

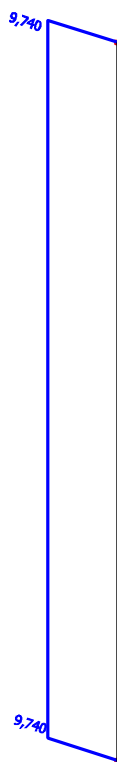
PRILOGA E: Kontrola nosilnosti in stabilnosti fasadnega stebra

1. Steel slenderness

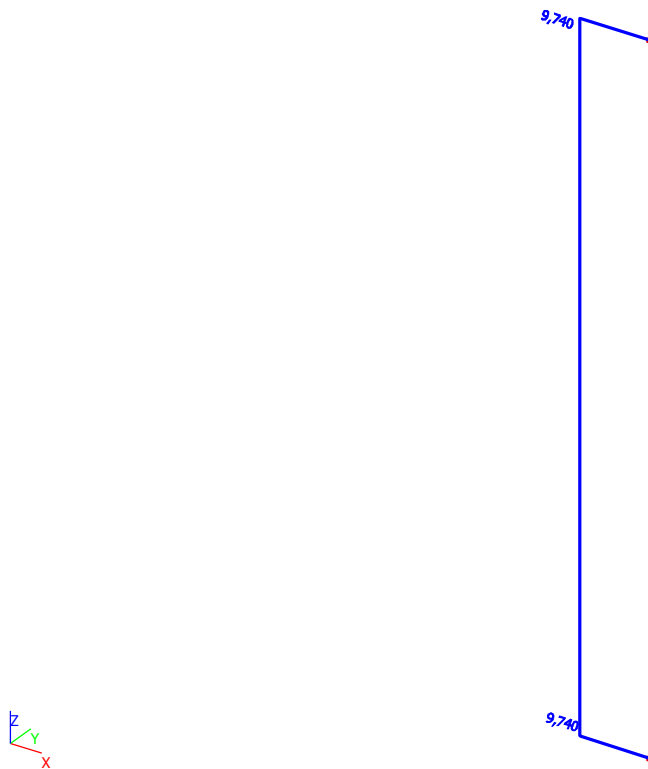
Linear calculation

Member	CS Name	Part	Sway y	Ly [m]	ky [-]	ly [m]	Lam y [-]	lyz [m]	I LTB [m]
			Sway z	Lz [m]	kz [-]	lz [m]	Lam z [-]		
B1	CS9	1	Yes	9,740	1,00	9,740	106,19	9,740	9,740
			No	9,740	1,00	9,740	176,42		

2. ly



3. Iz



4. Result classes

4.1. Result classes - All ULS

Name	List
All ULS	MSN - Envelope - ultimate

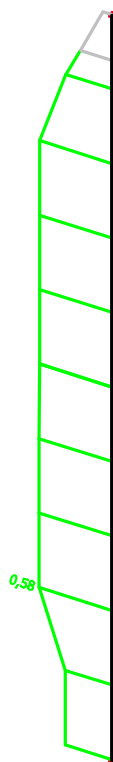
4.1.1. Check of steel

Linear calculation, Extreme : Member

Selection : All

Class : All ULS

Member	css	mat	Case	dx [m]	un.check [-]	sec.check [-]	stab.check [-]
B1	CS9 - HEA220	S 235	MSN/1	1,948	0,58	0,23	0,58



Linear calculation, Extreme : Cross-section

Selection : All

Class : All ULS

Member B1	9,740 m	HEA220	S 235	MSN/1	0,58 -
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Partial safety factors		
Gamma M0 for resistance of cross-sections	1,00	
Gamma M1 for resistance to instability	1,00	
Gamma M2 for resistance of net sections	1,25	

Material		
Yield strength fy	235,0	MPa
Ultimate strength fu	360,0	MPa
Fabrication	Rolled	

....SECTION CHECK:....

Classification for cross-section design

According to EN 1993-1-1 article 5.5.2

Classification of Internal Compression parts

According to EN 1993-1-1 Table 5.2 Sheet 1

Maximum width-to-thickness ratio	21,71
Class 1 Limit	70,27
Class 2 Limit	80,92
Class 3 Limit	119,31

=> Internal Compression parts Class 1

Classification of Outstand Flanges

According to EN 1993-1-1 Table 5.2 Sheet 2

Maximum width-to-thickness ratio	8,05
Class 1 Limit	9,00
Class 2 Limit	10,00
Class 3 Limit	13,77

=> Outstand Flanges Class 1

=> Section classified as Class 1 for cross-section design

The critical check is on position 1.948 m

Internal forces	Calculated	Unit
N,Ed	-5,21	kN
Vy,Ed	0,00	kN
Vz,Ed	11,97	kN

Internal forces	Calculated	Unit
T,Ed	0,00	kNm
My,Ed	31,08	kNm
Mz,Ed	0,00	kNm

Compression check

According to EN 1993-1-1 article 6.2.4 and formula (6.9)

A	6,4300e-03	m ²
Nc,Rd	1511,05	kN
Unity check	0,00	-

Bending moment check for My

According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

Wpl,y	5,6667e-04	m ³
Mpl,y,Rd	133,17	kNm
Unity check	0,23	-

Shear check for Vz

According to EN 1993-1-1 article 6.2.6 and formula (6.17)

Eta	1,20	
Av	2,0630e-03	m ²
Vpl,z,Rd	279,90	kN
Unity check	0,04	-

Combined bending, axial force and shear force check

According to EN 1993-1-1 article 6.2.9.1 and formula (6.31)

Mpl,y,Rd	133,17	kNm
Unity check	0,23	-

Note: Since the shear forces are less than half the plastic shear resistances their effect on the moment resistances is neglected.

Note: Since the axial force satisfies both criteria (6.33) and (6.34) of EN 1993-1-1 article 6.2.9.1(4) its effect on the moment resistance about the y-y axis is neglected.

The member satisfies the section check.

.....STABILITY CHECK:....

Classification for member buckling design

Decisive position for stability classification: 0,000 m

Classification of Internal Compression parts

According to EN 1993-1-1 Table 5.2 Sheet 1

Maximum width-to-thickness ratio	21,71
Class 1 Limit	33,00
Class 2 Limit	38,00
Class 3 Limit	42,00

=> Internal Compression parts Class 1

Classification of Outstand Flanges

According to EN 1993-1-1 Table 5.2 Sheet 2

Maximum width-to-thickness ratio	8,05
Class 1 Limit	9,00
Class 2 Limit	10,00
Class 3 Limit	14,00

=> Outstand Flanges Class 1

=> Section classified as Class 1 for member buckling design

Flexural Buckling Check

According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

Buckling parameters	yy	zz	
Sway type	sway	non-sway	
System length L	9,740	9,740	m
Buckling factor k	1,00	1,00	
Buckling length Lcr	9,740	9,740	m
Critical Euler load Ncr	1181,95	428,21	kN
Slenderness Lambda	106,19	176,42	
Relative slenderness Lambda,rel	1,13	1,88	
Limit slenderness Lambda,rel,0	0,20	0,20	

Note: The slenderness or compression force is such that Flexural Buckling effects may be ignored according to EN 1993-1-1 article 6.3.1.2(4).

Lateral Torsional Buckling Check

According to article EN 1993-1-1 : 6.3.2.1. and formula (6.54)

LTB Parameters		
Method for LTB curve	Art. 6.3.2.2.	
Wy	5.6667e-04	m ³
Elastic critical moment Mcr	121.72	kNm
Relative slenderness Lambda,LT	1.05	
Limit slenderness Lambda,LT,0	0.40	
LTB curve	a	
Imperfection Alpha,LT	0.21	
Reduction factor Chi,LT	0.63	
Buckling resistance Mb,Rd	84.35	kNm
Unity check	0.37	-

Mcr Parameters		
LTB length	9.740	m
k	1.00	
kw	1.00	
C1	1.13	
C2	0.45	
C3	0.53	

Note: C Parameters according to ECCS 119 2006 / Galea 2002
load in center of gravity

Compression and bending check

According to article EN 1993-1-1 : 6.3.3. and formula (6.61), (6.62)

Interaction Method 1

Table of values		
kyy	1.008	
kyz	0.900	
kzy	0.522	
kzz	1.022	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	6.4300e-03	m ²
Wy	5.6667e-04	m ³
Wz	2.7042e-04	m ³
NRk	1511.05	kN
My,Rk	133.17	kNm
Mz,Rk	63.55	kNm
My,Ed	48.56	kNm
Mz,Ed	0.00	kNm
Interaction Method 1		
Mcr0	108.01	kNm
reduced slenderness 0	1.11	
Psi y	1.000	
Psi z	1.000	
Cmy,0	1.000	
Cmz,0	1.003	
Cmy	1.000	
Cmz	1.003	
CmLT	1.002	
muy	1.000	
muz	1.000	
wy	1.100	
wz	1.500	
npl	0.003	
aLT	0.995	
bLT	0.000	
cLT	0.405	
dLT	0.000	
eLT	0.086	
Cyy	0.998	
Cyz	0.790	
Czy	0.990	
Czz	0.993	

Unity check (6.61) = 0.00 + 0.58 + 0.00 = 0.58

Unity check (6.62) = 0.00 + 0.30 + 0.00 = 0.30

Shear buckling check

in buckling field 1

According to article EN 1993-1-5 : 5. & 7.1. and formula (5.10) & (7.1)

Table of values	
hw/t	26.857

The web slenderness is such that the Shear Buckling Check is not required.

The member satisfies the stability check.