0.651

relative slendernesses for bending axes

buckling about y-axis		buckling about z-axis	
lqy	= 0.416	lqz	= 0.549

Chi-values

buckling about y-axis		buckling about z-axis	
chi	= 0.9195	chi	= 0.8152

Cross-section values

Steel		Concrete		Reinforcement	
Aa =	219.6 cm2	Ac =	1348.2 cm2	As =	32.2 cm2
Iy =	31306.9 cm4	Iy =	172724.2 cm4	Iy =	9302.3 cm4
Iz =	10448.6 cm4	Iz =	198971.0 cm4	Iz =	3913.8 cm4

Results

cross-section capacities
Npl.R = 12624.10 kN
Npl.Rd = 10579.46 kN
Mpl.y.Rd = 1102.26 kNm
Mpl.z.Rd = 626.57 kN

stiffnesses for the bending axes
EIy = 118.0 MNm2 EIz = 67.9 MNm2

axial bearing capacity (= Nb.Rd)

buckling about y-axis		buckling about z-axis	
chi	= 0.9195	chi	= 0.8152
Nu.y.Rd	= 9728 kN	Nu.z.Rd	= 8624 kN

load level - centrical (=NSd/Nb.Rd)

buckling about y-axis		buckling about z-axis	
eta	= 0.1028	eta	= 0.1160

load level including bending
eym = 0.2871 (y-axis bending only)
ezm = 0.4462 (z-axis bending only)
eyz = 0.6184 (biaxial bending)

DESIGN OK

cross-section interaction curve

z0 and y0 indicate the position of the neutral axis, measured from centre of section

N/Npl.Rd	My/Mpl.y.Rd	z0 [cm]	Mz/Mpl.z.Rd	y0 [cm]
0.0000	1.0000	-6.44	1.0000	-0.62
0.0500	1.0238	-3.47	1.0040	-0.34
0.1000	1.0333	-0.49	1.0057	-0.05
0.1500	1.0285	2.48	1.0049	0.24
0.2000	1.0095	5.45	1.0016	0.53
0.2500	0.9762	8.43	0.9959	0.82
0.3000	0.9292	10.92	0.9868	1.44
0.3500	0.8749	11.49	0.9718	2.11
0.4000	0.8190	11.80	0.9508	2.92
0.4500	0.7617	12.11	0.9214	4.06
0.5000	0.7028	12.42	0.8823	5.20
0.5500	0.6425	12.73	0.8337	6.31
0.6000	0.5806	13.04	0.7771	7.07
0.6500	0.5173	13.35	0.7143	7.87
0.7000	0.4525	13.66	0.6430	9.01
0.7500	0.3862	13.97	0.5621	10.15
0.8000	0.3184	14.28	0.4716	11.28
0.8500	0.2476	16.30	0.3731	12.04
0.9000	0.1679	16.85	0.2684	12.83
0.9500	0.0860	17.32	0.1488	16.53
1.0000	0.0000	20.00	0.0000	20.00

Npl.Rd = 10579 kN
Mpl.y.Rd = 1102 kNm
Mpl.z.Rd = 627 kNm

load bearing interaction curve for bending about y-axis

max x/l indicates the position on the column of the most unfavourable combination (1: bottom, 0: top)

N / Npl.Rd	N / Nu.Rd	My / Mpl.y.Rd	x max - / l
0.0000	0.0000	0.9000	0.000
0.0460	0.0500	0.9000	0.000
0.0920	0.1000	0.9000	0.000
0.1379	0.1500	0.9000	0.000
0.1839	0.2000	0.9000	0.000
0.2299	0.2500	0.8906	0.000
0.2759	0.3000	0.8485	0.000
0.3218	0.3500	0.7986	0.000
0.3678	0.4000	0.7451	0.000
0.4138	0.4500	0.6903	0.000
0.4598	0.5000	0.6344	0.000
0.5057	0.5500	0.5774	0.000
0.5517	0.6000	0.5192	0.000
0.5977	0.6500	0.4599	0.000

0.6437	0.7000	0.3994	0.000
0.6896	0.7500	0.3378	0.000
0.7356	0.8000	0.2750	0.000
0.7816	0.8500	0.2112	0.000
0.8276	0.9000	0.1454	0.000
0.8735	0.9500	0.0749	0.000
0.9195	1.0000	0.0000	0.000

Npl.Rd = 10579 kN
Mpl.y.Rd = 1102 kNm

load bearing interaction curve for bending about z-axis

max x/l indicates the position on the column of the most unfavourable combination (1: bottom, 0: top)

N	N	Mz	x
Npl.Rd	Nu.Rd	Mpl.z.Rd	max - l
0.0000	0.0000	0.9000	0.000
0.0408	0.0500	0.9000	0.000
0.0815	0.1000	0.9000	0.000
0.1223	0.1500	0.9000	0.000
0.1630	0.2000	0.9000	0.000
0.2038	0.2500	0.9000	0.000
0.2445	0.3000	0.8704	0.000
0.2853	0.3500	0.8375	0.000
0.3261	0.4000	0.8016	0.000
0.3668	0.4500	0.7622	0.000
0.4076	0.5000	0.7192	0.000
0.4483	0.5500	0.6711	0.000
0.4891	0.6000	0.6162	0.000
0.5299	0.6500	0.5559	0.000
0.5706	0.7000	0.4908	0.000
0.6114	0.7500	0.4215	0.000
0.6521	0.8000	0.3486	0.000
0.6929	0.8500	0.2698	0.000
0.7336	0.9000	0.1851	0.000
0.7744	0.9500	0.0951	0.000
0.8152	1.0000	0.0000	0.000

Npl.Rd = 10579 kN
Mpl.z.Rd = 627 kNm

imperfection favouring buckling about z-axis with lbuck = 4.00 m

load bearing interaction curves for biaxial bending

max x/l indicates the position on the column of the most unfavourable combination (1: bottom, 0: top)

N	N	My	Mz	x
Npl.Rd	Nu.Rd	Mpl.y.Rd	Mpl.z.Rd	max - l
0.0000	0.0000	0.3624	0.6376	0.000
0.0408	0.0500	0.3657	0.6434	0.000
0.0815	0.1000	0.3675	0.6464	0.000
0.1223	0.1500	0.3677	0.6468	0.000
0.1630	0.2000	0.3664	0.6446	0.000
0.2038	0.2500	0.3636	0.6397	0.000
0.2445	0.3000	0.3522	0.6195	0.000
0.2853	0.3500	0.3389	0.5962	0.000
0.3261	0.4000	0.3241	0.5702	0.000
0.3668	0.4500	0.3081	0.5421	0.000

0.4076	0.5000	0.2911	0.5121	0.000
0.4483	0.5500	0.2726	0.4795	0.000
0.4891	0.6000	0.2521	0.4435	0.000
0.5299	0.6500	0.2300	0.4046	0.000
0.5706	0.7000	0.2063	0.3629	0.000
0.6114	0.7500	0.1811	0.3185	0.000
0.6521	0.8000	0.1542	0.2712	0.000
0.6929	0.8500	0.1245	0.2189	0.000
0.7336	0.9000	0.0909	0.1599	0.000
0.7744	0.9500	0.0513	0.0903	0.000
0.8152	1.0000	0.0000	0.0000	0.000

Npl.Rd = 10579 kN
Mpl.y.Rd = 1102 kNm
Mpl.z.Rd = 627 kNm