Aluminium check

This benchmark shows the results obtained by Scia Engineer for a combined stability check of an aluminium cross-section.

Input data

Linear calculation, Extreme : Member
Selection : All
Load cases : LC1

Beam B6	**0.000 m**	**CS6 Sheet Initial shape**	**EN-AW6082 (ER/B) T6 (0-20)**	**LC1**	**9.93 -**

Basic data EC9: EN 1999	
Partial safety factor Gamma M1 for resistance of cross-sections	1,10
Partial safety factor Gamma M1 for resistance to instability	1,10
Partial safety factor Gamma M2 for resistance in tension	1,25

Material data		
0,2% proof strength f0	250.0	MPa
Ultimate tensile strength fu	295.0	MPa
0,2% proof strength for HAZ f0,haz	125.0	MPa
Ultimate tensile strength for HAZ fu,haz	185.0	MPa
Buckling Class	A	

The critical check is on position 0.000 m.
This section is located in a HAZ-zone.

Internal forces		
NEd	-1000.00	kN
Vy,Ed	-60.00	kN
Vz,Ed	60.00	kN
TEd	0.00	kNm
My,Ed	-180.00	kNm
Mz,Ed	180.00	kNm

Classification of Cross-Section	
N-	4
My-	4
Mz+	4

Results

..:: SECTION CHECK ::..
Compression check
According to EN1999-1-1 article 6.2.4 and formula (6.20).

Table of values		
Aeff	6752.51	mm^2
Nc,Rd	1534.66	kN
Unity check	0.65	-

Bending check
According to EN1999-1-1 article 6.2.5 and formula (6.23).
Bending Moment My
Section is classified as class 4

Table of values		
Alpha	0.67	
Wel,y	1136067.84	mm^3
My,Rd	172.20	kNm
Unity check	**1.05**	-

Bending Moment Mz
Section is classified as class 4

Table of values		
Alpha	0.46	
Wel,z	360264.96	mm^3
Mz,Rd	37.73	kNm
Unity check	**4.77**	-

Shear check
According to EN1999-1-1 article 6.2.6 and formula (6.28).
Shear force Vy

Table of values		
Avy	7200.00	mm^2
Vy,Rd	944.75	kN
Unity check	0.06	-

Shear force Vz

Table of values		
Avz	2412.00	mm^2
Vz,Rd	316.49	kN
Unity check	0.19	-

Combined Bending, Axial force and Shear force Check.
According to EN1999-1-1 article 6.2.9.1 & 6.2.10 and formula (6.40),(6.41).

Table of values		
Eta0 (6.42a)	1,00	
Gamma0 (6.42b)	1,00	
Xi 0 (6.42c)	1,00	
w0	0,65	
NRd	1534.66	kN
My,Rd	172.20	kNm
Mz,Rd	37.73	kNm

Unity check (6.40) = 1.00 + 1.61 = 2.61 -
Unity check (6.41) = 1.00 + 1.61 + 7.33 = 9.93 -
The member does NOT satisfy the section check!

..:: STABILITY CHECK ::..
Flexural Buckling check
According to EN1999-1-1 article 6.3.1.1 and formula (6.48).

Buckling parameters	yy	zz	
Sway type	sway	non-sway	
System Length L	6.000	6.000	m
Buckling factor k	2,02	0,73	
Buckling length Lcr	12.147	4.399	m
Critical Euler Load Ncr	797.96	1929.74	kN
Relative slenderness Lambda	1,53	0,98	
Limit slenderness Lambda,0	0,10	0,10	
Imperfection Alpha	0,20	0,20	
Reduction factor Chi	0,36	0,67	
Welding factor Kappa	0,65	0,65	
Buckling resistance Nb,Rd	396.60	736.53	kN

Table of values		
Ahaz	1800.00	mm^2
Aeff	7448.35	mm^2
Nb,Rd	396.60	kN
Unity check	**2.52**	-

Lateral Torsional Buckling Check
According to EN1999-1-1 article 6.3.2.1 and formula (6.54).

LTB Parameters		
Alpha	0,667	
Wel,y	1136067.84	mm^3
Elastic critical moment Mcr	340.40	kNm
Relative slenderness Lambda,LT	0,746	
Limit slenderness Lambda,0,LT	0,400	
Imperfection Alpha,LT	0,200	
Reduction factor Chi, LT	0,881	
Buckling resistance Mb,Rd	151.63	kNm
Unity check	**1.19**	-

Mcr Parameters		
LTB length	6.000	m
k	1,00	
kw	1,00	
C1	1,78	
C2	0,09	
C3	0,94	
Load Position	Normal	

Combined Bending and Axial Compression Check
According to EN1999-1-1 article 6.3.3.1, 6.3.3.2 and formula (6.59),(6.60),(6.63).

Table of values		
Eta,c (6.61a)	0,80	
Xi,yc (6.61b)	0,80	
Xi,zc (6.61c)	0,80	
Gamma,c	1,00	
Relative slenderness Lambda,HAZ,y	1,23	
Relative slenderness Lambda,HAZ,z	0,79	
Relative slenderness Lambda,HAZ,LT	0,60	
Reduction factor Chi,y	0,506	
Reduction factor Chi,z	0,785	
Reduction factor Chi,LT	0,942	
Alpha,y	0,67	
Alpha,z	0,46	
NRd	1692.81	kN
My,Rd	172.20	kNm
Mz,Rd	37.73	kNm

Unity check (6.59) = 1.60 + 1.61 = 3.20 -
Unity check (6.60) = 1.12 + 4.92 = 6.04 -
Unity check (6.63) = 1.12 + 1.70 + 4.92 = 7.75 -

Table of values		
Method for xs,y	Half of Buckling Length	
Method for xs,z	Half of Buckling Length	
xs,y	6.073	m
xs,z	2.199	m
w0	0,651	
wx,y	0,651	
wx,z	0,651	
wxLT	0,651	

Shear buckling check.
According to EN1999-1-1 article 6.7.4 & 6.7.6.1 and formula (6.147).
Rigid end posts

Table of values	
hw/tw	23,000
The web slenderness is such that the Shear Buckling Check is not required.	

The member does NOT satisfy the stability check!