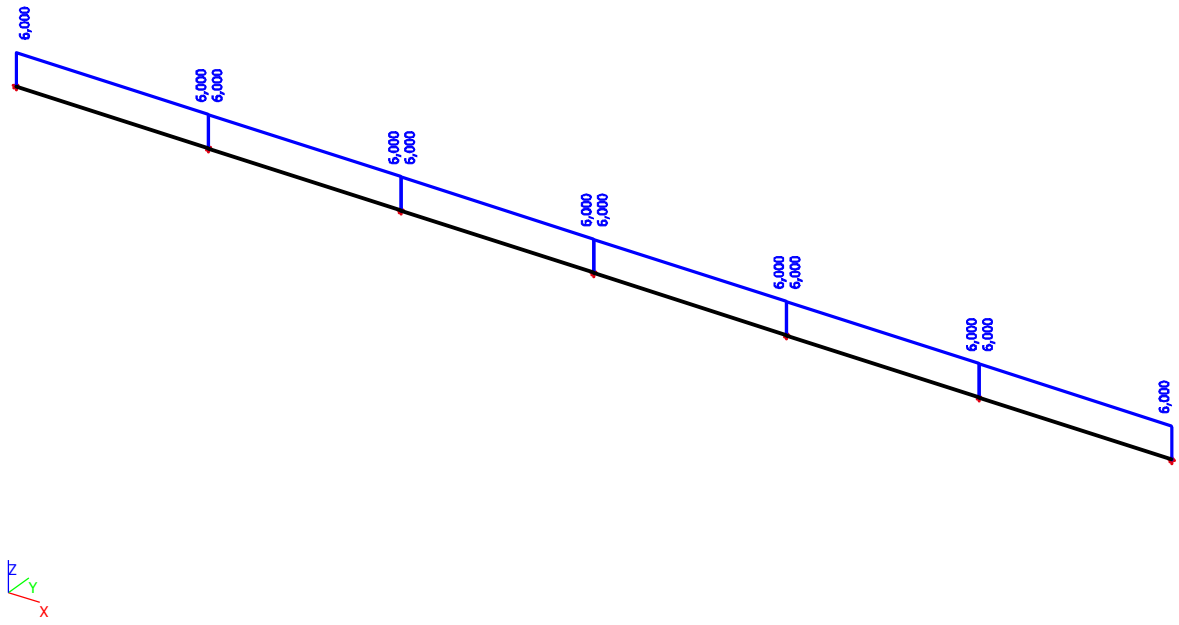
PRILOGA A: Kontrola nosilnosti in stabilnosti žerjavne proge

1. Steel slenderness

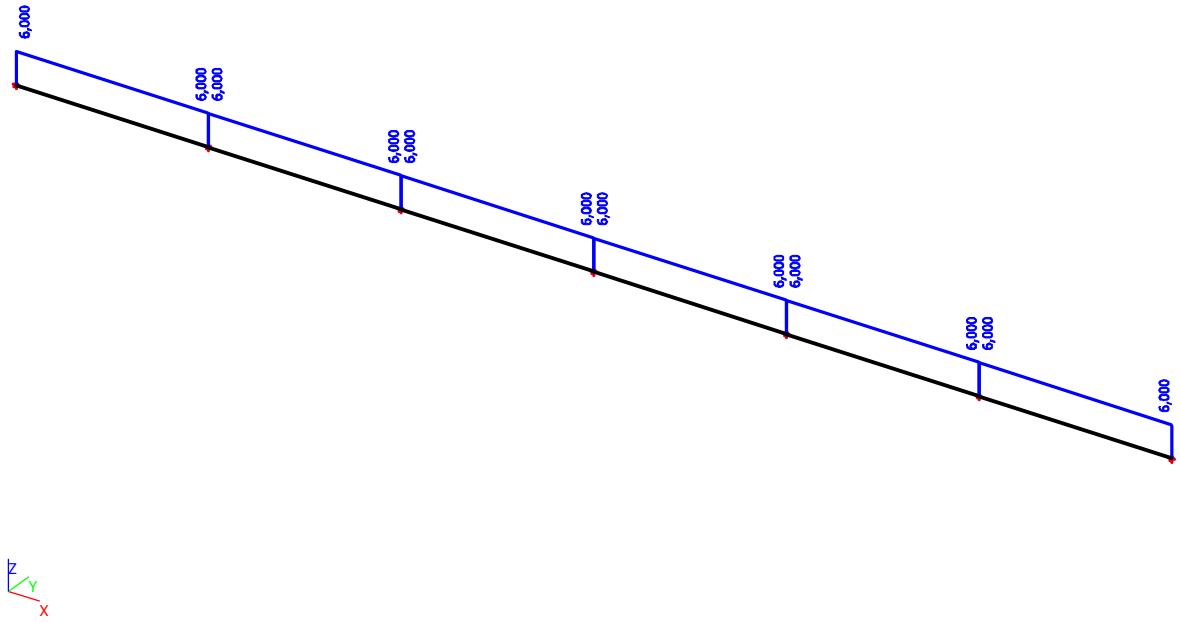
Linear calculation

Member	CS Name	Part	Sway y	Ly [m]	ky [-]	ly [m]	Lam y [-]	lyz [m]	l LTB [m]
			Sway z	Lz [m]	kz [-]	lz [m]	Lam z [-]		
B1	CS1	1	Yes	6,000	1,00	6,000	47,15	6,000	6,000
			No	6,000	1,00	6,000	80,29		
B2	CS1	1	Yes	6,000	1,00	6,000	47,15	6,000	6,000
			No	6,000	1,00	6,000	80,29		
B3	CS1	1	Yes	6,000	1,00	6,000	47,15	6,000	6,000
			No	6,000	1,00	6,000	80,29		
B4	CS1	1	Yes	6,000	1,00	6,000	47,15	6,000	6,000
			No	6,000	1,00	6,000	80,29		
B5	CS1	1	Yes	6,000	1,00	6,000	47,15	6,000	6,000
			No	6,000	1,00	6,000	80,29		
B6	CS1	1	Yes	6,000	1,00	6,000	47,15	6,000	6,000
			No	6,000	1,00	6,000	80,29		

2. ly



3. Iz



4. Result classes

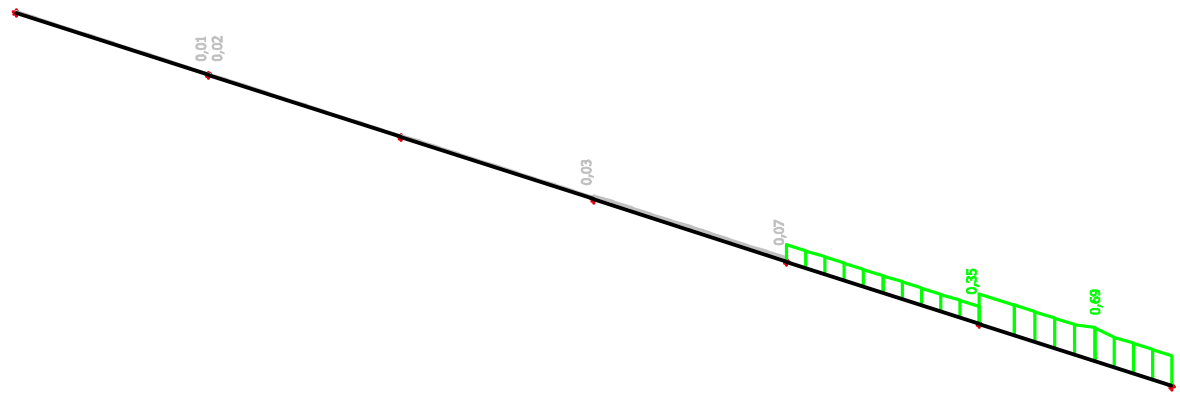
4.1. Result classes - All ULS

Name	List
All ULS	CO1 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	CS1 - HEA300	S 235	CO1 MSN/1	6,000	**0,01**	**0,01**	**0,01**
B2	CS1 - HEA300	S 235	CO1 MSN/1	0,000	0,02	0,01	0,02
B3	CS1 - HEA300	S 235	CO1 MSN/1	6,000	0,03	0,03	0,03
B4	CS1 - HEA300	S 235	CO1 MSN/1	6,000	0,07	0,06	0,07
B5	CS1 - HEA300	S 235	CO1 MSN/1	6,000	0,35	0,31	0,35
B6	CS1 - HEA300	S 235	CO1 MSN/1	3,600	**0,69**	**0,47**	**0,69**



Linear calculation, Extreme : Cross-section
Selection : All
Class : All ULS

Member B6	6,000 m	HEA300	S 235	CO1 MSN/1	0,69 -

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	24,47
Class 1 Limit	71,16
Class 2 Limit	81,94
Class 3 Limit	122,52

=> 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	8,48
Class 1 Limit	9,00
Class 2 Limit	10,00
Class 3 Limit	14,31

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

The critical check is on position 3.600 m

Internal forces	Calculated	Unit
N,Ed	-4,16	kN
Vy,Ed	-10,37	kN
Vz,Ed	37,29	kN

Internal forces	Calculated	Unit
T,Ed	0,00	kNm
My,Ed	151,63	kNm
Mz,Ed	-25,92	kNm

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

A	1,1300e-02	m^2
Nc,Rd	2655,50	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	1,3833e-03	m^3
Mpl,y,Rd	325,08	kNm
Unity check	0,47	-

Bending moment check for Mz
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

Wpl,z	6,4167e-04	m^3
Mpl,z,Rd	150,79	kNm
Unity check	0,17	-

Shear check for Vy
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

Eta	1,20	
Av	8,7017e-03	m^2
Vpl,y,Rd	1180,63	kN
Unity check	0,01	-

Shear check for Vz
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

Eta	1,20	
Av	3,7750e-03	m^2
Vpl,z,Rd	512,18	kN
Unity check	0,07	-

Combined bending, axial force and shear force check
According to EN 1993-1-1 article 6.2.9.1 and formula (6.41)

Mpl,y,Rd	325,08	kNm
Alpha	2,00	
Mpl,z,Rd	150,79	kNm
Beta	1,00	

Unity check (6.41) = 0,22 + 0,17 = 0,39 -

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.
Note: Since the axial force satisfies criteria (6.35) of EN 1993-1-1 article 6.2.9.1(4) its effect on the moment resistance about the z-z 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	24,47
Class 1 Limit	72,00
Class 2 Limit	83,00
Class 3 Limit	124,00

=> 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	8,48
Class 1 Limit	9,00
Class 2 Limit	10,00
Class 3 Limit	14,16

=> 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	6,000	6,000	m
Buckling factor k	1,00	1,00	
Buckling length Lcr	6,000	6,000	m
Critical Euler load Ncr	10535,80	3632,84	kN
Slenderness Lambda	47,15	80,29	
Relative slenderness Lambda,rel	0,50	0,85	
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	1.3833e-03	m^3
Elastic critical moment Mcr	831.98	kNm
Relative slenderness Lambda,LT	0.63	
Limit slenderness Lambda,LT,0	0.40	
LTB curve	a	
Imperfection Alpha,LT	0.21	
Reduction factor Chi,LT	0.88	
Buckling resistance Mb.Rd	286.15	kNm
Unity check	0.53	-

Mcr Parameters		
LTB length	6.000	m
k	1.00	
kw	1.00	
C1	1.18	
C2	0.62	
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	1.002	
kyz	0.898	
kzy	0.524	
kzz	1.001	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	1.1300e-02	m^2
Wy	1.3833e-03	m^3
Wz	6.4167e-04	m^3
NRk	2655.50	kN
My,Rk	325.08	kNm
Mz,Rk	150.79	kNm
My,Ed	151.63	kNm
Mz,Ed	-25.92	kNm
Interaction Method 1		
Mcr0	707.76	kNm
reduced slenderness 0	0.68	
Psi y	0.000	
Psi z	0.000	
Cmy,0	1.000	
Cmz,0	1.000	
Cmy	1.000	
Cmz	1.000	
CmLT	1.000	
muy	1.000	
muz	1.000	

Table of values		
wy	1.098	
wz	1.500	
npl	0.002	
aLT	0.995	
bLT	0.021	
cLT	0.438	
dLT	0.194	
eLT	0.958	
Cyy	0.998	
Cyz	0.782	
Czy	0.980	
Czz	0.999	

Unity check (6.61) = 0.00 + 0.53 + 0.15 = 0.69
Unity check (6.62) = 0.00 + 0.28 + 0.17 = 0.45

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	30.824

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

The member satisfies the stability check.