SCI TEDDS MODULES

Steel Knowledge

Light gauge steel member designer is based on the provisions of EN 1993-1-3 for the design of cold-formed members and sheeting along with EN 1993-1-1 and their associated UK National Annexes. There is a wide range of geometries for light gauge steel sections supported, however, the built-in sections available in the module are plain C-shapes (tracks), lipped C-sections (studs), lipped Z-sections (purlins). The scope of this module is to process the provided data from the user in order to perform all the required member strength checks (ULS) to Eurocode 3 .

CALCULATION DETAILS

Calculation Version: **1.1.01**

Project Name: **SCI Tedds Module**
Client: **Demo**
Project Reference: **Sample**
Location: **Sample**

Design Standard: **Eurocode**
Analysis Date & Time: **31/10/2023 - 16:24**
Prepared By: **ABC**
Checked By:

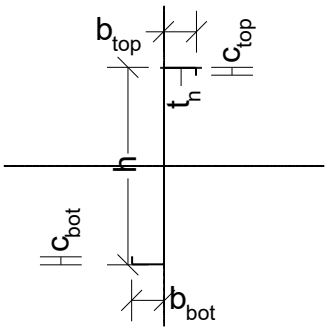
ANALYSIS SUMMARY

CALCULATION SUMMARY

	Critical Check	Max. Utilisation Factor	PASS / FAIL
Resistance of Cross-Section	Combined Axial Force and Bending;	0.907;	PASS;
Buckling Resistance	Combined Bending and Axial Force;	0.464;	PASS;

OVERALL	**Critical Check:;**	Combined Axial Force and Bending;
	Max. Utilisation Factor:;	0.907;
	Analysis Result:;	PASS;

SECTION



Section type; Lipped Z-Sections;

Section used in the design; Section: 300 x 50 x 50 x 1.5, S350 (350/420MPa);

MATERIAL PROPERTIES

Young's modulus	E = 210000 MPa
Poisson's ratio	v = 0.30
Shear modulus	G = E / (2 × (1 + v)) = **80769** MPa
Forming method coefficient	k = **7**
Average yield strength	f_{ya} = **357** MPa
Basic yield strength	f_{yb} = **350** MPa
Ultimate tensile strength	f_u = **420** MPa
Number of 90° bends in the section	n = **4**

GROSS SECTION PROPERTIES

Section Dimensions

Design Core Thickness	t = **1.5** mm
Section depth	h = **300** mm
Top Flange width	b_{top} = **50** mm
Bottom Flange width	b_{bot} = **50** mm
Top Lip size	c_{top} = **12.0** mm
Bottom Lip size	c_{bot} = **12.0** mm

Section Properties

Gross Cross-Sectional Area	A_g = **605** mm^2
Radius of Gyration about the Major y-y Axis	i_y = **107** mm
Radius of Gyration about the Minor z-z Axis	i_z = **17** mm
Torsion Constant	I_t = **434** mm^4
Warping Constant	I_w = **3255621591** mm^6
Second Moment of Area about the Major y-y Axis	I_y = **7068617** mm^4
Second Moment of Area about the Minor z-z Axis	I_z = **184767** mm^4
Plastic Section Modulus about the Major y-y Axis	$W_{pl,y}$ = **46871** mm^3

Relative Axes Positions

Position of the Major y-y Axis from the Flange	y_f = **149** mm
Position of the Minor z-z Axis from the Web	z_w = **0** mm
Position of the shear centre with respect to the z-z axis	y_o = **0** mm
Position of the shear centre with respect to the y-y axis	z_o = **0** mm

Shear Parameters

Flange length in the y-y Axis	$h_{w,y,top}$ = **49** mm
	$h_{w,y,bot}$ = **49** mm
Web length in the z-z Axis	$h_{w,z}$ = **299** mm
Slope of the Web Relative to the Flanges	ϕ = **90** deg
Slant Flange Length in the y-y Axis dir.	$s_{w,y,top}$ = **49** mm
	$s_{w,y,bot}$ = **49** mm
Slant Web Length in the z-z Axis dir.	$s_{w,z}$ = **299** mm

EFFECTIVE SECTION PROPERTIES

Effective Cross-Sectional Area	A_{eff} = **262** mm^2
Section Modulus about the Major y-y Axis	$W_{eff,y}$ = **35884** mm^3
Section Modulus about the Minor z-z Axis	$W_{eff,z}$ = **3811** mm^3
Position of the Eff. y-y Axis from the Flange	$y_{f,eff}$ = **149** mm
Position of the Eff. z-z Axis from the Web	$z_{w,eff}$ = **0** mm
Eff. Bending Resistance of Flanges only	W_f = **25039** mm^3

LOADS SUMMARY

INTERNAL FORCES

Loads from analysis of a member

Axial Force	N_{Ed} = **1.00** kN
Bending Moment about y-y Axis	$M_{Ed,y}$ = **0.90** kNm
Bending Moment about z-z Axis	$M_{Ed,z}$ = **1.10** kNm
Shear Force in y-y Axis	$V_{Ed,y}$ = **1.00** kN
Shear Force in z-z Axis	$V_{Ed,z}$ = **0.50** kN

Additional bending moment due to Neutral Axis shift

Bending Moment about y-y Axis	$\Delta M_{Ed,y}$ = **0.00** kNm
Bending Moment about z-z Axis	$\Delta M_{Ed,z}$ = **0.00** kNm

ANALYSIS RESULTS

RESISTANCE OF CROSS-SECTION

Axial Compression Resistance Check

Axial Force	N_{Ed} = **1.00** kN
Axial Compression Resistance	$N_{c,Rd} = A_{eff} \times f_{yb} / \gamma_{Mo}$ = **91.70** kN

Bending Moment Utilisation Factor	$UF_c = N_{Ed} / N_{c,Rd}$ = **0.011**
Axial Compression Check	**PASS**

Additional bending moment due to Neutral Axis shift

Shift of major y-y axis	$e_{Ny} = abs(y_{f,eff} - y_f)$ = **0** mm
Shift of minor z-z axis	$e_{Nz} = abs(z_{w,eff} - z_w)$ = **0** mm
Additional moment due to NA y-y shift	$\Delta M_{Ed,y} = e_{Ny} * abs(N_{Ed})$ = **0.000** kNm
Additional moment due to NA z-z shift	$\Delta M_{Ed,z} = e_{Nz} * abs(N_{Ed})$ = **0.000** kNm

Bending Moment Resistance Check against major y-y Axis

Bending Moment	$M_{Ed,y}$ = **0.90** kNm
Bending Moment Resistance	$M_{y,Rd} = W_{eff,y} \times f_{yb} / \gamma_{Mo}$ = **12.56** kNm
Bending Moment Utilisation Factor	$UF_{My} = M_{Ed,y} / M_{y,Rd}$ = **0.072**
Bending Moment Check (y-y)	**PASS**

Bending Moment Resistance Check against major z-z Axis

Bending Moment	$M_{Ed,z}$ = **1.10** kNm
Bending Moment Resistance	$M_{z,Rd} = W_{eff,z} \times f_{yb} / \gamma_{Mo}$ = **1.33** kNm
Bending Moment Utilisation Factor	$UF_{Mz} = M_{Ed,z} / M_{z,Rd}$ = **0.825**
Bending Moment Check (z-z)	**PASS**

Biaxial Bending

Biaxial Bending Utilisation Factor	$UF_{B.B.} = (M_{Ed,y} / M_{y,Rd}) + (M_{Ed,z} / M_{z,Rd})$= **0.896**
Biaxial Bending Check	**PASS**

Shear buckling stress

Shear buckling strength	$f_{bv,y,top}$ = **203.00** MPa
	$f_{bv,y,bot}$ = **203.00** MPa
	$f_{bv,z}$ = **28.11** MPa

Shear Force Resistance parallel to y-y Axis Check

Shear Force	$V_{Ed,y}$ = **1.00** kN
Resistance to shear in y-y axis	$V_{y,Rd} = (h_{w,y,top} \times f_{bv,y,top} + h_{w,y,bot} \times f_{bv,y,bot}) \times t / \gamma_{Mo}$ = **28.77** kN
Resistance check	$UF_{Vy} = V_{Ed,y} / V_{y,Rd}$ = **0.035**
Shear Force Check	**PASS**

Shear Force Resistance parallel to z-z Axis Check

Shear Force	$V_{Ed,z}$ = **0.50** kN
Resistance to shear in z-z axis	$V_{z,Rd} = h_{w,z} / \sin(\phi) \times t \times f_{bv,z} / \gamma_{Mo}$ = **12.25** kN
Resistance check	$UF_{Vz} = V_{Ed,z} / V_{z,Rd}$ = **0.041**
Shear Force Check	**PASS**

Combined Axial Compression and Bending Check

Utilisation Factor	$UF_{A.B.} = (N_{Ed} / N_{c,Rd}) + ((M_{Ed,y} + abs(\Delta M_{Ed,y})) / M_{y,Rd}) + ((M_{Ed,z} + abs(\Delta M_{Ed,z})) / M_{z,Rd})$ = **0.907**
Interaction Check	**PASS**

Combined Shear Force, Axial Force and and Bending Moment Check

The resistance check is not applicable, since the applied shear force is not greater than 50% of the shear resistance.

BUCKLING RESISTANCE

Flexural Buckling about y-y Axis Check

Axial Force	N_{Ed} = **1.00** kN
Buckling length	$L_{y,cr}$ = **4.00** m
Flexural Buckling Resistance	$N_{y,b,Rd} = \chi_y \times A_{eff} \times f_{yb} / \gamma_{M1}$ = **87.85** kN
Flexural Buckling Utilisation Factor	$UF_{FB,y} = N_{Ed} / N_{y,b,Rd}$ = **0.011**
Flexural Buckling Check	**PASS**

Note: The effect of flexural buckling about y-y axis may be ignored since "$N_{Ed} / N_{cr,y} \leq 0.04$"

Flexural Buckling about z-z Axis Check

Axial Force	N_{Ed} = **1.00** kN
Buckling length	$L_{z,cr}$ = **4.00** m
Flexural Buckling Resistance	$N_{z,b,Rd} = \chi_z \times A_{eff} \times f_{yb} / \gamma_{M1}$ = **19.96** kN
Flexural Buckling Utilisation Factor	$UF_{FB,z} = N_{Ed} / N_{z,b,Rd}$ = **0.050**
Flexural Buckling Check	**PASS**

Torsional Buckling Check

Axial Force	N_{Ed} = **1.00** kN
Buckling length	$L_{T,cr}$ = **4.00** m
Torsional Buckling Resistance	$N_{b,Rd,T} = \chi_T \times A_{eff} \times f_{yb} / \gamma_{M1}$ = **30.14** kN
Torsional Buckling Utilisation Factor	$UF_{b,T} = N_{Ed} / N_{b,Rd,T}$ = **0.033**
Torsional Buckling Check	**PASS**

Note: The effect of torsional buckling may be ignored since "$N_{Ed} / N_{cr,T} \leq 0.04$"

Torsional-Flexural Buckling Check

The buckling check is not applicable, since the shear centre coincides with the centroid of the section.

Lateral Torsional Buckling Check:

Bending Moment	$M_{Ed,y}$ = **0.90** kNm
Length between laterally restrained points	L_{LTB} = **4.00** m
Lateral Torsional Buckling Resistance	$M_{b,Rd} = \chi_{LT} \times W_{eff,y} \times f_{yb} / \gamma_{M1}$ = **3.09** kNm
Lateral Torsional Buckling Utilisation Factor	$UF_{b,LT} = M_{Ed,y} / M_{b,Rd}$ = **0.291**
Lateral Torsional Buckling Check	**PASS**

Combined Bending and Axial Compression Check

Buckling resistance	$N_{Rd} = \min(N_{y,b,Rd}, N_{z,b,Rd}, N_{b,Rd,T}, N_{b,Rd,TF})$ = **19.96** kN
Utilisation Factor	$UF_{b,A.B.} = (N_{Ed} / N_{Rd})^{0.80} + ((M_{Ed,y} + abs(\Delta M_{Ed,y})) / M_{b,Rd})^{0.80}$ = **0.464**
Interaction Check	**PASS**